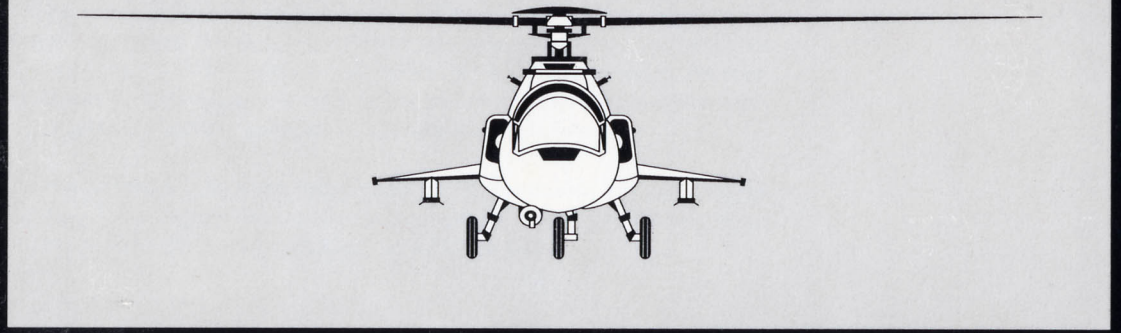
LHX ATTACK CHOPPER™



Pilot Handbook

Truth, Justice, and the American Way

When you enlist in the United States Military, you pledge to protect and defend the American way of life. The civilian population depends on you to guard not only its security, but also its precious freedoms. One of the principles you are committed to defend is the freedom to sell goods and services on an open competitive market.

Developers of computer simulations, like manufacturers of super-secret military hardware, use the money they make from their products to create more goods. If potential customers steal their goods and services, they have to raise their prices to compensate for their losses. Soon people can't afford to buy their products, and the company closes. If many people don't pay for the goods they use, the American economy collapses. Common theft can undermine the American way of life just as effectively as an enemy invasion.

LHX Attack Chopper was produced through the efforts of many dedicated members of the Electronic Arts staff: designers, artists, programmers, and other committed workers. We are depending on you to pay a fair price for our software so we can generate the revenue needed to create and develop new and better software. And please remember, copying computer software without permission is a violation of federal law.

As a member of the Software Publishers Association (SPA), Electronic Arts supports the fight against the illegal copying of personal computer software. Thank you for helping us in our effort to control software costs by eliminating software theft.

Contents

INSTALLING AND STARTING LHX ATTACK CHOPPER

For IBM and IBM Compatible Computers

To play LHX Attack Chopper, you need 512K of memory for CGA or EGA, and 640K of memory for other modes. See the README file on your original LHX Attack Chopper Disk 1 for possible information not contained in the documentation. For information on viewing a text file, see your DOS manual.

INSTALLING LHX ATTACK CHOPPER

LHX Attack Chopper comes on two 360K 5.25 inch disks or one 720K 3.5 inch disk. Before playing LHX Attack Chopper, you can install the original disk(s) onto a hard disk or make copies of the disks to play from.

Hard disk users should use the Install utility included on Disk 1 to install the game on their hard disk. Follow the steps outlined under Installing to a Hard Disk.

Floppy disk users should simply copy the original disk(s) using the DOS Diskcopy command. (If you are unfamiliar with this procedure, follow the specific steps outlined under Copying Your Disks.) If you have a 1.2 megabyte floppy drive, you can install the contents of both 5.25 inch disks to a 1.2 megabyte floppy disk by using the DOS Copy command. See your DOS manual for information on using Copy.

INSTALLING TO A HARD DISK

If you wish to install the game onto a hard disk, use the Install utility as outlined here.

Note: The Install utility creates a directory named LHX on the hard disk and then copies the contents of your floppy disk(s) into that directory. If you already have a directory called LHX, it's contents will be replaced with LHX Attack Chopper.

1. Boot your computer with DOS (any version from 2.10 to 4.0).
2. Insert Disk 1 into drive A (or any appropriate floppy drive).
3. Type **A:** and press **Enter**. (Type the appropriate drive letter if you have inserted Disk 1 into a drive other than drive A.)

4. To install the disk, type **Install** followed by the drive letter you are installing FROM and the drive letter you are installing TO. For example, to install from drive A to drive C you would type:
   Install A: C: and press **Enter**.
5. If you are installing from 5.25 inch disks, you're prompted when to insert Disk 2. When the prompt appears, remove Disk 1 from the drive, insert Disk 2, and press any key.
6. The game is now copied into the LHX subdirectory on your hard disk. Put your original disks in a safe place.

COPYING YOUR DISKS

The following steps for copying disks are standard DOS procedures. However, DOS commands may vary. If you have any difficulties with copying, refer to your DOS manual for specific information on how to copy files.

Boot your computer with DOS (any version from 2.10 to 4.0) before you install or start LHX Attack Chopper.

One Drive Systems:

1. Put your DOS disk in drive A, type **A:**, and press **Enter**.
2. Type **DISKCOPY A: A:** and press **Enter**.
3. You're asked to insert a source disk; put Disk 1 in the drive and press **Enter** to start copying. With a single drive system, you must swap disks during the copying process. You're prompted when to insert your source disk (the original Disk 1) and when to insert your destination disk (the backup copy).
4. When the disk copy is complete, you're asked if you want to make another copy.
   5.25 Inch Disk Users: Type **Y** and press **Enter**. Now repeat step 3 with Disk 2.
   3.5 Inch Disk Users: Type **N** and press **Enter**.

Two Drive Systems:

1. Put your DOS disk in drive A, type **A:**, and press **Enter**.
2. Type **DISKCOPY A: B:** and press **Enter**.
3. You're prompted to insert your source disk in drive A and the destination disk in drive B. Put Disk 1 in drive A, put a blank disk in drive B, and press **Enter** to start

copying. Note: This will work only if both drives are the same size. If your drives are different, follow the One Drive Systems instructions to use the Diskcopy command.

4. When the disk copy is complete, you're asked if you want to make another copy.
   5.25 Inch Disk Users: Type **Y** and press **Enter**. Now repeat step 3 with Disk 2.
   3.5 Inch Disk Users: Type **N** and press **Enter**.

STARTING LHX ATTACK CHOPPER

We recommend that you do not play with your original disks; make copies of your disks to play from or install the game onto a hard disk. See *Installing LHX Attack Chopper* for details on installing or copying your disks.

The program automatically detects the best graphics mode for your computer and starts the game in that mode. If you want to play the game in a different graphics mode or use an AdLib music card, see *Starting Features* for instructions on these options.

Note: You may need to remove any TSRs (terminate-and-stay-resident programs) before starting LHX Attack Chopper. You can temporarily avoid these TSRs by booting from your original DOS disks. See your user manuals for information on removing your TSRs.

Starting From an Installed Disk

If you installed the game using the Install utility that came with LHX Attack Chopper, use the following procedure to start the game.

1. Type **C:** and press **Enter**. (If your hard disk isn't **C:**, enter the correct letter.)
2. Type **CD \LHX** and press **Enter**.
3. Type **LHX** and press **Enter**. The game will load and you'll see the title screen. Press the **spacebar** to continue.
4. To pass the Armed Services Vocational Aptitude Battery (ASVAB), read the question on the screen, type the answer, and press **Enter**. You may use the LHX Attack Chopper manual, and there is no time limit. If you answer incorrectly, you get two additional chances.
5. Type your name carefully on the Personnel Enlistment Form (PSNLELF), and press **Enter**. Note: If you logged in a pilot name the last time you played, and that pilot

was not killed in action, you proceed directly to "Choose a Mission Category" in *Tour and Mission Assignment.* If you want to log a new pilot (erasing your current pilot), press **Esc** twice to back up to the Enlistment screen, press **Esc** again to erase the current pilot. Now type in a new pilot as explained above.

6. Proceed to *Tour and Mission Assignment.*

Note: At any time during the game, you can press **Ctrl-P** to pause the game, and any key will resume. You can also press **Ctrl–C** to quit the game (press **Y** to confirm).

Starting From a Copied Disk

Use this procedure to start the game.

1. Insert your *copy* of Disk 1 in drive A or drive B. If you have a second floppy drive, insert Disk 2 in that drive.
2. Type **A:** or **B:** (whichever drive you put the disk in) and press **Enter**.
3. Type **LHX** and press **Enter**. The game will load and you'll see the title screen. 5.25 inch 360K single floppy disk users see a prompt for Disk 2. Remove Disk 1 from the drive, insert Disk 2, and press **Enter**.
4. To pass the Armed Services Vocational Aptitude Battery (ASVAB), read the question on the screen, type the answer, and press **Enter**. You may use the LHX Attack Chopper manual, and there is no time limit. If you answer incorrectly, you get two additional chances.
5. Type your name carefully on the Personnel Enlistment Form (PSNLELF), and press **Enter**. Note: If you logged in a pilot name the last time you played, and that pilot was not killed in action, you proceed directly to "Choose a Mission Category" in *Tour and Mission Assignment.* If you want to log a new pilot (erasing your current pilot), press **Esc** twice to back up to the Enlistment screen, press **Esc** again to erase the current pilot. Now type in a new pilot as explained above.
6. Proceed to *Tour and Mission Assignment.*

Note: At any time during the game, you can press **Ctrl-P** to pause the game, and any key will resume. And you can press **Ctrl–C** to quit the game, and press **Y** to confirm.

STARTING FEATURES

When you start LHX Attack Chopper, the program automatically detects the best graphics

mode for your computer and starts the game in that mode. However, if you want to start the game in a different graphics mode, you can do so by adding a few extra characters (called arguments) to the start command.

EXAMPLE: Let's say you want to load the game with EGA graphics. You'd type **LHX EGA** and press **Enter**.

The order of the extra arguments doesn't matter as long as there's a space between each argument.

These are the arguments you can use:

CGA	Loads game in CGA mode.
EGA	Loads game in EGA mode.
MCGA	Loads game in MCGA 256-color mode.
VGA	Loads game in MCGA 256-color mode.
TANDY	Loads game in Tandy graphics mode.
JOYSTICK	Loads game with joystick control.
KEYBOARD	Loads game with keyboard control.
MOUSE	Loads game with mouse control.
MOUSE2	Loads game with the Slow Mouse setting on for a high precision mouse.
LOW	Loads game in low graphics detail mode.
MEDIUM	Loads game in medium graphics detail mode.
HIGH	Loads game in high graphics detail mode.
PCSOUND	Loads game with PC sound.
ADLIBSOUND	Loads game with AdLib sound.
TANDYSOUND	Loads game with Tandy sound.
SMALL	Use this if you have a computer with less than 640K of memory. It deletes complex versions of some shapes to speed up the simulation.

STANDARD MISSION PROCEDURES (GAME OVERVIEW)

CALL TO ACTION

They say war is a thing of the past. Everyone is talking about it: one undivided world, the peace dividend, no more instant enemies. They all say it is so.

The Berlin Wall is in pieces. China has lifted martial law, and most of the nations in eastern Europe have liberated themselves from ruthless and corrupt dictators. Revolutions in the name of democracy are going on all over the world, and Soviet *glasnost* has everybody breathing easy. The worm, they say, has turned. War, they say, is no more.

But remember, talk is cheap. And saying (or even wishing) something IS, doesn't make it so.

As you are about to discover, Americans are fighting to defend democracy all around the world, every day. Behind the glib newspaper headlines and the pathetic platitudes of political hacks, there are thousands of military personnel, laying their lives on the line every day for the American way of life. Here is the rest of the story.

> In the absence of any officially sanctioned retaliation, Libya relentlessly and with impunity supports attacks against US military installations and allied civilian populations. These cowardly attacks are supplied almost exclusively with Soviet weaponry.
>
> Aggressive and brutal forces in Southeast Asia are trying to crush the life-blood from struggling democracies as they valiantly struggle for the right to exercise freedoms we take for granted.
>
> The volatile East German buffer zone is rarely more than one serious incident away from hot shooting war.

Make no mistake about it, this is not just talk. The generals may be pushing red and blue pins on a map to plan strategies, but for you, the pilots and gunners of US Armed Forces attack helicopters, the red pins will be shooting missiles at you as you try to accomplish

your dangerous mission. If you succeed, you help the world take one more step toward democracy, freedom, and most of all, peace. You may get a medal, but it won't make the newspapers. If you fail, Uncle Sam will deny the incident, and your folks will be told you disappeared in a boating accident. Some accident. Some boat.

If you are willing to fight courageously for your country and its values, take all the heroic risks and get none of the glory, follow the instructions in *Installing and Starting LHX Attack Chopper* and procede to Tour and Mission Assignment.

TOUR AND MISSION ASSIGNMENT

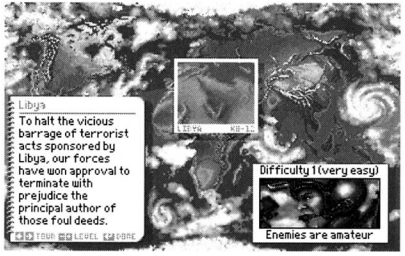
Here in the ready room you'll use COMPTAMS (Computerized Tour and Mission Selection) to request a tour of duty, a skill level, and a mission assignment. COMPTAMS is a computerized system that contains information regarding all active tours worldwide, including current mission assignments. Press **Esc** at any time while using COMPTAMS to go back to the previous screen.

When you first start LHX Attack Chopper, you must enlist by entering a pilot name. From then on you fly under that pilot's name, rank, and service record. When you complete a mission, you return to the ready room to select a new one. To change your tour, you must press **Esc** until you see the tour selection screen again. If you want to start over with a new pilot name and a clean record, press **Esc** again and re-enlist. If you are killed in action, you must re-enlist.

CHOOSE A TOUR OF DUTY

There are currently three tours available to Level One Warrant Officer Pilots like yourself: Libya, Vietnam, and East Germany. (On the unlikely event that the tours offered on your terminal are different from these, remove this page immediately and request an updated page by submitting form 2E-3486KJ-2.4L to Requisitions.) The terminal screen will look like this:

[See Figure 1]



Tour Assignment Screen
(Figure 1)

To review each tour opportunity, press the right or left cursor key (← or →) to see the next tour. Examine the map and review the engagement synopsis. When the tour you want is on the map, choose a skill level as described below.

Mission Availability Report (MAVRP)
(Figure 2)

CHOOSE A SKILL LEVEL

We recognize that many of you are only Second Lieutenants fresh out of flight school; therefore, you may log your own skill appraisal so we don't send you on a mission you are not prepared to handle. To log your skill level, press - (minus) to reduce the skill level required for your engagement, or press + to increase it. You'll be sent on missions appropriate to the level of confidence you have in your abilities. *Do not select a skill level beyond your abilities!* Heroes who don't get back home make for poignant news stories, but they can't defend their country effectively.

When the tour of duty and skill level you want are displayed on the screen, press **Enter** to review the Mission Availability Report (MAVRP).

CHOOSE A MISSION CATEGORY

The Mission Availability Report (MAVRP) lists the available mission categories from which your specific mission assignment will come. The terminal screen will look like this:

[See Figure 2]

To select a mission, press the up or down cursor key (↑ or ↓) to highlight your choice. Press **Enter** to log your selection and proceed to your preflight briefing. For a complete description of all missions, see the following section, *Profiles of Mission Categories.*

Note: Whenever you complete a mission, you return to the Mission Availability Report after your debriefing to continue your tour. If you want to select a different tour or skill level, press **Esc** to go back to the previous screen. For an in-depth description of the strategic and political context of these missions, see *Appendix A: Tour Briefings.*

PROFILES OF MISSION CATEGORIES

There are literally hundreds of missions to be accomplished. These missions are grouped into categories, and vary according to tour location. Note: The most significant consideration in helicopter and weapon selection is mission category.

Alpha Strike

Pilots and gunners, listen up. These hazardous seek-and-destroy missions *will* test your

intestinal fortitude. Your stealth technology, flying skill, and weapons load will be stacked against the sophisticated security systems, air defense installations, and ack-ack batteries of the enemy. Welcome to the big time. Our best lifers dream of this kind of mission. They aren't always good dreams. Be alert! Stay alive!

Surgical Strike
If you're risk adverse and "Danger" does not appear on your dog tags, give this mission a pass. The termination of a precise target at a fortified enemy airport has humbled better flyboys than you. But be advised: the real pros live for these assignments. And these missions must, repeat must, be run.

Dustoff
One of our best pilots has been nicked by unfriendly fire. His buggy's history but he bailed safely and is waiting for relief. Unfortunately his 20 is deep behind enemy lines. U.S. Army Ranger-trained, bought and paid for, he's a valuable working asset and a storehouse of classified information. Right now he's in the toilet and somebody's about to send him a long-distance flush-o-gram. His medal will have to go to his family if you can't bring him home.

Truck Convoy
When Command Intelligence gets wind of a motorized convoy carrying hostile materiel, the knee-jerk response always is: "No problem. Take it out with a chopper." What these desk jockeys can't seem to get straight is that they're never talking about a couple of jerks hauling Saturday-night specials in unguarded pickup trucks. These are dangerously unpredictable missions. When a good pilot sees tanks on this run, he believes that they're not guarding vacuum cleaners. In short, he watches his butt; so should you.

Supply Run
Every ground-slogging GI grunt knows, like he knows his mother's name, that the thing he needs most in a combat-zone is whatever he doesn't have enough of (if he has it at all). Could be ammo, could be bandages. It doesn't matter. If he really needs it, it's not there. So what else is new? We've got to bail our guys out again. They're in a fire-fight and they need what's loaded in your chopper, now. The problem is, the enemy knows our guys need it. And I guarantee, they'll do what they can to make sure you don't deliver.

Medevac
We perform no higher military duty than when we do our best to evacuate casualties from the battlefield—and you'll do no less. Tough luck that temporary truces to rescue the wounded are out of style. In our times enemies treat the white flag of truce like a bull treats a red piece of cloth. Medevac missions scream vulnerability to them. Believe it. Your enemies won't respectfully avert their eyes or their weapons when you try to assist your comrades.

Aerial Intercept
Forget your target coordinates, forget your navigator's advice, and the praise you got from your flight instructor at Ft. Hood. You've got to stop a real live bogey who's bent on inflicting some serious damage on you and yours. You've got to eyeball this tuna and stop him cold; and you better do it right the first time. Hope you're having a good day.

Chemical Warfare
Some unfriendlies just can't take care of business with missiles, heavy flack, and machine-gun fire. They're looking for a sharper edge. They're thinking plague, water poisoning, and civilian carnage. The Geneva Convention means nothing to this scum. You've got to stop their plans — and then you can feed them their lunch.

Free Flight
Flying an attack helicopter is not as easy as riding a bike. If that comes as a shocker, better resign your commission now and save the squad a ton of grief. Flying a chopper takes lots of practice. Flying it well in combat demands that you be physically and morally fit, have better than average smarts, have a high regard for Uncle Sam's property and a low regard for your personal safety. Take time now to learn your surroundings. Failure to do so will affect your health. We don't want to 86 you out of the Corps or write a letter to your folks.

Chopper Escort
The CO thinks this mission's a piece of cake. But he hasn't sat under the rotor since '68. He loves surprises. But he's never seen the business end of a Hind's machine gun close up, in anger. The CO thinks protect and defend is something the police do in his home town. The CO doesn't have a clue about just how tricky this mission can be. When you've logged some hours in the high-profile missions, step up to where the big boys play. No rookies need apply.

POW Rescue
We have men rotting in an enemy POW compound. Behind electrified razor wire, surrounded by anti-personnel mines and heavily fortified guard towers, the lives and dreams of a few brave men are hanging on the hope that you make all the right moves. Their time is running out. Only you can stop the clock.

B-2 Support
Every professional helo jock knows there are two types of missions: *glamour* and *grind it out*. Glamour is flying the President's dog to Camp David; traffic reconn; celebrity shuttles and other similarly taxing duty. Grind it out is anything else, as long as it's physically demanding, extremely dangerous, and usually thankless. If those conditions ring your bells, sign on the dotted line. You'll be running interference through a hostile gauntlet in East Germany for a certain classified low-observables-heavy-ordnance bomber. You locate, define, and draw first fire from enemy SAM installations. Naturally you try to take some of them out. The glory boys in the bomber slip in behind you, do their business and are home polishing their promotions before you clear the fire zone.

Sanction
We train pilots to do their duty — neutralize the enemy, destroy the target, protect their comrades and themselves. All this they understand and do automatically, or else they're out of here. Every so often a mission comes along that's above and beyond the usual call. A Sanction is that kind of mission. We're ordering you to terminate a known individual. No one will blame you for keeping to yourself in the preflight meet. But focus on this: the target is a heinous criminal; you're risking your life and the lives of your crew; and a hit means that many lives will be saved. Accentuate the positive. For now, bury the negative. When you're ready, this mission must be flown.

Pick Up
In this vital mission, you must penetrate enemy lines to escort a Soviet Hokum and a defecting pilot out of the wrong side of Germany. The success of a full-blown military engagement with the Soviets rests on your ability to out-think and out-fly the enemy. We're not talking small potatoes. If *pressure* is your middle name, if *sweating bullets* is something you've grown almost fond off, if going over Niagara Falls in a barrel, and treating the rocks below as so many flags in a slalom course, sounds like a fun way to spend a summer afternoon, you're ready for the challenge.

PREFLIGHT BRIEFING

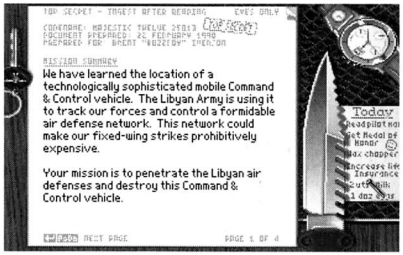
Expect the following from your preflight briefing: you are briefed with your mission summary, you request a helicopter and a weapons load, and you receive your waypoint map and a weather report. Some information from this briefing will be available for review when you are inside your helicopter; some won't. See the following descriptions to learn which sections require you to take notes. (Or you can rely on your memory — at your own risk.) Read your entire briefing thoroughly before proceeding to your helicopter .

To see the next page of your briefing, press **PgDn** or **Enter**. To see the previous page, press **PgUp**. If you want to change any of your previous selections, press **Esc** repeatedly until you see the selection screen you want.

MISSION SUMMARY

Your mission summary outlines your assigned mission within the category you requested.

[See Figure 3]



Mission Summary
(Figure 3)

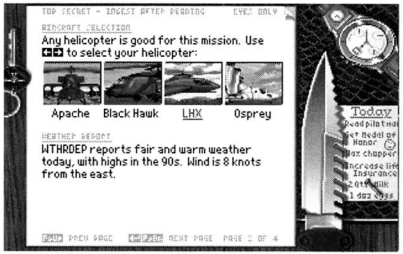
Strategically significant locations are recorded on your waypoint map, which is available in your aircraft. You may want to take notes concerning objectives unrelated to your map; for example, the number of targets you need to eliminate, or the number and distribution of wounded that require medevac. If your mission requires you to intercept a moving enemy vehicle, you should note the direction it is travelling to learn its approach to the intercept point.

Once you've assimilated the contents of your mission summary, press **PgDn** or **Enter** to requisition a helicopter for your mission.

HELICOPTER REQUISITION

Selecting the wrong helicopter can jeopardize your mission, no matter how good a pilot you are. For information that will help you decide which helicopter best satisfies the requirements of your mission, read the helicopter descriptions in the *Helicopter Technical Briefing* section.

[See Figure 4]



Helicopter Requisition Screen
(Figure 4)

Not all helicopters are suitable for all missions, because some mission scenarios require special hardware, like cargo holds or winches. Unsuitable helicopter choices are dimmed by your ground crew. Select a helicopter by pressing the right or left cursor key (← or →) to highlight your choice.

To help you select a helicopter, a current weather report is included. This report also tells you whether your mission is a day or night flight, and it lists the wind speed and direction. Take special note of the wind speed and direction; this information will help you hover and land with precision. This is crucial for many missions, especially dropping supplies or picking up wounded GIs.

Once you've picked a helicopter and noted the weather, press **PgDn** or **Enter** to review and alter your weapon mix.

WEAPON SELECTION AND LOADING

Selecting the right weapons for your mission is as important as choosing the right helicopter. Your helicopter comes already loaded with a standard weapons mix, but different missions require different weapons. To help you decide which weapons to use, recall the targets you've been assigned in your mission summary, and read the "Weapon Targeting and Firing" section in the *TUTORIAL*.

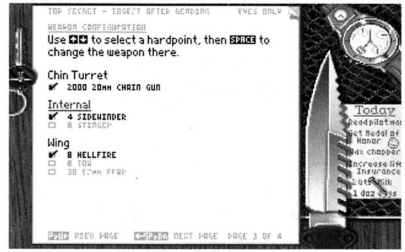
[See Figure 5]

In addition to the chin turret machine gun, each helicopter has from two to six fittings, called *hardpoints*, where weapons are loaded in pairs. Press the up or down cursor key (↑ or ↓) to highlight the hardpoint you want to change. Then press the **spacebar** to put a check mark next to the weapon you want on that hardpoint.

When you are satisfied with your weapons mix, press **PgDn** or **Enter** to review your waypoint map.

WAYPOINT MAP

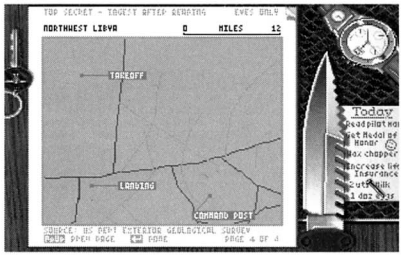
Identified on your map are locations significant to your mission, called "waypoints." Mark your waypoints on your personal tour map for reference. (You may want to encase your



Weapon Selection and Loading Screen
(Figure 5)

map in plastic or acetate and mark on it with a grease pencil, so as not to write on the actual map.)

[See Figure 6]



Mission Waypoint Map
(Figure 6)

North is always up on your map. Your waypoints include your airstrip of origin (labeled "TAKEOFF"), your destination airstrip (labeled "LANDING"), your target location(s), and any other locations pertinent to your mission. This map will be available, without labels, in your helicopter throughout your mission.

In your helicopter, the map numbers your waypoints in the order you are to approach them. Fly to your targets in a different order if you believe it is strategically appropriate to do so. Just be sure to end your mission at the designated landing strip, your last waypoint.

When you've digested all the information, flip to your Waypoint Map and press **Enter** to fly to your assigned airstrip, Waypoint One, where your selected helicopter is fueled, loaded, and ready to take off. To skip the zoom effect and go straight to your helicopter cockpit, press any key.

Note: For introductory information on flying and completing your mission, see the *FLIGHT TRAINING* section. For information on the various flight instruments in your cockpit, see the "Flight Instruments" section of the helicopter you are flying in *HELICOPTER TECHNICAL BRIEFINGS*.

DEBRIEFING

When you land at your destination airport, the mission ends and you are returned to the ready room for your debriefing. To end your mission unsuccessfully at any time and await rescue, press **Ctrl-Q**. Even if you can't make it back to your destination airport, try for any allied airfield, or friendly territory at the very least. If you are lucky enough to be rescued, you are brought immediately to your debriefing. If you aren't rescued, you become MIA and a debriefing is the last of your worries.

At the debriefing you receive a Mission Outcome report, a Personnel Report, and an Aircraft Damage Report. To see the next page of your briefing, Press **PgDn** or **Enter**. To see the previous page, press **PgUp**.

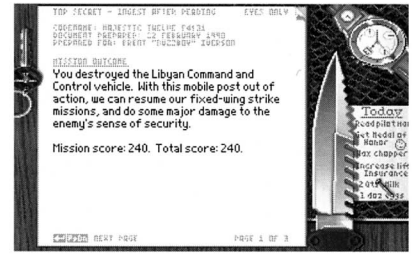
MISSION OUTCOME REPORT

Your Mission Outcome Report is a detailed evaluation of your mission's success or failure, including possible consequences. Your performance rating follows.

[See Figure 7]

You receive points for succeeding in your mission, and for destroying enemy targets. You lose points for accidentally destroying allied forces, not going to your assigned destination, and selecting Easy Landings from the SIM menu. Successfully completing more difficult missions on a more difficult tour increases your score. The tour in Libya is the easiest, and the tour in East Germany is the hardest. You get more points for using a technologically less sophisticated helicopter. The helicopters, in order of increasing sophistication are: Black Hawk, Apache, Osprey, LHX. Remember, you might not complete your mission if your helicopter isn't sophisticated enough.

Once you have read your Mission Outcome Report, press **PgDn** or **Enter** to check your Personnel Report.



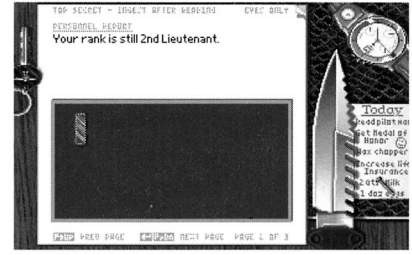
Mission Outcome Report
(Figure 7)

PERSONNEL REPORT

Any medals you are awarded are posted here, along with any promotions you may have received. All medals you already have from other missions are dimmed.

[See Figure 8]

Press **PgDn** or **Enter** to review your Aircraft Damage Report.



Personnel Report
(Figure 8)

AIRCRAFT DAMAGE REPORT

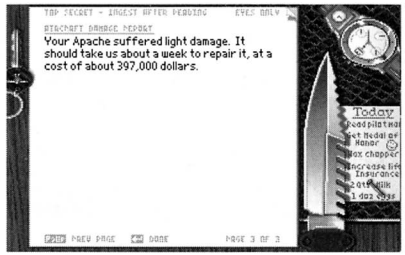
The amount of damage your helicopter sustained is listed, including the time estimated to repair it, and the total cost to the American taxpayers.

[See Figure 9]

To conclude the debriefing, press **PgDn** or **Enter** until you see your Aircraft Damage Report, and then press **Enter** again. You are taken back to the Mission Selection screen.

If you want to change your tour or skill level, press **Esc** to back up, and then select a new tour and skill level.

If you quit LHX Attack Chopper, your pilot records are written to disk for the next time you start the game. This saves your pilot name, your accumulated points, medals, and promotions, the settings on your Bolt-Down Menus, the CRT configuration of your current helicopter, and your starting features. It does not save the status of your current mission.



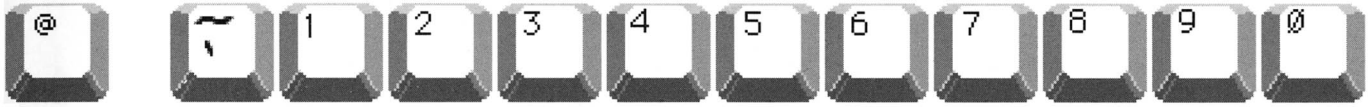
Aircraft Damage Report
(Figure 9)

FLIGHT CONTROLS

This is a graphical overview of all the flight controls for your helicopter. These controls apply to all helicopters, though the performance of each type of helicopter is different. For further details on using these controls, see the "Tutorial" section.

VERTICAL THRUST (ENGINE POWER PLUS COLLECTIVE)

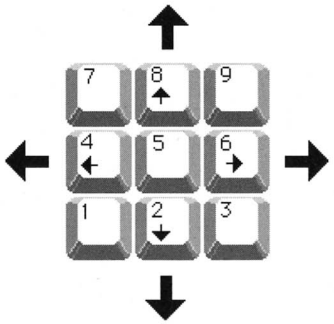
ROTOR CONTROLS



Percentage of Maximum Thrust

Autorotate on Tandy 1000s | Autorotate | 0% | 30% | 50% | 70% | 100% | -10% | +10% | Rotate Left | Rotate Right

MOVE VIEW ANGLE

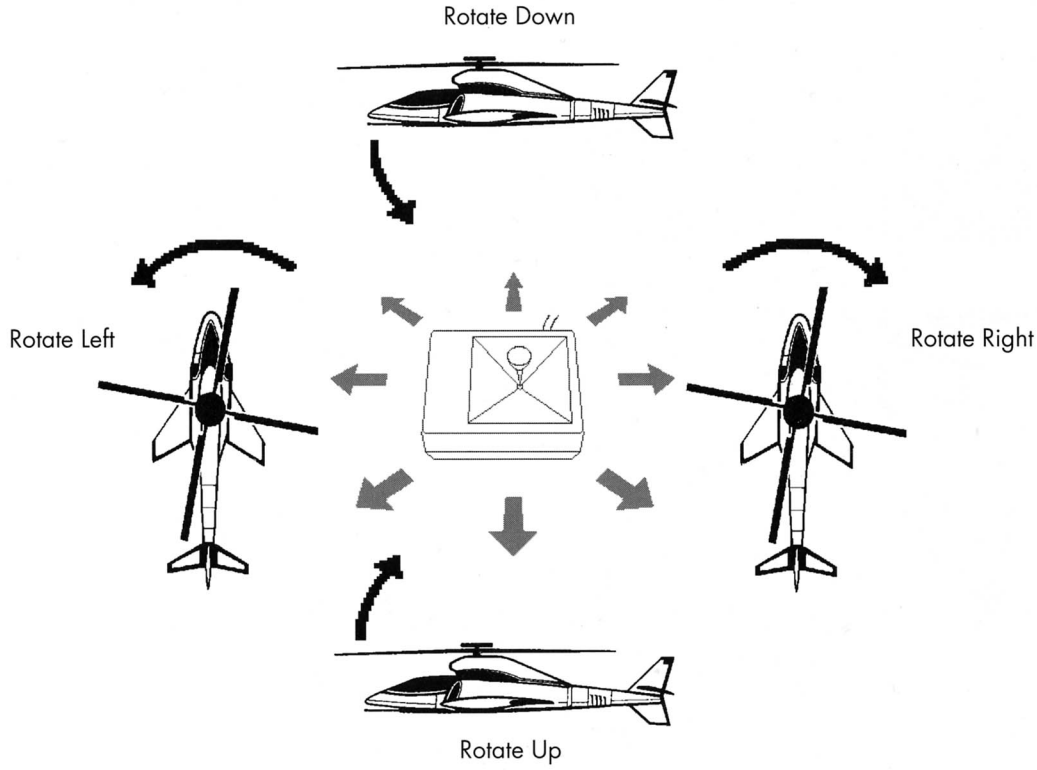


Keyboard Users: Press **Ctrl** plus an arrow to move the view angle.

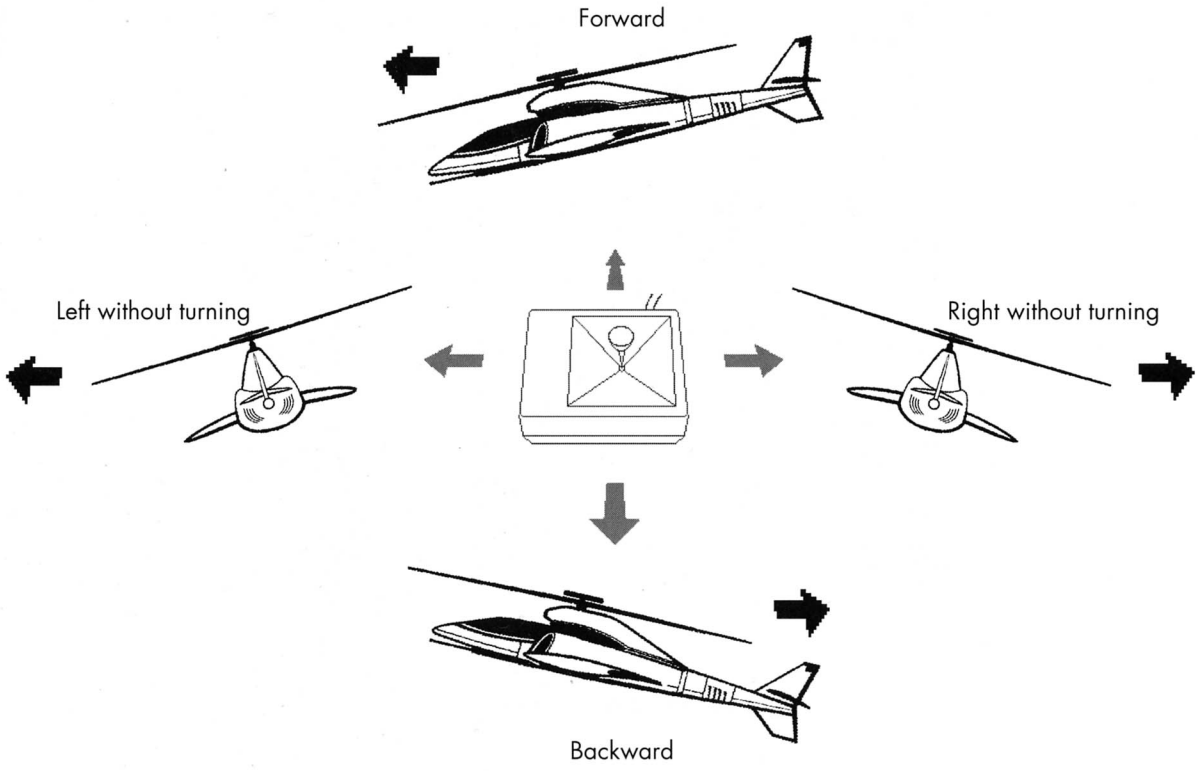
Change the direction you're looking. The crosshair indicates straight ahead of your helicopter.

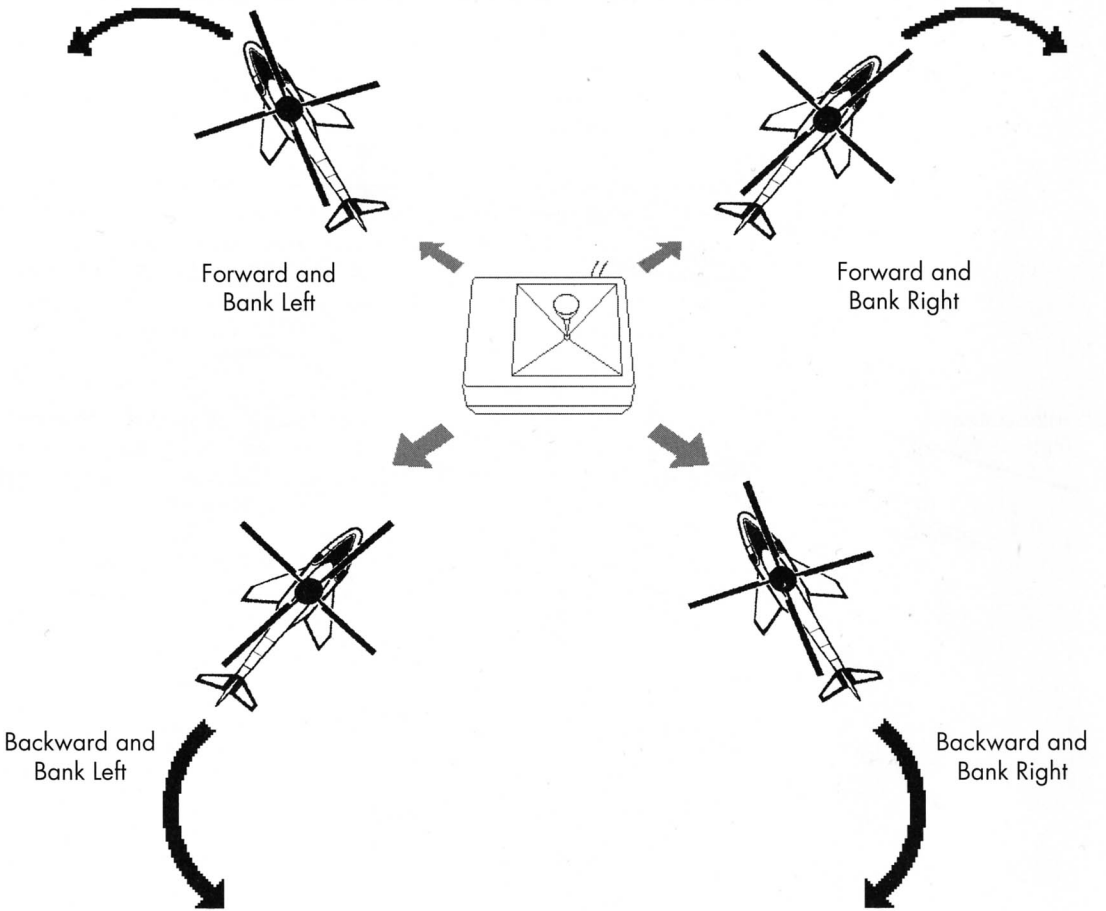
ROTATE CONTROLS

Hold down the **Alt** key while moving your flight stick to rotate your helicopter.



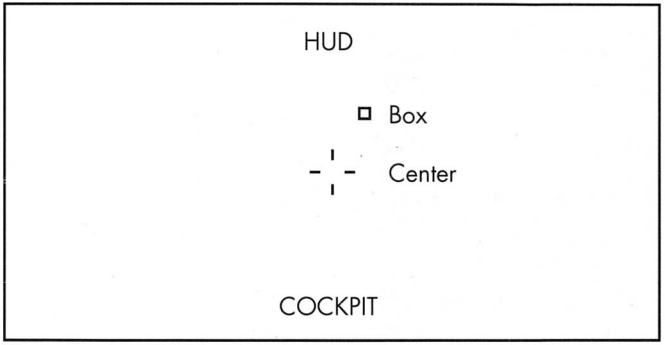
STEERING CONTROLS

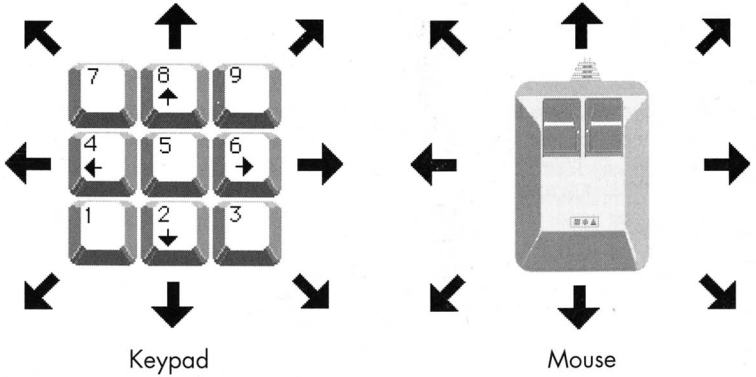



Forward and
Bank Left
Forward and
Bank Right
Backward and
Bank Left
Backward and
Bank Right

KEYBOARD AND MOUSE CONTROL

Pressing the numbers on the keypad, or moving the mouse, moves a small box on your cockpit Head Up Display (HUD). The box indicates the position of your flight stick with respect to center. Move the box to control the helicopter as described in the previous diagrams.





Keypad

Mouse

CENTERING THE CONTROLS

Press **5** on the keypad or **/** to center the controls left to right.
Press **5** on the keypad or **/** again to center the controls up and down.

SPECIAL WEAPON CONTROLS

Left Mouse Button Joystick Button 0	Fires weapons (as does the **spacebar**).
Right Mouse Button Joystick Button 1	Targets weapons (as does the **Enter** key).

TUTORIAL

Reading about flying is like reading about how to swim; you'll never really *learn* how to do it until you jump in the water. This section is an interactive overview of the many different procedures involved in flying and fighting, and you should be flying a helicopter as you read it. Try each technique and then practice until it becomes second nature. For diagrams of the controls referred to in this section, see the "Flight Controls" section. For more information on the instruments mentioned in this section, see the "Flight Instruments" section for the helicopter you are flying in *HELICOPTER TECHNICAL BRIEFINGS*. For more information on other topics, see the other *TECHNICAL BRIEFINGS*.

PRACTICE

Choose Free Flight as your mission to practice using your helicopter. Here are a few features that are helpful in learning your way around your combat helicopter.

Changing Your View Angle

Press the arrow keys on the keypad to change the direction you are looking out the cockpit. (Keyboard users must hold down the **Ctrl** key while pressing the keypad keys.) This helps you see in directions other than straight ahead, which is useful for spotting and targeting enemies, and for maneuvering your helicopter. The crosshair in the center of the Head Up Display (HUD) shows you the direction your helicopter is pointed.

Changing Your View Perspective

There are many different perspectives from which you can view the world. Most of these views are from outside your helicopter. See the "View" section of *Flight Option Menus* for a complete list of views and keyboard commands. Use these alternate view perspectives to watch your helicopter from different angles, to give you a clear picture of how your controls affect your flight path.

If you have a target lock and you change views, you do not lose that lock if you are playing skill level 1 or 2 (the easiest levels). If you are playing the three higher skill levels, changing your view loses your target lock.

Visual Magnification

You can change the magnification of your view (and the camera view on your Multi-Function Display) from 1x to 64x by pressing **+** or **-**. While magnification increases the

size of your current view, it doesn't reveal details that aren't already visible. The current zoom magnification is shown on the lower right of your HUD.

Time Compression

Pressing **T** toggles time compression on and off. When time compression is on, everything happens twice as fast, and the symbol TIME: 2 appears on the lower right of your HUD. This is a useful feature for reaching your destination faster than the time it really takes, but it's also more dangerous because your reactions must be twice as fast.

TAKEOFF

Taking off is as simple as increasing the throttle and pulling up on the collective. Press **5** to open the throttle all the way to 100% engine power and increase your collective to maximum. Watch your throttle setting in the Engine Status display to see the thrust indicator climb as the engine revs up. When your overall upward thrust exceeds 50%, you take off. The controls are calibrated so you hover when you maintain your thrust setting at 50% of maximum. Press **3** to reduce your throttle and collective to achieve and maintain 50% thrust. Notice that you don't immediately stop climbing; that's because your engine must overcome the inertia of its blades to slow down.

If you are flying the Osprey or the LHX, press **G** after taking off to retract the landing gear. Leaving the gear down increases drag, reducing your maximum forward speed and gas mileage. The Apache and the Black Hawk have fixed gear that cannot be retracted.

FLYING

The flight stick is a combination of many helicopter controls: the collective, the cyclic, the rudders, and the engine power output. To move forward, push the flight stick forward. This in effect moves the cyclic forward, which tilts the main rotor disk forward. To move backward, pull your flight stick back. Move the stick side to side, and you move side to side under the same principle. Notice that when you move your flight stick left or right, your helicopter moves left and right, but doesn't turn. To turn, you must also use the rudders.

Turning

To bank right, move your flight stick forward and to the right (see diagrams under *Flight Controls*). This combination moves you forward and to the right using the cyclic, and it rotates you to the right (clockwise if you are looking down on your helicopter) using your

tail rotor. To bank left, you just move the flight stick forward and left, and the same principles apply.

Turning while flying backward is counter-intuitive. If you pull your flight stick backward and to the right, your tail turns to the *left* as you move backward. This is because moving the flight stick to the right doesn't turn you right, it turns you *clockwise* (looking from above) using the tail rotor. That's why if you want to back up and turn your tail to the left, you must pull the flight stick back and to the *right*.

Rotating

When your aircraft is hovering, pressing the **Alt** key lets you use the flight stick to change the attitude (direction) of your helicopter without changing your location. You can do this while gaining or losing altitude, but you must not be moving in any other direction, otherwise you will stall, which is the equivalent of spinning out in a car. Hold down **Alt** and move your flight stick right to rotate right, left to rotate left. Hold down **Alt** and move the flight stick backward to tilt your nose up, forward to tilt the nose down. Releasing **Alt** returns your flight stick to normal.

Nap of the Earth (NOE) Flying

There is only one way you can fly a dozen miles over enemy territory without using all your weapons in self-defense before you reach your target, and that is to fly as low as possible, hiding behind objects when you can. Flying at top speed only 100 feet above the ground is dangerous, but flying high where the enemy can see and hear you easily is deadly. You must continually monitor your altitude, because ground turbulence will bury your nose in the ground if you don't make corrections from time to time. And the faster you fly, the harder it is to correct for turbulence.

Stunt Flying

When you're flying normally, the control system of your helicopter limits the moves you make based on the helicopter's flight envelope, which describes the stresses the aircraft can withstand and the angles at which it can maintain lift. If you're travelling at high speed, pressing the **Alt** key lets you bypass these limitations. This lets you perform barrel rolls, loops, and stalls. Stunt flying can get you out of an emergency; for example, if you are in a losing dogfight at very high altitude (a situation you should have avoided in the first

place), you can perform half a barrel roll, lose a lot of altitude fast, restore normal flight, and bug out fast. However, remember that most stunt flying must be performed at altitudes higher than you should be anyway, and they require an expert hand at the controls.

Special Osprey Controls

When flying the Osprey, you can convert the flight stick from a helicopter control stick to an airplane flight stick. Press **V** when you're flying forward at maximum speed to convert the stick. While the conversion is in progress, center the flight stick. If you are using the mouse or keyboard to fly, be sure to center the controls during the conversion or you might end up diving into the ground. A message appears telling you if your conversion was successful; if the conversion fails, you weren't flying forward fast enough.

After the conversion, pulling the flight stick back makes you climb, pushing it forward makes you dive, and moving it left or right makes you bank left or right. The thrust controls now change only engine power and forward speed. Do not reduce your thrust to 0% or your aircraft will stall. To convert back to helicopter controls, press **V** again.

Note: When you bank an Osprey with airplane controls, your wings tilt, reducing your lift. This makes your nose fall and you start descending. To counteract this, you must pull back slightly on the stick as you turn to maintain altitude. This technique is called *trimming* your aircraft.

LANDING

If you're flying the Osprey or the LHX, you must lower your landing gear before landing or you will crash. Press **G** to lower the gear. The symbol GEAR is visible in the upper right corner of your HUD if your landing gear is down. The Apache and the Black Hawk have fixed gear so you don't need to lower them.

Landing is as simple as hovering over the landing spot, reducing thrust below 50% by pressing **2** or **6**, and gently touching down. Trying to land while moving forward, backward, or side to side can make you crash. If you land at the destination airport for your mission (your last waypoint) you automatically return to HQ for debriefing after a few seconds. If you land somewhere other than the assigned destination airstrip, and you want to end your mission, usually because you are unable to complete your mission and return

to base, press **Ctrl-Q** to ditch your helicopter and await pickup.

Note: Ospreys must be landed with helicopter controls, not with airplane controls. This is because the rotors are too big and would hit the ground and snap off before the wheels touched down.

AUTOROTATION

When the engines cut out in an airplane, you can often glide down to make a rough emergency landing. Since helicopters cannot glide, engine failure is a more desperate situation, but it isn't hopeless because you can autorotate your main rotor. Autorotation is a technique that keeps the rotors turning freely until the last moment, near the ground, when helicopter speed is traded for rotor speed, slowing the helicopter in time to touch down safely.

The instant the engines fail, your main rotor starts to slow down. Immediately disengage the rotor from the engines by pressing ~ (tilde) or @ on a Tandy 1000. In the Apache and the Black Hawk, the throttle bar on the Engine Status Panel flashes red; in the Osprey and the LHX, the symbol (AR) appears next to the Thrust symbol on the HUD. Disengaging the rotor from the engine lets you keep the rotors spinning at top speed while your crippled engine grinds to a halt.

When the rotor disengages, drop the nose of your aircraft to increase forward speed as you fall out of the sky. The more forward speed you can get the better, because your high speed keeps the main rotor spinning.

As you near the ground, pull back on the stick to reduce forward speed by pulling up the nose of your helicopter. This technique is called *flaring*. As you lose forward speed to your flare, the rotors begin to rotate faster, slowing your descent. When your forward speed goes to zero, your falling rate is at its slowest. At this point, you should be as close to the ground as possible, since your helicopter begins to fall again. Landing successfully during autorotation requires knowing when to start your flare so that you reach your slowest falling rate very close to the ground. Developing a feel for this technique requires practice. Choose the Free Flight mission and practice autorotation landings by pretending to lose engine power and disconnecting the rotor. Only by practicing this technique during free

flight will you be able to safely land your craft when you lose your engines in a combat situation.

NAVIGATION

Your list of waypoints is available on a Multi-Function Display (MFD), and it is visible when you first enter your helicopter. The highlighted waypoint is your first destination. Beneath the waypoint name is its relative distance and *bearing*. The bearing is the waypoint's direction relative to the direction you are facing. The direction is shown in degrees on a circle, with positive degrees to the right, negative degrees to the left. For example: bearing 0 is straight ahead, 90 is 90 degrees to your right, -90 is 90 degrees to your left, and both 175 and -175 are almost directly behind you.

At the top of the Head Up Display (HUD) in the cockpit window is a compass (except for the Black Hawk, which has a mechanical compass). Under this compass is an arrow that points in the direction of the highlighted waypoint. Steer your helicopter so the arrow is lined up with the center tick mark of the compass, and you're flying directly toward your next waypoint. Note: if the waypoint isn't within 15 degrees of straight ahead, the arrow stops on the side of the compass that you should turn toward.

If you want to highlight a different waypoint so you can use the HUD arrow to navigate, press **W** until the waypoint you want is highlighted.

ENEMY AVOIDANCE AND COUNTERMEASURES

Recognizing how vulnerable your helicopter is to enemy fire is the first step in understanding the importance of not engaging the enemy head-to-head. The first, best defense against enemy attack is avoiding detection. This is best done by flying NOE and staying as far as you can from enemies on your Radar Warning Receiver (RWR). Take the time to fly around potential hotspots on the way to your mission waypoint — the enemy is close enough so fuel consumption is not a problem, and as far as your mission objectives are concerned, it's better late than never.

If you do get pulled into combat, your Countermeasures Panel is your best friend. When an enemy spots you on radar or infrared, the appropriate Search light comes on, telling you if the search is by radar or infrared. This is your invitation to increase the distance

between you and any enemies you suspect might be on to you. Reduce altitude if you can. Avoiding this initial detection is important for two reasons. Most immediate, you avoid taking hits from nearby enemy vehicles. Secondly, when the enemy knows your position, they vector aircraft into the area to intercept you.

Guns are unguided, but if the enemy is using radar to aim their guns, they fire ahead of you, or *lead* you with their guns. Fly zigzags to confound this technique. If the enemy is not using radar, they are firing *directly* at you. Fly across their field of view to avoid getting hit.

If an enemy starts tracking you, the appropriate Tracking light comes on, telling you if the track is by radar or infrared. This means your enemy has a target lock on your signature. Turn on your jammers to scramble the enemy's target lock; **I** for the infrared jammers, or **R** for the radar jammers, depending on the target lock type. A few seconds after the enemy gets a target lock on you, he will zero in on your position and fire.

If the enemy fires a guided missile at you, the appropriate Guidance light comes on, telling you if the target lock is on your radar or infrared signature. If it's a radar lock, quickly dump chaff by pressing **C**. If it's an infrared lock, quickly drop a flare by pressing **F**. Immediately after dropping a decoy, change course. Watch your RWR to see if the missile is still bearing down on you. If your countermeasures are successful, the color of the missile on your RWR changes from guided to unguided. Drop more decoys and fly evasively as required. Take cover if any buildings or hills are nearby.

When you are out of danger, be sure to turn off your jammers by pressing **R** or **I** again. Jammers are broadcasters effective at scrambling a target lock on an inbound missile, but they will reveal your location when you are trying to remain undetected. Enemies will be able to get a search lock on you from farther away if your jammers are on.

WEAPON TARGETING AND FIRING

Select your weapon by pressing **[** or **]**. The name of the selected weapon appears on your HUD in the lower left corner. (It also appears in the Fire Control Panel of the Apache and Black Hawk, or the MFD of the Osprey and LHX.) Choose the right weapon for the right job. Unless you have no choice, fire your air-to-air missiles at enemy aircraft and launch

your air-to-ground missiles at enemy ground targets. If you're going to strafe tents, use the machine gun — missiles will go right through the fabric and explode somewhere else.

Press **Enter** to track the first available target on the left. Repeatedly pressing **Enter** cycles through all the available targets from left to right, and then starts over again on the left. For more controllable tracking, press ' (apostrophe) to track the target closest to the center crosshair on your HUD. Precise target selection is important, because you must first take out the targets that pose the greatest threat to your helicopter and your mission.

If you have a target (or a smoking crater) in your Multi-Function Display (MFD) camera view, and you want to return that instrument display to your waypoint list, press the key that changes that MFD. See the "Flight Instruments" section of the helicopter you're flying for information on changing MFD displays.

When you are tracking a target, a square appears over it on the HUD. You can only track targets in your field of vision, though you can change your view angle by pressing the cursor keys (keyboard users must press **Ctrl** and the cursor keys). When the target comes within range of your selected missile, a diamond appears on the tracking square indicating you have a target lock (only if your selected hardpoint has guided missiles — guns do not give you a target lock, neither do empty hardpoints). A percent chance of hitting the target appears on the HUD either above the selected weapon or under the target lock, depending on the helicopter. If you are tracking a target, but aren't getting a target lock when you think you should be, make sure your weapon is a missile and not a gun, and make sure the hardpoint you've selected is not out of missiles.

Fire the weapon by pressing the fire button on the control device you're using. What you do next depends on the weapon you fired.

Sidewinders and Stingers

These missiles are most effective against aircraft and personnel, and ineffective against armor or structures. They are infrared-seeking fire-and-forget weapons. As soon as one is fired, it homes in on the heat source of its target and requires no assistance from you. This makes it possible for you to quickly fire multiple air-to-air missiles at different targets.

Hellfires

Hellfires are laser guided air-to-ground missiles specifically designed to pierce armor, but they are also effective against slow-moving aircraft. A laser designator on your helicopter illuminates the target, and the missile homes in on the reflection. This means that you must hold your target lock on the target until the missile reaches the target. If you target something else while the Hellfire is in flight, the missile will turn and home in on the new target. This makes it impossible to quickly fire multiple Hellfires at different targets because they will all go to the currently illuminated target. Also, if the target moves out of your field of vision, out of range, or makes you lose your target lock for any reason, the Hellfires lose their laser guidance.

The advantage of dynamic laser guidance is that you can lock onto the target *after* you launch your missile. This makes it possible to hide from the target behind an obstacle, fire your Hellfire, and then leave your cover to illuminate the target at the last moment. You can also illuminate the target from cover by selecting the Mast view (on the Osprey and LHX only) so you can see your target while the bulk of your helicopter remains hidden. These procedures minimize the time the enemy has to retaliate.

TOWs

TOWs are designed to pierce armor. They are wire-guided air-to-ground missiles steered by the pilot. As soon as the TOW is fired, control of the missile is transferred to the flight stick. Guiding a TOW is like flying an airplane: push the flight stick forward to dive, pull it back to climb, move it side to side to turn. The missile explodes when it strikes a target, if you press the fire button again, or after 20 seconds when the missile runs out of propellant. The number of seconds of propellant remaining is shown in the upper left corner of your HUD. The drawback to this missile is that you can only have one TOW in flight at a time — pressing the fire button again detonates the current missile instead of firing another one.

TOWs give you the advantage of firing missiles and guiding them to their targets manually, without exposing yourself to return fire. You can also fire them while watching the target with the missile camera. To fire a TOW from cover, press **F10** before firing and your view will change to the missile camera when you fire the weapon. Steer it around the obstacles that protect you and fly it to the target. If it looks like you're going to miss the target, press the fire button again so you can fire another missile.

Guns and Rockets

Guns are fired in bursts of more than one round, with one tracer to show the ammunition's flight path. Although guns and rockets do not give you a target lock, because they aren't guided weapons, most of them are fired toward the tracked target. All guns and rockets are semi-automatic, requiring you to press the fire button repeatedly to fire multiple bursts.

Unaimed weapons include the 57mm FFAR rockets, the 7.63mm guns on the Black Hawk, and the 25mm x 5 wing guns on the Osprey. These weapons always fire straight ahead from the helicopter and do not track the current target. You must orient your helicopter to face the target directly, lining up the HUD center crosshair on the target, before firing.

The chain gun in the Apache fires armor-piercing rounds, and it is effective against all targets. The guns on the other helicopters are less effective against armor and structures. The best weapon to fire on structures are the 57mm FFAR rockets, and they have a proximity fuse that makes them effective even when not carefully aimed.

FLYING A MISSION

Your greatest challenge while flying to your mission target is to avoid detection. Fly as low as you can, and watch for ground turbulence that will push your nose into the ground. If the turbulence is too bad, slow down. Don't waste your ammunition on secondary targets even if they're easy kills. Remember, Mission First. Wasting resources on nonessential targets can jeopardize not only your mission, but your chances of coming home.

As you fly, periodically press **Enter** to show any targets in front of you that don't appear on your Radar Warning Receiver (RWR), like ground troops with missile launchers.

When flying into a hot LZ (landing zone), take out the enemy radar vehicles first. Many of the surrounding vehicles depend on them for target search/tracking support. When you arrive at your mission waypoint, you must target enemies to activate the camera view. If the target your weapon is locked on to is the mission goal, the message [MISSION GOAL] appears in the camera. Complete your mission. Don't forget, you might have multiple targets at each mission waypoint. And be sure to save some ammo for the trip home.

If your mission is to pick up men, hover directly above the man (you might find it helpful to select an exterior view by pressing **F4**) and reduce altitude to less than ten feet. The man

will climb on board. If your mission is to drop off supplies, hover close to the ground and press **X** when you are over the target waypoint. If you drop it out of the target area, land next to it and press **Z** to pick it up again. Hover over the correct location more carefully this time, nose into the wind, and drop it again.

When you land at the destination airstrip, in a few seconds you are taken to the debriefing. If you are unable to complete your mission and want to abort, press **Ctrl-Q**. If you're picked up, you are taken straight to the debriefing. Aborting your mission over enemy territory is dangerous. If you get rescued, you'll make it back to the debriefing. Otherwise you'll end up dead or MIA.

COCKPIT CONTROLS

Backspace	Toggle cockpit on and off (only available in cockpit and mast views)
G	Toggle landing gear up and down
[or]	Select weapon
Space, **Button 0**	Fire selected weapon
Enter, **Button 1**	Select next target to the right of current target
'	Select target closest to aiming crosshair
C	Drop chaff cartridge
F	Drop flare
R	Toggle radar jammers on and off
I	Toggle infrared jammers on and off
+	Increase visual magnification
-	Decrease visual magnification
,	Decrease RWR magnification
.	Increase RWR magnification
A	Activate next mode on the left-most MFD
Shift-A	Activate previous mode on the left-most MFD
S	Activate next mode on the second MFD to the right (LHX, Osprey only)
Shift-S	Activate previous mode on the second MFD to the right (LHX, Osprey only)

D	Activate next mode on the third MFD to the right (LHX only)
Shift-D	Activate previous mode on the third MFD to the right (LHX only)
Ctrl-A	Enter Config mode on the left-most MFD
Ctrl-S	Enter Config mode on the second MFD to the right (LHX, Osprey only)
Ctrl-D	Enter Config mode on the third MFD to the right (LHX only)
W	Highlight the next waypoint on your MFD
Shift-W	Highlight the previous waypoint on your MFD
X	Drop supplies
Z	Pick up supplies
T	Toggle time compression 2x (makes time go by twice as fast)
V	Toggle Helicopter/Airplane mode on Osprey.
Ctrl-P	Pause the game. Press any key to resume.
Ctrl-Q	Abort mission.
Ctrl-R	Resupply weapons (cheat). This forfeits all the points you get in the mission.
Esc	Toggle the Flight Menu on and off.

FLIGHT MENU OPTIONS

Bolt-Down Menus are available during flight to let you change various aspects of the simulation. Active options have a check mark next to them. Some options can be selected with a keyboard command; these keys appear after the option on the menus in the game. To make a selection:

1. Press **Esc** to display the Bolt-Down Menus.
2. Press the right or left cursor key (← or →) to display each menu.
3. Press the up or down cursor key (↑ or ↓) to highlight the option you want to select. Press **Home** or **End** to get to the top or bottom of the list.
4. Press **Enter** to select that option.

If you decide not to make a selection, press **Esc** again to hide the Bolt-Down Menus.

? Menu

End Mission (Ctrl-Q) Ends the mission and returns you to the Ready Room.

Exit to DOS (Ctrl-C)	Leaves the program and exits to DOS after you confirm the command by pressing **Y**.
About LHX...	Displays info about the program and the copyright notice.

SOUND Menu

Sound	Sound is on.
No Sound	Sound is off.
Background Sounds	The engine and rotor noise are on.
Missile Warning Sounds	A warning siren will come on when an inbound enemy missile has a guidance lock on you. A radar lock gives high pitched tones, and an IR lock gives high and low pitched tones.

CONTROL Menu

Keyboard	Your helicopter is controlled with the keyboard.
Joystick	Your helicopter is controlled with the joystick.
Mouse	Your helicopter is controlled with the mouse.
Slow Mouse	Your helicopter is controlled with the mouse, with a slower response time. You should select this option if you have a high precision mouse, or if your mouse control is too sensitive.

VIEW Menu

Cockpit (F1)	Through the cockpit (default).
Mast (F2)	From the mast above the cockpit. (Only LHX, Osprey)
Map (F3)	Mission Waypoint map.
Right Side (F4)	At the right side of your helicopter.
Left Side (Shift-F4)	At the left side of your helicopter.
Chase Plane (F5)	Following your helicopter.
Front (Shift-F5)	At the front of your helicopter.
Ground (F6)	From a point on the ground.
Circling (Shift-F6)	Circling around your helicopter.
Player → Target (F7)	From behind your helicopter, facing target. (If you've

selected a target.)

Target → Player (F8) From behind target, facing your helicopter. (If you've selected a target.)

Satellite (F9) From satellite. Select again to zoom out. Press **Shift-F9** repeatedly to zoom in.

Missile (F10) Forward view from your fired weapon.

Target (Shift-F10) Through the target's cockpit. (If you've selected a target.)

Zoom In (+) Increase screen magnification (64x max)

Zoom Out (-) Decrease screen magnification (1x min)

SIM Menu

Low Detail Display minimum detail to increase simulation speed.

Medium Detail Add certain details.

High Detail Include all details.

Slow Cockpit Updates the cockpit flight instruments infrequently, to speed up simulation.

Medium Cockpit Updates the cockpit flight instruments more often.

Fast Cockpit Updates the cockpit flight instruments most frequently.

Set Default CRT Config Reset MFD(s) configuration to the default setting(s).

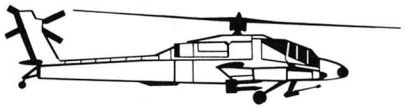
Easy Landings Lets you land without crashing no matter how badly you do it. Selecting this option substantially reduces your score.

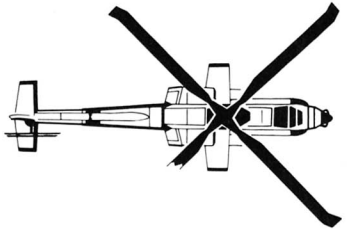
Always Show HUD Info Display the HUD even when you select a view that isn't through the cockpit.

Zoom To/From Briefing Zoom to and from your helicopter before and after your mission.

Eliminate Flicker Turn this option on if your screen flickers.

MCDONNELL DOUGLAS AH-64A APACHE





Anti-Armor Attack Helicopter

Crew	2
Main rotor diameter	14.6 m
Tail Rotor diameter	2.79 m
Length excl. rotor	14.7 m
Height excl. rotors	5.5 m
Weight (take off)	6,500 kg
Max level speed	365 km/hr (228 mph) @ sea level
Range	689 km
Ceiling (Hover-OGE)	2,440 m (8,000 ft)

In the early 1960s the U.S. Army wanted to procure a dedicated armed helicopter that could fly hazardous attack missions at any hour in any weather. In 1976, the Army awarded Hughes (a subsidiary of McDonnell Douglas since 1984) a contract to build a two-seat anti-armor attack helicopter. Following protracted negotiations about virtually thousands of large and small design alterations, the AH-64 Apache finally went into production in 1982.

As an engine performance specification, the Army demanded that the helicopter achieve a vertical climb rate of 450 fpm (feet per minute) in 95 degree heat at 4,000 feet. Apache achieves 1,450 fpm (1,000 fpm more than the Army required), the unequalled maneuverability envelope which ranges from +3.5g to -0.5g makes the Apache capable of performing very rapid changes in flight path when flying close to the ground or in air-to-air combat without overloading the structure.

In general the helicopter is a conventional design, with an all metal semi-monocoque fuselage and stainless-steel/fiberglass rotor blades. Where it parts company with and outstrips its predecessors of similar design is in its survivability. With its IR-suppressed engines, comprehensive EW (electronic warfare) installations, and most importantly an airframe and systems designed to live through medium-sized projectile strikes, the aircraft exemplifies capability and survivability.

The Apache's airframe has a high ballistic tolerance. It is designed to be completely invulnerable to 12.7mm armor-piercing incendiary rounds. Individual components will survive a hit by a single 23mm high explosive incendiary projectile. The aircraft's survivability ratio is further increased by redundancy and separation of critical parts, isolation of sensitive components, fire resistant subsystems, and armor plating. After most hits an Apache should be able to fly an additional 30 minutes, to complete its mission and return to base. It has an excellent recovery rating after crash landings.

It appeared to our investigators that the Apache is about to become the F-15 of the helicopter world; it provides its users with great flexibility, adaptability, and performance. Terrain masking, standoff strike range, and electronic countermeasures with a heavy weapons load make the Apache an unequalled strike force.

AVIONICS

The basic Apache avionics equipment package includes advanced lightweight Doppler radar with AHRS (Attitude/Heading Reference System), which permits nap-of-earth (NOE—flying at high speed close to the ground, following the contours of the earth) navigation and provides for simplified storage and retrieval of exact target locations. Survivability equipment includes state-of-the-art radar jammers (ECM—Electronic Countermeasures), passive radar warning receiver, Sanders infrared countermeasure (IRCM) installations and chaff/flare dispensers.

Hot gases streaming from turbine engines make many helicopters easy targets for enemy infrared (IR) guided missiles. Apache wraps its engines in a suppression system called Black Hole Ocarina (BHO) infrared suppression system. Cold external air is drawn in, circulated around the engine then mixed with the turbine exhaust. This cools the turbine gases so they're not easily detected by enemy heat-seeking missiles.

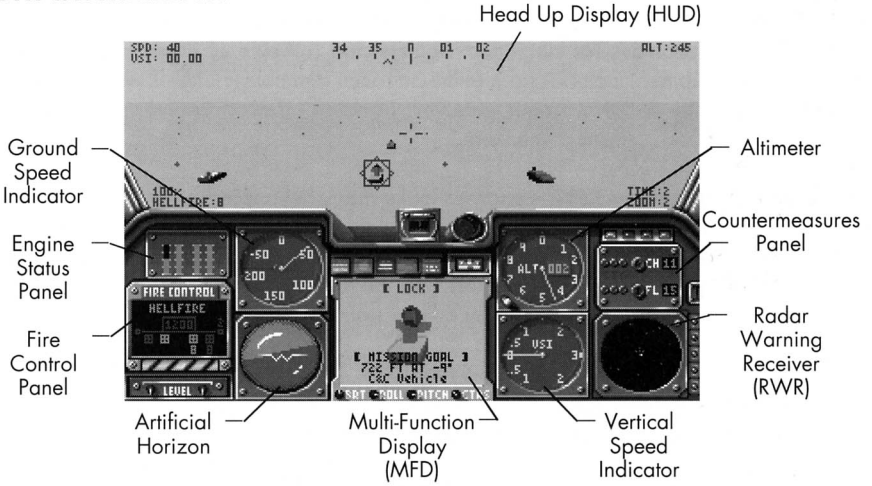
Perhaps the most technically advanced feature of Apache avionics is the TADS (Target Acquisition/Designation Sight). TADS consists of direct-view optics, a laser spot tracker, and a laser rangefinder/designator. TADS can also provide backup night vision to the pilot if his night vision sensor (PNVS) malfunctions. The PNVS is simply a forward-looking infrared sensor (FLIR), which sees objects ahead based on their temperatures. The FLIR information, like airspeed, radar altitude, and heading, is presented (superimposed) on

a monocle sight, which is part of the IHADSS (Honeywell's Integrated Helmet and Display Sighting System) headgear that both crew members wear. What they can see optically or electronically, they can target and hit.

ARMAMENTS

The Apache is a superb weapons platform and it has greatest delivery capability of any helicopter to date. Its armament consists of a remotely aimed M230 Chain Gun 30mm automatic cannon (maximum ammunition load of 1,200 rounds) located under the forward fuselage and ordnance stores carried beneath the fixed wings. The ordnance is comprised of four hardpoints, each of which can carry up to 4 Hellfire anti-tank missiles (maximum total of 16), 4 TOW anti-tank missiles (maximum total of 16), or 19 57mm folding fin aerial rockets (FFAR—maximum total of 76) in their launchers, or a combination of both Hellfires and FFARs. The Apache can also be fitted to carry Sidewinders (maximum total of 2) and Stingers (maximum total of 4) on its wingtips.

FLIGHT INSTRUMENTS



Apache Cockpit
(Figure 10)

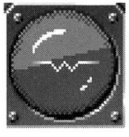
Ground Speed Indicator [Figure 11]
This gauge displays ground speed in miles per hour. If the needle moves clockwise, your helicopter is moving forward; if the needle moves counterclockwise, your helicopter is moving backward.

(Figure 11)

Altimeter [Figure 12]
This gauge displays altitude in feet. The digital readout reflects altitude in hundreds of feet, and the needle tells you how much higher than that you are. For example, the gauge shown here reads 245 feet; two hundred feet on the digital readout plus forty-five feet under the needle.

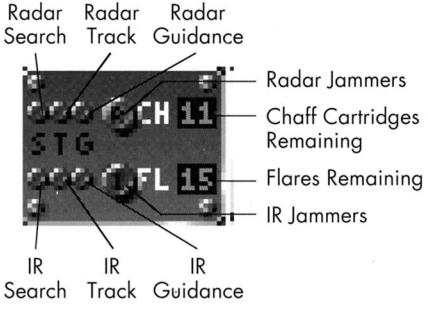
(Figure 12)

Artificial Horizon [Figure 13]
This instrument represents your helicopter's orientation with respect to the horizon. Use it when you cannot see the actual horizon due to darkness or bad weather. Your helicopter is the "W" in the center of the gauge, and the artificial horizon moves to represent the real horizon. If the artificial horizon is flat and level with the "W", you're flying straight and level. If the horizon moves up, your nose is pointed below the horizon and you're accelerating forward (or are flying forward at maximum speed). If the horizon moves down, your nose is pointed above the horizon and you're accelerating backward (or are flying backward at maximum speed).



(Figure 13)

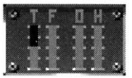
Countermeasures Panel
This panel displays the enemy weapons tracking you and the status of your countermeasures. The panel is divided horizontally; the top half pertains to radar tracking and countermeasures, and the bottom half pertains to infrared tracking and countermeasures.



Countermeasures Panel
(Figure 14)

Search Light (Top)	The enemy has detected you on radar.
Tracking Light (Top)	An enemy weapon is tracking your precise location on radar. The enemy will probably fire a weapon at you in seconds. Press **R** to turn on the radar jammer. The Radar Jammer Light goes on to confirm.
Guidance Light (Top)	The enemy fired a weapon that is locked onto your radar signature. As soon as you detect a guidance lock, press **C** to dispense a chaff cartridge to fool the weapon.
Search Light (Bottom)	The enemy has detected you on infrared.
Tracking Light (Bottom)	An enemy weapon is tracking your precise location on infrared. The enemy will probably fire a weapon at you in seconds. Press **I** to turn on the infrared jammer. The Infrared Jammer Light goes on to confirm.
Guidance Light (Bottom)	The enemy fired a weapon that is locked onto your infrared signature. As soon as you detect a guidance lock, press **F** to dispense a flare to fool the weapon.
Flare Count	The number of flares you have.
Chaff Count	The number of chaff cartridges you have.

Engine Status Panel [Figure 15]
The Engine Status Panel displays fuel level, throttle settings, and fluid pressures in your helicopter.



(figure 15)

T	Thrust setting, as a percentage of maximum engine power.
F	Fuel level, as a percentage of a full fuel load.
O	Engine oil pressure as a percentage of maximum pressure.
H	Flight control hydraulic pressure as a percentage of maximum pressure.

Running out of fuel makes your engines cut out immediately. Loss of oil pressure eventually burns out your engine. When you lose engine power for any reason, you must autorotate to land safely. See the "Autorotation" section in the *Tutorial* for a description of this procedure.

Loss of hydraulic pressure leads first to a reduction, and finally to a complete loss, of flight controls. When you lose control of your helicopter, you have little choice but to reduce thrust and set down.

Fire Control Panel [Figure 16]
This panel displays the number of weapons remaining on your aircraft, the hardpoints they occupy, and the currently selected weapon. The boxed number indicates the rounds remaining in your internal gun. The numbers under the hardpoints represent the total number of weapons for that hardpoint on both sides of the fuselage. Your onboard weapons computer automatically fires from both sides of your helicopter in turn to keep the weight distribution roughly equal. If a hardpoint is damaged in combat and becomes unusable, the name of that hardpoint's weapon reads "*DAMAGED*" when you select it.

(Figure 16)

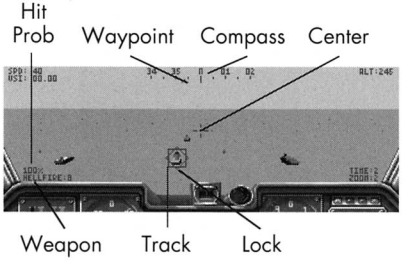
Press **[** or **]** to cycle through your weapons. The highlighted weapon is selected, and it discharges when you press the fire button. The symbols for the weapons are as follows:

▫	Sidewinders, Stingers
⊞	HELLFIREs, TOWs
●	57mm FFARs

Head Up Display
Superimposed on your forward view is your Head Up Display (HUD), which allows you to see various important flight data without looking down into your cockpit.

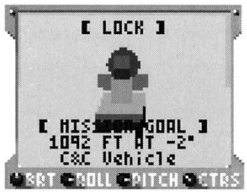
[See Figure 17]

HUD symbology in the Apache is as follows:



Apache HUD
(Figure 17)

SPD	Forward ground speed in miles per hour. This number is positive when flying forward, negative when flying backwards.
VSI	Vertical speed in thousands of feet per minute. This number is positive when ascending, negative when descending.
ALT	Altitude in feet.
TIME:2	Time compression is on — everything is happening at twice normal speed. Press **T** to toggle on and off.
ZOOM	Optical zoom magnification: 1x, 2x, 4x, 8x, 16x, 32x, and 64x.
COMPASS	Your heading in degrees, with N, E, S, and W indicating the four compass points.
WAYPOINT	Align this arrow with the center tick mark to fly toward your highlighted waypoint.
CENTER	The centerline of your helicopter.
WEAPON	Your selected weapon and number of rounds remaining.
HIT PROB	Probability that selected weapon will hit current target.
TRACK	This square is superimposed over the target you're currently tracking with your selected missile.
LOCK	This target-lock diamond is superimposed on the tracked target when it comes within range of your selected guided missile.



Camera View MFD Setting (Figure 18)

Multi-Function Display
The Multi-Function Display (MFD) is a video monitor, also called a CRT (Cathode Ray Tube), that can be configured by the pilot to display different information screens. In the AH-64A Apache, there are three possible displays: a target camera, a mission waypoints list, and a damage report screen.

Camera View (CAMERA): A video image along with range, bearing, and status information of the target you're currently tracking. If your current target is your mission goal, the display [MISSION GOAL] appears on the camera view.

[See Figure 18]

Mission Waypoints (WAYPTS): Your list of mission waypoints, along with range and bearing information for each waypoint.

[See Figure 19]

Damage Report (DAMAGE): Displays a list of all your primary systems. Highlighted systems are damaged and nonfunctional.

[See Figure 20]

The systems are as follows:

MN ROTOR	Main Rotor
TL ROTOR	Tail Rotor
L ENGINE	Left Engine
R ENGINE	Right Engine
OIL	Engine Oil System
HYD	Hydraulic Control System
FUEL	Fuel Tanks and Lines
CONTROLS	Flight Controls
SENSORS	Countermeasures Tracking Sensors
JAMMERS	Radar and Infrared Electronic Counter Measures
CHFF	Chaff Dispensers
FLR	Flare Dispensers
HARDPT1	Hardpoint1 and its weapons load
HARDPT2	Hardpoint2 and its weapons load
HARDPT3	Hardpoint3 and its weapons load
HARDPT4	Hardpoint4 and its weapons load

To configure your MFD: Press **Ctrl-A** to put the MFD in Config mode. A list of available displays appears on your MFD. Highlighted displays are ones you can access on this MFD. Press the number of a system to toggle it on and off; for example, press **5** to deselect DAMAGE, and leave the other two displays highlighted. Press the **spacebar** to leave Config mode.

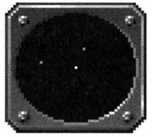
To use your MFD: Press **A** to change your MFD from one display to another. In the example, pressing **A** toggles between the Camera View and the Mission Waypoints

Mission Waypoints MFD Setting
(Figure 19)

Damage Report MFD Setting
(Figure 20)

screen because you turned off the Damage Report display when you configured the MFD. (You must be tracking a target to see a Camera View. Maneuver your helicopter so a target is visible, and then press **Enter** to track it and see a Camera View.)

To restore your MFD to its default configuration, select Set Default CRT Config on the SIM menu.

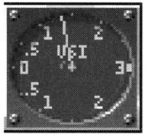


(Figure 21)

Radar Warning Receiver [Figure 21]
Your Radar Warning Receiver (RWR) displays potential threats in your area. Your RWR does not distinguish between allied and enemy targets. Remember that you may be flying over civilian airspace, so check your targets carefully. The color code is as follows:

Target Type	EGA, MCGA, TANDY	CGA
Missile with lock	Yellow	White
Missile without lock	Red	Magenta
Ground target (tank, etc.)	Brown	Magenta
Aircraft above you	Light cyan	Cyan
Aircraft below you	Dark cyan	Cyan

Note: Some targets in the area do not have a sufficiently strong signature to be detected by your RWR, so do not trust it 100 percent. And enemy infantry armed with automatic weapons or portable SAMs (Surface-to-Air Missiles) never appear on your RWR.



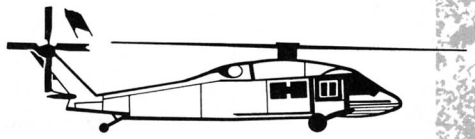
(Figure 22)

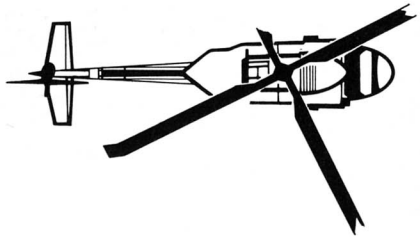
Vertical Speed Indicator [Figure 22]
This gauge displays vertical speed in thousands of feet per minute to a maximum of 3,000. If the needle moves clockwise, your helicopter is ascending; if the needle moves counterclockwise, your helicopter is descending.

SIKORSKY UH-60A BLACK HAWK

Multi-Role Utility Transport Helicopter

Crew	3
Main rotor diameter	16.4 m
Tail Rotor diameter	3.35 m
Length excl. rotor	19.8 m
Height excl. rotors	5.1 m
Weight (take off)	7,375 kg
Max level speed	296 km/hr (185 mph) @ sea level
Range	373 km
Ceiling (Hover-OGE)	1,830 m (6,000 ft)





In 1967 the U.S. Army requested manufacturers' designs for a UTTAS (Utility Tactical Transport Aircraft System) in the 10-ton class, which would be capable of carrying an 11-man infantry squad and its equipment. This new design would replace the serviceable but aging UH-1 Iroquois helicopter fleet. In 1976, three prototypes were built and Sikorsky's S-70 design, named Black Hawk, was judged the best. At this writing over 1000 S-70s, in various versions and configurations, have been delivered to the U.S. Armed Forces, and several hundred modified Black Hawks are currently being used by off-shore military agencies, foreign governments, and in civilian commercial applications.

AVIONICS

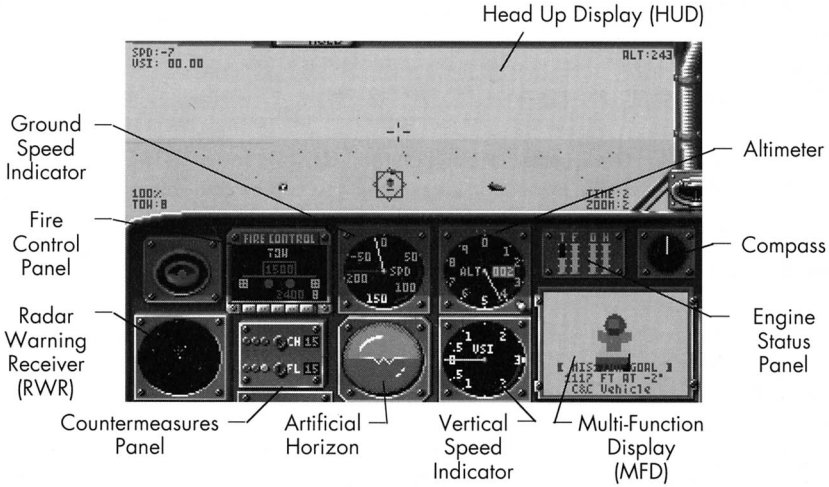
The basic equipment package includes advanced Doppler radar and automatic direction finding (ADF), secure voice radio, Quick Fix IIB electronic countermeasure (ECM) installations designed to intercept, monitor, and jam enemy battlefield communications, and the Tracor XM130 chaff dispenser. A new HIRSS (Hover Infra-Red Suppressor Subsystem) is designed to work specifically in hovering flight, so that the Black Hawk presents a smaller target for heat seeking missiles. Older models have been retrofitted with this device.

ARMAMENTS

The Black Hawk's armament consists of a 7.62 mm automatic cannon (maximum

ammunition load of 1,500 rounds) located under the forward fuselage and ordnance stores carried in the External Stores Support System (ESSS) beneath the fixed wings. The ordnance is comprised of four hardpoints, each of which can carry up to 4 TOW anti-tank missiles (maximum total of 16), 19 57mm folding fin aerial rockets (FFAR—maximum total of 76) in their launchers, 2 AIM-9L Sidewinders (maximum total of 4), 4 Stingers (maximum total of 8), an M60 7.62 mm five barrel automatic cannon (maximum ammunition load of 2,400 rounds), or a combination of the above.

FLIGHT INSTRUMENTS



Black Hawk Cockpit
(Figure 23)

(Figure 24)

Ground Speed Indicator [Figure 24]
This gauge displays ground speed in miles per hour. If the needle moves clockwise, your helicopter is moving forward; if the needle moves counterclockwise, your helicopter is moving backward.

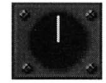
Altimeter [Figure 25]
This gauge displays altitude in feet. The digital readout reflects altitude in hundreds of feet, and the needle tells you how much higher than that you are. For example, the gauge shown here reads 245 feet; two hundred feet on the digital readout plus forty-five feet under the needle.

(Figure 25)

Artificial Horizon [Figure 26]
This instrument represents your helicopter's orientation with respect to the horizon. Use it when you cannot see the actual horizon due to darkness or bad weather. Your helicopter is the "W" in the center of the gauge, and the artificial horizon moves to represent the real horizon. If the artificial horizon is flat and level with the "W", you're straight and level. If the horizon moves up, your nose is pointed below the horizon and you're accelerating forward (or are flying forward at maximum speed). If the horizon moves down, your nose is pointed above the horizon and you're accelerating backward (or are flying backward at maximum speed).

(Figure 26)

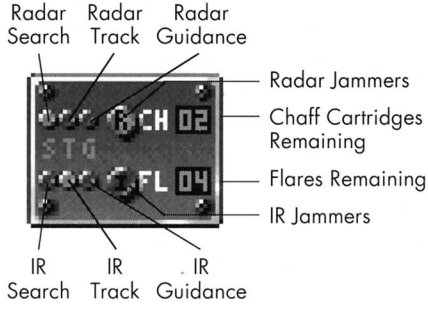
Compass [Figure 27]
Magnetic North (or a heading of 0 degrees) on the compass is straight up.



(Figure 27)

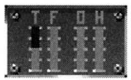
Countermeasures Panel
This panel displays the enemy weapons tracking you and the status of your countermeasures. The panel is divided horizontally; the top half pertains to radar tracking and countermeasures, and the bottom half pertains to infrared tracking and countermeasures.

Countermeasures Panel
(Figure 28)



Search Light (Top)	The enemy has detected you on radar.
Tracking Light (Top)	An enemy weapon is tracking your precise location on radar. The enemy will probably fire a weapon at you in seconds. Press **R** to turn on the radar jammer. The Radar Jammer Light goes on to confirm.
Guidance Light (Top)	The enemy fired a weapon that is locked onto your radar signature. As soon as you detect a guidance lock, press **C** to dispense a chaff cartridge to fool the weapon.
Search Light (Bottom)	The enemy has detected you on infrared.
Tracking Light (Bottom)	An enemy weapon is tracking your precise location on infrared. The enemy will probably fire a weapon at you in seconds. Press **I** to turn on the infrared jammer. The Infrared Jammer Light goes on to confirm.
Guidance Light (Bottom)	The enemy fired a weapon that is locked onto your infrared signature. As soon as you detect a guidance lock, press **F** to dispense a flare to fool the weapon.
Flare Count	The number of flares you have.
Chaff Count	The number of chaff cartridges you have.

Engine Status Panel [Figure 29]
The Engine Status Panel displays fuel level, throttle settings, and fluid pressures in your helicopter.



(Figure 29)

T Thrust setting, as a percentage of maximum engine power.
F Fuel level, as a percentage of a full fuel load.
O Engine oil pressure as a percentage of maximum pressure.
H Flight control hydraulic pressure as a percentage of maximum pressure.

Running out of fuel makes your engines cut out immediately. Loss of oil pressure eventually burns out your engine. When you lose engine power for any reason, you must autorotate to land safely. See the *Autorotation* section for a description of this procedure.

Loss of hydraulic pressure leads first to a reduction, and finally to a complete loss, of flight controls. When you lose control of your helicopter, you have little choice but to reduce thrust and set down.

Fire Control Panel [Figure 30]
This panel displays the number of weapons remaining on your aircraft, the hardpoints they occupy, and the currently selected weapon. The boxed number indicates the rounds remaining in your internal gun. The numbers under the hardpoints represent the total number of weapons for that hardpoint on both sides of the fuselage. Your onboard weapons computer automatically fires from both sides of your helicopter in turn to keep the weight distribution roughly equal. If a hardpoint is damaged in combat and becomes unusable, the name of that hardpoint's weapon reads "*DAMAGED*" when you select it.

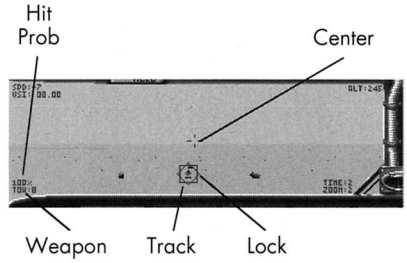
(Figure 30)

Press [or] to cycle through your weapons. The highlighted weapon is selected, and it discharges when you press the fire button. The symbols for the weapons are as follows:

▫	Sidewinders, Stingers
⊞	HELLFIREs, TOWs
●	57mm FFARs, 7.62 x 5 Wing Guns

Head Up Display
Superimposed on your forward view is your Head Up Display (HUD), which allows you to see various important flight data without looking down into your cockpit.

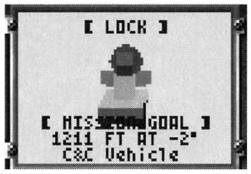
[See Figure 31]



Black Hawk HUD
(Figure 31)

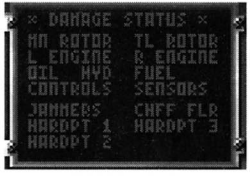
HUD symbology in the Black Hawk is as follows:

SPD — Forward ground speed in miles per hour. This number is positive when flying forward, negative when flying backwards.



Camera View MFD Setting
(Figure 32)

Mission Waypoints MFD Setting
(Figure 33)



Damage Report MFD Setting
(Figure 34)

VSI	Vertical speed in thousands of feet per minute. This number is positive when ascending, negative when descending.
ALT	Altitude in feet.
TIME:2	Time compression is on — everything is happening at twice normal speed. Press **T** to toggle on and off.
ZOOM	Optical zoom magnification: 1x, 2x, 4x, 8x, 16x, 32x, and 64x.
HIT PROB	Probability that selected weapon will hit current target.
CENTER	The centerline of your helicopter.
WEAPON	Your selected weapon and number of rounds remaining.
TRACK	This square is superimposed over the target you're currently tracking with your selected missile.
LOCK	This target-lock diamond is superimposed on the tracked target when it comes within range of your selected guided missile.

Multi-Function Display
The Multi-Function Display (MFD) is a video monitor, also called a CRT (Cathode Ray Tube), that can be configured by the pilot to display different information screens. In the UH-60A Black Hawk, there are three possible displays: a target camera, a mission waypoints list, and a damage report screen.

Camera View (CAMERA): A video image along with range, bearing, and status information of the target you're currently tracking. If your current target is your mission goal, the display [MISSION GOAL] appears on the camera view.
[See Figure 32]

Mission Waypoints (WAYPTS): Your list of mission waypoints, along with range and bearing information for each waypoint.
[See Figure 33]

Damage Report (DAMAGE): Displays a list of all your primary systems. Highlighted systems are damaged and nonfunctional.
[See Figure 34]

The systems are as follows:

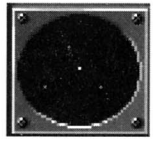
MN ROTOR	Main Rotor
TL ROTOR	Tail Rotor
L ENGINE	Left Engine
R ENGINE	Right Engine
OIL	Engine Oil System
HYD	Hydraulic Control System
FUEL	Fuel Tanks and Lines
CONTROLS	Flight Controls
SENSORS	Countermeaures Tracking Sensors
JAMMERS	Radar and Infrared Electronic Counter Measures
CHFF	Chaff Dispensers
FLR	Flare Dispensers
HARDPT1	Hardpoint1 and its weapons load
HARDPT2	Hardpoint2 and its weapons load
HARDPT3	Hardpoint3 and its weapons load

To configure your MFD: Press **Ctrl-A** to put the MFD in Config mode. A list of available displays appears on your MFD. Highlighted displays are ones you can access on this MFD. Press the number of a system to toggle it on and off; for example, press **5** to deselect DAMAGE, and leave the other two displays highlighted. Press the **spacebar** to leave Config mode.

To use your MFD: Press **A** to change your MFD from one display to another. In the example, pressing **A** toggles between the Camera View and the Mission Waypoints screen because you turned off the Damage Report display when you configured the MFD. (You must be tracking a target to see a Camera View. Maneuver your helicopter so a target is visible, and then press **Enter** to track it and see a Camera View.)

To restore your MFD to its default configuration, select Set Default CRT Config on the SIM menu.

Radar Warning Receiver [Figure 35]
Your Radar Warning Receiver (RWR) displays potential threats in your area. Your RWR does not distinguish between allied and enemy targets. Remember that you may be flying over civilian airspace, so check your targets carefully. The color code is as follows:



(Figure 35)

(Figure 36)

Target Type	EGA, MCGA, TANDY	CGA
Missile with lock	Yellow	White
Missile without lock	Red	Magenta
Ground target (tank, etc.)	Brown	Magenta
Aircraft above you	Light cyan	Cyan
Aircraft below you	Dark cyan	Cyan

Note: Some targets in your area do not have a sufficiently strong signature to be detected by your RWR, so do not trust it 100 percent. And enemy infantry armed with automatic weapons or portable SAMs (Surface-to-Air Missiles) never appear on your RWR.

Vertical Speed Indicator [Figure 36]
This gauge displays vertical speed in thousands of feet per minute to a maximum of 3,000. If the needle moves clockwise, your helicopter is ascending; if the needle moves counterclockwise, your helicopter is descending.

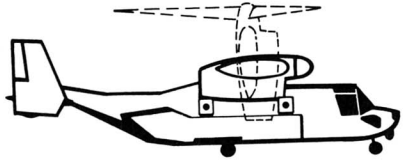
BELL/BOEING V-22 OSPREY

Multi-Mission VTOL Aircraft
Crew ..... 2 plus 12-24 passengers
Main rotor diameters ..... 11.5 m
Tail Rotor diameter ..... None — Tilt-Rotor technology
Length excl. nose gun ..... 17.5 m
Height excl. rotors ..... 6.15 m
Weight (VTOL) ..... 21,500 kg
Max level speed ..... 645 km/hr (403 mph) @ sea level
Range ..... 3,891 km
Ceiling (Hover-OGE) ..... 610 m (2,000 ft)

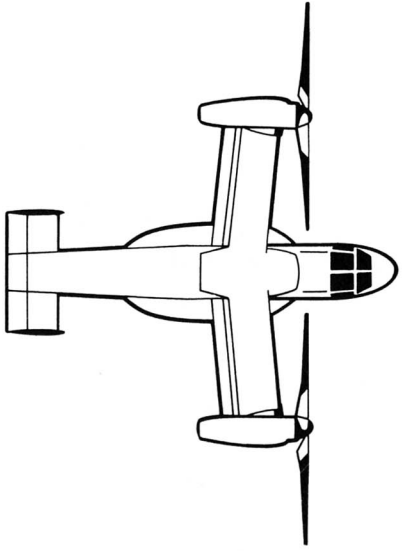
In 1973 NASA and the U.S. Army resurrected the idea for a plane that used tilting rotors for vertical takeoffs and landings (VTOL). The major advantage of such a flying vehicle is that it's a dynamic compromise between a helicopter and fixed wing-aircraft. It can hover and do many things helicopters are expected to do, and it can fly like an airplane after tilting the rotors full forward, so it's not subject to the inherent speed limitations of a

helicopter. That's an attractive and interesting idea, but hardly revolutionary. The concept was developed, tested, and then unexpectedly mothballed (for reasons known only to the Army) after the successful 1955 flight of the Bell XV-3 convertiplane.

Bell, in 1977, working under U.S. government contract and formal specifications, built and flew two tilt-rotor prototypes called the XV-15. These had twin engines on the wingtips, and the whole nacelle of each engine pivoted for vertical flight. Following highly successful test results, the decision was made (in 1983) to put the aircraft into production, adding an enlarged fuselage that could be used to transport special mission troops or cargo. This experimental aircraft became the V-22 Osprey.



Our investigation has discovered that an influential group of aviation industry insiders and Pentagon officials believe that the Osprey's wide-ranging capacities make it (or a similar aircraft) the best candidate to replace the majority of traditional helicopters in the not-too-distant future. The biggest obstacle currently is the Osprey's high cost of 40 million dollars, as opposed to 10 million dollars for conventional helicopters.



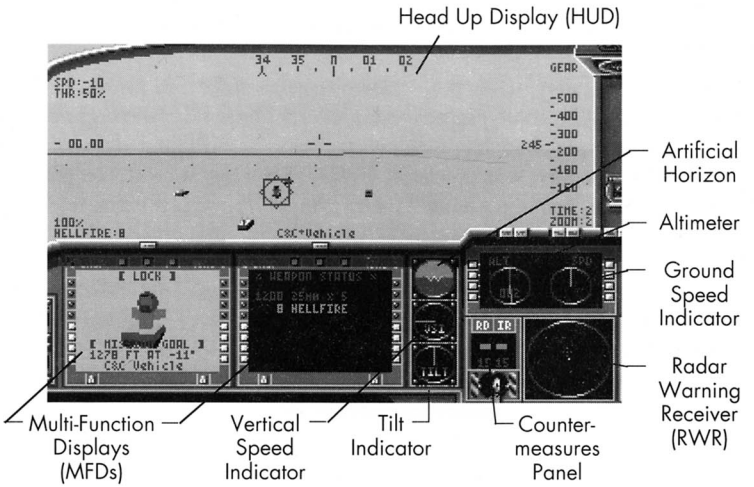
Avionics

The Osprey's hovering capabilities are understandably inferior to a traditional helicopter's, but its translational speed is so far superior to a helicopter's that this was considered an acceptable trade-off. Though it's not a true helicopter, strictly speaking, it does have conventional collective and cyclic pitch controls. Its elegantly designed rotors make it one of the quietest and most efficient flying vehicles ever. A quiet aircraft necessarily vibrates less, leading to a lower incidence of pilot fatigue. It also contributes to the Osprey's low observables or stealth characteristics. It possesses comprehensive, state-of-the-art electronic and infrared countermeasure (ECM/IRCM) installations.

Armaments

Armament for the Osprey consists of a remotely aimed GE GAU-12/U 25mm five-barrel gun (maximum ammunition load of 1,200 rounds) located under the forward fuselage, and ordnance stores carried beneath the fixed wings. The wings can each carry up to 4 Hellfire anti-tank missiles (maximum total of 8), 4 TOW anti-tank missiles (maximum total of 8), or 19 57mm folding fin aerial rockets (FFAR—maximum total of 38) in their launchers, 1 AIM-9L Sidewinder (maximum total of 2), 2 Stingers (maximum total of 4), or two additional GE GAU-12/U 25mm five barrel guns (maximum ammunition load of 2,500 rounds).

Flight Instruments



Osprey Cockpit
(Figure 37)

(Figure 38)

Ground Speed Indicator [Figure 38]
This gauge displays ground speed in miles per hour. If the needle moves clockwise, your helicopter is moving forward; if the needle moves counterclockwise, your helicopter is moving backward. The instrument is calibrated so the entire circumference equals 4,000 feet per minute.

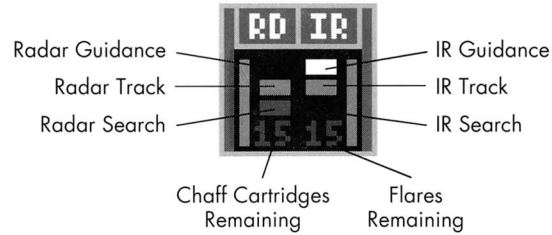
(Figure 39)

Altimeter [Figure 39]
This gauge displays altitude in feet. The digital readout reflects altitude in hundreds of feet, and the needle tells you how much higher than that you are. The gauge is calibrated evenly from 0 to 100 feet, clockwise. For example, the gauge shown here reads 245 feet; two hundred feet on the digital readout plus forty-five feet under the needle.

Artificial Horizon [Figure 40]
This instrument represents your helicopter's orientation with respect to the horizon. Use it when you cannot see the actual horizon due to darkness or bad weather. Your helicopter is the "W" in the center of the gauge, and the artificial horizon moves to represent the real horizon. If the artificial horizon is flat and level with the "W", you're straight and level. If the horizon moves up, your nose is pointed below the horizon and you're accelerating forward (or are flying forward at maximum speed). If the horizon moves down, your nose is pointed above the horizon and you're accelerating backward (or are flying backward at maximum speed).

(Figure 40)

Countermeasures Panel
This panel displays the enemy weapons tracking you and the status of your countermeasures. The panel is divided vertically; the left half pertains to radar tracking and countermeasures, and the right half pertains to infrared tracking and countermeasures.

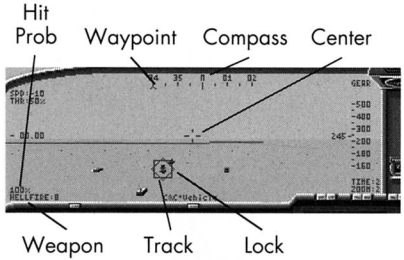


Countermeasures Panel
(Figure 41)

Search Light (Left) — The enemy has detected you on radar.

Tracking Light (Left) — An enemy weapon is tracking your precise location on radar. The enemy will probably fire a weapon at you in seconds. Press **R** to turn on the radar jammer. The Radar Jammer Light goes on to confirm.

Guidance Light (Left)	The enemy fired a weapon that is locked onto your radar signature. As soon as you detect a guidance lock, press **C** to dispense a chaff cartridge to fool the weapon.
Search Light (Right)	The enemy has detected you on infrared.
Tracking Light (Right)	An enemy weapon is tracking your precise location on infrared. The enemy will probably fire a weapon at you in seconds. Press **I** to turn on the infrared jammer. The Infrared Jammer Light goes on to confirm.
Guidance Light (Right)	The enemy fired a weapon that is locked onto your infrared signature. As soon as you detect a guidance lock, press **F** to dispense a flare to fool the weapon.
Flare Count	The number of flares you have.
Chaff Count	The number of chaff cartridges you have.



Osprey HUD
(Figure 42)

Head Up Display

Superimposed on your forward view is your Head Up Display (HUD), which allows you to see various important flight data without looking down into your cockpit.

[See Figure 42]

HUD symbology in the Osprey is as follows:

SPD	Forward ground speed in miles per hour. This number is positive when flying forward, negative when flying backwards.
THR	Vertical thrust applied by the helicopter's collective, as a percentage of maximum engine power.
VSI	Vertical speed in thousands of feet per minute. This number is positive when ascending, negative when descending.
ALT	On the left is your altitude in feet; on the right is the scale.
GEAR	Appears when your landing gear is down. Press **G** to toggle the gear

	up and down.
TIME:2	Time compression is on — everything is happening at twice normal speed. Press **T** to toggle on and off.
ZOOM	Optical zoom magnification: 1x, 2x, 4x, 8x, 16x, 32x, and 64x.
COMPASS	Your heading in degrees, with N, E, S, and W indicating the four compass points.
WAYPOINT	Align this arrow with the center tick mark to fly toward your highlighted waypoint.
CENTER	The centerline of your helicopter.
WEAPON	Your selected weapon and number of rounds remaining.
HIT PROB	Probability that selected weapon will hit current target.
TARGET	Target identification.
TRACK	This square is superimposed over the target you're currently tracking with your selected missile.
LOCK	This target-lock diamond is superimposed on the tracked target when it comes within range of your selected guided missile.

Multi-Function Display
The Multi-Function Displays (MFD) are video monitors, also called CRTs (Cathode Ray Tubes), that can be configured by the pilot to display different information screens in different locations. In the V-22 Osprey, there are five possible displays: a target camera, a mission waypoints list, a weapon status display, a damage report screen, and an engine status display.

Camera View (CAMERA): A video image along with range, bearing, and status information of the target you're currently tracking. If your current target is your mission goal, the display [MISSION GOAL] appears on the camera view.

[See Figure 43]

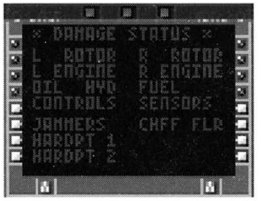
Mission Waypoints (WAYPTS): Your list of mission waypoints, along with range and bearing information about each waypoint.

[See Figure 44]

Camera View MFD Setting
(Figure 43)

Mission Waypoints MFD Setting
(Figure 44)

Weapon Status MFD Setting
(Figure 45)



Damage Report MFD Setting
(Figure 46)

Weapon Status (WEAPONS): This panel displays the number of weapons remaining on your aircraft, the hardpoints they occupy, and the currently selected weapon.

[See Figure 45]

The top weapon is your internal gun. The numbers next to the hardpoints represent the total amount of weapons for that hardpoint on both sides of the fuselage. Your onboard weapons computer automatically fires from both sides of your helicopter in turn to keep the weight distribution roughly equal. If a hardpoint is damaged in combat and becomes unusable, the name of that hardpoint's weapon reads "*DAMAGED*" when you select it.

Press **[** or **]** to cycle through your weapons. The highlighted weapon is selected, and it discharges when you press the fire button.

Damage Report (DAMAGE): Displays a list of all your primary systems. Highlighted systems are damaged and nonfunctional.

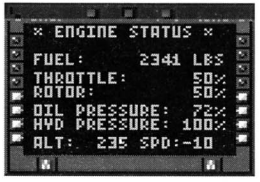
[See Figure 46]

The systems are as follows:

L ROTOR	Left Rotor
R ROTOR	Right Rotor
L ENGINE	Left Engine
R ENGINE	Right Engine
OIL	Engine Oil System
HYD	Hydraulic Control System
FUEL	Fuel Tanks and Lines
CONTROLS	Flight Controls
SENSORS	Countermeasures Tracking Sensors
JAMMERS	Radar and Infrared Electronic Counter Measures
CHFF	Chaff Dispensers
FLR	Flare Dispensers

HARDPT1	Hardpoint1 and its weapons load
HARDPT2	Hardpoint2 and its weapons load

Engine Status (ENGINE): The Engine Status Panel displays fuel level, throttle settings, and fluid pressures in your helicopter.



Engine Status MFD Setting
(Figure 47)

[See Figure 47]

The systems are as follows (all displayed as percentages of maximum):

FUEL	Fuel level
THROTTLE	Engine Throttle setting
ROTOR	Nacelle Tilt Rotors
OIL PRESSURE	Engine Oil Pressure
HYD PRESSURE	Hydraulic Control Pressure
ALT	Altitude
SPD	Ground speed in miles per hour.

Running out of fuel makes your engines cut out immediately. Loss of oil pressure eventually burns out your engine. When you lose engine power for any reason, you must autorotate to land safely. See the "Autorotation" section in the *Tutorial* for a description of this procedure.

Loss of hydraulic pressure leads first to a reduction, and finally to a complete loss, of flight controls. When you lose control of your helicopter, you have little choice but to reduce thrust and set down.

To configure your MFDs: Press **Ctrl-A** to put the left MFD in Config mode. A list of available displays appears on your MFD. Highlighted displays are ones you can access on this MFD. Press the number of a system to toggle it on and off; for example, press **5** to deselect DAMAGE, and leave the other two displays highlighted. Press the **spacebar** to leave Config mode.

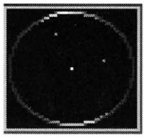
Configure the other MFD using the above procedure, but press **Ctrl-S** for the right

configuration screen. Dividing the functions between the MFDs is a useful way to organize your information to make it quickly accessible.

To use your MFDs: Press **A** to change your left MFD from one display to another. In the example, pressing **A** toggles between the Camera View and the Mission Waypoints screen because you turned off the Damage Report display when you configured the MFD. (You must be tracking a target to see a Camera View. Maneuver your helicopter so a target is visible, and then press **Enter** to track it and see a Camera View.)

To use your right MFD, press **S** as described above. If you group the functions of each MFD in categories, you can more easily remember where each function is and quickly display the information you want.

To restore your MFDs to their default configuration, select Set Default CRT Config on the SIM menu.



(Figure 48)

Radar Warning Receiver [Figure 48]
Your Radar Warning Receiver (RWR) displays potential threats in your area. Your RWR does not distinguish between allied and enemy targets. Remember that you may be flying over civilian airspace, so check your targets carefully. The color code is as follows:

Target Type	EGA, MCGA, TANDY	CGA
Missile with lock	Yellow	White
Missile without lock	Red	Magenta
Ground target (tank, etc.)	Brown	Magenta
Aircraft above you	Light cyan	Cyan
Aircraft below you	Dark cyan	Cyan

Note: Some targets in the area do not have a sufficiently strong signature to be detected by your RWR, so do not trust it 100 percent. And enemy infantry armed with automatic weapons or portable SAMs (Surface-to-Air Missiles) never appear on your RWR.

(Figure 49)

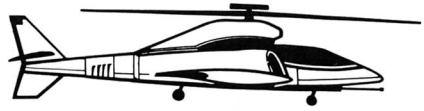
Tilt Indicator [Figure 49]
This indicator tells you the degree of tilt of your rotors. Straight up means you're hovering; straight right means you're flying forward at maximum rate.

Vertical Speed Indicator [Figure 50]
This gauge displays vertical speed in thousands of feet per minute to a maximum of 1,000. If the needle moves clockwise, your helicopter is ascending; if the needle moves counterclockwise, your helicopter is descending. The top half is calibrated from 0 to 1,000 clockwise; the bottom half is calibrated from 0 to -1,000 counterclockwise.

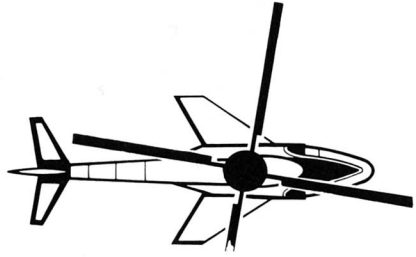
(Figure 50)

LHX (LIGHT HELICOPTER EXPERIMENTAL)

Scout/Attack (SCAT) Helicopter
Crew 1
Main rotor diameter ..... 11.5 m
Tail Rotor diameter ..... None — Ducted fan technology
Length incl. rotor ..... 15.23 m
Height ..... 3.77 m
Weight (take off) ..... 3,550 kg
Max level speed ..... 330 km/hr (206 mph) @ sea level
Range ..... 1,425 km
Ceiling (Hover-OGE) ..... 2,745 m (9,000 ft)



There is no doubt that the aerodynamic and structural efficiency of helicopters, as well as their general performance, can be improved with advanced composite structures in rotor blades and the fuselage, and also with computerized FBW (fly-by-wire) or FBL (fly-by-light) flight controls. With this fact in mind, the U.S. Army, in 1982, asked interested manufactures to submit designs for its proposed Light Helicopter Experimental (LHX) family of combat helicopters.



In the first set of required operational capabilities, the Army restricted design concepts to what might be called conventional helicopter technology, but it asked designers to push that technology to the limit. Although the Army reversed itself in 1986 and announced that tilt-rotor or other unconventional designs would receive thoughtful consideration, reliable DoD sources unanimously believe that high performance conventional helicopter designs have the inside track.

Initially reluctant suppliers warmed to the LHX when it was revealed that over 5,000 units would be required in only two variants, a scout/attack model (SCAT), and a utility vehicle

to replace aging Huey transport inventory. The later variant will be required to carry a squad of 6-8 fully armed troops. The SCAT is unarguably envisioned as the ultimate gunship for one, and this is the helicopter available to you for your missions. We will confine our descriptions to the SCAT LHX.

While no LHX has been seen by the public (except as drawing-board mockups), its general outlines and numerous specifications are known. There are persistent and intriguing rumors concerning the premature release of a SCAT prototype to a certain U.S. military agency, and there have been more than a half-dozen, albeit unconfirmed, sightings of the aircraft in both eastern Europe and North Africa. Regretfully, we cannot verify these rumors: but we also cannot deny them in good conscience.

The LHX has a number of advanced features that give it a high survivability factor. Most visible is the tail fan that replaces the traditional helicopter tail rotor. In conventional helicopters, the tail rotor is extremely susceptible to damage, even from small arms fire. In the LHX, a ducted fan pumps air out through vents in the tail to counteract the torque generated by the main rotor. This approach is not only less vulnerable to weapon fire, but it is much quieter, making the LHX more difficult to locate.

Avionics

The LHX is required to fly all-weather, day and night, NOE (nap-of-the-earth) missions. To achieve this it uses ADOCS (advanced digital/optical control system) technology, a triply-redundant electronic flight control system, which has replaced hundreds of conventional helicopter mechanical control links. This makes the LHX much simpler, more reliable, and more survivable on the battlefield. The nose of the LHX is an unglazed stealth nose, covered in low observables RAM (radar absorbent material). Adding this to advanced IR suppression techniques makes the LHX more difficult to spot than any helicopter ever built.

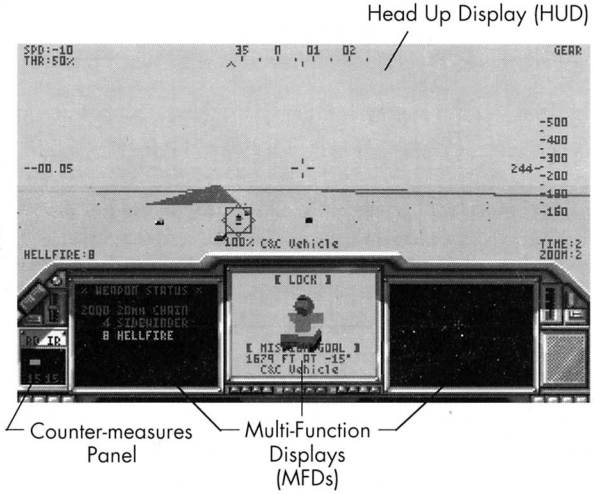
It seems obvious that the aircraft must have a sophisticated autopilot control so it can fly itself while the pilot consults comprehensive instrumentation and sensors that simultaneously seek, identify, track, and prepare to fire on hostile targets. The pilot's helmet visor display further reduces his work load by displaying all flight information in his immediate field of vision.

Armaments

According to Army specifications, the LHX accommodates a single-barrel 20mm automatic cannon (maximum ammunition load of 2,000 rounds) positioned in the forward fuselage and ordnance stores carried in the fuselage and on the fixed wings. To reduce the LHX's radar signature, air-to-air missiles are carried in an internal hardpoint, capable of carrying 4 AIM-9L Sidewinders or 8 Stingers (maximum total of 4). Each wing will support 4 Hellfire anti-tank missiles (maximum total of 8), 4 TOW anti-tank missiles, or 19 57mm folding fin aerial rockets (FFAR—maximum total of 38).

No new weapons systems are under development for the LHX. The reasons generally posited by experts to explain this fact are the LHX's high speed, superior combat maneuverability, and advanced avionics, which make more efficient and lethal use of currently available ordnance.

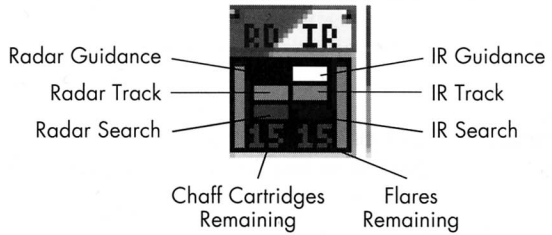
FLIGHT INSTRUMENTS



LHX Cockpit
(Figure 51)

Countermeasures Panel

This panel displays the enemy weapons tracking you and the status of your countermeasures. The panel is divided vertically; the left half pertains to radar tracking and countermeasures, and the right half pertains to infrared tracking and countermeasures.



Countermeasures Panel
(Figure 52)

Search Light (Left)	The enemy has detected you on radar.
Tracking Light (Left)	An enemy weapon is tracking your precise location on radar. The enemy will probably fire a weapon at you in seconds. Press **R** to turn on the radar jammer. The Radar Jammer Light goes on to confirm.
Guidance Light (Left)	The enemy fired a weapon that is locked onto your radar signature. As soon as you detect a guidance lock, press **C** to dispense a chaff cartridge to fool the weapon.
Search Light (Right)	The enemy has detected you on infrared.
Tracking Light (Right)	An enemy weapon is tracking your precise location on infrared. The enemy will probably fire a weapon at you in seconds. Press **I** to turn on the infrared jammer. The Infrared Jammer Light goes on to confirm.

Guidance Light (Right)	The enemy fired a weapon that is locked onto your infrared signature. As soon as you detect a guidance lock, press **F** to dispense a flare to fool the weapon.
Flare Count	The number of flares you have.
Chaff Count	The number of chaff cartridges you have.

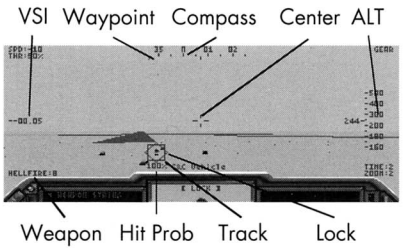
Head Up Display

Superimposed on your forward view is your Head Up Display (HUD), which allows you to see various important flight data without looking down into your cockpit.

[See Figure 53]

HUD symbology in the LHX is as follows:

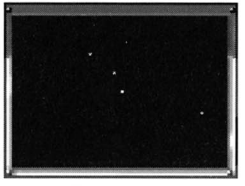
SPD	Forward ground speed in miles per hour. This number is positive when flying forward, negative when flying backwards.
THR	Vertical thrust applied by the helicopter's collective, as a percentage of maximum engine power.
VSI	Vertical speed in thousands of feet per minute. This number is positive when ascending, negative when descending.
ALT	On the left is your altitude in feet; on the right is the scale.
GEAR	Appears when your landing gear is down. Press **G** to toggle the gear up and down.
TIME:2	Time compression is on — everything is happening at twice normal speed. Press **T** to toggle on and off.
ZOOM	Optical zoom magnification: 1x, 2x, 4x, 8x, 16x, 32x, and 64x.
COMPASS	Your heading in degrees, with N, E, S, and W indicating the four compass points.
WAYPOINT	Align this arrow with the center tick mark to fly toward your highlighted waypoint.
CENTER	The centerline of your helicopter.
WEAPON	Your selected weapon and number of rounds remaining.



LHX HUD
(Figure 53)

Camera View MFD Setting
(Figure 54)

Mission Waypoints MFD Setting
(Figure 55)



Radar Warning Receiver (RWR)
MFD Setting
(Figure 56)

HIT PROB	Probability that selected weapon will hit current target.
TARGET	Target identification.
TRACK	This square is superimposed over the target you're currently tracking with your selected missile.
LOCK	This target-lock diamond is superimposed on the tracked target when it comes within range of your selected guided missile.

Multi-Function Display

The Multi-Function Displays (MFD) are video monitors, also called CRTs (Cathode Ray Tubes), that can be configured by the pilot to display different information screens in different locations. In the LHX, there are six possible displays: a target camera, a mission waypoints list, a weapon status display, a radar warning receiver, a damage report screen, and an engine status display.

Camera View (CAMERA): A video image along with range, bearing, and status information of the target you're currently tracking. If your current target is your mission goal, the display [MISSION GOAL] appears on the camera view.

[See Figure 54]

Mission Waypoints (WAYPTS): Your list of mission waypoints, along with range and bearing information for each waypoint.

[See Figure 55]

Radar Warning Receiver (RWR): Your Radar Warning Receiver displays potential threats in your area.

[See Figure 56]

Your RWR does not distinguish between allied and enemy targets. Remember that youmay be flying over civilian airspace, so check your targets carefully. The color code is as follows:

Target Type	EGA, MCGA, TANDY	CGA
Missile with lock	Yellow	White
Missile without lock	Red	Magenta
Ground target (tank, etc.)	Brown	Magenta
Aircraft above you	Light cyan	Cyan
Aircraft below you	Dark cyan	Cyan

Note: Some targets in the area do not have a sufficiently strong signature to be detected by your RWR, so do not trust it 100 percent. And enemy infantry armed with automatic weapons or portable SAMs (Surface-to-Air Missiles) never appear on your RWR.

Weapon Status (WEAPONS): This panel displays the number of weapons remaining on your aircraft, the hardpoints they occupy, and the currently selected weapon.

[See Figure 57]

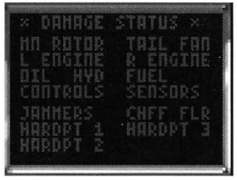
Weapon Status MFD Setting
(Figure 57)

The top weapon is your internal gun. The numbers next to the hardpoints represent the total amount of weapons for that hardpoint on both sides of the fuselage. Your onboard weapons computer automatically fires from both sides of your helicopter in turn to keep the weight distribution roughly equal. If a hardpoint is damaged in combat and becomes unusable, the name of that hardpoint's weapon reads "*DAMAGED*" when you select it.

Press **[** or **]** to cycle through your weapons. The highlighted weapon is selected, and it discharges when you press your fire button.

Damage Report (DAMAGE): Displays a list of all your primary systems. Highlighted systems are damaged and nonfunctional.

[See Figure 58]

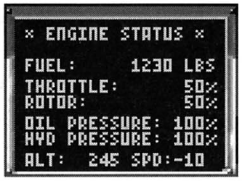


Damage Report MFD Setting
(Figure 58)

The systems are as follows:

MN ROTOR	Main Rotor
TAIL FAN	Tail Ducted Fan System

L ENGINE	Left Engine
R ENGINE	Right Engine
OIL	Engine Oil System
HYD	Hydraulic Control System
FUEL	Fuel Tanks and Lines
CONTROLS	Flight Controls
SENSORS	Countermeasures Tracking Sensors
JAMMERS	Radar and Infrared Electronic Counter Measures
CHFF	Chaff Dispensers
FLR	Flare Dispensers
HARDPT1	Hardpoint1 and its weapons load
HARDPT2	Hardpoint2 and its weapons load
HARDPT3	Hardpoint3 and its weapons load



Engine Status MFD Setting
(Figure 59)

Engine Status (ENGINE): The Engine Status Panel displays fuel level, throttle settings, and fluid pressures in your helicopter.

[See Figure 59]

The systems are as follows (all displayed as percentages of maximum):

FUEL	Fuel level
THROTTLE	Engine Throttle Setting
ROTOR	Main Rotor Power
OIL PRESSURE	Engine Oil Pressure
HYD PRESSURE	Hydraulic Control Pressure
ALT	Altitude
SPD	Ground speed in miles per hour.

If your HUD is damaged, look at this display to see your altitude and ground speed data.

Running out of fuel makes your engines cut out immediately. Loss of oil pressure eventually burns out your engine. When you lose engine power for any reason, you must autorotate to land safely. See the "Autorotation" section in the *Tutorial* for a description of this procedure.

Loss of hydraulic pressure leads first to a reduction, and finally to a complete loss, of flight controls. When you lose control of your helicopter, you have little choice but to reduce thrust and set down.

To configure your MFDs: Press **Ctrl-A** to put the left MFD in Config mode. A list of available displays appears on your MFD. Highlighted displays are ones you can access on this MFD. Press the number of a system to toggle it on and off; for example, press **5** to deselect DAMAGE, and leave the other two displays highlighted. Press the **spacebar** to leave Config mode.

Configure the other MFDs using the above procedure, but press **Ctrl-S** for the center configuration screen and press **Ctrl-D** for the right configuration screen. Dividing the functions between the MFDs is a useful way to organize your information to make it quickly accessible.

To use your MFDs: Press **A** to change your left MFD from one display to another. In the example, pressing **A** toggles between the Camera View and the Mission Waypoints screen because you turned off the Damage Report display when you configured the MFD. (You must be tracking a target to see a Camera View. Maneuver your helicopter so a target is visible, and then press **Enter** to track it and see a Camera View.)

To use your center MFD, press **S** as described above, and press **D** for your right MFD. If you group the functions of each MFD in categories, you can more easily remember where each function is and quickly display the information you want.

To restore your MFDs to their default configuration, select Set Default CRT Config on the SIM menu.

TACTICS

AVOIDANCE, EVASION, AND FIGHTING TACTICS

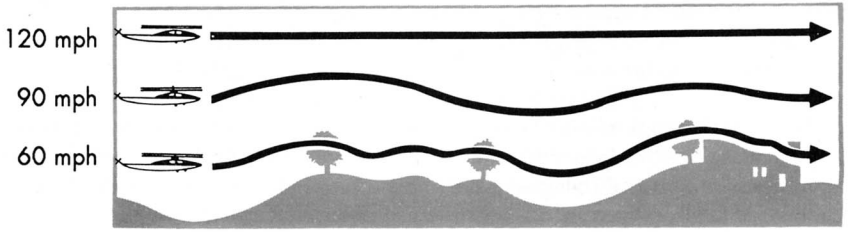
Some amateur observers have a hard time believing that rapidly deployable attack helicopters are the logical response to first strike tank forces. But it's a fact. Military experts generally acknowledge that helicopters are indispensable for anti-tank missions. Other missions such as Search and Rescue in-combat reconnaissance (through darkness, smoke, and all weather), casualty evacuation (CASEVAC), anti-submarine warfare (ASW), and defensive air combat, are easier for the uninformed to accept and understand. Those missions don't seem as technically demanding. But as some of you already know, in the case of attack helicopters, appearances are deceiving. They are remarkably rugged and useful machines.

Compared to a jet fighter, the helicopter appears to have severe performance limitations: the chopper is relatively slow, has a low ceiling, carries a small ordnance load, and covers a small range. This data, however, should not mislead you into underestimating the helicopter. What appear as limitations are often virtues, the very things that make the helicopter an incomparable front line attack weapon.

The helicopter is the only aircraft that can fly at low altitude at low speed and often avoid detection by radar; it easily uses natural formations (trees, hills, rocks, etc.) for concealment; it has the capabilities of a fast surface vehicle, but better, since no terrain is too rough for it to jump over, and it can land almost anywhere in any weather. Uniquely, it can load and unload cargo or personnel while hovering, so troops and/or materiel can be quickly delivered to or evacuated from a strategic location. Finally, the introduction of light but powerful guided missiles to helicopter arsenals has meant that these awkward flying machines have become superb offensive strike forces, dangerous "birds of prey." Their mobility and flexibility let them strike targets of almost any size, suddenly and often unexpectedly, with devastatingly effective results. To see this advantage in action, try flying a mission in the Osprey in airplane mode, and then try it in helicopter mode. Most missions are impossible to complete without the flexibility of vertical flight.

All the helicopter's advantages notwithstanding, every pilot ruefully acknowledges that his aircraft's survival on the battlefield (or in any conflict) depends primarily on remaining

undetected by the enemy. The best way to avoid detection is to fly very low (altitude 100'; this is called nap-of-the-earth [NOE] flying). According to the Army Field Manual 90-1, good pilots are able to use "the terrain, vegetation, and manmade objects to enhance survivability by degrading the enemy's ability to visually, optically, or electronically detect or locate the aircraft..." In short, NOE tries to *mask* the helicopter's presence. Flying low is also less aurally obtrusive; it takes advantage of enemy radar's limited range at low altitude; and most anti-helicopter IR sensors and guided weapons require a visual sighting before they're launched. The obvious trade-off for flying NOE, however, is that the pilot may have to sacrifice up to 50% of his maximum straight-line speed to ensure his aircraft's security.



Nap of the Earth (NOE) flying

When conditions (such as vicious weather, night flight over unfamiliar terrain, bad luck) or adverse tactical situations conspire to frustrate the pilot's efforts to remain undetected by the enemy's electronic surveillance, he can perform various evasive maneuvers. His choice of actions usually depends on the type of weapon the enemy is using.

For example, if the pilot's cockpit avionics report that hostile radar is sweeping his sector and his current position has been discovered, he'll likely turn on his radar jammer and dump a load of *chaff* as an effective countermeasure. Chaff consists of billions of tiny slivers of metallicized Mylar film. The slivers are cut to various lengths to match a range of radar wavelengths. When a load of chaff is released it forms a kind of decoy near the helicopter. Radar-guided missiles that have locked on their targets often become confused and subsequently misdirected when they encounter chaff.

When confronted by enemy IR-homing (heat-seeking) missiles, the pilot can turn on his infrared jammer, which creates diverse sources and signals of infrared energy to confuse the missile's guidance system. He can also dispense flares as a defensive countermeasure (IRCM). Flares are special sorts of fireworks whose infrared heat is designed to attract and confuse the heat-seeking missile.

Most jamming equipment is passive or reactive, that is, the pilot uses it *after* enemy radar or IR sensors have locked on his aircraft. The reason for this is that the jammer itself emits readable wavelengths that hostile radar can detect and track, long before the helicopter comes into view. Again we see a trade-off. Here it's between security and stealth. If the pilot turns on the jammers too early the aircraft is more vulnerable than it might otherwise have been to radar tracking; he may be spotted and unable to begin his mission. But if he waits too long to turn on the jammers he'll not only lose the element of surprise, but jeopardize his aircraft, his mission, and even his life. Timing is everything.

Once a helicopter's attack mission has begun, the pilot, like all commanders of militarily deployed vehicles, follows one strict rule of engagement: the mission comes first. The message to the pilot is clear: "Your goal is to complete the mission and return safely to base. Your chances of fulfilling the goal are enormously increased if you remain undetected by enemy radar, aircraft and anti-aircraft installations. Therefore, be discreet. Be cautious. Be inventive. Don't be distracted by easy targets of opportunity; don't be deflected by unexpected quantity or kinds of opposition ordnance or material; and don't be discouraged by imprecise data. Fulfill your mission if at all possible, and live to fight another day."

Enemy radar, heat-seeking missiles, and anti-aircraft armor-piercing ordnance are often trying to keep the pilot from even starting his mission, let alone completing it successfully. We've noted some of the actions taken by the pilot when the helicopter confronts some of these obstacles. But what happens when a helicopter encounters a hostile jet or helicopter?

Engaging Jet Fighters

To a casual and uninformed observer, any in-air hostile confrontation between a helicopter and a fixed-wing jet fighter seems barely competitive. A simple evaluation of the performance and weaponry of the two aircraft reveals a frightening disparity. Neverthe-

less, when both aircraft are airborne, a different story emerges. While it is a fact that a helicopter will be on the defensive in any confrontation (no sane helicopter pilot goes looking for a jet to tangle with), many experts believe that the helicopter has the upper hand when the two aircraft meet.

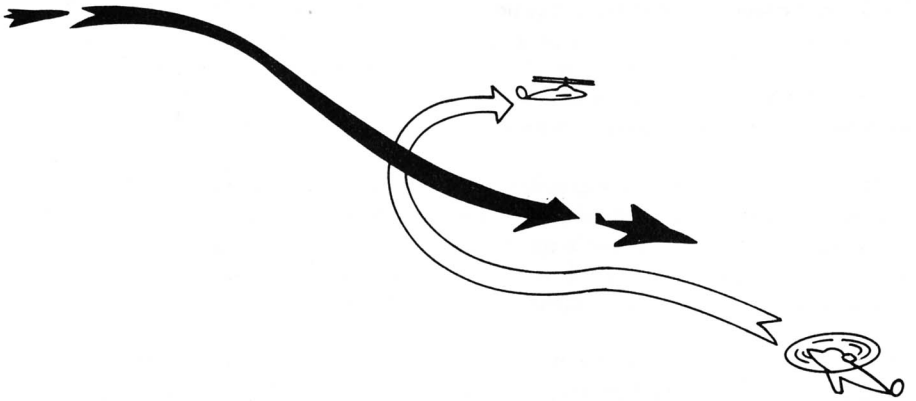
The helicopter pilot is (or can quickly be) in his element, flying NOE at 60 mph. That's where he's comfortable and most dangerous to the jet's security. The jet moves too fast to fly much lower than 200 feet; there's no time to recover from a mistake. So the jet must sight, target, and fight from above. Usually this would be considered an advantage, but not when fighting a helicopter.

Naturally if the helicopter pilot sees the jet before he himself is spotted, he'll try to lose himself behind (among, under) whatever cover is available. He might also try to fly directly away from the fighter to provide as little relative motion as possible. However, if he confronts a jet over open ground, with no chance to retreat or hide, the first thing the helicopter pilot will do to avoid detection is get low.

NOE flying virtually cancels out the jet's superior avionics and weaponry. If the the helicopter is flying at less than 100 mph, the jet's pulse Doppler radar won't track it. It ignores the helicopter as it would ignore a jeep. Similarly, conventional radar often gets lost in conflicting ground returns. This makes shooting difficult by adversely affecting the ability of any radar-homing missile to successfully lock on and hold its target. Even the jet's IR sensors have a problem with helicopters, because they run so much cooler and closer to the ground than the jet's usual air-to-air-targets, which are hot running, high-flying enemy jets. If the helicopter is equipped with a chaff and/flare dispenser, judicious use of them can further complicate, and often completely frustrate, detection by the jet's radar or infrared installations and aid in the helicopter's escape.

This all means that in most cases the jet pilot's weapon of choice against a helicopter is a gun with a fixed sight or a pod of unguided rockets, which produce a kind of shotgun effect. The jet pilot positions himself at a shallow angle to the helicopter and attacks. If he catches the helicopter unawares and gets in close, the helicopter is in grave danger of being terminated. If, however, the helicopter pilot "sees" him from a distance, and he's carrying air-to-air missiles, the jet's advantage disappears. The helicopter is so much more

maneuverable than the jet that even a single misjudged or poorly executed overshoot of the target can result in the jet's destruction. Since it's impossible for the jet to avoid overshooting the slow moving helicopter, an air-to air missile up the tail pipe is an ever-present risk to the retreating jet. Here's the way it works.



Fighter Overshoot

When a helicopter pilot sees that he's about to be attacked by a jet, his first move is to turn into the attack and simultaneously increase his altitude by about 150 feet. This gives the fighter less time to align his attack and allows the helicopter to use its offensive weapons. When this maneuver is completed, and the jet is in mid-attack, the helicopter pilot fires off some of his ordnance (he always wants to get off the first shot, regardless of its suitability or likelihood of success) and veers off course by 45 degrees or so. The high speed and shallow angle of the attack is now further complicated by the pilot's need to react to the "incoming" rounds and the jet's need to bank to track the helicopter. As the jet rapidly closes on the helicopter, the angle of attack becomes increasingly steeper and the rate of descent incrementally faster. The pilot tries to make all the necessary adjustments in flight path and sight his guns at the same time, all the while plummeting towards earth at about 150 feet per second.

When the helicopter pilot believes that his aircraft is within the jet's effective firing range (about 5,000 feet) his next move is to make a hard 90 degree turn (opposite the direction of the earlier 45 degree turn), and lose as much altitude as possible. This makes it appear to the jet pilot as if the helicopter has fallen like a stone, because it has disappeared, at least temporarily, from his gun sight. The jet must either increase the angle of attack to track the helicopter (and the ground is really uncomfortably close now) or break off the attack. It's estimated by usually reliable sources that this evasion technique alone is successful approximately 90% of the time. And, if the fighter overshoots the helicopter, and the helicopter pilot is good and very, very lucky, it's possible that the helicopter can send a lethal Stinger up the tail pipe of the departing jet.

All things considered, it's not difficult to understand why experienced fighter pilots engage well-armed attack helicopters with the greatest reluctance, and only when they think they have a strategic advantage or when the tactical situation of battle demands it. All but the most foolhardy fighter jocks leave enemy helicopters to anti-aircraft installations, tanks, or their own helicopter fleet because there's very little to be gained in a victory and much to be lost in a defeat.

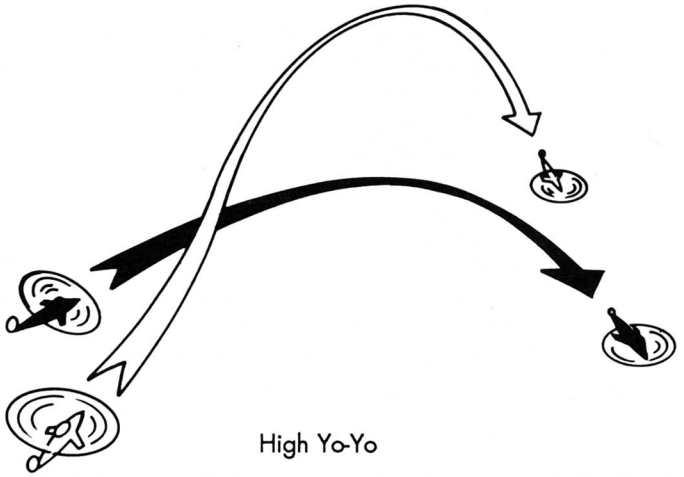
Engaging Hostile Helicopters

Most military experts agree that the weapon they must want to respond to the challenge and threat of a well-armed enemy attack helicopter is a similarly armed helicopter of their own. All of the in-air advantages a helicopter has over a jet fighter in combat (NOE flying, slow translational speed, and superior maneuverability) are neutralized when two helicopters meet in battle. If both aircraft are roughly equal in speed, turning rate, and armaments, a premium is placed on the skill of the pilot and his knowledge of tactics.

Because anti-armor attack helicopters are relatively new to the battlefield, there's not much empirical evidence on which to base a discussion of helicopter v. helicopter fighting tactics. However, extensive testing and experimentation with simulated combat provide suggestive if not surprising results. They indicate that combat will take place in short bursts at close range. Once the battle is joined, disengagement will be difficult because the aircraft have equivalent top end speeds and maneuverability. Because the fighting is in "close quarters," line-of-sight guns are more likely to be the weapons of choice rather than missiles, which need to be armed and targeted.

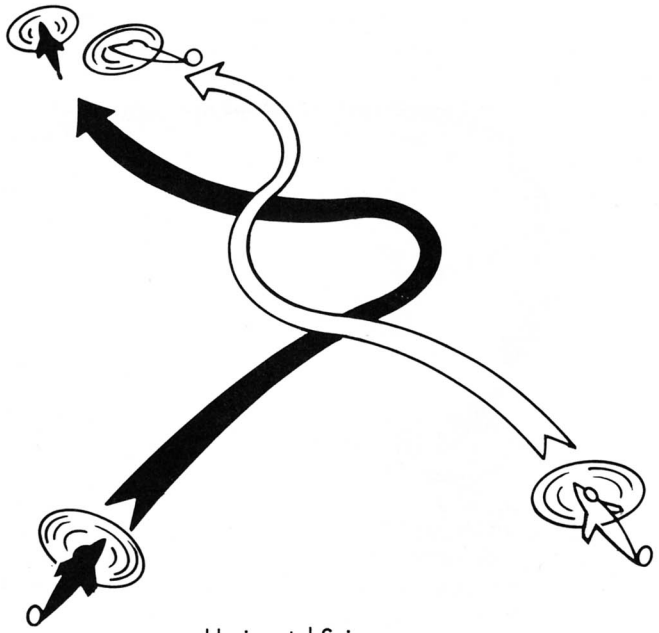
Like jet fighters in combat, the opponents in a helicopter "dog-fight" try to fly into a position from which they can shoot but cannot be shot at. The most favored location is indicated by the clock-face position 6 o'clock, where the attacker wants to be behind and above the defender, who can't shoot up through his own rotor blades. Because each combatant wants to be above the other a fight often results in a continuing upward spiral. This takes both aircraft out of their preferred environment close to the ground and makes them both more vulnerable to anti-aircraft projectiles.

The three most common maneuvers for pilots trying to achieve an advantage over an in-air helicopter opponent are known as the High Yo-Yo, the Horizontal Scissors, and the Flare Stop.



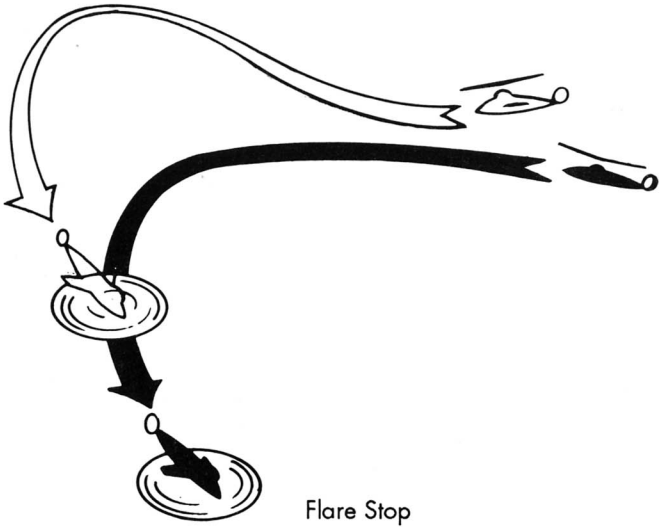
High Yo-Yo

The High Yo-Yo is the attacking helicopter's response to an opponent's (defender's) hard-breaking turn across the attacker's flight path. The tactical situation is this: Attacker is immediately behind Defender, closely following him on the same plane and ready to fire. Defender turns sharply (90 degrees–perpendicular to attacker's flight path) and slightly down. To avoid overshooting the defender and thus becoming the hunted rather than the hunter, attacker pulls forcefully up on the collective lever to elevate steeply; at the same time he sideslips in the direction of the defender's turn and once again drops in behind him.



Horizontal Scissors

The Horizontal Scissors is useful when both combatants are moving parallel to one another. It's simply a series of hard turns on a horizontal plane whose purpose is to suddenly decrease forward speed so that the opponent moves in front and exposes his aircraft to a fuller range of the attacker's weapons. As a tactical consideration, horizontal scissors has the additional advantage of not driving the combat higher in the sky and subjecting one's aircraft to attacks from highly accurate and lethal ground-to-air ordnance.

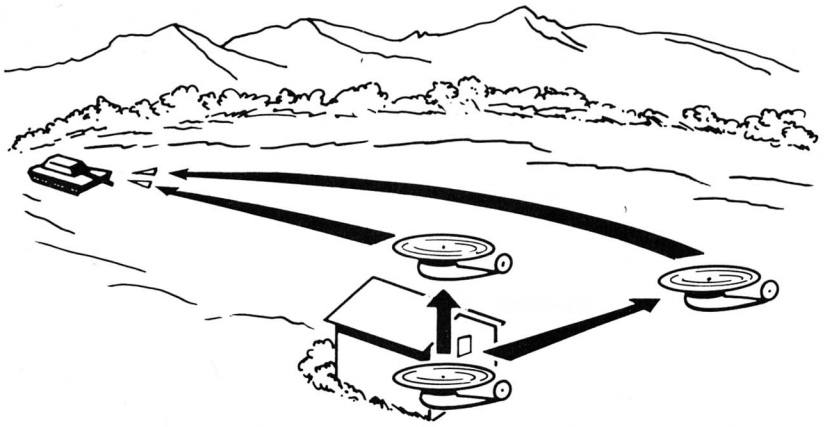


Flare Stop

The Flare Stop was developed by the USMC as a response to an attack from close range. It's designed to turn a defender position into an attacker position. As the attacker approaches from the rear, the defender pulls up the nose and throttles back to quickly decelerate. The attacker overshoots the decelerating defender. The moment the attacker overshoots, the defender radically dives and accelerates. Defender is now in the ideal position and takes the offensive.

Engaging Ground Targets

You must remember that the two tactical and doctrinal principles upon which an American attack helicopter pilots act are: the mission comes first; and avoid detection. Obviously these two principles are interrelated and often interdependent. The premise is: if you avoid detection, you increase the likelihood of fulfilling your mission. Therefore most tactical theory consists of several common elements designed to avoid detection. These include, NOE flying whenever possible, detailed reconnaissance of defensive positions for concealment, and attacking, at the last moment, from ambush.



Shooting from Cover

Shooting from Cover, which has been used effectively to suppress mobile anti-aircraft weapons and destroy enemy tanks, is one of the attack helicopter's classic ambushes. The mission begins when a well-armed helicopter carefully chooses a concealed position close to his objective, from which to launch an attack. This position is likely to seem an obvious attack site to enemy intelligence and they are likely to have it heavily shelled and perhaps have it reconnoitered. The shelling, however, will have no effect on the attack helicopter because the pilot will not take his position until the very last moment. Until that time he will hover just above the ground at a secondary spot of concealment (called a secondary hide, perhaps some trees or a cliff), which will allow him covert access to the ambush position.

When the enemy has satisfied itself that the likely ambush position is either unoccupied or disarmed, it begins to move forward into the trap. At this moment the attack helicopter surreptitiously moves to the ambush position (let's say it's a house overlooking a road). When the enemy is in firing range, the helicopter must expose itself to launch its missiles. It accomplishes this by unexpectedly popping above or beside the house, optically or electronically sighting the target, and firing its load. The trap is sprung. Rather than examining his devastating handiwork in detail, the pilot briefly ensures that his mission has been accomplished and immediately beats a retreat back to base.

Allied Hardware Technical Briefing

INTRODUCTION

Read this section to familiarize yourself with the hardware you have at your disposal. Take special note of allied vehicle designations so you can distinguish between friendlies and enemies in the field.

MISSILES

AGM-114A Hellfire Anti-Tank Missile

Length ..... 1,727 mm
Diameter ..... 178 mm
Weight ..... 45.7 kg
Guidance ..... IR
Weapon Range ..... 7,000 m
Warhead ..... Tandem twin shaped charges

BGM-71 TOW Anti-Tank Missile

Length ..... 140 mm
Diameter ..... 152 mm
Weight ..... 21.5 kg
Guidance ..... Wire guided - pilot controlled
Weapon Range ..... Min 65 m/Max 3750 m
Warhead ..... High Explosive Anti-Tank (HEAT) shaped charge

FIM-92A Stinger Missile

Length ..... 140 mm
Diameter ..... 152 mm
Weight ..... 21.5 kg
Guidance ..... IR
Weapon Range ..... Min 65 m/Max 3,750 m
Warhead ..... HEAT shaped charge

AIM-9L Sidewinder Air-to-Air Missile

Length ..... 2,870 mm
Diameter ..... 127 mm
Weight ..... 86.1 kg
Guidance ..... IR
Weapon Range ..... Min 100 m/Max 14,000 m
Warhead ..... Annular blast fragmentation high explosive

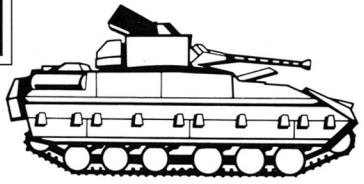
57 mm FFAR

Length ..... 769 mm
Diameter ..... 57 mm
Weight ..... 4.7 kg
Guidance ..... None
Weapon Range ..... Min 50 m/Max 1,400 m
Warhead ..... High explosive

VEHICLES

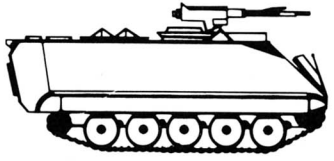
M1 Abrams Main Battle Tank

Crew 4
Length overall ..... 9.766 m
Width ..... 3.653 m
Height ..... 2.885 m
Ground Clearance ..... 0.432 m
Max speed on road ..... 72.5 km/hr
Range ..... 500 km
Engine power ..... 1,500 hp
Main gun ..... 120 mm
Weapon Range ..... 1,846 m



M2 Bradley Infantry Fighting Vehicle

Crew	3 and 7 passengers
Length overall	6.453 m
Width	3.2 m
Height	2.972 m
Ground Clearance	0.432 m
Max speed on road	66 km/hr
Range	483 km
Engine power	500 hp
Main gun	25
Weapon Range	1,538 m



M113 Armored Personnel Carrier

Crew	2 and 11 passengers
Length overall	4.863 m
Width	2.686 m
Height	2.5 m
Ground Clearance	0.41 m
Max speed on road	67.6 km/hr
Range	483 km
Engine power	215 bhp
Main gun	12.7 mm
Weapon Range	1,324 m

Enemy Hardware Technical Briefing

INTRODUCTION

In your new job as attack helicopter pilot, you'll be facing many types of enemy vehicles. One solution to an environment with multiple threats is to kill everything you see. Unfortunately, you only have a limited supply of ammunition. If you learn which targets are threats and which are just icing on the cake, not only will you preserve your ammunition, you'll be able to deal with the biggest threats first, increasing your probability of survival.

Armored Cars and Infantry Fighting Vehicles

Vehicles in this category are not well equipped to deal with aerial threats. Typically, you'll find them armed with obsolete SAMs (if any) and weak machine guns. You should have no trouble avoiding their fire, and they can only cause minor damage to a modern attack helicopter that's designed to withstand 23mm shells.

Tanks

Tanks pose little threat to you unless they carry guided missiles. The T-72 has no such luck. The newer T-80 is not such an easy target. In addition to its very effective armor, it carries the laser-guided AT-8 Songster missile which is all the more dangerous because none of your ECM devices have any effect on its laser guidance system. To your advantage, the missile must be fired from the main gun, which must be aimed in your general direction to get a missile lock. Approach these tanks from the rear and hit them while they try to turn on you.

Anti-Aircraft Guns

The ZSU-57 and S-60 AA guns both date from the 1960s, and are both obsolete due to their optical tracking: at night or in bad weather, they'll probably never know you passed by unless you stop to say hello (preferably with a Hellfire). Even if they do get a track lock on you, you can avoid their shots by flying across their field of fire.

The ZSU-23 Shilka was the first AA gun to pose a serious threat to a fast-moving jet. Even though the design is 25 years old, the ZSU-23 remains one of the worst threats to an attack helicopter. In fact, the Hellfire was designed specifically to give helicopter pilots the ability

to destroy a ZSU-23 while remaining outside its effective range. The ZSU-30 is an updated version of the ZSU-23 that uses a 30mm projectile with greater penetrating power (to counter the Western helicopters that have been designed specifically to withstand hits from the ZSU-23), and improves on the accuracy of the ZSU-23 as well.

Not only are the tracking systems of these "Zoos" unaffected by bad weather, they can predict your movement and aim accordingly, so flying across their field of fire is ineffective. They aren't likely to be fooled by chaff, and since their shells don't show up on your RWR, it can be difficult to tell which of several targets on your RWR is firing at you. Your best tactic (apart from simply staying away from them) is to zig-zag as you approach them. This confuses their tracking electronics.

Surface-to-Air Missiles

The Sa-6 Gainful saw extensive action in Middle East conflicts in the early 1970s. Israeli aircraft were forced to fly below its minimum tracking altitude, thereby putting themselves at risk from ZSU-23 AA guns and low-altitude SAMs. The Sa-6 no longer poses so great a threat. It's easily fooled by chaff or jammers, and if you stay low it won't see you until you're close enough to finish it off.

The Sa-7 Grail is the weapon that changed attack helicopter design forever. In Vietnam, American tactics favored high-speed attack helicopters that made diving attacks with rockets and guns. With Viet Cong soldiers able to fire Mach 1.5 guided missiles, the Army brass quickly realized that speed was no defense. A modern attack helicopter has to be able to fly low and present a small IR signature. This decision brought about the cancellation of the expensive, high-speed Cheyenne attack helicopter, and created the requirements that were eventually fulfilled by the Apache.

The Sa-9 is one weapon you don't have to worry much about. Its heat-seeking missile is likely to miss you even if you don't drop a flare in its path. And if it does hit, it won't do much damage. The Soviets are quite aware of the inadequacy of the Sa-9, and have been replacing it with the Sa-13 Gopher. Unfortunately for you, the Gopher's cryogenically cooled IR seeker is not easily fooled by flares.

The Sa-8 and Sa-11 radar-guided SAMs are also major threats. The Sa-11, especially, packs a powerful punch. Don't forget that these systems are effective in any weather.

Airplanes

The MiG-27 is unlikely to cause you major grief if you take the proper precautions. You'll probably see it most often as it circles around you, attempting to get a missile lock on you. Unless you fly at high altitudes or otherwise make yourself available, the MiG-27 will pose little threat.

The Su-25 Frogfoot, on the other hand, has the maneuverability and low minimum airspeed to be a major headache. Its AA-8 radar-guided missiles can find you even when you're at low altitude, and its nose-mounted machine gun is powerful enough to penetrate your armor.

Helicopters

The biggest threat to any weapon is usually another weapon of the same type, and helicopters are no exception. As the fighter jets sweep by overhead and the infantry huddles under whatever cover is available, another helicopter is likely to be maneuvering for the best position to blow you away.

The most common helicopter on the battlefield in poor Soviet-bloc countries is likely to be the Mil-8 Hip. This transport helicopter has been modified for attack use by mounting large numbers of unguided rockets in external pods. The Hip may be the most heavily armed helicopter in the world, but lethality means not only carrying the firepower, but getting it to its target. Here the Hip falls short: unless you fly straight and level, it's unlikely to hit you.

The Mi-24 Hind is a fast, well-armed helicopter that is not only well suited to the attack role, but it can also carry eight battle-ready troops in its cabin. Since its introduction in 1970, the Hind has been enhanced several times, adding better armor and better weapons. While the Hind-A's you encounter will be armed mostly with obsolete anti-tank missiles and puny 7.62mm guns, later models, like the Hind-D and Hind-F, will pose a much greater threat.

The Soviets have shown that they know a good thing when they see it, and have copied the AH-64 Apache design with their own Mi-28 Havoc. However, the Havoc weighs more and doesn't have the advanced fire-control system that makes the Apache so deadly.

The Ka-34 Hokum has caused a great deal of controversy among NATO planners: is it intended to attack tanks or helicopters? If it is intended for the anti-helicopter role, it would certainly be the first of its type. The LHX might deal adequately with this threat, but unfortunately it is several years away from large-scale production. In the meantime, the maneuverable Hokum, armed with hard-hitting radar-guided missiles, will be the most potent airborne threat to Western attack helicopters.

MISSILES

AA-2 Atoll Air-to-Air Missile

Length	2,800 mm
Diameter	120 mm
Weight	75 kg
Guidance	IR
Weapon Range	16,000 m
Warhead	High explosive (HE)

AA-2A Atoll Air-to-Air Missile

Length	2,800 mm
Diameter	120 mm
Weight	77 kg
Guidance	Radar
Weapon Range	16,000 m
Warhead	HE

AA-8 Aphid Air-to-Air Missile

Length	2,100 mm
Diameter	118 mm
Weight	54 kg
Guidance	IR
Weapon Range	8,000 m
Warhead	HE

AT-2 Swatter Missile

Length	1.16 m
Diameter	132 mm
Weight	29.4 kg
Guidance	Optically Tracked
Firing range min.	500 m
Firing range max.	3,000 m
Warhead type	HIGH EXPLOSIVE ANTI-TANK (HEAT)

AT-5 Spandrel Missile

Length	1.3 m
Diameter	155 mm
Weight	15 kg
Guidance	Optically Tracked
Firing range max.	4,000 m
Warhead type	HEAT

AT-6 Spiral Missile

Length	1.2 m
Diameter	140 mm
Weight	33 kg
Guidance	Optically Tracked
Firing range max.	8,000 m
Warhead weight	10 kg HE

AT-8 Songster Missile

Length	940 mm
Diameter	125 mm
Weight	10 kg
Guidance	Optically Tracked
Firing range max.	5,000 m
Warhead weight	HE Fragmentation

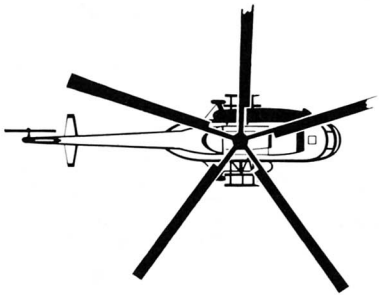
70 mm Rockets

Length ..... 944 mm
Diameter ..... 70 mm
Weight ..... 8.6 kg
Guidance ..... None
Weapon Range ..... 1,840 m
Warhead type ..... HE

57 mm Rockets

Length ..... 769 mm
Diameter ..... 57 mm
Weight ..... 4.7 kg
Guidance ..... None
Weapon Range ..... Min 50 m/Max 1,400 m
Warhead type ..... HE

VEHICLES

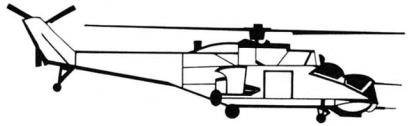


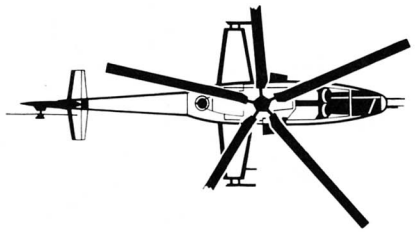
Mil Mi-8 (V-8) Hip-C Assault Transport Helicopter

Crew ..... 2 or 3
Main rotor diameter ..... 21.29 m
Length incl. rotors ..... 24.53 m
Height ..... 5.65 m
Weight (take off) ..... 11,100 kg
Max level speed ..... 250 km/hr @ sea level
Range ..... 465 km
Service ceiling ..... 4,500 m
Hover ceiling OGE ..... 800 m
Armament rockets ..... 57x2 128 rounds
Armament gun 7.62mm

Mil Mi-24 Hind-D Armed Assault Helicopter

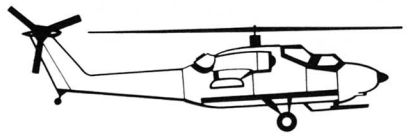
Crew	2 (3 for Hind-A)
Main rotor diameter	17.00 m
Length incl. rotors	21.50 m
Height	6.50 m
Weight (take off)	11,000 kg
Max level speed	310 km/hr @ sea level Hind-D
Range	750 km (Hind-D)
Service ceiling	4,500 m (Hind-D)
Hover ceiling OGE	2,200 m (Hind-D)
Armament rockets	AT-2 Swatter anti-tank missiles (Hind-A)
	AT-6 Spiral anti-tank missiles (Hind-D, F)
Armament gun	12.7mm

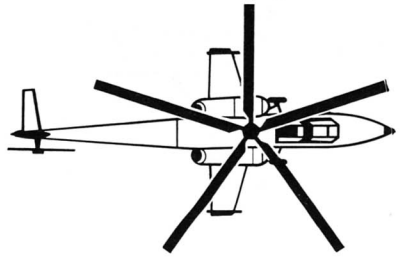


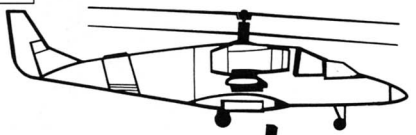


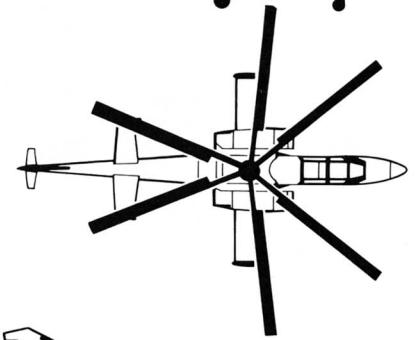
Mil Mi-28 Havoc Attack Helicopter

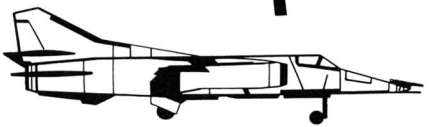
Crew	2
Main rotor diameter	17.00 m
Length excl. rotors	17.04 m
Weight (max take off)	8,000 kg
Max level speed	300 km/hr @ sea level
Range	480 km
Service ceiling	UNKNOWN
Hover ceiling OGE	UNKNOWN
Armament rockets	70 mm x2 Rockets
	AA-2A Atoll Air-to-Air Missiles

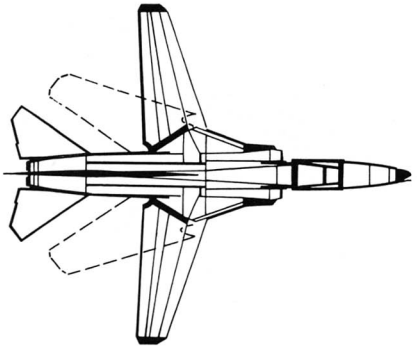










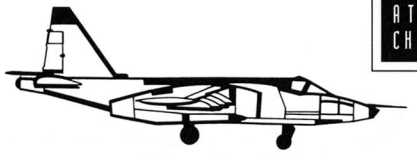


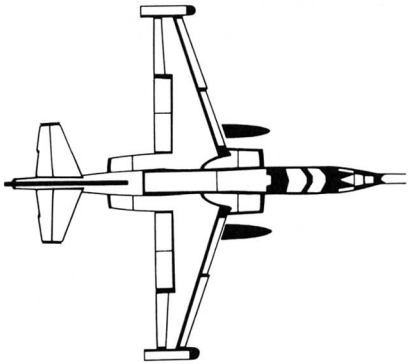
Kamov Ka-34 Hokum Attack Helicopter

Crew	2
Rotor diameters	14.0 m
Length incl. rotors	13.5 m
Height	5.4 m
Weight (max take off)	7,500 kg
Max level speed	350 km/hr @ sea level
Range	500 km
Service ceiling	UNKNOWN
Hover ceiling OGE	UNKNOWN
Armament rockets	AA-8 Aphid Air-to-Air Missiles
	57 mm Rockets

Mikoyan MiG-27 Flogger-J Attack Aircraft

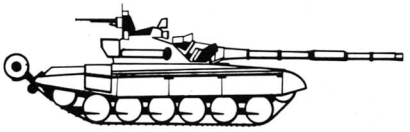
Crew	1
Length	16.00 m
Weight (max take off)	15,500 kg
Max level speed	Mach 1.1 @ sea level
Range	465 km
Service ceiling	16,000 m
Min. runway length	800 m
Armament rockets	AA-2A Atoll Air-to-Air Missiles
	AA-8 Aphid Air-to-Air Missiles





Sukhoi Su-25 Frogfoot Ground Attack Aircraft

Crew	1
Length	15.40 m
Wing span	14.30 m
Weight (max take off)	18,000-19,000 kg
Max level speed	Mach 0.8 @ sea level
Range	1,100 km
Service ceiling	UNKNOWN
Armament rockets	AA-8 Aphid Air-to-Air Missiles
Armament guns	30 mm

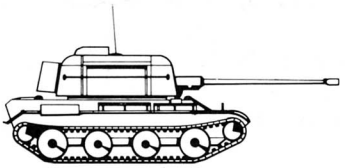


T-72 Main Battle Tank

Crew	3
Length overall	9.53 m
Width w/ skirts	4.75 m
Height w/o AA MG	2.37 m
Ground Clearance	0.43 m
Max speed on road	80 km/hr
Range	700 km
Engine power	780 hp
Main gun	125 mm
Weapon Range	1,424 m

T-80 Main Battle Tank

Crew	3
Length overall	9.9 m
Width	3.4 m
Height w/o AA MG	2.2 m
Ground Clearance	0.38 m
Max speed on road	75 km/hr
Range w/ extra tanks	600 km
Engine power	985 hp
Main gun	125 mm
	AT-8 Songster Missiles
Weapon Range	1,657 m



ZSU-57-2 Twin 57mm Self-Propelled Anti-Aircraft Gun System

Crew	6
Length overall	8.48 m
Width	3.27 m
Height	2.75 m
Ground Clearance	0.425 m
Max speed on road	50 km/hr
Range	450 km
Engine power	520 hp
Main gun	Twin 57 mm
Search/Targeting	Optical
Weapon Range	1,592 m

ZSU-23-4 Shilka Quad 23mm Self-Propelled Anti-Aircraft Gun System

Crew	4
Length overall	6.54 m
Width	2.95 m
Height w/ radar	3.8 m
Ground Clearance	0.4 m
Max speed on road	44 km/hr
Range	450 km
Engine power	280 hp
Main gun	23 mm x 4
Search/Targeting	Radar
Weapon Range	1,484 m

ZSU-30-2 Twin 30mm Self-Propelled Anti-Aircraft Gun System

Crew 4
Length overall ..... 6.9 m
Width ..... 3.0 m
Height w/ radar ..... 4.1 m
Ground Clearance ..... 0.5 m
Max speed on road ..... 42 km/hr
Range ..... 470 km
Engine power ..... 292 hp
Main gun ..... 30 mm x 2
Search/Targeting ..... Radar
Weapon Range ..... 1,580 m

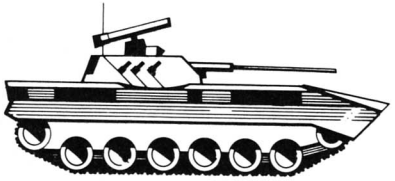
No Photo Available

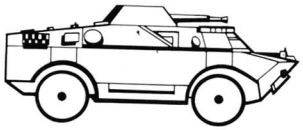
BTR-70 Armored Personnel Carrier

Crew ..... 2 and 9 passengers
Length overall ..... 7.535 m
Width ..... 2.8 m
Height to top of sight 2.32
Ground Clearance ..... 0.475 m
Max speed on road ..... 80 km/hr
Range with ext. tanks ..... 600 km
Engine power ..... 240 hp
Main gun ..... 7.62 mm cannon
Weapon Range ..... 1,370 m

BMP-2 Infantry Fighting Vehicle

Crew ..... 3 and 7 passengers
Length overall ..... 6.858 m
Width ..... 3.089 m
Height 2.077
Max speed on road ..... 80 km/hr
Range ..... 500 km
Engine power ..... 350-400 hp
Main gun ..... 30 mm cannon
..... AT-5 Spandrel Anti-Aircraft Missiles
Weapon Range ..... 1,580 m





BRDM-2 Amphibious Scout Car

Crew	4
Length overall	5.75 m
Width	2.35 m
Height	2.31
Ground Clearance	0.43 m
Max speed on road	100 km/hr
Range with ext. tanks	750 km on roads
Engine power	140 hp
Main gun	7.62 mm cannon 23 mm cannon
Weapon Range	1,484 m

No Photo Available

57 mm Automatic Anti-Aircraft Gun S-60

Length	7.61 m
Barrel Length	2.9 m
Width	7.38 m
Height	1.85 m
Firing Range	1,592 m
Firing Rate	120 rpm

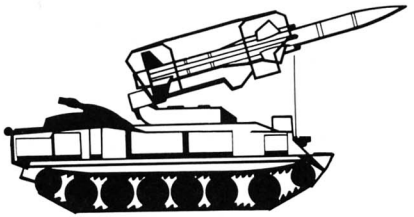
No Photo Available

180 mm Artillery Gun S-23

Crew	16
Length	10.485 m
Barrel Length	8.8 m
Width	2.996 m
Height	2.31
Ground Clearance	0.4 m
Firing Range	30,400 m
Firing Rate	1 rpm
Weapon Range	1,710 m

SA-6 Gainful Low- to Medium-Altitude Surface-to-Air Missile System

Crew	3
Length overall	7.389 m
Width	3.18 m
Height incl. missiles	3.45 m
Ground Clearance	0.4 m
Max speed on road	44 km/hr
Range with ext. tanks	260 km
Engine power	240 hp
Search Type	Radar
Armament	SA-6 missiles

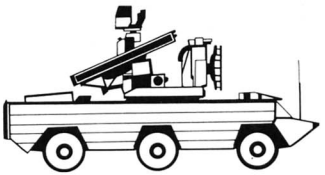


SA-6 Gainful Missile

Length	5.8 m
Diameter	0.335 m
Weight	580 kg
Warhead Weight	80 kg HE
Max speed	Mach 2.8
Guidance	Radar
Firing range min.	3,700 m
Firing range max.	24,000 m
Min target height	80-100 m

SA-8b Gecko Low-Altitude Surface-to-Air Missile System

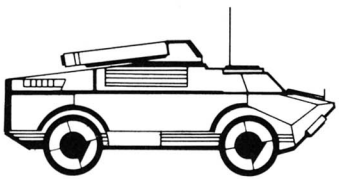
Crew	3
Length	9.14 m
Width	2.9 m
Height	1.845 m
Ground Clearance	0.4 m
Max speed on road	60 km/hr
Range	500 km
Engine power	175 hp
Search Type	Radar
Armament	SA-8 missiles



SA-8b Gecko Missile

Length	3.1 m
Diameter	0.21 m
Weight	170 kg
Warhead Weight	40 kg HE
Max speed	Mach 2
Guidance	Radar
Firing range min.	1,600 m
Firing range max.	12,000 m
Min target height	10 m

SA-9 Gaskin Low-Altitude Surface-to-Air Missile System



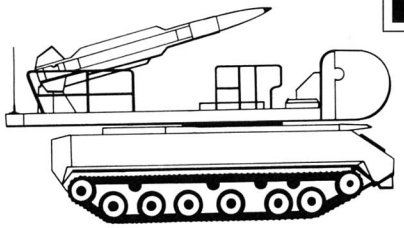
Crew	3
Length	5.8 m
Width	2.4 m
Height	2.3 m
Ground Clearance	0.43 m
Max speed on road	100 km/hr
Range	750 km
Engine power	140 hp
Search Type	Optical
Armament	SA-9 missiles

SA-9 Gaskin Missile

Length	1.8 m
Diameter	0.12 m
Weight	30 kg
Warhead Weight	2.6 kg HE
Max speed	Mach 1.5
Guidance	IR
Firing range min.	800 m
Firing range max.	6,500 m
Min target height	13.7 m

SA-11 Gadfly Low- to Medium-Altitude Surface-to-Air Missile System

Crew	4
Length	9.4 m
Width	3.1 m
Height	3.7 m
Max speed on road	50 km/hr
Range	300 km
Search Type	Radar
Armament	SA-11 missiles

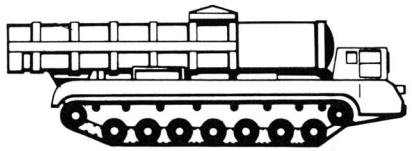


SA-11 Gadfly Missile

Length	5.6 m
Diameter	0.4 m
Weight	650 kg
Warhead Weight	90 kg HE
Max speed	Mach 3
Guidance	Radar
Firing range min.	3,000 m
Firing range max.	28,000 m
Min target height	30 m

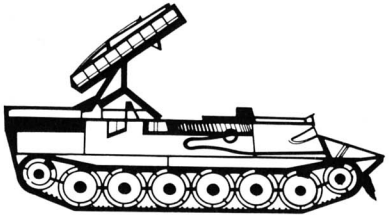
SA-12a Gladiator Low- to High-Altitude Surface-to-Air Missile System

Crew	4
Length	12.5 m
Width	3.5 m
Height	3.8 m
Max speed on road	50 km/hr
Range	450 km
Engine power	525 hp
Search Type	Radar
Armament	SA-12 missiles



SA-12a Gladiator Missile

Length	7.2 m
Diameter	0.5 m
Weight	2,000 kg
Warhead Weight	150 kg HE
Max speed	Mach 3
Guidance	Radar
Firing range min.	5,500 m
Firing range max.	80,000 m
Min target height	90 m



SA-13 Gopher Low-Altitude Surface-to-Air Missile System

Crew	3
Length	6.6 m
Width	2.9 m
Height	3.8 m
Max speed on road	55 km/hr
Range	450 km
Engine power	240 hp
Search Type	Radar
Armament	SA-13 x 4 missiles

SA-13 Gopher Missile

Length	2.2 m
Diameter	0.12 m
Weight	55 kg
Warhead Weight	4 kg HE
Max speed	Mach 1.5
Guidance	IR
Firing range min.	500 m
Firing range max.	8,000 m
Min target height	10 m

SA-7 Grail Man-Portable Anti-Aircraft Missile

Length	1.29 m
Diameter	0.1 m
Weight	9.0 kg
Warhead Weight	2.5 kg high explosive
Max speed	Mach 1.95
Search Type	Optical
Guidance	IR
Firing range min.	None
Firing range max.	3,500 m
Min target height	None

No Photo Available

SA-14 Gopher Man-Portable Anti-Aircraft Missile

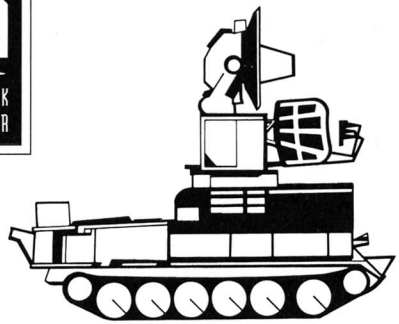
Length	1.3 m
Diameter	0.1 m
Weight	9.2 kg
Warhead Weight	2.5 kg high explosive
Max speed	Mach 1.95
Search Type	Optical
Guidance	IR
Firing range min.	None
Firing range max.	4,000 m
Min target height	None

No Photo Available

SSC-4 Sepal Cruise Missile Launcher

Crew	UNKNOWN
Length	4.46 m
Width	1.65 m
Height	1.95 m
Max speed on road	70 km/hr
Range	UNKNOWN
Engine power	UNKNOWN
Armament	Nuclear Cruise Missiles

No Photo Available



Same as Straight Flush Radar Vehicle

Straight Flush Radar Vehicle

Crew 4
Length ..... 9.8 m
Width ..... 4.9 m
Height to top of radar ..... 8.1 m
Max speed on road ..... 38 km/hr
Range ..... 340 km
Engine power ..... 280 hp
Armament ..... None

Command & Control Vehicle

Crew 6
Length ..... 9.8 m
Width ..... 4.9 m
Height to top of radar ..... 8.1 m
Max speed on road ..... 38 km/hr
Range ..... 340 km
Engine power ..... 280 hp
Armament ..... None

Man

Crew 1
Length ..... Variable
Width ..... 285 mm Semi-Fixed (Average - depends on rank)
Height ..... 1.8 m (Average)
Max speed on road ..... 18 km/hr
Range ..... 8 kpk (kilometers per K-ration)
Engine power ..... 0.1 hp
Armament ..... SA-7 missiles
..... SA-14 missiles
..... AK-47

Appendix A: Tour Briefings

LIBYA

In principle, every civilized inhabitant of the modern world repudiates, censures, and condemns an outlaw nation. But in fact, the leaders who represent us in international affairs are far from unanimous in applying sanctions against a renegade. Misguided and self-interested notions about the balance of power, religious communality, or the intrinsic right to conduct one's affairs as one sees fit , are paraded about as if they were legitimate excuses for not condemning, let alone not trying to stop, a nation's patently criminal behavior. Mitigating circumstances are conveniently discovered and invoked by countries whose prosperity depends on not offending the outlaw (or the outlaw's friends), to explain away or forgive state-sponsored terrorism, assaults on human dignity, random attacks on civilian targets, or the illegal production of chemical weapons.

We, however, have learned the hard way that such outlaws must be resisted, contained, and eliminated. Two world-wide conflicts in our century have shown that these states have no real goals; they place no limits on their criminal agendas. They just want more. Their will is to inflict as much damage on the established order as possible. They make the world an enemy, and virtually declare war on all of us. As such, the outlaw is a dangerous destabilizing force, first in its own region and later all over the world. An outlaw state puts the world at risk. Lacking the unanimous political, diplomatic, and military support of the world community, we have served as mostly passive witnesses to this phenomenon numerous times in the last two decades; and we are watching it happen again in Libya.

Now is the time for action, even if we must act alone; even if we must act surreptitiously. The information provided by the heroic efforts of an in-country intelligence network gives us a unique opportunity to disable and perhaps permanently incapacitate the most vicious terrorist organization in the eastern hemisphere. Military intelligence has been able to conclusively locate and identify the guiding hand behind Libya's unreasoned and savage policies. Surprisingly, he is not the self-proclaimed head of the Libyan government and army, though that person must be suspected of acquiescing in his nefarious activities. He is rather, a GRU-trained minor official in the Intelligence and Security service of his country.

Despite his lack of title and ministerial portfolio, no terrorist act is undertaken by his world-wide network without his knowledge and approval. He carries his movement's confidential papers, disguised as government documents, in a briefcase handcuffed to his wrist. In one small case are the names of his contributors, supporters, future targets, ordnance suppliers, money launderers, and assassins. His physical security is insured by three discreet but ever-present body guards. Get him and the briefcase and we could slam the brakes on current terrorist operations, and turn up the heat of world opinion against active and tacit supporters of those operations. The principle here is decapitate the terrorist group and the body dies.

The mission looks like a repeat of a cautionary bomb-over; but its true purpose is to exterminate the head honcho and get the briefcase. This would be difficult because his daily movements are intentionally unpredictable. However, having monitored his activities for almost two years, we've learned he keeps a liaison in the desert with scrupulous, even fanatical regularity. In short, we know where to find him on any Saturday we choose.

The mission begins several days before the prospective sanction with a number of conventional Alpha and Surgical Strikes. After bombers, jets and helicopters have softened things up, three Ranger teams are to be simultaneously dropped in different parts of the interior.

As events unfold, the following helicopter missions become necessary:

Alpha Strike
Surgical Strike
Dustoff
Truck Convoy
POW Rescue
Medevac
Chopper Escort
Supply Run
Sanction
Aerial Intercept
Chemical Warfare
Free Flight

VIETNAM

The Phun Luc corridor is an unforgiving, treacherous, and God-forsaken spit of impenetrable jungle, bordered on three sides by Cambodia and controlled, without formal opposition, by a group of opportunistic anarchists. In the last thirty years this highly disciplined, extensively trained, and heavily armed cadre of fanatics has been successively supplied, encouraged and ultimately abandoned by the Russians, the Chinese, and the Albanians. Since the group refuses the oversight or even the advice of any country or political persuasion, they're eventually perceived as uncontrollable, and therefore useless to the powers that be.

The current source of their enormous store of state-of-the-art military hardware of every type and description is a matter of some debate and speculation in the international community. The Cambodians and the Vietnamese don't really care. They just want the rebels gone, because this group is allowing the savage Khmer Rouge to use this piece of Vietnamese territory as a staging area for their planned takeover of Cambodia. Cambodia has been down the Khmer Rouge road once before. The government, the people, and the nation itself would likely not survive another such journey.

Today the majority of the Khmer Rouge leaders and their lieutenants are in Phun Luc for a negotiating session. It would be an opportune time to rain hard on them. Unfortunately the fragile democratically-based Cambodian government does not have the resources needed to pursue and destroy the rebels. In any case an invasion into Vietnamese territory would be difficult to control. Any military spillover would not serve as a good beginning to improved diplomatic relations with its neighbor, even though the Vietnamese don't want this destabilizing influence within their borders.

In a stroke of terrible and desperate irony, the Americans have been secretly called in to help solve this seemingly insoluble problem. The United States has agreed to acknowledge our on-going commitment to the security of this part of the world. However, for obvious reasons, it is not prepared to put a large number of forces on the ground. Fortunately combined intelligence has indicated the points of rebel vulnerability; helicopter assaults with a few good men are tailored-made for this mission. But because the rebels are not entirely idiotic, and understand that the only real danger they face in their entrenched position is from the air, all of their defenses are aimed at neutralizing this danger.

Because we don't want to expose our intentions prematurely and give the enemy time to dig in, the mission begins with an unobtrusive Chopper Escort run. The real mission is to pick up some in-country infiltrators who have detailed information about the enemy. An accurate description of the difficult terrain is critical and we must have better intelligence about their weapons installations and numbers before a fight begins. We must also find suitable places for LZ and a supply dump.

Throughout the ensuing battles, the following helicopter missions are carried out:

Chopper Escort
Dustoff
Aerial Intercept
Supply Run
Alpha Strike
Surgical Strike
Truck Convoy
Medevac
Chemical Warfare
POW Rescue
Free Flight

EAST GERMANY

When the interests of the two super powers publicly collide, the rest of the world has heart palpitations anticipating the range of potential consequences. Nuclear annihilation of the planet is not a happy thought for most people. Mindful of this, both governments have tried in recent years to conceal or minimize the significance of accidental though inevitable confrontations that occur while their military forces police what they consider their respective spheres of influence. And contrary to the operative conditions of a few short years ago, the alleged infringement by one nation's ship of the other's declared territorial waters, or the alleged violation of one nation's airspace by the other's aircraft are barely considered newsworthy in the current political climate.

As a result of this policy, the world rests easier; more ignorant of reality of course, but easier. The super powers certainly don't want to fight; they don't want us even to think

they're going to fight; consequentially they don't want us to know if they do in fact fight. When the well-worn cliche, "What the public doesn't know won't hurt it," is elevated to an operating political principle, the goal of foreign policy becomes "keeping the lid on" hostile confrontations. Naturally confrontations do occur; we just don't hear about them. Usually we never know how close we've come to hot-shooting war.

In this predictably tense environment of hyper-secrecy, a serious incident is unfolding. During the course of bilateral military exercises, the Soviet first deputy minister of defense has communicated his desire to defect to the West. This highly-decorated soldier is an expert in aeronautical engineering, and his knowledge of Soviet air-weapons policy is unique. However, the allied forces, not wanting to stunt the fragile growth of friendly relations with the USSR, initially balked at his offer. He, not wanting to take no for an answer, has now made the allies an offer they can't refuse. He has arranged to defect in the Soviet top-secret, multi-billion ruble, state-of-the-art Hokum attack helicopter. To military intelligence, one real chopper is worth a hundred sets of blueprints. They have accepted his offer. The problems are, the air minister is in hiding 100km east of Berlin, the Soviets are on to the whole deal, and *glasnost* notwithstanding, they are not about to let him or the helicopter go without a fight.

While both sides are committed to not implementing their nuclear arsenals and to maintaining as much secrecy as they can enforce, both know that conventional combat can't go on unannounced or unexplained for more than 48 hours. There is face to be saved after all. The joint military maneuvers that are in process means there's a lot of hardware in East Germany that can be mobilized quickly. Lightning strikes and precision raids will determine the outcome of this conflict. Each side has the means to be victorious. The question of what will happen if neither side achieves its goal in the time allowed is one that no one wants to answer.

The mission begins with a series of ALPHA STRIKES on a Soviet front-line installations and intelligence command post; looking to disable radar tracking stations, and perhaps some KGB spooks.

Nothing about this affair is simple, and as complications multiply, the following helicopter missions are called for:

Alpha Strike
Medevac
POW Rescue
Surgical Strike
Dustoff
Supply Run
B-2 Support
Chopper Escort
Pickup
Aerial Intercept
Free Flight

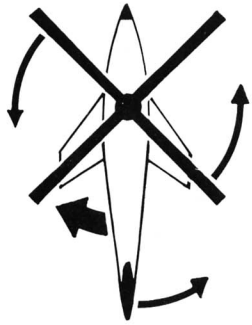
Appendix B: Helicopter Dynamics

AERODYNAMICS

The helicopter's basic aerodynamics impose limitations on ordinary flight: its unique engineering makes it fine for going up and down, but very poor for going from point A to point B (translational flight). As a consequence of using most of its installed power to overcome gravity, and because a rotor system is mechanically inefficient for propelling a machine forwards, translational speed is severely restricted. Nevertheless, if you need to hover, only a helicopter (or a tilt-rotor aircraft) will do. So how do they do it? How do they achieve their unique style of flight? Is the rotor simply a horizontal propeller? These are the complex questions we want to answer.

A helicopter's dynamic parts (rotors, shafts, and gears) can be arranged in many ways. By far the most common, and probably the most stable configuration, is the so-called *penny farthing* design, which is the main and tail rotor arrangement used by the Apache and the Black Hawk helicopters. The main rotor provides lift and propulsion, and the tail rotor, turning on a horizontal axis, pulls the tail sideways to counteract the main rotor's torque that attempts to drive the helicopter's fuselage in a direction opposite to that of the main rotor.

[See Figure 60]



Torque Problem
(Figure 60)

As the main rotor spins (counterclockwise in all American helicopters) the blades powerfully thrust air downward and generates the relative wind that flight requires. Each main rotor blade becomes, in effect, the equivalent of a super-thin wing. Its slender profile makes it efficient, and centrifugal force keeps it from bending under the huge weight it's trying to lift. The airflow caused by the spinning rotors creates intense suction (caused by the reduction in air pressure) above the wing (blade), and similarly increases air pressure below the blade. If the engine drives the blades with sufficient force, the aerodynamics provide sufficient lift to overcome the helicopter's weight. To get and keep the helicopter off the ground, the pilot encounters a different, though related set of problems, starting with how to control the aircraft.

CONTROLS AND OPERATIONS

The pilot uses two primary flight-control levers ("sticks") to move the helicopter into and through the sky. They're called the *collective* lever, which also has the twistgrip throttle of the aircraft, and the *cyclic* lever. To lift off the ground, the pilot pulls up on the collective, which increases the pitch of the twisting main rotor blades at the same angle (collectively), and increases the throttle.

When the rotor lift overcomes the helicopter's weight, the aircraft rises. To keep it from rotating in the direction opposite to the rotor spin, the pilot simultaneously increases the pitch of the tail (anti-torque) rotor using the left push pedal. The push pedals make the tail rotor work like a rudder of an airplane. Pressure on the left or right pedal makes the helicopter rotate left or right without moving forward, so they're ideal steering controls.

[See Figure 61]

Collective and Cyclic Control Levers
(Figure 61)

To move the helicopter forward, the pilot uses the cyclic pitch lever to oscillate the pitch of the blades. The cyclic corresponds to the control column in an airplane. It does not interfere with the collective setting, but by means of swashplates, changes the pitch of each blade for one portion of its *cycle* around the rotor hub. The amount of tilt is proportional to the movement of the cyclic lever.

When the swashplates are tilted, the helicopter moves in the direction of the tilt. For example, if the pilot pushes the cyclic straight ahead, the nose of the helicopter tilts forward and the aircraft moves forward. This happens because the cyclic movement increases the pitch of the rotor blades during the back half of the cycle, which increases lift, while simultaneously reducing the blades' pitch in the front half of the cycle, decreasing lift. This imbalance in lift causes the whole rotor plane to tilt forward, which moves the helicopter forward. This is how all translational movement (forward, left, right, or backward) is accomplished.

Translational flight also gives rise to *translational lift*. This is the unrequested lift that results in a sudden climb as forward speed increases. The lift occurs because the aircraft's blades become more efficient as they move into air undisturbed by the rotor's *wash*. The pilot compensates for translational lift by reducing total lift with the collective lever. Translational

lift makes it possible for helicopters to carry more weight than they can support in a hover, as long as the helicopter maintains a minimum forward speed.

Flying a helicopter requires the pilot to continuously adjust the four flight controls: the collective stick in his right hand for directional control, the collective lever in his left hand for vertical thrust, the throttle twistgrip on the collective lever for engine power, and the rotor pedals under each foot for rotational control. And the problem is compounded by many other factors. As one example, increasing the collective to increase lift creates more torque, and the pilot must press the left foot pedal increasingly to compensate. Increasing the force exerted by the tail rotor takes power from the main rotors, in turn decreasing the helicopter's ascent rate, forcing the pilot to pull up on the collective further to maintain his speed of ascent.

It is a difficult enough task to fly a real helicopter when your hands and feet are changing all the controls simultaneously. In a computer simulation, using only the joystick, mouse or keyboard, modelling these four controls separately would make flying impossible — you would have to be pressing many different keys at once, probably while manipulating a joystick or mouse, while never taking your eyes off the screen. Because of this complexity, these four controls are combined in various ways in LHX Attack Chopper to more closely approximate the experience of being an expert helicopter pilot.

ABBREVIATIONS AND GLOSSARY

AA	Air-to-Air
AGM	Air-to-Ground Missile
AIM	Air Intercept Missile
APC	Armored Personnel Carrier
AT	Anti-Tank
Autorotation	Technique for landing a helicopter without engine power
Bearing	Heading required to fly to target/waypoint
BMP	Bronnevaya Machina Piekhoata (Russian for Infantry Fighting Vehicle)
BRDM	Bronnevaya Razvedyvatelnaya Dozornaya (Russian for Armed Reconnaissance Patrol Vehicle)
BTR	Bronnetransporter (Russian for Armored Personnel Carrier)
C&C	Command and Control
Ceiling	The highest altitude an aircraft can fly
Chaff	Metal film strips dispensed as a decoy to confuse radar-guided missiles
CO	Commanding Officer
Collective	Helicopter control for ascending and descending
COMPTAMS	Computer Tour and Mission Selection
CRT	Cathode Ray Tube (a video monitor)
Cyclic	Helicopter control for steering
DoD	Department of Defense
ECM	Electronic Countermeasures
FFAR	Folding Fin Aerial Rocket
Flare (1)	A firework decoy dropped to confuse infrared-guided missiles
Flare (2)	Technique for reducing speed by pulling up an aircraft's nose
fpm	Feet per minute
Hardpoint	Fixture on an aircraft where weapons are loaded
HE	High Explosive
Heading	The compass direction a vehicle is facing
HEAT	High Explosive Anti-Tank
HUD	Head Up Display

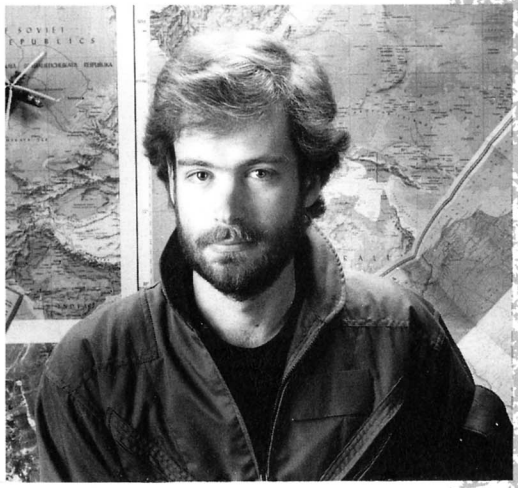
IR	Infrared
IRCM	Infrared Countermeasures
Jammer	A device used to confuse weapon guidance systems
LHX	Light Helicopter Experimental
LZ	Landing Zone
MAVRP	Mission Availability Report
Medevac	Medical evacuation
MFD	Multi-Function Display
MIA	Missing In Action
NOE	Nap-of-the-Earth, as in NOE flying
OGE	Out of Ground Effect
POW	Prisoner Of War
RWR	Radar Warning Receiver
SAM	Surface-to-Air Missile
SCAT	Scout/Attack
Signature	The electromagnetic image presented by a vehicle to a weapon, on infrared, radar, or optical wavelengths
SPD	Ground Speed
TOW	Tube-launched Optically-tracked Wire-guided
Trim	Technique for maintaining altitude during a turn in an aircraft by pulling back on the flight stick
USMC	United States Marine Corps
VSI	Vertical Speed Indicated
VTOL	Vertical Take Off and Landing
Waypoint	A map location significant to a mission

INDEX

CREDITS

At the age of fifteen, Brent went to a friend's house to play games on an Apple II. That was his first experience with a computer. He liked it a lot better than anything he was studying in school. Brent still thinks computers were made for playing games.

When he went to the University of Michigan, Brent dreamed of majoring in Art and becoming a great artist. His dream mutated when he met a lot of artists who were better than he was, and who weren't making any money. He also knew computer programmers he was just as good as, and they made more money. Brent majored in Computer Science.



Before coming to Electronic Arts in 1986, Brent worked for a company you've never heard of, doing things he's really ashamed of. Besides programming flight simulators, Brent also enjoys computer graphics programs. He programmed the IBM and Apple IIgs versions of DeluxePaint II. So all that artist stuff didn't go to waste.

If you ask how he really feels about helicopters, Brent will tell you that he used to think flying in a helicopter was unsafe. But now that he knows how they really work, he's even afraid when one flies overhead.

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NO POLITICS INTENDED

The duty tours and missions available in LHX Attack Chopper should not be construed as a political statement made by Electronic Arts. The software merely attempts to simulate the experience of piloting attack helicopters in an imaginary combat setting, and the story line described in the software and in this manual should not be confused with the current global political climate.

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