COMANCHE® 2



PILOT
MANUAL

MACINTOSH®

NOVA LOGIC™

COMANCHE® 2



Le Vieux Manuel

PILOT
MANUAL

MACINTOSH

LETTER FROM THE PRESIDENT

Dear **Comanche 2** Player,

We at NovaLogic thank you for purchasing Comanche® 2, the latest version of the Comanche helicopter simulator. It has been four years since the original release of Comanche Maximum Overkill®. A lot has happened since then. Perhaps most significantly, a real Comanche has been built and delivered to the Army for flight tests.

The release of Comanche® 2 marks the third major enhancement to the original product. Features such as better terrain, reflective water and haze effects first appeared in the Over the Edge® mission disk and Comanche CD®. Comanche® 2 adds *multiplayer capabilities, translucent smoke, ground hulks* and many other features.

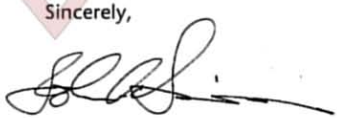
Once you climb aboard the RAH-66 Comanche, you will notice the improved cockpit layout. Cockpit Multifunction Displays have been re-dimensioned to enhance forward visibility. Best of all, you can now test your skill against an opponent wilier than any computer AI – another human. Watch your six and your instruments because you are now playing The Most Dangerous Game®. With Werewolf® vs. Comanche® 2, NovaLogic offers the first of a series of multiplayer games, featuring the ultimate challenge of man against man (or woman).

Comanche® 2 can be played with other Comanche® 2s or with Werewolf. You and a friend can play Comanche against Werewolf, using the two CDs you just bought. If your friend has also bought Werewolf vs. Comanche® 2, you can play cooperatively with other Comanches against one or more Werewolves or team up in a Werewolf pack against the Comanches. Of course, you can still play either game as a stand alone.

Many dedicated gamers worked super hard to bring you Werewolf vs. Comanche. I hope you enjoy playing it as much as we did creating it. Let us know what you think by returning your registration card.

Thanks for your support!

Sincerely,



John Garcia
President, NovaLogic, Inc.

NOVA LOGIC

Loyalty Manual

NovaLogic Technical Support

The entire staff here at NovaLogic, Inc. would like to thank you for purchasing this copy of Comanche® 2, the latest in our series of fine helicopter simulations for the Macintosh. We're committed to producing quality entertainment software that pushes the technological envelope. This commitment doesn't end when you purchase our games however, it's just begun. NovaLogic's Technical Support staff is ready to assist you.

NovaLogic Technical Support Line: (818) 878-0325

If you need to speak to someone directly, our Technical Support Staff can be reached during normal business hours (Monday through Friday 9AM to 5PM Pacific Standard Time). To better assist you, a Technical Support staff member is likely to ask questions regarding your specific hardware set-up. Have this information handy. Also, be prepared to explain the exact nature of any problems you are experiencing. For example, write down the exact wording of any on-screen error messages you may be receiving.

NovaLogic Fax Support Line: (818) 880-3448

You may fax your questions or comments to a member of Technical Support at any time day or night. To send us a fax, dial (818) 880-3448. Be as specific as possible regarding any problems you may be experiencing.

NovaLogic Email Support Line: support@novalogic.com

You may email your questions or comments to a member of Technical Support at any time. Send your email to *support@novalogic.com* Again, to better assist you, please be as specific as possible regarding any problems you may be experiencing.

NovaLogic Internet Website: http://www.novalogic.com

Those of you who have access to the World Wide Web may visit the NovaLogic website for up-to-the-minute product information, previews of coming attractions, game updates and screen shots, and a host of other NovaLogic goodies.

NovaLogic Bulletin Board Service: (818) 880-3444

The NovaLogic BBS can be reached 24 hours a day for your convenience. It is offered to our customers as an alternative to visiting our website. You may log-on to the NovaLogic BBS via modem by dialing (818) 880-3444.

Committed to Quality
Dedicated to Excellence

All Rights Reserved
©1996 NovaLogic, Inc.

CREDITS

Programmed by
Todd Stewart

Game Design
Kyle Freeman
John Garcia

Executive Producer
John Garcia

Art and Animation
Keith Rust
Rod Parong
Dean Fowler
John Dugan
Daniel Cabuco
Walter Schulz
Kyle Freeman
Paul Drzewiecki
Jason Tull

Mission Design and Testing
Paul Robinson
Keith Rust
Wes Eckart
Jay C. Boone
James Kaspert
Kyle Freeman
Gavin James

Mission Orders Written by
Paul Robinson

Music Composition
Jeff Marsh
Stewart Pekins
Gary Wilens

Voices
Nancy Gilmour
Roger Steffens

Sound Effects
Kyle Freeman

Voice Audio Production Assistance
Jeanne Hartman
Paul Moser

Manual Written and Edited by
Ed Dille, Fog Studios, Inc.
John Garcia
David R. Holmes
Lawrence T. Russell

Manual Layout and Design
Rafael Bautista
Lawrence T. Russell

Graphic Illustrators
Rafael Bautista
Brett Wooldridge

Special Thanks to
David Seeholzer
James Lamorticelli
Glenn Kronick
John Butrovich
Richard Matsuura
Dave Woldrich
Kyle Rode
Patric McMenamin

Lavieux Manuel

Original Package Design
The Design Office
of Wong & Yeo

Project Manager
David Seeholzer

Technical Manager
John Butrovich

QA Mgmt
Rich Matsuura
Tim Knight

Lead QA Tester
Tony Kotelenets

Technical Consultants
Frank Colucci
Simon Bradley

NovaForce
Daniel Chang
Jason Chein
Stephen Chein
Tom Harrison
Cory Holloway
Mat Jennings
Tony Kotelenets
Stephen Merkel
Gregg Nakawatase
Dan Roy
John Savage
Angel Sisson
Jay Tando
Tyler Ziemann

Le Vieux Manuel



GAME INSTALLATION

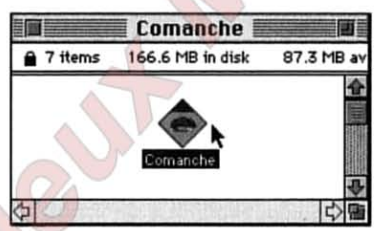
Comanche® 2 Mac (hereafter known simply as Comanche 2) can be played entirely from the CD in order to save space on your hard drive. It is not necessary to "install" the game at all, however if you would like to increase the loading speed of the game, it is recommended that you copy portions of it to your hard drive. Before performing this operation, check the available free space on the drive.

TO PLAY COMANCHE 2 FROM THE CD:

1. Insert the Comanche 2 CD into your CD-ROM drive.



2. Double click on the Comanche 2 icon after it mounts in the Finder.
3. Double click on the application icon as shown in the window below to run the game.



TO INCREASE THE LOADING SPEED OF THE GAME:

1. Choose a location on your hard drive for the Comanche 2 files. Create a brand new folder for them and call this folder "Comanche ".



2. Open the Comanche 2 window by double clicking on the CD icon.
3. Drag the Comanche 2 application icon and the Mission Folder from the CD window and drop them in the newly created Comanche 2 folder on your hard drive.



4. To run the game, double click on the Comanche 2 application icon on your hard drive. Make sure that the Comanche 2 CD is still in your CD-ROM drive. You are required to have the Comanche 2 CD in your CD-ROM drive in order to play the game.

LeVieux Manuel

COMANCHE STRIKE

: 0045 HOURS ZULU 18 SEPTEMBER 1999
: FARP JULIET... SOMEWHERE NEAR ENEMY LINES

The darkness shrouds the blacked-out Forward Area Refueling Point (FARP) code named "Juliet" like a blanket. Although the location is highly classified, you, your crew, and your companions are painfully aware of your exact coordinates: roughly 7 miles behind enemy lines. Tensions are running high in the region and diplomatic solutions have failed. As is so often the case, when the politicians pull out, the military moves in. Tonight is no training exercise; you're here to start a war.

Nearly nine years ago the 1991 Gulf War began in the middle of the desert night with U.S. Army Aviation leading the charge. AH-64 Apaches launched from forward replenishment areas not unlike FARP Juliet at 00:56 hours local time and initiated hostilities at 02:38 hours on Iraqi early-warning radar stations. Tonight that drama will be replayed, only this time you are on the stage and the highly celebrated AH-64 Apaches stand in the shadow of tonight's star: the RAH-66 Comanche.

The enemy has threatened invasion several times and seems intent of fulfilling those threats, having established three "launch points" for an armored invasion of friendly territory. Task Force Tripoli has been deployed to FARP Juliet to deal with this threat. Six RAH-66 Comanches (two for each target) have been ordered to penetrate enemy lines and neutralize these "launch points." A pair of USMC MH-60 "special forces" helicopters will follow each pair of Comanches. If the Comanches successfully destroy their assigned targets, the MH-60s will insert troops and secure the area. If a Comanche, which has not yet been proven in combat, goes down, the MH-60s will execute crew extraction. Eight AH-64 Apaches will provide fire support by locating and engaging any enemy armor which escapes the Comanche raids or protect FARP Juliet in the event of an enemy counterattack.

Your particular target is an enemy supply depot roughly 60 nautical miles from your current position. INTEL has reported hostile armor to be refueling at this supply depot in preparation for an invasion into friendly territory. Tonight, cloaked by a moonless night, you will participate in the destruction of that base—and the armored units located there—before they can make good their invasion threats. You are assigned to first destroy communications equipment, then fuel tanks, then expend any remaining ammunition on enemy armor. If the quantity of targets exceeds your weapons capacity, direct artillery fire into the target area then report surviving enemy armor positions to the eagerly awaiting Apaches.

You glance around the blacked-out base as you climb into the cockpit. Nothing, not even the glow of a cigarette, exists to betray FARP Juliet's position. For all practical purposes, the base is invisible. Hopefully, your Comanche will be likewise invisible during ingress. Through a combination of extremely low-level flight and stealth designs, the first warning the enemy receives of your presence should be the detonation of your weapons in their faces. With no visible exterior lights, minimal cockpit lights, and other "low observable" designs, the Comanche should glide invisibly through the darkness. From your perspective, however, thermal imaging and

light intensification equipment onboard the RAH-66 turn the night into a sort of "monochrome day," turning imperceptible shades of heat and darkness into easily distinguishable shades of green. The night is your friend; it hides you while exposing the enemy.

With the engines now warmed up you watch the seconds tick off on the digital clock. At exactly 00:58 hours TF Tripoli's commander, Lt. Col. Lamorticelli announces one prearranged code word over the radio: "Arrowhead." You lift the collective and all six RAH-66 Comanches lift off in unison as if connected to a single control, turn toward their assigned headings, and disappear into the blackness. Flying just fast enough to remain ahead of the dust cloud generated by your main rotor, you and your wingman make your way toward the target while flying only 50 feet above the desert floor. Your target is the closest to FARP Juliet, therefore you must fly slow to ensure you do not arrive and betray your presence before the rest of TF Tripoli is in position.

All units in TF Tripoli maintain strict radio silence. No warning of any kind can be awarded the enemy. In order to guarantee total success on tonight's raid as well as "convince" enemy leaders of U.S. military superiority the raid must catch all intended victims totally unaware. At exact 01:47 hours Lt. Col. Lamorticelli announces the second prearranged code word, "Whistle," thereby indicating all units should now be 5 minutes from their assigned targets. You and your wingman approach the entrance to the long, narrow valley containing your target. Slinking stealthily to canyon's rim, you locate your target and lock your first Hellfire missile on the communications van. Exactly 4 minutes and 50 seconds after the "Whistle" call, Lt. Col. Lamorticelli announces over the radio, "Party in ten." This indicates all Comanches are to begin employing ordnance in 10 seconds.

You watch the seconds tick down. Three... Two... One... You squeeze the trigger and receive immediate gratification as the missile strikes the "comms" van which subsequently erupts into flame. Your gunner busies himself designating targets and releasing countermeasures. Quickly realizing there are more enemy tanks here than expected your order your wingman to start picking them off from his present position, then request artillery fire support. Between two Comanches and artillery raining down on the target, the destruction is nearly absolute.

With only a few rounds of 20mm cannon ammunition remaining, you turn your aircraft toward home only to be jolted as brightly colored tracers shower your aircraft — an enemy AAA gun, probably a Russian-built ZPU-4, survived the attack. Dropping behind a nearby ridge you assess that your aircraft has taken little, if any, damage while you watch machine guns from an approaching MH-60 open fire toward the AAA's position. The tracers stop immediately.

Your Comanche vibrates a little at speeds over 150kts on the route home, but otherwise seems unscathed. Enroute to FARP Juliet, you observe outbound Apaches on their way to pick off stragglers. "Good luck finding targets," you think to yourself, "there aren't that many left." Then a new thought strikes you: were the other raids as successful as yours?

Upon arrival at FARP Juliet, a quick inspection reveals a fist-sized hole in the tail structure accompanied by a severely bent blade on the tail rotor. Such damage would have sent a lesser helicopter immediately into the dirt, but the combination of a survivable airframe and computer-controlled fly-by-wire flight controls kept the Comanche airworthy. Further, you learn shortly that all three targets were devastated with equal efficiency. Although no soldier likes war, you can't help but feel a sense of pride at having executed your mission so professionally while simultaneously proving the Comanche battleworthy. Unfortunately, the aggressors aren't ready to surrender yet. After brief repairs, you and your Comanche will be heading out on the second wave of attacks in just a few hours.

Table of Contents

Letter From The President ii
NovaLogic Technical Support iii
Credits iv
Game Installation vi
Table of Contents ix
Chapter I Game Menus 11
A. The Pilot Roster Screen 11
1. Adding Pilots to the Pilot Roster 12
2. Deleting Pilots from the Pilot Roster 12
3. Pilot Roster Ranking 12
B. The Main Operations Menu Screen 12
C. The Menu Bar 14
Chapter II How To Fly The Comanche 21
A. Primary Flight Controls 21
1. The Collective 21
2. The Cyclic 22
3. The Rudder 23
4. An Easy Aircraft to Fly 23
B. Cockpit Avionics 25
1. Pilot Views 25
2. Helmet Integrated Displays (HID) 26
3. Tactical Information Displays (TIDs) 28
4. Other Console Avionics 30
5. Weapons System Controls 31
6. Hands-Off Weapons 32
Chapter III Multiplayer Gaming 35
A. Multiplayer Modem Gaming 36
1. Initiating a Modem Game 36
2. Multiplayer Modem Victory Conditions 37

Le Vieux Manuel

B. Multiplayer Network Gaming 38
1. Initiating a Multiplayer Network Game 38
2. Network Play Victory Conditions 39
Chapter IV Helicopter Strategy & Tactics 41
A. General Survival Hints 41
1. Altitude Considerations 41
2. Duck and Cover Tactics 41
3. Masking and Unmasking 42
4. Following Fire 43
5. Defensive Maneuvering 43
B. The MultiPlayer environment 43
1. Drag and Ambush Tactics 43
2. Drag and Pursue Tactics 44
3. Crossfire Attacks 44
4. The Echelon 44
5. Deception and Attack Tactics 44
C. Forward Area Refueling Points (FARPs) 44
Chapter V About The Comanche 45
Chapter VI Technical Specs 59
A. Aircraft 59
B. Land Vehicles 62
C. Naval Vessels 65
Chapter VII Hardware Configurations 67
A. Joysticks 67
B. Throttle 70
C. Foot Pedals (Rudders) 70
Glossary 71
Comanche Index 80
Pilot Notes 84
Player Reference Chart 85, 87

Le Vieux Manuel

CHAPTER 1
GAME MENUS

Once the game is properly installed on your hard drive you'll find that Comanche 2 is designed to have you up and flying in no time at all. This chapter explains the various Game Menu screens that assist you in getting started. It also details the menu bar options that enable you to tailor the game to suit your particular hardware.



A. THE PILOT ROSTER SCREEN

The Pilot Roster is your squadron's Ready Room. This is the place where your pilots hang out between missions. In order to fly a Comanche 2 mission (either Single or Multiplayer) you first need to choose a pilot to represent yourself in the game. Several default pilots are already present on the Pilot Roster to help you get started. Select one of these pilots by 'clicking' your mouse button on the pilot's name as it appears on your screen. The pilot's name is momentarily highlighted to indicate your selection.

Le Vieux Manuel

1. Adding Pilots to the Pilot Roster

To add a pilot to the Pilot Roster, simply click your mouse button on NEW PILOT. A dialogue box appears prompting you to type in the name of your new pilot. When you are done, click on the OK button. Your new pilot is added to the Pilot Roster.

2. Deleting Pilots from the Pilot Roster

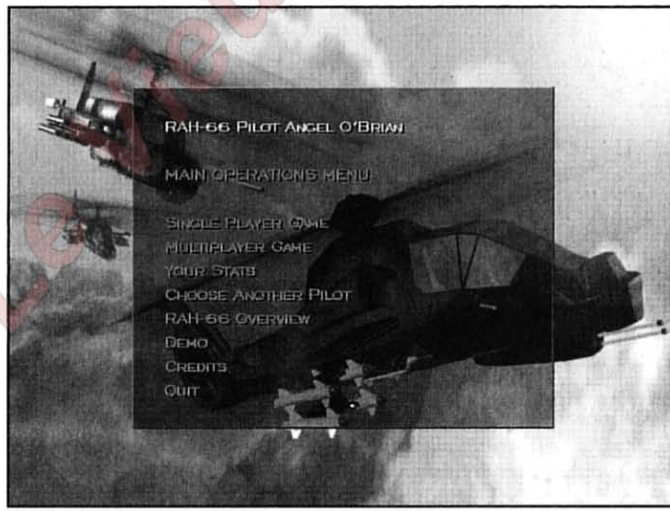
To remove a pilot from the Pilot Roster, simply click your mouse button on Delete PILOT. You are directed to select the name of the pilot you wish to remove. Once you have made your selection, a dialogue box appears asking you to confirm this selection.

3. Pilot Roster Ranking

Pilots are ranked according to the number of successful missions they have flown (and survived). This number appears to the left of the pilot's name. The pilot with the highest number of successful missions is listed at the top of the Roster. Pilots that have completed fewer successful missions appear in descending order.

B. THE MAIN OPERATIONS MENU SCREEN

The Main Operations Menu screen is your launching point into the game.



1. Single Player Game

This option opens the SELECT CAMPAIGN dialogue box. On this dialogue box are listed the Comanche 2 campaigns.

Le Jeu Manuel

a) Selecting a Campaign

Make a campaign selection by clicking your mouse button on the name of one of the six campaigns. After you make your campaign selection, a dialogue box appears which lists of all the missions that make up this particular campaign.

b) Selecting a Mission

You are free to fly the missions listed here in any order you wish. Make a mission selection by clicking your mouse button on the name of the mission you wish to fly.

c) Mission Briefing

Once you have made a selection, a mission briefing appears which details this particular mission. After reading the briefing, you are given the two options; Accept Mission or Reject Mission. If you choose Accept Mission, you are placed in the cockpit of your Comanche and the mission begins. If you Reject Mission, you return to the Select Mission dialogue box to choose another mission.

NIGHT MISSIONS - The Army likes to brag that it "owns the night". That's not far from the truth. With the help of image intensifiers that amplify moon and starlight over 30,000 times and Forward Looking InfraRed (FLIR) that looks for temperature differences, your Comanche was built to operate equally well in darkness as in light.

During all of your night missions on-board the Comanche, the cockpit display will appear in green and black tones. This means that your image intensifiers and thermal imagers are on-line and operating for night duty. Your two Tactical Information Displays will also be operating in this mode while in use during night missions.

2. Multiplayer Game

This option enables you to begin a multiplayer game session. See Chapter III: MultiPlayer Gaming for details.

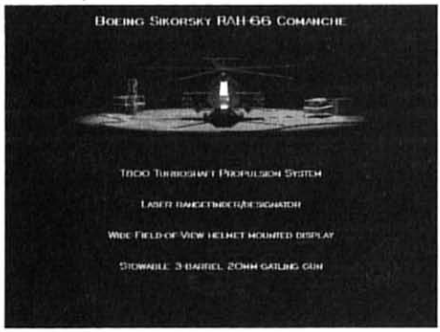
3. Your Stats

This option gives you access to your pilot's statistics. Listed on this screen are your pilot's cumulative score, number of victorious (successfully completed) missions, and the number of enemies this pilot has destroyed.

4. Choose Another Pilot

This option enables you to change pilots by granting you access to the Pilot Roster.

Levity Manuel



5. RAH-66 Overview

This option gives you a brief technical overview of your RAH-66 Comanche.

6. Demo

This option initiates a self-running demo of your RAH-66 Comanche in action.

7. Credits

This option displays a list of the people who made this product possible.

8. Quit

This option ends your gaming session. Please hurry back.

ESC- Pressing the ESC key at any time pauses the simulation and displays the Menu Bar across the very top of your screen. See below for details concerning the Menu Bar.

C. THE MENU BAR

Before you take off on your first mission, let's make sure that the combat simulator is precisely configured to your computer's hardware. To access the menu bar from the Main Operations Menu screen press the esc key.

At the top of the screen, above the shot of the RAH-66 in flight, you will see the menu bar appear with four menu selections and their respective options. Next to some of these menu options are keyboard alternatives that you may use without having to use the esc key to access the menu bar. You may use these keyboard shortcuts even while in the midst of your missions.

1. Menu

a) About COMANCHE

Pressing this selection will display the game credits.

2. File Menu

a) Abort Mission ⌘+A

This option allows you to exit out of your present mission and go back to the Main Operations Menu screen for reassignment. You can abort a mission by pressing the esc key or by pressing the ⌘+A keyboard shortcut.

Le Vieux Manuel

b) Resume ⌘+R

Choosing this menu option during a mission will resume a paused game. This option functions as an alternative to pressing the esc key in order to resume play.

c) Quit ⌘+Q

Selecting this option exits you from the game following a confirmation. You may access this option from the File menu or via the ⌘+Q keyboard shortcut.

3. Edit Menu

a) Undo, Cut, Copy, Paste, and Clear

These functions are disabled while Comanche 2 is running.

b) Preferences

This menu option displays a dialog box allowing you to specify detailed information about your system. It also allows you to optimize Comanche 2 to run on your computer. If the program is not operating properly, or is running slowly, try changing these settings. If you want to reset your program preferences to their default settings, hold down the Option key when you start the game.

1) Stereo

Use your mouse to place an X in this box if you have external speakers and wish to listen to your sounds in stereo.

2) Engine Sounds

Use your mouse to place an X in this box if you wish to hear engine noise.

3) Hi-Rez Anims.

Use your mouse to place an X in this box to display animated sequences in high resolution.

4) Monitor Resize

Use your mouse to place an X in this box to set the screen resolution to match the selected game resolution.

5) Use Quickdraw

Use your mouse to place an X in this box to activate your Quickdraw Accelerator if available.

Le Vieux Manuel

4. Detail Menu

These menu options allow you to configure the highest resolution of our Voxel Space graphic technology that your computer can handle. The faster your computer, the faster the game will play, and the more detail it will be able to show per frame. As a rule, the lower the detail you select, the faster the simulation will run. Experiment with the settings until you find the Detail Setting best suited to your computer's configuration.

a) Terrain Detail

This option allows you to select the optimal level of detail for the speed of your computer.

1) Low Detail

Changes your monitor to display a screen resolution of 320 x 240 pixels.

2) High Detail

Changes your monitor to display a screen resolution of 640 x 480 pixels.

b) Gamma ⌘+G

Press this key to toggle the brightness of your monitor between four different levels of brightness. Once the desired level of brightness is reached, it will cycle back to the darkest setting.

c) Clouds

This option allows you to turn the cloud backgrounds On or Off. On some computers this is the best way to maintain a high frame rate with no loss in play quality. Use your mouse to place a checkmark next to this menu entry if you want to turn cloud backgrounds On.

d) Small Pixels

Use your mouse to place a checkmark next to this menu option to improve your graphic detail. This option reduces the size of your individual on-screen pixels.

e) Haze

Use your mouse to place a checkmark next to this menu option to turn on atmospheric haze.

f) Reflections

Use your mouse to place a checkmark next to this menu option if you wish to have reflections appear on water surfaces.

Le Vieux Manuel

g) Frame Rate Lock

Use your mouse to place a checkmark next to this menu option if you wish to limit your computer to a maximum framerate of 12 frames per second.

5. Control Menu

This menu allows you to change the audio component of the game. It also allows you to configure your hardware control devices.

a) Sound

This menu option lets you control the volume of your Sound and Voice Effects. A pop-up menu will appear allowing you to set the volume of your sound and voice effects between zero and seven (with the loudest being seven).

b) Music

This menu option lets you control the volume of your music. A pop-up menu will appear allowing you to set the volume of your music between zero and seven (with the loudest being seven).

c) Keyboard

Select this option if you want to use the keyboard to control your helicopter. This option is set by the program as the default control option. The keyboard can control all functions of the simulator.

d) Mouse

Choose this option if you are planning on using a regular mouse or a controller that emulates the mouse as your flight controller.

e) ThrustMaster

Choose this option if you wish to use the ThrustMaster Flight Control System (FCS). Refer to your user manual and the illustration in Chapter VII: Hardware Configurations for instructions.

f) Gravis

Choose this option if you wish to use one of the following Gravis products: Firebird, Mousestick, or GamePad. Refer to your user manual and the illustrations in Chapter VII: Hardware Configurations for instructions.

Le Vieux Manuel

g) Throttle

Choose this option if you wish to use a seperate throttle controller such as the ThrustMaster WCS or CH Pro Throttle. Refer to the illustration in Chapter VII: Hardware Configurations for operating instructions.

h) Pedals

Choose this option if you wish to use a seperate pedal controller such as the ThrustMaster RCS. Refer to the illustration in Chapter VII: Hardware Configurations for operating instructions.

6. Options Menu

The RAH-66 Comanche utilizes a Helmet Integrated Display (HID) system for the pilot to manage the navigation and weapon systems. These HID Display Options control the amount of information visible through your Helmet Integrated Display. Place a checkmark next to the option as it appears on the menu to activate the following options.

a) Artificial Horizon

This option controls the display that shows your present "pitch" (whether your bird's nose is up or down) and your helicopter's roll (left or right bank).

b) HID Indicators

This option controls the Helmet Integrated Displays that report your Comanche's present physical position and status. This setting will simultaneously turn "On" or "Off" the following HID indicators: Radar Altimeter, Rate of Climb Indicator, Heading Velocity Indicator, and Speed Indicator Display.

c) HID Compass

Disables/enables the compass display along the upper edge of the HID.

d) Missile Cam

Changes your view while in TAS Camera mode. When this display is engaged, your Stinger or Hellfire missiles will relay closing views of the target.

e) Rotor Mixed w/ Cyclic

When disengaged, the rotor and cyclic can now function independently via the joystick and the rudder pedals (or keyboard), providing for more precise and realistic movement.

Le Vieux Manuel

f) Altitude Stabilizer

When disengaged, the Comanche's pitch is no longer held stable by the computer. This requires greater pilot emphasis on altitude control.

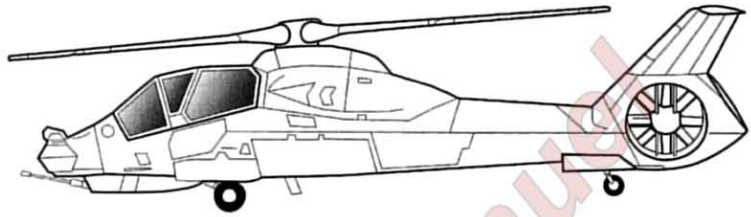
g) Auto Chaff

Lets the on board computer dispense chaff as needed.

h) Auto Flare

Lets the on board computer dispense flares as needed.

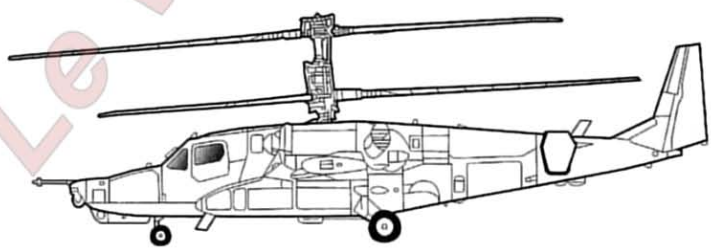
Le Vieux Manuel



RAH-66 Comanche

"Just as tanks have always been the most effective weapon against other tanks, helicopters are the most effective means of fighting other helicopters."

-Colonel M. Belov,
How to Fight Helicopters, Soviet Military Review



Ka-50 Hokum

Le Vieux Manuel

CHAPTER II
HOW TO FLY THE COMANCHE

A. PRIMARY FLIGHT CONTROLS

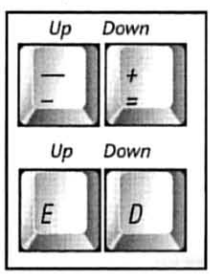
Visually, helicopter flight controls resemble jet fighter flight controls. There is some kind of control stick for the right hand, some kind of throttle/power for the left hand and a pedal for each foot. That's where the similarities between rotary-wing and fixed-wing flight controls end.

1. The Collective

The Collective, located under your left hand, controls the amount of lift generated by the main rotor by controlling the pitch of the main rotor blades. The collective in most helicopters is a long arm attached at one end to the cockpit floor. The pilot holds the arm much like a relay runner holds a baton. The arm pivots at the connection point to the floor. The pilot "pulls" the collective up to increase lift and "pushes" it down to decrease lift.

Do not confuse the collective with throttle. The throttle controls the engine RPM while the collective controls the pitch of the rotor blades. Helicopters have separate throttle controls, but are usually left at a constant setting during flight. Since it is rarely necessary to adjust throttle during flight we have not included separate throttle controls in Comanche. Users with analog throttle controls, such as the Thrustmaster WCS Mk II and TQS, will note that sliding the throttle backwards results in increased torque. This operation is "backwards" from throttle controls in other flight simulations because it more accurately simulates the movements made with the left hand to control torque.

The main rotor provides the only source of thrust available to the helicopter. That thrust, which is generated directly downwards from the rotors, must be used to lift the helicopter as well as propel it. Since this thrust is pointed directly downward when the helicopter is straight and level, the thrust only lifts the helicopter. In order for the helicopter to climb, torque must be increased via lifting the collective. To make the helicopter move forward (or backward), the cyclic must be moved in conjunction with the collective.



a) Collective Control

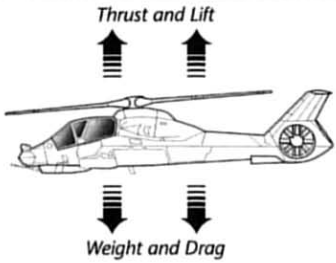
Any analog throttle device, such as the throttle control on the

Le Vieux Manuel

CH Flightstick or the Thrustmaster WCS Mk II, can be used for collective control. Keyboard users increase torque with the dash [-] key or the [E] key and decrease torque with the equal [=] key or the [D] key.

b) Collective Indicator

Situated on the left side of the screen next to the left tactical display, two bar graphs labeled "C" and "T" indicate the current collective and throttle settings, respectively. Note that the throttle is set automatically by Comanche's onboard computers to provide the requested amount of collective.



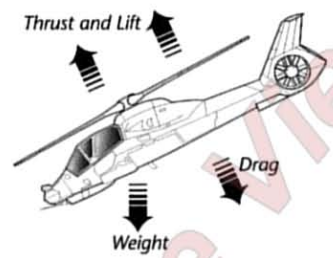
Comanche in Hover or Vertical Flight

2. The Cyclic

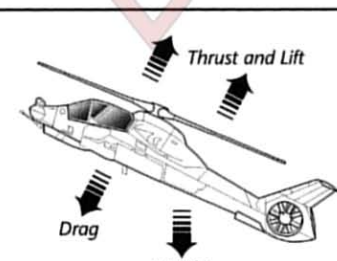
The "control stick" in a helicopter is called a cyclic. The cyclic controls pitching and banking the helicopter. As with a normal aircraft, pushing the cyclic forward lowers the nose, pulling the cyclic back raises the nose, and moving the cyclic to either side banks the helicopter to that side.

a) Vectored Lift

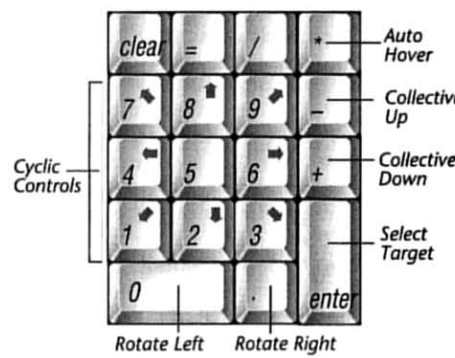
Unlike fixed-wing aircraft, pushing the nose down does not necessarily mean the aircraft will descend. As described in the collective section, the thrust generated by the main rotors is pointed directly downwards. Tilting the body of the aircraft therefore tilts the direction of the generated lift. Pointing the nose down cause the lift to be pointed somewhat behind the helicopter. Less lift is generated directly downwards (which may cause the helicopter to descend slightly) but the lift pointed behind the



Comanche in Forward Flight



Comanche in Backward Flight



Le vieux manuel

helicopter pushes it forward. Likewise, pulling the nose up points lift forward and slows the helicopter until eventually if flies backwards.

When flying, if you need to accelerate increase collective while simultaneously pushing the cyclic. Lowering the nose creates a greater horizontal component thus increasing speed, while increasing collective increases the overall amount of lift being generated, thus maintaining altitude.

b) Cyclic Controls

The cyclic can be controlled with either a standard joystick, with the arrow keys located between the main keyboard and numeric pad, or with the arrow keys on the numeric keypad.

3. The Rudder

The main rotor continues rotating at the same speed regardless of the pitch of the blades. Increasing the blade pitch (to increase lift) also increases drag, thus making it harder to move rotate the blades, therefore requiring more torque to actually turn the rotor. The laws of physics tells us that for every action there is an opposite reaction. When a helicopter is not firmly planted on the ground, the torque generated by the rotor in one direction causes the helicopter body to rotate in the opposite direction.

a) Tail Rotors & Torque Effects

Obviously, a helicopter spinning madly is of little tactical use. Most helicopters make use of a tail rotor to offset the main rotor's torque effects. In the real Comanche, the amount of thrust generated by the tail rotor is controlled by a twisting action on the cyclic control stick. Twisting the cyclic effectively yaws the helicopter left or the right much like a rudder on a fixed wing aircraft.

b) Tail Rotor Controls

In Comanche 2, the twisting action of the cyclic has been replaced by the [ ] and [ ] keys on the numeric keypad. It can also be simulated by any device connected to the X-axis of the second analog joystick port, such as Thrustmaster RCS pedals.

4. An Easy Aircraft to Fly

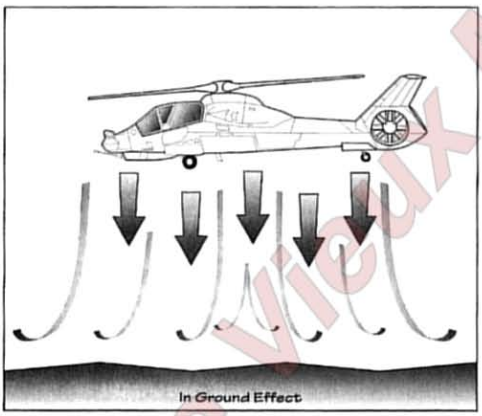
Helicopter flight is an exercise in coordination. Moving the cyclic alters the vertical lift component, therefore requiring a change in collective to maintain altitude. Changing collective changes the amount of torque on the main rotors. This requires the pilot to simultaneously change the tail rotor setting also. In short, every movement of any of the three controls generally requires compensating movements in the remaining two controls.

Le Lieux Manuel

The Comanche is different. Being a product of the modern era, it uses a computer-monitored fly-by-wire(FBW) flight control system. The pilot's controls are not directly connected to any of the control surfaces. Instead, they are connected to an onboard computer that analyzes the inputs and determines what the pilot is asking the aircraft to do. The computer then alters all controls simultaneously to accomplish that task, generally making the RAH-66 quite easy to fly. The FBW flight controls offers some advantages not available to older helicopters, such as auto-hovering mode.

a) Auto Hovering

Pressing the asterisk ⊡ key on the numeric keypad orders Comanche to immediately stabilize into a hover at low altitude. This is an effective way to slow the helicopter while maintaining a stable altitude, especially before crossing a ridge or exposing your aircraft to potential enemy fire.



b) In Ground Effect (IGE)

At low altitudes, the air thrust downward from the main rotor rebounds upward after striking the ground creating an extra cushion of lift. This is called "In Ground Effect" (IGE). Generally speaking, at low altitude once you've provided enough collective to become airborne, In Ground Effect provides enough additional lift to keep you airborne at a constant height over rolling terrain. As you approach gradual slopes, In Ground Effect will keep you stable at a fairly constant altitude above the ground.

In Ground Effect has its limits. Do not expect it to instantaneously allow you to navigate over steep cliffs and mountains.

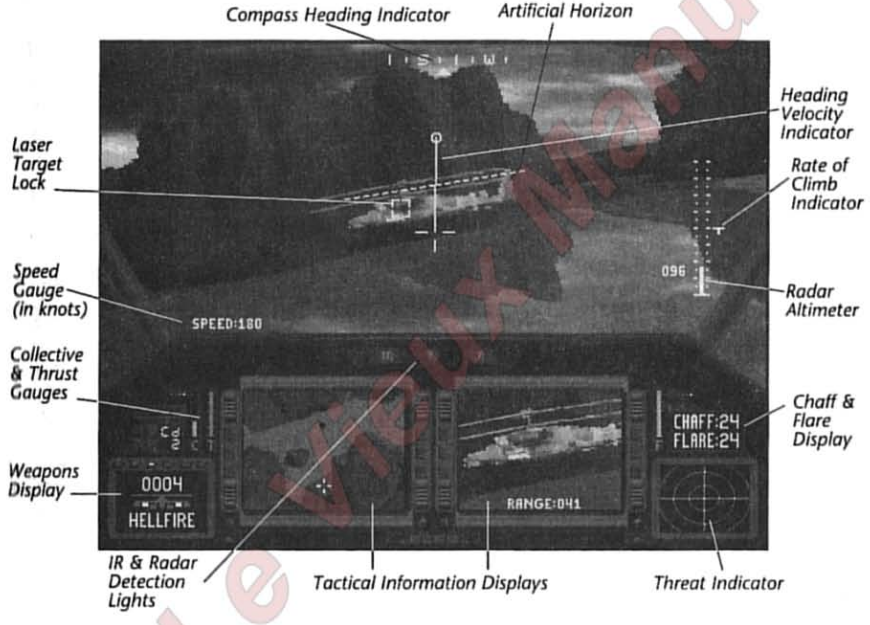
c) Wind

Wind plays a major role in aerial navigation. When floating unsecured above the Earth, no matter how fast you're moving, wind will push your aircraft. A steady wind will cause long-term navigational errors requiring you to make compensating course corrections. Gusty winds will suddenly push your aircraft one direction, sometimes dramatically depending on the strength of the wind. Read the pre-mission briefings carefully for any available weather reports.

Le Vieux Manuel

B. COCKPIT AVIONICS

Although it looks intimidating, the Comanche cockpit is based upon a simple concept: the pilot has enough work to do already, so don't add to his workload by cluttering up his office. Despite its complex appearance, the cockpit is actually quite intuitive and easily mastered.



Le vieux Manuel

1. Pilot Views

You have eight primary view controls: four internal views and four external views.

The four internal views are:

- [1] - Forward View - also known as the Cockpit View
- [2] - Left-side View - view out the left side of your helicopter
- [3] - Right-side View - view out the right side of your helicopter
- [4] - Rear View - view out the rear side of your helicopter

The external view controls are:

5 - Panoramic View - The HID and Targeting information remains but all cockpit framework disappears.
6 - Chase View - Shows your aircraft as seen from an imaginary observer directly behind the helicopter.
7 - Drop Camera - Places a camera on the ground at a fixed point. The camera monitors your helicopter at all times.
8 - Active Last Drop Camera - Returns you to the view of a previous drop camera if you've released more than one.

2. Helmet Integrated Displays (HID)

Modern attack helicopters all utilize helmet mounted displays. Usually, a monocle is placed over one of the pilot's eyes. The pilots's helmet then projects information onto the monocle similar to a jet fighter's Head-Up Display (HUD).

Helmet Integrated Displays (HIDs) are superior to conventional HUDs since the display is attached to the helmet and moves with the pilot's head. The pilot can see symbology related to his avionics and weapon systems wherever he turns his head. Because the display monitors where the pilot is looking, targeting information is sometimes overlaid over the instrument panel.

a) Artificial Horizon

The Artificial Horizon is a dashed line running through the middle of the HID to indicate the position of the actual horizon. This line is most useful when the actual horizon isn't visible either because of obstruction or darkness. It can often help prevent disorientation caused by rapid maneuvering.

b) Radar Altimeter

The radar altimeter is a bar gauge along the right side of the HID which indicates your altitude Above Ground Level (AGL). Altitude can also be described as above Mean Sea Level (MSL). MSL means how high you are above sea level while AGL describes the exact distance between you and the ground. For example, suppose you are hovering 200 ft. above a 10,000 ft. mountain. Your altitude is 10,200 ft. MSL, but your radar altimeter will read 200 ft. AGL.

c) Rate of Climb Indicator

The Rate of Climb Indicator is located along the right side of the Radar Altimeter. This indicator graphically illustrates your rate of climb. If the bar extends above the center line, you are climbing. If the bar drops below the center line, you are descending. The length of the line is a representation of the speed at which you are climbing or descending.

Le Manuel Virtuel

d) Heading Velocity Display

The display is a graphic representation of your true heading. It also gives you an indication of your velocity as measured by the distance between the circle and cross-hair.

e) Digital Speed Indicator

Located in the lower left corner of the HID, the Digital Speed Indicator displays your exact speed in knots (forward or reverse). 1 knot = 1.15 miles per hour.

f) Compass Display, Waypoint Indicator, and Base Indicator

Located along the upper edge of the HID, the compass indicates your current heading where North equals 360° or 000°, east equals 090°, south equals 180°, and west equals 270°. The number (or letter) located exactly in the center indicates your current heading. Other indicators specify the direction to the next waypoint or to the resupply base (if available). When the indicator is placed in the center of the compass display, you are headed directly toward that object.

g) Distance to Base

The distance to base indicator lists the distance in meters to the nearest friendly base, if a friendly base exists in the mission.

h) Goals Remaining

A goal is an object in the game (tank, aircraft, helicopter, etc.) that the player is required to destroy in order to complete his mission. This display indicates how many mission goals remain undestroyed.

i) Targeting

When you acquire a target the HID will highlight the target by superimposing a symbol over the object. The available symbols are:

Green Square	=	Friendly aircraft (in air or on ground)
Grey Square	=	Inert, neutral target
Red Square	=	Enemy aircraft (in air or on ground)
Yellow Square	=	Enemy on ground
Flashing Square	=	Mission goal

Le Vieux Manuel

3. Tactical Information Displays (TIDs)

The two Tactical Information Displays (TIDs) dominate the instrument panel. They display a variety of information depending upon their selected mode of operation. Either monitor can display any of the six available modes. The F1 key through F6 key control the left TID while the F7 key through the F12 key control the right TID.

Tactical Information Display Damage *— Should a monitor become damaged, it will no longer function. Luckily, the TID Displays have redundant systems and if one of them becomes damaged, the other can still display all the TID functions.*

a) Digital Map F1

The digital map shows an overhead view of the OP zone. The - and = keys decrease and increase view magnification, respectively. Objects on the map are color coded for rapid recognition as follows:

Orange	=	Airborne Threat
Yellow	=	Ground-based Threat
White	=	Neutral Unit (such as fuel tanks)
Green	=	Friendly Aircraft
Blue	=	Friendly Ground Unit

The digital map is updated based on your RAH-66's surveillance systems. Not all targets are necessarily detectable by your helicopter and subsequently are not displayed on the overhead map.

b) Threat Indicator F2 and F8

The Threat Indicator visually indicates objects which threaten your aircraft. It shows a top-down view of the surrounding area with your aircraft located in the center of the display. This display reveals the bearing to the source of the threat. The top of the display represents the area directly in front of your aircraft, the bottom represents the area directly behind your aircraft. The right and left sides of the display represent the right and left sides of your helicopter, respectively.

The Threat Indicator searches for radar emissions used for weapons guidance, laser emissions used for weapons guidance, and sudden sources of heat (such as a missile's motor).

c) Target Acquisition System (TAS) F3 and F9

The Target Acquisition System (TAS) view shows an image of the currently selected target as seen by your helicopter's targeting system. This lets you take a close look at your intended victim before you actually open fire. This

Le Vrai Manuel

view is especially useful when searching for one particular target vehicle.

d) Mission Status [F4] and [F10]

This display indicates how many mission goals have yet to be destroyed.

e) Operational Status Indicator [F5] and [F11]

The Operational Status Indicator shows a graphical representation of your helicopter, illustrating what systems (if any) have been damaged by enemy fire or collision.



1) T. Rotor Damage

A damaged tail rotor will cause the helicopter to spin, making the aircraft difficult to control.

2) Engine Damage

Damaged engines will limit your altitude and speed.

3) Target Acquisition System (TAS)

If the Target Acquisition System becomes damaged, holding a target lock becomes difficult. This may eliminate some of your weapon choices. For instance, the AGM-114 Hellfire requires a laser lock on the intended target until impact. Further damage can keep it from working altogether.

4) Weapon Mount Damage

The external weapon mounts can be damaged or destroyed by enemy fire. This will prevent you from using your long range weapons, such as the Hellfires, Stingers or rockets.

TACTICAL INFORMATION DISPLAY SUMMARY

FUNCTION	LEFT	RIGHT
Digital Map	[F1]	[F1]
Threat Indicator	[F2]	[F2]
TAS	[F3]	[F3]
Mission Status	[F4]	[F10]
Operational Status	[F5]	[F11]
Last Mode	[Q]	[A]
Next Mode	[W]	[S]
Zoom Map Out	[<]	[<]
Zoom Map In	[>]	[>]

Le Quebix Manuel

5) Cannon Damage

If your cannon becomes damaged it will no longer function. The onboard computer will automatically disable it.

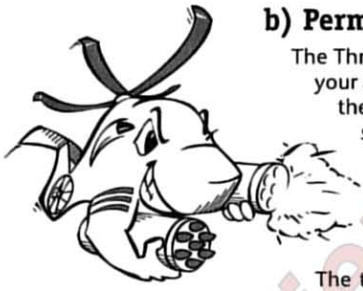
f) Information Display

This display merely shows information about the other TID modes.

4. Other Console Avionics

a) Weapons Display

The weapons display indicates the currently selected armament type and the quantity of that weapon remaining.



b) Permanent Threat Indicator

The Threat Indicator visually indicates objects which threaten your aircraft. Showing a top-down view with your aircraft at the center, the threat indicator reveals the bearing to the source of the threat. The top of the circle represents directly ahead of your aircraft, the bottom represents directly behind your aircraft, and the right and left sides represents the right and left sides of your helicopter, respectively.

The threat indicator "listens" for radar emissions used for weapons guidance, laser emissions used for weapons guidance, and sudden sources of heat (such as a missile's motor). As such, you can often receiving warning of inbound rockets (which use no type of laser or radar emissions for guidance) because of the heat they generate.

c) Countermeasure Display

Chaff and Flares are used to decoy radar-guided and heat-seeking missiles, respectively. Chaff consists of aluminum foil and other types of metallic strips designed to create a false radar image. Flares produce a bright flash of heat designed to lure heat-seeking missiles away from the intended target. Both are normally deployed automatically by the helicopter's defensive systems; however either may be manually deployed by pressing the semicolon [;] key for chaff or apostrophe ['] key for flares. The countermeasure display, located along the right side of the instrument panel, details the quantity of each device remaining.

d) Collective/Throttle Display

Two bar graphs directly left of the left TID illustrate the level of collective input and the amount of throttle required to supply it. As pilot, you select the desired collective level. The helicopter's onboard computers automati-

Le Manuel

cally adjust throttle to provide the required collective level. If your engine takes damage, it may become unable to run high enough to supply the requested level of collective.

e) Fuel Gauge

Located between the right TID and the countermeasures display, the fuel gauge indicates how much onboard fuel remains. Run out of gas and it's a long hike back to friendly territory

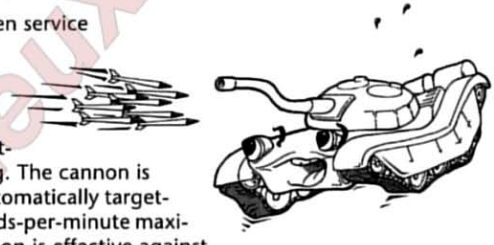
f) Warning Panel

Centered above the two TIDs are three warning lights labeled IR, L, and R which indicate heat-seeking, laser, and radar threats, respectively. When your onboard systems detect a threat, the threat indicator displays the bearing to the threat and the warning panel illuminates, describing the threat type. The L Warning lamp only illuminates during multiplayer missions when you are locked by another human player.

5. Weapons System Controls

a) 20mm Vulcan II Cannon [Z]

The 20mm Vulcan cannon has seen service with dozens of Western aircraft and heads into the 21st century with the Comanche. Housed internally to reduce radar signature, the cannon swings outside its compartment before firing. The cannon is slaved to your HID sight and is automatically targeting by the TAS. With a 1,500 rounds-per-minute maximum rate of fire, the 20mm cannon is effective against most targets at close or medium range.



b) 70mm Rockets [X]

The 70mm rockets carry varying types of warheads depending upon the mission, including the "flechette" warhead which dispenses a cloud of shrapnel capable of penetrating soft and medium targets. These weapons are unguided; the angle of the launching platform determines how far the weapons will travel but they will only travel in a straight line. The TAS will automatically set the launch pitch when a target is acquired.

These weapons can be used to strafe larger areas by manually setting the pitch of your helicopter then ripple firing a volley of rockets as you move the helicopter's nose.

Le Manuel

c) Hellfire Laser-Guided Missiles [C]

The Hellfire laser-guided missile is your primary weapon. Effective against hardened targets, the missile's 8 km range lets you attack enemy targets while remaining out of range of return fire. The missile requires a constant laser-lock on the target throughout its entire time of flight. Accordingly, you must unmask (leave cover) long enough to locate a target, lock it with the TAS, and wait for the missile to strike. Fortunately, the Hellfire follows the laser-lock even if the laser-lock moves.

You can fire multiple Hellfires staggered a few seconds apart, then switch the target lock after each missile hits. You can let subsequent missiles continue to toward the original target if the first missile misses or fails to destroy it, or switch locks and guide the missile to a new target infight. Since all missiles are infight simultaneously, this significantly reduces the amount of time you expose yourself to the enemy.

Be warned, however, the missiles move quite fast. If you switch targets the missile will try to turn to the new target, but may be unable to make the turn in time or may have already passed the new target. Try to lock a closer target first, then redirect subsequent weapons toward more distant targets in order to provide yourself the maximum possible targeting time.

d) AIM-92 Stinger Air-to-Air Missiles [V]

The Stinger made a name for itself in Afghanistan as a small, portable, but very effective heat-seeking missile. Supplied by the US to the Afghan's, this shoulder launched missile was so effective it forced dramatic changes in Russian helicopter operations in order to avoid it. Now carried by the RAH-66 Comanche, the Stinger is your primary air-to-air weapon.

There are two other Weapon Selection Options for you to choose from. These "weapons" are not carried aboard the helicopter, but can be designated and fired as if they were.

6. Hands-Off Weapons

a) Artillery & MLRS Indirect Fire [B]

The helicopter's computer knows at all times its precise location. Once locked onto a target, the TAS subsequently derives the precise location of the target. When you call for fire support, the TAS transmits the exact coordinates of the target to the Command and Control network. Support forces provide fire support from conventional artillery or ground based Multiple Launch Rocket Systems (MLRS), sometimes called "Steel Rain."

Le Manuel Web

If available in a mission, this is the most destructive weapon at your disposal. This is a fire-and-forget system. The main disadvantage is that since it takes time for the shells to reach their destination, they are less effective against fast moving targets. The accuracy of your navigational systems, however, guarantees exact target strikes.

b) Wingman Support [N]

A wingman will occasionally be assigned to you during various missions. In general, your wingman will fly conservatively and stay in ground cover, however, when you select the Wingman Support option, he assumes a targeting position and engages your currently selected target. As you switch target locks, your TAS transmits the target info to the wingman who subsequently attacks the specified target. When heavily outnumbered careful coordination with your wingman may be the only way to win a mission. The wingman cannot be ordered to engage targets on his own. He will remain glued to your helicopter until you order him to attack. He will maneuver into the open, destroy the specified target(s), then maneuver back to your wing.



Le Vieux Manuel

Be careful not to keep your wingman in a precarious position for too long. The enemy could concentrate their fire on him and destroy his ship. Obviously, if your wingman goes down you can no longer call on him for assistance. You will not receive a replacement wingman during the mission.

WEAPON CONTROL SUMMARY

ACTION	***KEY***
Previous Weapon Selection	I
Next Weapon Selection	J
Fire Salvo (2 x 70mm Rockets)	M
Select 20mm Cannon	Z
Select 70mm Rockets	X
Select Hellfire Missiles	C
Select Stinger Missiles	V
Select Indirect Fire Support	B
Select Wingman	N
Fire Selected Weapon	SHIFT

Le Vieux Manuel



Chapter III
Multiplayer Gaming

Although Comanche 2 offers a challenging set of single-player missions, you have not experienced the full excitement of this simulation until you've participated in a multiplayer game. Multiplayer gaming brings you one step closer to the "real world" where everyone works together as a team. Your success in this environment still depends upon your performance, but now your performance must be integrated into that of the "team".

Working as a team requires coordination and precision. During the Gulf War, the US Army required attack helicopters to arrive at their designated stations within 10 seconds of a specified time. If the mission orders said, "be on station by 01:05:00 hours" you had to be there at that precise moment, no earlier and certainly no later. Why? Because each element of the battle plan had to stick to the timetable or the delicate choreography would be lost.

You can experience no greater sense of accomplishment than leading three of your fellow pilots into battle and emerging victorious. Besides the thrill of real-time human interaction, multiplayer missions build an esprit de corps. Shooting down that Ka-50 on your buddy's "six" and saving his life in the process adds an element that is lacking in Single Player gaming. After all, who cares if a wingman gets shot down when it's a computer controlled wingman. It's all just "ones and zeros". Things are different when the pilot getting blasted is a friend of yours. You begin to feel sorrow at the loss of a friend then anger and an eagerness for "payback". Somehow, defeating a live opponent is significantly more rewarding than defeating an entire horde of computer-controlled adversaries.

As hard as the chopper jocks at NovaLogic have worked on providing you with realistic artificial intelligence, no computer simulation can ever measure up to the cunning and unpredictability of a live human opponent. Therefore, Comanche 2 comes complete with a comprehensive set of Modem or Network multiplayer options. Now you and your friends (up to four players can participate in Network play) can experience the fun of flying together. The multiplayer environment is versatile enough to allow all of you to cooperative toward achieving a common set of goals or compete against each other to see just who is the best pilot on the block.

Digital Manuel

A. MULTIPLAYER MODEM GAMING

Modem connections allow you and a friend to fly together. If both of you decide to fly Comanches, a list of Cooperative missions to choose from is made available. If the two of you decide to fly opposing helicopters (i.e. you fly a Comanche while your friend insists on flying the Werewolf), the two of you are given a set of specially designed Head to Head missions.

1. Initiating a Modem Game

Initiating a multiplayer game via Modem is quick and simple. It's designed to get you and a friend up and flying in no time. Before you start however, the two of you will have to agree beforehand which of you will be the session "Initiator" and who will be the "Receiver". Once you have decided on your roles, you're ready to begin.

a) Beginning a Multiplayer Modem Connection

1) Starting from the Main Operations Menu, select the Multiplayer Game menu option. A inset menu box appears with two menu options:

Begin Network Game
Begin Modem Game

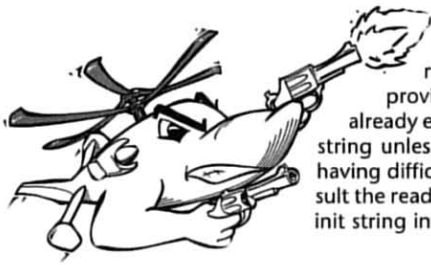
2) Select Begin Modem Game.

3) Once you select Begin Modem Game, a new inset box appears with the following menu options:

Dial Modem
Wait for Call
Setup Modem

b) Setting up your Modem

1) Before you and your friend can connect, you need to insure that your modem has been properly setup. Both parties should select the Setup Modem option and perform the steps indicated below.



2) Once you have selected Setup Modem, a Modem Options inset box appears. You are required to enter an Init String in the window provided. Note that there is a default init string already entered in the window for you. Use this default string unless you are experiencing problems. If you are having difficulties getting your Modems to connect, consult the read.me file on the Comanche 2 CD for additional init string information.

Le Vieux Manuel

3) Select the port where your Modem is located. This menu option defaults to Modem Port.

4) Select the type of phone you are using to transmit data, either Tone or Pulse.

5) Press OK to return to the Begin Modem Game dialogue box.

c) Making the Connection



1) You are now ready to make your Modem connection. Assuming that you are the designated "Initiator", select the Dial Modem menu option. Enter the phone number of the modem you are connecting to in the window now provided. When you have finished typing in the number, press DIAL.

2) If you have been designated the "Receiver", your job is simple. You need to select the Wait for Call menu option and sit back while the "Initiator" does his/her thing. Note that you can press the Esc key to abort the connection process at any time. Aborting the connection returns you to the Multiplayer Game screen.

3) The "Initiator" enters the phone number of the modem and presses DIAL to initiate the modem connection. Upon connecting, the "Initiator" is given access to the Select Campaign menu screen. Choose any one of the various campaigns which appear on this menu.

4) After choosing a campaign, the "Initiator" is now required to choose a mission from the Select Mission menu screen. Once a specific mission is chosen, the "Initiator" is shown a mission briefing text applicable to the mission selected. The "Initiator" may either Accept or Reject the mission at this point. Rejecting the mission allows the "Initiator" to select a new mission. Pressing the Accept Mission button sends a copy of the mission briefing text to the "Receiver" who has been patiently waiting all this time.

5) The "Receiver" now has the ability to Accept or Reject the mission. If the mission is rejected by the "Receiver", the "Initiator" must start over and select a new one. If the mission is selected by the "Receiver", the mission is loaded and play begins.

2. Multiplayer Modem Victory Conditions

a) Head to Head Victory

These missions often become something of a "horse race". The player that is first to destroy all of his/her assigned mission goals is the winner. Of course

Not Yet Manuel

it's hard to destroy mission goals if you keep getting shot down and having to start over on your base. When the mission is concluded, you receive a mission summary detailing your individual performance.

b) Cooperative Mission Victory

These missions are more difficult in that precise cooperation and coordination is required but less difficult in that you have all the time you need to complete your mission. Victory is achieved when you destroy all of your assigned mission goals. When the mission is concluded, you receive a mission summary detailing your individual and collective performance.

B. MULTIPLAYER NETWORK GAMING

Network play gets as close to the real thing as most of us are likely to get. You and up to three other players can link together and fly joint missions, either cooperating with each other against a common enemy or fighting against one another in Comanche vs. Werewolf team showdowns.

1. Initiating a Multiplayer Network Game

Initiating a multiplayer Network game is quick and simple. It's designed to get you and a group of friends (opponents) up and flying in no time. Before you start however, the group will have to agree beforehand on who will be the session "Initiator". Once this has been agreed upon, you're ready to begin.

a) Beginning a Multiplayer Network Connection

1) Starting from the Main Operations Menu, select the Multiplayer Game menu option. A inset menu box appears with two menu options:

Begin Network Game
Begin Modem Game

2) Select Begin Network Game.

3) Once you select Begin Network Game, a new inset box appears with the following menu options:

Create Head to Head Game
Create Cooperative Game
Join Network Game

b) Preparing for Network Play

Up to four players can participate in Network play simultaneously. Before beginning a Network session, one player must be designated as the "Initiator". The "Initiator" is responsible for making play decisions for the group. It is best if everyone decides beforehand who the "Initiator" is going to be. The other members of the play group will be "passive" partners

Le Viet Manual

during the mission selection phase.

1) The designated "Initiator" must select one of the two main play options (Head to Head Game or Cooperative Game) from the Network Game menu. In order to play a Head to Head game, at least one of the other players must be flying a Werewolf. You cannot select a Head to Head game if everyone happens to be flying Comanches (i.e. everyone is on the same side).

2) Players not designated as the "Initiator" must choose the Join Network Game option from the Network Game menu. After choosing this option, they must wait for the "Initiator" to finish doing his thing. At that time, they have the option of joining in if they like the mission conditions set by the "Initiator".

3) Once a play option has been selected, the "Initiator" is now required to choose a specific campaign from the Select Campaign menu screen.

4) Once a campaign has been chosen, the "Initiator" is now required to choose a specific mission from the Select Mission menu screen.

5) Once the "Initiator" chooses a specific campaign and mission, the network game is initialized. These choices now appear on the screens of all the other participants. They are now given a chance to enter the game by clicking on the name of the mission as it appears on-screen.

6) As the other players log in agreeing to the mission selection, their callsigns (name) appear on everyone's screen. When all participating players have logged in, the "Initiator" presses the Start Game button to begin play.



Le Vieux Manuel

2. Network Play Victory Conditions

a) Head to Head Victory

The side (group of players) that first destroys all of their assigned mission goals is the winner. Concentrate on destroying goals rather than air combat. Getting shot down only delays your inevitable victory. When the mission is concluded, all players receive a mission summary detailing their individual and collective performance.

b) Cooperative Mission Victory

Victory is achieved when players destroy all of their assigned mission goals. Take your time. You're not on the clock. When the mission is concluded, all players receive a mission summary detailing their individual and collective performance.

Le Vieux Manuel



Chapter IV
Helicopter Strategy & Tactics

A. General Survival Hints

Most of the time you'll operate your helicopter independently, even during multiplayer games. Each helicopter will maneuver after its assigned target on its own with mission success depending on each person completing there assignment. As such, you must understand the basic helicopter tactics.

1. Altitude Considerations

Always remember, altitude is bad. The higher you fly, the more people that will see you. The more people that see you, the more likely someone will shoot at you. When you're flying a helicopter in combat altitude is the epitome of evil.

Fly low, hug the ground just high enough to prevent colliding with obstacles. This is called Nap of the Earth (NOE) flying and it is designed to minimize your exposure to enemy fire. Flying close to the ground isn't enough, however. Flying over a mountain top, even if you're only 50 ft. above the peak, still exposes you to more potential fire than flying through a ravine. You must stay low to the ground, but you must also choose "low ground" to fly over. Hug the base of hills and mountains, fly low through ravines, and never fly directly over a ridge unless there's no other way around.

2. Duck and Cover Tactics

Sometimes, in order to get where you need to go, you have no choice but to pop over a ridge or move across an open plain. Charging headlong across open territory bears a striking resemblance to suicide. Instead, look for objects, hills, or ridges between you and your desired destination. Move at high speed from object to object, stopping to "mask" yourself behind each. Slowly maneuver your helicopter until you can see around the obstacle and search for enemy positions. If no enemy is visible, make another high-speed run to the next obstacle and repeat the process. This is obviously slower than proceeding straight across the open area, but often prevents the enemy from spotting you or at least prevents him from shooting at you once you've masked behind the available terrain.

Le Guide Manuel



MASKED
Firing Position

UNMASKED
Firing Position

3. Masking and Unmasking

As you can see by the diagram above, firing from a Masked position is much safer than moving out into the open and firing from an Unmasked position. It decreases the amount of time that your helicopter is exposed to hostile fire. It also allows you to set up an ambush attack and trigger it at a time and place of your own choosing. Always try to place obstacles between yourself and the enemy. Since you are airborne, line of sight problems work out in your favor. Vehicles on the ground are unable to compensate for obstacles as easily as you can in your helicopter. Use this to your advantage.

Most of your weapons travel along a direct, straight-line path meaning there can be no masking obstacles between you and your target when you fire. Even your guided air-to-ground missiles which can maneuver requires a laser constantly locked onto the target. Since the laser travels in straight line, a clear and unobstructed view of the enemy is still required. If you can see the enemy, however, he can see you. If he can see you he can shoot at you.

Therefore, while it is necessary to unmask to fire you must minimize how long you expose yourself. Generally, maneuver to a terrain masked position near the desired firing position. Gently maneuver the helicopter into the open, quickly search for enemy targets, then remask. Determine which targets you wish to attack, then briefly unmask and release your ordnance. As described in the Weapons section, you can ripple fire multiple laser-guided missiles, then switch the target lock while the missile is inflight thereby engaging multiple targets while minimizing missile flight times.

If the enemy detects you when you unmask, they will determine how much of a threat you pose to them based on your proximity and altitude. The closer and

Users Manuel

higher you are, the more of a threat they perceive you to be. The enemies will generally turn to face you to attack. If you remask, they will usually continue to monitor your last position, waiting for you to unmask again. Subsequently, you may wish to maneuver to a new position before engaging the enemy.

4. Following Fire

You have two other weapons at your disposal during some missions: a wingman and artillery support. Artillery is especially effective due to the accuracy of your guidance system which subsequently ensures highly accurate artillery fire. As described above, de-mask long enough to lock a target and request artillery support. Then, remask and wait for the shells to fall. After the downpour ceases, move into the combat zone and destroy any survivors. This tactic is possible, but less effective, with your computer-controlled wingman since you must lock the targets the wingman attacks. You must continually unmask to select a new target, thereby exposing both you and your wingman to enemy fire.

5. Defensive Maneuvering

Most weapons are unable of maneuvering around terrain. Some guided weapons, however, can maneuver around obstacles as long as the guidance system remains locked on you. To evade unguided weapons, simply move your helicopter or duck behind cover. To evade guided weapons, you must maneuver behind an obstacle such that the guidance system (either located on the launcher or the missile depending on the weapon type) loses lock. In general, to be safe, attempt to obscure both the launcher and the missile.

Some missiles climb rapidly then dive on the target. Generally, these weapons move very fast during the dive and subsequently cannot maneuver as well. Often lowering your altitude will move you out of the missile's engagement envelope as well as possibly mask you from its guidance system.

Flares and chaff work well to decoy heat-seeking and radar-guided missiles, respectively, but are not 100% fool proof solutions. Use them liberally (preferably allow "automatic" release from the inflight menu bar), but do not rely solely on them.

B. THE MULTIPLAYER ENVIRONMENT

Operating with other human players allows a much wider variety of tactical options. The following "formation tactics" utilize two-ship formations. Obviously, players can expand the basic idea to incorporate larger numbers or multiple two-ship formations.

1. Drag and Ambush Tactics

In air combat, the word "drag" equates to the phrase "sucker punch." In essence, a drag gives the enemy such a juicy target that he can't resist engaging. A successful drag, however, always has a trap set for the enemy. The Drag and

Low Vision Model

Ambush tactic positions one helicopter hidden safely behind some large obstacle. A second helicopter moves forward to the enemy position, then reverses course and runs away. In many cases, especially against human opponents, this will lure enemy helicopters into chasing the second helicopter. The chase, however, leads the enemy directly past the first helicopter who ambushes the enemy. The ambush requires careful timing; the "drag" helicopter is exposed to enemy fire during the entire chase. The longer the drag continues, the more likely the friendly helicopter will be shot down.

2. Drag and Pursue Tactics

Drag and Pursue tactics are similar to the ambush, except the "lure" helicopter does not reverse course. It proceeds normally allowing the enemy to maneuver in behind it. Meanwhile, the second friendly helicopter moves up from behind and engages the enemy.

3. Crossfire Attacks

The Crossfire attack engages the enemy from two directions simultaneously. This requires precise coordination to ensure that the helicopters arrive on station at exactly the same time.

4. The Echelon

Echelon formation works best when the formation moves into a combat area after artillery. The helicopters fly close formation and each monitor an assigned "arc." Each helicopter only engages targets in the assigned arc. This tactic exposes all helicopters involved to substantial enemy fire and should be used only in lightly defended areas or areas which have been previously bombarded with artillery.

5. Deception and Attack Tactics

Deception and Attack is one of the oldest military tricks around. Quite simply, one helicopter exposes itself, draws the enemy's attention, then re-masks. Meanwhile, a second helicopter maneuvers behind the enemy and attacks from the rear.

C. FORWARD AREA REFUELING POINTS (FARPS)

Helicopters have severely limited ranges and move very slowly compared to fixed-wing aircraft. The Army therefore, establishes helicopter bases near to the front lines in order to minimize the amount of time and fuel helicopters spend in transit between their bases and the enemy. These bases are called Forward Area Refueling Points (FARPs). All Single Player and Multiplayer missions include a FARP. You begin each mission situated at your respective FARP. If you crash or are shot down during a MultiPlayer mission you rejoin the game from your FARP.

LeMulux Manuals



Chapter V
About The Comanche

by Frank Colucci

THE ORIGINS OF THE COMANCHE

Born To Fly - and Fight

The world has changed a lot since a US Army Aviation Mission Area Analysis sketched the need for a new Light Attack Helicopter two decades ago. The threat of a massive Warsaw Pact armored assault on NATO is gone, but whatever the conflict, the US Army still needs a survivable scout-attack helicopter that flies and fights at night.

After years of research and testing, the RAH-66 Comanche impressively combines advanced technologies with an array of modern armament in a powerful fighting machine for what the Army calls the nonlinear battlefield.

Instead of large armies massed behind discrete lines, the nonlinear battlefield disperses small forces for their own protection, then concentrates them for decisive action. It demands timely reconnaissance and accurate long-range firepower to strike deep and shape the situation before the decisive battle. The Comanche flies armed reconnaissance, light attack and air combat missions in a fast-moving war.

Within US Army Aviation, the Air Cavalry finds the enemy for a combined arms team. Attack helicopter battalions strike fast and deep. The RAH-66 is a stealthy Reconnaissance/Attack Helicopter with the sensors, communications systems, and precision navigation aids to be the perfect scout. It also flies and fights like no other helicopter in history.

Shaping The LHX

How did the RAH-66 come about? Back in 1982, the Mission Area Analysis listed shortcomings in US Army Aviation, mostly tied to the 7,000 Vietnam-vintage Cobras, Kiowas, Cayuses, and Hueys in use at that time. A new development, LHX -the Light Helicopter Experimental, was originally two helicopters with about 70% commonality in dynamics and subsystems.

The armed scout-attack version (SCAT) would find the enemy with advanced

Le Fan Manuel

sensors and attack with missiles, rockets, and guns while the larger Utility LHX would haul a six-man tactical team or about 2,000 lbs. of cargo. At 8,000 lb gross weight, LHX SCAT or Utility was to do small jobs more efficiently than the 14,000 lb. Apache and 17,000 lb. Black Hawk.

The one other major consideration was speed. This airship had to fly at least 185 knots per hour. A small, fast LHX would also be harder to see and hit on the high-intensity European battlefield. Faced with modern Soviet air defenses, the US Army's underpowered light helicopters proved to be slow and vulnerable. They had no air combat capability to fend off Hinds and later attack helicopters.

Whatever the shape of LHX was going to be, fiber-reinforced composite materials promised lightweight, crashworthy structures free of metallic corrosion and more tolerant of battle damage. Bell and Sikorsky built flying demonstrators for the Army's Advanced Composite Airframe Program in 1984 to verify the advantages and explore tooling and production using composites instead of metal.

Low Observable technology could give combat aircraft reduced radar, infrared and acoustic signatures. Passive or self- contained navigation systems could reduce electronic emissions; and Nap-of-the-Earth (NoE) flying at night negated most air defense threats. Army and industry planners briefly considered a single-engine LHX to cut weight and cost, but two engines obviously enhanced wartime survivability and peacetime safety, particularly during long flights over water. Strategic airlift is always scarce and sealift is always slow, so the US Army wanted an air vehicle that could self-deploy over 1,260 nautical mile stages to reach Europe by southerly routes.

Less clear was how many crew members would fly the LHX, since a trained copilot was an expensive 'processor' for a flood of cockpit information. Bell, Boeing, Hughes, IBM and Sikorsky all did simulation studies and flight tests in the Advanced Rotorcraft Technology Integration Effort in 1984. Their measures of workload indicated a solo pilot in an automated cockpit might fly, but probably couldn't fight nap-of-the-earth at night. The scout Battle Captain was even busier managing his own situation and that of his team.

As ambitious technologies and diverse requirements made LHX bigger, heavier and more expensive, the Army had to come to terms with the US budget crisis. In 1985, an LHX fleet of 4,545 aircraft was expected to replace a larger fleet of less reliable and less available light helicopters. In August , 1990, the Secretary of Defense reduced the LHX fleet to 1,292 new light attack helicopters, or 1,610 if the Army Reserve and National Guard units had to become fully modernized.

LHX Realities

Today's Comanche is a compromise of capability, cost and risk. The Army declared its Light Helicopter would be a conventional, two-seat scout-attack helicopter that would weigh no more than 7,500 pounds empty and cost no more

than $7.5 million in 1988 dollars based on production of 2,096 aircraft. When the Department of Defense cut the number to 1,292 helicopters, the average flyaway cost went up to $8.5 million each. Half of the total program cost was tied to avionics. The First Team, Superteam and their subcontractors approached the LHX air vehicle and its mission equipment package with their different technologies hanging from the same advanced engines.

Allison Gas Turbine joined Garrett Turbine Engine Company to compete against a team from Avco Lycoming and Pratt and Whitney. In October 1988, the Allison-Garrett Light Helicopter Turbine Engine Company - LHTEC - was named supplier of the LHX powerplant. The T800-LHT-800 engine for the Light Helicopter had to generate 1,200 hp intermediate rated power and spool up from idle to IRP in just two seconds for NoE agility and air-to-air combat. It was expected to burn 10 to 30% less fuel than older engines.

The original T800 requirement called for an engine that could grow 50% more powerful in the same physical envelope. And before the first prototype flew, the picture of a Comanche loaded with mast-mounted radar, infrared jammers and other add-on equipment led the Army to specify the T800-LHT-801 with 12% more power to preserve the performance of a heavier helicopter. The T800 has a Full Authority Digital Electronic Control for fast power response and to reduce pilot workload. FADEC also provides important diagnostic functions that can isolate faults down to the module.

From the outset, the Army wanted a reliable, durable engine that was easy to maintain. LHTEC chose a dual-centrifugal compressor specifically for its resistance to sand and particle erosion and, unlike its competition, avoided complex variable inlet guide vanes. The T800 incorporates an integral inlet particle separator. A suction fuel pump reduces risk of fire from ruptured lines and a self-contained emergency oil system keeps the engine running should external lubrication be lost. The engine is effectively an on-condition maintenance item without fixed overhaul intervals.

Without the funds heaped on the Advanced Tactical Fighter for the US Air Force, the Army's Light Helicopter Demonstration- Validation had no flying prototypes, but a wealth of computer simulations on the ground and systems demonstrations in laboratories and on surrogate aircraft instead. In April, 1991, the Boeing-Sikorsky First Team won the right to build dem-val prototypes and pursue a Full Scale Development contract for the RAH-66 Comanche. The first prototype is to fly in 1995.

A DIFFERENT KIND OF HELICOPTER

Point and Shoot

The Army wanted a fast, agile, stealthy scout with a protected anti-torque system in place of dangerous tail rotors. Bell and McDonnell Douglas based their LH proposal on a four-bladed main rotor and the NOTAR no-tail rotor system.

Boeing and Sikorsky chose a five-bladed main rotor and a shrouded tail fan with eight broad-chord blades.

The five-bladed Pentaflex main rotor pushed vibration into higher frequencies more easily damped with less weight. It also increased main rotor disk density to improve agility and reduce noise. The amount of hinge offset is a good indicator of the aircraft's roll agility, so important in air-to-air-combat. The all-composite bearing-less main rotor designed for LH has elastomeric elements instead of hinges, and it is tailored with 9.5% equivalent hinge offset for crisp, fighter-like control response.

Conventional tail rotors are readily damaged by trees or terrain and too often mangle people on the ground. The Fantail shroud protects the composite blades and enhances the performance of the fan. The canted tail rotor gives the Comanche a measure of super-maneuverability, enabling it to point its nose quickly and fire on a target off the flight path.

The optoelectronic interfaces and actuators in fly-by-light controls never proved reliable enough for the First Team's Comanche proposal. But fly-by-wire flight controls still save weight compared to old mechanical rods and cranks, and their redundant control paths improve survivability. The Comanche flight control computer reduces pilot workload and opens new firing possibilities.

With some allowances, the Comanche ultimately met the Army's 7,500 lb empty weight requirement, but armed reconnaissance mission weight is 10,630 lb. with four Hellfires, two Stingers, 320 rounds of 20 mm ammunition, and 2.5 hours of fuel. The clean RAH-66 has a dash speed of 177 knots and a never-exceed speed of 190 kt. Rate of climb is 1,182 feet per minute at 95% maximum power, and a 180° hover turn to target takes just 4.6 seconds. A 90° constant altitude turn requires 5.5 seconds. Negative G maneuvering is a distinct possibility in air combat or evading air defenses, and the Comanche flight envelope spans +3.5 to -1.0 G.

The Comanche is flown by two rated pilots in identical cockpits, both wearing helmet displays and helmet-mounted image intensifiers. Multifunction head-down displays show infrared and television sensor imagery, systems data, and the three-dimensional digital map. NOE tactics call for the Comanche to pop up from terrain mask, sweep the battlefield with its target acquisition system, and return to cover so the crew can review the stored imagery in safety.

Thinking Machine

The Comanche Mission Equipment Package is built around a Core Computer Cluster with data and signal processor, memory, and data bus control elements in SEM-E standard electronic modules. VHSIC (Very High Speed Integrated Circuit) processors are tied to sensors and displays by an 800 megabit per second per channel data network. Other communications are carried by a MIL-STD 1553B data bus.

The power of the processors and the speed of the data buses open new possibilities for a scout-attack helicopter. The Target Acquisition Subsystem combines a high resolution focal plane array, infrared imager and digitized television. The combined picture of the battlefield is processed with Assisted Target Detection/Classification algorithms, and hidden targets are exposed and identified on cockpit and helmet displays.

Integrated Communication, Navigation, and Identification Avionics (ICNIA) include a radio and navigation package made of SEM-E modules that are able to assume the functions of burnt-out or battle-damaged components. The "comm" and navigation systems reconfigure themselves automatically to provide accurate position fixes or secure communications for the scout on deep strikes. The automatic hand-over target function within the ICNIA suite ties the battlefield scout into a combined arms team, sending target positions to artillery or fixed-wing attack aircraft.

The two-level maintenance schedule for the Comanche has only unit maintenance and distant depots, eliminating big intermediate maintenance facilities in the theater. Built-in test functions isolate faults down to the module and eliminate the enormous electronic test facility trailers that still accompany Apache battalions. Redundant, fault-tolerant avionics are housed in three bays, slightly pressurized like the cockpit for chemical warfare protection with cool, filtered air from the environmental control system.

Stealthy and Lethal

All of this technology would be useless if the Comanche couldn't protect itself. The designers were well aware that advanced air defense weapons now protect the armies of many nations, and the classified annexes of the LH Request For Proposals included specific signature reduction goals to make the Comanche less vulnerable to those threats. The RAH-66 has radar and infrared jammers, but Comanche design philosophy emphasized passive protection.

Flat plate canopies are a common way to prevent telltale glint, and the dull black-olive infrared-suppressing paint protects all Army helicopters. Stealth styling however, gives the RAH-66 a faceted nose turret for its target acquisition and night vision pilotage systems. Low Observable design rules flared the fuselage sides, and put an inverted shelf under the tail to reflect radar returns away from threat emitters. Radar absorbing material is applied sparingly to "hot spots." The radar flicker of main and tail rotor systems has long been a dead giveaway for helicopters. The composite rotor and fan blades on the Comanche are treated to minimize return, and the main and tail rotor hubs are neatly covered.

The Comanche infrared suppression system mixes hot exhaust with ambient air and ducts it down through two long slits under the tail shelves. The swirling double mix effectively dissipates the exhaust plume, and hot metal engine parts are buried within the airframe. An infrared jammer is available for the latest, most sensitive IR threats.

LeMieuxMarcel

The Comanche RFP also includes acoustic signature requirements, and the RAH-66 is quieted by both the five-bladed main rotor and shrouded tail fan. The flight control system gives the pilot a "whisper mode" that reduces tail rotor speed 10% for stealthy surveillance situations. With weapons bays closed and gun retracted, the Comanche is a very low-observable scout.

The Army did not want to tie development of its new helicopter to the development of new weapons, and the internal weapons bays of the Comanche are sized for proven Hellfire anti-tank and Stinger air-to-air missiles. Each bay has three hardpoints for a single Hellfire or two Stingers, and the doors swing up when the aircraft is on the ground to speed reloading. The doors can also double as work platforms. The three-barrelled General Electric Vulcan II 20 mm cannon fires 750 rounds per minute at ground targets or 1,500 rounds per minute in air-to-air combat, and swings in and out of its protective fairing in 2 seconds.

Outfitted with the External Fuel and Armament Management System (EFAMS), the RAH-66 is the attack helicopter of the US Army's Light Divisions. The non-lifting EFAMS "wings" are attached or removed in 15 minutes and increase the Comanche weapons load to fourteen Hellfires or sixty-two 70 mm rockets or fourteen Stinger missiles. The EFAMS also carry two 430 gallon tanks for long-range self-deployment or crashworthy 230 gal tanks for extended combat endurance. Maximum weapons load for an RAH-66 would be 13 Hellfires, two Stingers, and 500 rounds of 20 mm ammunition.

For all its firepower and intelligence, the Comanche is supposed to be easy and inexpensive to operate. Onboard automatic boresighting functions keep gun, sensors, and EFAMS aligned. A Portable Intelligence Maintenance Aid (PIMA) that diagnoses aircraft system saves troubleshooting time and eliminates heavy, expensive support equipment.

The RAH-66 is fielded with an Integrated Training System for pilots and maintenance personnel. Its Combat Mission Simulators are designed around Fiber Optic Helmet Mounted Displays to eliminate big simulator domes, and allow mobile Team/Combined Arms Trainers to enable Comanche crews to rehearse their missions in the field, before they fly.

The political landscape has indeed changed from Cold War days, but today's battlefields are no less dangerous for those in combat. The Comanche is supposed to be the world's most survivable and lethal combat helicopter. Given its job, it had better be.

Flying the Comanche

The first training helicopter you, another student, and an instructor pilot suffered in at Fort Rucker had no automatic flight control system, and you quickly learned why helicopters are harder to fly than fixed-wing airplanes. Pulling the collective up with your left hand got you up in the air, but staying there called for many power changes and a lot of stick and pedal movements.

Do Not Manual

The cyclic in your right hand worked like an airplane stick — sort of. Pushing forward put the nose down and got you moving. Pulling back flared the nose up and slowed you down. Pushing left or right put you in a bank. But for every simple action, there were several collective and pedal reactions. Eventually, the reactions became habit, but they could never be forgotten, and they always kept you busy.

But now it's 1999 and the Comanche is smarter than earlier rotorcraft, and the fly-by-wire flight controls put every command through computers that understand what you want to do and figure out how to do it. Control laws within the computers provide a velocity stabilization mode to simplify hovering; a normal automatic flight control stabilization mode for routine handling; and an integrated fire and flight control mode to help track targets. Which set of laws the Comanche obeys depends on the flight environment, but the result is a responsive weapons platform that is easy to point where you want to go or where you want to shoot.

Most helicopters are controlled entirely by changing the pitch of rotor blades cutting through the air. Coarse pitch or a higher blade leading edge increases lift. Increase the pitch or angle of all the main rotor blades at once and you go up. Increase the pitch on one side more than the other, and you roll left and right or pitch the nose up or down.

The Comanche collective stick in your left hand works just like any other helicopter collective, although it is connected to wires instead of control rods. Pull the collective up and you increase pitch to go up in the air. Push it down, and you decrease pitch to descend.

Normally, movements of the collective are matched by movements of foot pedals. A tail rotor counteracts the torque of the big main rotor, and regular helicopter foot pedals vary the pitch of tail rotor blades to push or pull the tail left or right.

The Comanche has a very powerful rudder with a protective shroud that keeps the blades from being mangled by tree limbs, wires or buildings, and from mangling people on the ground. The flight control system however, automates the routine tail rotor control, so flying is much simpler. The Comanche has fixed footrests instead of moving tail rotor pedals.

The cyclic stick between your knees on most helicopters has been replaced by a sidearm longitudinal stick in your right hand on the Comanche. Pulling back or pushing forward moves the nose up or down in pitch; pushing left and right provides roll, and twisting left or right gives you yaw. The sidestick has only limited travel, but the flight control computers turn them into smooth aircraft response and do away with the constant corrections needed by earlier helicopters.

Full Authority Digital Electronic Control (FADEC) takes care of the engines. Once you hit the startup switch, power management is automatic. You decide where you want to go and how fast with cyclic and collective. Once you're flying,

Le vieux Manuel

if you put the nose down, you go forward. If you want to go faster, just pull more collective. The engines will generate more power to apply more main rotor torque automatically. The flight control computer will increase tail rotor pitch to counter the extra torque.

THE COMANCHE IN BATTLE

The Big Picture

You fly and fight mostly at night to catch the enemy unawares and to enhance your own survivability. You stay low and slow to get in under air defenses and pick your shots. You thrive on an electronic battlefield rich with targets and threats, and you tie into a combined arms team that puts enormous firepower right where you tell them to. You're the cutting edge of US Army Aviation. You fly the RAH-66 Comanche.

Eight out of ten Comanches in the US Army are allocated to the scouting mission in either Cavalry squadrons or attack battalions. Cav squadrons generally have two troops of eight Comanches apiece. The attack battalions in light infantry divisions have up to 25 RAH-66s, and their Comanches play scout with internal weapons alone or attack with up to 14 Hellfire missiles. Attack battalions in "heavy" divisions use their 10 Comanches as scouts and escorts for their 15 AH-64 Apaches. Whatever the organization, the Comanche exists to support the Army ground commander, and it has to survive, see and shoot in a unique environment.

Compared to flashy tactical jets, helicopters are slow and short of range. Main rotor aerodynamics make helicopter speeds greater than 200 kt an expensive struggle. With a dash speed of 177 kt at 4,000 ft. on a hot day, your Comanche is about 100 kt. slower than the propeller driven Mustang of World War II. The Mustang could get up to 40,000 ft. The Comanche often fights less than 50 ft. above the battlefield. A half-century of helicopter experience has taught the US Army how to master that environment, and a thin slice of that experience was passed along to you at the Army Aviation Center at Fort Rucker, Alabama.

Cockpit Consciousness

In order to run all of its systems, the RAH-66 is powered by three engines. The Secondary Power Unit that provides the electrical power to your systems on the ground and starts the engines, keeps working in the air. The Startup Sequence starts the SPU, which enables you to do a systems checkout and allows you to load the optical disk with your mission plan.

The optical mission disk will carry your route, navigation waypoints, communications frequencies and the location of known air defense threats. The navigation information is superimposed on the color digital map display on your liquid crystal displays. An inertial navigation system with ring laser gyro, and a receiver to take fixes from the Global Positioning System satellites, gives you your precise location within a few meters at all times.

Layout Manuel

Flying, navigating, communicating, and shooting generates a high cockpit workload, and because of this, the Comanche needs two pilots to do its job. Cobras and Apaches put the pilot in back so the copilot/gunner could have a sighting system with direct-view optics. High-resolution television and thermal imagers did away with DVO, so the Comanche pilot sits up front with a better all-around view. Everything in the RAH-66, from the step up to your climate-controlled cockpit, to your crewchief's hand-held maintenance computer is designed with MANPRINT — Manpower Integration — in mind.

The Comanche systems are designed for management by exception. If things are working properly, the aircraft keeps to itself and lets you get on with flying and fighting. Malfunctions bring up systems warnings and menus on the head-down display. The Comanche avionics and flight controls have built-in test capability, and can reconfigure themselves to preserve functions should modules or data buses burn out or be shot out. When your diagnostic routines are completed, you're ready to fly.

Fort Rucker taught you how to fly and how to work the Comanche systems. Field units and experience will teach you how to use this marvelous fighting machine and come back alive. Your primary access to the aircraft and the outside world comes through the helmet-mounted display.

At night, your helmet display shows you either image-intensified scenes from the tubes on either side of your head, or thermal imagery from the FLIR turret on the nose of the helicopter. In daytime, you look through the display to see the real world. At any time, the picture you see will be covered with symbology to help you find your way and manage your aircraft.

The Apache had a display over the pilot's right eye that showed essential flight and targeting data. The Comanche's Helmet Integrated Display (HID) shows you airspeed, altitude, heading, rate of climb, and much more. It can show you where your sensors are in relation to the aircraft; the time of flight of your missiles heading to their target; and the number of rounds of ammunition you have left. The helmet display can give you quick warnings of malfunctions and air defense threats that you can identify by looking down in the cockpit.

The Comanche sensors and gun move with your helmet as followed by a magnetic head tracker. The display has a field of view 52° wide by 35° high, and the resulting scene is a virtual display, moving through its field of regard as you turn your head. Most of the controls you need to fly and fight are on the sidestick and collective, and you can page through system menus without taking your hands from the controls.

Stealthy and Dangerous

The Army likes to say "We Own The Night." In fact, you lease it with the help of Image Intensifiers (Night Vision Goggles - NVGs) and thermal imagers (Forward Looking Infrared - FLIR). The Image Intensifiers amplify moonlight, starlight, and

cultural lighting like that from towns and cities up to 30,000 times. FLIR looks for the temperature differences between objects. The Comanche is designed to use them together.

On a clear night with a full moon, the RAH-66's third generation Image Intensifiers are a miracle. But on an overcast night with no moon they're almost completely blind. In summer or winter, over desert or ocean, second generation FLIRs detect subtle temperature contrast and paint a picture in the darkest night and see through fog and smoke. But after a couple of cold, rainy days or in a humid jungle people, trees, and the air itself are all the same temperature. To survive, you need both the Image Intensifiers on your helmet and the thermal imagers in the nose of the Comanche to fly and fight at night.

The Night Vision Pilotage Subsystem (NVPS) in the nose of your Comanche is a FLIR for you, the pilot. The Target Acquisition Subsystem (TAS) below it shows your "backseater" the targets through magnified FLIR at night or TV by day, and it includes a laser to guide Hellfire missiles and other "smart" munitions to targets. The laser also gives you precise range information for your gun and rockets.

You fly from your squadron or battalion base area with its Tactical Operations Center (TOC) to forward arming and refueling points (FARPs) to get fuel, weapons, and target and threat updates. The digital map is a wealth of information with navigation waypoints, air defense threats, targets, and other information. The Comanche navigation system benefits from the Global Positioning System and can use the constellation of satellites to find its own position, and pinpoint the location of targets within feet.

If you know your own position within feet, the laser range data and turret azimuth from the TAS turret and the precision elevation data from the digital map also tell you the position of the enemy within feet. The Automatic Target Handover System (ATHS) used in the Apache and OH-58D has been refined on the Comanche and interconnected to an advanced data modem that uses any of your radios.

Airborne with your wingman, and with all lights off, you stay at an altitude of 100 ft. or less, just hugging the hills and treetops to keep under enemy radar. At night and at your speed, individual soldiers can't see you to aim guns much less IR sensors or laser-guided missiles. Even if you are spotted by an enemy with night vision goggles, the targeting opportunity is brief, and the chances of you being identified and engaged are small. Of course, radio transmissions are kept to a minimum to keep from drawing attention to yourself.

Jamming air defense radars, and shooting flares and chaff lets the enemy know you are around. The Comanche relies on stealth to avoid detection and resorts to active countermeasures only when trapped. Your digital map display shows the detection area of known air defense sites. But mobile guns, SAMs, and radars are surprises to be countered with tactics and countermeasures, in that

Low Flight

order. The objective is to avoid detection, and if detected, to hide in terrain mask. Radar and IR jammers, chaff, and flares are automated and tied to your radar warning receiver and missile launch detectors.

As you approach the target area, you slow down to a near-hover at treetop level. The navigation system shows the possible target area on the digital map, and you close for a pop-up with weapons bays still shut and gun covered to minimize your radar signature. The Comanche tail rotor can slow down in Whisper Mode to reduce noise and let you get even closer without being detected.

Pull the collective and climb over the terrain. Your targeting system automatically sweeps across its field of regard. You drop back to terrain mask, and the stored image of the target area appears on the heads-down display. The Comanche computer cluster contains aided target detection/classification (ATD/C) algorithms to recognize stored target signatures, and it shows you tanks, command-and-control vehicles, trucks, and air defense vehicles hidden beneath the trees. Your wingman does his own pop-up and scan off to the side, then returns to safe cover.

As your helmet and cockpit displays point out the targets, you and your copilot/gunner decide what to do. A secure data burst to your TOC feeds the type of target and its location to the Command and Control network. The network enables Division commanders to call up fire from conventional artillery or Multiple Launch Rocket Systems 30 km. away to blanket entire map grids with shear firepower, or bring in tactical jets with their own cluster munitions. They can also bring in Apaches or Comanches to strike with Hellfires.

The TOC decides you can have these few targets, and you pop open the weapons bays to swing your Hellfires and rockets into the night. An encrypted message to your wingman on FM radio sends him further out to one side, and you shift your position laterally so you won't emerge from cover in the same spot again. You begin the pop-up, unmask, and your backseater laser designates the air defense vehicle first.

A Hellfire leaves the rail and follows its characteristic lob to the laser spot more than 8 km. away. The air defense threat disappears in a bright blob. Another shot from your wingman still hiding behind the hill hits the first tank you designate, and another kills the next. You drop back into cover, and your wingman pops up to shoot. Another lateral remask maneuver, and you shoot again. Rockets leave both helicopters and climb high to rain submunitions on the armored personnel carriers.

You withdraw and go on to another possible target site. An air defense vehicle with an unknown radar surprises you with a blast of gunfire. You snap off a burst of cannon fire and break away from the threat, noting the location in your navigation system. At the end of your mission, you return to base. The recorded target imagery is downloaded for further analysis, and the brief encounter with an unidentified air defense threat adds a new signature to the threat library.

Leader Manual

Survive to Shoot

Scout missions call for the RAH-66 to use its Low Observable design to get in close to the enemy undetected, and report enemy strength and position to the ground commander. Comanche Scouts in Cavalry Squadrons or Heavy Division attack battalions are lightly armed and operate in pairs; each helicopter with up to six Hellfire anti-tank missiles or a mix of Hellfires, 70 mm rockets, and Stinger air-to-air missiles neatly covered in internal bays. The three-barrelled 20 mm cannon hides in a LO fairing to minimize the Comanche's radar signature, but swings out to engage ground or air targets.

A Light Infantry Division fields battalions of 25 Comanches, some playing stealthy scout with only internal weapons, others fitted with the External Fuel and Munitions System (EFAMS) which carry another four Hellfires on each side. EFAMS can also take rockets, Stingers, or extra fuel, and the deep strike configuration puts four Hellfires on one side and a 230 gallon drop tank on the other. If your unit can't wait for C-5s or C-17s to carry its Comanches to war, EFAMS are loaded with a big 430 gallon ferry tank on each side for the long overwater legs.

How your Comanche is configured depends on your mission and the air defense threat, and the threat has grown more complicated since the end of the Cold War.

The Soviet Union pressed on with "double-digit" SAMs up through the SA-19 with infrared or laser guidance and a range of 10 km. The Soviets packaged 30 mm guns and SA-19s on a fearsome helicopter killer, the ZSU-30-4 anti-aircraft vehicle. They developed a single-seat "fighter" helicopter, the Ka-50 Werewolf (NATO called the Ka-50 the Hokum, but there's nothing phoney about an agile 190 kt. helicopter with laser-guided missiles, 80 mm rockets, and a 30 mm cannon). The Soviets built and stole air defense technology, and they developed integrated air defense tactics to protect their field armies. The Soviet Union equipped and trained armies around the world to protect themselves from helicopters. Then the Soviet Union disappeared.

The sudden disintegration of the Warsaw Pact early in the last decade made the High Intensity European battlefield unlikely. Falling defense budgets generally made armies smaller everywhere. But the technology of the high intensity battlefield survived and propagated. A hungry Russia without political stigma could sell its best weapons to former Soviet allies and countries who would not deal with the old Moscow. Smaller domestic markets put added pressures on US and European arms manufacturers to find export markets to survive. The Red threat of Soviet air defense technology and the "Blue threat" of French, British, and even American technology became a mixed "Purple threat". Your mission and your life depend on defeating the mixed air defense threat.

The US Army stresses a mix of tactics, reduced signatures, and active countermeasures to help helicopters survive on the modern battlefield. NoE

tactics hide helicopters behind terrain and foliage. It takes them below the line of sight of radar and optically directed air defense threats. Night flying hides helicopters from optically directed weapons, including the heat-seeking SAMS initially aimed by unaided eyes. Low Observable technology addresses radar, infrared, optical, electronic, and audible signatures. Flares and IR jammers confuse infrared threats, and chaff and radar jammers blind air defense emitters. The Comanche is the first fighting machine designed to blend all three survivability elements in an integrated package.

Comanche Battle Strategies

Modern wars do not end at sunrise any more than they do at sunset, and you can be called upon to scout and attack by day as well as at night. Daylight operations add risk, and they increase the chance of air-to-air combat with enemy helicopters. The Comanche is the first Western helicopter designed for air-to-air combat, but it is not your job to seek out dogfights. Unlike jet fighters, helicopters cannot run from the fight. Once the fight is on, somebody is going to die; and the more close-in fights you join, the greater your chances of not coming back.

The Kamov Ka-50 Werewolf with its contra-rotating main rotors has extremely high yaw and roll rates. The more conventional Mil Mi-28 Havoc and Eurocopter Tiger or Gerfaut have high-agility rotor systems and ample power margins to be flung around the sky. Even the little MD500s spread all over the world are truly deadly opponents. The only way you can beat these challengers in the long run is by fighting smart.

US Army doctrine says helicopters will engage in air combat only when air combat fits the ground commander's scheme of battle or in self defense. The RAH-66 can lay in ambush for enemy airmobile forces, and it can be deployed as an escort for our own Apaches, Black Hawks, and Chinooks. It can be used to protect friendly armored forces from air attack, or to feed data to ground-based air defenders.

Hidden in ground clutter, helicopters are difficult and deadly targets for tactical jets. In the current air defense environment, the fighter or ground attack pilot who hangs around in blue sky trying to get a firing solution on a helicopter in the weeds is likely to become an early casualty. Properly armed, helicopters are lethal in air combat. They are extraordinarily agile at low speed, and they can use terrain to their advantage. Unless you are deployed to strike from ambush as part of the ground commander's scheme, odds are your contest with enemy helicopters will be a chance encounter.

The Comanche pilot chasing enemy helicopters to become an ace is not doing his job. But supporting the ground battle plan, the same pilot surprised by an enemy helicopter had better be ready to hide or fight. Compared to jet fighters, a dash speed of 177 kt, vertical rate of climb of 1,200 fpm, and a maneuvering envelope from -1 to +3.5 G seems puny, but in the low altitude world of helicopter air-to-air combat, your Comanche is the most agile and powerful fighter ever fielded.

Preview Manual

The RAH-66 ordinarily carries two or four Stinger air-to-air missiles. The IR-seeking Stinger is more or less effective at 1 to 2 km. "It is a fire and forget" weapon. Flechette warheads on your 70 mm rockets fill the sky with nails out to 1 km. They are a shotgun weapon good for surprise encounters. The 20 mm Vulcan II cannon is tied to your helmet sight and can go to its full 1,500 rounds-per-minute rate of fire for the close-in shootout. It is accurate enough for air-to-air engagements out to perhaps 1,500 m. Never forget the Hellfire missile is a devastating weapon at 8 km. or more against a hovering or slow- flying target.

Tactically, you try to avoid the close-in turning fight, especially if facing multiple bogeys - the odds of winning are no better than 50-50. You try to engage targets from the safety of terrain at the full standoff range of your weapons. If caught in a surprise encounter, turn into the attack, both to bring your own weapons to bear, and to increase your closure rate and minimize the enemy's aiming time. In a maneuvering fight, the one who gets behind wins, and the safest place for you to be is perched above and behind the enemy's rotor system. From there, his weapons are blocked and yours can be aimed effectively.

Never forget you are a member of a combined arms team, and to use the firepower behind you when appropriate. An enemy airmobile advance can be decimated by MLRS submunitions or artillery fire, or fast movers with cluster bombs. You can report oncoming enemy aircraft to your own air defenders and let them engage with SAMs and gunfire.

The Comanche is what engineers like to call an integrated system. Airframe, engines, avionics, and weapons were all taken into account at each design step to achieve the greatest effect. Likewise, the modern Army has to be an integrated system with aviation, artillery, armor, and infantry tied together for maximum effect. The Comanche is the best Army Aviation has to offer; it's up to you to make the most of it.

Le Vous Manuel

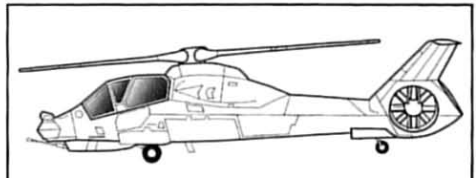
CHAPTER VI
TECHNICAL SPECS

The following Technical Specs chapter is intended to give you a general description of the important friendly and enemy aircraft, land vehicles, and naval vessels you'll encounter in this simulation. The illustrations accompanying each briefing have not been drawn to scale. They have been included merely as a means of enabling you to visually identify the objects on the battlefield.

A. AIRCRAFT

Boeing Sikorsky RAH-66 Comanche

The Boeing Sikorsky RAH-66 represents the U.S. Army's concept of what a reconnaissance/ attack helicopter of the future should be. It is fast, relatively lightweight, and packs a powerful punch. Most of all, the Comanche is quiet, hard to spot with the naked eye, and nearly invisible to enemy radar. Since the enemy can't hit what it can't see, the Comanche is superbly designed to survive on the 21st century battlefield. Even if detected, it can take hits from triple-A fire that would blast lesser helicopters from the sky.


RAH-66 Comanche

It's not enough just to survive, however. The Comanche sports the very latest in high tech electronic surveillance and targeting equipment. Its avionics are purpose-built for maximum commonality with the F-22, the USAF's advanced tactical fighter. Day or night, this bird is made to hunt prey. The pilot is equipment with a Helmet Mounted Display (HMD) which acts as a pseudo-HUD allowing him to track objects independent of the helicopter's flight path. On the pilot's console are two multifunction monitors which can display a colorized moving navigational map, monochrome FLIR and magnified TV imagery, plus a variety of situational and targeting information.

The Comanche features two side-mounted weapon storage bays instead of external hard points. The bays are located internally to reduce the helicopter's radar signature. Each bay can carry up to three AGM-114 Hellfires, six AIM-92 Stingers, or a single rocket pod with four Hydra-70 rockets. In addition, the

Manuel

Comanche carries a three barrel 20 mm cannonwith 500 rds. of ammunition located in a chin mounted turret. The gun is slaved to the pilot's helmet. He only needs to look at a target to train his gun on it and then make it disappear.

The Comanche's five-bladed main rotor is powered by two LHTEC T800-LHT-801 turboshafts each rated at 1,380 shp. These engines give the RAH-66 a maximum speed approaching 175kts and a flight endurance of almost 2.75 hours. The engine exhaust is cooled and vented downward before being released into the surrounding atmosphere. This further reduces the Comanche's IR signature. The rear rotor is an eight-bladed enclosed system known as FANTAIL®. This system has been credited with allowing the Comanche to fly sideways at well over 70 knots.

Ka-50 Werewolf (Hokum)

Known as Werewolf to its Russian pilots, the Kamov Ka-50 Hokum is a very capable attack helicopter. It features dual contra-rotating, three-bladed main rotors which eliminate the need for a tail rotor. Although the prototype Ka-50 flew successfully back in 1982, the Werewolf did not enter low level series production until 1994. Russia has been actively marketing this helicopter to foreign buyers ever since. Had the Werewolf program progressed satisfactorily during the 1980s, it is possible that a number of these helicopters may have shown up in Iraq prior to Desert Storm.



Ka-50 Hokum

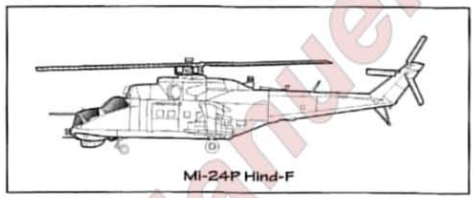
The Ka-50 features a comprehensive mix of air-to-air and air-to-ground weaponry. While its primary mission seems to be killing other helicopters, the Werewolf is well able to dish out death and destruction on the ground. It possesses a single barrel 30 mm chain gun (model 2A42) located along the right side of its fuselage. There are four external hardpoints able to carry a combination of up to twelve AT-12 Vikhr LGMs, eighty S-80 80 mm rockets (in four 20 rd. pods), or four AA-11 Archer heat-seeking AAMs.

Overall, the Werewolf is a typically solid Russian design. Its avionics are perhaps less advanced than those commonly available in the West, but they are tough, easy to maintain, and most importantly; they work! Its engines (two 2,190 shp Klimov turboshafts) give it a top speed of approximately 165 knots with an endurance of 2.5 hours. The helicopter's only major shortcoming is the reliance on a single pilot. Without a co-pilot (WSO), a Werewolf pilot is expected to both fly and navigate, fight and communicate. If the pilot is a good cockpit manager, he will do okay. The majority of Werewolf pilots however will tire quickly due to the stress of such a heavy workload.

Eurieux Manuel

Mi-24P Hind F

The Mi-24 Hind was a shock to Western intelligence analysts when it first appeared in the mid 1970s. The Soviet Union had fielded what looked to be every bit the flying tank. It scared the US military silly and touched off a minor "helicopter gap" arms race. Hundreds were exported (outside of former Warsaw Pact nations) during the early 1980s. These days production of the Hind helicopter is centered around manufacturing plants in Arsenyev and Rostov with more than 15 new Mi-24s built each month.


Mi-24P Hind-F

The early Mi-24s (models A, B, and C) boasted thick belts of armor able to withstand small arms fire and triple-A hits up to 12.7 mm in caliber. Later model Hind Ds, Es and Fs feature this same level of protection plus a comprehensive targeting and avionics package. Based upon some expensive lessons learned in Afghanistan, the Soviet's post-war Mi-24s were given an even greater offensive punch. The Hind Fs represented in this simulation all have an electro-optical (LLTV) sensor, radar, and FLIR. They carry twin GSh-30 30 mm cannons mounted in a chin turret. These guns are equally effective against helicopters as well as tanks. Externally hardpoints provide space to mount rocket pods and AT-6 Spiral air-to-ground missiles.

Although Mi-24s are beginning to show their age, the Hind F remains an extremely tough opponent. In the hands of a skilled crew it can be devastating and virtually unstoppable. Fortunately, the Hind F is primarily interested in blowing things up on the ground. This "flying tank" can withstand a lot of damage but is too cumbersome to maneuver effectively against a lighter aerial opponent.

Hughes 500MD

The Hughes 500MD (McDonnell Douglas) was designed in response to the US Army's request for a light observation helicopter. In 1961, the OH-6A Cayuse won the Army's Light Observation Helicopter (LOH) competition. The 500MD is main beneficiary of the all knowledge gained during the development of the Cayuse program. Until the Comanche appeared on the scene, the 500MD could boast of having the most advanced avionics suite of any modern helicopter. This fast and maneuverable helicopter has been widely exported in both civilian and military versions. Chances are you'll run into one of these helicopters being flown by a bad guy at some point in your career.

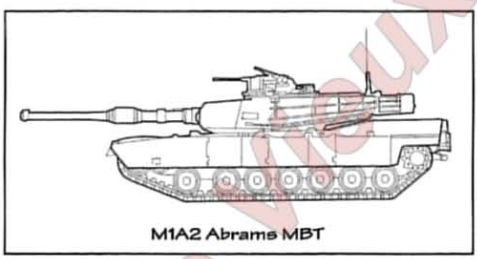

Hughes 500MD

Although not all weapon and avionic systems are licensed for use by foreign nations, even the most basic stripped down models remain lethal adversaries. Fortunately, most 500MDs you happen to run into are configured for reconnaissance or ground support operations. Even so, this nimble little helicopter is hard to spot in a dogfight. Its small cabin and blade radius allows it to get into tight hiding places. In combat, it has a nasty tendency to pop up at inopportune moments and maneuver in close. Let this one get on your "six" and it'll use its 30 mm M230 chain gun to carve up your bird like a Thanksgiving turkey.

B. LAND VEHICLES

M1A2 Abrams MBT

The M1 Abrams main battle tank is named in honor of Gen. Creighton Williams Abrams (1914-1974), the US Army Chief of Staff from 1972-1974. It is the first tank in history to be powered by a gas-turbine engine. Despite criticism of potential servicibility problems, the M1 in all its variant forms is the most potent fighting vehicle on the modern battlefield. Despite numerous clashes with well-equipped Iraqi armor units during Desert Storm, not a single M1 was lost to enemy action. Overall operational readiness exceeded 90% throughout the war.



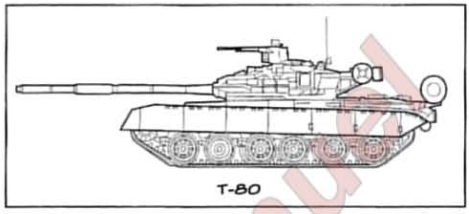
M1A2 Abrams MBT

The M1A2 is currently produced by General Dynamics at its Lima Army Tank Plant in Lima, Ohio. Almost 7,500 M1s have been built and delivered since 1982. The M1A2 model represented in this simulation features advanced Chobham ceramic armor providing the ultimate in protection to its crew of four. This honey-combed armor fiber makes the Abrams nearly impervious to ATGMs and HEAT rounds fired by other tanks. It carries a 120 mm smoothbore main gun made by Rheinmetall of Germany and redesignated M256. This is the same main gun used by Germany's Leopard 2 MBT. The gun is most famous for firing depleted uranium slugs used with APFSDS rounds (armor-piercing, fin stabilised, discarding sabot).

The M1A2 also features state of the art imaging and target acquisition systems. It can fight equally well during the day or night. This gives it advantages over other lesser equipped vehicles. During the Gulf War, Iraqi T-72s were consistently engaged and destroyed by US tanks before they knew what hit them Over and over again, M1 platoons suddenly found themselves facing entire companies of Iraqi tanks. Invariably the Iraqi armor would be shot up by with little or no loss to the American crews.

Manuel Vieux Manuel

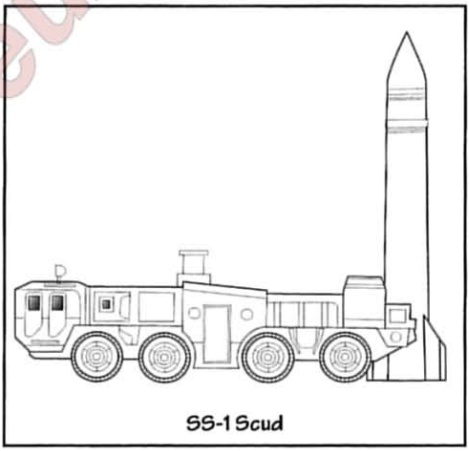
T-80 MBT


T-80

The T-80 is a fine example of Soviet heavy metal. This main battle tank (MBT) went into low level production at the Leningrad Kirov Plant (LKZ) in the mid 1970s. It entered service in 1976. Although the internal layout is similar to the earlier Soviet MBTs, the T-80 features a number of significant improvements. For one thing, the T-80 uses the same 125 mm 2A46 smoothbore main gun as the T-72 but with a more modern system of fire control which includes a laser rangefinder. This gun can also be used to launch 9M112 Kobra (AT-8 Songster) missiles. These wire-guided anti-tank rounds are controlled much like the TOW system used by US forces.

Though the T-80 is slowly being phased out and replaced by newer MBTs, it still remains very common among Russian units. This highly exported vehicle can be bought direct from the Leningrad showroom floor for $2.5 million. Thousands of these vehicles have been exported to the Third World so you are likely to run into them in any future conflict.

Represented in this simulation is the T-80BV model which features belts of explosive reactive armor, a thermal night sight, and a 12.7 mm machine gun. It has a combat weight of 45 tons and can travel at speeds of up to 45 mph. Its gas turbine engine is rated at 1,100 horsepower with a manual transmission featuring five forward gears and one reverse. This represents a noticeable power/ weight ratio improvement over its predecessors.


SS-1 Scud

SS-1 Scud

The SS-1 Scud is a Russian-made surface-to-surface missile system. Western media made this crude weapon a celebrity overnight. Before 1990, the average American citizen didn't know a Scud from a "Bud". But these days, everyone remembers the Scud. The massive amount of free publicity given it during the Gulf War must have its makers very proud. To bad it is no longer in production. Many of the Scuds fired during the Gulf War were so old and poorly maintained that they broke up in flight.

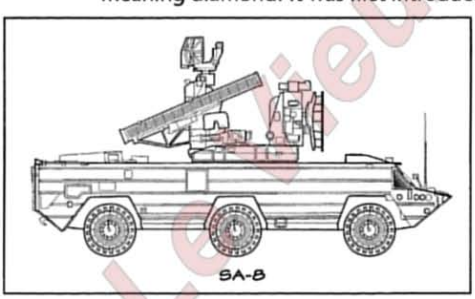
Les Aeux Manuel

Billed as the villain of Desert Storm, a Scud claimed the lives of more Americans than any other single event of the war. Serious analysts remain unimpressed by the Scud as a weapon of war, however. It lacks the accuracy , range, and payload necessary for practical military use on the battlefield. The Scud's 2,000 lb. high explosive warhead is insufficient to cause damage to face-hardened structures. Most importantly, the inertially guided Scud is totally useless against mobile targets and about as subtle to radar as a city bus.

As a weapon of terror on the other hand, the Scud is unsurpassed. In the 1980s, it was used during the Iran-Iraq war as a means of striking back at the other side's civilian population. In 1991, America was treated to a Scud report each night on television. We witnessed Israeli citizens taking to bomb shelters and donning gas masks. Casualties and damage were exceedingly light but people started dropping in the street from heart attacks. In short, this stubby little inconsequential missile was able to *terrorize* an entire country. The very fact that it generates such levels of fear makes this weapon dangerous. Scuds must be hunted down and eliminated wherever they are found.

SA-8 Gecko

The Antey 9K33 Osa SA-8 (known by the NATO designation "Gecko") is a self propelled surface-to-air missile system. It also goes by the Russian name "Romb", meaning diamond. It was first introduced into service during the mid 1970s as a complete SAM system wrapped up in a single vehicle. That is to say, each individual SA-8 vehicle is capable of independently searching, targeting, then tracking enemy targets.


SA-8

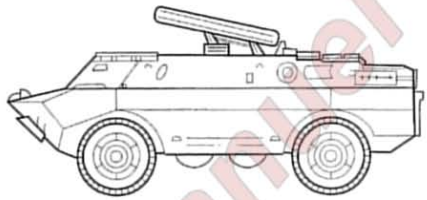
In the late 1970s, the SA-8 underwent a major upgrade. The resulting modifications gave the missile a better ability to track hovering helicopters as well as helicopters with spooling rotors still on the ground. This upgrade entered service in 1980 and is referred to as the Antey 9K33M. It was used by the Iraqi army during the Gulf War and has been credited with downing numerous Tomahawk cruise missiles.

The SA-8 Gecko uses a "Land Role" H-band fire control radar centrally located on the top of the vehicle chassis between the two 3-round launch boxes. Tracking and guidance is also conducted by a monopulse J-band radar. As a back-up, each vehicle carries a TV-optical guidance system on-board just in case the radars are degraded due to heavy ECM.

Lethal Intent

BRDM-2 w/ AT-5 Spandrel (BRDM-3)

The BRDM-2 is a Soviet-made amphibious scout car. It was first shown in public in 1966 and entered military service shortly thereafter. The typical Soviet motorised rifle division had a total of 28 of these vehicles assigned to its TO&E. This successful vehicle spawned a number of variants including one anti-aircraft version consisting of an SA-9 SAM launcher mounted atop the standard BRDM chassis. Represented in this simulation is the anti-tank BRDM-2 armed with AT-5 Spandrel missiles. It is sometimes referred to as a BRDM-3.



BDRM-2 w/AT-5 Spandrel

This variant was first seen in 1977. It carries a crew of two, a driver and vehicle commander. The vehicle commander is responsible for operating the AT-5 launcher located to the rear of the vehicle. Each vehicle carries five missiles inside the launcher. They are second generation wired-guided ATGMs much like the TOW missile system used by US forces.

These vehicles are fully amphibious. They are equipped with a single water jet propulsion system which allows the BRDM-2 to cross water obstacles at speeds of 2-3 mph. The crew compartment is airtight and over-pressurized to protect the crew from nuclear, biologiocal, and chemical (NBC) hazards. Comanche pilots should be aware that these vehicles also carry a 14.5 mm machine gun.

NAVAL VESSELS

Osa II Patrol Boat

Throughout its history the Soviet Navy has concentrated on building coastal defense craft rather than "blue water" vessels. Consequently, they have become very adept at constructing light but powerful patrol boats. This type of warship is characterized as being fast, nimble, yet packed full of modern anti-ship weaponry. The Osa II is one such vessel. It entered service in 1966 as a replacement for the Osa I and Komar class patrol vessels.



Osa II

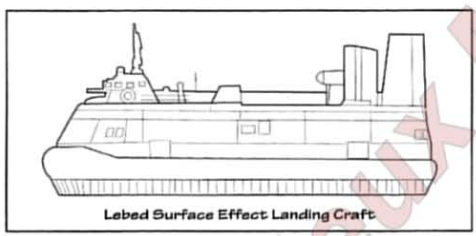
The Osa II is driven by three diesel engines which provide power to three separate propeller shafts. This tiny boat is able to sustain speeds up to 40 knots and has a combat radius of just under 1,000 nautical miles. It is the epitome of

Classified Manual

what's termed in modern navy parlance; "an egg shell with a sledgehammer". An Osa II boat is unarmored and only 128 ft. long from stem to stern. (We're not talkin' the Queen Mary here.) One hit from a missile or bomb will be sufficient to send an Osa to the bottom. At the same time, an Osa carries a mighty hammer in the form of four SS-N-2B Styx anti-ship missiles. Of more importance to Comanche pilots however, is the Osa II's compliment of SA-N-5 SAMs and twin 30 mm AAA guns.

Lebed Air Cushioned Landing Craft

The Lebed 'surface effect' (hover craft) landing craft entered service during that period of massive Soviet naval expansion during the late 1970s. They are designed for use as an amphibious assault vessel as well as an "over-the-shore" logistics platform. Each vessel is equipped with a bow ramp allowing for quick Roll On- Roll Off (RO-RO) operations.



Lebed Surface Effect Landing Craft

In combat, Lebeds are normally pre-loaded with men and material, then placed in pairs aboard an "Ivan Rogov" class LPD mothership. They are stored internally until such time as the Rogov reaches the assault point. Once off-shore of the landing beach, the Lebeds exit the stern of the Ivan Rogov and proceed to the beach at speeds reaching 65 knots. Each vessel carries a single 30 mm CIWS (pronounced "Sea-Whiz") gatling gun to be used as an air defense weapon or to support the troops going ashore.

When used as assault vessels, these craft normally carry two light MBTs or up to 120 marines and their equipment. Because they are "surface effect" or air cushioned, Lebeds can move directly onto the beach and perform dry insertions. When operating as re-supply vessels, these craft can carry over 40 tons of cargo. Again, these vessels can deliver supplies directly onto dry land obviating the need for ship-to-shore off loading.

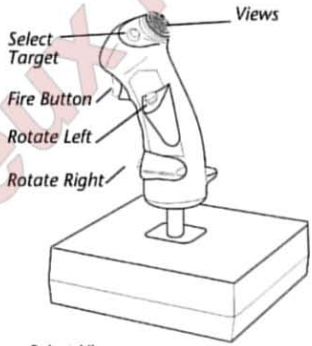
Le Vieux Manuel

CHAPTER VII
HARDWARE CONFIGURATIONS

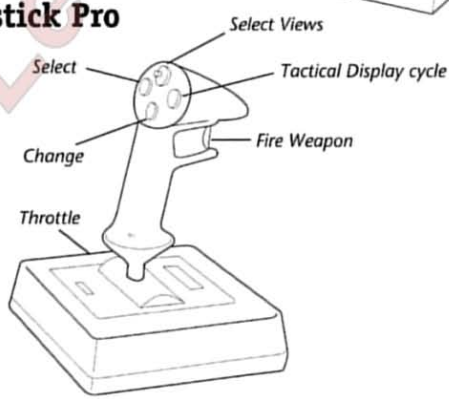
A. JOYSTICKS

Although you may play Comanche 2 using only keyboard inputs, most players find that using a joystick as a cyclic control more closely simulates actual flight conditions. Default joystick configuration files therefore have been included with your Comanche CD ROM. Consult your joystick user manual for specific information on implementing the files provided. Examples of default joystick programming are illustrated below.

1. ThrustMaster Flight Control Stick (FCS)

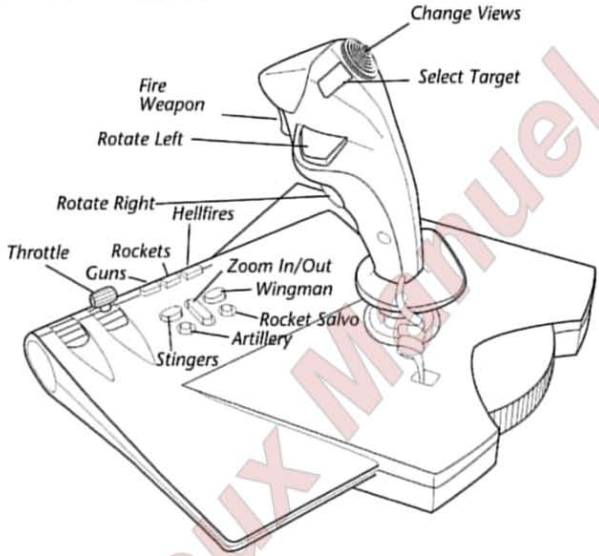


2. CH Flightstick Pro

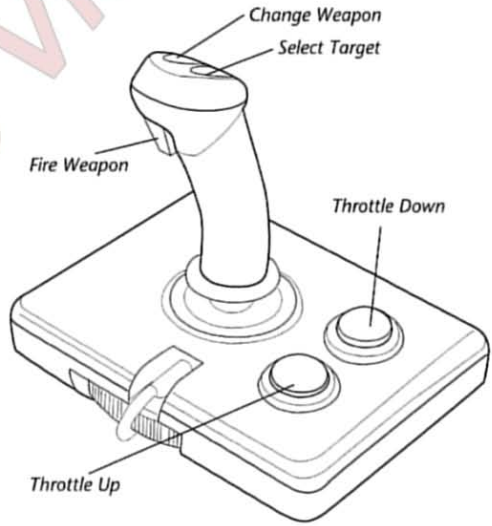


Le Vieux Manuel

3. Gravis Firebird

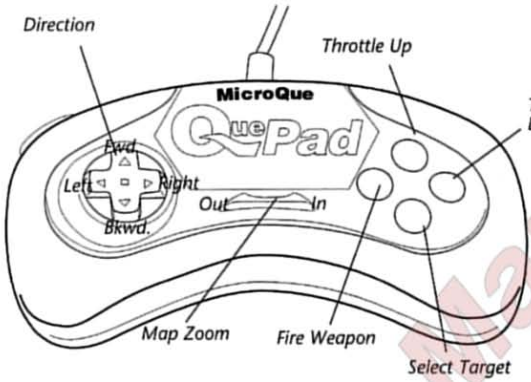


4. Gravis Mousestick



Le Vieux Manuel

5. Que Pad



6. Que Stick

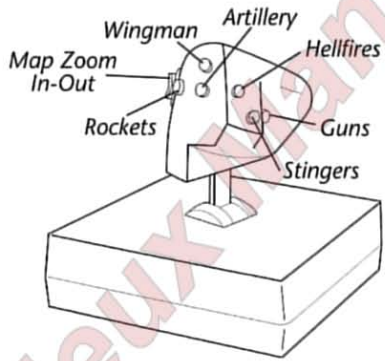


Le Vieux Manuel

B. THROTTLE

Although you may play Comanche 2 using only keyboard inputs, most players find that using a throttle device as a collective control more closely simulates actual flight conditions. Default throttle configuration files therefore have been included with your Comanche CD ROM. Consult your particular throttle device user manual for specific information on implementing the files provided. An examples of default throttle programming is illustrated below.

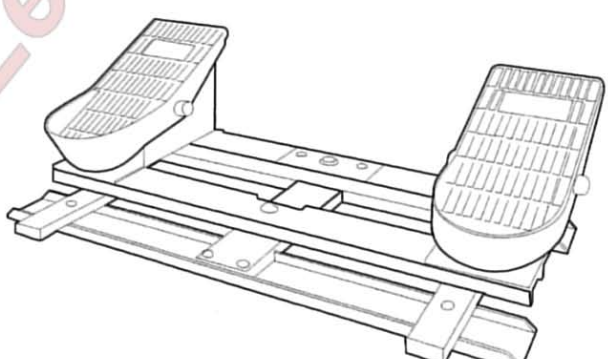
1. ThrustMaster WCS



C. FOOT PEDALS (RUDDERS)

The actual Comanche helicopter uses a unique FANTAIL tail rotor to control torque. You may use foot pedals to simulate this effect.

1. ThrustMaster Pedals



Le Vieux Manuel



GLOSSARY

This section of your User Manual contains definitions or explanations of unfamiliar words, terms, acronyms, and phrases. Spoken phrases or terms relating to audio prompts (alerts, alarms, enunciators, etc.) are italicized in the body of the text. Note that the words aircraft and helicopter are used interchangeably such that all helicopters are considered aircraft but obviously not all aircraft can be considered helicopters.

A (alpha) *AL fah*

AAA : (Anti-Aircraft Artillery); commonly referred to as "triple A", refers to bullets, shells, or projectiles that are fired from guns on the ground. Normally, the term is not meant to include surface-to-air missiles (SAMs).

AAM : (Air-to-Air Missile); a missile that is fired from an aircraft in flight with the intent of shooting down another aircraft, e.g. Sidewinder, AMRAAM, Alamo, Apex, etc.

ACM : (Air Combat Maneuvering); a fancy term for dogfighting. The art of engaging enemy aircraft and shooting them down using a combination of maneuver and weaponry.

ADF : (Automatic Direction Finding); equipment used to process navigational signals.

affirmative : term meaning Yes, a positive response, opposite of *negative*.

AFV : (Armored Fighting Vehicle); another name for a tank or APC.

AGL : (Above Ground Level); refers to your altitude in relation to the actual elevation of the ground you are traveling over and not sea level.

AGM : (Air-to-Ground missile); a missile launched from an aircraft and directed at targets on the ground, i.e. the AGM-65D Maverick.

AH : (Attack Helicopter); as in (R)AH-66 Comanche.

AIM : (Air Intercept Missile); another name for U.S. air-to-air missiles, e.g. AIM-92 Stinger.

altimeter : an instrument which displays your altitude by measuring differences in air pressure.

AOA : (Angle of Attack); the angle between the chord line of the rotor blade and the direction of the relative wind. An indication of the "bite" your blades are making in the surrounding air mass.

APC : (Armored Personnel Carrier); an armored transport vehicle which offers troops some measure of protection from small arms fire and shrapnel.

ASL : (Above Sea Level): refers to your altitude above sea level and not the actual altitude above the terrain you are passing over.

aspect angle : a comparison of flight paths between the target and the attacking aircraft, usually referenced from the attacking aircraft's perspective, i.e. head-on aspect, tail aspect, etc.

Preview Manuel

ATO : (Air Tasking Order); a secret list scheduling what targets are to be hit and when.

avionics : the electronic components and subsystems onboard an aircraft, a catch-all phrase that can be used to denote just about anything that moves, blinks, or beeps.

B (bravo) *BRAH voh*

bandit : an aircraft that has been positively identified as enemy or hostile, a bad guy.

BDA : (Bomb Damage Assessment or alternatively Battle Damage Assessment); a post-strike estimation of the damage caused to a particular target.

bearing : horizontal direction to or from a given point, a compass heading usually given in degrees through 360°.

bingo : a term used to describe a condition in which an aircraft has only enough fuel remaining to return to base.

blade time : term for the number of flight hours a pilot has spent in the aircraft.

blood chit : a cloth pass carried by pilots in case they are shot down behind enemy lines. The pass (written in several languages) promises a reward to anyone who helps return the downed pilot to friendly forces.

Bogey : an aircraft which as not been positively identified, basically just an unknown blip on the radar.

bolo : a mistake, a "screw up".

bolo badge : slang name for a Purple Heart medal. The thinking is if you are awarded a Purple Heart, you must have screwed up or "bolo-ed" somehow.

bounding overwatch : a tactic by which two helicopters advance across the battlefield in stages, one providing cover while the other moves forward.

BVR : (Beyond Visual Range); a term indicating that a target is too far away to be seen with the naked eye.

C (charlie) *CHAR lee*

callsign : the nickname by which you are known throughout your squadron, e.g. "Sandy405", "Slick", "Mongo", "BigRick", etc.

CAP : (Combat Air Patrol); a term which usually refers to a defensive sortie or air-to-air mission centered around a particular fixed location.

CAS : (Close Air Support); used to indicate tactical aircraft used to attack enemy ground targets in conjunction with friendly forces on the ground.

C³I : (Command, Control, Communications and Intelligence); pronounced *See-Three-Eye*; a term for the infrastructure responsible for battlefield management.

chaff : passive form of electronic countermeasure, metallic strips usually carried in a pod or dispenser aboard an aircraft that when released disrupt radar tracking and/or target acquisition much like an electronic smoke screen.

check fire : an order given to cease firing according to a current ROE.

cherry hop: your first flight in a Comanche.

closure : rate at which two objects are approaching each other.

collective : pilot control used to "collectively" change the pitch of the main rotor blades, enabling you to control the helicopter's altitude.

creep : a slow, stealthy reconnaissance patrol or mission, as in "to go on a creep".

cyclic : pilot control used to selectively change the pitch of the main rotor blades, enabling you to control the helicopter's direction of flight.

LeVrai Manuel

D (delta) *DELL tah*

ditch : bailing out of an aircraft, see ejecting.

down : term used to describe any piece of equipment which is taken out of action due to maintenance, something which won't work until repaired.

dust-off : slang term for medevac (medical evacuation) flights, e.g. "Tango Two Charlie, we have two whiskey-india-alphas. Request an immediate dust-off."

E (echo) *ECK oh*

ECM : (Electronic Counter-Measure); usually refers to chaff, flares, or other means of interfering with enemy radar or radio transmissions.

ECCM : (Electronic Counter Counter-Measure); refers to things done to minimize the effectiveness of ECM.

ECCCM : (Electronic Counter Counter Counter-measures); There's really no such thing but you get the idea how this electronic warfare stuff works.

egress : leg of flight plan from a target location, the route an aircraft takes after striking a target.

ejecting :common term for bailing out of a damaged aircraft, pilots are equipped with an ejection seat which blasts them free from the aircraft.

EW : (Electronic Warfare); usually refers to jamming, signal intercept, etc.

F (foxtrot) *FOKS trot*

FARP : (Forward Area Refueling Point); a semi-permanent operating base close to the action where helicopters can be armed and refueled.

fast mover : slang for a high performance, fixed wing aircraft.

FEBA : (Forward Edge of the Battle Area); the front line, a demarcation line indicating the point at which friendly troops are separated from the enemy.

FFAR : (Folding-fin Aircraft Rocket); rockets which extend their guidance fins after being ejected from their pod containers.

final approach : the last leg of traffic pattern flown by an aircraft getting ready to land, a flight path consisting of a line extending back from the runway centerline intersecting with the base leg.

First Team : industry name for the Boeing/ Sikorsky employees and sub-contractors working on the RAH-66 project.

flak : (flugabwehrkanone); a German word for triple AAA fire, seldom used anymore except as a slang term for petty annoyances, e.g. "I caught some flak from the Captain for being late again today."

flare : a magnesium pyrotechnic which is released from an aircraft, a countermeasure designed to attract the IR sensor of a heat-seeking missile.

FLIR : (Forward-Looking Infrared); an IR imaging system that contrasts differences between objects and background temperatures. Although commonly thought of as a means of viewing objects at night, a FLIR also can be used in daylight to see through smoke, haze and even camouflage.

FLOT : (Forward Line of Own Troops); something pilots in fast moving aircraft have always had trouble discerning, see FEBA.

flush : a precautionary scramble from airbase to avoid being caught on the ground.

Fly-By-Wire : aircraft controls which are actuated by electronic rather than mechanical

Eurocopter Manuel

means.

FM : *(friggin' magic);* a profane term used by pilots to describe how and why some things just seem to turn out the way they do.

F-Pole : the distance between yourself and the target at the moment your ordnance impacts, an important consideration for helicopter pilots.

fratricide : term used to describe the act of shooting up friendly troops by mistake, in training this is referred to as a "blue-on-blue" incident.

G (golf) *GOLF*

G force : the force of gravity, one G is a measure of gravity equal to the force exerted on a stationary object at sea level.

GCI : (Ground Control Intercept); a radar command installation responsible for vectoring friendly fighters and targeting enemy aircraft for SAMs.

G.I.B : (Guy In Back); slang term for your Weapon System Operator (WSO).

GLOC : (G-induced Loss Of Consciousness); cute phrase which means blacking out due to positive G stress forcing blood from the brain and into the lower body. This is more of a problem for pilots in high performance fixed wing aircraft, though. Chances are your rotors would break off under heavy G stresses long before you would ever black-out.

GPS : (Global Positioning System); a highly accurate satellite-based navigation system.

ground speed : speed of the aircraft in relation to the actual distance being traveled on the ground.

H (hotel) *hoh TELL*

heading : horizontal direction of flight given as a compass heading where 0°/360° equals magnetic north, 90° equals east, 180° equals south and 270° equals west.

heater : pilot slang for a heat-seeking (IR) missile.

HEI : (High Explosive Incendiary); term used to classify the ammunition used by the RAH-66's 20 mm cannon.

HID : (Helmet Integrated Display); an imaging system, somewhat like a HUD, which superimposes flight and weapon symbology directly onto your helmet visor.

HOTAS : (Hands On Throttle and Stick); refers to a throttle and stick design which allows a pilot to operate his aircraft's flight and weapon systems using actuators located right on these devices.

HUD : (Head-Up Display); a transparent display containing flight/ weapons symbology that is set directly in front of the pilot. The idea is to give the pilot access to information without forcing him to avert his gaze from outside the cockpit, i.e. allowing him to keep his head-up and looking around rather than starring at gauges.

I (india) *IN dee ah*

IADS : (Integrated Air Defense System); a multi-layered air defense plan consisting of many different elements which are bound together by comprehensive radar coverage.

ILS : (Instrument Landing System): an all-weather means of controlling the

Le Vieux Manuel

three- axis movement of an aircraft using a radio-frequency beacon, normally used in the context of assisting a pilot attempting to land during periods of low or no visibility.

ingress : the approach leg of flight plan to a target location.

IGE : (In Ground Effect); the beneficial lift produced by the deflection of rotor downwash when operating near to the ground.

IR : (Infra-Red); used in the context of missiles able to track targets based on sensors able to detect radiated energy.

J (juliet) *JEW lee ett*

jamming : term used to describe an active attempt to create signal interference to prevent an enemy from using his radar or radio.

jinking : erratic gun-defense skidding maneuver designed to spoil an attacker's firing solution.

K (kilo) *KEE loh*

Ka : a military prefix used in identifying aircraft produced by the Russian design bureau Kamov.

KIAS : (Knots Indicated Air Speed); term used to refer to your helicopter's airspeed, a knot is one nautical mile (2,000 yds) per hour.

Knock It Off : terminate fighting maneuvers immediately.

L (lima) *LEE mah*

LHX : (Light Experimental Helicopter); acronym for the U.S. Army's Comanche design program.

LOH: : (Light Observation Helicopter); pronounced "loach", generic name for any reconnaissance helo but primarily refers to the OH-6 Cayuse.

Loach : slang term for a light observation helicopter or LOH

Longbow : nomenclature referring to the long range millimeter radar and targeting designator used on the Apache. Only a third of the Comanche fleet will be issued the Longbow radar system.

Low Observable : stealth features of an aircraft which reduce or eliminate an enemy's ability to detect it.

LZ : (landing zone); the place where helicopters drop off troops and equipment, a "hot" LZ is one that is still under enemy fire when landing operations take place.

M (mike) *MIKE*

MANPRINT : (Manpower Integration); electronic and software system which essentially allows the helicopter to maintains itself, freeing the pilot to perform other tasks.

marking : leaving smoke contrails or otherwise making aerial detection easy, (i.e. The F-4 Phantom was a famous case. Its engines caused it to trail a thick cloud of smoke.)

masking : term used to describe the conscious act of using terrain to block (or degrade) the ability of an enemy's sensors to detect your aircraft.

MayDay!!! : an emergency call, the anglicized version of *m'aidez*, a French word

Le Vieux Manuel

meaning "Help Me!!", normally said three times in rapid succession.

MBT : (Main Battle Tank), see AFV.

merge : the point at which two or more opposing aircraft meet or cross paths during an ACM engagement.

MFD : (Multi-Function Display); acronym referring to cockpit monitors which can be configured to display various flight/weapon data.

Mi : a military prefix used in identifying aircraft produced by the Russian design bureau Mil.

MiG : a military prefix used in identifying aircraft producing by the Russian design bureau Mikoyan-Gurevich.

MiG country : slang term for enemy territory wherever it is found.

MSA : (Minimum Safe Altitude); go below the MSA and you're asking for trouble.

N (november) *noh VEM ber*

nautical mile (nm) : nautical mile equals 2000 yds or 1.15 statute miles.

negative : a term meaning no, the opposite of roger, a non-affirmative response.

NOE : (Nap of the Earth); a flight path which hugs the ground in order to avoid detection.

No Joy : opposite of Tally, no visual or radar contact with enemy aircraft.

NOTAR : (No Tail Rotor); term used to describe a helicopter design which does not use a tail rotor to offset the torque produced by the main rotor.

O (oscar) *OSS cah*

ordnance : term referring to bombs, rockets, missiles carried by the aircraft, basically anything that can be fired, shot, dropped or launched.

OTH : (Over the Horizon); usually used in the context of missiles being fired at long distance targets which are masked by the curvature of the Earth.

P (papa) *pah PAH*

pad alert : a readiness condition which requires pilots to occupy their aircraft and be ready to take-off at a moment's notice.

padlocked : a term referring to a pilot who cannot take his eyes off a target for fear of not being able to spot it again.

pickle : slang term for releasing ordnance; (as in to *pickle* off a rocket).

pitch : measure of aircraft motion around its lateral axis, controlled by input to the elevators, helicopters also control the pitch of their rotor blades to take larger or smaller "bites" out of the surrounding air mass.

P_k : (probability kill); the percentage chance that a given munition will result in a target kill.

pop-up : a sudden climb from a low altitude, refers to a maneuver used to minimize an aircraft's exposure to hostile fire during a target ingress.

Pucker Factor : method of rating particularly a hazardous mission or flight situation.

pull-pitch : term used to describe adding collective control to quickly gain altitude or slow the forward/ downward motion of the helicopter.

PUNTS : (People of Utterly No Tactical Significance); derogatory acronym used by the British army and subsequently adopted by US soldiers during the Persian Gulf War to denote just about anyone that got in the way of combat

Le Yeux Manuel

operations.

push : military term meaning "go to", e.g. "Tango Six Leader to Tango Six: We've received orders to *push* the primary target."

Q (quebec) *keh BECK*

R (romeo) *ROW mee oh*

radar : (Radio, Detection, and Ranging); a device which detects objects by bouncing radio waves off them.

RAH-66 : (Reconnaissance Attack Helicopter); military nomenclature used to denote the Boeing/ Sikorsky RAH-66 Comanche.

relative wind : direction of wind in relation to the chord line of the helicopter's rotor blade.

ROE : (Rules of Engagement); a set of instructions letting pilots know under what conditions it is okay to shoot at somebody.

roger : a term meaning yes, an affirmative acknowledgment.

RTB : (Return to Base); radio call indicating that the receiver should immediately return to base.

RWR : (Radar Warning Receiver); pronounced "raw"; a network of sensors around the aircraft which alert the pilot when radar emissions are detected.

S (sierra) *see AIR rah*

saddled : pulling alongside another aircraft in formation flight and assuming a stable position relative to that aircraft.

SAM : (Surface to Air missile); a missile which can be fired at aircraft from either a fixed site or mobile launch vehicle, e.g. SA-9 Gaskin.

SAR : (Search and Rescue); highly trained teams of guys that 'come getcha' should you be forced to eject from your aircraft. Also, CSAR (Combat Search and Rescue).

scramble : quick take-off, usually an emergency situation.

Scud : a Russian-built SSM that uses inertial guidance, inaccurate but effective as a terror weapon, made famous during the Gulf War.

SEAD : (Suppression of Enemy Air Defenses); a mission designed to destroy or otherwise hinder the effectiveness of an enemy's air defense.

signature : the telltale indications of an aircraft's presence, such as its radar cross-section or IR emissions.

situational awareness : refers to your mental ability to read a given tactical situation, being aware of what is going on around you.

six : in clock terminology, your "six" is behind you or 180° from your direction of flight, (i.e. "Hey, check my *six* for Bandits, you guys!!!"

shooter : any aircraft in a formation that is designated to release ordnance.

slick : an aircraft is flying with no external equipment or ordnance that would create drag.

snap shot : a gun attack with a high angle-off perspective.

sortie : one flight mission by one aircraft.

spike : an indication from the RWR sensor that a radar beam has passed over your aircraft.

splash : a terms used to indicate an air-to-air kill or weapons impact on ground target by an outside source which is illuminating the target.

Bruno Luxx Manuel

spooling : term that refers to winding up the helicopter's rotors to their lift producing or operating speed.

SSM : (Surface-to-Surface Missile); a missile with a very large warhead designed to be fired from a ground installation or mobile launcher at ground targets, e.g. Scud, FROG, etc.

stall : the separation of airflow from the upper surface of a wing or rotor blade, an aircraft is subject to stall at any altitude and any speed, a common mistake is to equate a stall with engine failure.

Standard European Day : term used to describe a helicopter's ability to hover at 2,000 ft. on a typical 75° day.

strike package: group of different aircraft combined to perform a single mission. For example, a single strike package may consist of fighters, bombers, EW, and AWACS aircraft.

Su : a military prefix used in identifying aircraft produced by the Russian design bureau Sukhoi.

Super Team : name for the Bell/ McDonnell Douglas employees and industry sub-contractors working on the RAH-66 project.

T (tango) *TANG go*

tally-ho! : sighting of a confirmed target, opposite of *No Joy*.

target rich environment : an area of operations has many eligible targets to attack.

terminal leave: leave taken by a person in the military just before being discharged from the service, watch yourself on some of these missions or the phrase "terminal leave" may take on a whole new meaning.

TLAR : (That Looks About Right); method of bombing using unguided munitions and gut instinct.

TOL : (Take-Off and Landing); a complete flight cycle.

Top : slang term for the senior Non-Commissioned Officer (NCO) in the unit, usually holds the rank of a Master Sergeant(E-8) or Sergeant Major (E-9).

torque : the reactive forces acting in opposition to the action of the main rotor. If uncorrected, a helicopter's fuselage would turn in the direction opposite of its rotors.

tracers : projectiles which are coated with a phosphorus substance that ignites making them visible to the naked eye.

trailer : the last aircraft in a formation.

triple-A : see AAA.

tumbleweed : refers to a pilot with no situational awareness, a clueless individual, basically someone just waiting to get shot down.

Tu : a military prefix used in identifying aircraft produced by the Russian design bureau Tupolev.

two-shipper : standard flight of two aircraft, lead and wingman.

U (uniform) *YOU nee form*

UH : (Utility Helicopter); as in the UH-60 Blackhawk, usually denotes a transport helicopter .

unmask : moving from behind cover so that you become visible to enemy observers.

unobtanium : a needed material or piece of equipment that you can never seem to get

Le Faux Manuel

your hands on when you need it.

V (victor) *VIK tah*

V_c : velocity (closure); speed at which two objects are approaching each other.
V_{ne} : velocity (never exceed); speed at which you begin to risk structural damage to the aircraft.
V_{max} : velocity (maximum); a maximum safe speed for a particular altitude.
vector : a compass heading (direction given in degrees).

W (whiskey) *WISS key*

water-walker: a Comanche pilot who can do no wrong, a helicopter hero whose accomplishments are legendary.
waypoint : a pre-set fixed navigational point which is tied in to your auto-pilot flight controls, a designated point in the sky.
weapons free : a condition related to your ROE; a term used to describe full freedom to fire weapons within a given air space.
weapons hold : the opposite of weapons free, a directive to cease firing or not to begin firing.
weed-whacker : a low flying helicopter.
Werewolf : Russian name for the Ka-50 Hokum helicopter.
winchester : a term used to describe an aircraft which has no ordnance remaining.
whiskey check : humorous term used to describe a flight crew that chucks your personal equipment out of the helicopter rather than setting down inside an LZ to off load it. If there's a bottle of whiskey inside, it'll break when your duffel hits the ground.

WSO : (Weapon Systems Officer); pronounced "Whizzo", another name for your co-pilot, your backseater responsible for operating much of the on-board targeting and weapon systems, see GIB.

X (xray) *ECKS ray*

Y (yankee) *YANG key*

yaw : measure of aircraft motion around its vertical axis, in helicopter flight yaw is controlled by the tail rotor, see torque.

Z (zulu) ZOO loo

zulu time : military time using Greenich Mean Time as the common standard, e.g. "Be on the pad and ready to go at 1315 hours zulu."

Le Vieux Manuel

Comanche Index

Symbols

20mm Vulcan II Cannon 31
70mm Rockets 31

A

Abort Mission 14
About Comanche 14, 45
Above Ground Level (AGL) 26
AIM-92 Stinger Air-to-Air Missiles 32
Altitude Considerations 41
Altitude Stabilizer 19
Artificial Horizon 18, 26
Auto Chaff 19
Auto Flare 19
Auto Hovering 24

B

Base Indicator 27
Boeing Sikorsky RAH-66 Comanche 59
BRDM-2 65

C

Cannon Damage 30
Chaff 30
Clouds 16
Cockpit Avionics 25
Collective Control 21
Collective Indicator 22
Collective/Throttle Display 30
Compass Display 27
Console Avionics 30
Control Menu 17
Countermeasure Display 30
Crossfire Attacks 44
Cyclic Controls 22, 23

D

Deception and Attack Tactics 44
Defensive Maneuvering 43
Detail Menu 16
Digital Map 28
Digital Speed Indicator 27
Drag and Ambush Tactics 43
Drag and Pursue Tactics 44
Duck and Cover Tactics 41

E

Echelon formation 44
Engine Sounds 15

F

FARP vii
Flares 30
Following Fire 43
Forward Area Refueling Point vii, 44
Frame Rate Lock 17
Fuel Gauge 31

G

Game Installation vi
Game Menu 11
Gamma 16
Gravis Firebird 68
Gravis Mousestick 68
Gulf War vii

H

Hands-Off Weapons 32
Haze 16
Head-Up Display (HUD) 26
Heading Velocity Display 27
Heading Velocity Indicator 18
Hellfire Laser-Guided Missiles 32
Helmet Integrated Display (HID) 18, 26
Helmet Mounted Display (HMD) 59
HID Compass 18
HID Indicators 18
High Detail 16
How To Fly The Comanche 21
Hughes 500MD 61

I

In Ground Effect 24
Initiating a Modem Game 36
Initiating a Multiplayer Network Game 38

K

Ka-50 Werewolf (Hokum) 60

Vieux Manuel

L

Lebed Air Cushioned Landing Craft 66
Low Detail 16

M

M1A2 Abrams MBT 62
Main Operations Menu 14
Mean Sea Level (MSL) 26
Menu Bar 14
Mi-24P Hind F 61
Missile Cam 18
Mission briefing 13
Mission Status 29
Monitor Resize 15
Multiplayer Game 13
Multiple Launch Rocket Systems (MLRS) 32
Music 17

N

Nap of the Earth (NoE) 41, 46
NovaLogic Technical Support iii

O

Operational Status Indicator 29
Options Menu 18
Osa II Patrol Boat 65

P

Pedal Controls 23
Permanent Threat Indicator 30
Pilot Views 2,5 83, 85
Pilot Roster 11, 12
Player Reference Chart 83, 85

Q

Quickdraw 15

R

Radar Altimeter 18, 26
Rate of Climb Indicator 18, 26
Reflections 16
Rotor Damage 29

S

SA-8 Gecko 64
Select Campaign 12
Selecting a Campaign 13
Selecting a Mission 13
Single Player Game 12
Small Pixels 16
Sound 17
Speed Indicator Display 18
SS-1 Scud 63

T

T-80 63
Tactical Information Display (TID) 28, 83, 85
Target Acquisition System (TAS) 28, 29
Terrain Detail 16
Threat Indicator 28
Thrustmaster RCS 23

V

Vectored Lift 22
Victory Conditions 37

W

Warning Panel 31
Waypoint Indicator 27
Weapon Control Summary 83, 85
Weapon Mount Damage 29
Weapon Selection Options 32
Weapons Display 30
Wingman Support 33

Le Vieux Manuel

Comanche and Armored Fist are registered trademarks of NovaLogic, Inc. F-22, F-22 Lightning II, Comanche, Comanche 3, Armored Fist, Armored Fist 2 - M1A2 Abrams, WolfPack, Ultrabots, Voxel Space, Voxel Space 2, NovaLogic, the NovaLogic logo and NovaLogic - The Art of War are trademarks of NovaLogic, Inc. Werewolf is a registered trademark of Data East, Inc. for video games in the United States. Werewolf is a registered trademark of NovaLogic in the United Kingdom and Germany and is a trademark of NovaLogic in all other territories. Dolby and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation. Microsoft and Windows are registered trademarks of Microsoft Corporation. Pentium is a registered trademark of Intel Corporation. Apple, AppleTalk, the Apple logo, and Macintosh are registered trademarks, and Mac is a trademark of Apple Computer, Inc. All other trademarks are property of their respective owners. Copyright 1996 NovaLogic, Inc.



Le Vieux Mart

Chief Warrant Officer 2 "Angel"
Comanche Pilot RAH-66

NovaLogic's Limited Ninety-Day Warranty and License Provisions

IMPORTANT: By retaining this product or breaking the seal on the software, you agree to the following terms and conditions. If you do not wish to be bound, promptly return this product in its entirety with proof of purchase to NovaLogic, Inc., 26010 Mureau Road, Suite 200, Calabasas, California 91302, and a full refund will be made.

Limited Warranty on Media

NovaLogic, Inc. ("NovaLogic") warrants the compact disc on which this product is recorded to be free from defects in materials and workmanship under normal use for a period of ninety (90) days from the date of purchase as evidenced by a copy of your proof of purchase. NovaLogic's entire liability and your exclusive remedy in the event of such defect will be replacement of the compact disc not meeting NovaLogic's limited warranty and which is returned to NovaLogic with a copy of your proof of purchase. NovaLogic will have no responsibility to replace any such compact disc damaged by accident, abuse or misapplication. This policy applies to the initial purchase only.

ANY IMPLIED WARRANTIES ON THE COMPACT DISC, INCLUDING THE IMPLIED WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO NINETY (90) DAYS FROM THE DATE OR DELIVERY. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY BY JURISDICTION.

If you believe you have found any such error or defect during the warranty period please return the defective compact disc together with a dated proof of purchase to NovaLogic, Inc., 26010 Mureau Road, Suite 200, Calabasas, California 91302, for a free replacement. As a condition precedent to the limited warranty coverage provided by NovaLogic and to ensure identification, the original purchaser must complete and mail to NovaLogic, at the above address, within thirty (30) days after purchase, the warranty registration card enclosed in this product.

Disclaimer of Warranty on Product

YOU EXPRESSLY ACKNOWLEDGE AND AGREE THAT USE OF THIS PRODUCT IS AT YOUR SOLE RISK. THIS PRODUCT AND RELATED DOCUMENTATION ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND AND NOVALOGIC EXPRESSLY DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE. UNAUTHORIZED REPRESENTATIONS: NOVALOGIC WARRANTS ONLY THAT THE PROGRAM WILL PERFORM AS DESCRIBED IN THE USER DOCUMENTATION. NO ADVERTISING, DESCRIPTION OR REPRESENTATION, WHETHER MADE BY A NOVALOGIC DEALER, DISTRIBUTOR, AGENT OR EMPLOYEE, SHALL BE BINDING UPON NOVALOGIC OR SHALL CHANGE THE TERMS OF THIS DISCLAIMER OR THE LIMITED WARRANTY ON MEDIA SET FORTH ABOVE. NOVALOGIC DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE NOVALOGIC PRODUCT WILL MEET YOUR REQUIREMENTS, OR THAT THE OPERATION OF THE NOVALOGIC PRODUCT WILL BE UNINTERRUPTED OR ERROR-FREE, OR THAT DEFECTS IN THE PRODUCT WILL BE CORRECTED. FURTHERMORE NOVALOGIC DOES NOT WARRANT OR MAKE ANY REPRESENTATIONS REGARDING THE USE OR THE RESULTS OF THE USE OF THE PRODUCT OR RELATED DOCUMENTATION IN TERMS OF THEIR CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY NOVALOGIC OR NOVALOGIC'S AUTHORIZED REPRESENTATIVE SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY, SHOULD THE PRODUCT PROVE DEFECTIVE, YOU (AND NOT NOVALOGIC) ASSUME THE ENTIRE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION, SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU.

NO CONSEQUENTIAL DAMAGES: NOVALOGIC SHALL NOT BE LIABLE FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES, EVEN IF NOVALOGIC IS ADVISED OF OR AWARE OF THE POSSIBILITY OF SUCH DAMAGES. THIS MEANS THAT NOVALOGIC SHALL NOT BE RESPONSIBLE OR LIABLE FOR LOST PROFITS OR REVENUES, OR FOR DAMAGES OR COSTS INCURRED AS A RESULT OF LOSS OF TIME, DATA OR USE OF THE SOFTWARE, OR FROM ANY OTHER CAUSE EXCEPT THE ACTUAL COST OF THE PRODUCT. IN NO EVENT SHALL NOVALOGIC'S LIABILITY EXCEED THE PURCHASE PRICE OF THIS PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

License

NovaLogic grants you a nonexclusive, nontransferable license as follows. You are entitled to use this product for your own use, but may not make (except for backup), sell or transfer reproductions of the software or manual to other parties in any way, nor rent, lease, or preview the product to others without the prior written permission of NovaLogic. You may use one copy of the product on a single terminal connected to one particular computer. You may not reverse engineer or disassemble the product.

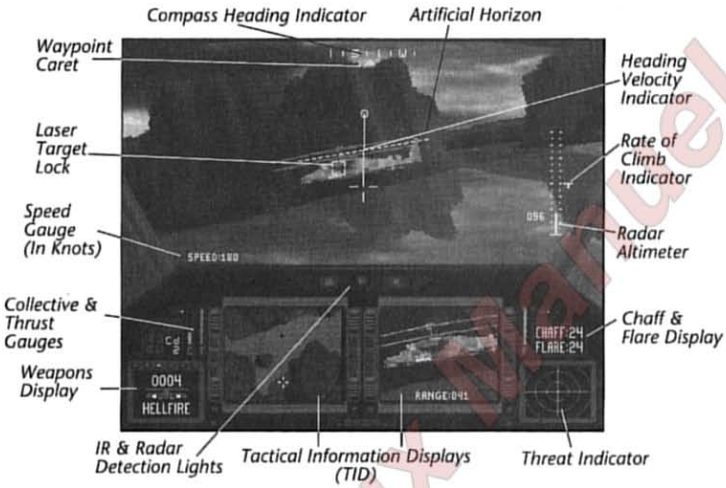
For technical support, on this or any other NovaLogic product, please call 818/878-0325.

Locked 'n Loaded Manual

Pilot Notes

Le Vieux Manuel

PLAYER REFERENCE CHART



DETACH HERE

Pilot Views

- 1 - Forward View
- 2 - Left-side View
- 3 - Right-side View
- 4 - Rear View
- 5 - Panoramic View
- 6 - Chase View
- 7 - Drop Camera
- 8 - Last Drop Camera

WEAPON CONTROL SUMMARY

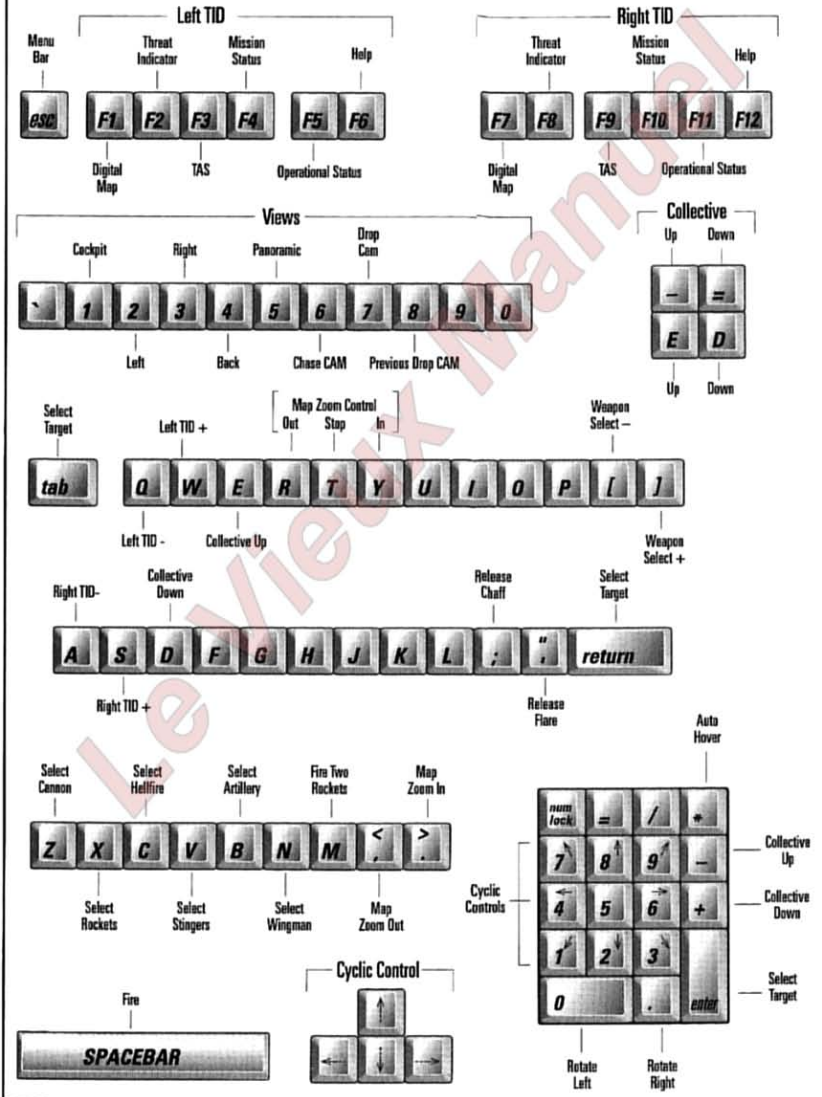
ACTION	KEY
Previous Weapon Selection	[
Next Weapon Selection	]
Fire Salvo (2 x 70mm Rockets)	M
Select 20mm Cannon	Z
Select 70mm Rockets	X
Select Hellfire Missiles	C
Select Stinger Missiles	V
Select Indirect Fire Support	B
Select Wingman	N
Fire Selected Weapon	SPACE

TACTICAL INFORMATION DISPLAY

FUNCTION	LEFT	RIGHT
Digital Map	F1	F2
Threat Indicator	F3	F4
TAS	F5	F6
Mission Status	F7	F8
Operational Status	F9	F10
Last Mode	Q	A
Next Mode	W	S
Zoom Map Out	<	<
Zoom Map In	>	>

Le Vieux Manuel

Comanche® 2 MAC



LeVieux Manuel



Comanche is a registered trademark of NovaLogic, Inc. Comanche 2, RAH-66, Werewolf vs. Comanche 2, Voxel Space, The Most Dangerous Game, NovaLogic and the NovaLogic logo are trademarks of NovaLogic, Inc. Macintosh is a registered trademark of Apple Computer, Inc. Voxel Space - Patent U.S. 5,550,959 © Copyright 1996 by NovaLogic, Inc. All rights reserved.

09596-01