RAPTOR

"It is always the one you don't see that gets you."

- Major Thomas B. "Tommy" McGuire
USAAF

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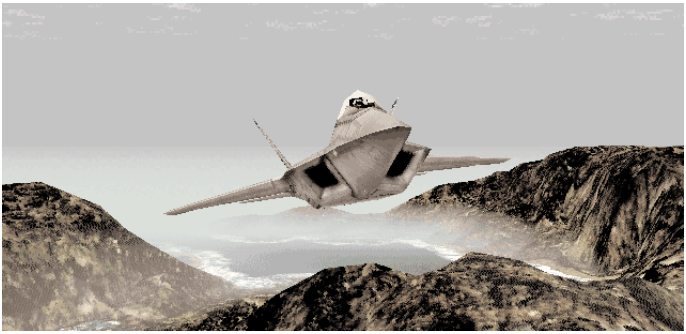
INTRODUCTION



With the advent of increasingly sophisticated integrated air defense systems around the world, and with the continued foreign development of more and more capable fighter aircraft, it is clear that the U.S. Air Force's aging F-15 air superiority fighters will soon be unable to ensure aerial supremacy for the United States in a future conflict. The Air Force has therefore undertaken development of a new fighter aircraft, one that can survive in the modern air defense environment and dominate any other fighter in the air. This new aircraft is almost ready to enter production, and now you can step into the cockpit of the latest and most capable fighter plane in the world—the F-22 Raptor.

A product of the combined development expertise of Lockheed/Martin and Boeing, with new engines by Pratt and Whitney, the superior performance of the F-22 comes from a variety of new technologies. Reduced observables and advanced sensors give the Raptor first-look, first-shot, first-kill capability. Powerful engines, a very large lifting area, and a unique thrust vectoring system make the F-22 the most maneuverable fighter aircraft in the world. Its ability to cruise supersonically gives the F-22 a very long range. Less visible, but equally important technologies include a high-speed data bus, VHSIC technology, fiber-optic data transmission, and integrated communications, navigation, and identification modules, with an advanced avionics suite configured for easy pilot use. Each F-22 carries computing power on board equivalent to

two Cray supercomputers.

The F-22 Raptor is a stealth aircraft, built with the most advanced composites and radar-absorbing materials. The design of the external skin of the plane renders it nearly invisible to most current radars, especially from below. To go with its superior Low Observable defenses, the F-22 can carry the latest air-to-air missiles, and has a 20mm cannon for close-in fighting. The F-22 can also carry the JDAM bomb system, making it a ground attack threat as well. With its unique combination of survivability and lethality, the F-22 Raptor will ensure the continued dominance of US air power.

NovaLogic is grateful to the United States Air Force and to Lockheed Martin Aeronautical Systems for their kind assistance. We have tried to make this the most realistic and authentic F-22 flight simulation in the world, and we hope that you enjoy playing the game as much as we enjoyed bringing it to life.

Chapter One:
GETTING STARTED

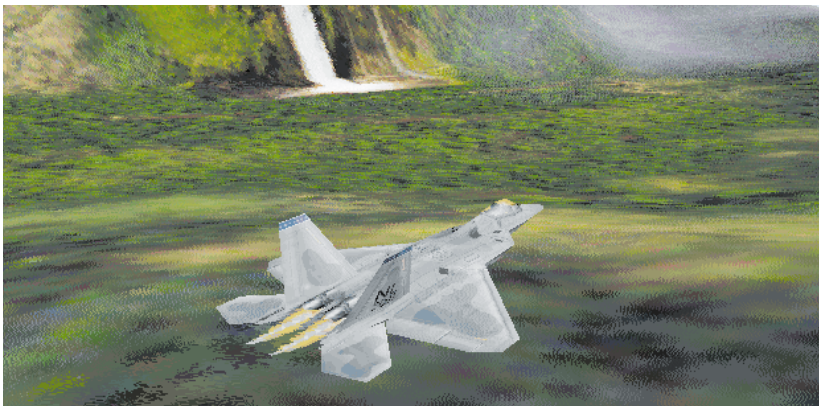
Welcome to ***F-22 Raptor.*** This chapter will help you get the program installed on your computer, and will walk you through the configuration of your system. The last part of this chapter is a Quick Start section for those of you with significant flight sim experience, or for those who want to jump right in and learn by doing.

Installing Raptor and Starting Play

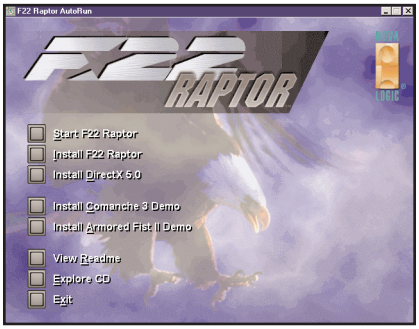
In order to play ***F-22 Raptor***, you must first install the game files onto your computer's hard drive. You should also calibrate your joystick before beginning play, and there are a series of game Options offered by the program itself that you should consider.

Game Installation

Your gateway to installing and running ***F-22 Raptor*** is the *AutoRun* program. *AutoRun* will automatically load itself and run each time you insert the Raptor CD into your CD drive.



The AutoRun Program



Before you begin installing the game, close all programs that your computer may be currently running. The installation program requires all your computer's resources. Then:

1) Place the game CD into your CD ROM drive and close the drive door. The AutoRun program will now take over;
2) Click the mouse on one of the menu choices, or type the letter corresponding to the underlined hot-key. The AutoRun menu gives you the following choices:

Start Raptor— Select this option to play the simulation. You will first have to install the program to your hard drive.

Install Raptor— Select this option to install the simulation onto your hard drive. You must install the game before you can play.

Install Armored Fist 2 Demo— Click here to have a demo version of Armored Fist 2 installed on your hard drive.

Install Comanche 3 Demo— Click here to have a demo version of Comanche 3 installed on your hard drive.

Explore CD— This CD also contains informational files and demos of other Novalogic games, such as Comanche 3 and Armored Fist 2.

View Readme— The Readme file contains the latest technical and game-related information about the program.

Install DirectX 5.0— Make this selection to install this version of DirectX. You must have DirectX 5.0 or greater installed on your machine to play ***F-22 Raptor***.

Exit— Exits the AutoRun program.

When you are ready, select **Install Raptor.**

Installing F-22 Raptor Game Files

Use your mouse to make appropriate selections, or press the letter of the underlined hot key.

1) At the beginning of the installation program you are given the opportunity to select a destination folder for the game. A default destination (C:\Program Files\Novalogic\F22_Raptor) is typed in the window for you. Press the **Enter** key to select the default destination. Otherwise, select your own folder name. If the folder you specify does not already exist on your hard drive, the Install program will create it for you;

2) If there is enough free hard drive space at the destination site, the program will copy the files from your ***F-22 Raptor*** CD ROM. An on-screen progress meter displays the completion percentage as the program transfers the files;

3) The install procedure automatically adds a *NovaLogic* folder to your *Windows® 95 Start Menu* under the *Programs* heading. An F22_Raptor sub-folder within the *NovaLogic* folder contains an application short-cut icon for the game.

4) If your system does not already have DirectX 5.0 installed, you will need to install it now. Select **Install DirectX 5.0** from the *AutoRun* program, then follow the on-screen instructions.

5) You will need to restart your computer to activate DirectX 5.0 before you can play ***F-22 Raptor***.

Calibrating the Joystick

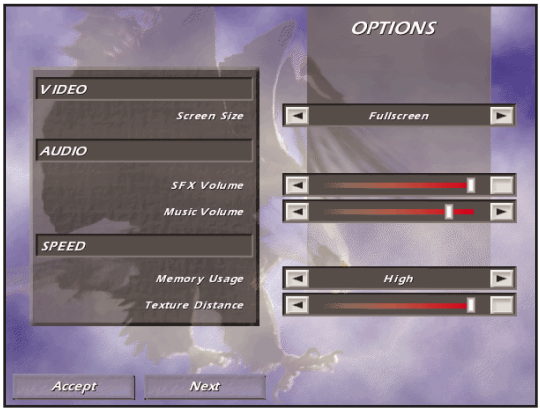
You will need to calibrate your joystick in Windows® 95 for it to work properly in ***F-22 Raptor***. Follow these steps:

1. Click on the **Start** button at the far left of the *Taskbar* at the bottom of the screen.
2. Highlight **Settings,** then select **Control Panel** from the menu.
3. Double-click on the Game Controllers icon.
4. Select your joystick from the list of game controllers you have installed, then follow the on-screen instructions to calibrate your joystick.

Starting the Game

1. If your computer is already turned on and the ***F-22 Raptor*** CD is in the CD drive, double-click on the ***F-22 Raptor*** shortcut icon, or go to the directory containing the simulation and double-click on the ***F-22 Raptor*** program icon.
2. If your computer is on, but the program CD is not in the drive, insert the ***F-22 Raptor*** CD into the drive and select **Start** from the AutoRun screen. If no screen appears when you insert the CD, double-click on the My Computer icon on your desktop, then double-click on the icon for your computer's CD drive. You can then choose Start from the AutoRun screen. You may also use your computer's Browse function to locate and launch the program.
3. Enjoy!

Configuring the Game for Play



F-22 Raptor offers the player a variety of options for game play, so you can take full advantage of your system and any auxiliary devices you may have connected. Access the configuration features via the **Options** choice on the *Main Menu.* When in the *Options* menu system, press **Back** to go back one page, **Next** to go forward to the next page, or **Main** to return to the Main Menu screen. Press **Accept** to activate choices or settings. The **Back Space** key works like the **Back** button, and the **Enter** key acts like the **Accept** box.

Video

F-22 Raptor allows you to select a **Screen Size** to display the game. When you are playing the simulation you may also toggle between the choices using **Ctrl +V.** Your choices are:

Windowed

If you select **Windowed** from the *Video Options* the game will run inside a familiar Windows® 95 window.

Full Screen

Selecting **Full Screen** gives you a full-screen view of the simulation, without the window controls.

Audio

Set your audio preferences here. ***F-22 Raptor*** lets you select sound volumes for music and sound effects separately, and gives you the option of playing your own music CDs while you fly. Your choices are:

Sound Volume

Use the mouse to slide the bar to an appropriate volume level for Game Sounds.

Music Volume

The slide bar sets the volume for music in the game.

Speed

F-22 Raptor allows you to configure the memory usage of your computer, and to set some of the graphical detail levels for faster play.

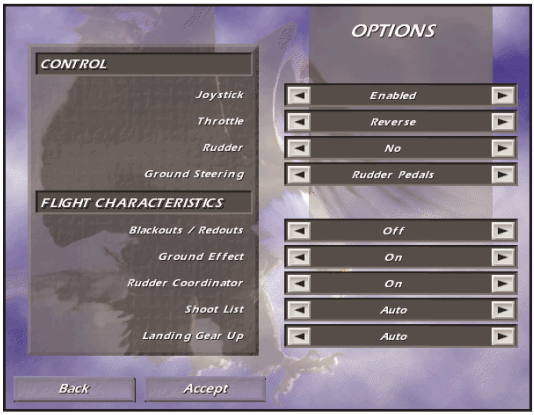
Memory Usage

Your choices are **High, Medium,** and **Low.** F-22 Raptor can give you increased performance, especially on 16 Mb machines by lowering its memory usage. Selecting **MEDIUM** or **LOW** will force Raptor to use lower-resolution graphics, and thus, less main memory.

Texture Distance

This slide controller allows you to set the distance at which the ***F-22 Raptor*** simulation will apply textures to the terrain. Players with slower machines should move the slider to the left to speed up the graphical presentation.

Controls



This section lets you enable various external control devices, such as a Joystick or Rudder Pedals, and allows you to determine the F-22's steering method when on the ground.

Joystick

Your joystick control choices are **Enabled** and **Disabled.** When you select Enabled, your joystick will be the primary flight control device for the simulation. If you select Disabled, the keyboard's arrow keys are the only way you have of flying the F-22.

Throttle

Allows you to select an external throttle device. Your choices are **Yes, No,** and **Reverse.** Selecting Reverse means that your external throttle will accelerate the airplane when you pull back on the throttle yoke rather than when you push it forward. Note you cannot use an external throttle to start the engines. You will have to press one of the **Engine Control** keys to start them.

Rudder Pedals

Your choices are **Yes** and **No.** Select Yes if you have a set of external **Rudder Pedals** connected.

Ground Steering

This selection lets you determine what method of steering control you use when on the ground. Your selections are **Stick** or **Rudder.** Selecting Stick means that the joystick (or the **arrow** keys if you

have no joystick installed) steers the aircraft while it is on the runway. Select Rudders if you want to steer the aircraft with rudder pedals.

Flight Characteristics

F-22 Raptor allows you to control some of the aspects of the flight model, giving you the opportunity to increase the realism of the simulation. All of these choices can be either **On** or **Off.**

Blackouts/Redouts

Sharp turns and rapid acceleration can cause severe G-force consequences to an aircraft's pilot. High-G turns, for example, cause blood to drain from the pilot's head, leading to blackouts. Similarly, maneuvers that lead to negative-G situations can cause the body's blood supply to rush to the head, filling the eyes with blood and causing a redout. If you want this degree of realism in an F-22 mission, turn this selection to ON.

Ground Effect

When you fly close to the ground your airplane compresses the air between the plane and the ground below, providing a "cushion" of lift near the ground. This compressed air affects the way your airplane maneuvers close to the ground. It will be more difficult to land, for example, because your airplane will tend to "float" on this cushion rather than descend those final few feet to the runway. If you would like to experience these effects, check here.

Rudder Coordinator

Modern fly-by-wire jet aircraft usually automatically coordinate the rudder to assist in turns. Coordinating the rudder inputs sharply reduces the incidence of spins. Most pilots flying modern jet aircraft prefer not to use their rudder controls, and just let the airplane take care of rudder inputs. The default for **Rudder Assist** is **On.**

Shoot List

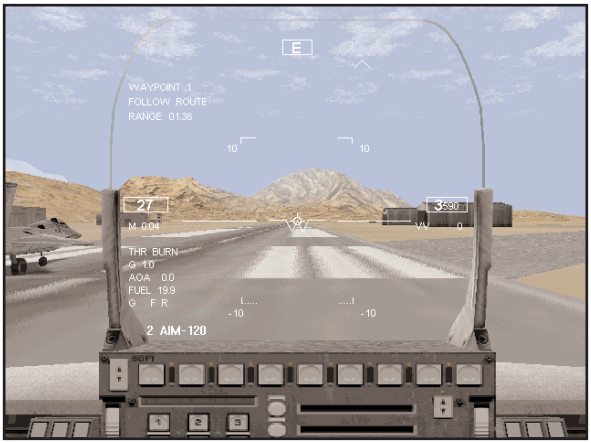
Your choices are **Auto** and **Manual**. If you select Manual you will have to press the **Enter** key to have your aircraft create a shootlist. Auto shootlist creates it whenever you have targets available. The default for this feature is Auto.

Landing Gear Up

Select **Auto** to have you F-22 automatically raise its landing gear after takeoff. **Manual** means you perform this task yourself. The default value for this feature is Manual.

Quick Start

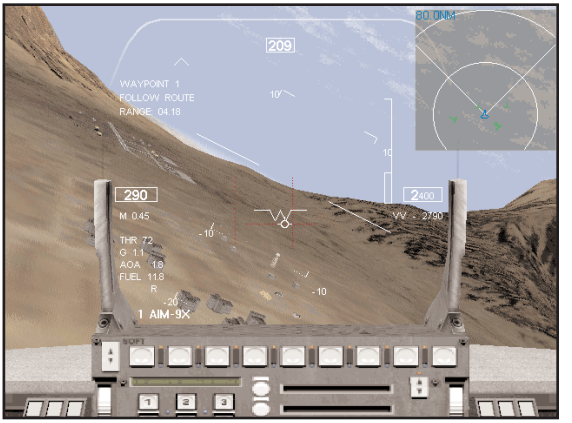
For those of you who want to get right into the simulation, without waiting for detailed instructions, go to the *Main Menu* and select **Quick Mission,** then choose any mission from the list. Click on **Accept** to get the *Mission Briefing,* then click on **Accept** again to start the mission. You will have an appropriate weapons load. You can Pause the simulation at any time with the **Pause** key, or abort a mission with the **Esc** key. Turn **Num Lock** (at the top of the keypad) off.



Next you will find yourself in the cockpit, cleared for takeoff. You are looking forward through the Raptor's *Heads Up Display* (HUD). Airspeed shows in the box at the left of the HUD. Your Heading is in a box at the top, and your current Altitude Measured from Sea Level (MSL) is in the box at the right.

The **5** through **0** (zero) keys set engine output, from 0 (the 5 key) to 100 %. The + (plus) and - (minus) keys on the keyboard increase and decrease engine thrust in small increments, and the **Back Space** key engages your afterburner. Set your engine power to 100% (Full Military Power) with the **0** (zero) key. You will shortly begin to accelerate down the runway. Check your speed. The F-22 Raptor's takeoff speed is 160 knots.

Press **G** after you are off the ground to retract your landing gear and flaps. Climb out to your desired altitude and get ready for combat. Select a weapon with the **1-4** keys. Turn your radar on and off with the **R** key. You will need to use your radar to acquire targets for the AIM-120C missile, but it will also warn any foes of your presence.



At the lower right of your HUD is target data. When your radar detects targets they are placed on a shoot list and presented here on the HUD. Cycle through the potential targets with the [and] (bracket) keys. Targets also show up on your HUD as large triangles. The direction the triangle faces reflects the direction the target is moving, as seen from overhead, and the line extending from the front of the triangle indicates the target's airspeed. A red arrowhead (the Target Location Indicator) shows up on the perimeter of the HUD display when you have a target selected but are not pointed in its direction.

At the top right of your screen is a miniature version of the *Attack Display.* Toggle it on and off with the keypad **8** key. Enemies are red. Friendlies are green. You can change the range displayed by using the **S** key to zoom in and the **X** key to zoom out.

F-22 Raptor has a number of other useful displays. Use the keypad number keys to bring these up. When you are looking at one of these specialized displays you can insert a small version of an Artificial Horizon in the upper right by pressing the **8** key. The Artificial Horizon can help you keep your airplane in the air while you scan the data.

If you have targets less than 24 nautical miles away, you can target them with the AIM-120C. Turn on your radar. When you can successfully engage the selected target, its triangle will turn red, and the word SHOOT will appear at the bottom of your HUD. Press the **Trigger** (or the **Space Bar**) to launch a missile. When you launch against a target, the HUD automatically displays the next target available. If that new target is inside the missile's kill enve-

lope, you can shoot at the new target immediately. You will need to have your radar on to get the **Shoot Cue,** but once you have launched you no longer need to track the target. The missile will take care of that.

To engage targets with the AIM-9 Sidewinder missile you must have targets selected, and will need to get within six nautical miles of the target. The Sidewinder does not require that you have the radar on. When you are within range you will get the Shoot Cue, and can fire.

When you select the M61A2 20mm Cannon as your weapon, the HUD displays a small circle with a dot in the middle. This is your Gunsight. It takes into account your aircraft's motions, the wind, and the force of gravity. Bring the circle over a target and squeeze the Trigger (or press the **Space Bar**) to fire a burst of 20mm rounds. The M61A2 gun has a maximum range of three nautical miles, but you should close to half that distance or less.

To drop bombs, select the JDAM munition as your weapon. When you have JDAM selected your HUD will show data concerning ground targets. When you are close enough to the target the Ground Target Designation Box on your HUD turns red, and the word DROP will appear. You can drop your bombs with a good chance of hitting the target.

When you have accomplished all the goals assigned to you in this mission, Raptor will inform you that you can now terminate the mission with the **End** key. Press **End** to close out the mission and get your score, or fly back to base and land your aircraft for an even higher score.

At the top of your HUD is navigation data. The caret **(^)** points to your next navigational **Waypoint.** Use the **N** key to cycle through the waypoints until the HUD shows the **Initial Approach Waypoint.** With that waypoint selected you can press the **A** key to engage the autpilot and have it fly you back to base, or you can steer in the direction indicated by the caret. If you have completed the mission you can also press the **H** key to take your aircraft to the Initial Approach Waypoint immediately.

When you reach the Initial Approach Waypoint you should get ready for landing (speed about 250 knots, altitude around 5,000 feet Above Ground Level (AGL)), and steer to the next waypoint, the **Final Approach Waypoint,** while slowly bleeding off altitude and airspeed. Set your throttle to about 70% (press the keyboard **7** key). At this point the runway should be visible, so press **G** to lower your landing gear and extend your flaps. When you lower

the landing gear, you are telling the F-22's computer that you are ready to land. The airplane will automatically extend its flaps and reduce joyctick input levels to make control more certain and landing easier. Bring the airplane in for a landing. Keep your airspeed above 125 knots to avoid stalls. When the plane has come to a complete stop (brake by holding down the **B** key), press **End** to get your mission evaluation.

The F-22 is powered by twin Pratt and Whitney F119 turbofan engines rated at 35,000 pounds of thrust apiece. These engines allow the Raptor to reach a supersonic cruising speed of Mach 1.58 without the use of afterburner.

CHAPTER TWO:
Playing F-22 RAPTOR

Flying the F-22

The ***F-22 Raptor*** is no ordinary airplane, and one of the main reasons for that status is its extraordinary flight envelope. The Raptor can stay in the air under flight conditions that would make a typical aircraft fall from the sky. Even if you are an experienced flight sim player, we urge you to go through our tutorials and get some practice in the F-22. It flies like nothing else in the air.

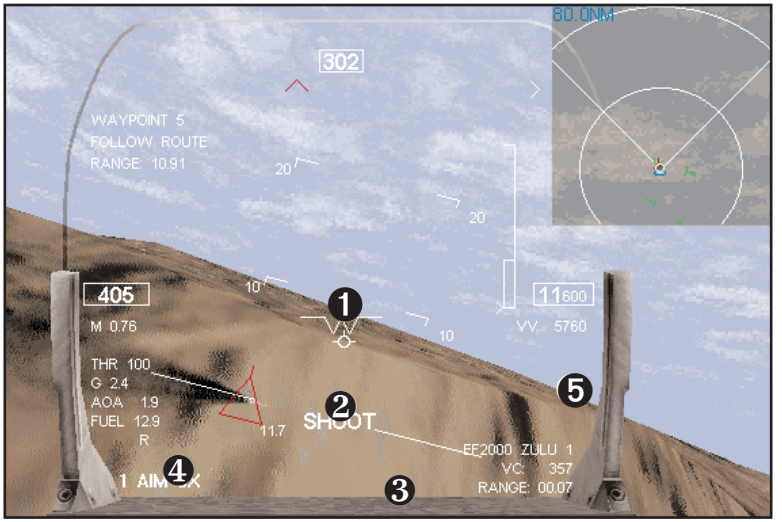
General

The F-22 features a large lifting surface and powerful engines, and a unique **Vectored Thrust** system. The F-22 can direct part of the engine's thrust in directions other than straight out the tailpipe, allowing it to perform radical maneuvers, and maintain flight at angles of attack that would doom an ordinary airplane. This marvelous capability is completely transparent to the pilot. You don't have to throw any switches or enter a special mode to take advantage of thrust vectoring. You simply fly the plane normally, and let the on-board computers direct engine thrust as needed.

One of the consequences of the thrust vectoring system is that it is more difficult to make the F-22 stall. In situations where a normal fighter plane would be falling out of control, the F-22 can maintain flyability, using the thrust of the engines to partially com-

pensate for the lack of lift. This feature is especially noticable at low speeds and at high angles of attack. The F-22 can maintain controlled flight at angles of attack greater than 60 degrees.

The Heads Up Display



The *Heads Up Display,* or HUD, can help you stay in control of your airplane by presenting you with the important flight data, all projected on a transparent screen right in front of you. Your eyes do not have to leave the sky for you to be able to check the flight status of your airplane.

For a complete description of the Raptor's HUD, see the HUD section of the *Controls, Displays, and Menus* chapter of this manual, starting on page 60.

Some of the most useful HUD data appears in the boxes at the left, right, and top of the HUD screen. On the left you can read the plane's Airspeed, in knots, with the Mach Number (a multiple of the speed of sound at the current altitude) just below it. At the top you will find the current Compass Heading, and on the right side of the display is the box containing the Altitude, in feet, Measured from Sea Level (MSL).

The HUD presents a wide variety of other information, but for flight purposes the most important data comes from the symbols in the middle of the HUD, and from the informational display at the lower left.

❶ **Watermark**— The "flying W" shape in the middle of the HUD is the *Watermark.* It represents your airframe. The middle peak of the "W" is the nose of the aircraft, and the extensions represent the wings.

❷ **Flight Path Indicator**— The small circle with the vanes is the *Flight Path Indicator.* If all flight parameters stay just as they are, your airplane will wind up right where the circle indicates.

❸ **Pitch Ladder**— Crossing the middle of the HUD is the *Pitch Ladder.* Each of the rungs of the ladder ends in a tick mark, which always points to the horizon. The numbers at the end of the rungs indicate the pitch angle of the nose of the aircraft. Negative numbers indicate that the nose is pointing below the horizon.

❹ **Aircraft Data**— In the lower left of the HUD is a panel with data concerning your aircraft. Here you can read the **Thrust** (THR) of the engines, the current **G Forces** (G) on the aircraft, its **Angle of Attack** (AoA), and the amount of **FUEL** left (in thousands of pounds). The bottom line displays an "F" and a "G" if you have your flaps and landing gear extended, a "B" if you deploy the air brake or apply wheel brakes, and an "R" when you have your Radar set turned On.

❺ Just below the **Altimeter** box at the right of the HUD, Raptor displays your **Vertical Velocity** (VV). The number indicates your rate of altitude change, in feet per minute. Negative numbers mean you are losing altitude.

Multifunction Displays

The F-22's avionics systems include a series of digital displays to provide important navigation, combat, and systems status information. Use the *Multifunction Displays* to manage your air battle. For complete descriptions of each display, see *Chapter III, Controls, Displays, and Menus.*

Stores Management Display (keypad 2)— Lets you see what bombs, missiles, cannon rounds, and defensive devices you are carrying.

Attack Display (keypad 6)— Helps you keep track of targets, and manage missile battles, especially at long range. You can toggle a smaller version of the Attack Display on and off in the upper right of your HUD screen with the keypad 8 key.

Defense display (keypad 4)— Keeps you aware of threats, including the tracks of incoming missiles.

Navigation Display (keypad 5)— Keeps you informed about where you are, and about your mission waypoints.

Aircraft Status Display (keypad 7)— Tells you if any parts of the aircraft or its associated systems are damaged.

Artificial Horizon (keypad 9)— Provides a simplified view of the horizon and the most important flight data. When examining other Multifunction Displays you can toggle a smaller version of the Artificial Horizon off and on in those displays with the keypad **8** key.

Tutorials

You can fly any available Raptor mission whenever you wish, but we recommend that you begin your experience with this simulation by undertaking the **Tutorial Missions.** It won't take long, and even if you are an experienced flight sim pilot, you will come out of the experience better able to control the F-22.

The ***F-22 Raptor*** Tutorial Missions are part of the **Quick Mission** set, available from the Main Menu. Mission #1, Check Ride, introduces you to some of the basic flying features of the aircraft. Mission #2 gives you practice in Takeoff and Landing. In Mission #3 you get an introduction to Air Combat Maneuvers, and Mission #4 does the same for Ground Assault. Mission #5 puts it all together for a combined arms mission, Deep Strike.

Basic Flight Maneuvers

F-22 Raptor also includes a sixth Tutorial Mission, *Basic Flight Maneuvers.* This mission has no enemies or other distractions, and is designed to give you a place to practice flying the F-22. Before you start the Campaigns that are the heart of ***F-22 Raptor,*** you should be able to perform the Basic Flight Maneuvers, as well as a couple of the most important Air Combat Maneuvers. This manual section will get you into the cockpit and up in the air, and provide detailed instructions for practicing the flight techniques you will need in combat. It will also give you instruction on how to land, and warn you of some of the dangers you face.

Getting Into the Cockpit

Before you can fly the F-22 you will have to choose a mission. Select **Quick Mission** from the *Main Menu* to gain access to the training flights and other missions, then follow these steps:

- **Choose a Mission.** The Quick Mission menus give you a variety of missions from which to choose. We recommend that you choose **Tutorial Mission #6, Basic Flight Maneuvers.** Highlight this mission, then click on the **Accept** box (or press **Enter**) to undertake the mission.
- You will be taken to the Mission Briefing screen. For this first experience, just click on **Accept** (or press **Enter**). In other scenarios you will want to pay more attention to the Map and to your Weapons Loadout, but this first mission is designed to give you experience *flying* the F-22, so these are not important considerations. The mission will load.
- Now you are in the cockpit of an F-22, positioned at the end of your home runway with your engines off. A message should inform you that you are cleared for takeoff. Take a few moments here to familiarize yourself with the situation.
- You are in what is known as the **Virtual Cockpit.** If you hold down **Button 2** on your **joystick**, you can use the stick to look around. Move the stick left to look left, pull back to look up, etc. Release the button to return the **joystick** to its proper role, which is controlling your aircraft.

Prepare for Takeoff

Take a moment to review the mission in your mind, concentrating on the tasks you have to perform, then get ready for takeoff:

- **Check your HUD.** Note the altitude of the runway and the direction you are pointing. When you return to base you will want to know this information. In the lower left of the HUD you should see the letters *G, F,* and *R.* They indicate that your landing gear is down, your flaps are extended, and your radar is on. In the upper right corner of the screen is a miniature ver-

sion of the Attack Display. Toggle it on and off with the keypad **8** key.

- **Turn on the Engines.** Press the keyboard **6** key to turn your engines on and set them to 60% power (Idle). Note the Thrust reading (THR) at the lower left. It should now read 60.

Takeoff and Rotation

It's time to get airborne. Takeoff velocity in the F-22 is 160 knots, so you will need to pick up quite a bit of speed before you begin flying.

- **Set your engines to Afterburner.** Press the **Backspace** key to bring up maximum thrust. The Thrust reading should now say "Burn". Your F-22 will start to accelerate down the runway, picking up speed rapidly. Keep your eye on the Airspeed Indicator at the left of the HUD. It should reach 160 knots about one-third of the way down the runway.
- When the Airspeed Indicator reaches 160 knots, you are ready to "rotate," or lift off from the runway. Pull back gently on the stick, and keep a little back pressure on. When your wheels leave the runway your on-board computer will announce "Airborne." Pitch the nose of your aircraft up about 20 degrees (use the HUD Pitch Ladder to determine your pitch.) Gain some altitude as soon as possible, just in case an engine should fail or some other in-flight emergency occurs. You do not want to be too close to the ground if that happens. Climb out to a mission altitude of about 25,000 feet.

Climb Out to Mission Altitude

Now that you are in the air and headed for mission altitude, it's time to clean up the airplane and prepare for the mission.

- As soon as you hear the on-board computer announce that you are airborne, it's safe to raise your landing gear. Press the **G** key. The small "G" and "F" at the lower left of your HUD

should disappear, indicating that the gear is up. Raising the gear will automatically retract your flaps.

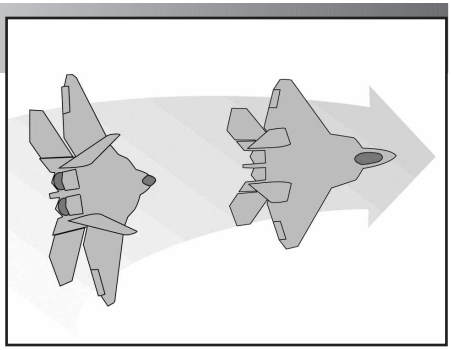
- It is now also safe to reduce thrust and save on fuel. Press the keyboard **8** key to put your engines on Cruise setting (80% power). You will hear a distinct difference in the sound of the engines.
- Maintain a steady climb, keeping your pitch angle at about 20 degrees. Your Altimeter, in the box on the right side of the HUD, gives you the altitude of your aircraft, in feet Measured from Sea Level (MSL). Your distance Above Ground Level (AGL) is sometimes quite a bit less than this.
- When you reach an altitude of about 25,000 feet, level off. You can do this manually by using the joystick, or you can just press the **L** key. This automatically puts the F-22 in straight and level flight. You are ready to continue with your mission.

Flight Practice

Now it's time to undertake some of the **Basic Flight Maneuvers (BFM).** Take the time to practice the basics of flying. Your skills will improve, and you will make yourself a better pilot.

Always seek to make your control movements definite and positive. Remember, you are in control of the aircraft, not the other way around. You know where you want the plane to go, so put it there.

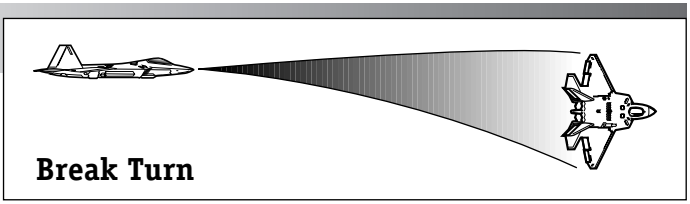
Turns



The first of the Basic Flight Maneuvers to master is the simple **Turn.** Smooth, well controlled turns are the hallmark of the expert pilot. Practice turning until you can do it with precision, and without wasting time, altitude, or airspeed.

- Start this series of turns from level flight. You will not, of course, always be in level flight when you initiate a turn, but for this practice session start from straight and level. Use the **L** key to level your aircraft if you have trouble keeping it stable.

- Note the direction you are flying. Check the compass indicator in the box at the top of your HUD to determine your compass heading.
- Note your speed and altitude. The boxes at the side of the HUD will tell you your airspeed and altitude above sea level.
- Now make a 120º turn to the left. Push the handle of your joystick part way to the left, and at the same time pull back on it slightly. Hold your aircraft in this flight attitude until your compass heading is 120 degrees left of your original direction, then use the joystick to bring the aircraft back to straight and level on the new course. Use the **L** key if you have to.
- Check to see if you have lost any speed and altitude in the turn. Anytime you maneuver in the air you potentially lose energy, so always keep an eye on your speed and altitude.
- Practice turning. The farther you push the stick to right or left during a turn, and the farther back you pull on it, the faster the turn will be. Practice both sharp and gentle turns. Strive to make your turns crisp and precise, so that you come out of the turn facing the direction you want to be going. Make each turn a definite movement, with a clear objective.
- Like all modern fighter aircraft, the F-22 can automatically actuate the rudder to coordinate turns; you do not have to use any manual rudder input. If you wish this feature turned on, go to **Options** under the *Main Menu* and select **Rudder Coordinator.** The default for this feature is Off.
- When you have spent some time practicing turns, and you are ready to go on, check your fuel supply to make sure you have enough jet fuel to continue (if you have less than about 5000 pounds left, it's probably time to head back for the runway). Make sure you have plenty of altitude. You'll need it for this next session.



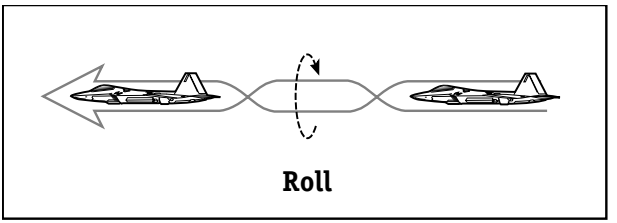
Break Turn

The **Break Turn** is an emergency combat maneuver. It is very expensive in terms of energy (you risk losing lots of speed and altitude). A break turn can let you cut inside the turning radius of an oncoming missile, or throw off an opponent who is moving in for a gun kill. Break turns are most effective when performed suddenly and unexpectedly.

- To start practice, get straight and level, then note your speed, heading, and altitude.
- Break right! Quickly push the stick all the way to the right, and pull it back all the way. This is actually two movements, but they should be performed very quickly and precisely. The first movement, to the right, rolls your aircraft until its wings are perpendicular to the ground, or even a little farther. Pulling back on the stick sharply then causes a very rapid turn. Watch the **Pitch Ladder** on your HUD to determine when you have rolled the aircraft sufficiently far to the right to make the turn crisp.
- Try to maintain the turn through at least 90 degrees of heading. Note how much speed and altitude you are losing in this turn. Never hold a break turn for so long that you are unable to maneuver (have little speed or altitude) when you come out of it.
- Break turns place extreme G-forces on the plane and pilot, and can lead to *Blackouts* from sustained high G force. The F-22's flight control computers limit the amount of G the aircraft will pull (-3.0 G to + 9.0 G), but if you hold a break turn too long and the screen begins to go dark, relax the joystick to reduce the tightness of the turn, or hold down the **B** key to activate your **Air Brakes** to reduce the aircraft's speed through the turn. You can choose whether you wish to have ***F-22 Raptor*** simulate *Blackouts* from high-G turns and *Redouts* from negative-G situations. Go to **Options** on the *Main Menu,* and check **Blackouts/Redouts.** The default for this function is Off.

- Practice break turns. As with any aircraft control movement, strive to make your breaks crisp and precise, with a definite purpose in mind. When you are good at break turns, you will be able to come out of one heading in precisely the direction you want to go. Watch your speed and altitude whenever you are performing break turns.

Roll

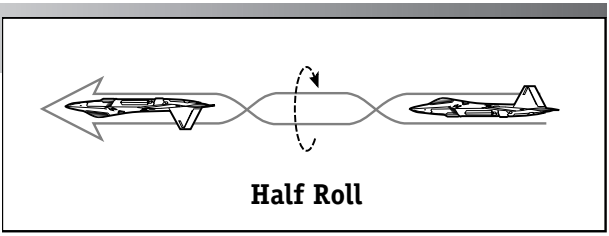


Roll

A Roll consists of a complete rotation of the aircraft around its longitudinal axis, from level flight to inverted, and back to level. As with all aerial maneuvers, make your rolls crisply and efficiently. Ideally, a roll should not include any forward or back pressure on the joystick, and you should come out of the roll headed in exactly the same direction you were headed when you started it.

- Make sure you have plenty of altitude and airspeed, then get into level flight and check your airspeed, heading, and altitude for reference.
- Roll left. Push the stick to the left, without any forward or backwards pressure. Hold the stick to the left as you roll through inverted flight and back to your original orientation, then level off. You should be headed in the same direction you were when you started the roll, and you should not have lost very much speed or altitude. If you did lose a lot of speed or height, that probably means you were performing the roll too slowly.
- Practice rolls. Try to make your motions smooth and definite, with a precise objective in mind. Practice rolling until you can perform the maneuver without causing too much change in the direction your aircraft is headed.

Half-Roll



Half Roll

The full roll is not really a very useful maneuver. After all, you wind up right back where you started. The Half-Roll, on the other hand, is quite handy. It is an important component of several of the more complex flight maneuvers, like the Immelmann and Split-S.

- Get yourself plenty of altitude and airspeed, then check your compass heading for reference.
- Half-roll your airplane. Push the stick right or left, and hold it in that position until you are flying inverted. Use the *HUD Pitch Ladder* to determine when you have acheived inverted flight. Stop the roll when your wings are level and you are flying upside down. Properly done, a half-roll should be quick and precise, without overshooting the roll and having to correct. There should be little change in the compass heading of the aircraft.
- Half-roll again to regain normal flight.
- Practice half-rolls. Try to make them definite and rapid, with no wasted motion. Note the loss of airspeed and altitude associated with this maneuver, so you will know when it is safe to perform.
- Check your fuel supply before continuing.

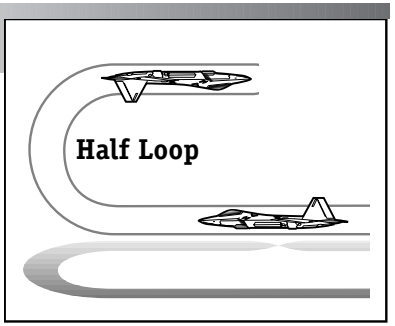
Loop

The Roll was a motion without any forward or backward pressure on the stick. The Loop is a maneuver that requires no right or left pressure. Properly done, a loop will deliver your aircraft back to where it began, with nearly the same heading, altitude, and airspeed that you had when you inititated the loop.

- Check airspeed, altitude, and heading for reference. You won't be able to tell if you have performed the loop properly unless you know where you started the maneuver.

- Get up a little airspeed by going into a shallow dive.
- Loop your aircraft. Pull back on the stick and hold it back while the airplane goes through a complete circle, then push the airplane back to level when you approach normal flight attitude again. Stay aware of where your airplane is during the loop, and keep a close eye on your altitude and airspeed indicators. Try to keep the *Pitch Ladder* rungs horizontal through the loop. When you are coming out of the loop, make your control motions definite and precise. You should be headed the same direction you were when you began the loop, and your altitude and airspeed should be pretty much the same as when you started.
- Practice looping. Try to visualize the movement of your aircraft through the air so you always know where you are in the loop, and can come out of the movement easily and under control. Perform loops at various speeds, and note how much altitude or speed you lose. You should always know the energy price of any maneuver you undertake.
- When you are satisfied with your loops, regain any altitude you may have lost, then check your fuel supply before going on.

Half-Loop



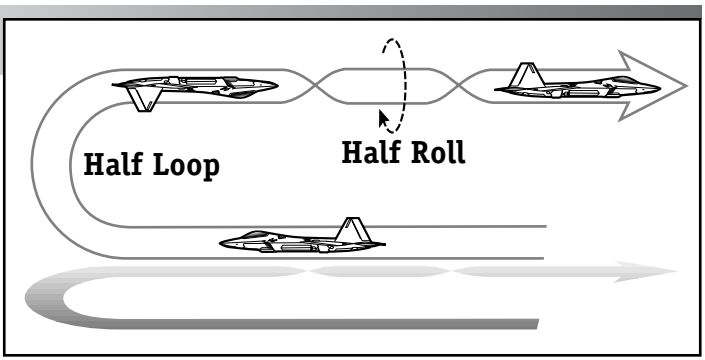
Like the Roll, the Loop is more useful as part of a more complex maneuver than it is by itself. A loop merely returns the aircraft to its start conditions. A Half-Loop, on the other hand, is a maneuver you will have to get good at, since it is a vital part of some of the most effective air combat maneuvers. When performing a half-loop, keep your awareness high, and make all your control motions quick and precise. You should have a little snap in each movement.

- As usual, check your altitude, airspeed, and heading before starting.
- Perform a half-loop. Pull back on the stick until you are flying inverted, on an opposite course from which you began the maneuver. Use the *HUD Pitch Ladder* rungs to keep aware of

where you are in the turn, and to help keep your wings level through the movement. Hold yourself in inverted flight for a few moments, then break out of the half-loop by either completing the loop and coming out headed the direction you were when you began, or by performing a half-roll to bring yourself right side up, headed in the opposite direction from the beginning of the maneuver. Note how much speed or altitude you have lost by half-looping.

- Practice half-loops. Enter the maneuver at various speeds, and make your half-loops of different sizes by pulling back more or less hard on the stick when you are initiating the motion. Stay under control at all times, and stay aware of where you are in the maneuver. Practice breaking out of the half-loop quickly and cleanly, ready for the next movement.
- When you can reliably perform a half-loop, check your fuel supply, then regain mission altitude to continue.

The Immelmann



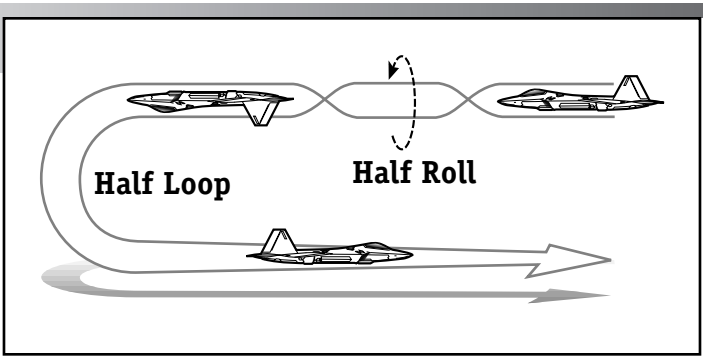
An Immelmann turn is a combination of a Half-Loop and a Half-Roll. It is an excellent way to simultaneously gain altitude and lose speed, which can be just what you want when you are getting ready to enter an air combat engagement. An Immelmann is also a good way to reverse direction to throw off an enemy or to recover after an attack. When you are good at Immelmanns you can come out of the maneuver headed any direction you like. As always, make your control movements quick and precise when performing this maneuver, and watch your heading, airspeed, and altitude.

- Check heading, airspeed, altitude.
- Perform a half-loop, then a half-roll, so you wind up flying right

side up, in the opposite direction from your previous course and at a higher altitude. Start the half-loop by picking up a little speed, then half-loop into inverted flight. When inverted, and flying on the opposite course, half-roll the aircraft back upright.

- Practice Immelmann turns. Concentrate on making your control movements with authority, putting the aircraft exactly where you want it to go. Also practice coming out of the turn. When you are half-rolling out of an Immelmann you can break the half-roll at any point, or hold it longer than normal, so that you come out of the Immelmann on any course you desire. The main idea of the Immelmann turn is that you will make a significant course change, and wind up at a higher altitude.
- When you are good at Immelmanns, check your fuel supply, then regain mission altitude to continue.

The Split-S



A Split-S is the opposite of an Immelmann. First you half-roll to the inverted position, then you pull back on the stick and do a half-loop. You wind up with a lower altitude and greater speed, headed in the opposite direction to your original line of flight. A Split-S is a good way to increase your energy state.

- Check your altitude, airspeed, and heading.
- Do a Split-S. Half-roll to the inverted position, then pull back on the stick and do a half-loop until you are rightside up and flying level again. Keep an eye on the HUD Pitch Ladder rungs to stay informed about your attitude, and stay aware of how much altitude you are losing. You should wind up on a course close to the opposite of the one with which you started.

- Practice the Split-S. If you find that you are losing a lot of altitude with this maneuver, try slowing down before you initiate the movement, or deploy your air brakes (hold down the **B** key) to reduce your speed through the half-loop. With practice, you should be able to come out of a Split-S on any desired course, so pay attention to your heading as you come out of the maneuver, and leave the half-loop whenever you need to in order to assume the course you want.
- Keep an eye on your fuel supply. If you still have plenty after getting good at the split-s, continue with flight practice. Otherwise, turn to the section on landing the F-22 (below) to return to base for more fuel.

Landing the Aircraft

Although you can terminate a mission any time you have completed your Primary Mission goals by using the **End** key, in campaign missions it is usually a good idea to bring the airplane home and land it. You will receive a significant addition to your mission score if you do so. ***F-22 Raptor*** provides you with tools to make returning to your base swift and easy, but to receive the mission bonus you will have to bring the airplane down yourself.

Screen messages will inform you when you have finished a mission and that it is okay to head for home. When you have completed a mission, press the **H** key. This will activate the autopilot and guide your aircraft directly to the *Initial Approach Waypoint.* At this point the navigation system updates the autopilot with the next waypoint, the *Final Approach Waypoint.* From the Final Approach waypoint you proceed directly to the runway. Going through the Initial and Final Approach waypoints keeps you clear of any other traffic that may be flying near the runway, and gives you a chance to get your F-22 set for landing.

Using the autopilot to get back to base is not a good idea if there are still bad guys in the area. The autopilot can get you to any given waypoint, but it can't avoid SAMs and enemy fighters while it does so. Take manual control yourself if there are still enemies around. Cycle through your waypoints with the **N** key until the Initial Approach Waypoint appears, then use the waypoint caret at the top of the HUD to help you steer to the direction you need to go.

To help keep aircraft from running into one another, the air traffic controllers at an airbase maintain an air traffic pattern in the sky, including corridors through which each aircraft is to fly. All aircraft taking off or landing must travel in the same direction, so before you leave a base you should note the direction that traffic flows around it. Then, when you are returning home, you will know ahead of time from which direction you will want to approach the runway.

Your *Instrument Landing System (ILS)* display on your HUD can be of significant assistance in landing, helping you keep the proper altitude and aligning you with the runway. The ILS only functions if you approach the runway from the proper direction. If you attempt to land against the flow of traffic, the ILS will not show up on your HUD. See the **HUD** section of the *Controls, Displays, and Menus* chapter of this manual for more on the ILS.

Landing takes skill. You are flying low and slow, with little margin to correct an error should something go wrong. Pay attention to the landing process, and keep your attention focused on what you are doing.

At the Initial Approach Waypoint

Your *Initial Approach Waypoint* is usually about 15 miles from the runway. Its purpose is to get you to the vicinity of the runway, yet still leave you time to get set for landing. Approach the waypoint at an altitude of about 5000 feet AGL, with a speed of around 400 knots. Well before you reach the waypoint you should reduce engine power to 70% to slow yourself down gradually. It is better to allow your airspeed and energy to bleed off slowly rather than have to use your airbrake to reduce speed.

At the Final Approach Waypoint

The *Final Approach Waypoint* is normally about five or six miles from the runway. By the time you reach this waypoint you should be at an altitude of around 1500 feet AGL, with an airspeed no greater than 250 knots. Press the **G** key to lower the landing gear and extend your flaps. You will notice a distinct drop in airspeed as the landing gear deploys and locks into place. You will also notice that your flight controls behave a little differently now than they did when you were in combat. The F-22 dampens flight control inputs when the gear is down.

Your joystick motions will not cause as much change in the aircraft's attitude when you are landing, allowing you to make small corrections without fear of overcontrolling and accidently destabilizing the aircraft. Your main task now is aligning yourself properly with the runway. Locate the centerline of the runway and use your stick to bring the nose of the aircraft into alignment with it. Avoid sharp banks and sudden turns. Gradually reduce both your altitude and airspeed.

When you are aligned with the runway centerline, check your airspeed to make sure that you are making about 160 knots. This gives you a little airspeed to play with if anything goes wrong.

Now you are on Final Approach. Perform the following checklist to make certain that your aircraft is properly configured for landing, and that the runway is clear for your use:

- Check to see that the traffic pattern is clear.
- Check to see that your wings are level. Use the *Artificial Horizon Indicator* if necessary.
- Check to see that your landing gear is extended. The flaps on the wings of your F-22 will extend with the landing gear, providing you with extra lift. If you try to land without lowering your landing gear, you will receive an audio warning.
- Check your airspeed. It should be between 150 and 175 knots. Do not extend your airbrakes if your speed is within this range. You can make minor speed changes by adjusting your pitch angle.
- Check the HUD Pitch Ladder. Your pitch angle should be about 10 degrees.
- Check your HUD to confirm that the ILS is engaged. It will be visible on the HUD when you are approaching the runway from the proper direction.

Touchdown

Keep your aircraft aligned with the runway centerline. Your landing gear should straddle the centerline on touchdown. Continue to lose altitude as you near the runway, but keep your pitch angle up. You do not want to dive into the runway. Time your touchdown so that it occurs in the first 1/3 of the runway. This will give you plenty of braking distance, or room to take off again if necessary.

Just before touchdown, pitch the nose of your airplane up slightly. This maneuver is known as a "flare." Use a flare to make sure that your rear wheels are always the first to make contact with the ground. If your nosewheel hits the ground first it can cause the F-22 to nose into the ground and crash. Avoid this.

When your wheels touch down you will hear the squeal of the tires. Apply brakes by holding down the **B** key to bring the aircraft to a gradual halt. Once the aircraft has completely stopped, press the **End** key to finish the mission and start the post-mission performance analysis. You are home, and safe. Congratulations!

Stalls

A Stall can happen any time a wing surface can no longer provide enough lift to keep an airplane flying. Low speeds and high Angles of Attack are the most common causes of stalls. The ***F-22 Raptor*** is much less prone to stall than other aircraft, due to its Thrust Vectoring system, but it can still happen. The most dangerous time to experience a stall is when you are flying low and slow, like when you are landing.

The F-22's stall speed in any given situation depends on a number of factors, such as the weight of the aircraft, its speed, the angle of attack of the wings, and whether or not it has its flaps and gear extended. To avoid stalls when landing, keep your airspeed above 140 knots and your angle of attack low.

If you do manage to stall the F-22, immediately drop your nose to reduce the angle of attack, raise the landing gear, and hit the afterburner (the **Back Space** key) to maximize engine thrust. Keep your wings level. As your airspeed increases, you will get more lift from the wings, which will allow you to fly out of the stall.

Air Combat

The ***F-22 Raptor***'s primary role is air-to-air combat, and it is superbly equipped for that mission. Its incredible maneuverability gives it a great advantage over other aircraft at short ranges, in either gun or missile combat, and its powerful radar allows it to engage multiple targets at longer range with radar-guided missiles. The F-22 is also almost invisible to most radars, with approximately the same radar cross-section as a large bird. In all combat modes,

the stealthy characteristics of the aircraft provide an extra curtain of concealment, enabling the F-22 to achieve tactical surprise in the air. Use all the features of your F-22 to maximize your chances of combat success, but remember, despite the amazing technical features of the airplane, in the end it will be the individual skill levels of the pilots in the fight that determines who will be flying home, who will be walking, and who will be riding in a hearse.

Radars

The F-22 features a superb radar set, the AN/APG-77, mounted in the nose of the aircraft. The AN/APG-77 can detect any potential target to the front or sides of the aircraft, to a range of 40 nautical miles. With the AN/APG-77, the F-22 can create a "shootlist" of the six closest targets, allowing the pilot to target and engage all of them simultaneously. If you turn off your radar, you will lose your shootlist, unless there is an AWACS (see below) on station to support you.

Many ***F-22 Raptor*** missions also provide the player with an AWACS (Airborne Warning and Control System) aircraft. The AWACS automatically downloads radar data to your airplane's computer system giving you excellent radar coverage without having to turn on the F-22's internal radar set. The AWACS provides 360 degree coverage around your F-22, and can reach more than 40 miles from your aircraft. If your mission provides you with an AWACS, guard it well. It is a very useful tool, and if you let it get shot down you will be unable to take advantage of its radar coverage.

Unfortunately, the radar signal that lets you detect enemy objects in the air also announces your presence to everyone in the area. You can see some of the effects of turning on the radar by watching the radar coverage circles on your Attack and Defense Displays. When you turn your AN/APG-77 radar on, the diameter of the radar coverage circles increase dramatically, reflecting the greater ease with which the enemy can now detect your aircraft. Fortunately, the radar signal from an AWACS does not give away the location of the F-22.

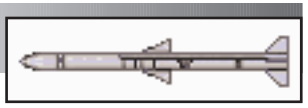
Radar is not the only method of detecting and tracking targets. Your AIM-9X Sidewinder heat-seeking missile, for example, relies on infra-red radiation to track and kill its targets, so it doesn't need any kind of radar signal to be effective. Similarly, when you are in close combat, at gun ranges, your eyes will often be a better target tracking device than radar. You should also be aware that some of the

enemy fighters you will encounter are equipped with infra-red target tracking systems. These systems rely on infra-red radiation to detect and track your F-22, and do not require the aircraft to broadcast a signal. You will therefore be unable to tell when an enemy fighter is tracking you with this device. Your enemies also have heat-seeking missiles, similar to the Sidewinder.

Air-to-Air Weapons

The ***F-22 Raptor*** has three different air-to-air weapons systems, each with unique characteristics, designed to engage targets under different conditions. You can fire at targets up to twenty-four nautical miles away with your AMRAAM radar-guided missile, engage enemies at up to six nautical miles with the Sidewinder heat-seeking missile, or close to under three miles and blast away with the M61A2 six-barreled 20mm cannon.

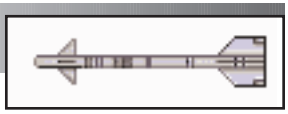
The AIM-120C AMRAAM Radar-Guided Missile



The AIM-120C AMRAAM (Advanced Medium Range Air-to-Air Missile) relies on the F-22's internal AN/APG-77 radar to acquire targets, but it can track them all on its own. Shortly after launch, a smaller radar in the missile's nose takes over the tracking task and guides the missile to its target. Once the missile locks on with its radar, the F-22 no longer has to provide targeting information. The AMRAAM can track and destroy the target by itself, leaving the pilot of the F-22 free to concentrate on other tasks, and other targets.

Firing an AMRAAM requires that you first select and ready an AIM-120C missile. Press the **1** key to ready AMRAAMs. The identity of the currently selected weapon appears at the bottom of the HUD. You must also have your radar turned on to acquire targets for these missiles. Press the **R** key to toggle your radar on and off. When it is on, a small "R" appears at the lower left of the HUD. When you have selected the AIM-120C and turned on your radar, you are ready to engage any target that the radar detects, out to the missile's maximum range (24 nautical miles).

The AIM-9X Sidewinder Heat-Seeking Missile



The AIM-9X Sidewinder (so called because of the peculiar back-and-forth motion it makes when tracking a target) tracks heat sources, such as jet engine exhausts. It does not need a radar signal to enable it to acquire a target. The AIM-9X is an "all-aspect" missile, meaning that it can track a target from any angle. Early heat-seeking missiles could only track targets if they were directly behind them, but you can fire the AIM-9X from any target aspect with a good chance of getting a kill. Of course, the "up-the-tailpipe" shot is still the most accurate and efficient use of the Sidewinder.

One of the nicest things about the Sidewinder is that it doesn't need your radar to acquire and track targets. It can take care of that on its own.

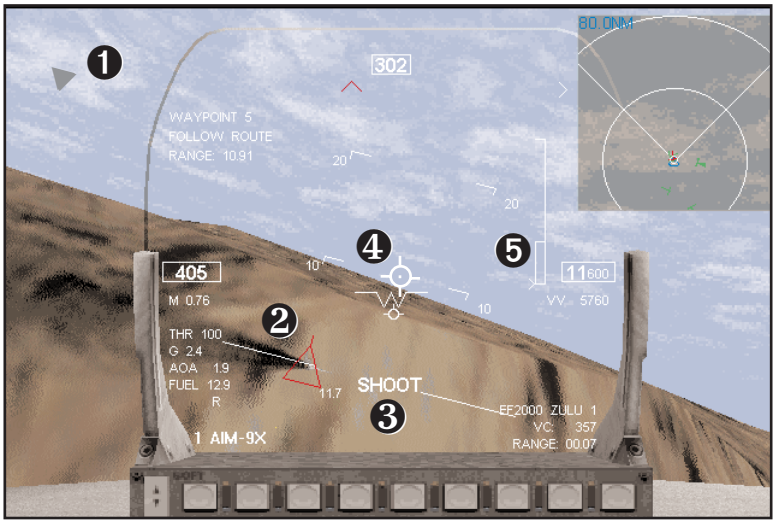
To fire Sidewinders, first select the AIM-9X from your weapons list by pressing the **2** key. The missile type and number available will appear at the bottom of your HUD. When you have an enemy aircraft targeted, and when you are within the Sidewinder's maximum range (about 6 nautical miles), you will get the Shoot Cue, and can fire the weapon. Thereafter you no longer need to control the missile. It will find and (hopefully) destroy the target all on its own.

The M61A2 20mm Cannon

After some embarrassing incidents early in the Vietnam war, when high-tech American aircraft armed with missiles alone fell easy victims to obsolescent Vietnamese fighters armed with simple machine guns, the U.S. Air Force swore never again to field a fighter without a gun. The gun aboard the F-22 is a lighter version of the well-tried M61 20mm cannon, with six rotating barrels to provide a very high rate of fire. The 20mm cannon is an effective close-in combat tool, made even more deadly by the excellent dogfighting capabilities of the F-22.

To engage in gun combat you must first select the M61A2 20mm cannon by pressing the **3** key. This will bring up your gunsight (see below). You are ready to shoot. The M61A2 has a maximum range of nearly 3 nautical miles, but for effective shooting you should close to under 1 nautical mile. Your F-22 carries 480 rounds of 20mm ammunition.

HUD Air Combat Symbols



Your Heads Up Display (HUD) provides extensive information about targets. The following HUD elements give you the data you need to track and destroy targets:

❶ **Target Steering Cue**— The Target Steering Cue is a red arrowhead that appears around the perimeter of the HUD whenever you do not have the selected target in front of your aircraft. Steer in the direction the arrow points to bring the target into the HUD.

❷ **Target Indicator**— The Target Indicator appears on the HUD when you have a target locked and in the front arc of your aircraft. It appears as a large triangle, with a line extending from its front. The faster the target is moving, the longer this line will appear. The orientation of the triangle indicates what direction the target is flying. If the triangle points up, the target is flying away from you. If it points down, the enemy aircraft is pointed straight at you. The number next to the Target Indicator tells you the target's altitude, in thousands of feet. Friendly aircraft show up as squares rather than as triangles, and they will normally have an "X" in the square. Don't shoot these.

❸ **Shoot Cue**— The F-22's on-board computers will determine when your selected missile weapon can effectively engage the chosen target. When the computers find that is the case, the

Target Indicator turns red, and the word "SHOOT" appears in the lower center of the HUD. When the Target Indicator is red, and the HUD displays the Shoot Cue, you may fire the selected missile with an excellent chance of making a kill.

❹ **Gunsight—** When you select the M61A2 20mm cannon as your air-to-air weapon the HUD brings up the Gunsight. This appears as a circle, usually toward the middle of the HUD, with a dot in its center and four small vanes extending from its sides. This circle indicates where your rounds will strike when you fire the cannon. The F-22's gunsight takes into account the motion of your aircraft as well as external conditions such as wind speed and gravity, so it is pretty accurate. All you have to do is get close enough to the target and bring the Gunsight circle over the enemy aircraft or its Target Indicator on the HUD, and you should be able to put 20mm rounds right on target. There is no Shoot Cue when you have selected the M61A2 as your weapon.

❺ **Missile Range Indicator—** The bar on the right side of the HUD is your Missile Range Indicator. The top of the bar, above the box, represents range beyond where your missile can shoot, and the box represents the range where it can strike the target. The caret represents your current target's range. When the caret enters the box you are in range, and will get your shoot cue.

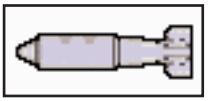
Your HUD presents data concerning your targets at the lower right of the display. The display shows information about the current target. Cycle through the targets with the **[** and **]** (bracket) keys. The HUD shows the target's **Type** and assigns it a unique Identification. Below the identification line you will find the **Velocity of Closure (VC).** This number indicates how fast you and the target are approaching one another, in knots. Negative VC numbers indicate that the target is moving away. At the bottom, you can read the current **RANGE** to the target, in nautical miles.

When you get the shoot cue and fire a missile, the F-22's targeting computer updates the current target on the HUD, automatically bringing up the next target on the shootlist. If this next target is within the kill envelope of the selected missile, its Target Indicator will stay red, and you will get the shoot cue. You can engage immediately, without having to wait for the results of the first missile shot.

Ground Attacks

Though its primary mission is air-to-air combat, the F-22 is also able to undertake ground attack missions with 1000-pound GPS-guided munitions. The F-22 can deliver its bombs with devastating accuracy, and without having to emit any radiation that might give away the aircraft's location.

The JDAM Bomb



The secret to this aspect of the F-22 is the Joint Direct Attack Munition (JDAM). This weapon is a marriage between a standard Mark 83 1000-pound bomb and a guidance unit. The guidance system for the JDAM bomb relies on Global Positioning System (GPS) data, transmitted from a satellite, and on internal sensors and gyroscopes. The JDAM flight system uses this data to move control surfaces on the bomb, allowing it to glide to its target without input from the F-22. The JDAM can achieve impressive accuracy with this system, usually planting the bomb within three meters of the computed impact point.

HUD Ground Attack Symbols

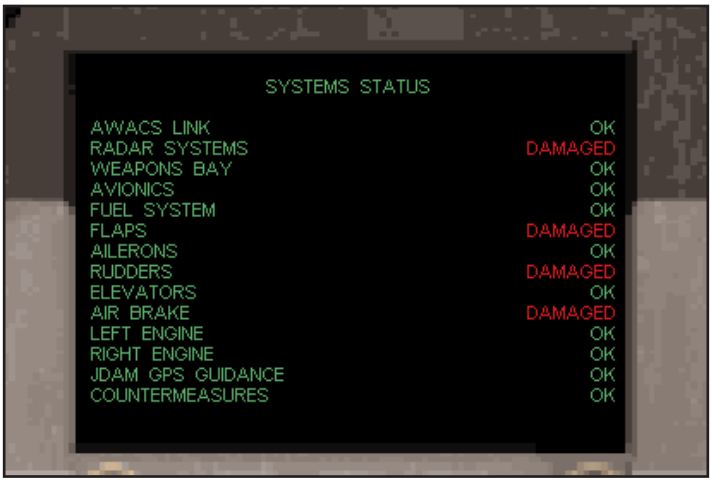
When you select the **JDAM** bomb as your weapon (keyboard **4** key), the HUD makes a few changes from the air-to-air combat mode. Selecting **JDAMs** places ground targets on the target list at the lower right, and adds a Ground Target Designation Box and a Drop Fall Line to the HUD screen. The Shoot Cue now becomes a Drop Cue.

The Ground Target Designation Box shows as a square on the HUD. When you are within JDAM drop range of a selected ground target, the Ground Target Designation Box will turn red, and the word Drop will appear at the lower center of the HUD. You can press the **Trigger** button or the **Space Bar** to drop the JDAM.

Whenever you select **JDAM** as your weapon type the HUD will also display a Bomb Fall Line. This line runs from the HUD's Flight Path Indicator to a diamond shape, with a dot in its center. If you "pickle" (drop) a bomb, it will theoretically impact inside the box. You can use this feature to drop bombs on sites that are not on your JDAM target list. Drop the weapon when the diamond is over the target. You may have to order the drop slightly early to compensate for the time it takes to open the weapons bay doors. The Bomb Fall Line moves around the HUD as your aircraft moves,

reflecting the different drop paths that the bomb would take if released while the aircraft is in different flight attitudes.

Damage



Your F-22 can suffer Damage to many of its components, which can significantly degrade flight operations or combat effectiveness even when the aircraft is still able to fly. You can check the damage status of your aircraft systems with the keypad **7** key. Damage to each separate airframe, avionics, and weapons component has unique effects, so you will face a different set of problems each time you attempt to bring an injured bird home. Just to increase the challenge, damage to some components may also significantly degrade the stealth of your aircraft, making you a larger radar target. The following F-22 systems can suffer damage:

AWACS Link— If your communications link with an AWACS is damaged, you will no longer receive AWACS data.

Radar System— If the AN/APG-77 Radar inside the F-22 gets damaged, it will no longer operate. You will be unable to detect long-range targets on your own, and will not be able to acquire targets for your AIM-120C AMRAAM missiles.

Weapons Bay— The F-22 normally carries all its armament in internal bays, to increase the stealthy nature of the aircraft. Damage to your Weapons Bays means that you will be unable to deploy any of your missile weapons or bombs. You will still have use of the M61A2 20mm cannon, but your radar cross-section will be much larger.

Avionics— Damage to your Avionics systems means you will no longer be able to access the Multifunction Displays.

Fuel System— If your Fuel System gets damaged, it will increase your rate of fuel consumption. If the damage is severe, your fuel use rate will increase dramatically, while if the damage is relatively minor you will notice only a slight increase in fuel use.

Flaps— Damage to Flaps limits the amount of extra lift available for takeoffs and landings. If your flaps are damaged, you will have to takeoff and land at higher speeds, to compensate for the lack of lift normally provided by the flaps. Damaged flaps also interfere with stealth, making you easier to spot on radar.

Ailerons— Aileron damage means that your aircraft will have a constant tendency to roll in one direction. The severity of the tendency depends on the amount of damage the ailerons have suffered. You will have to apply continual opposite pressure to left or right on the stick to counteract the effects of aileron damage.

Rudders— Damage to your Rudders makes them less effective. Rudder damage also means you will no longer be able to use your Air Brake, since the F-22 uses its rudders to create the braking effect.

Elevators— The Elevators on an aircraft control its Pitch Angle, so Elevator damage makes the aircraft slower to respond to pitch control inputs from the stick.

Air Brake— The F-22 uses its rudder to provide air braking. Rudder damage, therefore, also means Air Brake damage. You will not be able to use your air brakes if your rudder is damaged.

Left/Right Engine— Damage to an Engine decreases the amount of thrust you have available, and thus decreases the maximum speed, the rate of climb, and the acceleration of your F-22. You may even find it difficult to hold the plane in level flight on only one engine. Drop all bombs and release all missiles to lighten the aircraft if you cannot maintain level flight on a single engine.

JDAM GPS Guidance— If your JDAM Guidance System suffers damage it will no longer be able to direct the bomb to a target. You will have to drop all your bombs manually, using the Bomb Fall Line.

Countermeasures— Damage to your countermeasure system means you will no longer be able to drop chaff or launch flares.

Missions and Campaigns

You play ***F-22 Raptor*** as a series of Missions. These missions can be individual exercises, as when you choose a mission from the **Quick Mission** item on the *Main Menu,* or the missions can be a connected series of adventures, as when you are playing a Campaign. Either way, the missions are the heart of the ***F-22 Raptor*** experience.

Missions

The Mission Briefing

When you are given a mission, either because you selected it from the Quick Mission list or because you have been assigned a task as part of a continuing Campaign, the first element is always a **Mission Briefing.** The briefing details the tasks you must complete before the mission can be considered over. You are required to achieve all the mission's primary objectives before you are allowed to end the mission. Secondary and Bonus objectives are optional.

The *Mission Briefing* screen lets you determine some of the conditions under which you will fly the mission, including the ammunition Loadout you will take into the air, and the Map route you will follow to accomplish your goals.

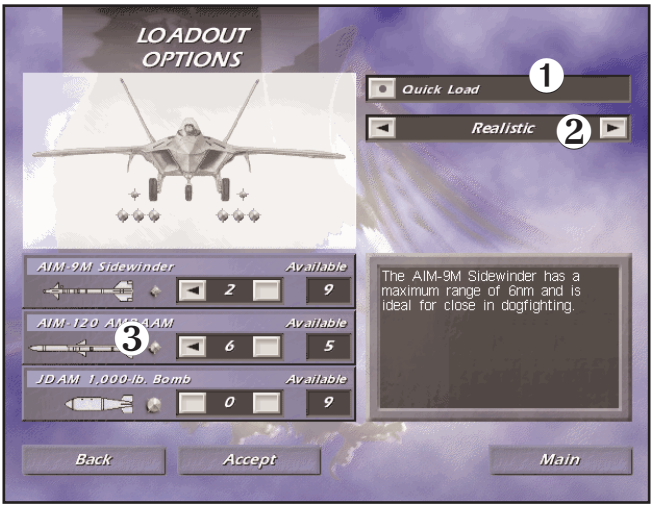
❶ **Loadout**– Click on **Loadout** to select your munitions load.

❷ **Map**– Click on **Map** to check out the battle zone and set your flight route for this mission.

❸ **Stats**– If you are playing a Campaign mission, you can also click on **Stats** to get a presentation of statistics concerning the

current pilot. If you are in a Quick Mission, this choice is not available.

The Loadout Screen



The Loadout screen is where you select the ammunition and fuel loads you will need for the mission.

❶ Quickload– At the top right you can click on **Quick Load** to have ***F-22 Raptor*** give you an appropriate loadout, or you can select your weapons yourself.

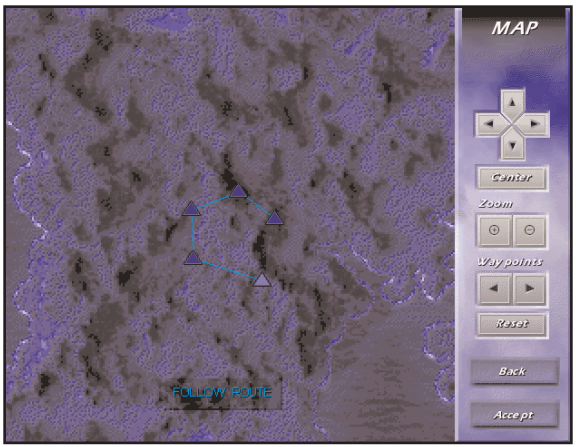
❷ Modes– Just below the Quick Load button you can toggle between **Realistic** and **Fun** for your loadout. Realistic loads are more restricted than Fun ones. You will not be able to carry as many missiles in Realistic mode as you will in Fun mode.

❸ Weapons Panel– The **Weapons Selection Panel,** at the lower left of the Loadout screen, is where you choose how many and what type of missile or bomb you will put on the aircraft for this mission. At the far right of each weapon's presentation is the number available. For *Quick Missions,* the amount available is the same as the maximum number of that missile type that you could carry. If you take a full load of one type of missile, you will not be able to carry any of another type. If you are undertaking a Campaign mission, the number of weapons available is the total number you can have for the entire campaign, unless friendly transport aircraft bring in more. If the transports in a particular campaign get shot down, you may

face ammunition shortages in that Campaign. Click on the arrows to increase or decrease the number of each different weapon type you want to carry.

When you have made your ammunition loadout selections, click on **Back** (or press the **Back Space** key) to return to the Mission Briefing screen, or click on Main to go back to the ***F-22 Raptor* Main Menu**. Click on **Accept** (or press **Enter**) to load the mission.

The Map Screen



The Map Screen gives you an overview of the terrain over which you will be flying and fighting, and lets you select a route to follow to accomplish your mission objectives. Use the Scroll Buttons at the top right to move around the map, and click on the Zoom buttons to shrink or enlarge the map display. The Waypoints button panel will take you to each individual waypoint on the map. Click to go to the next or previous waypoint.

Every mission begins with a series of Waypoints already entered on the map. Waypoints are locations that your on-board navigational computer can use to give directions to your Autopilot. They are also handy for manual navigation. Your HUD in the front of the cockpit will give you instructions on how to find any selected waypoint. This simplifies navigation enormously, particularly under conditions where you find it difficult to locate landmarks below, such as at night, or at dawn or dusk. **You can move most of the waypoints on the map, changing the designated mission route.** Simply click on a waypoint and hold the mouse button down while you drag the icon to a new location. You will not be able to move

the last two waypoints. These are your Initial and Final Approach waypoints, which help you land your airplane.

When you have thoroughly examined the terrain over which you will be flying, and have arranged the mission waypoints to your satisfaction, click on **Accept** (or press **Enter**) to begin the mission, or click on **Back** (or press the **Back Space** key) to return to the Mission Briefing.

If you make changes to your waypoints, and then decide you want them back where they began, click on **Reset** to put them back to their original position.

Mission maps also show the locations of all allies and known enemies. You can monitor the progress of your dynamic campaigns by looking at successive mission maps.

The Statistics Screen

If you have undertaken a Campaign mission you will have the option of checking a series of statistics concerning the current pilot. Click on **Stats** to bring up this screen. It gives you the Callsign of the pilot and the number of Air and Ground Kills that pilot has scored, then lists each weapon type and rates the pilot according to the number of weapons used and the number which hit their targets. The Statistics Screen also presents the number of times the pilot has Landed, Ejected, or Crashed, and gives the Service Time for the pilot (the amount of time that pilot has spent in the cockpit). At the bottom of the panel is the total this pilot has earned to date.

Pilots in Campaigns can earn Medals. Each time you successfully complete one phase of a continuing Campaign you will get an appropriate medal. Medals can be viewed by pressing the **Medals** button at the bottom of the Statistics screen. Clicking on a medal will replay that campaign's animations. Return to the Statistics screen with the **Back** button, or go back to the Main Menu with **Main.** From the Statistics Screen, click on **Back** (or press the **Back Space** key) to return to the Mission Briefing screen. To go back to the Main Menu, click on **Main.**

Completing Missions

You must complete all your primary mission objectives before you can end a mission. If, for example, your Mission Briefing orders you to shoot down a transport, eliminate its escorting fighters, and bomb its base, and you shoot down the transport and a few fight-

ers, you will still have to accomplish the rest of your mission goals to have a successful mission.

If you run out of ammunition or fuel on a mission, you may return to your base to rearm and refuel. You will have to land at your base and bring the aircraft to a complete stop. Damage to the aircraft, however, will not be repaired. It may be wiser to abort a mission than to continue it with a badly-damaged aircraft.

Ending a Mission

When you complete all the assigned goals on a mission, you will receive a text message across the top of your screen, giving you clearance to end the mission by pressing the **End** key. This will bring up the *Mission Statistics Screen,* which analyzes your mission performance. This is also where you receive your score for this mission. Press the Keyboard **1** key to exit the mission, or press **2** to replay it immediately.

To get the most points possible for a mission, do not press the **End** key as soom as you have accomplished the mission goals. Wait until you have taken your aircraft back to base and landed it before pressing **End.** That way you will receive the Landing Bonus, a large addition to your score, awarded once each mission for successfully landing the aircraft back at base.

Aborting a Mission

You may end any mission at any time by pressing the **Esc** key. When you abort a mission you will be taken directly back to the Mission Briefing screen. If you are playing a Campaign, you will get credit for any kills you made before you aborted the mission, but you will not get credit for a completed mission. Check the Stats screen to see what success you had before you aborted the mission.

Scoring

You receive points during a mission based on whether or not you accomplish certain tasks. Here are the tasks for which you can receive Promotion Points:

- Complete a Mission—1,000 points, once per mission.
- Successful Landing—1,000 points, once per mission.
- Achieve Mission Bonus Goal—1,000 points per goal.
- Shoot Down Enemy Aircraft—250 points per aircraft shot down.

- Missile Impact on Target—150 points per impact.
- Ground Object Destroyed—100 points per object.
- Cannon Round Hit—25 points per hit.
- Airframe Integrity—Airframe Integrity % of 500 points, at mission end. An undamaged airplane brings you 500 points.

Campaigns

The F-22 Raptor Campaign system consists of five dynamic Campaign scenarios, each with a number of missions connected to it. The missions in each campaign are linked, so that actions taken in one mission affect the conditions for the next. The goals for subsequent missions can be changed by your success (or lack thereof) in an earlier one. If, for example, you bomb a factory in one mission, it will still be destroyed when you fly over it on your next mission. Similarly, if you allow enemy fighters to destroy your AWACS plane, it will not be available for the remainder of that campaign. When you are conducting a campaign, you do not select your own missions. Raptor will assign missions based on what you have achieved so far in the campaign, and on what the overall campaign requires.

You may also have restricted Loadout choices. Each campaign allows your unit only a certain number of JDAM bombs and guided missiles, though supplies may be replenished by friendly transports. You must therefore pay attention to some of the logistical factors in a campaign. If you shoot a lot of AMRAAM radar-guided missiles, for example, you may run out of them, leaving you only Sidewinders and your 20mm cannon to combat enemy aircraft until new missiles can be flown in.

F-22 Raptor rewards successful completion of all the missions in a campaign with a Medal. You can view your medals from the Mission Briefing's Stats screen. When you earn a medal you can be rightfully proud of a job well done. There are also some dynamite animations as a reward for victory in each campaign.

There are five Campaigns in F-22 Raptor, all tied to a common story line. In order, they are:

Angola

The situation in Angola has been sliding out of control. Rival military factions, some with backing from outside the country,

have begun fighting in earnest, and even the capital is no longer safe. Yesterday, the largest of the militias, the Angolan People's Liberation Army, seized 50 UN relief workers as hostages. They demand the removal of all UN forces from Angola and formal recognition as the legitimate government of Angola. They are not going to get it.

At the request of the UN Security Council, US forces are going to Angola. Their mission– to rescue the hostages, and in the process establish some form of order in that unhappy country. Your unit will be an important part of that effort.

Jordan

No sooner has the situation in Angola stabilized, when urgent information arrives from the Middle East. Iraqi forces have invaded Jordan, despite the support Jordan gave Iraq during the Gulf War. Current intelligence reports put Iraqi armored columns less than 100 miles from Amman, the Jordanian capital. US forces in the Mediterranean are on full alert. Other forces, including your unit, are redeploying from Angola to Saudi Arabia. The US government will never allow Iraq to conquer Jordan.

Russia

With the cease-fire in Iraq barely in place, a new crisis appears in the far North. Renegade Russian military units seem to have seized control of Murmansk, one of the principal Russian fleet bases, and demand a military dictatorship to return Russia to its former glory. Using the traffic in black market arms as their primary source of financing, the rebel units are well equipped and can field a potent and technologically capable force. They may even have access to nuclear weapons.

The crisis is so dangerous that the Russian government has taken the unprecedented step of appealing for US aid to help put down the rising. In particular they have requested assistance in eliminating the air threat from the rebels. You know what that means. Dress warm.

Colombia

With Murmansk apparently now firmly back in the control of the Russian government, it's time to turn attention to the deteriorating situation in South America. The new military regime

in Columbia has been threatening to use newly-acquired modern attack aircraft to shut down the Panama Canal. Each day that passes increases the likelihood that the Columbian colonels will make good on their threat, and do something foolish with their new military toys. Your new base will be in Panama, in the jungle. What could be more perfect?

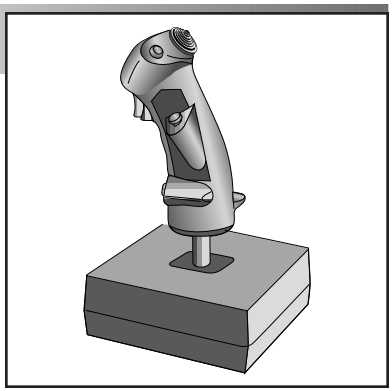
Iran

The surrender of the last of the Columbian military junta to advancing US forces signals the end of operations in South America, but not the end of trouble with military regimes. Iran has a new one, and it looks like it's getting ready to invade Saudi Arabia across the Gulf. By the time the US can redeploy forces (including you) to the region, Iranian forces may be well inside Saudi Arabia, and already in possession of the rich oil fields on the Saudi east coast.

The F-22 has been designed with stealth as a primary goal. Composed primarily of titanium, thermoplastic composites, and radar absorbent materials, the F-22 is both lightweight and strong.

CHAPTER THREE:
Controls, Displays & Menus

The Joystick



The primary flight control device for your ***F-22 Raptor*** is the Joystick, though the arrow keys on the keyboard will also serve. Take the time to get good at using your stick, until controlling the flight of the F-22 is second nature. Try to make your stick movements definite and purposeful. A good pilot is always in positive control of the aircraft.

The joystick controls the elevators, at the rear of the aircraft, and the ailerons, on the trailing edges of the wings. The elevators pitch the nose of the aircraft up or down, while the ailerons roll the airplane around its longitudinal axis. Combining these two elements allows you to turn.

When you move the joystick to the left or right, it causes the wings of your aircraft to dip (bank is the technical term) in the direction of the stick movement. If you move the stick to the right, for example, the ailerons cause the right wing of the aircraft to drop and the left wing to rise. The airplane is now "banked" to the right. Now when you pull back on the joystick the elevators will bring the nose of the plane up perpendicular to the wings, and cause the aircraft to turn in the direction of the bank. The further you push the stick to the right or left, and the harder you pull it back, the faster your turn will be.

Sharp turns increase the G forces exerted on the aircraft, which causes it to lose both airspeed and altitude. High G stresses can

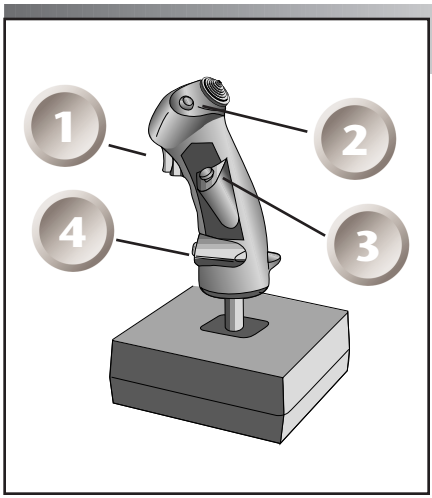
also cause the pilot to become unconscious. Save your violent maneuvers for times you really need them, like when you are trying to dodge a missile or get behind an enemy aircraft.

Joystick Buttons

F-22 Raptor supports joysticks with up to four buttons, and includes a number of custom joystick configuration files. See the readme.txt file on the Raptor CD for complete details on programming the buttons of your joystick with just the functions you desire.

The default configuration for joystick buttons is as follows:

- **Button 1**— The Trigger button fires or launches the selected weapon.
- **Button 2**— Allows you to scan the Virtual Cockpit. When you press this button the joystick is no longer controlling the flight of your aircraft. Instead, it controls where you are looking. As long as you have Button **2** depressed the joystick controls your head, not the airplane.
- **Button 3**— Cycles through all the targets on your Shootlist.



- **Button 4**— Cycles through your weapons
- **Hatswitch**— The four hat switch positions perform the following functions:

  Up— The Up position toggles between the Virtual Cockpit view and the HUD.

  Down— Push the hat switch button to the Down position to look to your rear ("check your six").

  Left— Look out the cockpit to the left.

  Right— Look right.

Rudder Controls

The rudders cause the airplane's nose to swing to the left or right (this motion is called yaw). Modern aircraft integrate the rudder into the operation of the joystick, automatically applying the proper amount of rudder to enhance the operations of the ailerons. Pilots normally prefer to allow the aircraft to handle rudder inputs for turns, so if you want this feature turned on, do so in the **Options** selection from the *Main Menu.*

You can use rudder inputs to make your flight maneuvers more violent, which can be useful in combat. Use the rudder to exaggerate your other control motions. Step on the right rudder, for example, when you are making a right-hand turn with the joystick. The actions of the rudders will bring the nose of the aircraft around more quickly than the effect of the ailerons and elevators alone. You can also use the rudders to make flight inputs in the opposite direction from your other controls. This will tend to throw your airplane out of control and make it difficult for an enemy to stay with you. Hopefully, you will be able to regain control of your airplane before you hit something, like the ground.

Keyboard Controls

F-22 Raptor uses the keyboard to control many of the on-board systems as well as a wide variety of camera views. The keyboard also gives you alternate methods of exercising flight control, provides a means of communicating with your wingman, and is used for game functions not specifically related to flying the F-22.

General Game Controls

These keys control aspects of the game not directly concerned with the flight of the aircraft or the operation of its weapons and other on-board systems.

- **Esc key (End Mission)**— Press **Esc** to end your current mission. You will have the option to change your mind before the mission aborts.
- **Pause key (Pause)**— Use this key as a toggle to halt/resume the current mission.
- **Ctrl +V keys (Video Resolution)**— Use this key combination to toggle your video resolution, from **Full Screen** to **Windowed** and back.
- **K key (Keyboard Help)**— Use the **K** key to bring up an on-screen key control summary. Press **K** again to remove the list from the screen.
- **M key (Mission Goals)**— Press **M** to toggle a list of your mission goals and their status.
- **End key (End Mission)**— Press this key to end the current mission and receive an evaluation of the mission's success or failure. You can only use this key when you have completed all the objectives in your current mission.

Time Compression

The ***F-22 Raptor*** simulation allows you to "speed up" the passage of time by using some of the function keys.

- **F9 key (No Time Compression)**— Press this key to resume normal time scaling.
- **F10 key (2x Time Compression)**— Sets the passage of time to twice the normal rate.
- **F11 key (4x Compression)**— Press **F11** to accelerate the passage of time to 4x normal.
- **F12 key (6x compression)**— Makes time pass at six times the normal rate.

Pilot Perspectives and Camera Views

F-22 Raptor provides an extensive series of perspectives from which to operate or view the simulation. Use the various points of view offered to increase your situational awareness. If there is one single rule for success in fighter aircraft, it is, "keep your head moving." You must always be looking around for threats and opportunities. The various views and camera perspectives detailed here will help you do so.

- **Keypad / (slash) (Look Left)**— Press this key to look out the left side of your aircraft's cockpit.
- **Keypad * (asterisk) (Look Right)**— Press this key to look out the right side of the cockpit.
- **Keypad - (minus) (Look Up)**— Press the "minus" key on the keypad to look straight up out the top of the cockpit canopy.
- **Keypad + (plus) (Look Behind)**— Very handy! Press the keypad + key to quickly look behind you.

The above views are static. You cannot pan, tilt, or zoom the image. When in one of the above perspectives, pressing the key a second time will return you to the screen from which you entered the view.

As an example, suppose you are currently looking forward from the cockpit through your HUD, but you would like to check your tail for enemies. Simply press the keypad + (plus) key. You are now looking aft, behind your aircraft. Press the + key again to return to the forward view through the HUD.

- **F1 key (Virtual Cockpit View)**— Press **F1** to place yourself in the cockpit, looking forward through the HUD. This is the most common perspective from which to operate the F-22. When in this perspective you can press **Button 2** on your joystick to let you look in any direction out the cockpit. When

you have **Button 2** pressed, the joystick controls where you are looking rather than where the plane is flying.

- **F2 key (HUD Toggle Views)**— Pressing the **F2** key puts you in a perspective similar to that available via **F1**, but removes the HUD frame from the screen, giving you a little better view of the terrain outside your aircraft. Pressing **F2** again removes all HUD data from the screen, allowing unrestricted viewing forward. The **F2** key now acts as a toggle, showing or hiding the HUD data each time you press the key.
- **F3 key (External View)**— Press **F3** to show an external view of your aircraft. You can move or zoom the camera perspective. See the Camera Controls section later in this chapter for how to change the camera point of view.
- **F4 key (Fly-By View)**— Pressing **F4** puts you at a fixed point outside your aircraft, watching it fly past your location.
- **F5 key (Target Padlock View)**— If you have a target designated, pressing **F5** will keep the target centered in your field of vision, regardless of where it moves.
- **F6 key (Wingman External View)**— Brings up an external view of your wingman's F-22. This view is movable.
- **F7 key (Missile Fly-By/External View Toggle)**— Press this key to watch your missile fly past a fixed location. Press **F7** again to get a movable external camera view of your missile. The **F7** key now toggles you between these two perspectives.
- **F8 key (Target View)**— Press this key to access a movable external camera view of your current target.

Camera Zoom Controls

The following controls apply to any camera perspective that you can zoom.

- **S key (Zoom In Slow)**— Press this key to magnify your camera view or display range and zoom in on the object you are viewing.
- **Ctrl + S keys (Zoom In Fast)**— As above, but faster.
- **X key (Zoom Out Slow)**— Press this key to expand your camera view or display range and zoom your perspective out.
- **Ctrl + X keys (Zoom Out Fast)**— As above, rapidly.

Engine Power Settings

The throttle controls regulate the amount of thrust being produced by your Engines. Higher power settings increase your speed, but they also increase fuel consumption alarmingly. Keep your eye on the amount of fuel you have remaining.

Use the number keys at the top of the keyboard to control the engines. You must press one of these keys to start your engines.

- **5 key (0% Power; Engine Off)**— Press this key to shut down your engines.
- **6 key (60% Power; Engine Idle)**— Press the **6** key to bring your engine thrust to the idle state (60% power).
- **7 key (70% Power)**— Press the keyboard **7** key to increase or reduce your engine output to 70% of maximum. Start the landing procedure with this setting.
- **8 key (80% Power; Cruise)**— Sets your engine power to 80% of maximum. This is the standard cruising power setting.
- **9 key (90% Power)**— Press this key to set your engine output to 90%.
- **0 key (100% Power)**— The **0** (zero) key on the keyboard puts your engine power to 100% (Full Military Power).

- **- (Minus) key (Decrease Thrust)**— Pressing the minus key decreases your engine power in small increments.
- **= (Equals) key (Increase Thrust)**— Pressing the = key increases engine power slightly each time you press it.
- **Back Space key (Afterburner)**— Press the keyboard's **Back Space** key to engage your afterburner. The word "BURN" will appear on your HUD when you have the afterburner engaged. Using the afterburner gives you a large boost in engine power, but uses fuel at an astonishing rate.

General Flight Controls

The following keys control flight operations and some of the airframe systems aboard the F-22. Some of these keys duplicate the functions of other flight control devices, such as a joystick or rudder pedals.

- **Up Arrow key (Pitch Down)**— Press this key to pitch the nose of your aircraft down.
- **Down Arrow key (Pitch Up)**— Press **Down Arrow** to pitch the nose of your aircraft up.
- **Left Arrow key (Roll Left)**— Press this key to bank your wings and roll the aircraft to the left.
- **Right Arrow key (Roll Right)**— Use the **Right Arrow** key to bank to the right.
- **Page Down key (Right Rudder)**— Press this key to yaw the nose of your aircraft to the right.
- **Delete key (Left Rudder)**— Yaws the nose of your aircraft to the left.
- **G key (Landing Gear/Flaps)**— The **G** key raises and lowers your landing gear and extends or retracts your flaps. A small

"G" appears at the lower left of the HUD when the gear and flaps are down. The landing gear will automatically raise and the flaps retract when your airspeed goes over 250 knots.

- **B key (Brakes)**— Press and hold down the **B key** when in flight to extend the F-22's air brakes. On the ground, pressing and holding the **B key** engages the craft's wheel brakes, allowing you to come to a stop. A small "B" appears at the lower left of the HUD when you apply air or wheel brakes.
- **Ctrl + J keys (Eject)**— Use this key combination to exit a stricken airplane. Ejections from aircraft in the inverted flight position at very low altitudes may be fatal.
- **, (Comma) key (HUD Dim)**— Decreases the contrast/brightness of your HUD display.
- **. (Period) key (HUD Bright)**— Increases the contrast/brightness of the HUD display.

Navigation Controls

These keys control some of the navigational capabilities of the F-22, mainly to allow hands-off flight control and allow you to get back to base quickly and easily.

- **A key (Autopilot)**— Use this key to engage your Autopilot. When engaged, the autopilot will take your aircraft automatically to the next selected waypoint. Exercising any of the manual flight controls, or pressing **A** again, will disengage the autopilot.
- **N key (Next Waypoint)**— Press **N** to cycle through your mission's waypoints. When you engage the Autopilot, it will automatically head for the selected waypoint.
- **L key (Auto-Level)**— Pressing **L** will immediately put your F-22 in straight and level flight.

- **H key (Home)**— Takes you immediately to the initial approach point for your home runway. Pressing **H** also engages the autopilot. You cannot use the **H** key until you have accomplished all the goals in the current mission.

Weapon and Radar Controls

These keys allow you to select weapons and use the radar aboard your F-22. You will quickly become very familiar with these controls, or you will be dead. Use the keyboard (not the keypad) number keys to control the appropriate functions.

- **1 key (AMRAAM)**— Press this key to ready an AIM-120 AMRAAM radar-guided missile. When you have an AMRAAM selected, your radar will only target air objects.
- **2 key (Sidewinder)**— Selects and readies an AIM-9X Sidewinder heat-seeking missile. Although the AIM-9X does not require the use of the radar, when you ready this missile your radar will only target air objects.
- **3 key (Cannon)**— Press this key to ready the M61A2 20mm cannon. The cannon does not require radar for use, but when you select the 20mm cannon, the F-22's radar will only target air objects.
- **4 key (JDAM)**— Pressing the **4** key readies a single JDAM bomb. When JDAM is the selected weapon only ground targets will appear in the targeting system.
- **Space Bar (Fire)**— Press the **Space Bar** to fire or drop the selected weapon.
- **C key (Launch Chaff)**— Press this key to release a bundle of chaff to throw off an enemy radar lock. The F-22's on-board computers will release chaff in a pre-set pattern when they

detect a radar threat.

- **F key (Launch Flares)**— Press **F** to launch a series of flares to confuse an enemy heat-seeking missile. The F-22's on-board computers will automatically release flares if they detect a heat-seeker.
- **R key (Radar)**— Use this key to toggle your AN/APG-77 radar from Standby to On and back. A small "R" will appear at the lower right of the HUD display when you have the radar turned on.
- **Tab key (Cycle Objects)**— Press this key to cycle through all detected objects that are in the forward arc of your aircraft and less than 40 nautical miles away including friendly aircraft. **Note: You can use the Tab key to target friendly aircraft. Certain wingman commands require that you designate a friendly aircraft.**
- **Ctrl + Tab keys (Reversed Cycle Objects)**— As above, but it cycles backwards through the list.
- **[(Left Bracket) key (Select Previous Target)**— Use this key to cycle backwards through the targets currently on your shootlist.
- **] (Right Bracket) key (Select Next Target)**— Press this key to cycle forward through the targets currently on your shootlist. **Joystick button 3** will do the same thing.
- **' (Quotes) key (Boresight Mode)**— Press this key to target the nearest object directly ahead of your aircraft.

Avionics

These keys bring up full-screen views of the various F-22 Avionics displays. Use the keypad (not the keyboard) number keys to access these displays.

- **Keypad 2 key (Stores Management Display)**— Brings up the Stores Management Display, where you can check your current weapons loadout.
- **Keypad 4 key (Defense Display)**— Press this key to access your Defense Display. You can use the Zoom keys (**S** and **X**) to change the range setting.
- **Keypad 5 key (Navigation Display)**— Brings up the Navigation Display. Use the **S** and **X** keys to change the range settings.
- **Keypad 6 key (Attack Display)**— Selects a full-screen Attack Display. The **S** and **X** keys operate in this display.
- **Keypad 7 key (System Status Display)** —Brings up a display of the current damage status of your critical aircraft systems.
- **Keypad 8 key (Atk/Nav Overlay)**— Toggle this key to insert/remove a thumbnail Attack Display in the upper right corner of the HUD screen. When you are using a Multifunction Display, press this key to toggle an Artificial Horizon in the upper right corner of each of the displays. This feature will help you orient yourself when you are not looking out of the cockpit. Use **S** and **X** to zoom the display in and out.
- **Keypad 9 key (Artificial Horizon)**— Press this key to access a full-screen view of your Artificial Horizon Display. The **S** and **X** keys work here.

Wingman Controls

These keys allow you some control over the actions of your Wingman. Your flight companion has a large degree of freedom when it comes to carrying out these directives. The **W key (Wingman Command Menu)** brings up a list of commands you can give your Wingman. Use the keyboard number keys to make your selections.

- **0 (zero) key (Wingman Cover)**— Pressing this key directs your wingman to form up on your right wing. Your wingman will maintain this formation until ordered otherwise.
- **1 key (Evasive Maneuvers)**— Directs your wingman to maneuver to avoid incoming missiles.
- **2 key (Wingman Engage)**— Press this key to order your wingman to engage targets at will.

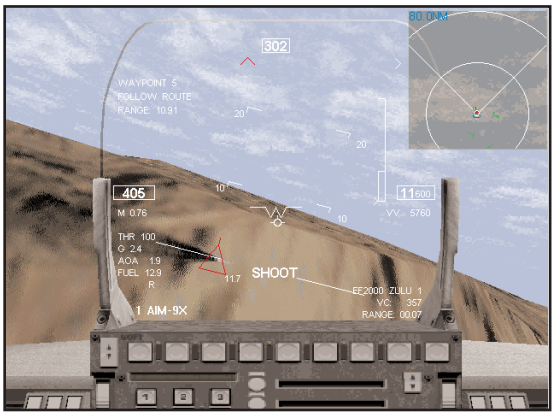
- **3 key (Wingman Attack My Target)**— Your wingman will immediately engage the target you have locked on radar.
- **4 key (Break Right and Engage)**— Orders your wingman to make a sharp turn to the right and engage at will.
- **5 key (Break Left and Engage)**— As above, but to the left.
- **6 key (Engage My Target's Attacker)**— If you have a friendly aircraft locked into your targeting system you can use this command to order your wingman to engage any enemy aircraft that attempts to attack the friendly. Use the **Tab** key to get a lock on friendly aircraft.
- **7 key (Escort My Target)**— Again, if you have a friendly aircraft in your targeting system, you can order your wingman to accompany that friendly aircraft and guard it from attack. The **Tab** key will select friendly aircraft.
- **8 key (Cover Me)**— Directs your wingman to engage any hostile aircraft with a radar lock on your aircraft.
- **9 key (Wingman Patrol Home Base)**— Press this key to order your wingman to return to your home base. Once there, your wingman will begin a Combat Air Patrol, keeping enemy aircraft away from your base.

Multiplayer Chat

- **T key (Multiplayer Chat)**— Press **T** to bring up the Multiplayer Chat menu. You can send messages to all players or to selected players. Use **Shift** + **T** to chat to your squadron only.

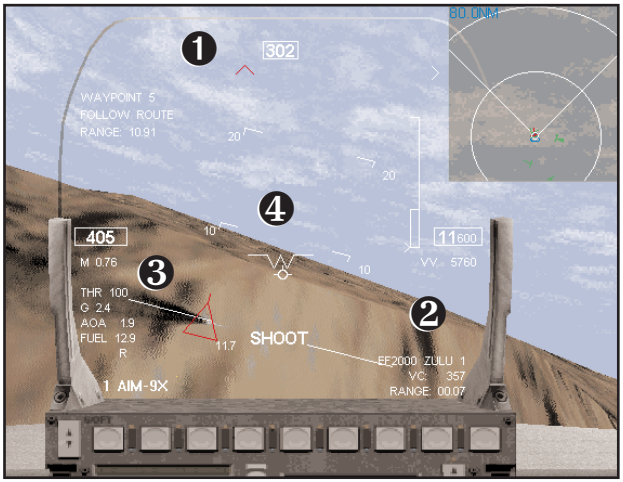
Displays

The Heads Up Display (HUD)



By far the most important cockpit display in the F-22 is the Heads Up Display, or HUD. The HUD displays information from many sources, including the avionics systems, radars, and weapons systems aboard your aircraft, all in a convenient and compact format. The HUD projects its data onto a transparent screen directly in front of the pilot's field of vision.

HUD Data Display



The HUD organizes the data it displays into several groups, making it easy to find the information you need.

❶ The top part of the HUD contains navigation data. At the lower left the HUD displays information concerning the aircraft.

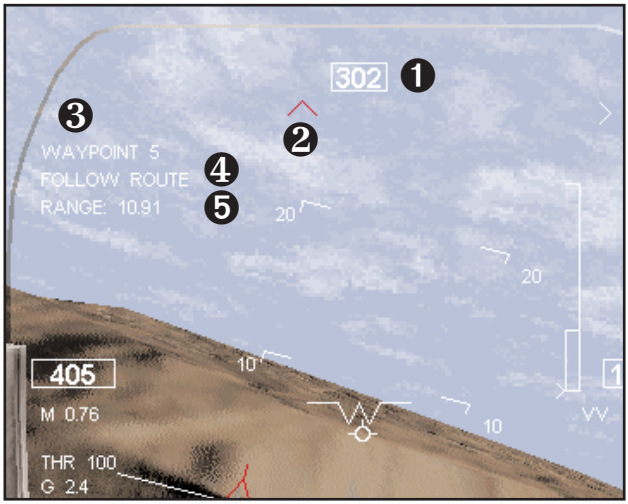
❷ The lower right it shows data concerning your targets.

❸ Speed and altitude data for your aircraft appear on the sides of the display.

❹ The middle are flight and targeting indicators.

With a little practice you will be able to read the HUD quickly and easily.

Navigation Data



The F-22's Heads Up Display puts the bulk of the navigation data you will need along the top and at the top right of the HUD.

❶ **Compass Heading Indicator**— At the top center of the HUD screen is a box with the current compass heading of the aircraft.

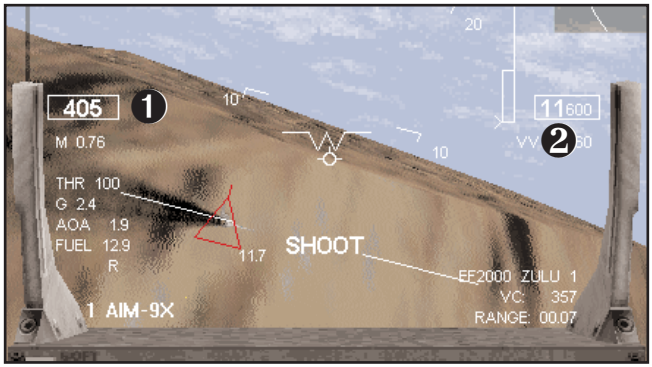
❷ **Waypoint Steering Cue**— The "caret" (^) marker indicates the direction to steer to reach the next waypoint.

❸ **Selected Waypoint**— Gives the number of the selected waypoint. Cycle through the waypoints for the mission with the **N** key.

❹ **Waypoint Comments**— Any special instructions associated with the selected waypoint will appear here.

❺ **Range to Next Waypoint**— The distance to the currently selected waypoint, in nautical miles.

Speed and Altitude Data



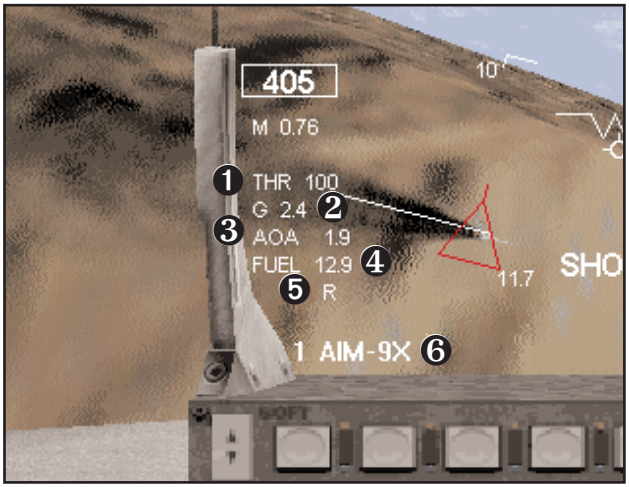
The HUD puts this important information inside easy-to-read boxes at each side of the display.

❶ **Airspeed Indicator**— On the left side of the HUD is the box containing the current airspeed for your F-22, in knots (nautical miles per hour). Just below the Airspeed Indicator box the HUD shows the current Mach number, a multiple of the speed of sound. A reading of 1.09, for example, means that the aircraft is travelling at 1.09 times the speed of sound.

Airspeed indicators are inherently inaccurate, due to variations in temperature and air pressure. Fighter pilots have found the Mach readings more consistent and reliable indicator of air speed. At Mach 1.0 you can figure that you will be travelling at about 10 nautical miles per minute.

❷ **Altimeter**— At the right of the HUD is a box containing the aircraft's current altitude, in feet. Right next to the Altimeter box is the Vertical Velocity Indicator (VV). It tells you your current rate of altitude change in feet per minute. Negative numbers mean you are losing altitude.

Aircraft Data



The F-22's HUD puts information concerning the current status of the airplane at the lower left of the HUD.

❶ **Thrust (THR)**— This data line tells you how much power your engines are producing, as a percentage of full power. If you have engaged your afterburner, the word "BURN" appears in this space.

❷ **Gravity Force (G)**— Indicates the amount of induced gravity currently pulling on the aircraft. A reading of 1.0 indicates level flight, with no acceleration acting on the aircraft. Negative numbers indicated negative G loads.

❸ **Angle of Attack (AoA)**— This is a measurement of the angle between the chord line of your wing and the angle of the relative wind. High angles of attack can lead to loss of lift in most airplanes, but in the F-22 your thrust-vectoring engines allow control at angles of attack far in excess of normal limits. A negative angle of attack means that the front of your wing slants downwards towards the ground, while an angle of 0 (zero) degrees means you are in level flight.

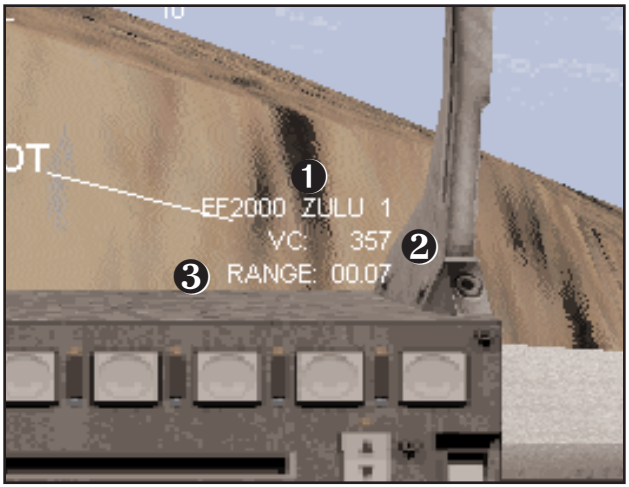
❹ **Fuel (FUEL)**— Displays the amount of fuel you have left on board, in thousands of pounds.

❺ **Status Line**— Indicates if you have certain pieces of gear activated. If your landing gear and flaps are down, you will see a "G" and an "F" here. A "B" appearing on this line indicates

that your air brakes or wheel brakes are on, while an "R" here indicates that you have your radar turned on.

❻ **Selected Weapon Indicator**— At the bottom left of the HUD your F-22 displays the currently selected weapon and the number of weapons or rounds available. Use the keyboard **1-4** keys to select a weapon, or cycle through all available weapons with button #4 on your joystick.

Target Data



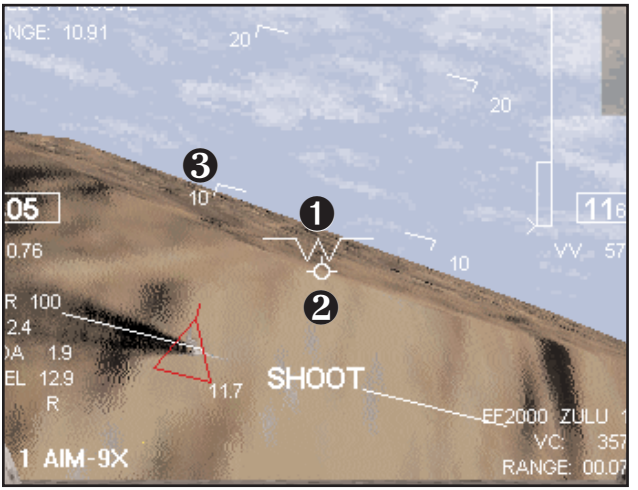
The HUD concentrates data concerning your current target at the lower right of the screen. Cycle forward or backward through your current targets with the **]** (right bracket) and **[** (left bracket) keys.

❶ **Target ID**— The top line of this display section gives you the target type for the current target, and assigns that target a unique identifier.

❷ **Velocity of Closure (VC)**— The rate at which your aircraft and your target are approaching one another, in knots. A negative number in this slot indicates that the target is moving away from your aircraft.

❸ **Range**— The range to the selected target, in nautical miles.

Flight Information



The HUD concentrates flight data in the middle of the screen, where it is most useful. Once you are familiar with the HUD display, you will be able to quickly and accurately determine your aircraft's flight attitude and its relationship to the ground.

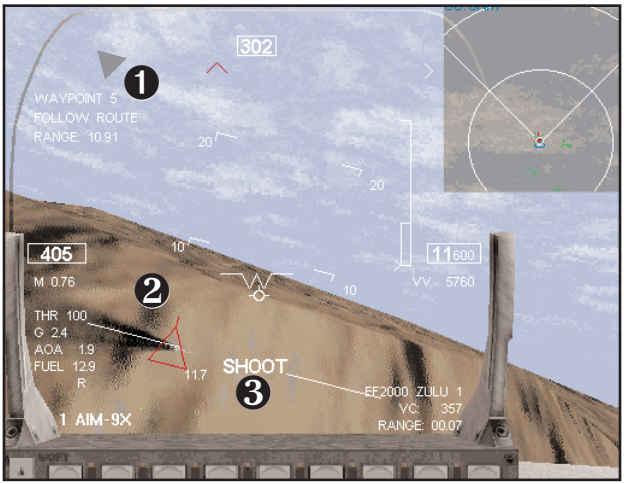
❶ **Watermark**— In the middle of the HUD is a "flying W" shape, called the Watermark. This shape represents your airframe. The center peak of the "W" is the nose of your aircraft, while the "wings" that extend the shape represent the wings of your plane. By comparing the various elements of the Watermark to the other data representations presented in the HUD you can easily tell what attitude your aircraft is currently in, and its relationship to the horizon.

❷ **Flight Path Indicator**— The small circle with the vanes extending from its top, bottom, and sides is the Flight Path Indicator. At any given moment the Flight Path Indicator points directly to where your aircraft would wind up if all flight parameters remained the same. If you are flying straight and level the Flight Path Indicator should rest right on the center peak of the "W".

❸ **Pitch Ladder**— The horizontal lines bisecting the center of the HUD are part of the Pitch Ladder. The lines themselves are always parallel to the horizon, and the tick marks on the tips of the Pitch Ladder rungs always point to the horizon, so you can quickly determine your relationship to the horizon, no matter how violent your maneuvers have been, or how

bad the visibility is. The numbers at the end of the pitch ladder lines show the pitch angle of the nose of your aircraft. Positive numbers represent angles above the horizon, while negative numbers indicate that your nose is pointing below the horizon.

Target Information



The F-22's HUD integrates data from all weapons and sensor systems available, presenting the results mainly in graphical format. Once you are familiar with the HUD targeting symbology you will find it simple to determine what target you have, and what your weapons are prepared to do about it.

❶ **Target Steering Cue**— This red arrowhead indicator points to the current target when the target is not in front of your aircraft, and therefore not visible on the HUD. Steer in the direction the Target Steering Cue points to bring the target into your HUD.

❷ **Target Indicator**— When you have an airborne target located and locked into your weapons systems, and when that target is in the forward arc of your aircraft, the HUD presents a Target Indicator, showing you the direction and orientation of the target. The Target Indicator appears as a large green triangle, with a line extending from its front. The faster the target is moving, the longer this line will be. The triangle's orientation mirrors that of the target. If the target is heading directly away from your aircraft the triangle points straight up,

while if the target is moving directly towards you the triangle points straight down. The small number attached to the Target Indicator is the target's altitude, in thousands of feet. If you have a missile weapon selected, the Target Indicator will turn red when that missile can hit the target. Friendly aircraft appear as squares rather than as triangles, and they have a large red "X" in the square, so you should have no trouble determining who's who.

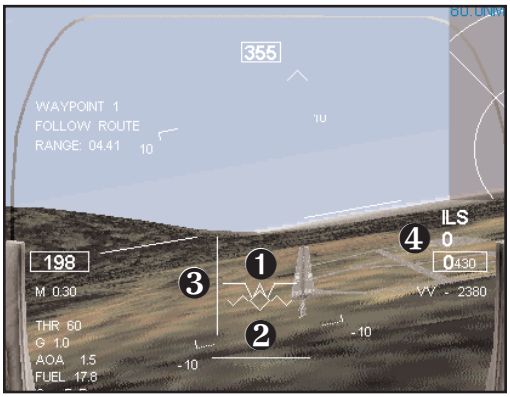
❸ **Shoot Cue**— When the relationship between your aircraft, its target, and the selected weapon aboard the F-22 is such that you can successfully engage the target, the word "SHOOT" appears in green at the lower center of the HUD. At the same time, the Target Indicator will turn red. Fire your selected weapon using the joystick **Trigger** button or the keyboard **Space Bar.** Once you have launched a missile against a given target, the F-22's targeting system automatically selects the next target in the shootlist for you. You may also cycle manually through the shootlist targets with the **[** or the **]** (bracket) keys.

❹ **Gunsight Pipper**— When you select the M61A2 20mm Cannon as your weapon, the HUD displays a circular Gunsight. The circle has a tiny dot in its center (the pipper) and four short vanes extending from its sides. Like the Flight Path Indicator, the gunsight shows where your 20mm rounds will wind up if you fired them right now. It takes into account the current flight attitude of your airplane, as well as of the effects of gravity and wind velocity. You do not need a radar to use the guns.

❺ **Ground Target Designation Box**— Ground targets entered into the JDAM guidance system will show up on the list of targets when you select the JDAM weapon, and a Ground Target Designation Box appears on the HUD, over the target location. When you have such a target selected, and when you are within JDAM glide range of the target, the Ground Target Designation Box turns red, and the Drop Cue comes up at the lower center of the HUD.

❻ **Bomb Fall Line**— If you have selected the JDAM weapons system to attack a ground target, the HUD will also display a Bomb Fall Line. This element appears as a diamond, with a line running from the center of the diamond to the Flight Path Indicator near the center of the HUD. If you released a bomb (use the Trigger or the Space Bar), it would impact the ground right where the center of the diamond indicates.

Instrument Landing System



The F-22 has an Instrument Landing System (ILS), which provides a means of landing the aircraft even when you can't see the runway. The ILS has several components, including a Desired Glideslope Indicator, showing you the flight angle at which you should be, a Glideslope Bar, showing you where your glide actually is, and a Localizer to get you oriented properly with the runway. The ILS activates when you are less than six nautical miles from the runway, and at an altitude of less than 5,000 feet AGL (Above Ground Level).

❶ **Current Glideslope Indicator**— The small diamond shape with the crooked "wings" is your Current Glideslope Indicator. It should appear at about 10 degrees pitch angle below the Watermark on your HUD.

❷ **Glideslope Bar**— The horizontal line below the Current Glideslope Indicator on the HUD is the Glideslope Bar. When you are approaching the runway at the proper altitude the Current Glideslope Indicator will be centered on the Glideslope Bar. If you are coming in too high, the glideslope line will be well below the CGI, and if you are too low the line will appear above it.

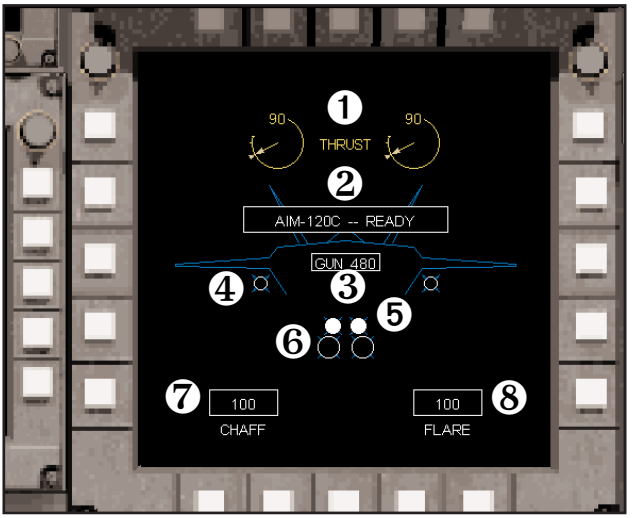
❸ **Localizer**— The solid vertical line is the Localizer. Its job is to keep you oriented along the runway centerline. If you are pointed to the left of the runway centerline the Localizer will point to the right side of the HUD, while if you are too far right, the Localizer line point left. When you are pointed correctly, the Localizer line will be vertical.

❹ When in ILS mode the HUD shows the Desired Heading just above the Altimeter box on the right. Keep pointed to the Desired Heading.

Multifunction Displays

The ***F-22 Raptor*** features a number of displays designed to present data in graphical form for quick analysis. Many of these Multifunction Displays center your aircraft in a series of concentric rings, allowing you to quickly determine how far away objects are. You can zoom these displays in and out with the **S** and **X** keys. The maximum display range is 80 nautical miles. Others list aircraft equipment or components, and tell you if you have suffered any damage.

Stores Management Display (Keypad 2 key)



The Stores Management Display gives you a graphical presentation of your current loadout, and tells you what weapon is readied and how much thrust your engines are producing. Here is the information in this display, from top to bottom:

❶ **Thrust Circles**— The arrows point to how much of their maximum thrust the engines are producing, and the number at the top of each circle is the thrust percentage.

❷ **Weapon in Priority (WIP) Box**— This text box tells you what weapon is currently ready for use.

❸ **Guns**— Shows the number of rounds of 20mm ammunition left.

❹ **AIM-9X**— The top row of missile shapes shows how many AIM-9X Sidewinder heat-seeking missiles you have left for use.

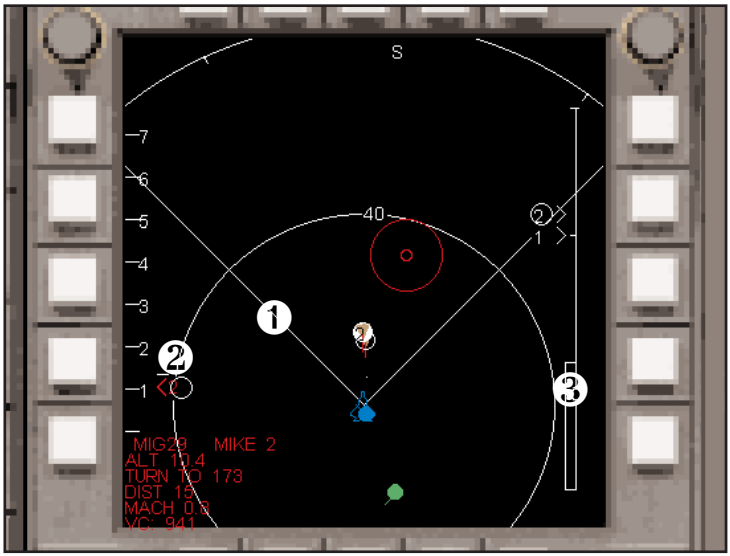
❺ **AIM-120**— The row of shapes below the Sidewinders is the number of AIM-120C AAMRAM radar-guided missiles left in your inventory.

❻ **JDAM**— The bomb shapes at the bottom of the aircraft indicate how many JDAM guided bombs you are carrying.

❼ **Chaff**— Shows the number of Chaff bundles on board.

❽ **Flares**— The number of Flares left.

Attack Display (Keypad 6 key)



Use the Attack Display to help you locate, target, and attack enemy aircraft and ground objects. This display is a particularly useful tool for managing missile battles.

Attack Display Symbols

The Attack Display uses shapes and colors to represent objects. Many of the Attack Display objects will have lines protruding from them. These are "lead lines." The faster an object is moving, the longer these lines will be.

- **Blue F-22 silhouette**— Your aircraft. This symbol is always in the middle of the range circles.

- **Blue circle**— Your wingman.
- **Green circle**— Friendly aircraft.
- **White square**— Unidentified aircraft.
- **Red triangle**— Enemy air target.
- **Red circle**— Enemy ground target.
- **Red lines**— Missile tracks.

Display Elements

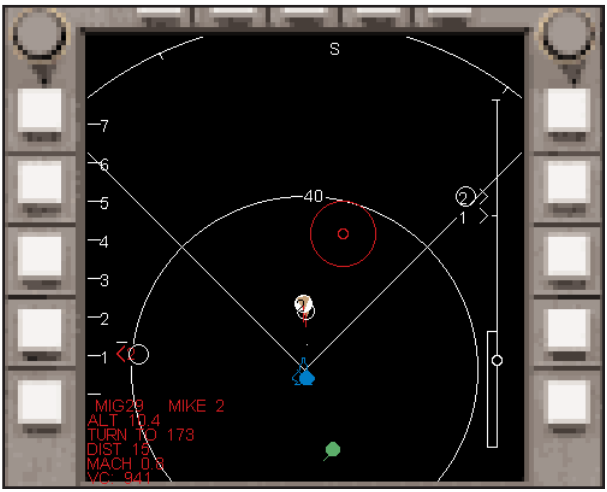
The Attack Display has several elements that help increase your situational awareness, including Range/Direction Circles, a Target Altitude Indicator, and a Missile Range Indicator.

❶ **Range and Direction Circles**— In the Attack Display, your F-22 is centered in the Range/Direction circles. The ranges on these circles are in nautical miles, and you can scale them with the **S** and **X** keys. The outer circle has a set of compass direction indicators, which rotate with your airplane's movements to keep the compass direction you are headed at the top of the circle.

❷ **Target Altitude Indicator**— At the left side of the display is a set of numbers indicating altitude, in tens of thousands of feet above sea level (not above ground level). A "caret" symbol (<) points to the altitude of each target on your shootlist.

❸ **Missile Range Indicator**— On the right side of the display is a bar representing the range of your currently selected missile weapon. The tick mark at the top is the weapon's maximum range, and the top of the box that forms the bottom of the bar is the weapon's minimum range. There is also a tick mark to represent the middle of the missile's range envelope. The small circle inside the bottom box is your aircraft. The number inside the circle next to the caret represents the target's shootlist number, while the caret itself points to the target's range from your aircraft, when the target is within missile range.

Target Data



When enemy aircraft have been detected, the F-22's targeting computers automatically generate a list of the closest four targets (the Shootlist). Shootlist targets on the Attack Display have large white circles around them. The first target on the list will have a solid circle, and the remaining circles will be open. All four shootlist targets have a red number superimposed, signifying their number on the shootlist. Cycle through the targets with the **[** and **]** (bracket) keys.

The Attack Display also provides detailed data concerning the currently selected target. The display places this information at the lower left of the screen.

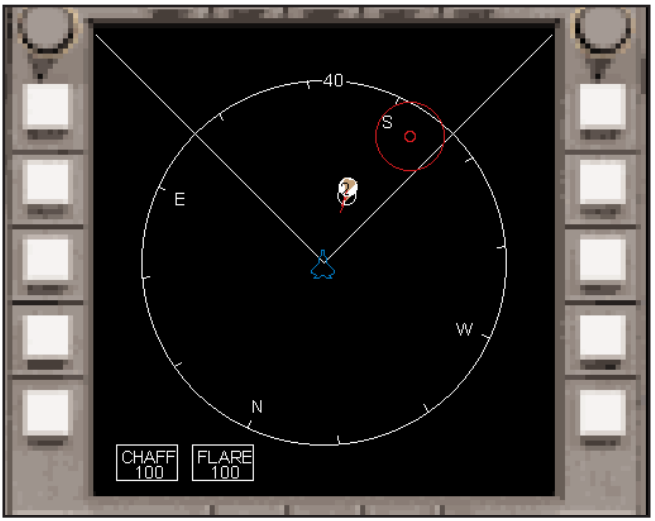
- **Target ID**— Gives the target type and a unique identifying number.
- **Altitude (ALT)**— The target's altitude, in thousands of feet above sea level.
- **Heading (TURN TO)**— Compass bearing of the current target.
- **Distance (DIST)**— Distance to the target, in nautical miles.
- **Speed (MACH)**— The target's current velocity, as a multiple of the speed of sound.
- **Velocity of Closure (VC)**— The rate at which your F-22 and the current target are approaching one another, in knots. Negative numbers indicate that the target is moving away from you.

F-22 Raptor can place a miniaturized version of the Attack Display in the upper right of the cockpit screen. Aircraft appear as "T" shaped objects on this display, with the stem of the T indicating the direction of flight, and the length of the stem indicating how fast the object is moving. While in the cockpit, you can toggle this display on and off with the keypad **8** key.

Boresighting

There are times, especially when you are using one of the Multifunction Displays, when a target will suddenly show up right in front of you. You can use the ' (apostrophe) key to direct the radar to get an immediate target lock on such an object. This can be very useful in emergencies, when you may not have time to cycle through the shootlist to select the target directly ahead.

Defense Display (Keypad 4 key)



The Defense Display can be of great assistance, especially to those pilots who wish to return safely home from a mission.

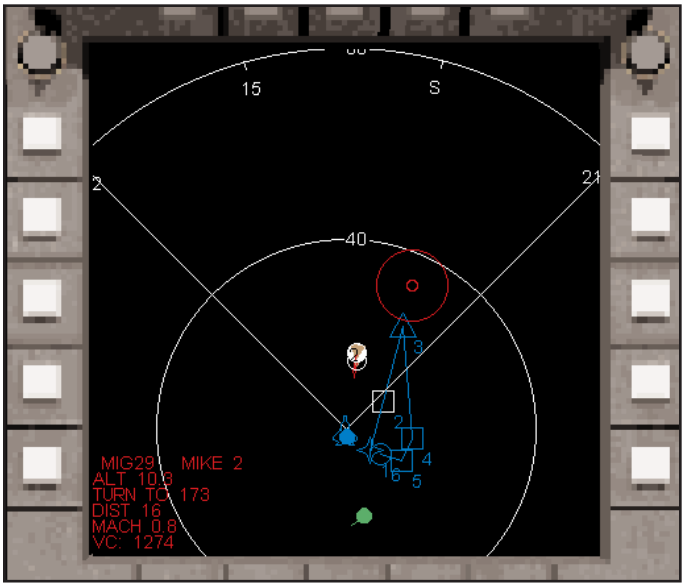
The Defense Display shows nearby aircraft, the location and radar coverage of ground-based missile and gun sites (the red circles), and the tracks of missiles in flight.

At the bottom of the Defense Display you can check the number of Chaff bundles and Flares still left aboard your airplane. Zoom in and out on this display with the **S** and **X** keys.

The F-22 depends on the smoothness of its outer surface for much of its stealth. You can see the effects of disturbing this surface by watching the radius of the radar coverage for enemy SAM or AAA sites. When you open a bay to fire a missile or drop a bomb, you will see the coverage circles expand significantly. This reflects the larger radar cross-section you present when one of your bay doors is open. Similar coverage expansions occur when you lower your landing gear or turn on your radar. Damage to your aircraft can also degrade the stealth of your plane.

Incoming missiles show as red lines on the Defense Display. The length of the line is proportional to the distance from the target.

Navigation Display (Keypad 5 key)



The Navigation Display can help you find your way around the battle zone. Squadron HQ has pre-programmed your F-22's navigational computers with your mission Waypoints, and these now show up on your Navigational Display, along with friendly and enemy aircraft that have been detected.

The waypoints for a mission should route you around known defensive sites, but you should be aware that the route reflects known data only. There may be SAM sites out there that have not been discovered and entered into the system. You can use the **S** and **X** keys to zoom in and out on the Navigational Display.

Waypoints are an important part of the F-22's Autopilot. When you engage the Autopilot (press the **A** key while in flight), it will fly you automatically to the selected waypoint. Use the **N** key to cycle through the waypoints on the Navigation Display. When you have completed a mission, pressing the **H** key will take you directly to the Initial Approach Waypoint, near your home base.

There are four types of waypoints on the Navigation Display:

- **Star**— The first waypoint on a mission is always shown as a stylized star, for easy reference.
- **Square**— Any waypoint at which you will be changing direction shows up as a square.
- **Triangle**— Triangular waypoints indicate flight locations where you will be escorting friendly aircraft or potentially engaging enemy aircraft.
- **Circle**— The final waypoint for your mission shows as a circle. This waypoint will be close to your home runway.

Aircraft Status Display (Keypad 7 key)

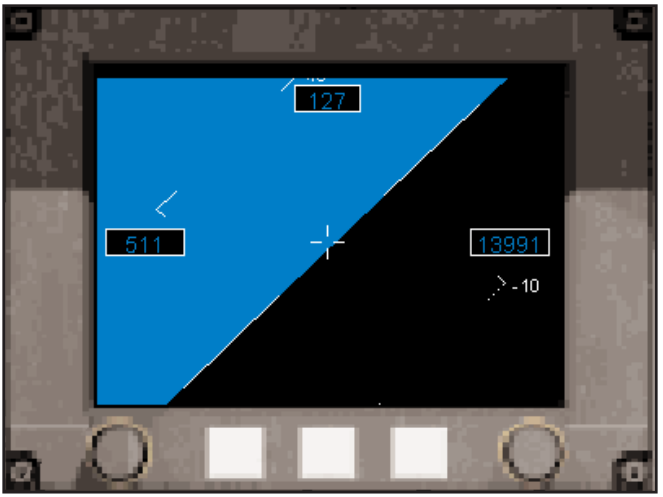
Pressing the keypad **7** key brings up the Aircraft Status Display, showing you the damage status of your critical flight, weapons, and sensor systems. This screen will also let you know if you have an AWACS link currently operating. The Aircraft Status Display offers you information on the following aircraft systems:

- **AWACS Link**— Indicates whether or not you have an AWACS aircraft on station, providing you with 360 degree continuous radar coverage. If your AWACS link gets damaged you will no longer have access to AWACS data.

- **Radar Systems**— Damage to Radar means you will be unable to use the AN/APG-77 radar aboard your F-22. You will not be able to acquire targets for your AIM-120C AMRAAM missiles, and you will not get any early warning of the presence of an enemy. You will still be able to use your AIM-9X Sidewinder heat-seeking missiles, and of course you can always bring up your 20mm cannon.
- **Weapons Bay**— If you take damage to your Weapons Bay you will be unable to use any bombs or missiles. Weapons Bay damage also makes you a larger radar target.
- **Avionics**— Avionics damage may make some or all of your in-flight displays, including your HUD, inoperable.
- **Fuel System**— Damage to the Fuel System makes your F-22 use fuel at a higher rate, due to leaks.
- **Flaps**— If your Flaps become damaged it will make landings more difficult. You will not have as much lift coming in, so you will have to make your approaches at higher speeds.
- **Ailerons**— Damage here will make your airplane more difficult to control. The Ailerons control the angle of bank, so a damaged aileron will tend to make your aircraft want to roll in one direction. You will have to keep constant stick pressure to counteract the effects of aileron damage.
- **Rudders**— Damage to your rudders means that it will be more difficult to maintain flight attitudes in turns. Since the F-22's rudders also provide air braking, rudder damage also means Air Brake damage.
- **Elevators**— If you suffer damage to your Elevators, the aircraft will have a continual tendency to pitch its nose up or down. You will have to keep constant pressure on the stick to control your aircraft's pitch angle.
- **Air Brake**— The F-22 uses its rudders as air brakes, so if you suffer rudder damage you will also be unable to use your Air Brake.
- **Left/Right Engine**— If you receive damage to an Engine, that engine will no longer produce full power. It may even shut off completely. You will consequently have less thrust available, and hence less ability to accelerate. Go home when this occurs. The F-22 can maintain level flight on a single engine, but only with difficulty. It cannot afford to get into a fight.

- **JDAM GPS Guidance**— Damage to the GPS Guidance System on your JDAM bombs means they will no longer be able to guide themselves to a target. You will have to aim them manually, using the Ground Target Designation Box on your HUD.
- **Countermeasures**— Damage to Countermeasure systems means you can no longer launch flares or drop chaff.

Artificial Horizon (Keypad 9 key)



The Artificial Horizon presents a few of the most critical flight parameters. This simplified display can be invaluable for night flying, and it can also be shown in miniature form on the other Multifunction Displays, allowing you to keep control of the airplane while using one of the other displays.

The artificial horizon itself is a line right across the display. The light half of the artificial horizon represents the sky, and the dark half the ground, so you will know how you are oriented in the air. The Artificial Horizon Display also gives you the Pitch Ladder, which tells you how far above or below the horizon the nose of your aircraft points. The boxes, from left to right, indicate your aircraft's Airspeed, Compass Heading, and Altitude (MSL).

To place a small version of the Artificial Horizon Display in the upper right corner of your other Multifunction Displays, use the keypad **8** key. Press keypad **8** again to remove the small Artificial Horizon from the screen.

The Menus

The ***F-22 Raptor*** Menu System gives you access to all game features, including campaigns and missions, multiplayer options, and information about the game and its construction. Each Raptor game begins at the *Main Menu,* from which you can make the following selections:

Quick Mission

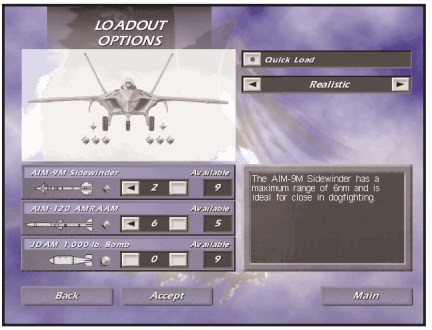
Select Quick Mission when you simply want to fly, without the complications of a campaign. ***F-22 Raptor*** provides you with a set of missions designed especially for this feature. In addition, whenever you complete a mission in a campaign, that mission is added to the Quick Mission list, so you will be able to select it for replay whenever you want.

To select a Quick Mission, click on the **Quick Mission** option on the *Main Menu,* then examine the list of missions provided. You can scroll through all the available missions with the scroll bars to the right of the mission title. Highlight a mission to get a description of the mission situation and goals. Click on the **Accept** box when you have highlighted the mission you wish to fly, or click on **Back** to return to the *Main Menu.*

Mission Briefing

If you **Accept** a mission, the next screen will be the Mission Briefing. The Mission Briefing screen provides a description of the mission you will be undertaking. To the right of the briefing is a short menu of mission options.

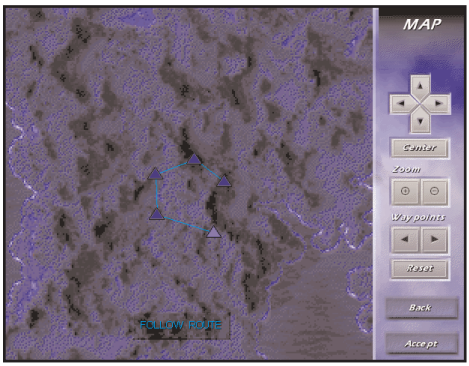
Loadout



Click on **Loadout** to select what armaments your F-22 will carry for this mission. This brings up the *Loadout Options* screen. You have several choices available here. At the top right of the screen you can choose a Quick Load, which makes the loadout selection for you, or you can toggle between **Advanced** and **Fun** loadout modes. Advanced loadouts are more restricted than Fun loadouts, and allow you to carry fewer weapons.

The main part of the Loadout screen is a list of available weapons. When you move your mouse pointer over a weapon on the list, the panel at the far right shows you details about that weapon. The weapons list tells you how many of a given weapon you have loaded on the airplane, and how many are available. Use the mouse to add weapons to your loadout. When you have finished, click on **Accept** to give yourself the weapons load you have selected and return to the Mission Briefing. Click on **Back** to return to the Mission Briefing screen without choosing a loadout, or click on **Main** to go all the way back to the ***F-22 Raptor*** Main Menu.

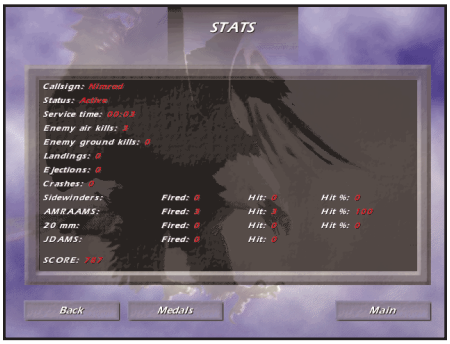
Map



Selecting **Map** from the Mission Briefing screen brings up a map of the battle zone, with your mission Waypoints displayed. Use the arrow buttons at the right to scroll the map, and click on the Zoom buttons to zoom the map in and out. Click on the Waypoint buttons to select the next or previous waypoint. You can change the location of any waypoint except the Initial and Final Approach waypoints, near your home runway. To change the location of a waypoint, click on the waypoint and hold the mouse button down, then drag the

selected waypoint to where you want it to be. Release the mouse button to place the waypoint in its new location. Click on **Back** to return to the Mission Briefing screen when you are familiar with the terrain over which you will be flying, and when you have the waypoints arranged to your liking.

Stats



F-22 Raptor provides a variety of statistics concerning each pilot you fly. This information is applicable only to **Campaigns,** so for **Quick Missions** the Stats selection is not available. When you are flying in a Campaign, click on this selection in the Mission Briefing to learn how many kills your pilot has made (both air and ground), how many weapons and of what type that pilot has launched, the number of crashes the pilot has suffered, how many times the pilot has been forced to eject, and how many successful landings the pilot has performed. Most important, this screen also gives you the pilot's current campaign score.

Continue Campaign

Select **Continue Campaign** if you already have a campaign underway and would like to go on with it. ***F-22 Raptor*** will display a list of your current campaigns. Highlight the one you wish to continue, then click on the **Accept** box. To return to the *Main Menu* without selecting a campaign to continue, click on **Back**. Accepting a campaign brings up the Mission Briefing screen, which gives you the next mission you must undertake in this campaign. See the description for **Mission Briefing** under *Quick Start* above.

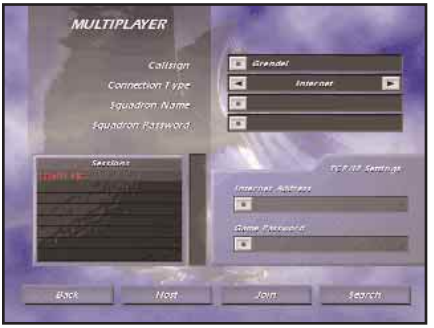
New Campaign

Choose **New Campaign** to start a new campaign game, with a new pilot. You can have up to nine campaigns. Select a slot using the mouse, then type in the callsign of the pilot who will be flying your new campaign and press **Enter**.

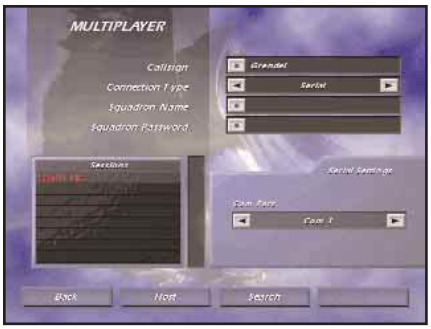
If you wish to edit a pilot's callsign, click on the name. You will be able to enter a new callsign for your pilot. To remove a pilot from the list and free up a campaign slot, click on the pilot's callsign and then click on **Delete Slot.**

When you have typed in and entered a callsign for your new campaign, click on the **Accept** box to continue, or click on **Back** to return to the Main Menu. When you **Accept** a campaign you will go directly to the Mission Briefing screen for the first mission in your new campaign. See the **Mission Briefing** section under *Quick Start* at the beginning of this chapter for a complete description.

Multiplayer



F-22 Raptor provides superior multiplayer gaming options. Multiple players can participate over a LAN/IPX Network, on the Internet with a TCP/IP Connection, via a Serial Cable, or by Modem. Only two players can fly simultaneously when the connection is a serial cable or modem, but up to 60 pilots can enter combat on the Internet or over a network.

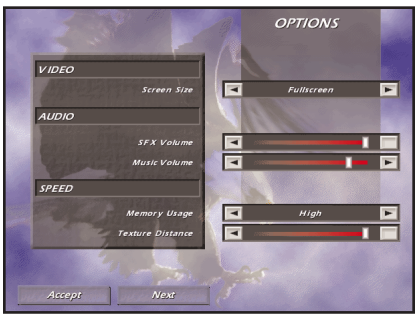


In the **Multiplayer Options** screen, first enter the Callsign of your pilot, then use the mouse to select a Connection Type. Each connection type has certain parameters you must also enter. For a serial connection you will have to provide the Com Port Number for the connection. See your computer's documentation for this information. A modem connection requires that you enter the Phone Number of the connection you want to establish, and choosing TCP/IP asks you for the IP Address and Game Password for that connection.

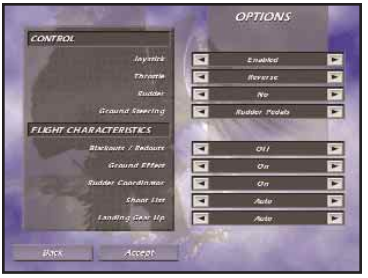
F-22 Raptor also gives you the opportunity to fly as part of a Squadron. If you are part of a squadron, enter its Name and Password in the spaces provided. You can join a squadron from within the multiplayer game. See the **Multiplayer Gaming** chapter of this manual for complete details.

If you have selected an IPX or TCP/IP connection, and you do not want to host a new game on your computer, you will have to find an open game on the network. Use the mouse to press the **Search** button at the lower right. A list of available game sessions will appear in the **Sessions** box to the left. Use the mouse to highlight which session you want, then press the **Join** button. If you wish to be the host for a new session, press **Host** at the bottom of the screen. Select **Back** to return to the Main Menu.

Options



The **Options** selection allows you to choose a variety of game-related parameters, allowing you to set up the game for best performance on your system. It also gives you options concerning some of the features you can include in a Raptor game.



For a complete description of the **Options** section, see the **Configuring the Game** section of the *Installation* chapter of this manual.

Overview

This section gives you the opportunity to learn more about the F-22 and about Novalogic.

Credits

Make this selection to learn more about the people who created the ***F-22 Raptor*** simulation.

Exit

Choosing **Exit** takes you directly back to the Windows® 95 operating system desktop.

CHAPTER FOUR:
Multiplayer Gaming

Multiplayer gaming against human opponents is the zenith of the ***F-22 Raptor*** experience. To date, no artificial intelligence can measure up to the cunning, unpredictability, and originality of a human opponent, so ***F-22 Raptor*** offers you the opportunity to engage your fellow humans in air combat in a wide variety of multiplayer modes. You can host games for other players on your machine, or join games that others have begun.

You can join a network multiplayer game of ***F-22 Raptor*** at any time, and leave whenever you wish. That means you do not have to be present at the initiation of a Raptor game to join in, and if you leave in the middle of a mission, the other players can continue to play without you.

Preparing for Multiplayer Play

To play a multiplayer game of ***F-22 Raptor*** you will have to make some choices concerning the game and the connections that allow it to happen. You will need to decide whether you will **Host** the game or whether you will **Join** someone else's game. You will also need to decide what Connection Type to use to play the game.

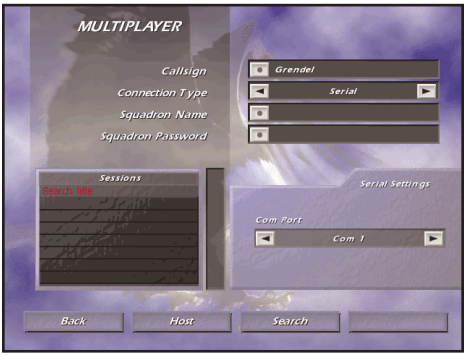
1) Enter Multiplayer Mode

To begin a multiplayer game session, first select **MULTIPLAYER** from the ***F-22 Raptor*** *Main Menu,* then click on the Callsign box at the top right. Type in the callsign of your pilot and press Enter.

2) Connection Types

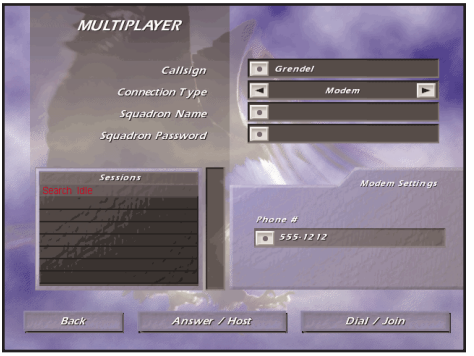
Next you must choose a **Connection Type.** Click on the arrows in the *Connection Type* box just below the *Callsign* box to cycle through the possibilities. There are four possible connection types:

Serial Cable



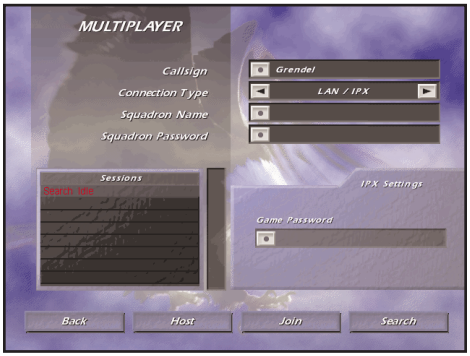
You can play ***F-22 Raptor*** against a single human opponent by using a Serial Cable to connect your two computers. Cycle through the Connection Types until **Serial** comes up. When **Serial** is the selected connection type, a Serial Settings panel appears below. You will need to tell the program which Com Port you will be using.

Modem



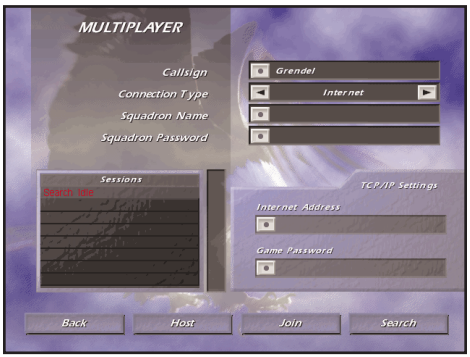
Two players can play ***F-22 Raptor*** over a Modem connection. Selecting **Modem** from the Connection Type box brings up the Modem Settings panel, which asks you to enter the phone number to dial to connect the two computers via modem. This should be the modem number for the player who will Host the game. Click on the button to put in a new phone number, then press **Enter.**

LAN/IPX Network



Many players can participate in a game of ***F-22 Raptor*** over a network. To undertake an ***F-22 Raptor*** game over a LAN/IPX network, click on the Connection Type box arrows until **LAN/IPX** appears. LAN/IPX games may require a password.

Internet Connection



Many players can participate simultaneously in an ***F-22 Raptor*** game over the Internet. To **Host** or **Join** a game of ***F-22 Raptor*** on the Internet, select **Internet** in the Connection Type box. You will be asked to provide the IP Address of the host and a Password to the game you want to play. If the game in which you want to participate does not require a password, leave this box empty.

3) Squadron Data

While playing Deathmatch ***F-22 Raptor*** games over a LAN/IPX network or an Internet connection, you may get the opportunity to become a member of a Squadron. A squadron is a group of Raptor players who fly together, cooperating to reach common goals. If you are a member of a squadron, click on the **Squadron Name** button at the right and type its name in the space provided, then press **Enter.** If your squadron has a Password, click on the **Squadron Password** box button and enter the password. Squadron member's aircraft appear green on the Attack Display, and you can chat with them privately using **Shift+T**. At the end of every Deathmatch round Raptor will display the top players and squadrons.

4) Joining a Game

If you want to Join a game hosted by another computer, click on the **Search** button at the bottom right. A list of the games currently running on the Connection Type you have selected will appear in the Sessions box at the left. Use the mouse to highlight the game you want to join, then click on the **Join** button. You will shortly find yourself in the cockpit of an F-22, about to face real humans. If you want to **Host** a game, see the manual section Hosting A Game, below.

Multiplayer Game Types

There are two types of multiplayer games in which you may participate. **Deathmatch** games are you and your F-22 against the world, where the only objective is to down as many of your fellow players as possible. **Raptor Air War** games require the participants to work together to accomplish common mission goals. The Host of a given game selects which type it will be.

Deathmatch Games

A **Deathmatch** game is just that, a fight to the finish, with every pilot seeking only to kill or be killed. A Deathmatch game differs from a normal ***F-22 Raptor*** mission in several respects:

- All players start on different airfields, inside an imaginary circle about 80 miles across.
- There are no Ground Targets in Deathmatch play.
- You can Rearm and Refuel your F-22 by landing it at any runway. You must bring the aircraft to a complete stop to have this take effect. Ground crews will not repair Damage.
- You cannot Pause the game.
- You cannot Eject from a crippled airplane.
- If you crash, Raptor removes one kill from your total.
- You will not have a Wingman.

Raptor Air War (RAW)

The computer assigns every player joining a RAW to one of two teams. The player sees an external view of the plane on the runway, and a dialogue box prompting selection of either a fighter or a

bomber loadout, along with a list of what other members of the team have chosen.

The object of a RAW game is to bomb the opposing team's base, wiping it out and achieiving total victory. All bombs have to be dropped manually, using the Bomb Fall Line. There will be no Ground Target Designation Box

Players choosing to fly fighters will be given a loadout of 8 Sidewinders and the F-22's gun. Use these to defend friendly bombers, harass the opposition, or destroy the enemy AWACS.

Players choosing to act as bombers will receive aircraft equipped with 2 JDAMs plus the aircraft's cannon. It is the task of the bombers to make it through enemy fighters, SAMs, and AAA to bomb the base and achieve victory.

Fighters alone cannot win. Some of the buildings require a JDAM hit to destroy them.

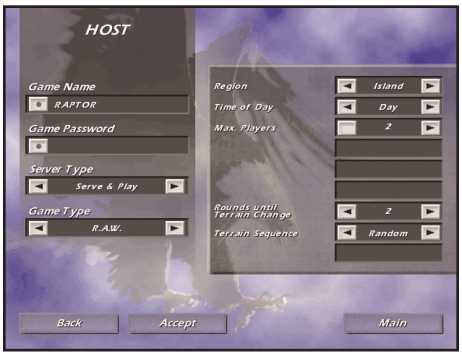
Each team is given an AWACS to provide radar coverage. It would be a good tactic for one team to take out the other's AWACS.

In a RAW there are no computer controlled aircraft. The players are responsible for flying CAP around their base, protecting their AWACS, escorting their bombers, and intercepting enemy forces.

Waypoints in a RAW game have special meanings. Waypoint #2 is always the enemy base, and Waypoint #3 is always your home base.

A RAW game also changes the symbols on the Attack Display. Red objects are enemy, Green objects are friendly fighters, and friendly bombers are coded Blue.

Hosting a Game



You can participate in a multiplayer ***F-22 Raptor*** game as either the Host or as a Guest. If you are the host, other players will Join your game, while if you are not hosting a game you will join one that some other player is hosting. To host a game, press the **Host** button at the

bottom of the screen. This brings up the **Host Options** screen. You have a number of choices to make:

- **Game Name**— Enter a unique name to identify your game. This title will appear in the Sessions box at the left.
- **Game Password**— If you wish to restrict access to a LAN/IPX or an Internet game, enter a Game Password here. Only players who know the password will be able to Join a password-protected game. You do not have to require a password, so if you do not want players to have to enter a password to join your game, leave this box empty.
- **Server Type**— Choose **Serve Only** or **Serve & Play.** If the computer on which you will be running ***F-22 Raptor*** will be doing nothing else but running Raptor games, choose **Serve Only.** If you will be playing in games you host, choose **Serve & Play.**
- **Game Type**— Select a **Deathmatch** or **Raptor Air War** Game Type for this game. See the previous manual section, Multiplayer Game Types, for a description of these choices.
- **Region**— Cycle through the list in the Region box to select a place for this game to take place.
- **Time of Day**— Pick the Time of Day at which you want this mission to be flown.
- **Max. Players**— Use the arrow buttons to increase or decrease the Maximum Number of Players allowed to Join this game. This can be a very large number….
- **Sidewinders**— If you have selected a **Deathmatch** game, choose the number of Sidewinder heat-seeking missiles each aircraft in the game will carry. This choice is not available in **RAW** games.
- **AMRAAMs**— In **Deathmatch** games, you must choose how many AIM-120C AMRAAM missiles each plane will carry. This choice is not available in **RAW** games.
- **Kills per Round**— For **Deathmatch** games only. Choose how many kills a player has to achieve to end the current Round. When any player reaches this total, the Round will end.
- **Rounds Until Terrain Change**— Select how many Rounds will run before a new battlezone loads. When the Terrain changes, a new Region will load.

- **Terrain Sequence**— You can have the game change the Terrain, the Time Of Day, or both, or have it change at random.
- **Spin Only Deaths**— For **Deathmatch** games. Choose **Yes** or **No.** Normally, pilots shot down in a Deathmatch game find themselves back on a random runway, ready to get back into the fray. If you select **Spin Only Deaths** (choose **Yes**), aircraft hit in the air will go into a spin for a few seconds, then revert to player control, all damage repaired. These aircraft will still be spinning, however. You'll have to pull out of the spin manually. Choosing **No** here puts pilots back on the ground when they are shot down, with a brand new airplane.

Click on **Accept** to start the game, with your computer as the Host. You will find yourself on the end of a runway, ready to get into the air. Other players will Join your game whenever they wish. They do not have to sign up at the beginning. They can also leave your game at any time, without affecting the other players.

MultiPlayer Chat

Chat allows you to type and send text messages to other players. Press the **T** key at any time in a mission to communicate with the other players in the game. You may send messages to all players, or just to squadron mates.

To send a message to all players press the **T** key to open an opaque *Chat Mode* message strip in the center of your screen. Simply begin typing, and press **Enter** when you are satisfied with your message. Press **Shift** + **T** to send a message to your squadron only.

The F-119 engines feature a two-dimensional thrust vectoring system. Horizontal fins at the exhaust deflect thrust plus or minus 20 degrees. This gives the Raptor is superior agility in combat.

CHAPTER FIVE:
Strategy and Tactics

You are not going to learn to fly a jet fighter simulation from this manual. The only way you will get good at flying and fighting in the F-22 is to go out and do it, and take your lumps in the process. This section is designed to give you a few hints, to remove some of the uncertainty that you undoubtedly feel about just how to do this. In general, use common sense, and watch your speed and altitude. You'll be all right.

Altitude

The F-22 is an air superiority fighter. Its primary mission is to establish and maintain aerial dominance. To take full advantage of the capabilities of the F-22, get your airplane up in the air.

One of the principal reasons the F-22 is so much more advanced than other air superiority fighters is stealth. The F-22 is one of the most difficult aircraft in the world to detect electronically. It therefore has far less to fear from both air and ground based radars. This allows the F-22 to fly high, taking full advantage of altitude. Altitude provides a convenient reserve of energy, which you can convert to speed at any time. Altitude also gives one the ability to maneuver at will, comfortable in the knowledge that there is a large reserve of empty air below. An aircraft at high altitude can see farther, and detect targets at greater ranges, and an undetected combat aircraft with an altitude advantage can strike with devastating suddenness. The stealth

characteristics of the F-22 make high altitudes its natural home. A normal F-22 mission altitude should be above 30,000 feet.

Another good reason to fly your F-22 at high altitudes is its ability to *supercruise,* or fly at supersonic speeds without using its afterburner. Supercruise is very fuel efficient, allowing you to travel at high speeds without burning up a lot of fuel. When going to and from your mission objectives, always strive to be at high altitudes, moving at better than Mach 1.0.

Flying at high altitudes also gives an aircraft a defensive advantage. It can see enemy missiles coming from far away, and can maneuver to avoid them. This is especially true of the F-22, because its vectored thrust system makes it a very maneuverable airplane indeed, and far better able to turn inside an enemy missile than other aircraft. Missiles climbing to high altitudes will also take longer to arrive than those fired at targets closer to their own level, and will be moving more slowly, making them even easier to detect and avoid.

High altitude flight provides other defensive advantages as well. Like missiles, enemy aircraft must approach "uphill," slowing their speed. This means they spend a longer time inside the F-22's missile radius. Since the missiles aboard the F-22 generally outrange those of its opponents type for type, this means enemy targets will spend longer in that part of the kill envelope where the F-22 can strike them, and where they cannot hit back.

High altitude is also the preferred place from which to drop a JDAM. Since the JDAM does not require any emissions from its carrying aircraft to locate a target, the F-22 can maintain its stealth profile when dropping the bomb. Dropping a JDAM from high altitude also gives the weapon more range and striking power, since it relies on its gliding ability to reach the target location. The higher the bomb is at launch, the farther it will be able to glide before impact, and the faster it will be travelling when it hits. The higher you are flying when you drop a JDAM, the further away from the target (and its defenses) you can be when you do.

If you still don't believe that the preferred place for your F-22 is at high altitude, consider the avionics aboard your aircraft. You cannot use your Multifunction displays if you are flying low, dodging hills. At low altitudes you can't take your eyes off the terrain long enough to get the data you need from a display, and if you use the displays as they were designed to be used, you'll fly into a mountain.

If you want to take advantage of the digital information capabilities of your F-22, get it up in the air, so you can read the displays without having to worry about running into something.

Speed

Selecting the proper speed at which to enter a given engagement envelope is one of the primary tasks of a fighter pilot. When considering combat, always check your speed. The velocity at which you are flying will have important effects on the coming fight.

The faster you are flying, the less maneuverable the F-22 will be. At higher velocities, your turns will be larger, and your breaks less crisp, due to the speed of the aircraft and the G-force limitations of the plane and pilot. At low velocities, the F-22 is highly maneuverable, due to its thrust vectoring system, but low speed manuevers rapidly eat up both velocity and altitude, and they can take more time to complete than maneuvers conducted at higher speeds. The speed at which your F-22 turns best, with the sharpest breaks and the least loss of speed and altitude, is called its corner velocity. For most flight configurations that speed will probably be somewhere near 400 knots, or a little less. To get the most out of your airplane, practice maneuvering it at various speeds, until you know what kind of response you can expect.

One factor you will have to take into consideration when flying the F-22 is that it can maintain maneuverablility at very low speeds or high angles of attack. Thrust vectoring does not provide the aircraft any extra lift. It simply allows you to maintain control of an aircraft that is actually no longer flying, but falling. This is a very handy feature, but it contains some dangers as well. In a normal aircraft, impending loss of control would signal a dangerous flight condition. In the F-22 you will not lose control, and so may fail to notice that, for example, your airspeed is down to around 60 knots, and that your aircraft is actually falling through the air rather than flying. This is an especially dangerous situation when you are in the middle of air combat, and might not have time to make regular speed and altitude checks. Since combat maneuvers usually cause loss of speed and altitude, you can suddenly find yourself very low, going very slow.

Flying at too low a speed can interfere with your ability to dodge missiles, because you cannot physically move the airplane fast enough to avoid the missile. Flying too fast can similarly interfere. At high speeds you cannot turn sharply enough to get inside the missiles turn radius. The missile, after all, is designed to maneuver

at high speeds, and with no pilot, it can make very high-G turns. To dodge missiles effectively you should be travelling somewhere near your corner velocity.

One tactical situation that calls for high speeds is JDAM bomb system delivery. The faster you are flying when you release your bombs the further they can travel, and the more kinetic energy they will have when they strike. If possible, always drop your JDAMs while at high speeds. You will be able to do so farther from the target's defenses, and your egress will be quicker.

Emmision Control (EMCON)

When your radar is turned on, you increase the chances that an enemy will be able to spot your aircraft. When your radar is turned off you cannot acquire targets for your best missiles, and, if there is no AWACS available, you may not even be able to spot other aircraft until they get quite close. Both modes provide significant advantages, and both lead to deadly dangers. You will have to resolve this contradiction.

The solution lies in common sense. Use your radar when you need to, and turn it off when you don't. You will need your radar to acquire targets for your AMRAAM, so don't be afraid to crank it up when you have enemy aircraft inside the AMRAAM range envelope. Turn on the radar until you get the Shoot Cue, then fire the missiles and turn the radar off. If you are flying with AWACS support, this may be the only time you have to use your radar.

If you do not have the support of an AWACS aircraft, your internal radar is your only early warning and target detection system, so you will have to use it less sparingly than you would if the AWACS were present. Just don't get carried away. Use the radar deliberately, to perform the tasks for which it was designed, then turn it off until you need it again. In practical terms, this means that you shouldn't keep your radar on at all times, but rather that you should make deliberate scans of your surroundings with the radar every so often. When flying a mission, turn on the radar every once in a while and make a 360 degree turn, keeping the nose of the aircraft pitched downward a bit while you turn. When you have scanned all around your location, turn off the radar and resume course, or take steps to deal with whatever your radar has turned up.

Wingman Tactics

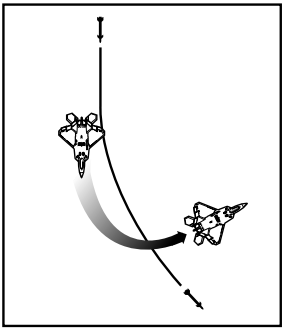
Strange as it may seem, many players forget that they are not alone. You have a wingman, and that essentially doubles your combat power, if you know how to use one. You should always have a positive role in mind for your wingman. Make sure that your wingman is doing something useful.

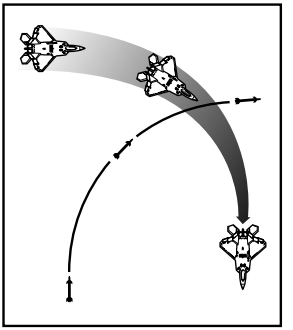
One of the most useful things a wingman can do is cover your butt. You can order your wingman to engage any object that targets you. This can be very handy, especially in situations where you are busy, and may not have time to deal with all potential threats. This can also be useful as a means of detecting an enemy trying to sneak up on your flight. As soon as the enemy turns on targeting radars, your wingman will attack, hopefully forcing the enemy to deal with the new threat rather than maintain the attack on you.

You can also use your wingman as a handy source of ordnance. By ordering your wingman to engage your target, you can keep target lock on an enemy and have your wingman launch the missiles, saving your own ammo for later in the mission. This can be especially useful on penetration missions, where you have to fight your way to an objective. Use your wingman to help get the flight through the danger zones.

Don't forget that you can order your wingman to head back for base and perform a Combat Air Patrol over it. This is especially useful for intercept missions, where you are trying to stop an enemy force from penetrating and attacking your base. While you fly out and try to engage the enemy before they get too close, your wingman can stay home and deal with any enemy aircraft that manage to get by you. Having a wingman covering the base is also nice when you are trying to bring back an injured aircraft, or one that is out of missiles. Your wingman can protect you long enough for you to land.

Missile Avoidance





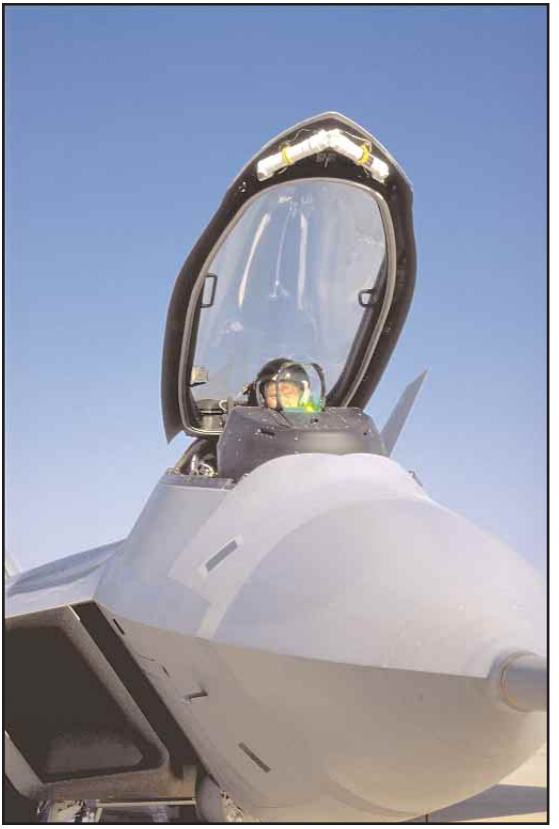
The vast bulk of the air-to-air combat in which you will engage will be missile combat. Avoiding enemy missiles is therefore an important combat tactic. The better you are at avoiding oncoming missiles, the longer you will stay in the air.

The first step in avoiding a missile is detecting it. Your Defense Display will track incoming missiles for you, giving you the opportunity to set yourself up to avoid them. Check this display often. The Attack Display also shows the tracks of missiles fired at you, so sometimes you can use the small Attack Display inset into the cockpit screen to spot incoming missiles.

Your F-22 will sometimes warn you of the approach of an enemy missile by releasing chaff or flares. Your aircraft sends out clouds of chaff when it detects an enemy target tracking radar lock, and launches flares when it detects a heat-seeking missile in flight. When you see that your F-22 is launching chaff or flares, maneuver immediately. Even if you don't know exactly where the missile is, it's a good bet that it knows where you are, so change things as rapidly as you can. As soon as your airplane warns you of a missile, execute a break turn and try to find your attacker.

If you have a missile incoming from fairly long range (more than five or six miles), you can be sure that it is radar guided. Unlike the AMRAAMs you carry, most radar missiles require that the launching aircraft maintain a radar lock on the target until impact. It may therefore be possible to move your aircraft out of the radar coverage of the firing aircraft, which will break target lock and force the missile to go ballistic (unguided). Try to gain a position behind the aircraft that fired at you. This should force the enemy radar to lose contact.

If you cannot break the target lock of the enemy missile with chaff, with flares, or by maneuvering your aircraft out of the radar envelope of your attacker, you will have to try to turn inside it. To do this, use the missile's speed against it. First, maneuver to put the missile on your beam, approaching from the side. This will force the missile to keep maneuvering to track you, wasting its fuel, and making it overcome losses in speed and altitude due to the maneuvers. Get yourself as close to your corner velocity as you can, so you can make a very sharp turn when the time comes. Finally, when the missile is very close, perform a break turn into the missile. You are trying to turn inside the missile's turn radius, so it will not be able to follow you through the maneuver. Do not break away from the missile. That just gives it additional time to find you, and keeps you inside its maneuver envelope. Make the break three-dimensional (change height as well as direction) to force the missile into an even more extreme situation. With any luck the missile will miss, and you will still be flying. Good Luck!



The rules of war have changed.
The wars of tomorrow will be won by those who control the battlefield.
Achieving air superiority will be the task of the only craft capable of striking at the heart of the enemy with impunity:

The F-22 Raptor.