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Quick Start: If you are the devil-may-care type of pilot who is ready to jump right in and sweep the enemy from the sky, we suggest you turn to the separate Quick Start Instruction folder. The more cautious flier will enjoy more success with a thorough reading of this manual before risking his electronic wings.

1. TUTORIAL

This Tutorial is designed to get you playing as quickly as possible. Detailed descriptions of game mechanics can be found in the following chapters of this manual.

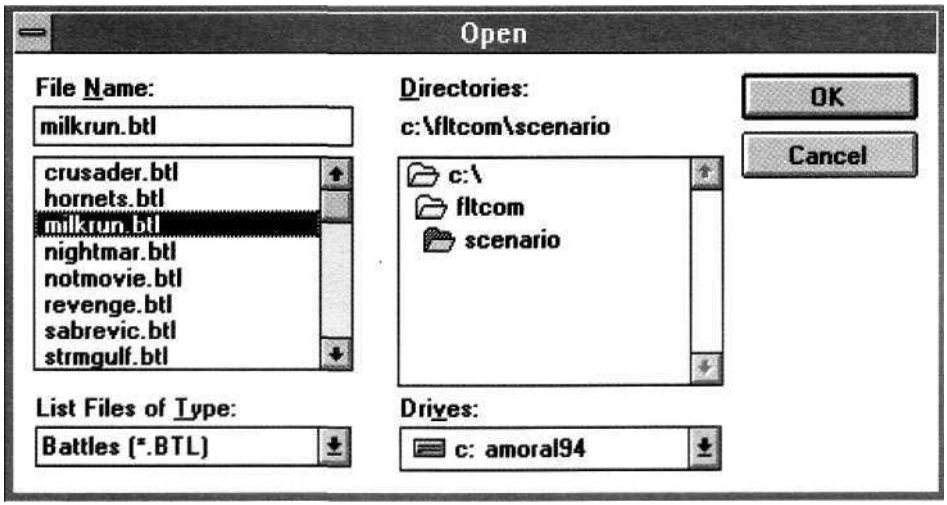
The Tutorial has two chapters. The first is a simple walk-through of a small battle called Milk Run in which you'll have a chance to attack dummy ground targets that won't shoot back. It will introduce you to the game's basic controls and concepts.

The second part is an introduction to a Campaign game in which you'll learn how to equip a squadron and lead it into battle. You will engage in air-to-air combat and learn about some systems not touched on in the Milk Run. You will also learn how to equip a squadron for a series of missions.

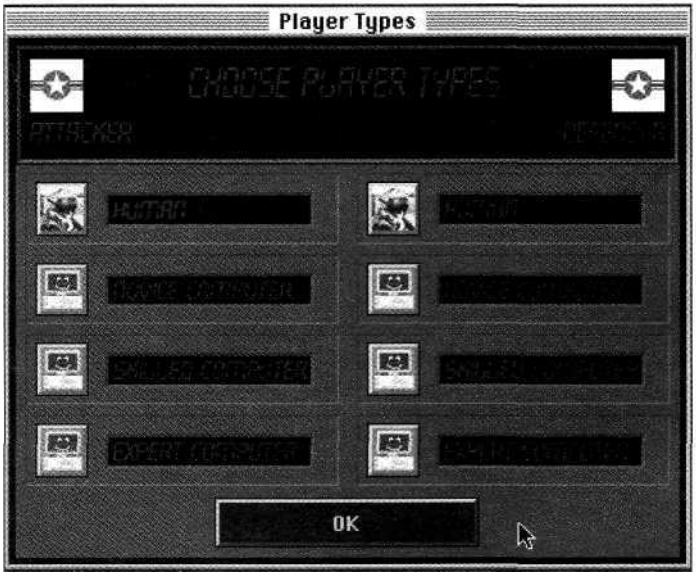
On a Macintosh, begin by double-clicking on the *Flight Commander 2* icon in the Finder to run the program. On a PC, load Windows and do likewise from the Program Manager.

START SCREEN

Following a rather impressive animation of the Big Time and Avalon Hill logos... Whoosh! You'll hear some jets flying overhead and the *Flight Commander 2* cover art will grace your monitor screen. Observe the five buttons at the bottom of the window which are pictured at the top of the page.



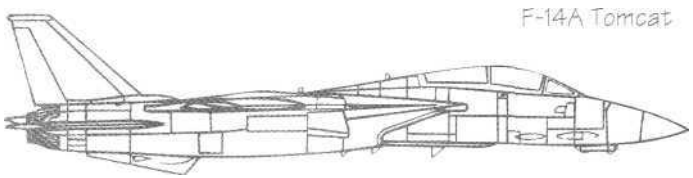
Click on the Open Battle button. This brings up the file dialog at left. Open the Scenario folder with a Double Click and then select the "Milk Run" scenario by double clicking on it also.

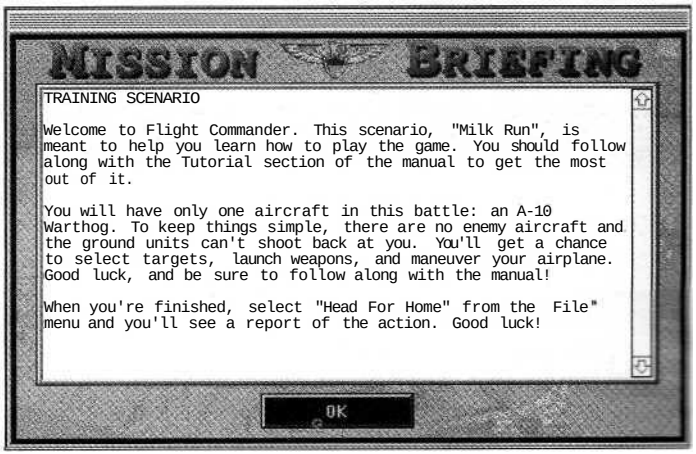


A Choose Player Types dialog will appear on screen. Here is the place you would normally select the quality of your computer opponent. In "Milk Run", however, there are no enemy aircraft so it doesn't matter. Just leave the settings alone (you will be playing the "attacker" as the human player). Click on the OK button.

DISPLAYS

The main battle screen will appear. The window on top of it is the Mission Briefing which prepares you for the coming battle.

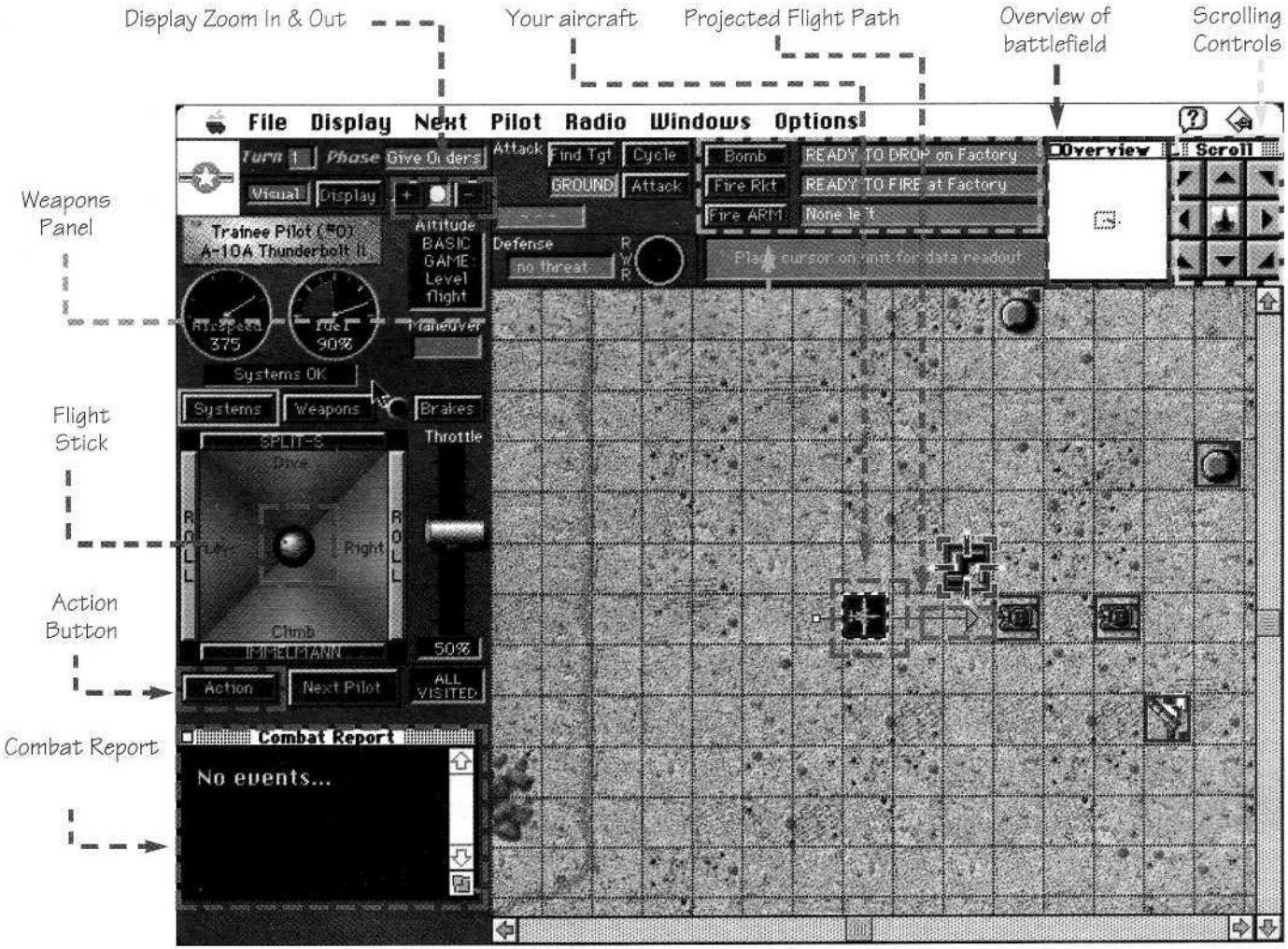




When you've finished reading about your upcoming mission click on the 'OK' button. The Mission Briefing window will be replaced by a Navigator window showing the direction to your target in red and your airbase in blue.

Click on "OK" to get into the action. You'll see all of the main screen now but before you do anything else, select Grid from the Display menu. This will show you the "squares" that aircraft and ground units occupy and move through. The screen will now look like the view on page 5.

COMBAT DISPLAY



The Combat Display occupies the lower-right portion of the screen. In it you'll see your A-10A Warthog aircraft which is green on a black (white on B&W monitors) background with a white marquee border.

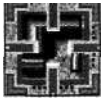
If you're using a small monitor, you may want to click and drag away the Overview, Scroll, and Combat Report floating windows to clear up more space on the screen. You don't have to do this, but the floating windows aren't important for this portion of the tutorial so you won't need them. You can also hide the floating windows by selecting them in the Windows menu.

To the right of your aircraft are the enemy ground units. It's your job to knock them out. You'll learn how to do that soon.

Tank

SCUD Launcher

Supply Depot

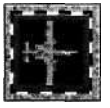


Factory

The Combat Display shows only a portion of the entire battlefield. You can move it around using the scroll bars. In this scenario all the combatants start out very close to one another, but this is not always the case. There will be times when units are spread out and you'll want to see a greater portion of the battlefield than is currently shown in the Combat Display. You can do this by Zooming Out. Look in the upper left corner of the screen for a button with a minus (-) sign on it. Click on it and you'll see the Combat Display "expand" to cover a greater area. Keep clicking on the minus button to zoom out even more. Clicking on the button with the plus (+) sign will zoom back in again.

If you should ever have trouble finding your aircraft after you've been scrolling the Combat Display, just select the Find Current Pilot item from the Display menu at the upper left. It will center the Combat Display on your aircraft. You can achieve the same result by clicking on the aircraft icon in the center of the Scroll Display or with keyboard command "Alt +F" in Windows. *Macintosh users must always substitute the Apple key for the "Alt" key of a PC.*

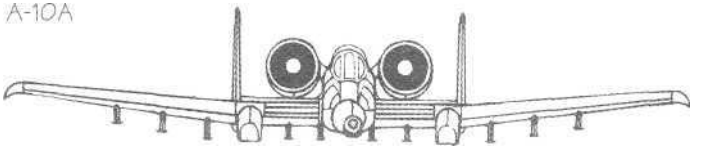
GIVING ORDERS

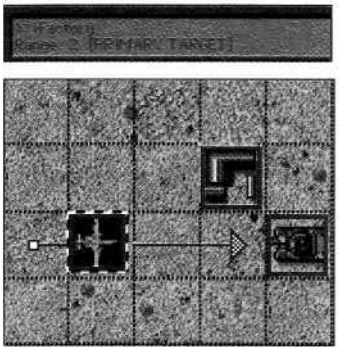


You give orders to each pilot separately. You can select a pilot by clicking on his aircraft. It will then be drawn with a shimmering "marquee" around its border. Its status will be displayed by Air Speed and Fuel gauges found on the left-hand side of the screen, beneath a brass plate with the pilot's name and the aircraft type. You have only one aircraft in this mission, though, so it is already selected to receive orders.

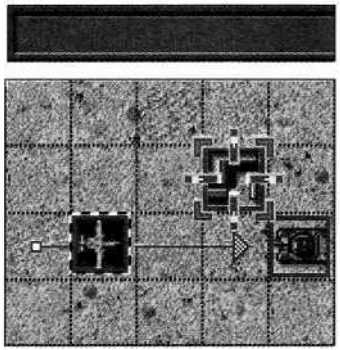
You're in the Give Orders Phase (which is indicated by the display in the very upper-left corner of the screen). Let's start giving some orders.

We'll start by dropping some bombs. Click on the enemy unit that looks like a factory. If it didn't already, it will now have a red, blinking "crosshairs" on it (black on B&W monitors). The factory is now your Selected Target. When you move the cursor over an enemy unit it becomes a (smaller) "crosshairs". The message panel directly above the Combat Display will identify the unit and its range from your aircraft. It will even remind you of the target's status as a primary target of the mission if that is applicable.





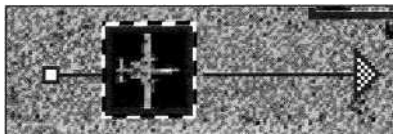
Before clicking on Factory



After Clicking on Factory

Observe the Weapons Panel at the top center of your screen. You'll see three displayed messages there, two of which are blinking. The top one blinks "READY TO DROP on Factory", and to its left is a button labeled "Bomb". Press that button and watch one of your bombs fly to the selected target. At the simplest level of play which we are using now you may observe the result of each bomb attack before deciding to bomb again. You may continue to bomb the target by pressing the button until you destroy the factory, run out of bombs, or decide to approach it from another angle.

The bomb may or may not hit (and a hit may not completely destroy the target). You can instantly observe the results of your attack by checking the message board at the top center of the Combat Display. If you destroyed the target, it will be replaced by a burning wreck. Either way, your attack is now complete for this turn. The instant you made a bomb attack, you'll note that the second line of the Weapons Panel stopped flashing. You could have made a Rocket attack instead, but you cannot do both. Once you bombed, the blinking "Ready to Fire Rockets" message was replaced by an "Already made ground attack" message if you failed to destroy the factory or a "no target selected" message if you did take out the target. Before we move on, take a look at your aircraft in the Combat Display. You will see an arrow extending straight ahead to the right. This represents the Flight Path planned for your aircraft. You can change it, but for now don't do that because you should fly straight ahead and over the tank in front of you in order to fire your cannon at it. Your Flight Path is straight by default, so we'll just leave it alone. You'll learn how to change your Flight Path soon.



You're all finished giving orders for this turn, so look to the lower left of the screen beneath the Flight Stick for the Action button. Clicking this button indicates to the computer that you've finished giving orders and that the Action phase should begin.

This is basically how the game is played. You give orders to each of your pilots in the Give Orders Phase, and when you're finished you click on the Action button to begin the Action Phase. You then see your squadron execute your orders. During the Action Phase, aircraft will maneuver, cannon will fire, radars will Lock on or be jammed, and visual contacts will be made and lost - all automatically. Then the process begins again with another Give Orders Phase. These two phases together make up one move, which represents 7.5 seconds of "real" time.

Press the Action button now and watch your A-10 fly forward and shoot at the tank! The sound of a jet plane flying overhead signals that the move is complete and the next Give Orders Phase is ready to begin.

The Combat Report window at the lower left of your screen notifies you of the outcome of your strafing attack. You can click and drag it away if you want to free up screen space.

Your aircraft is now two grid-squares closer to the enemy units than it was last turn, and even had a chance to strafe one of the tanks. You'll want to do the same thing this turn. First, let's fire a rocket.

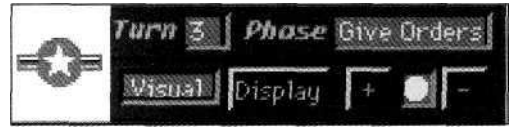
The crosshairs have already switched to another target without you selecting one and the top two lines of the Weapons Panel (if you still have any bombs left) may already be blinking to indicate that the plane is again ready to attack that target. However, we want the SCUD missile sites so we'll ignore the Supply Depot for now. Click on the nearby SCUD missile launcher instead. You'll see the second line of the Weapons Panel light up with "READY TO FIRE at SCUD" next to the "Fire Rkt" button. Click the Fire Rkt button and watch the missile move to its target. Unlike the earlier bomb attack, you will only be able to fire once. If the rocket misses, you'll have to wait for another turn to fire another rocket or drop bombs.

Systems Display

Weapons Readout

You can see how many weapons you have left by clicking on the Weapons button located on the left-hand side of the screen above the Flight Stick. The Airspeed and Fuel gauges will disappear, replaced by a weapons readout. Clicking on the nearby Systems button will bring back both gauges.

You've finished giving orders, so click the Action button to begin the Action Phase. As it flies over, your A-10 will take a shot at the second tank. Cannon attacks occur automatically - your pilot fires whenever he sees an opportunity.

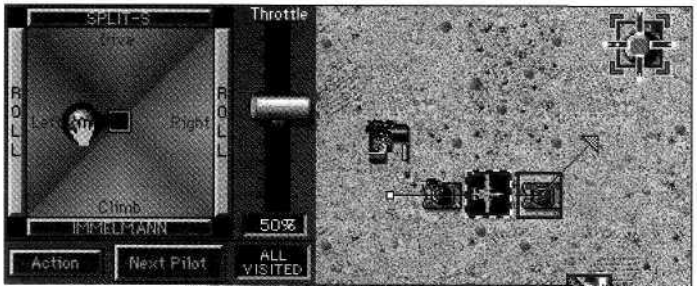


Congratulations, you have just successfully completed your second turn of *FLIGHT COMMANDER 2!* Look up in the upper left hand corner and you'll see that the Turn Display now indicates that you are in Turn 3. Let's try something new: maneuvering. Do you see the supply depots near the top of the screen? They look like oil drums. Let's go after them. To do this, you'll need to make a left turn. Click and drag the Flight Stick (which you'll find on the left-hand side of the screen) with the mouse.

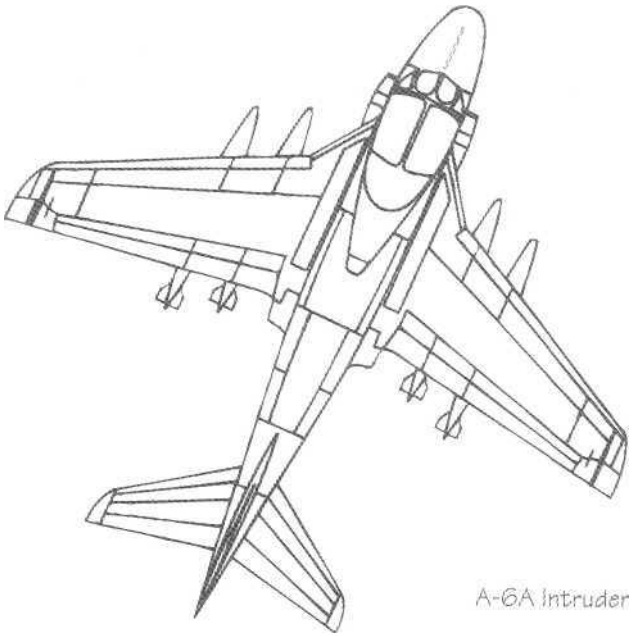
For the moment, just play around with the Flight Stick. Move it left and right. Observe the Flight Path (the arrow extending from your aircraft in the Combat Display) changing as you move the flight stick. The Flight Path is the course your aircraft is planning to follow in the upcoming Action Phase. You can change that Flight Path by adjusting the Flight Stick.

Aircraft can point in any of eight directions. Move the Flight Stick to the left of center as shown at right so your Flight Path is pointing at the enemy supply depot.

Click on the Action button to commit to the maneuver. Your A-10 will now make the left turn that you instructed. You should now be able to click on the supply depot and fire more rockets or drop bombs on it. Good luck!



Now fly around and use your remaining weapons against the other ground targets. It's good practice. Remember to use the Flight Stick to plan your maneuvers and to select targets by clicking on them. You can also use your cannon by flying directly over targets. Your pilot will fire automatically (except at the factory which can't be damaged by cannon fire).



When you feel comfortable with what you've seen so far, select the Head For Home item from the File menu. A message window will appear asking you to confirm your decision. Normally, if you are in close contact with the enemy when you head for home, the computer will take over your command while your forces disengage. You may choose between a Quick Withdrawal or a Fighting Withdrawal and the computer will then play out the End Game. However, there is no aerial opposition in the Milk Run so you can simply choose to "End the Mission". If you click the End Mission button, the scenario will end, but not before a Mission Debriefing Screen appears to inform you of the final outcome. After reading it, click on OK and you'll be brought back to the Start screen.

If you find the speed of the Action Phase either too slow or fast for your taste, you can change it by selecting "Slow", "Normal" or "Fast" Action Phase under the Options menu.

Now that you've had your first taste of *FLIGHT COMMANDER 2,* you should move on to the next chapter to see how both air-to-air combat and Campaign scenarios work. It's full of tips and explanations you'll find helpful.

2. CAMPAIGN TUTORIAL

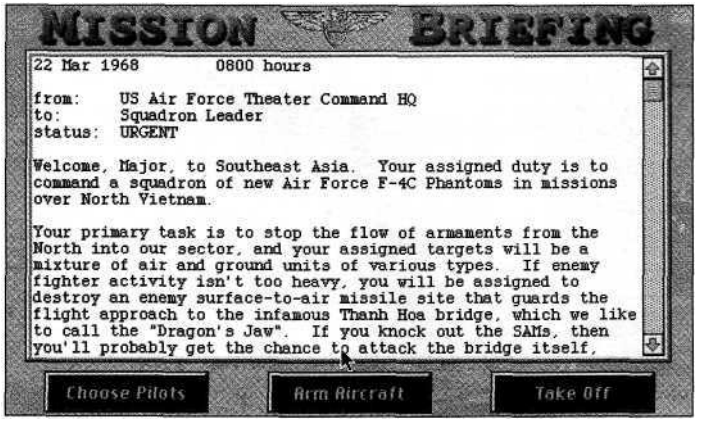
Congratulations. You've completed the Milk Run and you're ready for more. Let's try playing the first mission of a Campaign scenario in which you'll engage in an aerial dogfight. We'll also introduce a few more on-screen controls.

You should be back at the Start screen with the big picture of the *Flight Commander 2* cover art. This time click on the Open Campaign button. This brings up a file dialog. Open the "Scenario" folder, and then select "The Dragon's jaw". In Windows, this is listed as "dragnjaw.cam".

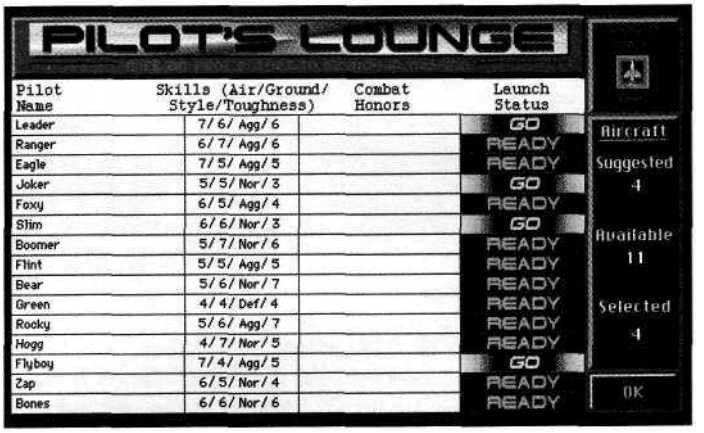
The Player Types dialog will again appear on screen. Select "Novice Computer" for the North Vietnamese side. You will fly with the U.S. Air Force. Click on OK when you're done. You're now in command of a squadron of F-4C Phantom jets operating in Southeast Asia.

MISSION PREPARATION

You'll see the Mission Briefing window next. It shows your base commander's report about the purpose of your campaign as a whole and the first mission you're about to fly. Read the information in the window (you may have to scroll down to see all of it). It's important!



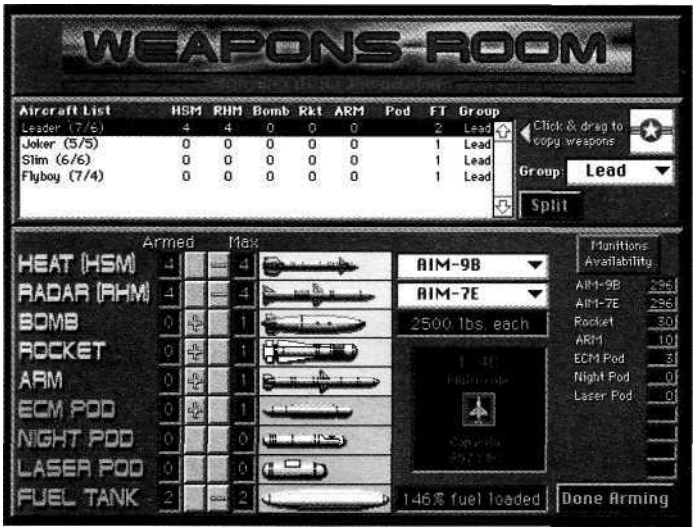
When you've finished reading about your mission, click on the Choose Pilots button to select which pilots from your squadron will fly. You have fifteen pilots under your command, but not all of them will participate in each mission.



The Pilot's Lounge window will appear. Take a look at the upper right corner and you'll see a silhouette of an F-4C Phantom. This is the type of aircraft your squadron flies. Below that are the number of aircraft that your base commander suggests you take on this mission, the total number of aircraft available (some must be held in reserve for upcoming missions), and the number currently selected to fly.

Most of the window is occupied by a "ledger" containing the names of the pilots in your squadron and related information. Click the mouse on a pilot's row in the ledger to select him to fly on this mission. Choose four since that is the recommended number. For now, it doesn't matter which pilots you choose.

Once you have finished selecting pilots, click OK and you'll be brought back to the Mission Briefing. Now click on the Arm Aircraft button.



The Weapons Room window appears. Observe the upper left and you'll see a scrollable box (the Aircraft List) with the names of the four pilots you chose to bring on this mission. The two parenthetical numbers following each pilot's name are his Aerial/Ground target skill ratings. Such information is helpful when doling out rare resources like ECM pods. Next to each name is a row of zeroes signifying that each pilot's aircraft currently has no weapons loaded. The first pilot's row is highlighted, so the "+" or "-" buttons you click to add or remove weapons will affect his aircraft. Once you're done with the first pilot, you can click on the rows for the other pilots to arm each of them also. Alternatively, if you wish to arm some or all of your aircraft in the same way, you can click on one armed aircraft and drag it to the next aircraft to copy its armament.

The following abbreviations are used in the Weapons Room:

- HSM: Heat-seeking missile.
- RHM: Radar-homing missile.
- Rkt: Rocket.
- ARM: Antiradiation missile.
- FT: Fuel tank.

Click the "+" button to the right of the "HEAT (HSM)" entry on the left side of the window, about mid-way down. Just to its left, in the ARMED column, the "0" signifying that no heat-seeking missiles are currently loaded has just changed to a "1". Now click and hold that "+" button until that number reads "4". That is all the heat-seeking missiles this aircraft can carry as signified by the "4" in the "Max" column to its right and the blank green button which replaced your "+" button. You have just loaded four heat-seeking missiles onto the first pilot's aircraft. If you look across that row to the right you will see an illustration of the missiles you have just loaded. To the right of that picture is a Pop Down Menu that names the heat-seeking missiles you have just loaded - AIM-9B's (an early model Sidewinder). In battles that take place in more modern periods, you'll often have a choice of different types of missiles. Click on the Pop Down Menu to see the choices available to you and select the missile type you want. For this scenario, however, the AIM-9B is the only heat-seeker type available to you.

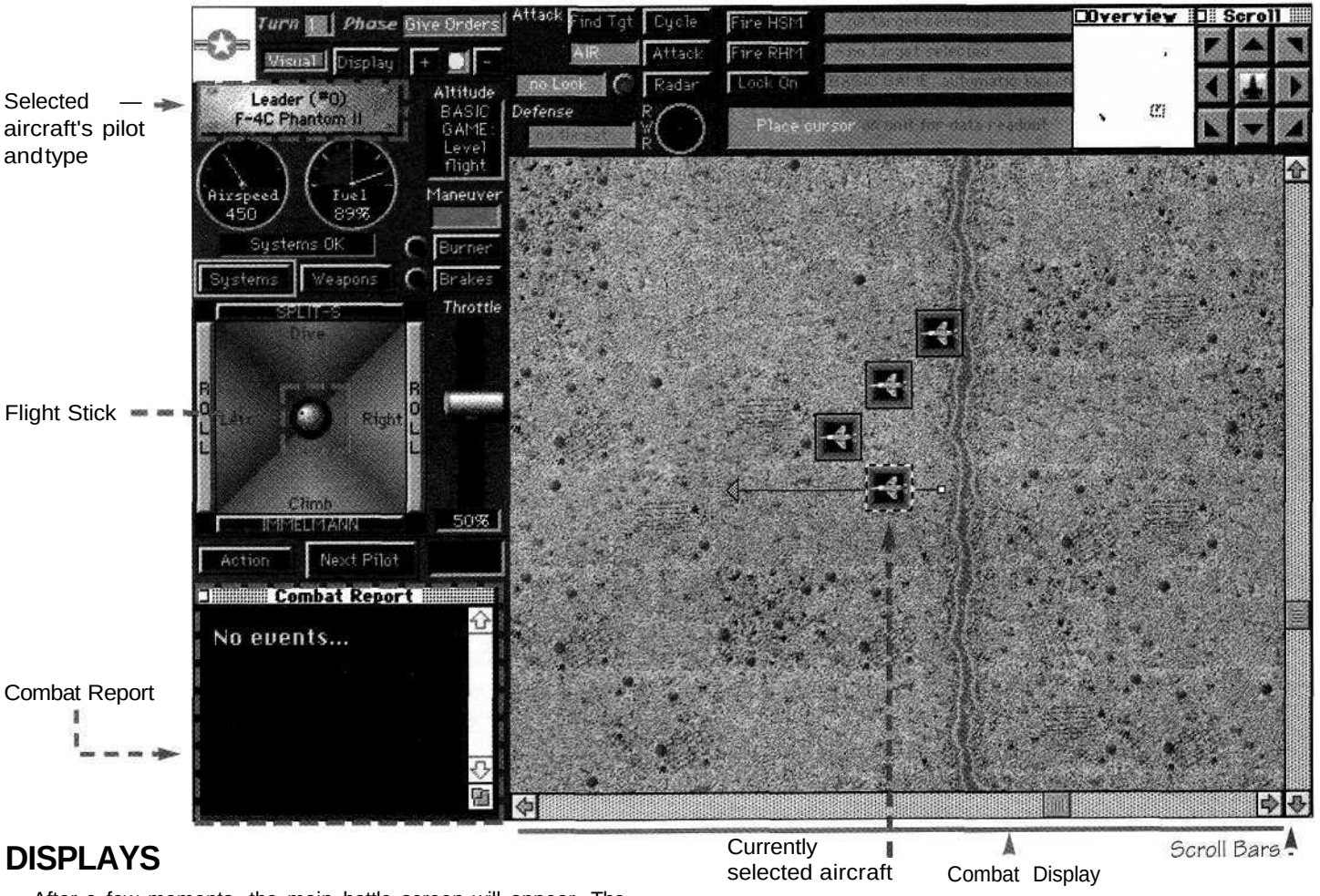
Now drop down to the next row of RADAR (RHM) missiles. You may have noticed that when you loaded the four heat-seeking missiles, your "Max" load of radar-homing missiles dropped from "6" to "4". Click and hold the Radar (RHM) "+" button until you've loaded four radar-homing missiles. Then add a second fuel tank by clicking on the Fuel Tank "+" button. (Your crew chief has already added one). Regardless of how much fuel you load, once you begin play you'll notice that your fuel level is less than what you loaded since your aircraft will have been flying a certain amount of time before the game joins them in flight with the action about to begin.

The last column entry in the Aircraft List is "Group". You can assign your pilots to one of four different attack groups by selecting the group type on the "Group" Pop Down Menu at the upper right. For now, keep everyone in the Lead Group.

You've just armed a Phantom jet! Copy that weapons load to the other aircraft by clicking and dragging the "loaded" aircraft's entry line onto the other three in the list (one at a time).

You're ready to go. Click the Done Arming button.

You're now back at the Mission Briefing. Click the Take Off button to enter combat.



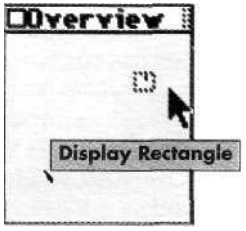
DISPLAYS

After a few moments, the main battle screen will appear. The Combat Display occupies the lower-right portion. In it you'll see your aircraft which are green on a blue (white on B&W monitors) background. The game is played on a grid, and each of your aircraft occupies a square on the grid. If the grid is not visible, you can activate it by selecting "Grid" from the Display menu.

NOTE: Campaign missions set your aircraft up in a different formation each time they're played, so some of your displays may not appear exactly the same as the ones pictured in the manual.

The Mission Briefing said your objective is to dogfight with MiG-17 fighters. Well, where are they? Unlike in the Milk Run scenario you just played, the Combat Display probably isn't big enough to show all the combatants at once if they're far apart.

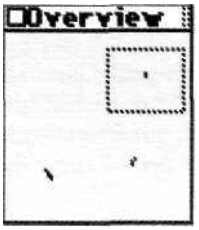
To find the MiGs. take a look at the upper right hand corner of the screen and locate the little floating window titled Overview. This window shows a miniature view of the entire battlefield. The Combat Display shows only a (magnified) portion of the battlefield. The clusters of small dots in the Overview window represent the aircraft in the battle, both yours and the enemy's. Inside the Overview window you'll also see a small rectangle around one of the clusters called the Display Rectangle. It shows that portion of the battlefield which you can see in the Combat Display. The dots inside this rectangle are your aircraft.



Move the mouse up to the Overview window and click on a group of dots other than the one that's already inside the Display Rectangle. You'll notice that the Display Rectangle moves to where you clicked the mouse, and the scene inside the Combat Display shifts accordingly.

You should now see some of the enemy aircraft in the Combat Display. They are white aircraft silhouettes on a red-framed (just black on B&W monitors) background. If you don't see any such aircraft in the Combat Display, keep moving the Overview window's Display Rectangle around with the mouse until it encloses some of the little dots which represent aircraft.

You may want to see a greater portion of the battlefield than is currently shown in the Combat Display. You can do this by Zooming Out, just like you did in the Milk Run. Look in the upper left corner of the screen for a button with a minus sign (-) on it. Click on it and you'll see the Combat Display "expand" to cover a greater area. Notice that the Display Rectangle in the Overview window grows also. Keep clicking on the "-" button to zoom out even more. Clicking on the "+" button will zoom back in again.

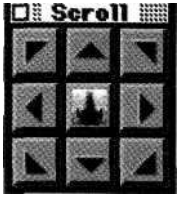


You can move the Combat Display around by using the scroll bars or the eight directional-arrow buttons in the Scroll floating window. The center button in the Scroll window centers the Combat Display on the aircraft receiving orders.

Because Campaign missions are designed to be a little different each time they're played, it's possible that your setup might have the MiGs starting out very close to your aircraft. This is normal, but for training purposes you'll need a little distance between you and the enemy to earn how to use your missiles, so if the MiGs are just a few grid squares away from your aircraft, quit and start this section of the tutorial over again.

GIVING ORDERS

In this scenario you have more than one pilot under your command, but you will still give orders to your pilots one at a time. You can give orders to a pilot by clicking on his aircraft. It will then be drawn with a shimmering "marquee" around its border and its status will be displayed by gauges found on the left-hand side of the screen, along with the pilot's name and aircraft type.



Click on the center "aircraft silhouette" button of the Scroll window. This centers the Combat Display on the currently selected aircraft (in case it isn't already) so you can see it. Incidentally, the "Find Current Pilot" item in the Display menu does the same thing.

Now look at the Overview window and determine where the enemy aircraft are located relative to your aircraft. You can also sometimes locate the enemy by Zooming Out all the way so the Combat Display shows a larger area. A quick way to do this is with keyboard command "Alt +-".

You want to point straight at the MiGs so you'll probably need your aircraft to turn left or right. You accomplish this by clicking and dragging the Flight Stick with the mouse, just like you did in the Milk Run. You'll find the Flight Stick on the left-hand side of the screen. Remember that as you move the Flight Stick back and forth, you change the Flight Path for the currently selected aircraft.

Aircraft can point in any of eight directions. Use the Flight Stick to change the Flight Path of the currently selected aircraft so that the arrow on the tip of the Flight Path is pointing toward the enemy MiGs. The maximum turn you can make is ninety degrees either left or right, so you won't be able to point at the MiGs right away if they started out behind you. If that's the case, just turn so you're pointing as close to them as possible.

Your aircraft's radar system has already been activated (by default) but you should take note of the Radar button located near the top-center of the screen. An adjacent red light (white on B&W monitors) will indicate that it's on. You'll need the radar to fire your radar-homing missiles, which you'll learn how to do soon. Don't turn it off!

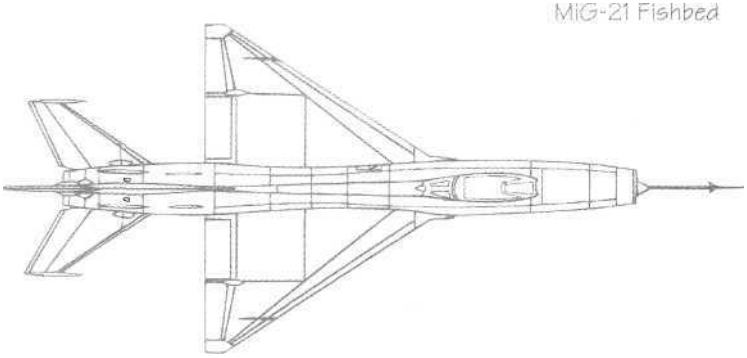
Now click on the "Next Pilot" button that's located just below the Flight Stick (or select the "Next Pilot" item from the Next menu). If you prefer you can do the same thing by pressing the space bar, or use keyboard command "Alt +N". This transfers you to the cockpit of the next jet in your squadron, just as if you had clicked the mouse on it. Make this pilot turn toward the enemy as well. Then alternate clicking on the Next Pilot button and using the Flight Stick to order your remaining aircraft to turn toward the MiGs.

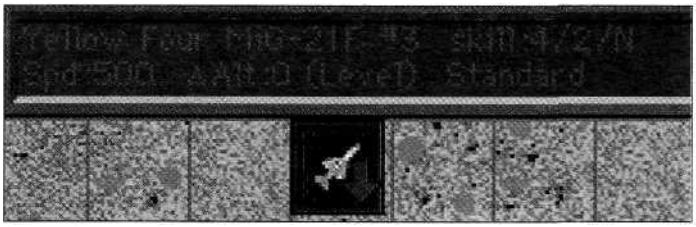
When you've "visited" every aircraft, the little panel to the right of the "Next Pilot" button will light up and display "All Visited" as a reminder that you've cycled through the entire squadron. You can continue to revisit your pilots and change their prior orders for this turn as many times as you like until you press the Action button.

Remember that *Flight Commander 2* is not a "flight simulator". At this point you are giving orders to your pilots, not actually moving their planes. You can switch from pilot to pilot planning moves as much as you want. You can change your mind. You can even go have dinner if you like, and when you come back to the game nothing will have changed in your absence. You're not committed to anything until you click on the Action button, located just to the left of the Next Pilot button. That causes the Action Phase to begin, and your pilots will carry out the maneuver orders that you gave them. There is one exception to this. The firing of weapons occurs immediately when ordered.

When you're finished changing the Flight Paths of your aircraft, click the Action button (or select the equivalent Begin Action Phase item from the "Next" menu or use keyboard command "Alt + E"). You'll see your aircraft move across the Combat Display just as you planned. The sound of a jet plane flying overhead signals that the next Give Orders Phase is ready to begin.

Now "visit" each of your aircraft again. If any of them isn't yet pointing at the enemy MiGs (which you can locate in the Overview window) maneuver them to do so. Make sure all radars are switched on (they will be unless you turned them off).





INFORMATION SYSTEMS

Before going any further, let's take a look at the information systems available to you. Any time you point the cursor at an aircraft or ground unit inside the Combat Display, the Data Readout (located at the bottom of the Weapons Panel) will display information about that unit. So, for example, if you want to know how fast an aircraft is moving, just point the mouse at it (you don't need to click) and then look at the Data Readout. Try it out by pointing the mouse at some aircraft on the screen.

The crosshairs appears when the cursor is clicked on a unit you can fire on or Lock your radar onto. All enemy units whom you can currently fire on will be drawn with a yellow border.

Green corners are shown when you point at an enemy you can't currently fire at or Lock-on to.

The mouse cursor will change depending on the unit beneath it. There are several different depictions:

The downward arrow appears when you're pointing at a friendly plane which you can select and command. If you click the mouse, you'll switch to that plane. The marquee border will appear on the new aircraft signifying that it is ready to receive your orders.

You can change the cursor into a magnifying glass symbol by holding down the shift key. Clicking on the mouse while in the magnifying glass mode will then perform the Zoom-in function.

Finally, there is the stack-switch cursor that looks like two little arrows going in a circle. This cursor appears when the mouse is pointing at a stack (more than one aircraft occupying the same grid square) and the Control and shift key (Option and Shift keys on the Macintosh) are held down. Clicking the mouse button will bring the next aircraft to the top of the stack. If you continue clicking you can cycle through and see all the aircraft in the stack. There is no advantage to being on the top of a stack. It's just a way to show who is there.

COMBAT SYSTEMS

And now back to the action. If at any time you should hear a buzzing noise and see a message flashing "READY TO FIRE" next to the "Fire RHM" button, it means that your radar has locked on to an enemy MiG and your radar-homing missiles are within range to be launched. Don't worry if this hasn't happened yet.

You may have noticed that the buttons on the Weapon Panel have different names than they did in the Milk Run. That's because you're in air-to-air attack mode now, and were in air-to-ground mode before. You can check this by looking at the display next to the Attack button. It should say "Air". If it doesn't, click on the "Attack" button.

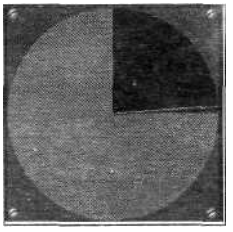
Be sure to "visit" all of your aircraft every turn regardless of whether you intend to change their Flight Path so you will notice if any have a chance to launch a missile. It may take a while, especially if the game starts with the MiGs far away from you. Normally your maximum launch range is about 25 squares.

Each time you select one of your aircraft for orders (either by clicking on it or the Next Pilot button), the computer automatically checks to see if the aircraft can fire. If it can, you'll hear a buzzing sound and the target will be selected automatically. If you can't see the target inside the Combat Display (this is common due to the relatively long range of radar-homing missiles), you can either click the

"Find Tgt" button or select the "Find Selected Target" item from the Display menu (or use keyboard command "Alt T"). The Combat Display will scroll over to your intended target. Clicking on the center button of the Scroll window returns the combat view to your aircraft. It can also be useful at times like this to "zoom out" using the minus "-" button to see a larger portion of the battlefield inside the Combat Display.

You don't have to let the automatic targeting system dictate your target selection. You can click on any enemy target you wish. A red pulsing crosshairs will appear on the target you click. If you can fire, you'll hear a buzzing sound and see one or more "READY TO FIRE" messages flashing in the Weapons Panel of the upper right corner of your screen. The crosshairs will be red (black on B&W monitors). If you can't fire, the Weapons Panel will show you the reasons why, and the crosshairs will resemble a green box (white on B&W monitors). A shortcut to clicking on the enemy units themselves is to click the "Cycle" button to the left of the Weapons Panel which will automatically put the crosshairs on the next potential target.

Sooner or later you'll have a chance to shoot (when the Weapons Panel flashes "READY TO FIRE"). When this happens... wait! Acquaint yourself with the Radar Display first. Click on the Display button (adjacent to the Zoom-in (+) and Zoom-out (-) buttons in the upper left). Your aircraft's radar screen will appear in the Combat Display. The MiGs show up as small white squares. The squares represent the MiGs you are Locked-onto. The red one is the MiG you have selected to attack. You can click on these little squares to select target just like you can in visual mode, but don't do that now. Click again on the Display button to return to visual mode. Now click on the Fire RHM button and watch your missile fly. Most likely it will miss. Don't be surprised if that happens. Even a miss often serves a useful purpose since it usually evokes some type of defensive reaction from the target.



OUT OF THE FRYING PAN ...

Keep firing radar-homing missiles each turn until the enemy MiGs are too close. At that point the radar-homing missile display will say "too close". You're now in dogfight range! It's up to you to take it from here. Remember that your Phantoms do not have internal cannon but the enemy MiGs do. These cannon have a range of one grid square and are fired during the Action Phase so try to keep the MiGs at a safe distance. It helps to keep your speed high so push your Throttle (the sliding control to the right of the Flight Stick) up to 100%. Use Afterburners if you need extra speed by clicking the "Burner" button above the throttle. The light next to the button will turn red when you use your Afterburners and your engine will emit a sonic boom. Be aware that hard maneuvering (especially a ninety-degree "High-G" Turn) causes significant deceleration.

The MiGs have no missiles. At close range your radar missiles are of little .use because they have a, minimum range below which they cannot be fired. Your heat-seekers work better at short range, but may only be launched at a target from the reap, so try to get on a MiG's tail and fire! Remember that you can select an enemy MiG as a target by clicking on it. A crosshairs will appear on the MiG. If it's red you can fire. If it's green you can't (look in the Weapons Panel Displays to see the reasons why).

Here's a tip: split up. Send two Phantoms to the left and two to the right. Once your fighter pairs are on opposite sides of the group of MiGs, turn toward them. That way, no matter which way the MiGs fly, at least one of your Phantoms can get a good shot from the read Have yourself a MiG "sandwich".

If you don't want to command the entire flight, you can put some of your aircraft under computer control. Click on an aircraft and then select the Computer Control item from the Pilot menu or use the keyboard command "Alt +9". Beginning with the *next* turn, that pilot will fly on his own with no orders from you. At any time you can regain control by clicking on him and selecting Human Control from the Pilot menu or keyboard command "Alt +8".

The mission will end when all of the aircraft on one side are shot down or you select Head for Home from the File menu. However, if you select this option and your aircraft are still closely engaged, the computer will take control and fly your aircraft while they seek to disengage. You have two choices. "Quick Withdrawal" sends your aircraft directly home while "Fighting Withdrawal" will commit them to mix it up with any nearby enemies for a few turns before breaking for home. The latter option is preferable for covering your retreat if enemies are nearby, but takes longer. Neither option is particularly safe if you are in a disadvantaged position, so don't rely on it to pull your butt out of the fire when you get a MiG on your tail. In either case, the Combat Display will turn to the second-largest scale and you'll be able to view the withdrawal before the Mission Debriefing sums up the action. You can most definitely be shot down while heading for home so don't resort to this unlessyou've destroyed the enemy, broken contact, or are willing to face the consequences.

If you're disappointed by the lack of fee of the third dimension, don't despair. In the Basic Game (which you're now playing) all aircraft are considered to be at the same altitude and vertical flight is not allowed. Because of this, the Flight Stick can only be moved horizontally. This greatly simplifies the game for novices so it's recommended that you play this way for your first few games. Altitude can be introduced through one of the combat options discussed in the Commander's Reference chapter. These options can be added individually or together to greatly enhance realism and increase the challenge.

For those of you who prefer keyboards to mice, there are keyboard equivalents for many of the commonly used commands. Select "Hot Keys" from the Windows menu to see an on-screen listing.

Once you feel comfortable with the basics of play presented in this Tutorial, you should proceed through the manual for more information and greater detail. There are many scenarios and campaigns from which to choose. Each is described fully in the accompanying Mission Briefing window.

RATING THE CAMPAIGNS

The Campaigns are purposely designed to offer differing levels of difficulty so that players can experience a Campaign without frustrating novices or boring expert playersThe Campaigns are rated from 1 (easiest) to 5 (the most difficult).

- 1. Tank Busters (A-10s in the Persian Gulf); tankbust.cam
- 2. South Atlantic '82 (Harriers in the Falklands War; southatl.cam
- 3. The Dragon's Jaw (F-4s in Vietnam); dragnjaw.cam
- 4. Thin Blue Line (F-15Es in Europe 1997); thinblue.cam
- 5. Red Storm (MiG-23s in Europe 1997); redstorm.cam

We suggest you begin your Campaign experiences at the simpler level and move on to the next level of difficulty only after winning a Campaign. By the time you've won Red Storm, you can claim mastery of the game.

One of the more rewarding features of playing a Campaign is gaining skill levels for your most successful pilots as they awarded medals for attaining "Ace" status by scoring five kills.

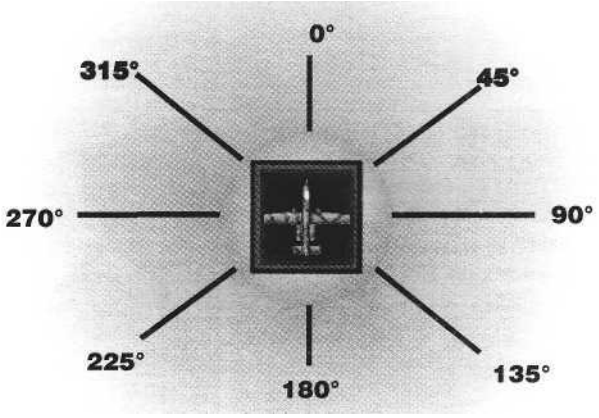
3.GAMEMECHANICS

This section is a detailed reference to *Flight Commander 2.* If you haven't done so already, please read and play through the Tutorial sections before continuing.

SCALE

Flight Commander 2 is played on a grid. Each grid square represents an area one-third of a mile (1,760 feet) across. An unlimited number of aircraft may occupy the same square. Each level of altitude also represents 1,760 feet. Each turn represents 7.5 seconds of "real" time.

Aircraft can face any of eight directions. Each direction change occurs in increments of 45 degrees. It requires 150 MPH of airspeed to move straight ahead one grid square in a move, and 210 MPH to move one square diagonally. For example, an aircraft traveling at 600 MPH can move four squares straight ahead in one move. Fractional MPH values are carried over to the next move. It also requires 150 MPH to move up or down one level of altitude.



If this seems complicated, don't worry about it. You won't have to solve any equations while you play. The computer takes care of it all.

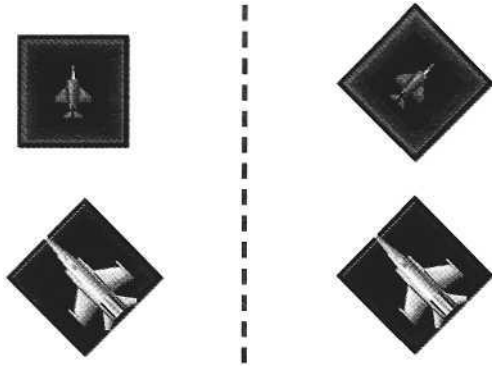
TURN SEQUENCE

The game is played in a series of moves. Each move has the following phases:

- Give Orders (you interact with the game)
- Action {you watch the action unfold)
- Movement and Cannon Attacks
- Antiaircraft Fire
- Detection (visual spotting, radar, IRST)

BEARING

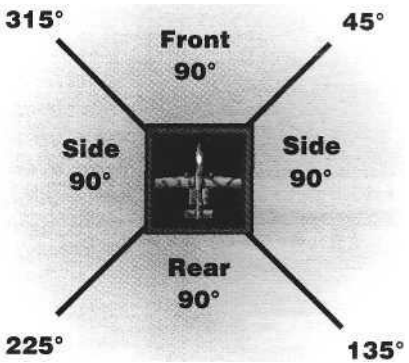
A term you'll often see in this chapter is Bearing. It refers to the angle at which an object lies relative to another object. There are two kinds of bearing: Absolute and Relative. Absolute Bearing uses values pegged to the screen, whereas Relative Bearing uses measurements based on the facing or heading of one of the objects involved.

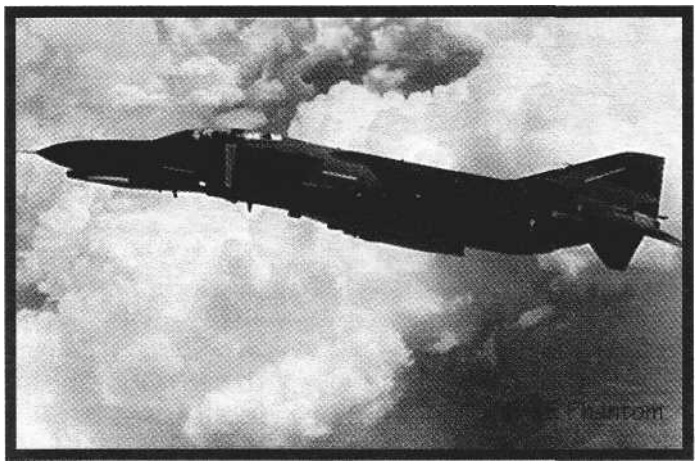


For example, in the figure above, the red plane on the bottom bears 180° (both Absolute and Relative) to the blue one on top. In the illustration on the right, the red aircraft still bears 180° Absolute but now bears 135° Relative, because the blue plane has turned 45° to the right.

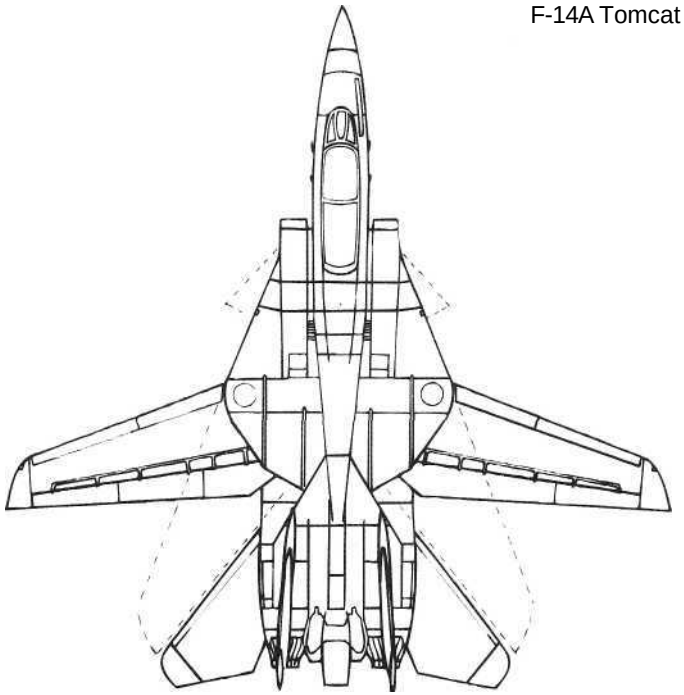
ARCS

Arcs are zones of airspace in the horizontal plane (the geometric kind of "plane", that is) with respect to the facing of an aircraft. See the figure below. Usually you'll be concerned about what arcs enemy aircraft lie in relative to your aircraft. For example, an enemy jet in your rear 90° arc can "tail" you, and you can only launch missiles into your own front 90° arc.

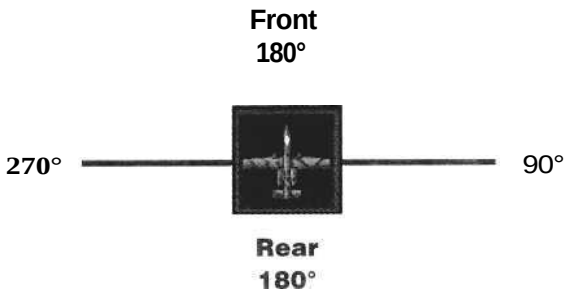




F-14A Tomcat



Arcs are similar to Relative Bearing. For example, if an enemy aircraft bears (relatively) between 135° and 225° to you, then it's in your rear 90° arc.



4. MISSIONS

There are two general types of mission in the game: air combat and ground attack. Air combat missions are the classic "dogfight" or "air superiority" missions and involve aircraft only. The object is simple: shoot down enemy aircraft while preserving your own. In a ground attack the attacking aircraft have the goal of destroying a particular ground target. That target may be defended by ground-based antiaircraft units and fighter planes. Ground attack missions often involve some air-to-air combat as well, usually when defending fighters attempt to shoot down incoming bombers.

SCENARIOS

All missions take place within the context of a scenario. Scenarios, in turn, come in three types: Battles, Generated Battles, and Campaigns. You can play the scenario of your choice by clicking the appropriate button on the Start screen.

Battle

Battle scenarios are single missions that recreate a combat engagement from history or an interesting hypothetical conflict. A battle is stored on disk and its forces and deployments remain the same each time it's played. When you play a battle, its full description will be displayed in the Mission Briefing on the first turn of the game.

Generated Battle

A Generated Battle is identical to a standard battle except that instead of being stored statically on disk it is created by the computer after you enter a set of battle parameters. You choose the mission type, decide which air forces will attack and defend, determine the size of the opposing forces, etc. The computer fills in the remaining details and sets up the game. It can even select and arm aircraft for your opponent in secret! Generated battles are so varied that they provide an infinite number of different games to play, each of which can be created with just a few clicks of the mouse.

The Create Battle window appears when you click the Create Battle button on the Start screen. It uses Pop-Up menus to enter information. In the first row, titled "Nation", you'll select the nationalities (and time periods) for the attacker and defender by clicking on the Pop Up Menu V and making your selection.

Below that is the Force Size line which you can use to select the number of aircraft in your scenario. You can increase or decrease force size by use of the green arrow buttons. The pop-up menu on this row gives you the choice of measuring force size in aircraft or C(ombat) Points. A Combat Point (CP) is a measure of aircraft quality. CPs are useful in balancing scenar-

ios between combatants of greatly different technology levels. For example, in a scenario pitting the U.S. Navy (with its high-tech F-14 Tomcats worth 62 CPs each) against North Korea (which uses obsolescent MiGs costing 32 CPs each) it would be fairer to allow each side an equal number of Combat Points, so the North Koreans will get double the number of aircraft.

In Air-to-Ground scenarios, the attacker will generally need a 3:1 advantage in CPs to approach balance.

The "Random Adjust" line is next. Selecting a value other than zero will cause the actual size of the force to be randomly chosen. This is useful if you want to add the "fog of war" to your games. It's fun to set up your enemy with a random factor because then you won't know how many aircraft he's got until you find them, just as in real life. For example, if a side is set up to have eight aircraft and a random value of ±40%, it will actually receive anywhere from five to 11 aircraft when the battle starts (and the opposing player won't know exactly how many).

The "Range to Home" line is the next category. Enter a value describing how far the battlefield is from the airbase from which that side took off by clicking on the Pop Up Menu ▼ and making your selection. This affects the amount of fuel required for the round trip and can be significant, especially for aircraft with "short legs". Increasing the range from an airbase is another way to subtly handicap a side in a created battle.

"Controller" can be either ground or AWACS-based radar stations that saturate the battlefield with long-range search radars. With a radar controller, a side will be informed of the locations of all enemy aircraft (except stealth-equipped ones). The Controller does not appear as a unit on the battlefield.

The "Selection" line is the last entry. Choose "Automatic" if you'd like to have the computer choose the aircraft for a particular side or "By Player" if you'd rather do it yourself. Either way, the game knows what aircraft are operated by which air forces and will make (or allow you to make) intelligent and realistic choices.

Now look to the lower-left corner to examine the Target Selection box. This is where you select the mission type. Click on either button to cycle through your choices. There are 14 ground attack and two air combat missions to choose from:

1. Headquarters control military command, control, and communications facilities. Their bunkers are impervious to cannon. Rockets are less effective against them.

2. SCUD Site. Attack a battery of SCUD missile launchers that have been terrorizing innocent civilians.

3. Bridge. Stop enemy troop and supply movements. Cannon fire is ineffective and rockets are less effective against a bridge.

4. Chemical Plant. Destroy an enemy chemical/biological weapons facility.

5. Airfield. Render a strategically important enemy airbase unusable for flight operations. It will be impervious to cannon fire. Rocket effects are reduced.

6. City. War-producing infrastructure. Expect heavy anti-aircraft fire. You may need multiple hits to destroy it.

7. Supply Dump. Destroy a weapons depot to deny munitions to enemy soldiers.

8. Air Defense. Suppress an air-defense battery that threatens the safety of friendly pilots in the sector. Watch out for SAMs.

9. Armor. Attack an enemy spearhead tank column that has broken through friendly lines. Only an A-10 can destroy a tank with cannon fire.

10. Infantry Unit. Fly a front-line attack mission in support of friendly ground troops.

11. Mechanized. Knock out an elite enemy mechanized battalion before it reaches the front lines.

12. Nuclear Reactor. Destroy a nuclear power plant suspected of being used to create atomic weapons. Cannon fire won't do it.

13-14. Naval/Fleet Strike. Attack or defend shipping/naval task force.

15. Fighter Sweep. [Air combat only] Dogfight with enemy fighters in a turn & burn "furball". Expect heavy casualties.

16. Radar Intercept. [Air combat only] Engage in long-range missile combat and then close to dogfight range with the survivors.

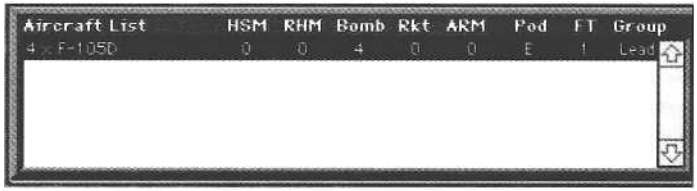
The center box to the right of the Target Selection area allows you to choose the weather or time of day in a similar way.

When you're all finished, click the "Fly" button. If you selected "Automatic" on the "Selection" line for both sides, you'll now proceed straight to the battle itself. Otherwise, the "Strike Hangar" window will appear and you'll have the opportunity to select your aircraft.

The scrolling box on the left-hand side is the inventory of the air force you have selected. The scrolling box on the right represents the aircraft you have so far selected for battle (it starts out empty).

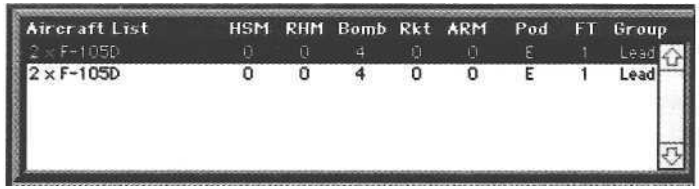
Choose your aircraft either by double-clicking them on the left side or by selecting them on the left side and then clicking either the "»1" or "»4" buttons, which will transfer one or four of the selected aircraft type to the box on the right, respectively. If you make a mistake, just click on the aircraft in the box on the right and click the "«1" or "«4" buttons to transfer the aircraft back out again.

When you're finished, click "Done". You cannot take more aircraft (or CPs) than you allowed yourself on the "Create Battle" window which is also recorded in the middle of the Strike Hangar.

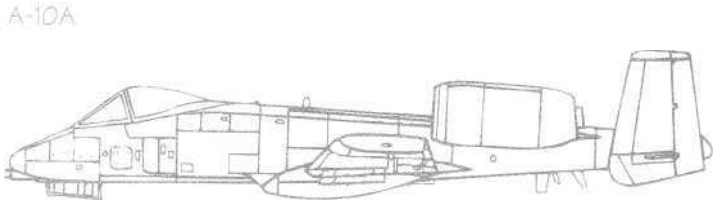


Now you must arm the aircraft you chose. This process is nearly the same as arming your squadron for a Campaign mission, which was detailed in the Tutorial section (page 1 1). The only difference is the way the Aircraft List is handled. Instead of seeing pilot names there, you'll see entries like "4 x F-105D". If that line is selected, you'll be arming four F-105D Thunderchiefs all at once. Each aircraft type you've chosen for the battle will get its own line.

If you decide that you want to arm some aircraft that are of the same type differently, just select their line and click the Split button. In the above example, the Split button would create two new groups of "2 x F-105D" out of the original group of four, which can be armed separately.



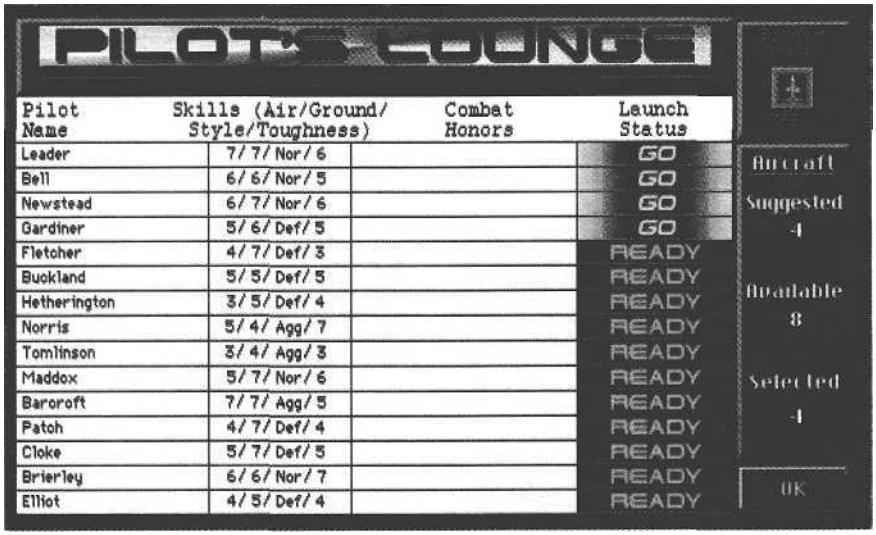
If you want to join split groups back together again, just click and drag one line onto the other.



Campaign

A Campaign is a series of linked missions. In a Campaign, you take command of a squadron of pilots, and your objective is to accomplish a series of assigned missions while minimizing friendly casualties. For example, you might find yourself commanding a squadron of fighter-bombers based near the front lines of a conflict in one of the world's hot spots, where typical missions range from strikes on enemy armor columns to interdiction of supply routes to combat air patrol over friendly airfields.

Each Campaign lasts for a specified length of time, usually measured in days with one or more missions being flown each day. Missions are assigned to you by your base commander. Which missions you get to fly depends both on the Campaign and the condition of your forces based on your performance in previous missions.



At the beginning of each mission you select the pilots from your squadron to fly on that mission. You then arm their aircraft with weapons, pods, and fuel. These selected pilots (along with some support aircraft that may be assigned to you by your base commander in the Mission Briefing and which start out under computer control) then carry out the mission. Upon completion, your success level is determined and the next mission begins. You keep flying missions until you've played the requisite number, at which point the Campaign ends and an overall victory level is determined.

The process of playing a Campaign mission is detailed in the Tutorial section of this manual, so please read pages 10-17 before continuing. This section presents some of the same information briefly while introducing a few important details.

You can begin a Campaign by clicking the Open Campaign button on the Start screen. Double-click on the scenario folder and select a Campaign from the file dialog. After choosing the skill level of the opposition on the "Choose Player Types" screen, click "ok". The Mission Briefing window will appear, describing the Campaign and the upcoming mission. Occasionally it will inform you of the arrival of support aircraft. These aircraft will be under your command for the duration of the mission. They begin combat, by default, under computer control but you can switch them over to human control later if you wish by clicking on them and selecting "Human Control" from the Pilot Window or using keyboard command "Alt +8".

First you must select pilots for the mission by clicking the Choose Pilots button in the Mission Briefing window. Then, in the Pilot's Lounge window you'll see a "ledger" for all your pilots showing their skills, combat honors and status.

Clicking on a pilot's row in the ledger selects/deselects him for flight on this mission. Only pilots whose status reads READY or TIRED are currently eligible to fly. If you run out of pilots, the mission will be scrubbed but HQ may send replacements.

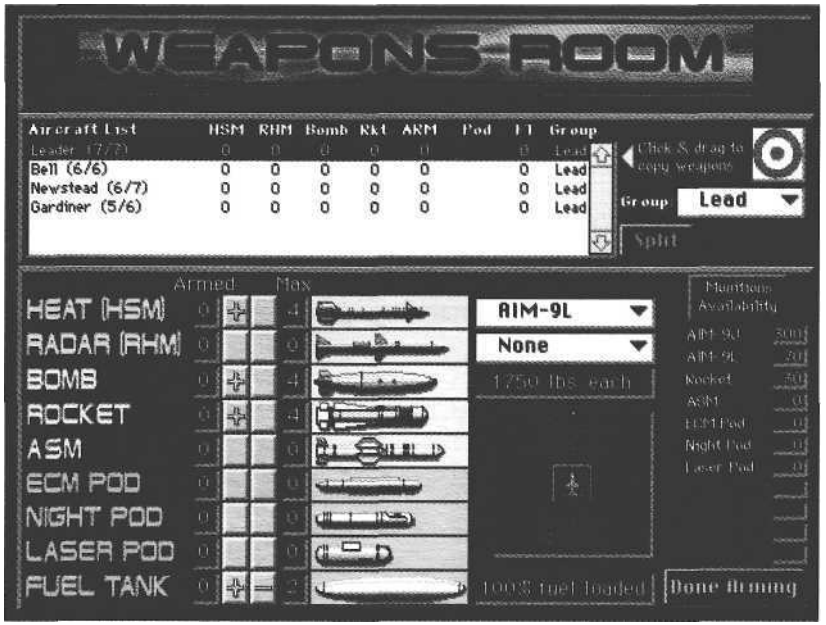
On the right hand side you'll see a number below the word "suggested". This is the number of aircraft your base commander wants you to take on this mission. At your discretion, you may take more or less than this number. Taking more will lessen your degree of victory at the end, even if you accomplish the mission goals. Normally you won't want to do this, but in some cases where your pilots are tired or you're short on weapons, this is your only option. Taking fewer pilots than suggested will give you a small bonus when the victory level is determined, but is usually not a good idea unless you have no choice. Taking enough pilots helps ensure everyone's survival through mutual cover.

When you're finished you can click "OK" to return to the Mission Briefing. Then click "Arm Aircraft" and refer to page 11 for a basic explanation of the Weapons Room.

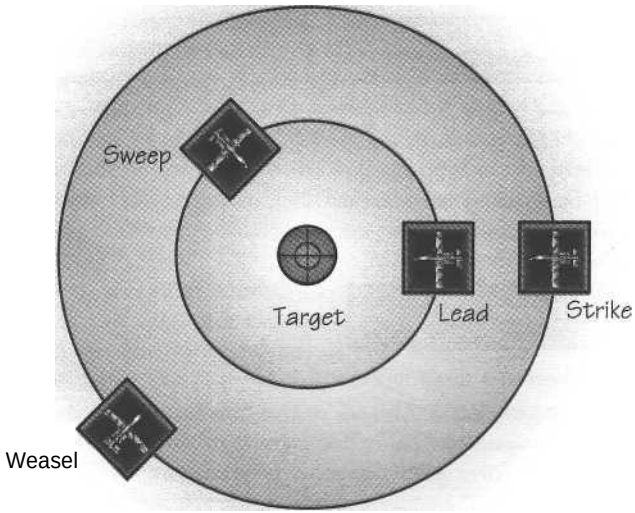
Campaigns add a special wrinkle to the Weapons Room: Munitions Availability. Unlike Generated Battle scenarios, you won't necessarily have as many weapons at your disposal as you'd like. The best ones will usually be the scarcest, with "smart bombs" often being in very short supply. This forces you to choose wisely and only take the weapons that are needed for the job. Munitions Availability is located on the right-hand side of the Weapons Room window.

Supplies of munitions arrive at your airbase every morning, and their abundance (or lack thereof) will be reported to you in the Mission Briefing. Bombs are always in plentiful supply, so there is no limit to the number you can use. Munitions that are brought back to base unused will be returned to the stockpile for future use (exception: laser pods, once taken, are gone for good, representing the relative scarcity of smart bombs). If you decide you want to change pilots after arming them, you can return to the Pilot's Lounge by clicking on the "Choose Pilots" button from the Mission Briefing screen.

To the right of the Aircraft List is the Group Pop Down Menu. Here you can select to have pilots enter combat in flight groups that come from different directions. There are four groups to choose from: Lead, Sweep, Strike, and Weasel.



The Lead group attacks the target from a randomly determined direction. The Sweep group begins at the same range to the target as the Lead group but comes in from a different direction. The Strike group follows directly behind the Lead group, a few miles back. The Weasel group been at the same range to target as the Strike Group but comes in from its own randomly determined direction. A diagram of how a typical strike setup might look appears on the facing page.



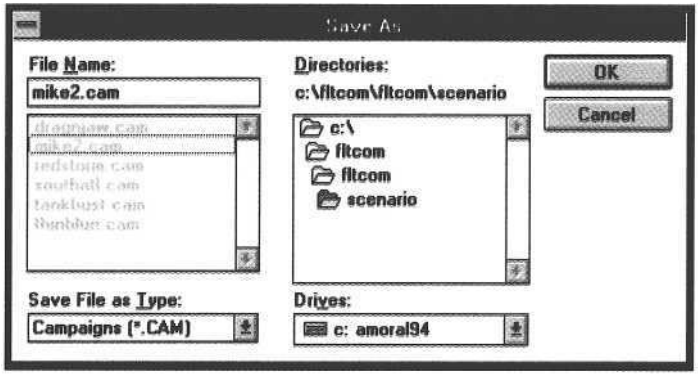
A standard approach is to put most of your fighters into the Lead group, followed by the bombers and a few fighters in the Strike group. You can get tricky, though, by putting a few fighters in the Sweep group in an effort to divert enemy attention away from the real attack or to give yourself a nice shot from the flank if the defending fighters chase after the Lead or Strike groups. The Weasel group is a wild card, usually used for either diversionary attacks or aircraft firing long-range SAM-suppression missiles (ARMs) who want to fire their weapons and then get away.

It is sometimes effective to reverse the norm and put bombers in the Lead group and fighters in the Strike group. That way, no enemy fighter can get on a bomber's tail without exposing his own tail to your fighters which trail just behind.

Once you click "Done Arming" from the Weapons Room and then click "Take Off" from the Mission Briefing, the actual mission begins. Your aircraft will start about twenty miles (sixty grid squares) from the target. In some missions you will be the defender, and the "target" is a friendly base of some sort which you are instructed to protect. The mission will end when all attacking aircraft are shot down, or when you select "Head for Home" from the File menu.

At the end of each mission you'll be debriefed on your success. The ultimate fate of all participants will be disclosed, as well as an evaluation of your performance. Your evaluation is based on the destruction of the primary target (if any) and casualties to both sides.

Click the "OK" button to continue. A "Save" window will appear, giving you the opportunity to save your game to disk. After you click "OK" (to save) or "Cancel" (to skip saving), a summation of your performance in the Campaign will be shown. Rename new Campaigns by changing the File Name in the "File Name" box. Currently underway Campaigns will be listed in the scenario folder beside the five original choices.



Pilots can become fatigued after flying missions. How tired they get depends on the difficulty of the missions flown, how much personal stress they endured, and their toughness skill levels. A tired pilot can still fly, but his skills are reduced so it should be avoided when possible. Really worn-out pilots are grounded until they recover. Grounding allows a pilot to rest, as does night time (unless flying on a night mission, which is very tiring). It also helps to take the squadron leader on missions. His leadership tends to reduce stress and fatigue for everyone else.

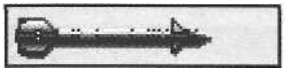
MISSION PREFLIGHT

In both Campaign and Generated-Battle missions you must do a little preflight setup.

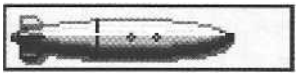
Loading an Aircraft

It's important to fit an aircraft with the right weapons and equipment for the job. That's what you do in the Weapons Room. If you're the attacker in a mission you should take note of the type of target you've been assigned and whether any defending fighters or antiaircraft units will be present. If you're the defender, determine the number and type of attacking aircraft and the ratio of bombers to fighters you'll likely face.

What can you load onto an aircraft?

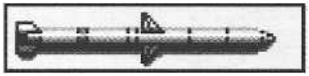


AIR-TO-AIR MISSILES (AAM): These are used to shoot down enemy aircraft and come in heat-seeking and radar-homing varieties. An aircraft can carry one type of heat-seeking missile (e.g. AIM-9L Sidewinder, AA-8 Aphid) and one type of radar-homing missile.



BOMBS: These are free-fall, high-explosive weapons that are best-suited to large unarmored targets. The number shown to the upper-right of the bomb picture is the weight, in pounds, of each "bombload". This value differs for each aircraft type. Each bombload, in reality, may represent several smaller bombs, but is treated as a single unit for dropping on enemy targets (so when you click to add one bombload you may actually be adding several bombs, but for game purposes you can think of it as one large bomb). If a Laser Pod is also carried, then all bombs on board are considered laser-guided "smart" bombs.

ROCKETS: Depending on the technology level of the user, these can range from old radio-guided rockets like the AGM-12 Bullpup to sophisticated infrared- or TV-guided missiles like the AGM-65 Maverick. Rockets are generally smaller than a typical bombload, but are more accurate and have a greater range.



ARMs: An anti-radiation missile (ARM) is an air-to-surface weapon that homes in on signals generated by ground-based radar systems like SAM (surface-to-air missile) sites. ARMs are highly effective at knocking out active SAM sites even from long range, but are useless against other targets. Depending on the user's technology level, an ARM can represent anything from an early model Shrike or AS-9 to a high-tech AGM-88 HARM.

PODS: These are adjunct systems that enhance the offensive or defensive capabilities of an aircraft. There are three types:

1. Laser Pod. This is a combination laser designator /receiver used to "paint" targets for "smart" bomb attack. Carrying a laser pod automatically converts any bombs on board to "smart" bombs that will guide themselves to their designated target. Smart bombs are much more accurate than regular bombs.

2. Night Vision Pod. This pod gives thermal (infrared) vision capability to the crew of the aircraft, allowing accurate air-to-ground weapons delivery during night missions.

3. ECM Pod. Carried as a defensive measure, this electronic countermeasures pod decreases the aircraft's vulnerability to radar Lock-on and radar-guided missile attack (from air and ground). They are usually carried by strike aircraft entering a high-threat environment.

FUEL: To extend their range, modern jets often carry drop-tanks of extra fuel. You may add two such tanks to an aircraft. This fuel not only allows the aircraft to reach distant targets, but allows freer use of full-throttle and afterburners during combat. Conversely, there are times when it is appropriate to carry even less fuel than the internal tank is capable of holding. On short-range missions where only a small amount of fuel is needed, the internal fuel tank can be filled to less than full, allowing more of the aircraft's weight-carrying capacity to be used for weapons. (To do this in the

Weapons Room, just remove all fuel tanks from the aircraft and then click the downward-arrow button again. Each successive click will remove 10% of the internal fuel load). In Generated Battles, sometimes the distance to target chosen by the player is greater than that which the aircraft can travel, even with a maximum fuel load. In these cases, the program allows the aircraft to participate in the mission, and assumes that it receives just enough in-flight refueling to allow it to reach the target (with little fuel to spare).

Of course, you can't always take as many weapons or fuel tanks as you'd like. This is because all aircraft have maximum load capacities, expressed as both a weight limit and a "Hardpoint" limit.

There is a weight above which an aircraft can no longer manage to take off from the ground. This Maximum Takeoff Weight is different for each aircraft. You may not load weapons, pods, or fuel in any combination which will make an aircraft exceed this limit. If you try, a "Too Heavy" message will flash in red on the screen.

Aircraft have a certain number of locations, normally under the wings and fuselage, where they can store munitions. These attachment points are called Hardpoints. You cannot load more munitions on an aircraft than can be attached to its Hardpoints.

The program automatically takes care of weight and Hardpoint limit calculations, so you needn't worry about breaking any rules. It will even determine the ideal configuration of your armaments on the Hardpoints, maximizing the ability of the aircraft to carry the weapons you want (this is necessary because some hardpoints are only "wired" to carry particular loads).

Fuel can be a little tricky. Loading more fuel gives an aircraft greater range. But fuel also adds weight, weighing the aircraft down and decreasing range! On balance, of course, adding fuel increases range despite the greater weight, but you will often find that loading extra fuel doesn't take you as far as you thought it would, because you must burn extra fuel just to transport that fuel! Having too much fuel can also detract from performance unless you jettison extra tanks before entering a dogfight.

When loading an aircraft you may bump into both a minimum and a maximum amount of allowable fuel for an aircraft on a particular mission. The minimum fuel limit exists because it takes that much fuel for the aircraft to reach the target. The game will not allow you to decrease the fuel load further. The maximum fuel limit exists because the airplane can't take off with a load that's too heavy.

Just because you can take that extra bomb or missile doesn't always mean you should. Adding weight to your aircraft means you need to burn more fuel just to get to the target, which means less fuel left over for emergencies when you might want to use your Afterburners. It also reduces your acceleration and turning ability. Second, hanging things like big iron bombs from your wings makes your aircraft less aerodynamic. This is called "Drag". When carrying a large number of external weapons, an aircraft will experience difficulty accelerating and maneuvering above and beyond the effect you'd expect from the added weight alone. This can be a critical disadvantage in a dogfight. For example, an A-10 Warthog is able to carry as many as 18 rockets, but almost never does in real life because the performance penalty is too severe.

Weather

Weather plays a significant role on the aerial battlefield and comes in three flavors in this game: Clear, Cloudy, and Night. Weather conditions are stated in the Mission Briefing for Campaign missions and are chosen by the player in Generated Battles. Either way, it's up to you to plan accordingly when you outfit your aircraft.

Clear weather is what you'd expect. All weapons and sensors function normally.

Cloudy weather causes problems for infrared/thermal systems. It's a good idea to load up on radar-homing missiles if you expect to see any air combat because heat-seekers won't perform well. If you're able to select

aircraft types (as in a Generated Battle) pick fighters that have powerful radar systems and don't rely on IRST. Cloudy weather also obscures vision over distances, and reduces the accuracy of bomb and rocket attacks. Laser pods cannot be used at all because the laser light is scattered by the water vapor in the clouds. AAA guns and heat-seeking SAMs will fire less frequently.

Night weather, which is actually the time of day rather than a weather condition, requires that N-Pods be used for ground attacks if you desire any accuracy whatsoever. It's possible to drop your bombs or launch rockets without one, but don't expect many hits. Radar and aerial combat with missiles are largely unaffected (though visual contact is very difficult to establish), but cannon attacks are much less likely to hit their targets. At night you should use as many N-Pods as you can if you're on a ground attack mission. Use your radars and IRST systems along with air-to-air missiles if you're fighting other aircraft. Carrying E-Pods is also a good idea because long-range, radar-guided missiles are the biggest threat. It is very difficult to visually spot an enemy and dogfight with him. AAA guns of users with a low technology level are significantly hampered at night.

Technology Levels

Air forces are rated for their technology. Each has a technology level rated from 1 to 4. This rating determines the effectiveness of its ground-attack and antiaircraft weaponry, as well as a pilot's chance of safely ejecting from a damaged aircraft. A technology level of 2 is required to use rockets and ECM Pods. A level of 3 is required for ARMs, Night Pods and Laser Pods.

Pilot Skills and Training Levels

There are four different measures for pilot skills. Excepting Style, they range from 1 (worst) to 7 (best). A pilot's Air and Ground ratings will improve as he gains kills and achieves awards in a Campaign Game.

1. Air: This skill affects a pilot's chances of hitting with his cannon, successfully performing High-G Turns (when using the High-G Turn Limits combat option), and regaining control of his aircraft in a stall or spin (when using the Stalls/GLOC advanced option).

PILOTS LOUNGE

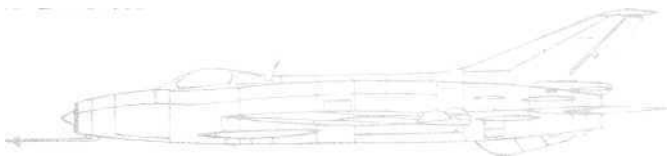
Pilot Name	Skills (Air/Ground/ Style/Toughness)	Combat Honors	Launch Status
Leader	7/7/Nor/6		READY
Bell	6/6/Nor/5		READY
Newstead	6/7/Nor/6		READY
Gardiner	5/6/Def/5		READY
Fletcher	4/7/Def/3		READY
Buckland	5/5/Def/5		READY
Hetherington	3/5/Def/4		READY
Norris	5/4/Agg/7		READY
Tomlinson	3/4/Agg/3		READY
Maddox	5/7/Nor/6		READY
Baroroft	7/7/Agg/5		READY
Patch	4/7/Def/4		READY
Cloke	5/7/Def/5		READY
Brierley	6/6/Nor/7		READY
Elliot	4/5/Def/4		READY

2. Ground: Higher skill aids in making accurate air-to-ground attacks.

3. Style: There are three kinds: Aggressive, Normal, and Defensive. Aggressive pilots are good at flying advantaged (when using the Movement Phasing combat option), but are more vulnerable to attacks by missiles or cannon. Defensive pilots are precisely the opposite.

4. Toughness: This is a measure of how resistant a pilot is to fatigue which is only relevant in a Campaign scenario.

Every pilot's skills are affected by his nation's overall training level. Pilots with good training are better at spotting enemy aircraft, defending against missile and cannon attacks, and flying advantaged when using the Movement Phasing combat option).



ENDING THE MISSION

A mission will end automatically when one of the following occurs:

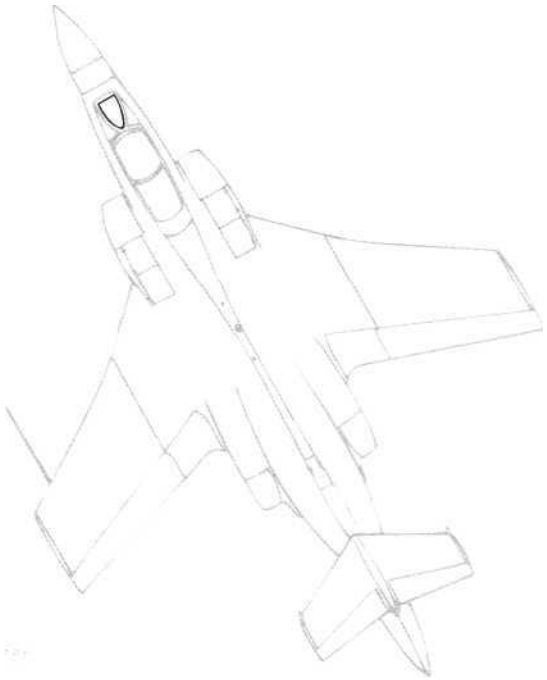
1. All attacking aircraft are shot down.

2. All defending aircraft are shot down in a non-ground-attack mission.

3. You select "Head for Home" from the File menu.

Alas, it's not quite that easy. The game will not allow you to turn tail and run after you've expended all your ammunition and are now firmly in the sights of an adversary. To give the enemy his due, you shouldn't end the mission until the combat forces of both sides have disengaged completely. If you're dashing for home and the computer's aircraft are still chasing you, the program won't end the mission until they've broken off pursuit (which they will eventually if they don't catch you). Of course, if you're really not chickening out and just need to go eat dinner and intend to come back and fight another day from the same relative positions, you can save the game in progress by selecting the "Save Game" command from the File Menu or using keyboard command "Alt+S".

If you do opt to Head for Home while closely engaged, the game will give you two choices. "Quick Withdrawal" puts your forces under the computer's command and sends them directly home as soon as possible. "Fighting Withdrawal" will instruct the computer which is now controlling your aircraft to mix it up with any nearby enemies for a few turns before breaking for home. The later option is preferable for covering your retreat if closely engaged. In both cases, the computer will take over your forces and play out the balance of the mission while trying to break off the action. Depending on the circumstances this may take quite some time. You can either watch the outcome unfold, or come back later and check the results in the Mission Debriefing. When you do retreat from combat, make sure you fly in the right direction! Select the Navigation item from the Radio menu to get directions to your airbase.

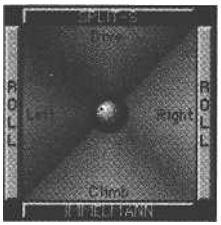


5.AIRCRAFTSYSTEMS

This section describes the aircraft systems that you'll use to maneuver, detect the enemy, and fight. Some of these systems are represented by on-screen graphical controls, and others are part of the game's underlying simulation engine.

MOVEMENT AND MANEUVER

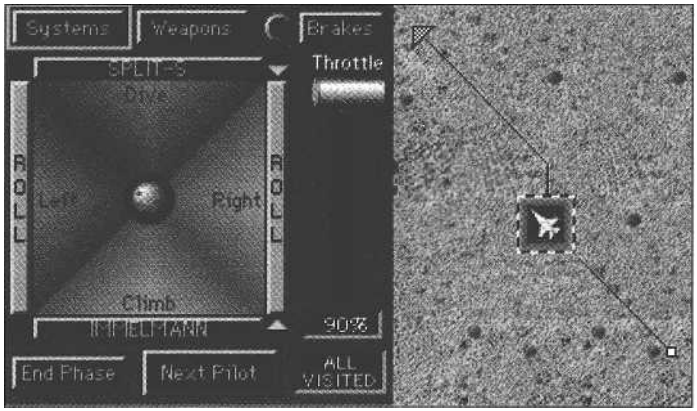
Your aircraft is guided by the Flight Stick to control the direction of flight and the Throttle to control acceleration.



The Flight Stick is an on-screen control that allows you to maneuver by changing your aircraft's Flight Path. It operates just like a stick from a real airplane. Push it to the left or right to turn your aircraft. The further you push it left or right, the tighter the turn will be. When playing with Altitude (one of the combat options) you can push the stick forward (upward on your monitor) to dive, or pull back (downward) to climb. Again, how far you push or pull the stick determines how much you climb or dive.

Ninety degrees is the most you can turn an aircraft in one move. When playing with the High-G Turn Limits combat option, even a 90° turn may not be possible. You must push the flight stick all the way to the left or right to make a 90° turn (also known as a High-G Turn because of the extreme G-forces that result from such a maneuver).

There are four push-bars surrounding the Flight Stick box. The two side bars are labeled "Roll" and the top and bottom bars are "Immelmann" and "Split-S". The latter two are used only with the Altitude combat option and are discussed later. The Roll buttons allow you to do barrel-roll maneuvers which offset the aircraft's path by one grid square to the left or right while maintaining the same direction of flight. Click on a Roll bar to select or deselect a barrel-roll maneuver as part of your upcoming Flight Path. Two little green (white on B&W monitors) arrows next to the Roll button will indicate that it has been selected.



There is a price to be paid for doing fancy maneuvers, however: deceleration. In the case of High-G Turns, deceleration is severe - as much as two hundred MPH! It's important to think ahead when using such maneuvers and offset the deceleration (at least partially) through the use of increased thrust (discussed below). Barrel Rolls and Low-G Turns (i.e. those of only 45°) cause much less deceleration than a High-G Turn, but the effect is still noticeable.

Deceleration in turn maneuvers is influenced by two factors: Wing Loading and Wing Type. Wing Loading is a measure of the lift required of the wing to keep the aircraft in flight. You can compute the Wing Loading of an aircraft by dividing its total weight by the square footage of its wings. For turning purposes, a lower Wing Loading is preferable, as this represents a relatively light aircraft with a large wing. As you can imagine, such an aircraft will perform better in a turn than a heavy aircraft with a small wing (i.e. a "flying brick"). Wing Type is also a factor. Delta wings, though they offer superior acceleration at supersonic speeds, bleed off a lot of airspeed in a tight turn. Swing wings, which behave like delta wings at high speeds, have the same problem at high speed.

Thrust Systems

The driving force behind a modern military plane is its jet engines. These engines are capable of propelling aircraft at incredibly high speeds, but are subject to the same laws of physics as power plants of earlier eras and still have significant limitations.

First of all, jets are not powerful enough to allow a pilot to ignore the decelerating effects of tight maneuvering or gaining altitude. As described in the previous section, it's important to "throttle up" when engaging in High-G Turns.

It's also important to remember that it takes time for the effects of acceleration to be felt. Although modern jets possess tremendous acceleration, their speed is so great that it takes several minutes (or more) to accelerate to maximum speed. You shouldn't expect to be supersonic after one move of flying on Afterburners. The effects of any changes to the throttle setting will be seen on the move after you set the throttle. If you turn on your Afterburner, your speed *in this move will not change.* However, at the beginning of the next move, you'll probably see a significant increase unless you did a High-G Turn.

In addition to the main throttle there are three related systems you need to know about: Afterburner, Airbrake, and Fuel. An Afterburner is a system that literally dumps fuel into the hot jet exhaust of your engines and ignites it, turning the jet engine info a form of rocket. This greatly increases thrust but at the cost of massive fuel consumption. Afterburners are far less fuel efficient than normal engine thrust (even at 100% power) and should be used sparingly. Not all aircraft are equipped with Afterburners and thus the "Burner" button will not appear on every Combat Display.

The counterpart to the Afterburner is the Airbrake. This is a kind of "flap" that is (usually) extended from the fuselage of an aircraft to increase drag and slow the aircraft down. Normally used when landing, the Airbrake can also be deployed advantageously for quick deceleration in a dogfight. Pushing the "Brakes" button will automatically turn off your Afterburner and push the Throttle back to 0.

As a combat pilot in a jet aircraft, your life blood is Fuel. You can't fly without it, and jet engines consume fuel so hungrily that fuel management is critical to mission success and survival. This subject is explored in more detail in the Tactics section of this manual, but the most important thing to remember is to keep your eye on the fuel gauge and not waste fuel. Afterburners are powerful but use a lot of fuel, so use them accordingly.

Gauges

Clicking on the Systems button just above the Flight Stick will show you the airspeed and fuel gauges for the currently selected aircraft.

The airspeed gauge (on the left) indicates your current airspeed. The fuel gauge (on the right) shows your current fuel level expressed as a percentage of a full load of internal fuel. In cases where you're carrying external fuel the displayed number may be greater than 100%. The "red zone" (gray on B&W monitors) inside the fuel gauge shows the minimum fuel you need to get back to your home airbase. This is also known as your "Bingo" value. Allowing your fuel needle to enter this red zone is very dangerous. You should not allow this to happen except in the direst of circumstances. Break off combat before your fuel drops into the red zone. Otherwise, you risk being diverted to another friendly airbase and delayed (at best) or crashing (at worst). A "fuel kill" is just as useful to the enemy as if he had shot you down with a missile!

However, the Bingo level is calculated using your current weapons load, so if you're carrying a lot of bombs, your fuel needle may start out alarmingly close to your red zone. Don't worry. As soon as you drop or launch your weapons, your aircraft will become lighter and the Bingo level will drop accordingly.

DETECTION

Combat of any sort can only take place when a combatant is able to find his opponent. This is an especially acute problem in aerial warfare where the "battlefield" is often an immense region of airspace. Fortunately (or not, depending on your mission) many systems have been developed for detection purposes.

The game handles all the details of detection and contact for you. Unless the Visual and Radar Contacting combat option is used, however, all detection systems function perfectly. That is, you will always be aware of every participant in the battle, both friendly and enemy. This is unrealistic, of course, but it's a good way for new players to become familiar with the game system. Once you're comfortable with the game, turn on the Visual and Radar Contacting option and experience the "fog of war"; you'll know someone is out there, but you won't know where!

Visual

The trusty "Mark 1 Eyeball" has been in use ever since the first dogfights of World War I. Despite the tremendous technical advances in detection systems over the last few decades, visually acquiring a target is still necessary in many circumstances, especially for target identification and in light of recent advances in stealth technology. That is why pilots in most air forces are required to have excellent vision.

Because pilots face the front of their aircraft, they have a much better chance of spotting enemies to the front. The chance of spotting an enemy in the rear 90° arc is considerably smaller, and is zero in the case of aircraft that do not have a bubble canopy. Even aircraft with bubble canopies can only see a rearward aircraft if the rearward aircraft is at a higher altitude.

The chance of spotting an enemy is also modified by the size of his aircraft and the distance to it. Maximum visual range is roughly 30 grid squares. Only when the enemy is fairly close is it possible to identify the type of aircraft. Until then, the enemy will be referred to as a Bandit if spotted or a Bogey if detected only by electronic means.

Radar

The need to detect enemy aircraft over distances greater than the eye can see was recognized as early as World War II when early ground-based radar systems were developed and deployed, most notably in the Battle of Britain. Since then, radar sets have evolved into much more powerful and portable systems. All state-of-the-art interceptors and fighter jets carry onboard air-to-air radar systems to locate and destroy enemy aircraft. Many bombers and older aircraft do not.

Air-to-air radars are capable of detecting an enemy in two ways. The first, called Contacting, is the result of a radar search where the radar system scans the sky quickly and broadly, looking for reflected signals. A "blip" on the radar screen usually informs the radar operator that something is out there and provides a little information (e.g. whether the aircraft is friendly, its airspeed) but not a strong enough fix to fire weapons. For that a Lock-on is required. A Lock-on is the result of the radar first searching for the target (and obtaining it as a contact) and then narrowing the focus of the radar beams to pinpoint the target aircraft. Once a Lock-on is achieved, weapons such as radar-homing missiles can be fired at the target. However, in the Basic Game (i.e., without employing the Radar and Visual Contacts option) radar Lock-ons are abstracted so the Lock-on button disappears while in Air Attack mode. Consequently, you only need a radar contact to fire a radar-homing missile.

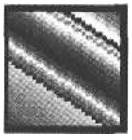
An attempt to Lock-on is not automatically successful. The chance of acquiring a Lock-on depends partially on the range to target as well as the strength rating of the radar. Lock-ons can sometimes be broken by strong ECM (electronic countermeasures) from the target.

You can see at once who you've contacted or Locked-onto by clicking the Display button located near the upper-left of the

screen. This shows your radar scope and what's on it. All radar contacts show up as hollow squares, and Lock-ons as solid squares. The currently selected target is colored red (or gray on B&W screens). You can click to select targets just like you can in visual mode.

The display to the left of the Radar button will also tell you when you're Locked-on.

An aircraft may not conduct a radar search if it fired its cannon or attempted a High-G Turn in the previous move, unless it has a second crewman on board (who operates the radar while the pilot has his hands full with other duties).



Additionally, active jamming can significantly interfere with radar. Only a few types of specialized aircraft can conduct active jamming, and these are identified in the Data Library as "jamming" aircraft. They are capable of confounding enemy radars by emitting electronic "noise". This noise radiates outward from the jamming aircraft to a range of 100 grid squares. All aircraft inside this radius, friendly and enemy alike, are "protected" by the jamming. The effective ranges of radars searching for aircraft inside the jamming radius are significantly reduced. Protected aircraft are shielded from detection by radar controllers and less likely to be hit by radar-homing missiles, and are less likely to be fired upon by SAM sites.

By looking in the on-line Data Library (which you'll find in the Windows menu) you can check out the radar systems installed on the different aircraft in the game. The different technologies you'll find listed there and their capabilities are of four types:

1. Track-While-Scan (TWS). This allows a radar system to maintain Contacts and Lock-ons simultaneously. Earlier radars lose all other Contacts as soon as a Lock-on is achieved.

2. Look-Down. (Only relevant when playing with the Altitude combat option). These radars can successfully Contact and Lock-on to targets flying at a lower altitude (and "hidden" by spurious radar signals bouncing back from the ground) although their effective range is reduced by 30% in this case. Radars without this capability can only Contact and Lock-on to aircraft flying higher than about two-thirds of their own altitude.

3. Multi-Target. These radars can Lock-on to more than one aircraft at a time. Such systems are normally only carried by dedicated interceptors with a two-man crew.

4. Expanded Arc. Most airborne radars cover only the front 90° arc, but some cover 1 80° or 360°.

Radar Warning Receiver (RWR)

Radar's Achilles' Heel is that its outgoing electromagnetic waves can be detected by the very aircraft that the radar is trying to locate! This is accomplished through the use of an only slightly more sophisticated version of the radar detectors people use in their cars. Thus, it's not possible to use radar without giving away your own presence. Radar is not stealthy.

Your on-board RWR device, located in the Defense Panel, will tell you if it has detected any hostile radars. The triangular lights inside reveal if the detected radars have contacted (hollow triangle) or Locked-on to you (solid triangle) and the approximate (Absolute) direction from which the signals emanate.

Infrared Search and Track (IRST)

Because of radar's tendency to "announce" its user to its target, the need for a passive detection system was recognized. The technology used in heat-seeking missiles was adapted to an on-board sensor system and IRST was born.

IRST passively detects heat (infrared) signals. It is undetectable to its target because it generates no signals of its own. IRST is relatively new and is not widely used. Its range is limited to 15 miles, and it functions poorly in cloudy weather. For simplicity's sake, IRST contacts are shown as blips on a radar display.

Stealth

In response to the growing power of radar systems to detect and lock-on to aircraft at long ranges, scientists in the late 1 960's embarked on several aircraft-design projects that, over a period of roughly twenty-five years, collectively introduced a new defensive technology to the air combat arena. Stealth technology is intended to greatly reduce the radar signature (i.e. the "visibility" to radar) of an aircraft through the use of designs that incorporate angular surfaces, radar-absorbent materials (RAM), engines with reduced thermal emissions, and more.

Functional stealth technology is a product of the last decade, and is used on only a few specialized aircraft. It is not perfect and does not make an aircraft totally invisible to radar, but it does significantly reduce the range at which a radar system can detect and Lock-on to the aircraft. Due to its reduced thermal signature, it also reduces the effectiveness of heat-seeking systems like missiles and IRST. In the game, radar controllers are not able to locate stealthy aircraft.

ATTACK SYSTEMS

Aircraft have two attack modes: Air and Ground. You can switch back and forth between these modes by clicking on the Attack button located next to the Weapon Panel, or by clicking on an enemy target in which case the program will automatically switch to the appropriate attack mode.

Each time you select a new aircraft to receive orders, the computer makes a quick check to see if that aircraft is able to fire on any enemy targets in its current attack mode. In other words, if you click on one of your aircraft that's in air mode, the program will check to see if it can shoot at any enemy aircraft. If it can, it will automatically place a crosshairs on the target and play a buzzing sound to alert you. It's important to remember that the program will not automatically target ground units when in Air mode or vice-versa, so it's a good idea to keep your bombers in Ground mode and your fighters in Air mode.

There are three buttons on the Weapons Panel. In Air attack mode these buttons fire heat-seeking (HSM) and radar-homing (RHM) missiles, and direct the radar to Lock-on. In Ground attack mode, these buttons drop bombs, and fire rockets and ARMs. In either case, the readouts to the right of each button tell you that you can fire or, if you can't, the reason why.

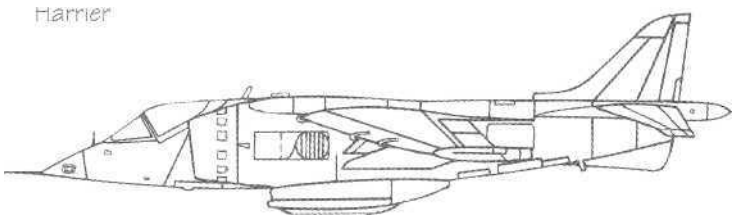
Weapons Panel in Air Mode

Weapons Panel in *Ground Mode*

Additionally, you can check on your current weapons load by clicking on the Weapons button located just above the Flight Stick. It will replace the airspeed and fuel gauges with a readout of the weapons you still have on-board.

CREW

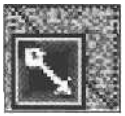
Many modern aircraft are so complex that they require two or more people to operate. One flies and the others manage the navigation, radar, and weapons systems. Aircraft that carry more than one crewman are better able to spot enemy aircraft, may determine the airspeed of unspotted radar contacts, and may conduct a radar search even if the aircraft fired its cannon or attempted a High-G Turn.



6. COMBAT

There are several different methods of using weapons. Except where noted, an aircraft or ground unit may make only one attack per move.

AIR-TO-AIR MISSILES



There are four types of air-to-air missiles:

1 .Rear-Aspect Heat-Seeking. Older missiles that can be fired only at a target's rear 1 80° arc, where they can Lock-on to the aircraft's hot jet exhaust.

2. All-Aspect Heat-Seeking. Possessing highly sensitive seeker heads, these can be launched at a target from any angle, though to much greater effect from the rear.

3. Semi-Active Radar-Homing. These are guided to the target by following the reflected signals of a continuous radar Lock-on which leaves the firing (guiding) aircraft in a rather predictable and vulnerable Flight Path. If the Lock-on is lost, the missile is lost.

4. Active Radar-Homing. Needs a radar Lock-on from the firing aircraft only to launch. After that, it is a "fire and forget" missile that has its own radar set to guide it to the target.

Launch Requirements

You can select a target for air-to-air missile attack by clicking on it. The Weapons Panel displays will flash a "READY TO FIRE" message if you are able to fire. If you select a target that you're not able to attack, the displays will light up with the reasons why you can't. Generally speaking, you need to satisfy the following conditions to launch a missile:

Heat-Seekers (HSM):

- You must have visual contact to the target, or possess a Heads-Up Display (HUD) and have a radar Lock-on to the target.
- The missile must be All-Aspect, or you must be firing at the target from its rear 1 80° arc.

Radar-Homers (RHM):

- You must have a radar Lock-on to the target.

All Types:

- The target must be within your front 90° arc.
- The target must be within the minimum and maximum ranges of the missile.
- The missile is "launchable under high-G" or you did not attempt a High-G Turn on the previous move.

Launch Ranges

Each missile has standard minimum and maximum ranges that you can access in the Data Library by selecting it from the Windows Menu or using keyboard command "Alt + D". These values can change in actual combat, however, for a number of reasons.

Due to the increased thermal signature from jet engine exhaust, heat-seeking missiles can track an aircraft from much longer ranges when facing the aircraft's rear than when facing its front. For this reason, the maximum launch range for heat-seeking missiles is only 50% of the stated value when firing at a target's front, and 75% when fired at a target's side 90° arc.

Radar-homing missiles are affected by the strength of signal returns as well, but in their case it is the size of the target aircraft that modifies the true maximum launch range. Larger aircraft reflect more radar waves so they can be fired upon from greater range. Maximum range when firing on tiny jets can be as little as 60% of the stated value.

All missiles need a few seconds after launch to ignite their motors, track the target, and arm their warheads. This time is represented by enforcing a minimum range for each missile

below which the missile cannot be launched because it won't have enough time to arm itself before intercepting the target. This range can be affected by the angle of intercept. When firing at a target's front, the closure speed between the missile and the target is much greater than when firing from the rear because the missile and target are flying toward each other. This leaves less time for the missile to arm itself after launch, which means that the missile's minimum launch range must be increased. When a missile is fired at a target's front, its minimum range is doubled. From the side, the minimum range is increased by 50%.

Missile Attack Modifiers

The following affect the likelihood of a missile hitting its target:

1. Target speed. When the target aircraft is traveling at less than 450 MPH, the chance of a missile hit increases (especially at very low speeds).

2. Pilot Training/Style. Pilots with better training are harder to hit as they are more adept at defensive maneuvering and decoy use. Pilots with a Defensive style are harder to hit than those with an Aggressive style.

3. High-G Turns. Targets that are in a High-G Turn are more difficult to hit, especially for missiles with poor agility ratings.

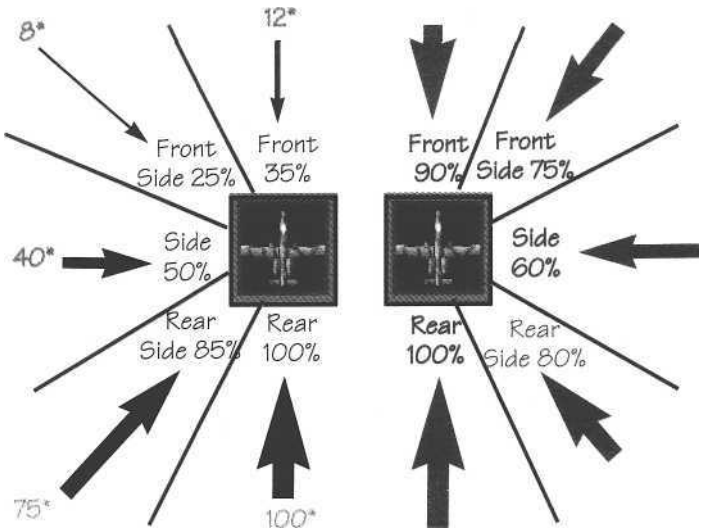
4. Target Throttle/Afterburner. [Heat-Seekers only]. Higher throttle settings generate more heat and make it easier for heat-seeking missiles to track. Afterburners are very easy to track.

5. Target ECM/Active Jamming. [Radar-Homers only]. Target ECM value (including ECM Pods) decreases a missile's chance of hitting. The missile's ECCM value can counteract this. Active radar jamming (friendly or enemy) also degrades attack capability.

6. Stealth. Stealthy targets are harder to hit.

7. Ground "Clutter". Targets at low altitude (3 or less) can be masked by interfering signals from the ground if the missile is intercepting from a higher altitude. Ground clutter affects older radar-homing missiles the most. For it to take effect, the target must be diving when the interception takes place. This is only relevant when using both the Altitude and Missiles Track combat options.

8. Angle of Attack. The effectiveness of a missile depends heavily upon the angle at which it intercepts the target. See the figure above, where larger arrows represent greater effectiveness.



*** Rear-Aspect Heat-Seekers cannot be launched at a target's front, but with the Missiles Track option activated, the target may be able to turn toward the missile so that it intercepts the aircraft's front.**

CANNON

Cannon are similar to the machine guns used in the early days of fighter planes except that they fire shells instead of bullets and have a much greater range. They often have a blindingly high rate of fire. Despite these technical advances, however, the cannon still serves the same basic purpose as the machine gun: it is the weapon of choice for close-range air combat.

Cannon operate in a different manner from air-to-air missiles. Rather than firing during the Give Orders Phase, cannon are fired automatically during the Action Phase at targets of opportunity. No special orders are needed. Firing takes place automatically if a target presents itself.

Your cannon has a range of one grid square and may fire once per Action Phase, regardless of whether you fired any air or ground weapons in the Give Orders Phase. If you want to fire your cannon at an enemy, try to predict where he'll fly and maneuver yourself so that you'll intercept him somewhere along his Flight Path.

A pilot running low on ammunition will not fire his cannon automatically. If he has three or less shots remaining, he will fire only if he has a reasonable chance of scoring a hit. Otherwise, he'll take any shot he can get.

You can also use cannon to strafe ground targets. Your pilot will automatically open fire as you fly over them unless the target is impervious to cannon fire. Buildings, bridges, bunkers, and airfields cannot be damaged by cannon. The only cannon that can damage a tank is that carried by the A-10A Warthog.

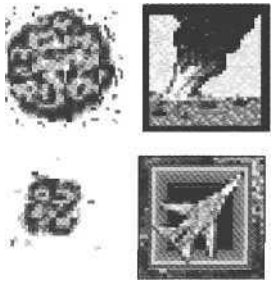
The accuracy of cannon attacks is affected by target bearing (similar to the effect on radar-homing missiles), airspeed (of both firer and target), and pilot skills (of both firer and target).

When playing with the Altitude option, a cannon may be fired up or down (depending on Pitch) a distance of one altitude level. When flying level, the cannon may be fired up or down as well as level. Strafing ground targets may only be performed from altitude level zero.

AIR-TO-GROUND ATTACKS

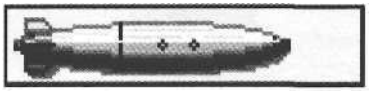
Air-to-ground attacks are made in a similar manner to air-to-air attacks. Just click on a ground target to select it and then use the buttons in the Weapons Panel to fire. Weapons include bombs, rockets, and ARMs.

Like missiles, air-to-ground weapons can only be launched into the front 90° arc.



There are four possible results from an air-to-ground attack: miss, near miss, hit, and hit and destroy. The result is shown briefly in the Data Readout, although the size and sound of the graphical explosion will also inform you of the outcome in the same way that they do for air-to-air combat. A large explosion will predict a wreck. A small explosion signifies damage which, on a target aircraft, is graphically shown by a purple border for the aircraft. Big targets are easier to hit than small ones. Some ground targets take more hits to destroy than others. Damaged, but not destroyed, targets are taken into consideration when determining your scenario performance.

Bombs



In the Basic Game you may drop as many bombs on a single target as you like in one move. Maximum range is six grid squares.

Having a good bombsight and low airspeed improves bombing accuracy. It's a good idea to stay below 400 MPH, depending on bombsight quality. When playing with the Altitude combat option, flying at low altitude improves accuracy. If also playing with the Advanced Ground Attack option, being in a Dive (especially a Vertical Dive) helps further. You can never drop bombs from a Climb or Vertical Climb Pitch.

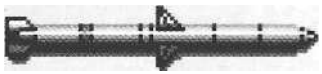
Rockets

The technology level of the user affects the accuracy and range of a rocket. If using the Altitude combat option, an aircraft's altitude is added to the distance the rocket has to travel, and reduces the maximum effective range accordingly. The minimum range is only in effect when playing with the Ground Attack option). Range values are in grid squares.

	Min. Range	Max. Range
Tech Level 4	2	20
Tech Level 2 or 3	4	15

When playing with the Altitude option, you can't launch rockets from a Climb or Vertical Climb Pitch.

Antiradiation Missiles (ARMs)



ARMs can only be fired at active SAM sites. SAM sites will sometimes shut down their radars in an effort to avoid ARM attack. The missile on the SAM portrayal on the screen points down when it is shut down.

Active SAM site

Shut-down SAM site

The technology level of the user affects the accuracy and range of an ARM. The minimum range is only in effect when playing with the Combat Ground Attack option).

	Min. Range	Max. Range
Tech Level 4	6	60
Tech Level 3	6	25

ANTIAIRCRAFT FIRE

Ground units capable of antiaircraft fire may automatically shoot at attacking aircraft in the Action Phase after aircraft complete their movement. Not all antiaircraft units will fire on every turn.

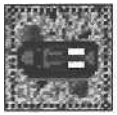
Antiaircraft Artillery (AAA)

These are typical small-caliber cannon mounted on fixed gunsites and vehicles. With a maximum range of ten grid squares, they can fire only as high as altitude 7. The accuracy of these guns is proportional to the technology level of the owner. Low-flying, slow-moving, and straight-flying aircraft are the most vulnerable to AAA fire.

Surface-to-Air Missiles (SAMs)

There are three ground units that can fire SAMs. SAM sites fire radar-guided SAMs, while SAM vehicles and Infantry units fire heat-seeking SAMs. SAMs are subject to all the same attack modifiers that air-to-air missiles are.

Radar-guided SAMs can be launched at a target at any altitude, but have a maximum range of 15 to 30 grid squares, depending on the technology level of the owner. Radar SAMs are better able to target high-flying aircraft, so it's a good idea to fly low if you want to avoid them. In addition, SAM sites are vulnerable to active jamming which can suppress their ability to launch missiles.



Heat-seeking SAMs launched by ground vehicles can be fired as high as altitude 1 2, and have a launch range of 12 grid squares. They are all-aspect weapons. Those launched by infantry units have a maximum altitude of 5 and range of 8. Nations with a technology level of 3 or more use All-Aspect infantry SAMs. Others use Rear-Aspect only.

7. COMBAT OPTIONS

The game is designed to suit players of any experience level by allowing them to tailor the game's complexity to suit their tastes. This is accomplished by a set of combat options. With these, players can choose just how much (or how little) added realism and complexity they want. This allows players to decide where the optimal trade-off between realism and playability lies for them.

At the Start screen, click the "Combat Options" button to see a window with a column of check boxes. Just click on the options you want to activate for the game. It's as simple as that! The game will remember the options you selected in your last saved game and will automatically default to those same options the next time you play until you change them. You can return to the Start screen from the Weapons Room or Pilot Lounge to change the selected options by selecting "Return to Start Screen" from the File menu. However, doing so cancels the current game in progress. Once a scenario actually begins, it is too late to change the options being used.

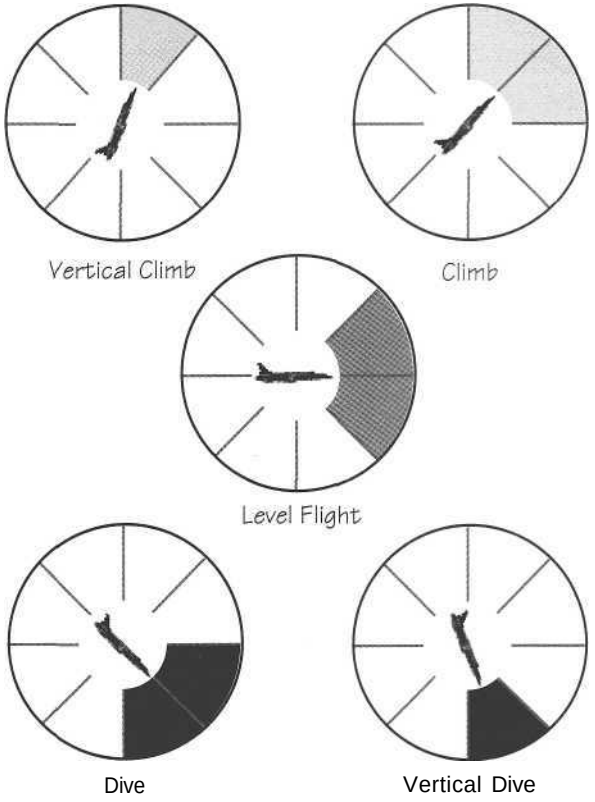
It's probably a good idea to play your first few games without using the combat options. As you become more comfortable with the game system, add one option at a time, giving yourself some time to get used to it. This will keep the game fresh and exciting, always presenting a new challenge.

NOTE: the term "Basic Game" used below refers to the game when the particular combat option being discussed is not in use.

ALTITUDE

When the Altitude option is activated, aircraft have not only a facing but a Pitch as well. Pitch refers to whether the aircraft is pointing up, down, or level. There are five different values for Pitch: Vertical Dive, Dive, Level Flight, Climb, and Vertical Climb.

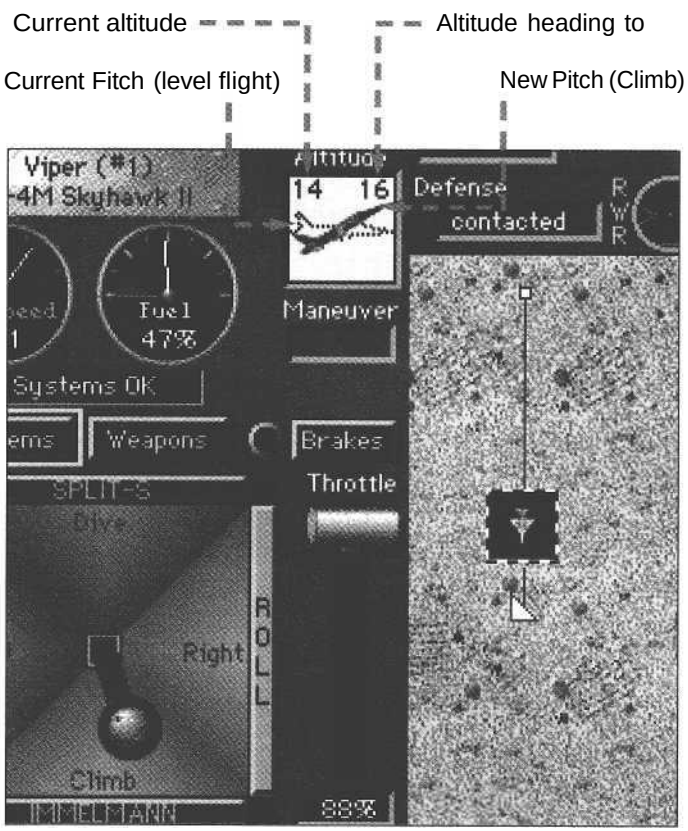
Targetting is now a matter of placing desired missile or radar targets not only in your front arc, but also within your Pitch. If you get the "not in pitch" message, it's because you're not pointing vertically at the target. Check your respective altitudes by selecting the Altitude item from the Display menu (or use keyboard command "Alt +A", which will replace all aircraft silhouettes in the Combat Display with altitude level readouts. Then you can tell whether you need to be pointing up, down, or level.



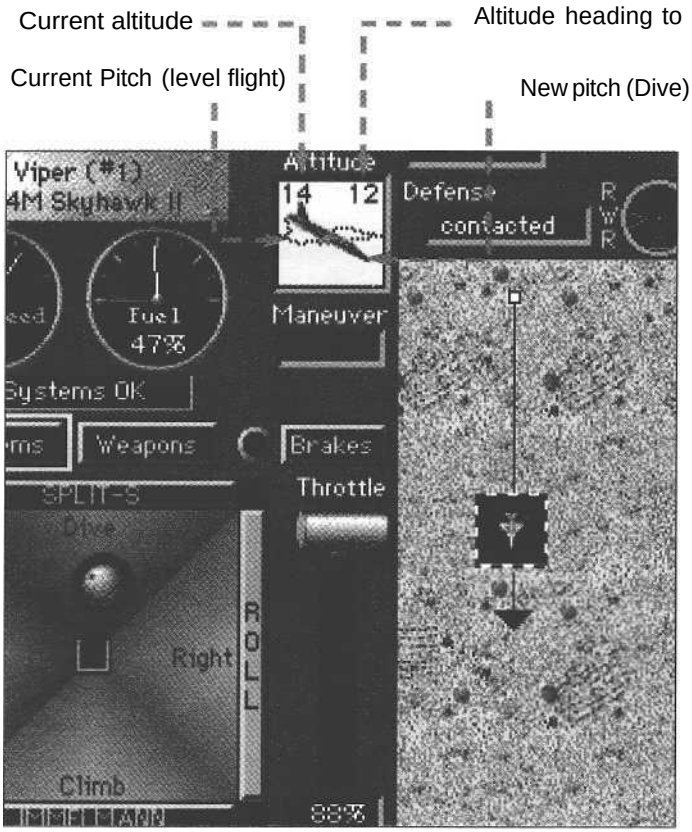
Zones of airspace covered by each pitch value.

The Flight Stick will now operate in the vertical as well as the horizontal direction, allowing you to mix climbs and dives with turning maneuvers. This can be a good way of decreasing your turn radius but be careful. Climbing (gaining altitude) causes significant deceleration and normally requires full throttle in order to avoid losing airspeed. Similarly, diving (losing altitude) accelerates an aircraft.

As you move the Flight Stick vertically, observe the Altitude Display which is located above the Throttle.

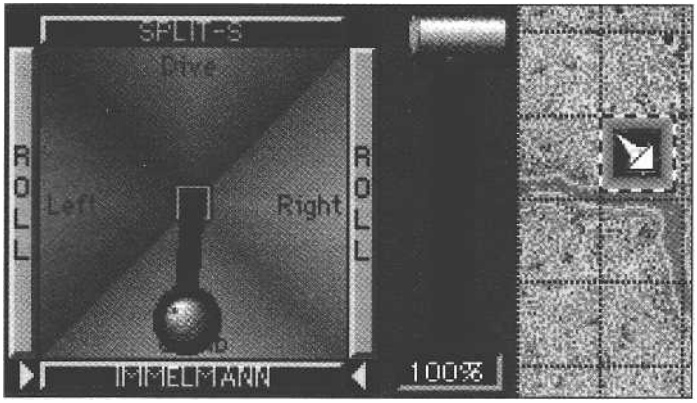


Notice that the colored aircraft shown in the Altitude Display changes vertical direction as you move the Flight Stick up or down. It demonstrates the Pitch that you will have on the *next turn after these maneuver orders are carried out.* Your current pitch is shown by the dotted silhouette behind the colored aircraft. In other words, Pitch is determined by the orders given in the previous move. The number in the upper left of the Altitude Display is the aircraft's current altitude. The number in the upper right is the altitude which the aircraft will achieve at the end of the move.



Now observe the Flight Path of your aircraft as you move the Flight Stick up and down. The arrowhead on the end of your Flight Path changes to a solid red when in a dive, to hollow white when climbing, and pink when level.

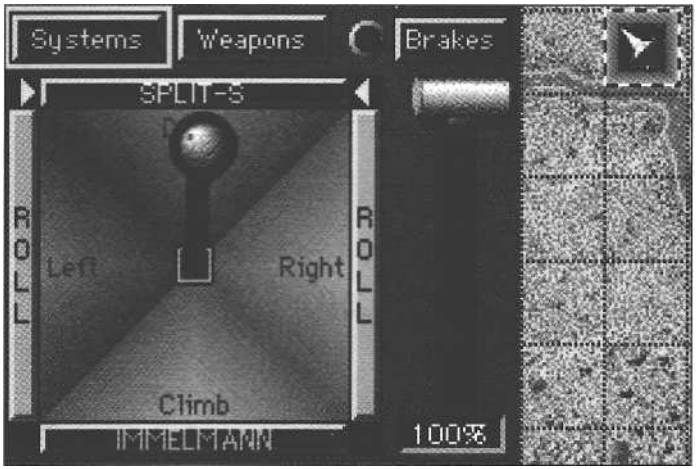
With the Altitude option in effect, you are now able to perform the Immelmann and Split-S maneuvers. The bars for these are located above and below the Flight Stick. Normally they will be inactive. To perform an Immelmann (a climbing half-loop that reverses an aircraft's facing), you must spend one move in a Vertical Climb. On the next move, if you pull the Flight Stick back into a Vertical Climb again, you will then be able to click on the Immelmann bar whose name will now be highlighted in green. Once you click on the Immelmann bar, the Flight Path arrow will reverse direction 180° and the Immelmann bar will be highlighted by green triangles. To cancel the Immelmann, simply click on the bar again. Otherwise, your aircraft will gain Altitude and reverse direction in the ensuing Action Phase.



An Immelmann in progress.

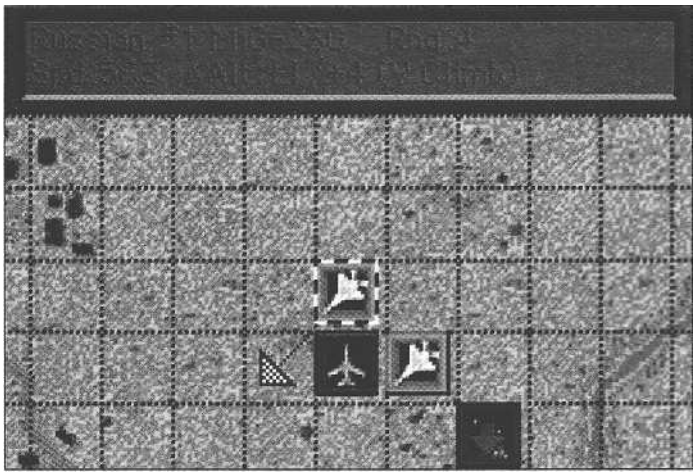
The Split-S is similar, except that it is a diving half-loop so you must be in a Vertical Dive on the first move, and in the next move do another Vertical Dive and click on the Split-S bar. Be aware that these maneuvers cause significant deceleration because they resemble High-G Turns executed in a vertical direction. The Immelmann bleeds off so much airspeed that it should only be attempted when flying at speeds of at least 400 MPH in a high-performance jet. Inexperienced pilots (those with air skill ratings of 3 or less) will decelerate even more due to their lack of finesse.

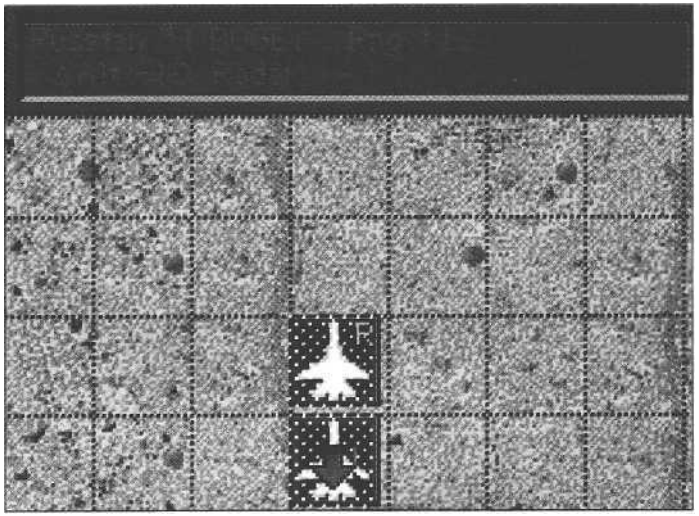
The Split S is the equal of the Immelmann but *loses* altitude.



All aircraft have an altitude limit above which the air is too thin for them to generate enough lift from their wings to fly. This limit is called a Ceiling. A typical ceiling is about 30 (50,000 ft.) but varies with aircraft type and Wing Loading. Aircraft may fly as low as altitude level 0.

When you're playing with the Altitude option, you will notice a new entry in the Data Readout when you place the cursor over an aircraft. In addition to the normal readouts for aircraft type, speed, and range, you may also see something like the one shown on the following page: ΔAlt:+1/+4 (V. Climb). The first number indicates the difference in altitude between the aircraft the aircraft under the cursor and the one currently receiving orders (your pilot). In this example, the red aircraft under the cursor is one level (+1) above the blue aircraft receiving orders. The next number (+4 in this example) only appears when you are

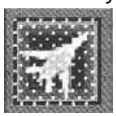




also playing with the Movement Phasing combat option, and it indicates the difference in altitude that will exist on the next move, assuming that the aircraft now receiving orders flies level. So, in this example, the red aircraft under the cursor is planning to climb three levels of altitude, going from one level above our blue airplane (+1) to four levels above it (+4). The Pitch value in parenthesis ("Vertical Climb" in the example) represents the current Pitch of the red aircraft under the cursor.

RADAR AND VISUAL CONTACTING

When using this option, aircraft will no longer be detected automatically. Instead, you must use your visual, radar, and IRST systems to find the enemy. These systems will not function perfectly, thus introducing "fog of war". You don't know where the enemy is or how many planes he has until you find them.



Any enemy aircraft to whom at least one friendly aircraft has some form of contact will be drawn in the Combat Display, even if your forces don't actually have a visual contact to it. If your active aircraft does not have visual contact to an enemy aircraft, that enemy will be shown with a speckled pattern of dots over its normal silhouette.

If you're ever unsure of the kind of contact your aircraft has to an enemy, place the cursor on top of the enemy aircraft. The Data Readout will indicate visual, radar, or IRST contact if it exists.

Radar controllers now become important. They are air- or ground-based radar systems that saturate the battlefield with powerful search radars. They contact all non-stealthy enemy aircraft and report their positions. With a radar controller, your awareness of the enemy will be much like it was in the Basic Game with the Radar and Visual Contacting option turned off.

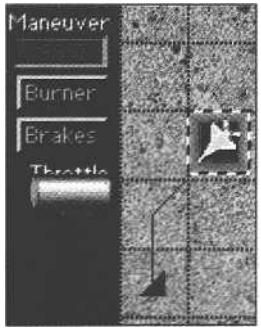
In the Basic Game, your aircraft began each mission with radars turned on by default. Now that there is a disadvantage to always having radar on (it announces your position to the enemy), games will begin with all radars off as the default. You can switch them on either individually or for all pilots by using the All Radar On/Off selection under the Radio Menu.

With Radar and Visual Contact activated, missiles will only be spotted when in visual range (1 8 squares) and not at all if in the only observer's blind spot. This makes having wingmen even more important because they protect your blind spots. Unspotted missiles are more lethal since a blind target isn't able to effectively engage the necessary defensive countermeasures.

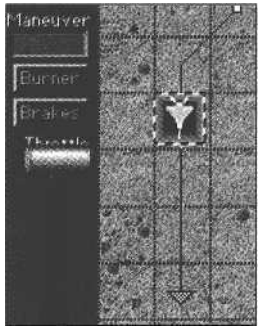
Aircraft with only one crewman will no longer see a value for an enemy aircraft's speed in the Data Readout unless it has established visual contact to that enemy. This represents a pilot's need to stay "heads up" when in close combat, and a second crewman's ability to work the radar in a dedicated fashion.

When in Air mode, clicking on the "Lock On" button will instruct your radar system to attempt to Lock-on to the currently targeted enemy aircraft. If you don't bother to click on this button and your radar is switched on and has TWS capability, then your aircraft will choose an enemy aircraft at random during the Action Phase and attempt to Lock-on to it. This may be a desirable convenience, but if you have a specific target in mind, click on that target with the mouse and click the Lock-on button.

With this option, aircraft using radar without TWS (Track-While-Scan) will not automatically attempt to Lock-on to an enemy aircraft at random as you might already be used to seeing. This is because Locking on would cause the radar contacts to be lost, which may be undesirable. You must select targets for Lock-on manually (by clicking on them and then clicking the Lock-On button) for aircraft with no TWS. When an enemy aircraft is selected for Lock-on, it will be shown with a small green "R" in the corner of its marker as shown on the top plane in the preceding illustration. It can be located by clicking on the "Find Tgt" button. A green crosshairs will appear over the target aircraft which will appear in the center of the screen. The Data Library reveals which aircraft are equipped with TWS.



Aircraft plans to make a High-G Turn (90°) with 69% chance of success ...



... but fails and only turns 45° in the Action Phase.

HIGH-G TURN LIMITS

You may have noticed that in the Basic Game all aircraft have the same ability to maneuver and turn on a dime. Real life isn't like that, and using this option reflects that reality. With this option in play, attempted High-G Turns may fail to execute.

Aircraft will no longer be able to make 90° turns whenever they please. Welcome to the concept of maneuver failure. Certain aircraft cannot always "pull G's" enough to successfully complete a High-G (90°) Turn. The game simulates this by allowing aircraft to attempt High-G Turns in the Give Orders Phase, but sometimes failing to complete them in the Action Phase.

High-G Turns consist of two separate 45° turns. When a High-G Turn fails, the second of the two 45° turns doesn't take place. The aircraft is treated as though it planned to turn only 45° instead of 90° except that deceleration is the same as if the High-G Turn had successfully completed and no defensive benefit against missile attacks is gained. As in the Basic Game, High-G Turns still bleed off a lot of airspeed, but now they do so with no guarantee of success!

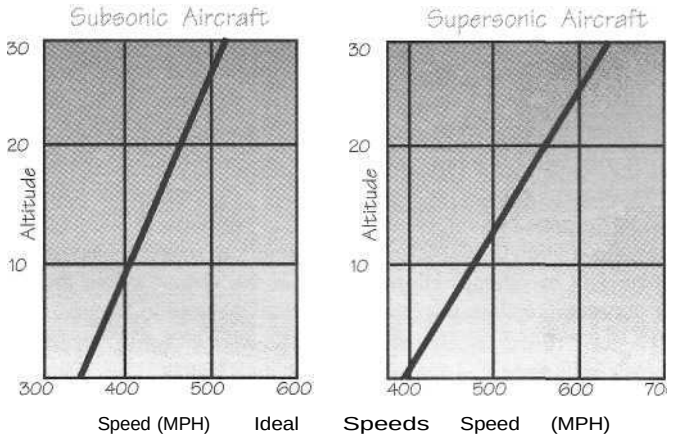
There is a chance that the High-G Turn will succeed. This value is called the Maneuver Percentage and is displayed in the Maneuver Display above the Afterburner button. The Maneuver

Percentage will appear on a red background whenever the Flight Stick is set for a High-G Turn.

Factors that improve an aircraft's maneuver percentage are:

- Aircraft type with high maneuver rating (A+ is best)
- Low altitude (where atmosphere is thicker)
- High pilot Air skill rating
- Few external weapons carried (less drag)
- Airspeed close to "ideal" (see below)

"Ideal" speed is the speed at which an airframe can "pull" the greatest number of G's, and hence make its tightest turn. The ideal speed for an aircraft depends on its current altitude and whether it's capable of supersonic speeds. Flying around 450 MPH is usually best as a general rule but the ideal speed for each altitude is shown on the graphs below.



Sometimes you'll find that your Maneuver Percentage is very low. This often happens as your airspeed bleeds off in a dogfight to well below your "ideal" speed. In these circumstances it's normally wise not even to attempt a High-G Turn, because the chance of succeeding is so low, yet the deceleration penalties are still high. You're usually better off cranking up your Throttle, and making a simple 45° turn, hoping to accelerate enough to reach your "ideal" speed on the next move to gain a better Maneuver Percentage.

Failing a High-G Turn represents anything from slow pilot reaction time to a clunky aircraft to a pilot attempting (and failing) to push his aircraft "beyond the envelope". For example, trying to pull high-G's in a Boeing 707 (the airframe used by the E-3 AWACS) is not a good idea. No matter how hard the pilot pulls back on the stick the airplane is simply not going to make a high-performance turn. It just wasn't built to do that. The same is true for many smaller aircraft as well, especially when they're flying at a speed that's too high (too much air resistance) or too low (not enough lift for the wings) to pull high-G's.

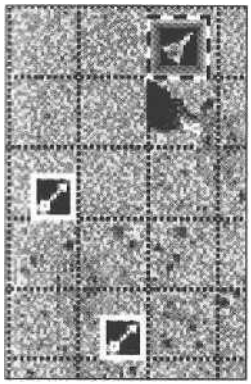
MISSILES TRACK

In real life, air-to-air missiles do not strike their targets immediately after launch (as they do in the Basic game). In fact, some missiles can be in flight for as much as a minute or two before either intercepting the target or running out of fuel.

With this option selected, missiles no longer attack immediately. When launched, a missile appears in a grid square adjacent to the aircraft that launched it. Over the next several Action Phases it will automatically fly toward its target, gaining or losing altitude if necessary. Once it enters the same grid square (and altitude) as the target, the missile will attack.

This means that aircraft firing Semi-Active Radar-Homing missiles must maintain the radar Lock-on to the target so the missile can track properly. If the Lock-on is lost, the missile is lost. The display to the left of the Radar button will tell you the I.D. number of the enemy you're guiding a radar missile toward:

Missile speeds are much greater than that of most jets, so it is rarely possible to outrun one. However, missile speeds are as much as 30% below their stated value at low altitudes where the air is thicker. A missile needs to accelerate to its top speed when launched and so flies more slowly on its first turn in the air. (NOTE: if fired from a fast-moving aircraft the missile will have more of a "boost").



Missiles will not be shown in the Combat Display until they are spotted. Starting with the move after launch, a missile can be spotted as soon as it's within 18 grid squares (five miles) of its target. You'll no longer always see the computer launching missiles. Instead, you'll just see the missile once it's close enough to spot. If a missile is chasing the aircraft to which you're currently giving orders, the missile frame will change to yellow. As can be seen at left, the active aircraft has some incoming problems. If those missiles had a blue border they would be targetted at another aircraft.

STALLS/GLOC

Aircraft are able to remain aloft because their wings convert some of the energy of forward motion into "lift". If the airspeed is too low there isn't enough energy to create the required lift, and the aircraft will lose altitude. This phenomenon is called a stall. When a stall results in uncontrollable and violent flight, it's called "departed flight", or a Spin.

In the Basic Game, no aircraft's airspeed will fall below 150 MPH, and no stalls occur. This is artificial and intended only to allow novice players to get a feel for flying before frustrating them with accidentally crashing aircraft (through the overuse of High-G maneuvers).

With this option selected, each aircraft has a stall speed, below which it cannot stay airborne. The stall speed is indicated by the "red zone" (gray on a B&W monitor) in the Airspeed gauge. Don't let your Airspeed needle fall into the red zone! Stalls and Spins can result. Your aircraft will automatically lose altitude until it regains sufficient speed, which can cause you to crash if you're flying low. You cannot give orders to an aircraft while it is stalled so the "Next Pilot" button will automatically skip over such aircraft. Don't worry. The computer will automatically hit the Afterburners to restart the engines of such aircraft if it is possible.

An aircraft's stall speed is primarily determined by its stall rating (see the Data Library). However, flying at high altitude and carrying heavy external armaments will increase stall speed significantly. Typical stall speeds are between 150 and 250 MPH.

Another effect of this option is the introduction of G-induced loss-of-consciousness (GLOC). When pulling eight or nine G's in a tight turn, a pilot can sometimes black out from the lack of blood flowing to his head. This is a grave situation because the aircraft is doomed to crash unless the pilot can regain consciousness in time. GLOC is rare, but is always a risk.

ADVANCED GROUND ATTACK

This option adds some realistic restrictions on air-to-ground attacks and is best used in conjunction with the Altitude option. The accuracy of bombing is seriously affected by aircraft Pitch. Being in a Vertical Dive is by far the most accurate way to deliver a bombload, though the maximum range then drops to two grid squares. A Dive is the next best pitch (maximum bombing range of four squares) followed by level flight (maximum range of six squares) which is inaccurate. Bombs may not be dropped from a Climb or Vertical Climb. It is the aircraft's current Pitch (shown by the dotted gray outline in the Altitude Display) that affects the bomb drop. For example, to perform a dive-bombing you would enter a Vertical Dive, and on the next move drop the bombs. Planes with low-quality bombsights will have a very difficult time hitting anything unless in a Vertical Dive. Pitch does not affect the accuracy of laser-guided bombs.

MINIMUM RANGES: Aircraft that attempted or performed a High-G Turn on the previous move may not launch an air-to-ground attack. In addition, the minimum ranges for rockets and ARMs detailed in the Combat section are now in effect. Bombs have a minimum horizontal range of two if dropped from level flight, one if from a Dive, and 0 from a Vertical Dive.

Players no longer have the advantage of hindsight in determining how many bombs to drop. When you press the Bomb button, a window will appear giving you a choice of how many of your bombs to drop at this time on this target.

Rockets can only be fired from either level flight at altitude 3 or lower, or from a Dive. ARMs may not be launched from a Climb, Vertical Climb or a Vertical Dive.

Flying a straight Flight Path now helps make attacks more accurate because it allows the pilot to aim properly. Fly straight on one move, and on the following move you'll qualify for the bonus. In other words, it's the Flight Path of your last move that affects your aim. The flip side is that flying straight also makes an aircraft more vulnerable to AAA fire.

MOVEMENT PHASING

This option breaks the Give Orders Phase down into two parts: the Standard and Advantaged Phases. The Standard Phase comes first, and all maneuvers planned in the Standard Phase are visible to any of the opponent's aircraft that plan maneuvers in the Advantaged Phase. This simulates the ability of some pilots to predict how their opponents intend to maneuver. A prime example is when one aircraft is "tailing" another. The pilot of the rear aircraft can see and quickly react to the movements of the aircraft he's tailing.

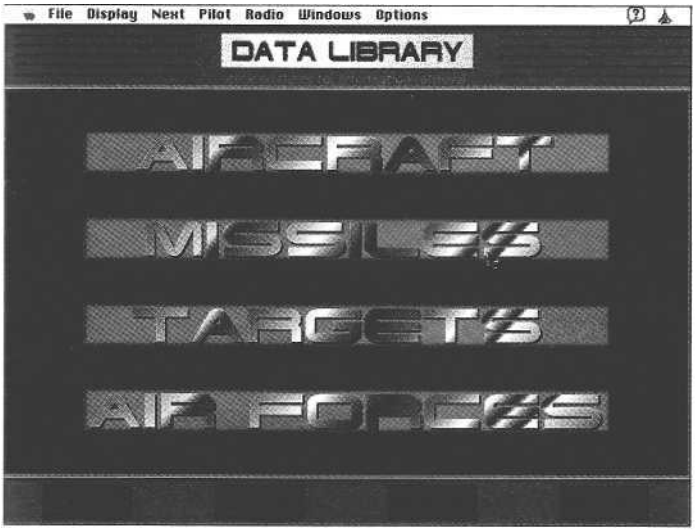
We simulate tailing by forcing tailed aircraft to plan maneuvers in the Standard Phase (exception: depending on pilot skill and training, some good pilots can avoid being forced into the Standard Phase, especially when tailed by poorly skilled pilots). An aircraft must face and be behind another aircraft in order to tail it. When one aircraft is tailing another and suddenly forces the tailed aircraft to plan in the Standard Phase when it would not otherwise have done so, you'll be informed by a message in the Combat Report window.

Pilots with high Air skill ratings are more likely to fly Advantaged than those with low skill, but only those pilots who have at least one visual contact to an enemy aircraft can plan moves in the Advantaged Phase. When playing with the Missiles Track option, aircraft that are guiding Semi-Active Radar-Homing missiles will automatically plan moves in the Standard Phase.

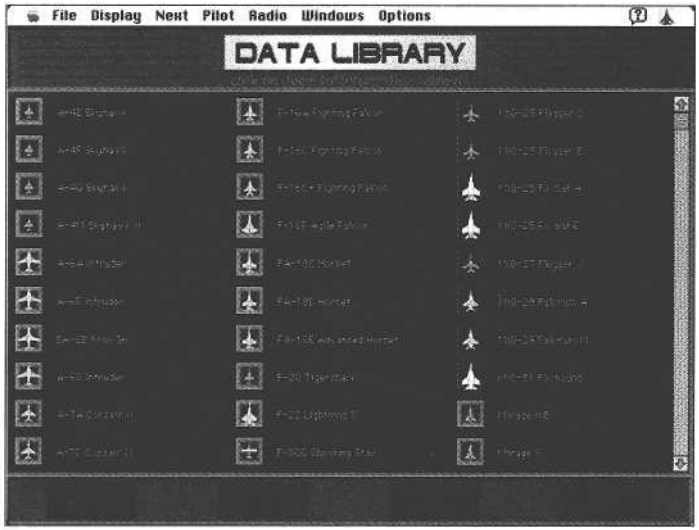
You should select the "All Aircraft Paths" item from the Display menu (or use keyboard command "Alt +P") when using this option, so your advantaged pilots can see the planned flight paths of enemy aircraft who moved in the Standard Phase.

8. DATA LIBRARY

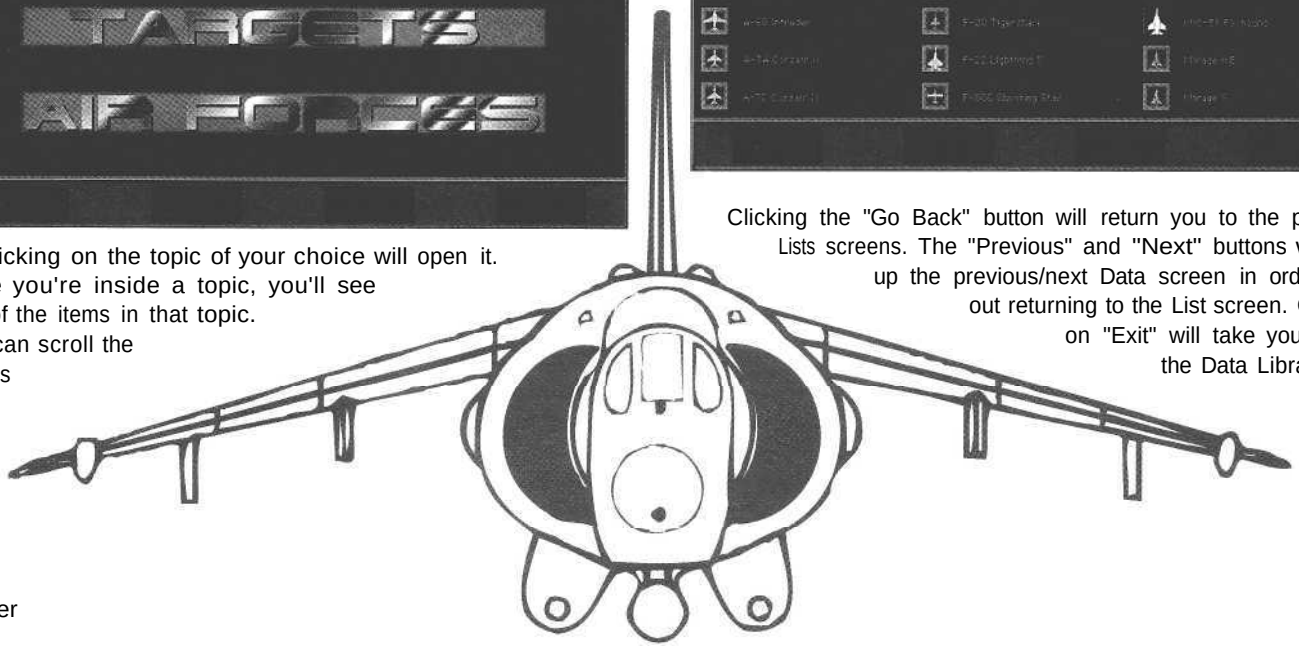
The game has an extensive on-line database that displays descriptions and performance data for the combatants in the game. Just select the Data Library item from the Windows menu or use keyboard command Alt +D" to see it.



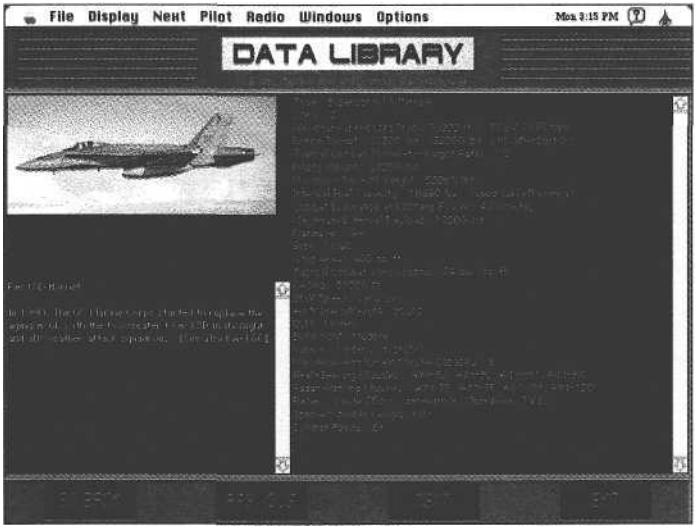
Clicking on the topic of your choice will open it. Once you're inside a topic, you'll see lists of the items in that topic. You can scroll the lists up or down by clicking on the Scroll arrows at the right. Clicking on any item listed will open the specific data screen for it.



Clicking the "Go Back" button will return you to the previous Lists screens. The "Previous" and "Next" buttons will call up the previous/next Data screen in order without returning to the List screen. Clicking on "Exit" will take you out of the Data Library.



Harrier



AIRCRAFT

The Data screen for each aircraft contains a description of the aircraft and a list of performance data. A brief summary of the different data fields is provided here:

Type: The name of the aircraft is on the first line, followed by its type and whether it's supersonic. There are eight different types:

Fighter: Primarily used to fight enemy aircraft of ail types in air-to-air combat. Fighters are typically small, very maneuverable aircraft with high thrust-to-weight ratios.

Interceptor: Designed to engage in air-to-air combat, but of a different sort than the Fighter. The interceptor's mission is to shoot down intruding bomber aircraft with long-range radar-homing missiles. Interceptors are usually fast but often lack maneuverability. They are usually big aircraft, enabling them to carry a large number of missiles. Older interceptors are typically relegated to the strike role once their weapons systems are obsolete.

Strike: An aircraft designed to execute air-to-ground attacks.

Close-Support: Similar to Strike, but intended more for "battlefield loitering" (i.e. flying around the front lines looking for enemy troops to attack). Usually armored.

Multi-Role: Fully capable of performing as either a Fighter or Strike aircraft.

Jamming: Equipped with a powerful active radar-jammer, these aircraft are intended to accompany a strike squadron to its target and shield it from enemy radar.

Air Radar: Sometimes referred to as air-early-warning (AEW), these aircraft carry huge 360° radars and effectively act as airborne radar controllers.

Spy *Plane:* Designed for covert strategic photo recon.

Crew: The number of people on board.

Maximum Speed: Measured at both sea level and high altitude (level 21).

Engine Thrust: Full-throttle thrust measured in pounds. Value for afterburner-assisted (i.e. maximum) thrust is shown if an afterburner is present.

Typical Combat Thrust-to-Weight Ratio: The ratio of the aircraft's maximum engine thrust to its (typical) combat-loaded weight. Higher values mean better acceleration.

Empty Weight: Weight of aircraft with no weapons or fuel.

Maximum Takeoff Weight: The maximum weight at which the aircraft can still take off from the ground.

Internal Fuel Capacity: The size of the internal fuel tank. The fuel efficiency of the engines is shown in parenthesis if other than average.

Combat Endurance at Military Power: How many minutes the aircraft can fly at full throttle (without afterburners) before running out of fuel with a normal full fuel load.

Maximum External Load: The maximum weight of external armaments that this aircraft can carry.

Maneuver: Rated from A+ (best) to F (worst). A better rating means High-G Turns have a greater chance of success.

Size: The physical size of the aircraft. Larger aircraft are easier to spot and pick up on radar.

Wing Area: A measure of the size of the wings. Divide the weight of the aircraft by the wing area to calculate Wing Loading in pounds per square foot. Higher Wing Loading translates to greater deceleration during turning maneuvers, so fighter aircraft prefer to have greater wing area (and lower Wing Loading).

Typical Combat Wing Loading: The average amount of weight per square foot of wing area, assuming typical combat loading. Higher values mean the aircraft will suffer greater deceleration in turning maneuvers.

Ceiling: The highest altitude the aircraft can reach. When carrying external weapons, the effective ceiling may be lower.

Stall Speed: Rated from very low to high, this is a measure of how slowly the aircraft can fly before losing control. The rating of N/A refers to VTOL jets like the Harrier that can hover in midair. These jets never stall in the game.

Airframe Strength: A measure of the amount of battle damage the aircraft can withstand.

ECM: A measure of the sophistication and power of the electronic countermeasures equipment carried on-board to confound enemy radars and radar-homing missiles. Rated from "none" to "highly advanced".

Bombsight: How accurate the on-board bombing system is, rated from basic to advanced. A rating of none indicates that the aircraft cannot carry air-to-ground weapons.

Cannon: A rating of the accuracy (and presence) of the cannon. Values range from none to modern. The label "heavy" indicates that the cannon is very powerful and can pierce tank armor. The ammunition carried (in shots) is noted in parenthesis.

Maximum Air-to-Air Missile Capacity: The number of air-to-air missiles the aircraft can carry.

Heat-Seeking Missiles: The types of heat-seeking missiles this aircraft can carry (if any).

Radar-Homing Missiles: The types of radar-homing missiles this aircraft can carry (if any).

Radar: If the aircraft has an air-to-air radar system, the following items may be shown.

Range: The maximum range, in miles, that this radar can contact an average fighter-sized target.

Strength: Measured 0 (worst) to 10 (best). Affects chances of obtaining radar Lock-ons and maintaining them versus defensive ECM.

Arc: Listed only if other than front 90°.

Lookdown: Noted if radar has lookdown capability.

Track-While-Scan (TWS): Noted if present.

Targets: Noted if radar can Lock-on to more than one target at a time.

Special: Any special characteristics not found on most aircraft are lumped under this category.

Active Jammer: Rated 1 to 3 for strength.

Stealth: Rated from 1 (early) to 2 (advanced).

Supercruise: The ability to fly supersonic without afterburners.

VIFF: The ability to use vectored-thrust, like the Harrier. This can make for tighter turns and avoid stalls.

Bubble Canopy: A high-profile cockpit canopy that gives an excellent view to the pilot. It enables the pilot to see enemy aircraft to his rear as long as the enemy is at a higher altitude.

Heads-Up Display (HUD): This is a system that projects flight and targeting information onto the pilot's windscreen. When an HUD-equipped aircraft has a radar Lock-on to an aircraft, it will gain automatic visual contact to the enemy aircraft if within visual range, be able to make effective cannon attacks against it at night, and be exempt from the requirement that visual contact to the target be established before a heat-seeking missile can be fired if a radar Lock-on exists.

Wing Type: Only noted if not "standard". Can be delta which gives improved acceleration at supersonic speeds but increases deceleration in turns, advanced delta which causes less deceleration than a normal delta, or swing-wing which behaves normally at subsonic speeds but like a delta at supersonic speeds.

IRST: Noted if present.

Laser Designator: Equivalent to a built-in L-Pod. Noted if present.

Night Vision: Equivalent to a built-in N-Pod. Noted if present.

Bomb Bay: No aerodynamic drag penalties are incurred for bombs stored inside. Noted if present along with capacity (in bombloads).

Combat Points: A measurement of the combat power of the aircraft.

MISSILES

The entry for each missile contains a description of the missile and a list of performance data. Below is a list of the different data fields and what each one means.

Type: The seeker type.

Kill: The rough chance that the missile will hit a non-maneuvering target from the rear, under normal circumstances.

ECCM: (Radar missiles only) A measure of the strength of the on-board electronic counter-countermeasures system that helps the missile burn through ECM.

Quickness: The agility of the missile. This determines the missile's ability to follow a target through High-G Turns.

Launch Envelope: Minimum and maximum launch ranges, measured in grid squares.

Maximum Speed: Speed traveled at high altitude once the missile has had time to accelerate fully.

Burn Time: The number of moves the missile can fly before running out of fuel.

Launchable under High-G: Yes if the missile can be launched from an aircraft that just performed a High-G Turn.

Weight: The weight of the missile.

TARGETS

The entry for each target unit contains a description of the unit and a list of performance data. Below is a list of the different data fields and what each one means.

AA Weapon: The weapon (if any) that can be fired at aircraft.

Size: Size of the unit, from small to large. Bigger units are easier to hit.

Toughness: How resistant the unit is to damage. Rated from "soft" to "hardened". This affects the damage sustained from near-misses. Larger units usually take more hits to destroy, even if they're "soft".

Value: The points scored by the attacker for knocking out this type of unit.

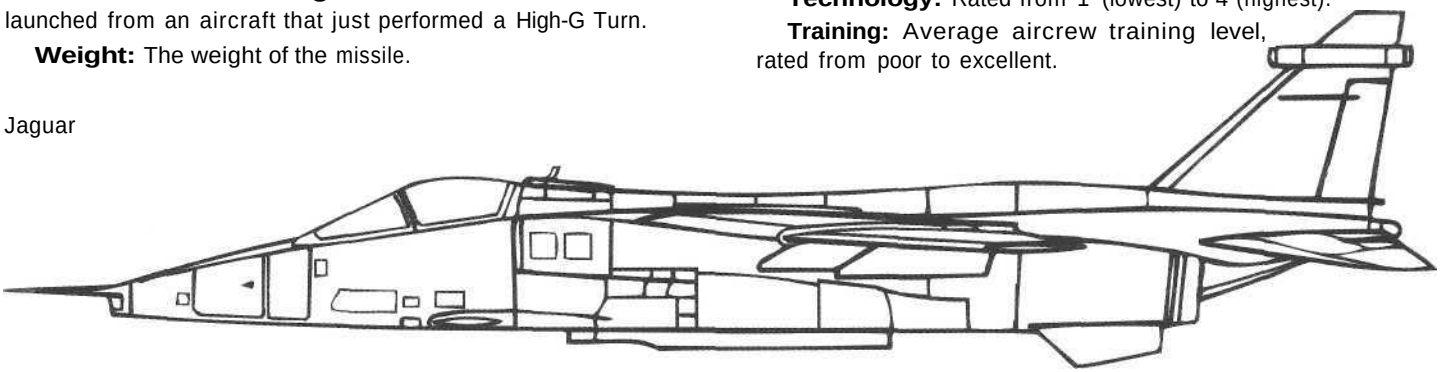
AIR FORCES

The entry for each air force contains a description and the force's combat insignia.

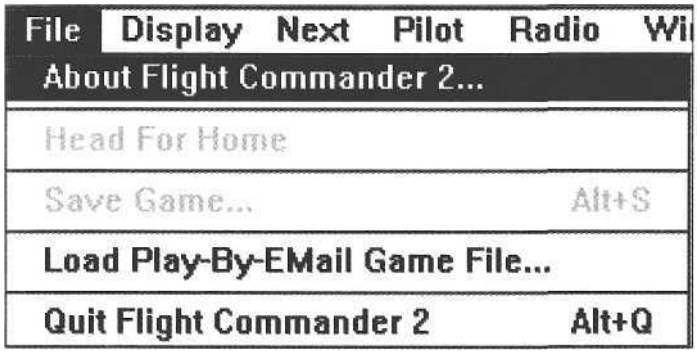
Technology: Rated from 1 (lowest) to 4 (highest).

Training: Average aircrew training level, rated from poor to excellent.

Jaguar



9. MENUS



File

Head For Home/Return To Start Screen

Head For Home" ends the current mission unless you are too closely engaged. You must separate from the enemy sufficiently to be allowed to end the mission without the computer taking command of your forces. Use this command when all aircraft have decided to break off from combat and are heading toward their respective airbases. "Return To Start Screen" is shown during the setup process for Campaigns. If you're setting up for a Campaign Mission and change your mind and want to play a different scenario, select this item and it will take you back to the Start screen.

Save Game - Alt +S

Saves the game currently in progress.

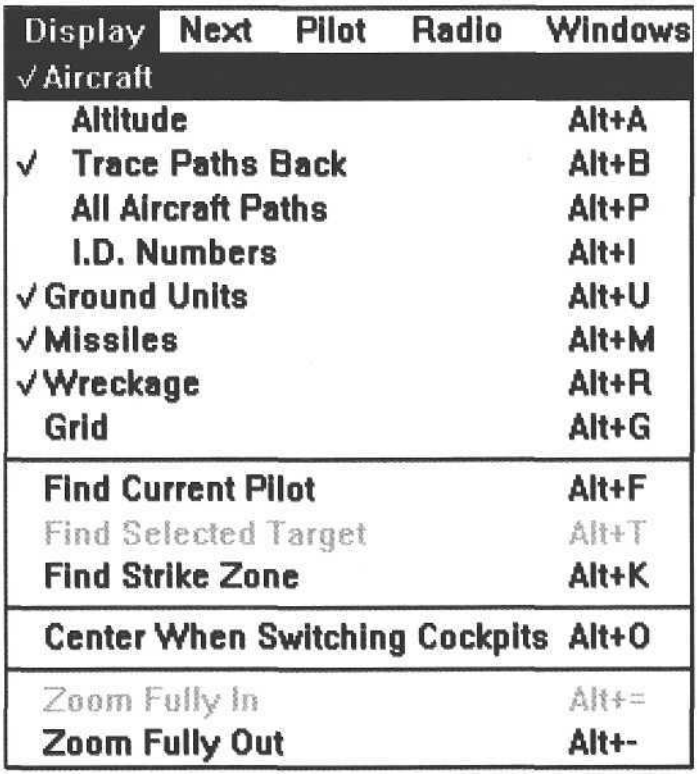
Load Play-By-EMail Game File

When beginning a Play-By-EMail game created by another player, select this menu item to load the file he sends you.

The Movement Phasing combat option is never used when playing an EMail game since its inclusion would double the number of responses needed.

Quit FLIGHT COMMANDER 2 - Alt +Q

Returns to the Program Manager in Windows (or the Finder for Macintosh).



Display

Aircraft

Toggles whether aircraft are shown in the Combat Display or not. If aircraft overflying ground targets obscure your view of the latter, toggling them off provides a clear view of the ground.

Altitude - Alt +A

Toggles whether aircraft altitude levels or their silhouettes are shown in the Combat Display. This is useful when you want to get a quick view of everyone's altitude alt at once.

Trace Paths Back - Alt +B

Toggles whether to show aircraft Flight Paths from the previous move (as well as the current move) in the Combat Display. This shows you where everyone is coming from.

All Aircraft Paths - Alt +P

Toggles whether to show the Flight Paths of all aircraft in the Combat Display or only that of the currently selected aircraft. It's often useful to use this so you can see where everyone is heading, but with a lot of aircraft it may cause the Combat Display to become cluttered in a dogfight.

I.D. Numbers - Alt +I

Toggles whether to display aircraft I.D. numbers in the Combat Display.

Ground Units - Alt +U

Toggles whether ground units are shown in the Combat Display.

Missiles - Alt +M

If Missile Track option is used, toggles whether fired missiles are shown in the Combat Display as visible counters.

Wreckage - Alt +R

Toggles whether aircraft wreckages are shown in the Combat Display.

Grid - Alt +G

Toggles whether the grid is shown in the Combat Display.

Find Current Pilot - Alt +F

Centers the Combat Display on the currently selected aircraft (the one that is receiving orders).

Find Selected Target - Alt +T

Centers the Combat Display on the selected target (the aircraft or ground unit with the crosshairs on it).

Find Strike Zone - Alt +K

Centers the Combat Display on the general vicinity of the The ground units will flash on the screen three times.

Center When Switching Cockpits - Alt +O

Toggles whether to center the Combat Display on the active pilot each time the "Next Pilot" button is clicked.

Zoom Fully In - Alt + =

Immediately shows the Combat Display at full scale.

Zoom Fully Out - Alt+-

Immediately shows the Combat Display at smallest scale.

Next	Pilot	Radio
Next Pilot...		Alt+N
End Phase...		Alt+E

Next

Next Pilot

Equivalent to pressing the Next Pilot button, this switches you into the cockpit of the next aircraft in your squadron.

Begin Action Phase/End Phase - Alt +E

Equivalent to pressing the button of the same name. In the Basic Game, this ends the Give Orders Phase and begins the Action Phase. With the Movement Phasing option activated, this menu item will end whatever phase you're in (Standard or Advantaged) and move on to the next.

Pilot	Radio	Windows
√ Human Control		Alt+8
Computer Control		Alt+9
Send Home		Alt+0
Change Name...		Alt+H
Crew Eject...		
Jettison Stores...		Alt+J

Pilot

Human Control - Alt +8

Places the currently selected pilot under your control.

Computer Control - Alt +9

When checked, this pilot will fly under computer control beginning on the following move (though still on your side!). This is useful if you don't want to personally fly every plane.

Send Home - Alt +10

When checked, the currently selected pilot is under your control, but will not be "visited" again when you click on the "Next Pilot" button. He will turn to head for home and fly straight unless you click on his aircraft to change his Flight Path. This is useful for aircraft that have finished with combat, so you don't have to be bothered with them as you click through your squadron with the "Next Pilot" button. However, such pilots fly a less evasive course and are easier prey if enemy aircraft are in the vicinity.

Change Name - Alt +H

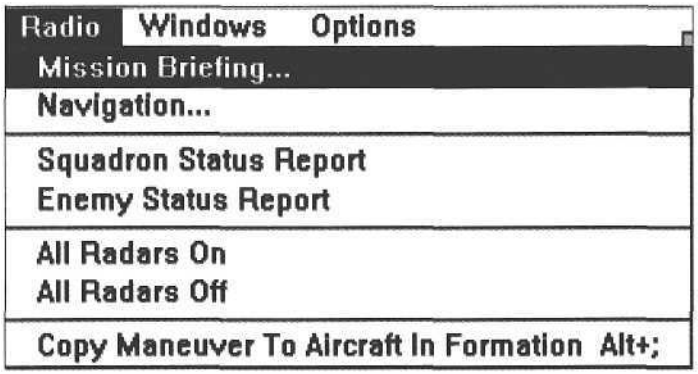
Change the name of the current pilot.

Crew Eject

Eject from the aircraft. Only do this if your aircraft appears to be about to go down in a Campaign game to save the pilot.

Jettison Stores - Alt +J

Brings up a dialog allowing you to dump weapons/external fuel stores you don't want. This can be useful to reduce fuel requirements for the flight home (due to less drag) or in order to dogfight with a lightweight fighter.



Radio

Mission Briefing

Recalls the Mission Briefing window in case there is some aspect of the mission you need to recheck.

Navigation

Recalls the Navigator window to show the way to the strike target (if there is one) or your home field. As you fly towards your homebase, your Bingo fuel value steadily decreases because you're getting closer to your airbase.

Squadron Status Report

Brings up a window containing your squadron's status report.

Enemy Status Report

Brings up a window containing the enemy's status report.

All Radars On

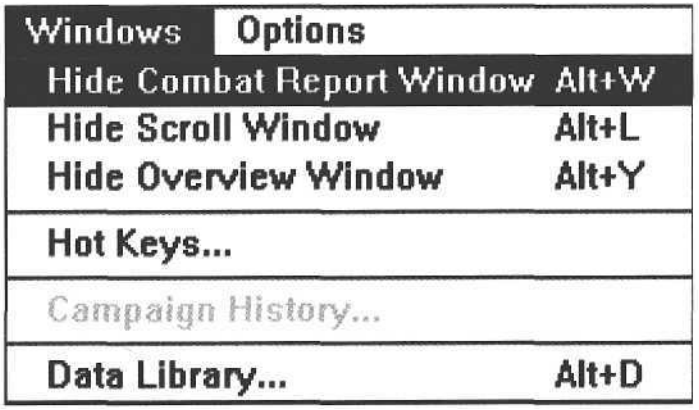
Turns on the Radar of all aircraft.

All Radars Off

Turns off the Radar of all aircraft.

Copy Maneuver to Aircraft in Formation - Alt +;

This duplicates the maneuver of the selected aircraft to all aircraft of same type and facing within ten squares. The copied maneuver includes Throttle, Burner, and Brakes settings.



Windows

Hide/Show Combat Report Window - Alt +W

Hide/Show Scroll Window - Alt +L

Hide/Show Overview - Alt +Y

Hides or shows the respective floating window. Those with small screens may find it useful to remove these windows.

Hot Keys

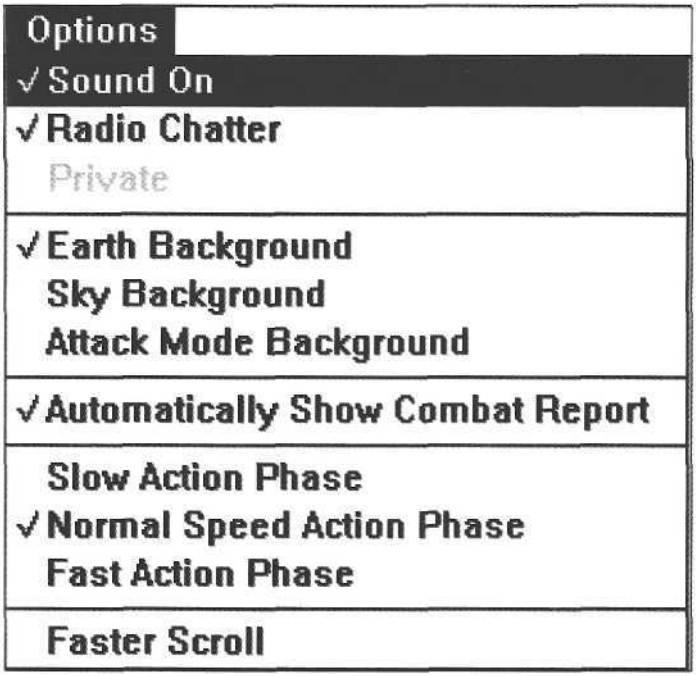
Brings up a window showing handy keyboard shortcuts.

Campaign History

If you're in the midst of a Campaign, this will bring up a window showing the success of your previous missions in the current Campaign.

Data Library - Alt +D

Summons the Data Library.



Options

Sound On

Toggles sounds on and off.

Radio Chatter

Toggles the background voices on and off.

Private

This is applicable only to two-player games. When selected, sounds are played only during the Action Phase so human players won't hear each other turn on Afterburners, activate radars, etc.

Earth Background

Sky Background

Attack Mode Background

This option toggles back and forth between Earth Background when in Ground Attack mode and Sky Background when in Air Attack mode.

Automatically Show Combat Report

When checked, the Combat Report window will appear at the beginning of each move if there's any battle news to report. This is useful if you're playing on a small monitor and you need to click away the Combat Report in order to free up screen space. When this menu item is checked, you won't miss any important news.

Slow/Normal/Fast Action Phase

Choose the speed at which you wish the Action Phase resolved. Fast speed presents the most fluid and pleasant viewing, but it becomes more difficult to follow what's happening. When using the High-G Turns and Missile Track Options, the slower speeds can be very entertaining and enlightening.

Faster Scroll

When checked, the Combat Display scrolls at twice normal speed.

10. TACTICS

The following discussion assumes that you're using all of the combat options (most importantly Missiles Track and Altitude). However, it could still enhance your skills even if you're not.

AIR-TO-AIR COMBAT

Be Aggressive!

Put simply, there are two things you must do in a dogfight: point at the enemy, and shoot first. It's even better if you can shoot often, although this will depend on the number of missiles you have.

One general rule of air combat you should take to heart is this: take any reasonable shot you can get. If you wait for the "perfect" opportunity, you may wait a long time only to get shot down before it arrives. This is especially true if you're flying a modern jet with a heavy load of missiles. Use those extra missiles to your advantage by filling the air with them. Any shot you take will put your opponent on the defensive, and remember: an aircraft downed by a lucky hit is just as dead as one hit by an "earned" shot.

You must get used to the fact that, in a dogfight, most missiles will miss their targets. But even those that miss still force the enemy to maneuver defensively to defeat them - by turning hard and going off-course, or shutting down afterburners and losing airspeed, or pointing away and losing the opportunity to fire back at you.

Long-Range Combat

Most modern air combat begins long before the combatants can actually see one another. For this reason it's important to master the use of radar and radar-homing missiles. Long-range combat is usually not as deadly as a dogfight, but casualties will occur and, perhaps more importantly, the maneuvering you do (or force your opponent to do) at this stage will affect the strength of your position once you close to dogfight range.

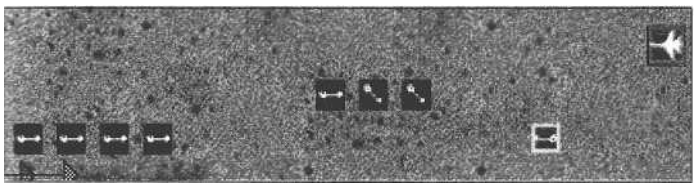
The first thing you should do is decide which side has the advantage at long range. Who has the more powerful radars? Which side has more or better radar-homing missiles? If you feel that your enemy has the advantage (if he's flying some modern Western jets, for example) then it's your best bet to crank up your afterburners and head in for close combat as quickly as you can. If you're flying older guns-only jets then this is your only option. If you have them, try to fire radar-homing missiles at your opponent on the way in, but make defensive maneuvering and closing the range your primary goals. If you are truly outclassed at long range and are flying small, hard-to-spot aircraft, you may want to consider leaving your radars switched off. That way you won't show up on your enemy's radar-warning receivers (RWR) and it will take him that much longer to find you on his radar. This may buy you enough time to close the range and not come under fire. Without your radar, you'll still know where the enemy is located by the directional signals on your radar-warning receivers. If your opponent lacks look-down radar, you may be able to escape detection entirely by flying very low to the ground.

On the other hand, if you feel that the two sides are evenly matched or that you have the upper hand, then it's to your advantage to find the enemy and get missiles into the air as soon as possible. Your enemy will be forced to maneuver defensively to avoid them, and while he's dodging your missiles you can line yourself up for a better shot. Even if you don't score any hits, at least his maneuver plans will be disrupted by having to dodge a barrage of incoming missiles. Radar-homing missiles are more useful than heat-seekers at this stage of the battle because they usually have a longer range and are more effective from the target's front aspect. Fire your radar-homers now. Don't wait for later because RHMs are next to useless at close range. Now is perhaps your only chance to use them. (There's one exception to this: at the end of the battle you may be able to nail an escaping enemy from the rear with a missile, but only save an RHM for this purpose if you are carrying so many that you can afford to hold on to one). If you're lucky enough to have a lot of missiles at your disposal, try to have a missile intercepting each enemy aircraft on every move so he never gets a break from defensive maneuvering.

If you have the better long-range capability, then you're in no rush to close the range. Keep your throttles at 50% (cruising speed — just enough to dodge the occasional missile) and take your time.

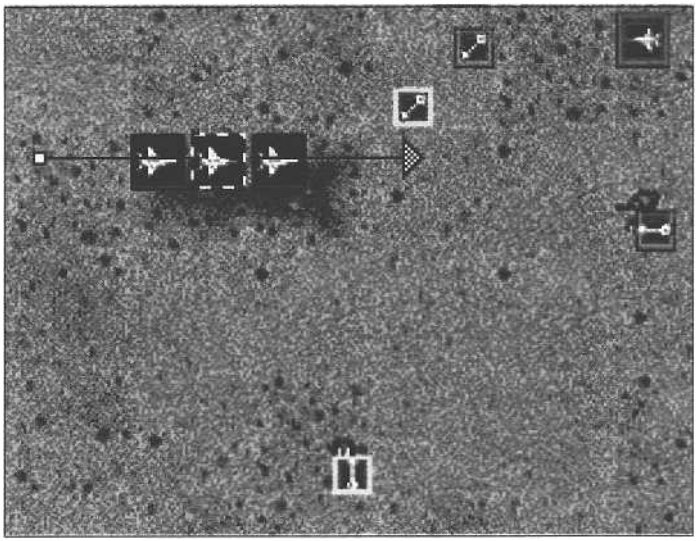
There are only two concerns you should have at this stage of me battle with regards to firing too often. First, because radar-homing missiles require a continuous Lock-on from the firing aircraft to intercept the target, if that Lock-on is lost, the missile will lose guidance and self-destruct. The obvious problem here is that if one of your aircraft has several RHMs in the air all guiding on one target and the Lock-on is lost, all of those missiles will be lost. Lock-ons can be lost for a variety of reasons, but the most common will be radar-jamming (ECM) emanating from the target. For this reason, you ought not to have more than one or two RHMs from any one aircraft in the air simultaneously. The exception to this is the Active-Homing Radar Missile e.g. AIM-54 Phoenix, AIM-120 AMRAAM) which requires a lock-on only to fire. If the firing aircraft's Lock-on is broken after launch, the active-homing missile is unaffected. Additionally, with quality missiles you may not want to launch too many (say, more than three) at one target because if the first missile destroys the target, the rest are wasted. With older missiles you should fire as often as you can because most of them will miss.

Poor fire control: seven missiles vs the same target can be



defeated by just one maneuver.

Your other concern regards the pattern in which you fire your missiles. Although you should fire freely and often, you should try to avoid having all your missiles intercept a target at the same time. The reason is that he can pull one defensive maneuver that will help defeat all incoming missiles at once. If there are no more missiles coming at him on the next move, then it's no problem for him if his airspeed is low or if he's caught out of position. You're better off "ripple-firing" your missiles so that a new one attacks the target each turn. That way, he'll have to make a separate defensive maneuver to defeat each missile. As soon as he dodges one, another arrives. Sooner or later he'll be so low and slow from all the twisting and turning he's done to avoid those missiles that he'll be a sitting duck.



The active aircraft is the meat in a missile sandwich - facing incoming missiles from two directions which will probably arrive in consecutive moves. In maneuvering to avoid the first, the aircraft will become more vulnerable to the second.

The Head-On Pass

Sooner or later, as the opposing forces converge, you'll find yourself in one of the classic opening situations of air combat: the head-on pass. To keep things simple, let's assume that you and your opponent each have only one aircraft.

The most important thing is to know your aircraft. Be familiar

with its strengths and weaknesses, and those of your opponent's. Generally speaking, the objective is to get behind your opponent so you can fire missiles or cannon at him from the rear, where you'll have the greatest chance of scoring a hit. How you go about this depends largely upon how the aircraft match up.

Use your strengths against your opponent's weaknesses. If your maneuver rating is better, reverse by turning horizontally after the head-on pass (pull a High-G turn). If you are coming in fast, make a shallow climb as you turn to reduce airspeed and turn radius. If not, then turn hard, crank up your throttle and dive, if necessary, to maintain airspeed and reduce turn radius. You may want to turn horizontally even if you possess an inferior maneuver rating if you have an angles advantage (e.g., if your opponent just dodged a missile and is heading off-course).

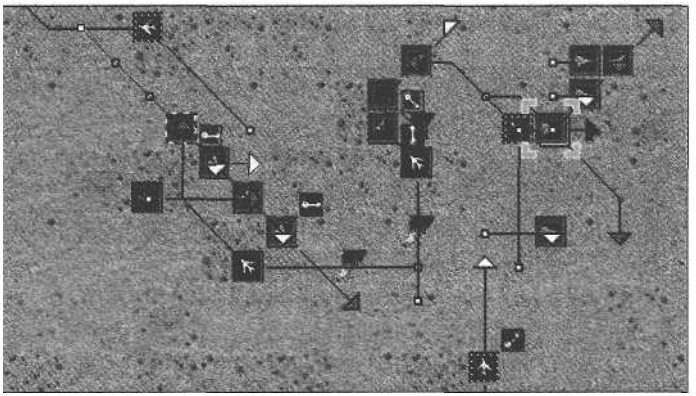
Conversely, do not try to keep turning in close with a more nimble adversary, unless you have a much better pilot which may offset the difference in maneuver capabilities of the respective aircraft. If you can be out-turned, pass your opponent at full-throttle, and reverse direction using the vertical: Immelmann or Split-S maneuvers. These are good maneuvers for aircraft with poor maneuver ratings but good acceleration (i.e., thrust-to-weight ratios). Vietnam-era F-4 Phantom pilots made frequent use of the vertical when dogfighting with MiG-17 fighters that were more agile but less powerful. Unfortunately, these vertical maneuvers can leave you pointing too steeply up or down rather than at your opponent. An Immelmann also bleeds off airspeed (about 300 MPH, even when you're on afterburner), so attempt one only when flying a high-performance jet moving at maximum throttle. Otherwise you risk stalling out, so use a Split-S.

If you're too slow to perform an Immelmann and too low to pull a Split-S, you can still turn horizontally to reverse. You'll probably need airspeed so light your afterburner and enter a shallow dive while turning 45° at a time. It's important to turn in the opposite direction that your enemy did to increase the distance between you and buy some time. You must use distance to negate his maneuver advantage. Speed helps to accomplish this so try to keep it high.

Dogfighting

The weapons of choice for close range combat are the heat-seeking missile and cannon. Radar-homing missiles have too long a minimum range to be useful at close quarters and also require a radar Lock-on before firing which takes too long to acquire (by the time you get one, the fire opportunity has passed).

Again, you should take whatever reasonable fire opportunity you can get. Launch your missiles and maneuver for cannon shots. At the very least it will keep your opponent off-balance, and with a little luck you'll get some hits even from shots that had a low "kill probability". However, you may want to save at least one heat-seeking missile for later. In the fast-moving chaos of a dogfight, occasionally you'll find yourself staring down an opponent's tailpipe. When that happens, it is extremely frustrating not to have a missile ready! This can happen in a multi-aircraft dogfight where aircraft become intermingled, or when your opponent decides to break off combat and head for home, presenting you with a nice shot from the rear. So if you can spare it, it's usually a good idea to hold on to a heat-seeker for a golden opportunity like this.



A "furball" in progress.

To maximize weapons use, you first need to maneuver into firing position. Normally this means getting behind an opposing aircraft. To accomplish this, you should follow the advice presented above for the "head-on pass" and practice energy management.

Energy is needed to accelerate, turn, and climb. It can be in the form of speed (kinetic energy) or altitude (potential energy). One form can be converted to the other by climbing or diving. Dogfights tend to end up "low and slow" as energy-depleted participants "trade" their altitude for speed as they twist and turn in combat.

Having too much energy (i.e. airspeed) increases your turning radius and makes it more difficult to get behind your opponent. However, too little speed causes you to stall after maneuvers and prevents you from covering ground quickly to escape danger. It's important to use your throttle to maintain a manageable energy state, and to use altitude to minimize turn radius and adjust your airspeed as necessary.

Your jet engines maintain your energy state, but they require fuel. The side that runs low on fuel first is at a significant disadvantage, because it is no longer able to use its engines and afterburners to maintain a high energy state. Hence, it will be unable to maneuver effectively. This means that monitoring fuel level is critical to survival. Afterburners are powerful but highly inefficient, so use them only when necessary, and keep one eye on the fuel gauge.

If you're running low on fuel, you'll have no choice but to break off combat unless you want this mission to be a one-way trip. But it's important to break off before your fuel drops below the "Bingo" level (the red zone on the gauge that represents how much fuel you need to return home). This is important because as you retreat from air combat you're vulnerable to missile shots from the rear. You must choose a time to break off that minimizes this vulnerability (such as when your opponent is facing the other direction) not a time when you are so low on fuel that you no longer have a choice. You can't escape with engines idling. You may need your afterburners to accelerate quickly away from danger and for that you need fuel.

Team Tactics

So far we've discussed tactics in the framework of a one-on-one engagement, but most air combat involves a group of aircraft on each side. Dogfights involving many aircraft are called "furballs" in pilot lingo because of the chaotic nature of such combat. You'll have to use different tactics in a multiple aircraft engagement than in a one-on-one. There are two key strategies to employ.

DIVIDE AND CONQUER

Shoot first and force your opponent to split his forces. Then gang up on the easiest target and destroy it. When opposing aircraft are scattered, they will be less able to provide mutual support for one another and you can gain a local numerical advantage. But don't get too focused on any one aircraft. The chance for a good shot can appear and disappear in an instant, so be flexible and engage targets of opportunity. You won't be able to spend much time maneuvering against a single enemy aircraft because other enemies will present new and shifting threats. You must go for the quick kill whenever possible.

ENCIRCLEMENT

The second principle is to surround your opponent and attack from several angles at once. Split your force and "sandwich" the enemy aircraft. That way, no matter which way the enemy aircraft turn, some of your aircraft will have a fire opportunity from the rear. Furthermore, since all of your aircraft are facing in toward his, the enemy will probably not have a good shot at you.

A variation on this tactic is to split your force into two "waves". One flies straight in to mix it up in close combat, while the other throttles down and holds back. Once the first group has engaged the enemy, the second hangs on the periphery where it should get many fire opportunities.

On the flip side, should you need to counter a split/surround move, you should face the enemy and move so as not to get "sandwiched" in the middle. Maneuver to attack and overwhelm one portion of the enemy's split force, leaving the other portion out of the fight.

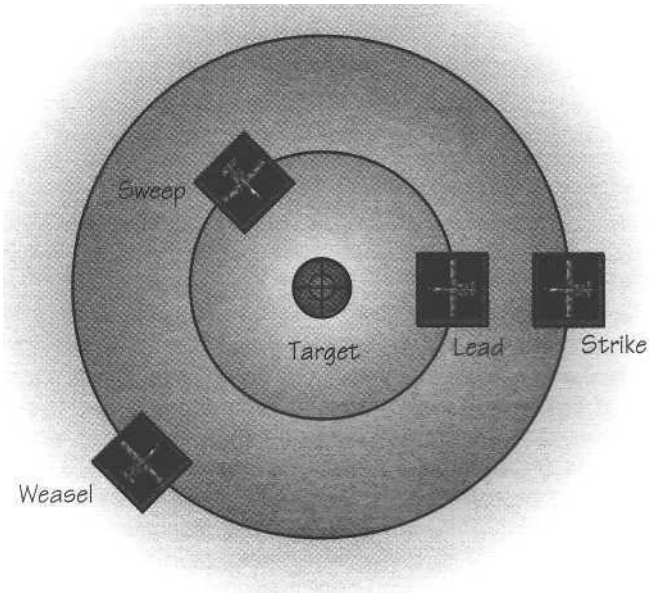
AIR-TO-GROUND COMBAT

Success on an air-to-ground strike mission begins with a solid plan of attack. This combines arming with the right weapons and organizing your aircraft into the proper flight groups.

FLIGHT GROUPS

When facing no opposition from the air, it's best to concentrate your forces and bring them over the target zone all at once. This oversaturates the air defenses and minimizes their ability to cause you harm. Try to fly in and out as fast as possible, slowing down only to deliver weapons. The faster you're moving, the less time you spend in the antiaircraft envelope.

If enemy fighters are present, the situation is more complex. Loaded bombers cannot maneuver effectively and so have only a limited ability to defend themselves against fighters and their missiles. As the attacker, you must use your own fighter force to destroy (or at least engage and occupy) the defending fighters. Proper organization of your flight groups can help you do this.



There are three basic plans, though you should feel free to modify them or invent your own. The standard plan places your fighters in the Lead group, followed by bombers in the Strike group. This arrangement affords protection to the bombers by forcing defending aircraft to pierce the fighter screen before getting to the bombers. Your fighters can tie up the defenders in close combat as the bombers fly through to the target.

A variation on this method is to reverse the groups: put the bombers in the Lead and the fighters in the Strike group. This is a bit risky, because it puts the bombers out front, but it sets an effective trap for defending fighters. If the defenders attempt to attack the bombers from the rear, they will themselves be vulnerable to attack from the rear by the fighters in the Strike group. This formation works better against air forces that reply on older technology rear-aspect heat-seeking missiles. If the defender has effective all-aspect heat-seekers or good radar-homing missile capability, you should not use this formation as it puts your bombers at too great a risk from the initial frontal attack.

You can combine the above two techniques, putting a mix of fighters and bombers in both Lead and Strike groups. Alternately, you can attempt to trick your opponent. Put fighter aircraft into the Sweep or Weasel groups, which approach the target from different directions than the main force (Lead and Strike groups). The defender will then be forced to make a decision as to which force to engage. If he chooses incorrectly his fighters will move off the target to engage your decoy force(s) of fighters in the Sweep/Wease group(s), clearing a path for your bombers.

A warning: try not to engage enemy fighters while flying near enemy antiaircraft units. As you maneuver to fight the enemy aircraft, you'll begin to slow down and the ground units will enjoy their best shot opportunities. Trying to take on too much at once like this is a sure way to get shot down.

Consequently, it's almost always a good idea to assign several aircraft the task of knocking out air defenses. The Weasel group is a useful place to put ARM-armed SAM-suppression ("Wild Weasel") aircraft that are meant to knock out missile defenses from long range but not to engage in air-to-air combat. Starting on the periphery of the battle enables these aircraft to carry out their mission without unnecessary exposure to fighters.

Weapons to Take

Your aircraft must be properly equipped for a strike mission if they are to succeed. You must select the appropriate weapons to accomplish your mission objectives.

Bombs are short-ranged, high-explosive weapons. Relatively speaking, they are not accurate and are best suited to large targets that are less difficult to hit. Bombs do supply a rather large amount of explosive power, though, so aircraft flying relatively short-ranged missions (thus able to carry less fuel and more weapons) can load up with more explosives (by weight) using bombs than other weapons.

Carrying a laser pod allows the use of "smart bombs", which are extremely powerful and accurate weapons. This doesn't mean, however, that you should use smart bombs all the time! For the sake of realism, you should know that even the high-tech air forces of today (like the U.S. Air Force) use far more regular bombs than "smart" ones.

Rockets offer a relatively accurate, long-range alternative to bombs. Though they usually offer less explosive power than an equivalent bombload (that is, what will fit on a weapons hardpoint) they are much more useful than bombs when attacking small targets like tanks and other vehicles. They can be used for accurate defense suppression as well because they can often be fired at antiaircraft units from outside the range of the antiaircraft weapons themselves.

ARMs (anti-radiation missiles) are designed purely tor defense suppression, specifically to destroy SAM sites. These are immensely useful long-range weapons and should be taken along in significant numbers any time moderate or heavy SAM defenses are expected. Even if you're not sure whether any SAMs will be present, you should take along a few ARMs just in case.

ECM pods are extremely useful as a defensive measure when attacking targets that are heavily defended by SAM sites. This is especially true for aircraft that do not possess a strong internal ECM capability. ECM pods even help spoof incoming radar-guided air-to-air missiles so they help protect against enemy fighters as well.

If the battle takes place at night, you want to take a night-vision pod on all strike aircraft if you're able. It's as simple as that.

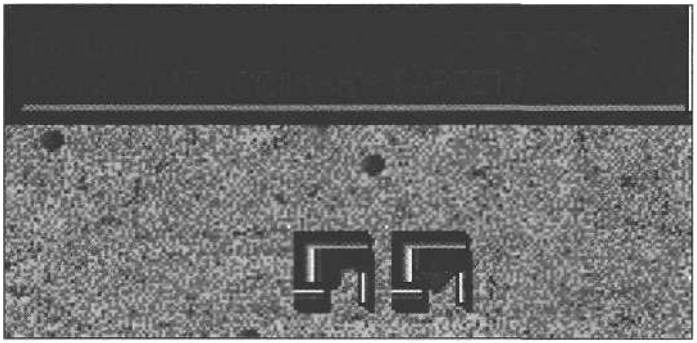
Altitude

The altitude at which you decide to fly when attacking a ground target should depend on your armaments as well as the types of antiaircraft weapons arrayed against you. AAA guns are effective only at low altitudes, while SAM units are better able to fire at high-flying targets. Your bombs are significantly more accurate when dropped from lower altitudes, though the accuracy of rockets and ARMs is not affected by altitude. So if you're attacking a target with rockets that is defended largely by AAA units, you should fly high. Conversely, if the target is guarded by SAMs and you're armed with bombs, you should approach at low altitude.

Weapons Delivery

All air-to-ground attacks benefit from proper aiming, and your pilots will hit more targets if they fly slowly (at speeds below 350-400 MPH, though with a quality bombsight you can fly as fast as 500 MPH without degradation) and straight for one turn before launching weapons. A word of caution: do not try this in a high-threat environment. Remember that when you fly slow and straight it improves not only your aim, but that of the gunners on the ground as well! One must weigh the need to score a hit against the survival instinct.

When using regular (i.e. not "smart") bombs, you'll find that your accuracy improves greatly when you drop them from low altitude in a vertical dive. Flying high and level is a good way to miss your target. Smart bombs are equally useful at any altitude or aircraft pitch.



Lastly, don't forget to attack the primary target(s) first. Don't waste ammo on other units unless they pose a direct threat to you (like SAMs). If you're unsure of whether a unit is a primary target, just put the mouse cursor on top of it and see if the Data Readout says "Primary Target". You'll score a lot more points if you do.

THE DEFENSIVE

So far we've talked a lot about how to attack. But what to do when you're under attack?

Maneuver

Violent High-G Turns do wonders to shake an attacking aircraft or missile from your tail. But you can only pull High-G's when you have sufficient airspeed, so be sure not to let it get too low. Dive if you must to maintain your airspeed. Remember: speed is life and "low and slow" equals dead. Also remember to turn toward the threat, never away from it - especially if the enemy is armed with Rear Aspect Heat Seekers.

Mutual Support

Always act as a team and help your wingmen. Gang up on enemy aircraft rather than breaking up into individual duels. That way, whenever an enemy gets on the tail of a friendly aircraft, you'll have another aircraft nearby that can get on the enemy's tail to chase him away. Being mutually supportive is the essence of aerial tactics.

Incoming Missiles

How do you shake an incoming missile? Reread the missile attack modifiers on page 36, and try to use them to your advantage. In general, you should try to present a poor intercept angle to the missile (45° off from your front is best) and turn off your afterburner unless you know the incoming missile is radar-guided. The incoming missile probably is radar-guided if it was launched from your front at long range and your RWR reads "Locked onto". If your aircraft is reasonably nimble you should perform a High-G Turn, which most missiles have difficulty following. Above all, stay fast-moving. You don't want to stall out or lack the airspeed to maneuver against the missile that may come along on the next turn. This is of particular concern since you're probably not using your afterburner but are making

warning on your Combat Display is a fanciful device for player convenience only. No such warning device exists for a real pilot. He can tell if he has been contacted by radar, but not whether a missile is actually incoming.

Disengagement

In the early days of jet warfare, aircraft were armed only with cannon. Disengaging from such a battle was not difficult, but with the introduction of air-to-air missiles the combat reach of the jet fighter plane was greatly extended.

Disengaging from a missile-armed enemy is difficult because missiles are too fast to outrun. Even worse, an aircraft must present its opponent with a perfect chance to fire on it from the rear in order to disengage. This is why conserving fuel is so critical. If your enemy runs out of gas first, then disengagement is his problem.

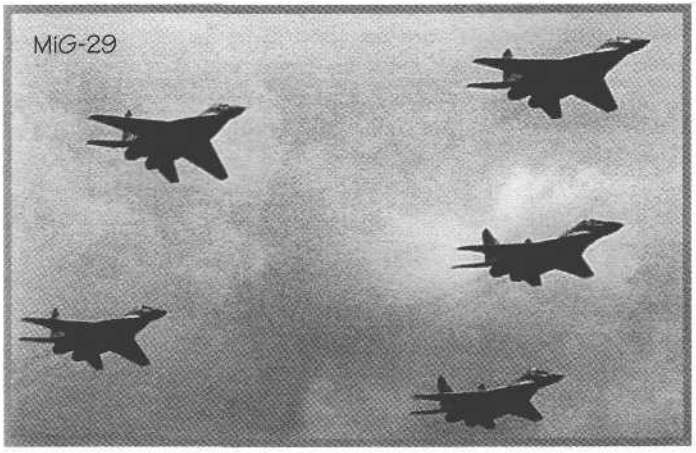
Otherwise, you need time and speed on your side. You need to disengage from combat when an appropriate situation or relative positioning of aircraft arises, not when you're so low on fuel that you're desperate. First, gain a speed advantage

over the enemy aircraft. Use your afterburner (this is why you need to save some fuel). Wait for a good opportunity. When your opponent is out of position, say, after a head-on pass, make your break. Maintain full throttle and afterburner and dive to accelerate.

If you are significantly faster than your adversary, especially if your aircraft is supersonic and his isn't, you should consider gradually climbing to a higher altitude once you've reached an airspeed of at least 500 MPH. The difference between your maximum speed and his will be greater at high altitude.

If your opponent manages to react quickly and get on your tail, you may have no choice but to cancel your disengagement plans for the moment and reverse direction yourself. Just keep accelerating and meeting your opponent in head-on passes, with ever-increasing speed. As you both speed up, the harder it will become for him to reverse quickly the next time you try to break away.

Of course, generating all this speed requires fuel, which is why it's a good idea to begin to disengage well before your fuel level drops to "Bingo". Be sure to fly in the right direction! Check the Navigator in the Radio menu to get directions to your airbase.



11. DESIGNER'S NOTES

For years I've had a near-rabid interest in jet planes, especially military types, and bought most of the books and games on the subject that I could get my hands on. I owned just about every boardgame in existence that involved modern military aviation, but I was never quite satisfied. Despite some excellent designs, these games were hampered by an intrinsic and unavoidable flaw: the fact that a boardgame requires its players to do a lot of bookkeeping and dice-rolling, which causes a move that is supposed to represent just a few seconds of "real time" to last much longer. Or at least that's the way it was with me (I am a little slow sometimes). I also found that my personal memory capacity - we're talking brain cells here - was overtaxed. I couldn't keep all the paperwork straight and made many mistakes.

I wanted a game that provided as realistic a simulation as the boardgames but at a much faster clip. I wanted hassle-free gaming: no pens, paper, or dice. And that's where the computer entered the picture. A computer is able to do something that no boardgame can do effectively. It can hide information. (It can roll the dice too, which is nice).

Simulating the "fog of war" in a game is possible only with a computer (or a dedicated human "umpire", but I never had one of those). At the time, computer strategy games had been around for a while, but few addressed the subject of military aviation at a tactical/operational level.

Oh sure, there were a slew of cool flight simulators on the market. I own some and play them often. They're a blast, but they're not what I had in mind. I wanted something that would let me fly aircraft with my tactical knowledge, not hand-eye coordination. I wasn't as interested in the individual pilot's experience as in depicting an entire air battle, involving many aircraft. I wanted to command a full squadron rather than a single plane. The details should be there, but in such a way as not to obstruct the player's enjoyment of the game and his ability to play rapidly. To my knowledge no such game existed, at least not on a computer. So I set to work.

The basic idea was simple: create a game that allowed players to experience the high-tech world of modern air combat without having to keep track of the myriad details and attendant complexities. Fortunately, it's possible to make the computer handle all of the "ugly" parts of the simulation, letting the players concentrate on what is happening in the game, not how it's simulated.

So I designed my first air combat computer game and let me tell you I thought it was the greatest thing since goat cheese. Unfortunately, most people who played it found it difficult to use and overcomplicated. I thought it was pretty realistic and fun to play in most regards, but for the majority of players (other than the true missile-heads like me) it was a little opaque. There was a small group of loyal fans, though, who enjoyed it and gave me a lot of great feedback and suggestions for improvement. I am deeply indebted to them as my next effort, *Flight Commander,* incorporated many of their ideas. The response to that game which was released only for the Macintosh, in turn, generated many helpful comments that culminated in *Flight Commander 2.*

I hope that I have now created a game that is both a powerful simulation of jet air combat and is quick and fun to play. The "combat options" are an effort to let people of differing tastes and backgrounds learn the game and play it at a level that is most comfortable for them. For the role-players out there, I hope that taking a group of pilots through the campaign missions gives a sense of them being "real" people with skills and frailties just like all of us. Racking up mission successes is great, but it hurts to lose a wingman, especially if he was just one step away from becoming an ace.

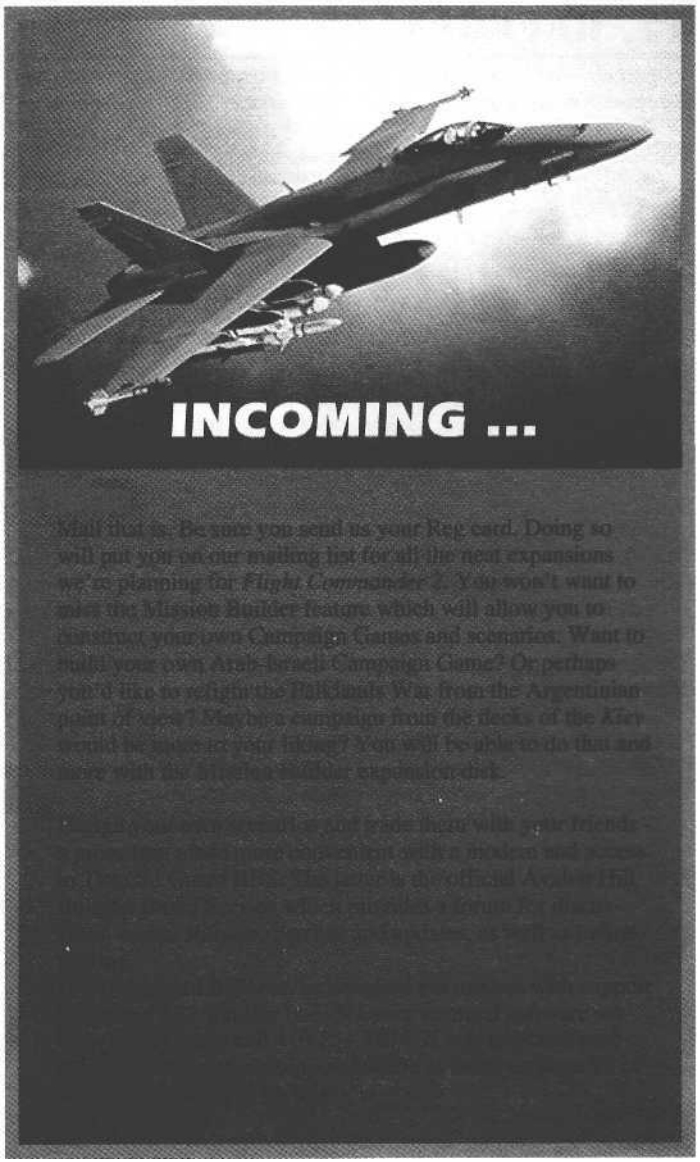
If enough people enjoy *Flight Commander* 2, I plan to create more battle and campaign scenarios on expansion disks as well as a campaign builder program and eventually to continue the series with a World War II version. The game was designed to be open-ended and compatible with future releases of scenarios, so the program you're holding in your hands right

now is only the tip of the iceberg. If you have some ideas for missions you'd like to see, please contact us here at Big Time. We take player feedback very seriously, so you might just get what you ask for! For you on-line folks out there, our electronic mailbox listed on page 1 is open twenty-four hours a day and is the best way to contact us.

In closing, there's one more point I'd like to make. It's very easy to be seduced by the cutting-edge technology of modern fighters like the F-16C and missiles like the AMRAAM. They're versatile, simple to use, and deadly. But if this is the only kind of equipment you ever use, you're missing half the fun. There is a special feel to flying the "old classics", like the jets of the Korean and Vietnam wars: Sabres, Phantoms, and MiGs. These older jets don't have either the high performance or the all-aspect missiles of the modern aircraft, but this is what makes them both a challenge and a joy to fly. There are no "A" maneuver ratings or thrust-to-weight ratios in excess of 1:1 here. You get every kill the old-fashioned way: you earn it! This is what *Flight Commander 2* is all about. And after turning and burning in a classic jet, you'll really appreciate that F-15E Strike Eagle when you next hop in!

Thanks for your support, and I hope you enjoy the game. Good luck!

Charlie Moylan



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13. PLAY BY EMAIL

People can play on separate computers if they are able to send files to one another across a modem, network, EMail or on a floppy disk. For simplicity, all of these methods will be referred to as "PBEM."

The game does not have a built-in modem or EMail program. It just saves data to a file that you may use your own modem to send to your opponent. In short, PBEM works thus: X sets up a battle and sends a setup file to Y. Y loads the file and both players enter the Give Orders Phase. Once they're done, Y sends a file to X, who loads it and watches the Action Phase unfold. X then sends a file to Y so he can see the Action Phase on his computer. Then the next move begins with the Give Orders Phase.

PBEM works differently for each player, depending upon whether he set up the battle ("Player X" in this example) or not ("Player Y").

To begin a PBEM game, Player X begins a battle scenario from the Startup screen by either loading a battle file from disk or by clicking on the Create Battle button just as he would to begin a one-player battle. You then set up the battle as you would for a one-player game, except when the Choose Player Types dialog appears, you choose Human for both attacker and defender.

A dialog window appears, asking if the human players wish to play together on one computer or through EMail. Click "Use EMail". Then in the following dialog window, indicate whether you will be the attacking or defending Force. You will then be asked to save an EMail file to disk. You can save it in any folder, but make sure you know where you saved it because you must send it to your opponent. This file contains setup information for him to begin the game.

Next, another dialog will appear telling you to send the file to Player B. Don't click it away yet. You will need to "switch out" of the game before you can send the file. Under Windows, press the "Alt" and "Tab" keys simultaneously to "switch" to the next program that you have running. Keep pressing these keys (together) until you reach the Program Manager. From there you can send the EMail file you just saved to Y. On the Macintosh, click the little icon in the upper-right-hand corner of the screen and a menu will pop up. This menu contains a list of all the active programs. Select "Finder", where you can run your modem program to send the file. If the game window is in the way, return to that same menu and select "Hide Others". Now send the file to Y. The file will be titled something like "EMOOOA.TXT" unless you renamed it.

Now switch back into the game. In Windows just hit the "Alt" and "Tab" keys simultaneously until the *Flight Commander 2* window appears. On the Macintosh, click the icon in the upper right corner and select *Flight Commander 2.* Once back in the game, click the OK button on the dialog window that's still there. The game now proceeds normally. Once you are finished with the Give Orders Phase, click the Action button.

A dialog will appear, informing you that it's time to load Y's file with his moves for the turn. If he hasn't sent you anything yet, just click on Cancel and wait. Once he's ready to send you a rile, you will probably need to "switch out" of the game to receive the incoming file if you're using a modem program.

Eventually, Y will send a file with a title like "EM001B.TXT". Once he has, you can click again on the Action button and then on the OK button of the dialog that follows. In the Open File dialog that appears, find Y's file and load it. The Action Phase will now occur. At the end you will be asked to save your orders for this turn into a file and send that file to Y so that he too may watch the Action Phase and keep your respective data in synch, men the next move begins and the EMail cycle repeats itself.

The process for Y (i.e. the player who doesn't set up the battle) is similar, except that to begin you should first receive an EMail file from X before you even run the game program. Once you have the initial EMail rile, run the game and select "Load Play-By-Email Game File" from the File Menu of the Startup screen. An Open File dialog will appear and you should select the file X just sent you. Thereafter, the game will play as in the above example except the order of sending and receiving files is reversed. When you click on the Action button, you will be asked to save and send your file to X first, and then wait to receive his file in return before your Action Phase begins.

EMail files are plain text files, so you can open them up in a text editor program and "cut and paste" to send them over EMail. But keep three things in mind:

- do not change the contents of the file.
- do not accidentally add any "white space" to the beginning of the file,
- if you're using Windows, make sure the file you "cut and paste" into has a ".txt" suffix when you save it.

14. GLOSSARY

AAA (Antiaircraft Artillery): Effective Range ten squares to an altitude of level 7. P. 38.

AAM (Air-to-Air Missiles): AAM consist of two types: heat-seeking and radar-homing. An aircraft can carry one variety of each type.

Absolute Bearing: Direction based on your screen with the top of the screen always being 0° and the bottom always being 180°. P. 18.

Active Radar-Homing: A missile needing a Radar Lock-on from the firing aircraft to launch. After that, it is a "fire and forget" missile with its own radar to guide it to the target.

Action Phase: Resolves moves from the Give Orders Phase. P. 7.

Afterburners: Pushing the "Burner" button will automatically accelerate your aircraft at the maximum rate at the expense of using far more fuel. When Afterburners are on, the gauge to the left of the Burner button will be red. P. 31.

Air Brakes: A flap that is (usually) extended from the fuselage of an aircraft to increase Drag and slow the aircraft. Normally used when landing, the Airbrake can also be deployed advantageously for quick deceleration in a dogfight. Pushing the "Brakes" button will automatically turn off your Afterburner and push the Throttle back to 0. P. 31.

All-Aspect Heat-Seeking: A missile which can be launched at a target from any angle, although it is more accurate when launched from the rear. P. 36.

Altitude: Option which adds the third dimension. P. 39.

Arm Aircraft: P. 11.

Arc: A zone of airspace in the horizontal plane with respect to the facing of an aircraft. See illustration on page 19.

ARM (Anti-Radiation Missile): An ARM is an air-to-surface weapon that homes in on signals generated by ground-based radar systems like SAM (Surface-to-Air Missile) sites. ARMs are highly effective at knocking out active SAM sites even from long range, but are useless against other targets. P. 26.

Bandit: A visually spotted, but as yet unidentified, aircraft.

Battles: A separate engagement which you may select from a pre-arranged scenario folder or design yourself using the Create Battle window. P. 20.

Bearing: The angle at which an object lies relative to another object. There are two kinds of bearing: Absolute and Relative. P. 18.

Bingo Level: The "red zone" (gray on B&W monitors) inside the fuel gauge showing the minimum fuel needed to get back to your home airbase. The red zone can be decreased by dropping bombs or jettisonning extraneous munitions. P. 31.

Bogey: An aircraft spotted by electronic means which has not yet been identified.

Campaign: A pre-designed series of linked scenarios in which you command a squadron and guide your pilots through a series of connected missions. Losses suffered in a mission detract from the available resources available to conduct the next mission. Conversely, kills scored in a mission can increase pilot skills in later missions. P. 10.

Ceiling: An altitude limit above which the air is too thin for an aircraft to generate enough lift from its wings to fly. A typical ceiling is about level 30 (50,000 ft.) but varies with aircraft type and Wing Loading.

Choose Player Types: The screen in which you can select the quality of your computer opponent (novice, skilled or expert). P.4.

Clear Weather: All weapons and sensors function normally.

Cloudy Weather: Infrared/thermal systems function poorly in cloudy weather. Radar-homing missiles should be the weapons of choice since heat seekers will perform poorly. In a Generated Battle, pick fighters that have powerful radar systems and don't rely on IRST. Cloudy weather also reduces vision and the accuracy of bomb and rocket attacks. Laser pods are useless. AA guns and heat-seeking SAMs will fire less frequently.

Combat Display: The arena in which we fly. P. 5.

CP (Combat Point): A Combat Point is a measure of aircraft quality. CPs are useful in balancing scenarios between combatants of greatly different technology levels by giving the weaker side more aircraft in compensation. P. 20.

Combat Report: Event notification at lower left of Combat Display. P. 8.

Contact: An initial stage of radar detection insufficient to pinpoint targets sufficiently to allow weapons to be fired in the Advanced Game.

Cycle: Pressing this button randomly cycles the current target selection to the next potential target. P. 16.

Data Library: Text and photographic references of vital statistics and background information for all aircraft, missiles, targets and air forces in the game. Access by selecting "Data Library" from the Windows option or using keyboard command "Alt +D". P. 47.

Data Readout: The Display directly beneath the Weapons Panel identifies the aircraft, pilot, speed and any damage assessment of friendly aircraft on which the cursor is placed. When the cursor is placed over an opposing aircraft, its speed and the range to that aircraft from the currently selected friendly aircraft is listed. P. 15.

Display Rectangle: The small rectangle within the Overview Window showing that portion of the battlefield which is visible in the Combat Display. The Display Rectangle contracts in size whenever the Combat Display is increased in scale by the Zoom-In feature and vice versa. You may change the location of the Display Rectangle by clicking elsewhere within the Overview Window. Each time you change the location of the Display Rectangle, the Combat Display will change to reveal the area contained within that rectangle. P. 13.

ECM Pod: Carried as a defensive measure, this electronic countermeasures pod decreases the aircraft's vulnerability to radar Lock-on and radar-guided missile attack (from air and ground). They are usually carried by strike aircraft entering a high-threat environment. P. 26.

Expanded Arc: Radar which covers a 180° or 360° arc, instead of the more conventional 90° arc.

Find Current Pilot: Display menu command that will center the Combat Display on the aircraft currently receiving orders. Keyboard command "Alt +F" or clicking on the Aircraft icon in the center of the Scroll window does likewise. P. 13.

Find Selected Target: Display menu command that will center the Combat Display on the opposing target selected by your currently active aircraft. This function can also be done by clicking on the "Find Tgt" button to the left of the Weapons Panel or using keyboard command "Alt + T".

Flight Path: An arrow extending from behind an aircraft to show where it has been, through it's current position, and extending in front of the aircraft to trace its potential flight in the upcoming turn. The length of the arrow will depend on the aircraft's current speed, degree of projected turns, and whether it is climbing or diving. When using the Altitude option, the arrowhead will change color to a solid red when it is diving or white when it is climbing. The arrowhead will change direction to show the new heading of the aircraft at the end of the move unless the aircraft fails to execute a High G Turn. P. 7.

Flight Stick: Maneuvers aircraft in Give Orders Phase. P. 8.

FT (Fuel Tank): P. 11.

Give Orders Phase: Plotting an aircraft's move. P. 5.

Grid: A feature in the Display Menu to overprint the main screen with the square grid used for visualizing orthogonal movement. It can be toggled on or off at the window or by using keyboard command "Alt +G".

Group: The scenario entry position of aircraft. P. 24.

Hardpoints: Attachment positions for mounting munitions.

Head For Home: This File Menu command ends the game by sending your aircraft home. A message window will appear asking you to confirm your decision. If you are in close proximity to the enemy, you may choose between a Fighting or Quick Withdrawal. In both cases, the computer will assume command of your forces and play out the remainder of the game while attempting to disengage. You may watch or return later and view the Mission Debriefing to see how you fared. See page 62 for tips on how to successfully disengage. P. 29.

High G Turn: A 90° turn causing significant deceleration. When using the High-G Turn option, such a move can fail to execute the planned turn. P. 43.

HSM (Heat Seeking Missile): P. 35.

Hot Keys: A Windows Menu command which displays the major Keyboard command equivalents. P. 54.

Immelmann: A climbing half-loop that reverses an aircraft's facing. The aircraft must spend one move in a Vertical Climb before it can attempt an Immelmann. P. 41.

IRST (Infrared Search and Track): A passive detection system for heat (infrared) signals. It is undetectable to its target because it generates no signals of its own. IRST is not yet widely available. It has an effective range of 15 miles in good weather. IRST contacts are shown as blips on the radar display.

Jamming Aircraft: Planes capable of confounding enemy radars by emitting electronic "noise" to a range of 100 grid squares. All aircraft inside this radius are "protected" by the jamming. The effective ranges of radars searching for aircraft inside the jamming radius are significantly reduced. Protected aircraft are shielded from detection by radar controllers and less likely to be hit by radar-homing missiles.

Laser Pod: Transforms all bombs into very accurate laser-guided "smart" bombs. P. 61.

Launch Requirements: Missile attack prerequisites. P. 35.

Lead Group: One of four formation choices available in the Weapons Room. The Lead group approaches the target ahead of the strike group. P. 24.

Lock-on: After initial contact, radar beams are narrowed to pinpoint target location sufficiently to allow weapons to fire.

Look-Down: These radars successfully Contact and Lock-on to targets flying at a lower altitude although their effective range is reduced by 30% while doing so. Non-Look-Down Radars can only Contact and Lock-on to aircraft flying higher than about two-thirds of their own altitude. Applicable only when Altitude and Radar and Visual Contacting options are both used.

Low G Turn: A 45° turn. It decelerates an aircraft less than a High G Turn, but is always executed as planned.

Maneuver Percentage: The chance that a High-G Turnwill succeed. P. 43.

Mission Briefing: Advance information on the upcoming scenario providing the player with intelligence pertaining to the target, weather, and expected opposition. While such information is usually helpful in deciding how many aircraft to take on a mission and how to arm them, it is not foolproof. The player should be prepared for the occasional surprise.

Multi-Target: Radars which can Lock-on to more than one aircraft at a time. Such systems are normally only carried by dedicated interceptors with a two-man crew.

Navigation: A window appearing at the start of every scenario showing the direction of the target and friendly airbase from your flight's current position. This window can be recalled by selecting "Navigation" from the Radio Menu. P. 4.

Night Pod: This pod gives thermal (infrared) vision capability to the crew of the aircraft, allowing accurate air-to-ground weapons delivery during night missions. P. 26.

Night: Necessitates use of N-Pods for ground attack accuracy. Radar and aerial combat with missiles are largely unaffected (though visual contact is very difficult to establish). Cannon attacks are much less successful. Carrying E-Pods is a good idea because long-range radar-guided missiles are the biggest threat (it's very difficult to visually spot an enemy and dogfight with him). AA guns of users with a low technology level are significantly hampered at night. P. 28.

Overview: This window shows a minimum view of the entire battlefield. The clusters of small dots in the Overview window represent the aircraft in the battle, both yours and the enemy's. Inside the Overview window you'll also see a small rectangle around one of the clusters called the Display Rectangle. It shows that portion of the battlefield which you can see in the Combat Display. P. 1 3.

Pilot's Lounge: The screen where you select the pilots to fly an upcoming mission in a Campaign. P. 23.

Pitch: An aircraft's vertical direction; climbing, diving or level flight. P. 39.

Radar Warning Receiver (RWR): The Defense Panel advises each pilot of any detected hostile radars. A hollow triangle indicates an enemy contact. A solid triangle indicates that an enemy radar has accomplished a Lock-on versus that aircraft. The location of the triangles indicates the approximate (Absolute) direction from which the signals emanate. P. 33.

Rear-Aspect Heat-Seeking: Older missiles that can be fired only at a target's rear 180° arc, where they can Lock-on to the aircraft's hot jet exhaust. P. 36.

Relative Bearing: The direction an object is from the heading of another object. P. 1 8.

RHM (Radar Homing Missile): P. 35.

Rkt (Rocket): Air-to-Ground missiles. Rockets are generally smaller than a typical bombload, but are more accurate and have a greater range. P. 37.

Roll: Clicking on a "Roll" bar to the left or right of the Flight Stick will change the Flight Path of the active aircraft one grid square in that direction by performing a barrell roll maneuver and maintaining the same direction of flight. However, the aircraft will lose speed in the process. P. 30.

SAM: Surface-to-Air Missile. P. 38.

Selected Target: Designate an opposing unit as the target of the active aircraft by clicking on it. P. 7.

Semi-Active Radar-Homing: Missiles guided to the target by following the reflected signals of a continuous radar Lock-on which leaves the firing aircraft in a predictable and vulnerable Flight Path. If the Lock-on is lost, so is the fired missile.

Split: A button in the Weapons Room which allows you to arm Groups of aircraft that are of the same type differently by selecting their line and clicking the Split button. This button has no use in a Campaign Game because all aircraft are listed individually rather than in Groups.

Split S: A diving half-loop maneuver requiring a vertical dive for two consecutive moves. P. 41.

Strike Group: One of four formation choices available in the Weapons Room. The Strike group follows directly behind the Lead group, a few miles back. P. 24.

Sweep Group: One of four formation choices available in the Weapons Room. The Sweep group begins at the same range to the target as the Lead group, but comes in from a different direction. P. 24.

Technology: Each air force has a technology level rated from 1 to 4 to determine the effectiveness of its ground-attack and antiaircraft weaponry, as well as a pilot's chance of safely ejecting from a damaged aircraft. A technology level of 2 is required to use rockets and ECM Pods. A level of 3 is required for ARMs, Night Pods and Laser Pods.

Throttle: The sliding control to the right of the Flight Stick which determines aircraft speed. Lowering the control decreases speed; raising it increases speed. Pushing the "Brakes" button will set throttle at 0%. Pushing the "Burner" button will set throttle at 1 00%. P. 31.

Track-While-Scan (TWS): This radar system can maintain Contacts and Lock-ons simultaneously. Earlier radars lose all other Contacts as soon as a Lock-on is achieved. Aircraft without TWS in a scenario using the Radar and Visual Contacting option will not automatically attempt Lock-on. P. 43.

Vertical Climb: The most extreme climbing Pitch. P. 39.

Vertical Dive: The most extreme diving Pitch. P. 39.

Weasel Group: One of four formation choices available in the Weapons Room. The Weasel group begins at the same range to target as the Strike Group but comes in from its own randomly determined direction. P. 24.

Weapons Room: The screen wherein you make armament choices for your aircraft before each mission. P. 11.

Wing Loading: A measure of the lift required of the wing to keep an aircraft in flight derived by dividing its total weight by the square footage of its wings. Low Wing Loading allows an aircraft to perform High-G Turns with less deceleration.

Zoom In/Out: The "+" and "-" buttons in the upper left corner which shrink/expand the area shown by the Combat Display with corresponding changes in scale for the pieces therein. Zoom In can also be accomplished by pressing the shift key and clicking. P. 1 3.

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