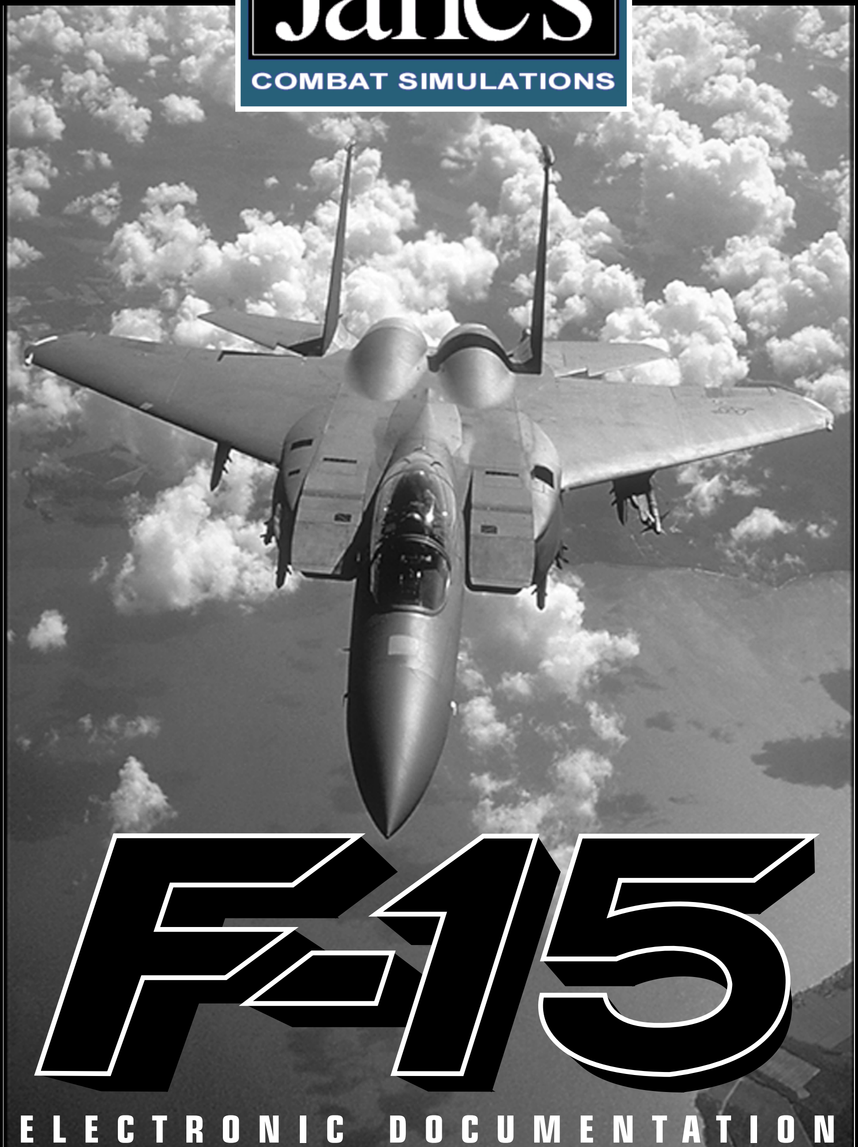
Jane's®

COMBAT SIMULATIONS



F-15

ELECTRONIC DOCUMENTATION

http://www.replacementdocs.com

HOW TO USE

CASUAL MANUAL

QUIT

EXPERT MANUAL

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STARTING THE GAME

When you finish the installation, you'll see that a *Jane's F-15* icon has appeared on your desktop. You can double-click on the icon to start the game.

If you don't see the icon, you can:

Click on the START button at the lower left of your desktop.

Go to PROGRAMS.

Go to JANE'S COMBAT SIMULATIONS.

Go to **F-15**.

Click on **F-15**.

You can skip the Introduction animation by pressing Esc.

This playguide was designed for casual players. *Jane's F-15* has many more features than are described here — we only put in what you'll need to get up in the air and start shooting. Chances are, if you click on a button we don't describe, it will do something — but it won't be anything vital.

If you want information about all of the ins and outs of *Jane's F-15*, check out the *Expert Flight Manual*.

AUTORUN

After installation, the game will automatically start anytime you insert the CD. Click PLAY to begin a game or continue a game in progress.

PRE-FLIGHT

GENERAL INSTRUCTIONS

Jane's F-15 uses the mouse for almost everything in the pre-flight screens. When we say "click" on something, we mean left-click with your mouse. One click is usually enough, but it won't hurt if you double-click on something instead.

In the lower-right corner of nearly every screen is a circle divided into four parts: a red CANCEL section, a blue ACCEPT section, a yellow HELP section and a spinning gray and black ball that looks like an airplane's "artificial horizon."

Clicking on the ball will usually bring up an **OPTIONS** screen where you select game options, like sound volume and graphics. (For details, check the *Setup and Troubleshooting Guide*.)

ACCEPT keeps any changes you've made on that screen, and goes to the next screen. (When you are about to enter a mission, ACCEPT changes to **FLY**.)

CANCEL backs up to the last screen without applying any changes made.

HELP brings up a window that explains the screen you're looking at.

Pop-Up Windows

Often, green windows will pop up and ask for extra information.

OK saves whatever you've put in the window, and returns you to the last screen you saw.

CANCEL returns you to the last screen without saving any of the information you put in the window.

MAIN MENU

The first thing you see, after the intro animation, is a multi-colored pie-shaped "menu" with the spinning gray-and-white ball in the middle. Each color wedge is for a different part of the game: Training Missions, Campaign, Instant Action, Multiplayer, Single Missions and the Reference section.

When you move your mouse cursor over a wedge, the whole section lights up. When it's lit up, you can click on it to start it. You can click on the name of the section if you want, but anywhere in the colored section is okay.

If you're not quite sure how to fly in *Jane's F-15*, the best thing is to try out some of the Training Missions.

TRAINING MISSIONS

Jane's F-15 has different kinds of training missions that teach you how to fly, fight and take out your targets. On the right side of the screen is a scrollable list of all the training missions that you can choose from.

What is it? If you click on a mission name (in the list of Available Missions), a description of what you'll learn will show up in the big window to the left.

How do I start? Click twice on the name of the mission (in Available Missions) and you'll go to that mission's briefing.

- Click FLY to begin the mission (after the briefing).

For details on the briefings, see **Briefing**, pg. 7.

INSTANT ACTION

If you simply want to choose a type of mission, and then get out and fly it, Instant Action is for you. It doesn't take the place of Training Missions, however. If you aren't sure how to handle an F-15, you might want to put some time into training before you try to put a Strike Eagle through her paces. (See **Training Missions**, above.)

Instant Action Parameters. Setting specific parameters for your instant missions isn't a necessary step. It is explained in *Expert Flight Manual*, **Instant Action**.

How do I start? Notice that instead of the blue ACCEPT button in the lower-right corner, there is a blue FLY button. When all the elements are arranged to your satisfaction, it's time to begin the mission.

- Click FLY to accept the mission and begin.

SINGLE MISSIONS

Single Missions are stand-alone jobs. They're not related to what happened in the last mission, and they aren't going to affect what happens in the next one. These are Get In, Get It Done, Get Out of There flights.

Load Missions. These are pre-existing missions, ready to fly, and can be played in any order.

Mission Builder. This is an advanced feature. For more information, see *Expert Flight Manual*, **Mission Builder**.

LOAD MISSION

Available Missions. There is a list of available missions in the scrollable window on the right side of the screen.

What's it about? Click on a Mission name to see what you can expect from it.

How do I start? Double-click on a Mission name to go to that mission's briefing screen.

Mission Information. The window in the upper left of the screen describes the overall mission. Read the summary to decide if this is the type of mission you want to fly.

BRIEFING

The Briefing screen is where you learn about the mission and make your pre-flight adjustments.

Main

All the available information that Military Intelligence can provide is presented on the Main Briefing screen.

Mission Briefing

This is where you read up on what the mission is about and what you're facing. Sometimes they'll give recommendations on what might be best for you to do or take — and it's always good advice.

Mission Map

Everything they know about the land you'll be flying over can be seen on the mission map. This includes all waypoints (the places you are assigned to fly by), other friendly planes or ground soldiers who might help you out and any known enemy forces that might be dangerous.

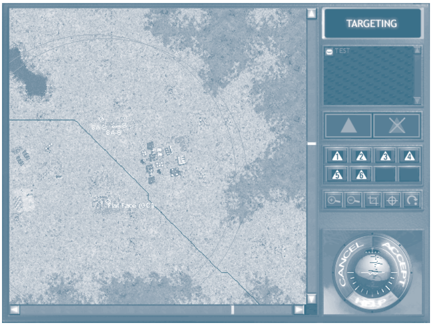
You can usually move (by click-and-dragging), add or delete waypoints on the Mission Map, if you feel that would help. An example would be if you saw that you were going to be flying through some dangerous areas (like lots of surface-to-air missile sites) and you thought you could find a better way to get to your target. However, you can only change the path you take to your target. You can't change your targets — and targets are always at a waypoint. So be careful you don't move your waypoints away from your target, or you won't be able to win the mission.

Intelligence Information

All known enemies are listed, both in the air and on the ground. Not all threats you will encounter are listed, however.

MISSION MAP CONTROLS, AIRFRAME, FLIGHT CREW, ARMING, TARGETING

Each mission can be customized. For an explanation of these advanced features, refer to the *Expert Flight Manual*, **Interface: Campaign**.



Targeting

When a mission has a ground target, the TARGETING button on the briefing screen will be active. Click on it to see a view of the target area. As an optional advanced feature, you can also reassign which targets your wingmen will go after. See *Expert Flight Manual*, p. 1.15.

Fly

Notice that in a mission briefing, instead of the blue ACCEPT button in the lower-right corner, there is a blue FLY button. When all the elements are arranged to your satisfaction, it is time to begin the mission.

- Click FLY to accept the mission and take off.

DEBRIEF

At the end of each mission, a Debriefing screen appears. It tells you how well you accomplished your goals, how your overall performance was, and the performance of the rest of the pilots in your flight.

Debriefing. Discusses the mission's accomplishments, or lack of them, waypoint by waypoint.

Statistics. Lists all applicable statistics, from total mission time to how much and what type of ordnance you used.

Flight Results. Lists the accomplishments and failures of each pilot who flew with you.

CAMPAIGNS

Campaigns are a series of missions where each success or failure affects the next mission. You don't get to choose what kind of mission you fly — your commanding officers tell you.

There are two possible campaigns: The United Nations war with Iraq — Desert Storm — and a hypothetical action against Iran in 2002. You can view a summary of each campaign's history by clicking on the campaign name in the Current Campaign list.

- Click on the campaign name IRAN or IRAQ, then select ACCEPT to begin a campaign.

Once you've flown in a campaign, the name of the squadron you chose will be in the Current Campaign list. That is the "title" of your campaign in progress.

- Click on the name of your squadron, and select ACCEPT to continue a campaign.

All statistics for your selected campaign will appear in the lower portion of the screen. These include aircraft status, flight crew status and number of missions you've flown.

Remove Campaign

You can delete any campaign that you've already started — the ones in the Current Campaign list that have squadron names. You cannot delete the original campaign starting points, IRAN and IRAQ.

Once you delete a campaign, there is no way to undelete it.

- Click on the name of the campaign in progress to be deleted.
- Click the REMOVE CAMPAIGN icon.
- Confirm that you wish to delete the campaign.

CHOOSE SQUADRON

When you start a campaign, you will also choose a squadron identity. Choosing a squadron determines what insignia will be on your F-15, and also determines who you will be able to fly with. Once you've chosen a squadron, you cannot change to another one without starting over at the beginning of the campaign.

- Cick on the name of your squadron and select ACCEPT to begin the campaign.

CAMPAIGN INFORMATION

Before the initial mission of a campaign, you will see an animation and will be given a brief written history of the overall situation.

- Click CONTINUE to go to the first Mission Briefing. (See **Briefing**, p. 7.)

ACCEPTING THE MISSION

- Click FLY to accept the mission.

MULTIPLAYER

Jane's F-15 supports IPX/SPX network (LAN) play (up to eight players), TCP/IP network (Internet) play (up to eight players), and modem and direct serial play (two players).

- Click on the "wedge" of the type of multiplayer game you wish to play.

Or

- Click MAIN to return to the Main Menu.

See *Expert Flight Manual*, **Multiplayer** for a description of how to set up each type of connection and begin a mission.

REFERENCE

You can get information on all the planes and weapons you will encounter in the game by choosing REFERENCE from the Main Screen. This takes you to the Reference screen, where you can view 3-D models and read information from Jane's Information Group.

- Click on the item you wish to view from the Object List.

INSIDE THE COCKPIT

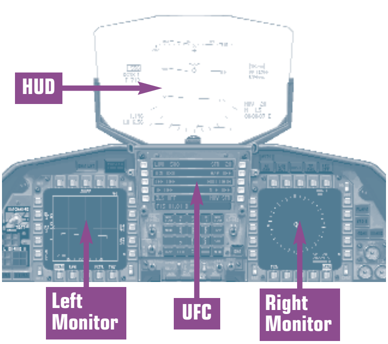
So, now you are inside the cockpit. You might want to pause the game (P) a second to read about some basic cockpit features, and how to use them to fly the plane and fire on targets.

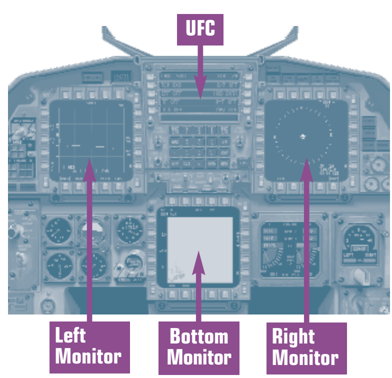
THE HUD AND MONITORS

The big sheet of glass mounted directly in front of you is the **HUD** (Head-Up Display). It superimposes navigation, targeting and weapons information over the view in front of you.

There are two **monitors** to the far left and far right of the cockpit. Each monitor can display one of several different screens — such as an air-to-air radar screen, an air-to-ground radar screen, a warning system (called the TEWS) and a moving map (called the TSD) screen, for example. (Because they can be used to display lots of different kinds of information, these monitors are also known as Multiple-Purpose Displays, or MPDs.)

There is one more monitor in the cockpit, but it isn't visible in the default view. Because of this, screens that are less important to the situation at hand are usually displayed here. Press F2 to look down at this monitor, and press F1 to return to the default view. (You'll probably find you don't need to do this very often.)



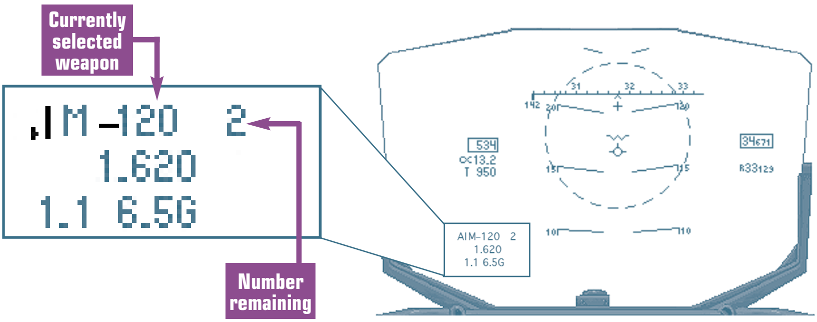


Between the left and right monitor is a panel of Up-Front Controls, called the UFC. This is an advanced feature, which you won't need for basic flight and combat. For more information, see the *Expert Flight Manual*.

CHANGE WEAPON KEY

The "change weapon" key reconfigures the HUD and monitors to perform specific tasks — navigating, firing air-to-air weapons, or firing air-to-ground weapons — in addition to selecting a weapon.

Press [Spacebar] to cycle through your weapons. The currently selected weapon appears in the bottom-left corner of the HUD. When you press joystick button 2, this is the weapon that will be released.



- When no weapon is listed here, you are in navigation mode — only navigation info appears on the HUD, and screens that are useful to navigation appear in the monitors. This mode is described under **Basic Flight**.
- If AIM-7, AIM-9 or AIM-120 appears, you have an air-to-air missile selected. Symbols that will help you aim and fire these weapons are added to the HUD and the air-to-air radar and warning systems information appear in the monitors. See **Air-to-Air Combat**.
- If AGM-65 or MK-82 appears, you have an air-to-ground bomb selected. Symbols that will help you aim and release these weapons are added to the HUD, and the air-to-air ground radar and a high-res targeting map appear in the monitors. See **Air-to-Gound Combat**.

Your gun is always active — you can fire it at any time by pressing the gun trigger (joystick button 1).

BASIC FLIGHT

When no weapon is selected, you are in navigation mode. Basic flight information appears on your HUD and in the monitors. This section gives a quick introduction to flying and moving around, and describes the symbols you'll see on the HUD and monitors when no weapon is selected. (You will return to this mode when you run out of weapons; you may also return to this mode by cycling the Change Weapon key.)

GETTING TO WAYPOINTS

When you fly a mission, you follow a set of waypoints (also called *steer points* in the F-15) in numerical order. Your takeoff point (if there is one) is 0A, your first waypoint is 1A, and so forth.

There are three ways to fly from one waypoint to another:

- **Jump** — press J. You will jump ahead in the mission, without any in-between flight, if no enemies are present.
- **Autopilot** to the waypoint — press A. The aircraft will steer itself to the next waypoint. (Be careful if you're flying at low altitudes in mountainous areas! The autopilot can't see what's in front of you.)
- Select a waypoint and **fly to it manually**. Press W to cycle through waypoints. Information about the new waypoint (how far away it is, what time you will reach it, etc.) is displayed in the bottom right corner of the HUD. A marker appears on the heading scale at the top of the HUD to show you which way to steer in order to reach the waypoint. All of these features are discussed under **Basic HUD Info**, p. 16.

If you do not want to sit through a real-time flight to the next waypoint, you can **accelerate time** (speed things up) by pressing Page Up, or turn it off by pressing Page Down. If time is accelerated, an indicator (e.g. 2X) will appear in the lower left corner of the HUD.

You can press P at any time to pause the game.

CONTROLLING THE AIRCRAFT

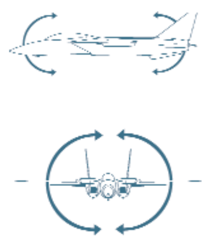
You will need to know how to use two things to control your aircraft — the joystick and the throttle. The joystick steers the aircraft, while the throttle controls speed.

Joystick

Push forward to *pitch down* (dive). Pull back to *pitch up* (climb).

Push left to *roll left* (drop the left wing). Push right to *roll right* (drop the right wing).

Keep in mind that you can move the joystick in two directions at once — for example, to dive and roll left, push the joystick forward and left at the same time.



Throttle

The throttle controls your speed. You may use the throttle control on your joystick, if you have one, or the keyboard. When using the keyboard, the default throttle setting is *full throttle*, which is really the only setting you need for most basic flight and combat.

If you want to adjust the throttle at some point, use the following keys:

| \ — Toggle afterburner on/off. Afterburners provide you with an extra burst of power that can be useful in a dogfight.

-_ — Reduce throttle. (This is the same as pulling a throttle wheel backward a little bit.)

+= — Increase throttle. (The same as pushing a throttle wheel forward a little bit.)

Shift += — Set throttle to full power (100% power, but no afterburner.)

TAKING OFF AND LANDING

You might occasionally run into a mission in which you're going to need to take off. It's not as difficult as you might think ...

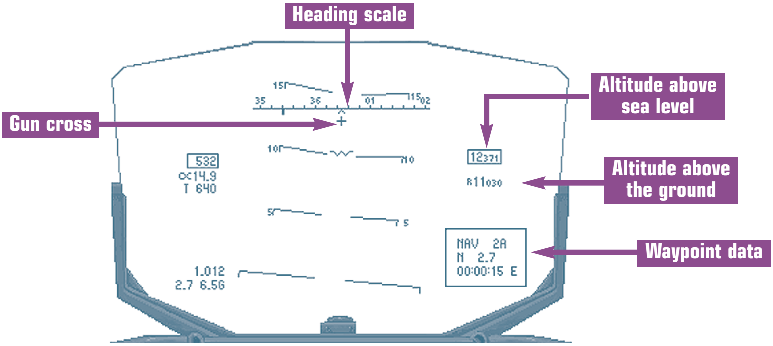
- Press B to release your wheel brakes.
- If you have a throttle device or throttle wheel on your joystick, move it all the way forward. (Full throttle is the default throttle setting if you are using the keyboard.)
- Pull back on the joystick before you get to the end of the runway.
- Once you're in the air, your landing gear will fold up automatically.

Landing is not necessary if you're playing the game in casual mode. If you want to learn more about landing, however, see the *Expert Flight Manual*.

BASIC HUD INFO

Lots of data and symbols appear on the HUD — those that are necessary for basic flight and navigation are called out on the picture below and described in greater detail. Chances are you won't ever need to use the other information that's displayed, but it's described in the *Expert Flight Manual*, if you are interested in learning more about it.

Because of the varied terrain and weather conditions in which you fly, the HUD symbols will sometimes blend into the scenery. To make them more visible against the background, you can change the HUD color by pressing H.



Airspeed and Thrust

Indicated airspeed. Your current airspeed is listed in knots. A knot is equivalent to one nautical mile per hour. (100 knots would be roughly 115 miles per hour.)

Your indicated airspeed will drop as you climb to higher altitudes, even though your throttle is set to full power. This is normal.

Thrust. This number appears in the bottom-left corner of the HUD if you are using the keyboard to control throttle. It tells you what your throttle setting is (100% is full power, 0% would be off, etc.). If you are using a throttle device on your joystick, the position of the device tells you what the throttle setting is — if it's pushed all the way forward, you're at 100% power.

Altitude

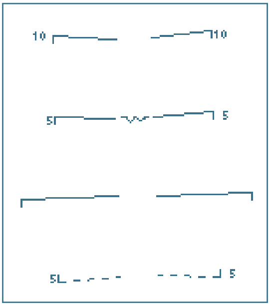
Altitude above sea level. Your current altitude is listed in feet above sea level.

Altitude above the ground. Your current altitude is listed in feet above the ground.

Note that these two are *not* the same. If you are flying at 4,000 feet above sea level over 3,000-foot mountains, you are flying only 1000 feet above the ground.

Pitch

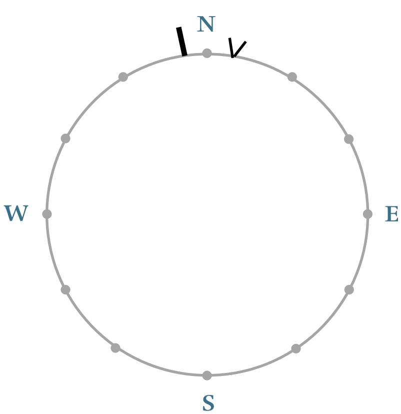
Pitch ladder. The pitch ladder is a series of paired lines.



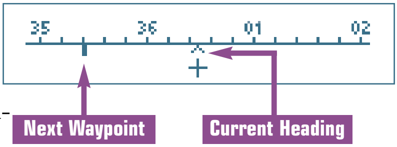
- The number at the end of each line tells you exactly how far down or up the nose is pitched, in degrees. A 10° pitch means your aircraft is pointed upward 10°, for example. At 0°, you are flying horizontally. At -10°, your nose is pointing down.
- Solid lines indicate angles above horizontal; dashed lines indicate angels below horizontal.
- The pitch ladder lines always remains parallel to the ground. To level your wings, move your joystick until the 0° line is horizontal.

Navigation

Heading scale. The heading scale is a compass — north is at 36, east is at 9, south is 18 and west is at 27 (see diagram). The arrowhead on the scale remains fixed, marking your current heading. In the diagram and in the picture of the heading scale, the current heading is between 36 and 01, or a little to the east of north. To head due east, turn until the arrowhead points at 09.



Next waypoint marker. This small bar on the *heading scale* indicates the heading to your waypoint. To steer to the waypoint, turn until the bar is centered under the arrowhead on the heading scale.



Waypoint data. Information about your waypoint appears in the bottom right corner of the HUD (see illustration on p. 16):

- The top line lists your current waypoint, such as **NAV 2A**.
- The second line lists the distance to that waypoint in nautical miles — for example, **N 2.7** would mean the waypoint is 2.7 nautical miles (nm) away. *(A nautical mile is roughly 1.15 miles.)*
- The third line lists your estimated time enroute to the waypoint — for example, **00:00:15 E** would mean you'll reach the waypoint in 15 seconds.

Gun

Gun cross. Use this cross to aim when you are firing the gun — place it over the target and pull the trigger (joystick button 1). The gun is always active and can be fired at any time.

FLIGHT AND NAVIGATION SCREENS

When you are in navigation mode (in other words, when you have no weapon selected), the following screens show up in the monitors:

Left monitor — TSD screen

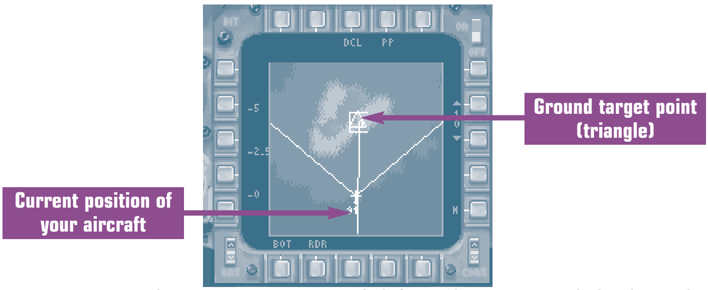
Right monitor — TEWS screen

Bottom monitor — ADI screen

These are described in the sections following.

TSD Screen (Left Monitor)

TSD stands for Tactical Situation Display. This screen features a moving terrain map. A tiny aircraft symbol in the center of the display indicates the current position of your aircraft on this map, circles indicate your waypoints, and the lines connecting them indicate the route you are to fly for the mission. Triangles mark waypoints with ground targets that are mission objectives (targets you have to destroy to win).

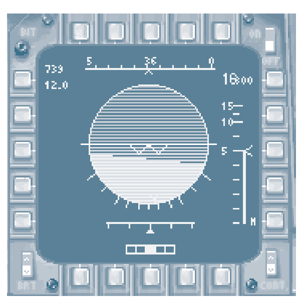


When navigating, the TSD is most useful for taking a quick look at the terrain you are flying over. It has several other more advanced features — these are described in detail in the *Expert Flight Manual*.

You can zoom and expand the display range using the Z and X keys, respectively. (This will also change the range for all the other screens in the monitors.)

ADI Screen (Bottom Monitor)

ADI stands for Attitude Director Indicator. Basically, this screen repeats information that appears on the HUD, and really isn't necessary for normal flight (unless your HUD goes out). The ADI screen is described in detail in the *Expert Flight Manual*.

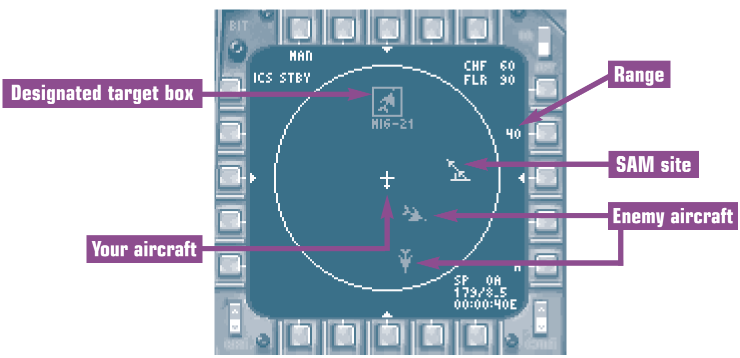


TEWS Screen (Right Monitor)

TEWS stands for Tactical Electronic Warning System. This screen gives you information about the aircraft, ground weapons and missiles that are tracking *you*. The TEWS screen shows a top-down screen of the area around your aircraft, with the aircraft's nose always pointed at the top of the screen.

Threats are marked by icons (these are listed on the next page). Where the icon is placed on the display tells you where it is in relation to your aircraft (e.g., behind or to the left of you). How far a threat icon is from the center of the display indicates how far it is from your aircraft. If the display range is set to 40, a threat at the edge of the display is 40 nautical miles away, whereas a threat halfway to the edge of the display is about 20 nautical miles away.

You can expand and zoom the display range using the X and Z keys. (This will also change the range for all the other screens in the monitors.)



Jammer, Chaff and Flares

Your jammer sends out mixed-up radar signals that make it harder for an enemy's radar to figure out where you are. It comes on automatically when the warning system detects a threat.

Chaff and flares decoy missiles,attempting to lure them away from your aircraft where they can explode harmlessly. The WSO (Weapons Systems Officer, a co-pilot who sits behind you — pronounced "wizzo") will drop chaff and flares for you. If you don't think he's doing a good job, press Del to drop chaff and Ins to drop flares yourself.

Threat Icons

The following icons mark threats and friendly objects:

 Aircraft (type of aircraft is listed next to the icon)

 SAM (Surface-to-Air Missile)

 Ground radar (not SAMs)

 Missile

- Red icons mark enemies. Blue icons mark friendlies.
- When an object locks onto you (makes you its target), that object's icon will flash.
- Mission objectives — things you need to protect or destroy in order to win the mission — will have a triangle around them.
- If one of the objects on the display is your current target, a box will appear around it. If it is within weapon range, this box will flash.

Warning Tones

The TEWS also gives you audio warnings. When a new threat appears on the display, you'll hear a short, high-pitched "boop." When something locks onto you, you will hear the high "boop" alternating with a lower "boop" five times — "boop-boop ... boop-boop ... boop-boop ... boop-boop ... boop-boop." The object's icon will start to flash on the display. If the object launches a missile at you, the alternating "boop-boop" sound becomes faster and constant. It won't stop until you have either successfully dodged the missile, or died trying.

Your WSO keeps his TEWS screen up all the time, and will help you by calling out the position of any threat he sees.

AIR-TO-AIR COMBAT

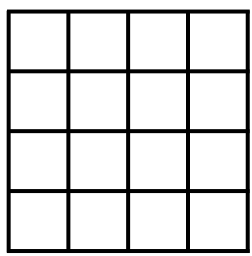
When an AIM-7, AIM-9 or AIM-120 is selected, you are in air-to-air mode. (AIM stands for Air Intercept Missile, meaning a missile designed to intercept air targets.) Missile steering and range information is added to the HUD and the Air-to-Air Radar, TEWS and TSD screens appear in the monitors.

The warning system (in the right monitor) functions as descibed above — see **TEWS Screen (Right Monitor),** p. 20. The TSD is now in the bottom monitor, but it too functions in the same way — see **TSD Screen (Left Monitor),** p. 19.

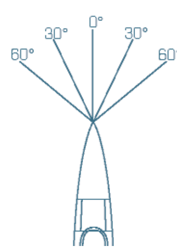
A new screen — the Air-to-Air Radar display — appears in the left monitor.

FINDING AIR TARGETS — THE AIR-TO-AIR RADAR SCREEN

Search Mode



Before you select a target, the radar is in search mode and displays all of the aircraft it detects in front of you (those that are within the current range setting, that is). The radar screen presents a top-down view of the area in front of your aircraft. The nose of your aircraft is at the bottom center of the display. The horizontal lines on the grid represent range, and the vertical lines represent angles off of your aircraft's nose.



For example, if the current display range setting is 80 nm, then the top horizontal line on the grid represents 80 nm, the next lower line represents 60 nm, the next lower 40 nm and so on. If an icon appears near the far right vertical line on the grid, then it is about 60° to the right of your aircraft.

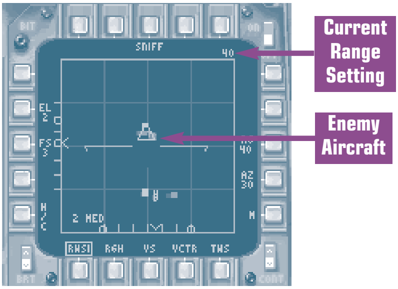
If the space around you was marked by the positions on a clock — so that 12 o'clock was directly in front of you, and 3 o'clock was the view over your right shoulder — an object that was 60° to the right of you would be at the 2 o'clock position.

You can expand and zoom the display range using the [X] and [Z] keys. (This will also change the range for all the other screens in the monitors.)

Radar Symbols

Small rectangles mark the positions of enemy aircraft. Circles mark the position of friendly aircraft.

- Enemy aircraft
- Friendly aircraft
- Designated Target

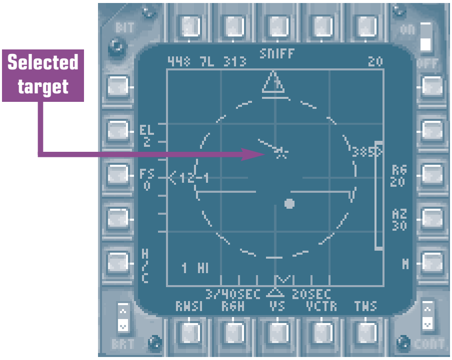


Selecting Targets (Change Target Key)

Press [T] or [Bksp] to cycle through targets. These keys cycle through all targets that the radar can "see," starting with the ones that are your air objectives (enemy aircraft that you must destroy or friendly aircraft that you must protect in order to win), if you have any. Once you have cycled through all of your objectives, these keys cycle through non-objective targets, from those closest to your aircraft to those farthest away.

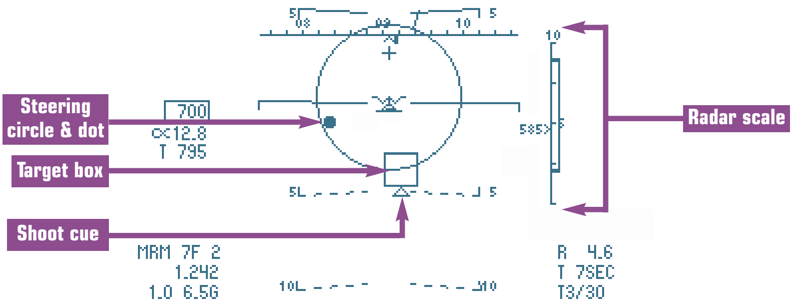
Track Mode

As soon as you select a target, the radar goes into track mode. The target's rectangle icon changes to a star on the end of a long stick. All other icons disappear from the screen.



Information about the target — its range, altitude, speed, etc. — is also displayed, but since this information is also passed on to the weapons system, which uses it to put symbols on the HUD that tell you where to aim the missile and when to shoot, you really don't need to worry about it. If you are curious, these are described in the *Expert Flight Manual*.

DESTROYING AIR TARGETS — HUD SYMBOLS



Once you have a target selected, the aircraft's computer puts symbols on the HUD to show you where the target is and where to steer so that the missile can see the target. A **shoot cue** will flash on the HUD when the missile is in range and you can fire.

The symbols called out on the picture above are described in the step-by-step instructions for firing a missile.

1. Press T or Bksp to select a target, if you haven't done so already. A **target box** marks the position of that target on the HUD.
2. The large **steering circle and dot** in the center of the HUD help you get your aircraft into a position where the missile's seeker head (a device in the nose of the missile which locks it onto a target) can find the target. Move your joystick around until the dot is inside the circle.
3. When the target is within range of your missile, a triangular **shoot cue** appears beneath the target box. Press button 2 on your joystick to release the missile.

   IMPORTANT: If the missile is an AIM-7, it needs to be guided by your radar until it hits the target — you can fire more AIM-7s at the same target, but don't change targets (don't press T or Bksp) and don't change weapons (don't press Spacebar) until you see the explosions.

What if the flashing shoot cue doesn't appear?

You may be too close to your target or too far away from it. The following symbols will give you a better idea:

- *A* ***range scale*** *on the right side of the HUD also tells you where the target is in relation to the weapon's range. The arrowhead on the scale points to the target's current range. (The number beside the arrowhead is a closure rate — this is an advanced feature that you can ignore.) The bracket on the scale indicates the weapon's possible range. If the arrowhead is above the bracket, the target is to far away. If it's below the bracket, the target is too close. If the arrowhead is inside the bracket, the shoot cue will flash beneath the target box, and you can fire.*
- *A large "X," called a* ***break X*** *appears in the center of the HUD when you are too close to the target to fire the missile.*

If you are too close:

- *If an AIM-7 or AIM-120 is your current weapon, press* Spacebar *to cycle to an AIM-9 (AIM-9 missiles have a shorter range and can be used when you're closer to a target).*
- *If an AIM-9 is your current weapon, and you're still too close, then the target is probably within gun range. To use your gun to destroy the target, move your joystick until the* ***gun cross*** *is over the target box, and squeeze the joystick trigger (button 1).*

If you are too far away:

- *If an AIM-9 is your current weapon, press* Spacebar *to cycle to an AIM-7 or AIM-120 (These have a longer range and can be used when you're closer to a target).*
- *Otherwise press* T *or* Bksp *until you cycle to a closer target, or steer toward the one you have and try to get closer to it.*

AIR-TO-GROUND COMBAT

When an air-to-ground weapon is selected, you are in air-to-ground mode. Air-to-ground guided missile information is displayed on the HUD if you have an AGM-65 selected (AGM stands for Air-to-Ground Missile). Bombing information is displayed if you have any other air-to-ground weaopn selected.

The TSD is still in the bottom monitor, and it functions in the same way as it did in navigation mode — see **TSD Screen (Left Monitor),** p. 19.

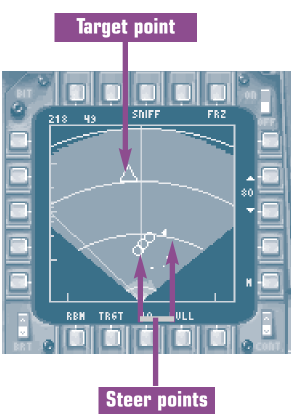
Two new screens — the Air-to-Ground Radar display and either a Target Map or Camera — appear in the left and right monitors, respectively.

FINDING GROUND TARGETS — AIR-TO-GROUND RADAR AND TARGET MAP/CAMERA

Air-to-Ground Radar

The Air-to-Ground Radar displays the ground terrain in an arc in front of your aircraft (your aircraft is at the bottom center of the display). Generally speaking, the brighter the area, the higher the terrain. Black areas on the screen are places the radar beam creating the map can't "see" — for example, because a hill is in the way. You may not be able to see targets in these areas until you fly past whatever is blocking the radar.

Small boxes on the terrain mark ground objects — buildings, tanks, SAM sites, trucks, etc. Objects that are your objectives (things you have to destroy in order to win) are marked by triangles. The currently selected target is marked by a box on the display.



- • Marks ground objects (buildings, SAM sites, tanks, trucks, etc.)
- △ Marks your ground objectives
- □ Marks your currently selected target

You can expand and zoom the display range using the X and Z keys. This will also change the range of TSD (in the bottom monitor), but it has no effect on the target map/camera screen (in the right monitor).

Selecting Targets (Change Target Key)

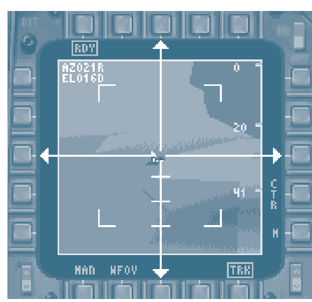
You select ground targets in the same way as you select air targets. Press T or Bksp to cycle through targets. These keys cycle through all targets that the radar can "see," starting with the ones that are your objectives (targets you have to destroy in order to win), if you have any. Once you have cycled through all of the objectives, these keys then cycle through non-objective targets from those closest to your aircraft to those farthest away.

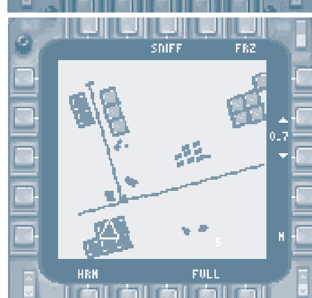
When you select an air-to-ground weapon, the objective target closest to you will already be selected as your first target.

Target Map/Camera

Once you've selected a target, either a top-down, high-resolution radar map or a camera video image of the target appears in the right cockpit monitor.

- Target camera video appears when you have an AGM-65 or GBU-15 selected. Both missiles have an infrared imaging camera mounted in the nose, and video from these cameras can be displayed in the monitor on your aircraft. These missiles' cameras automatically lock onto your target.
- A target map appears if you have any other ground weapon selected. The map is a top-down, high-resolution radar map of the target and the area around it. It is created by the radar.





Both the camera image and the map give you a little bit better idea what it is you have targeted.

DESTROYING GROUND TARGETS — HUD SYMBOLS

Once you have a target selected, the aircraft's computer puts symbols on the HUD to show you where the target is and how to aim your weapons toward it.

If AGM-65s Are Your Current Weapon

AGM-65s are guided, air-to-ground missiles. They automatically lock onto your currently designated target if it is in range.

1. Press T or Bksp to select a target, if you haven't done so already. A **target diamond** marks the position of that target on the HUD.
2. The AGM-65 missile will attempt to lock on to the target. When it has locked on and is in range, "IN RNG" will appear on the HUD.

   You will see the target in the center of the target camera (see **Target Map/Camera**, previous page), and you will know that the missile has found the target.
3. As soon as the missile has locked on, press joystick button 2 to fire.

What if the missile doesn't lock onto the target?

If you're directly over the target, fly away and try again. Otherwise, the target is probably outside of the missile's maximum range. Pick a closer target, or fly closer to your current target and try again.

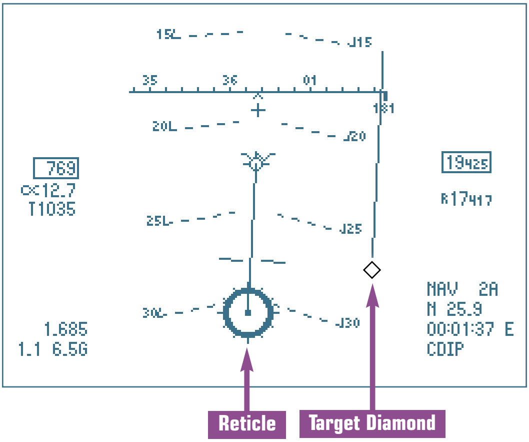
If Any Other Ground Weapon Is Your Current Weapon

The other ground weapons are unguided bombs. When you select one of them as your weapon, symbols that will help you aim toward your target and drop the bombs at the right time appear on your HUD.

1. Press T or Bksp to select a target, if you haven't done so already. A **target diamond** marks the position of that target on the HUD.

   (Actually, you can drop bombs without selecting a target, but having a target diamond on the HUD makes it easier to aim.)

2. A **reticle** appears on your HUD, indicating where on the ground the weapon would impact if it was released at this moment. As you fly, the reticle moves along the ground — steer the aircraft to place the reticle over the target diamond.



3. When the reticle is over the target diamond, press button 2 on your joystick to release the weapons.

What if I don't see a reticle?

It has probably slipped out of sight below the bottom edge of the HUD. A line is drawn up from this reticle to the center of your HUD, so that you can always tell where the reticle is. Push your joystick forward and dive a little until you can see the reticle again.

COMMUNICATION

You will be flying missions with a group of up to eight aircraft, called a flight. One of these aircraft, your wingman, is assigned specifically to work with you and protect you. The other aircraft will have similar objectives as you, but will not be looking out for you specifically.

During the mission, AWACS (Airborne Warning and Control System) can tell you where enemy aircraft are — either the one closest to you, or all the ones in your location. All you have to do is ask.

All messages — from your wingman, your WSO, your flight, other aircraft — will appear in the upper left corner of the screen.

WITH YOUR WINGMAN

Press the following keys to issue commands to your wingman.

Ctrl A	**"Attack my target."**	Your wingman will begin firing on your target. (If you don't have a target selected, your wingman will continue normal flight — and probably mutter something under his breath about your wanting him to do all the work ....)
Ctrl C	**"Cover me."**	Your wingman will watch your back, and take on anything that threatens you.
Ctrl H	**"HELP ME!"**	Your wingman will drop whatever he's doing and come to your aid. (*Unless* he's in hot water himself — in this case he'll tell you you're on your own, and not under his breath this time.)

WITH AWACS

Press the following keys to get information from the AWACS.

Ctrl B	**"Bogey Dope"**	AWACS will tell you where the nearest enemy aircraft is: bearing range and relative altitude.
Ctrl P	**"Picture"**	AWACS will begin telling you where all the enemy aircraft near you are. If there is a bullseye (special location told to the pilots during the briefing) assigned, positions will be in relation to the bullseye.

WITH YOUR FLIGHT

Press the following keys to issue commands to your flight.

Ctrl E	**"Engage."**	The aircraft in your flight will engage any enemy *air* targets they find. If they can't find anything, they will radio you and continue normal flight. If they find air targets and you forget to give this command, they will ask for permission to engage. Your WSO will give them permission if you are busy.
Ctrl G	**"Ground Attack."**	When your flight is within range of the target area they will request permission to start the attack. This command directs them to begin. Your WSO will give them permission if you are busy.
Ctrl S	**"List status."**	The aircraft in your flight will radio back just their flight numbers (if undamaged) or their flight numbers and amount of damage they've taken.
Ctrl W	**"List weapons."**	The aircraft in your flight will list off their current air-to-air missiles.

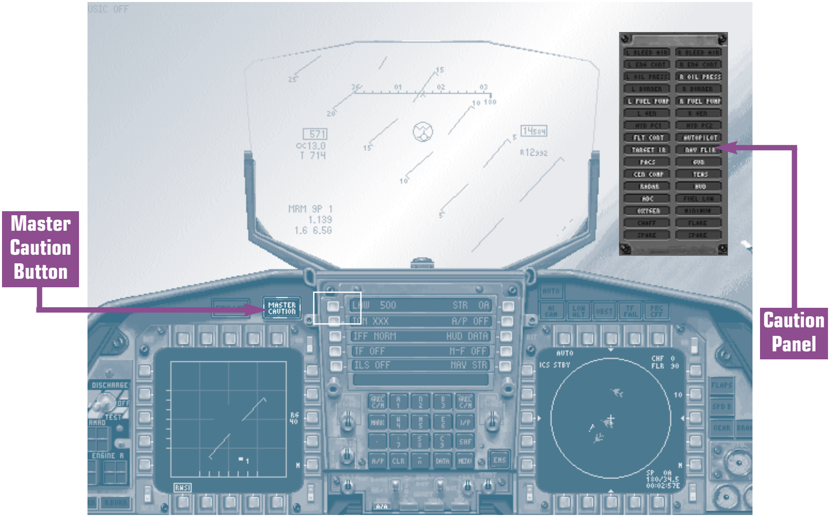
REARMING AND REFUELING

Press R to rearm and refuel your aircraft. You will get a full loadout of air-to-ground and air-to-air weapons, bullets and chaff and flare cartridges. Your fuel tanks will be refilled. Your wingman will receive the same.

There is no limit to the number of times your can rearm and refuel.

DAMAGE

The master caution light will come on when you take damage and a caution panel will come up on screen. Anything lit up is damaged.



ENDING THE MISSION

At any time you can press Esc to end your mission. Once you have accomplished your mission objectives and are out of harm's way, you will be prompted to do so. When you exit the game in this way, you will be brought back to debriefing. See **Debriefing**, p. 8.

Jane's
COMBAT SIMULATIONS

CASUAL PLAYGUIDE

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From the TOC, click **purple links** to open a chapter and view a topic.

Each chapter has its own table of contents with some active text links. You can also click on bookmarks to view a topic in that chapter.

At any time, you can click the tabs on the right to view another chapter.

CASUAL KEY GUIDE

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STARTING
PRE-FLIGHT
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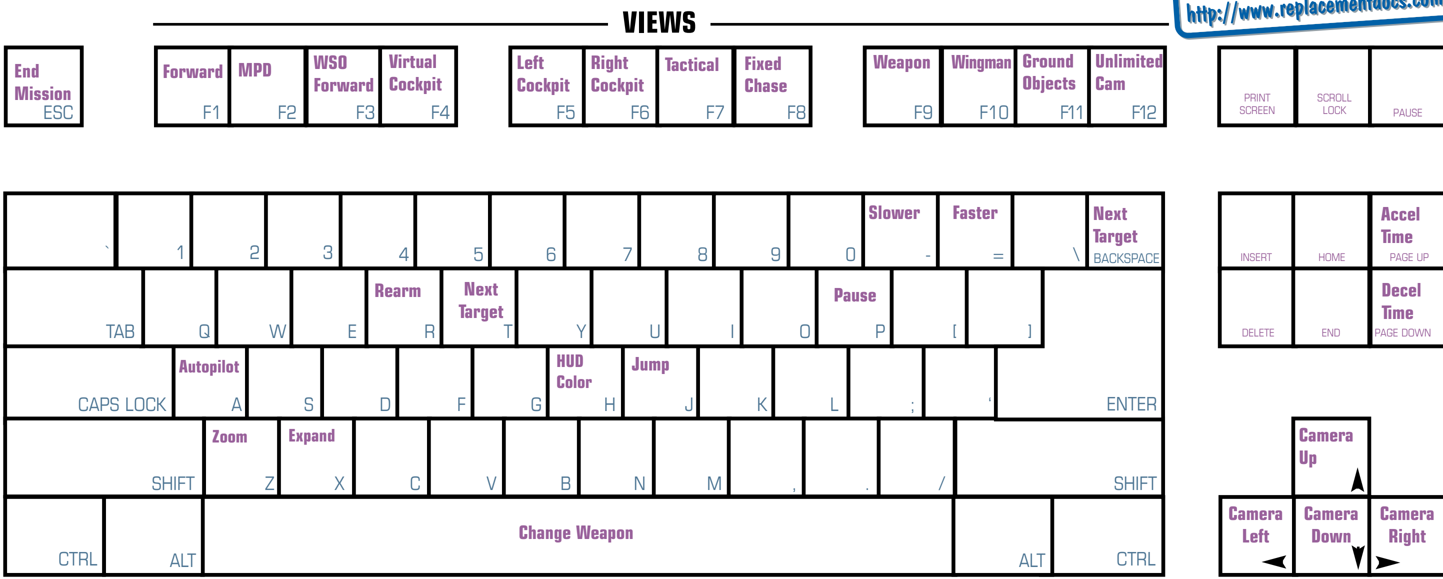
REARM

CASUAL KEY GUIDE



Ctrl A	Attack My Target (Wing)	Ctrl B	Bogey Dope (AWACS)
Ctrl C	Cover Me (Wing)	Ctrl E	Engage Bandits (Flight)
Ctrl G	Ground Attack (Flight)	Ctrl H	Help (Wing)
Ctrl P	Picture (AWACS)	Ctrl S	Status (Flight)
Ctrl W	Weapon Check (Flight)		

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2 - COCKPIT

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A-F - APPENDICES

INTERFACE

Starting the Game. After installing, double-left click the *Jane's F-15* shortcut icon, or select *Programs/Jane's Combat Simulations/F-15* from the START Menu.

You can bypass the Introduction by pressing Esc.

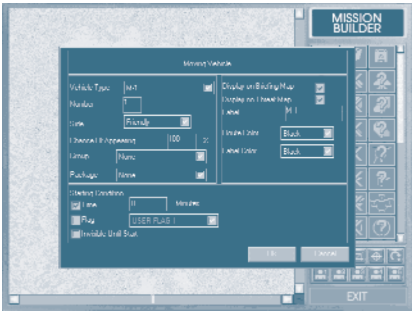
GENERAL INSTRUCTIONS

Jane's F-15 has a primarily cursor-driven interface. Unless specified otherwise, "click" always refers to left-clicking the mouse on an option.

In the lower-right corner of nearly every screen is a circle divided into four parts: a red CANCEL section, a blue ACCEPT section, a yellow HELP section and a central gray "artificial horizon."

In most cases, clicking on the artificial horizon will bring up an OPTIONS screen.

ACCEPT applies any changes you've made on that screen, and progresses to the



next screen. (When you are about to enter a mission, ACCEPT changes to FLY.)

CANCEL returns to the previous screen without applying any changes made.

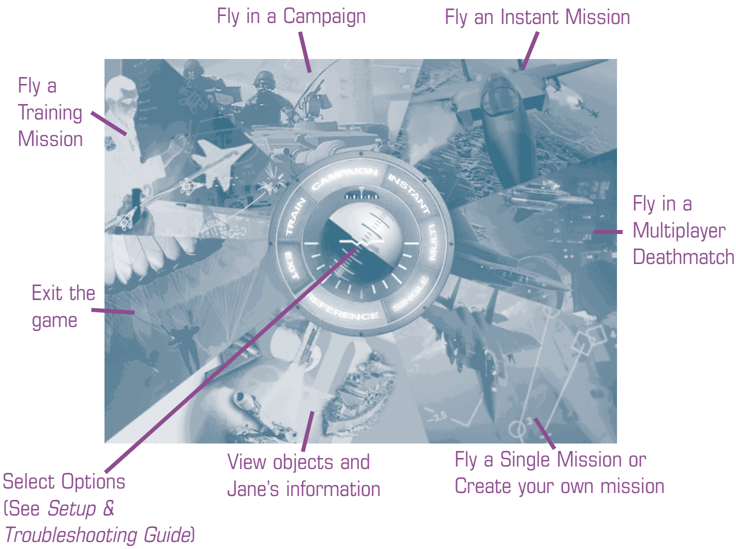
HELP brings up a window that explains the function of the current screen.

Pop-Up Windows

Often, pop-up windows will appear, and selections can be made or information can be entered.

OK saves any changes you've made in that window, and returns you to the original screen.

CANCEL returns to the original screen without saving any changes made.



MAIN MENU

The first thing you see after the introductory video is a main screen "menu" divided into seven multi-colored "wedges" and a central black-and-white artificial horizon. Each wedge performs one or more different functions. To select one of these wedges, move your cursor over the colored section to highlight it, and click.

Notice that it is not necessary to click on the word itself. Click anywhere in the highlighted colored section to proceed.

First-time pilots will benefit from playing *Jane's F-15* in Casual mode, which can be selected during installation.

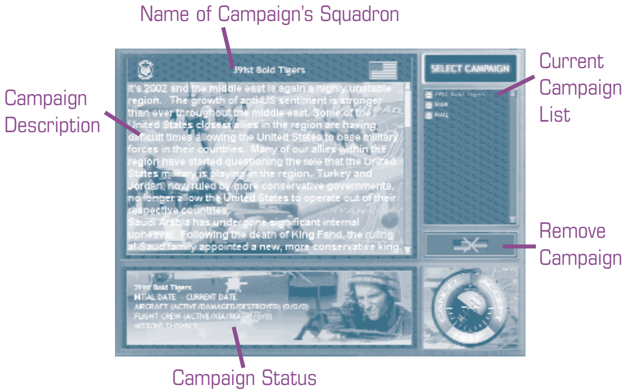
TRAINING

Jane's F-15 has a variety of training missions that cover the basics of flying this sophisticated fighter from takeoff to full combat situations. On the right side of the screen is a scrollable list of missions.

- Click once on the name of the mission to bring up a description of that mission.
- Click twice on the name of the mission (in Available Missions) to bring up the mission briefing.
- Click ACCEPT to proceed to the briefing.
- Click FLY to begin the mission (after the briefing).

For details on the briefings, see **Briefing**, p. 1.6.

CAMPAIGNS



There are two possible campaigns: The United Nations war with Iraq, Desert Storm, and a hypothetical action against Iran in 2002. You can view a summary of each campaign's history by clicking on the campaign name in the Current Campaign List.

- Click on the campaign name IRAN or IRAQ, then select ACCEPT to begin the campaign.

Once you've flown in a campaign, there will be an additional name in the Current Campaign List. It will include the name of the squadron you chose. That is the "title" of your campaign in progress.

- Click on the name of your squadron, and select ACCEPT to continue a campaign.

All statistics pertaining to your selected campaign will appear in the lower portion of the screen. These include aircraft status, flight crew status and number of missions flown.

REMOVE CAMPAIGN

You can delete any campaign in progress. You cannot delete the original campaign starting points, IRAN and IRAQ.

Once you delete a campaign, there is no way to undelete it.

- Click on the name of the campaign in progress to be deleted.
- Click the REMOVE CAMPAIGN icon.
- Confirm that you wish to delete the campaign.

SQUADRON

Choose your squadron. This not only determines the tail insignia on your F-15, but it affects the airframes and aircrew available for each mission. Once you have selected a squadron for a campaign, you cannot change squadrons — you must begin a new campaign to fly with another squadron.

The right window shows a scrollable list of all available squadrons. As each squadron's name is highlighted, its history and insignia appear in the upper-left window.

- Click on the name of the squadron you wish to view.
- Click ACCEPT to select that squadron and continue.

VIDEO INTRODUCTION

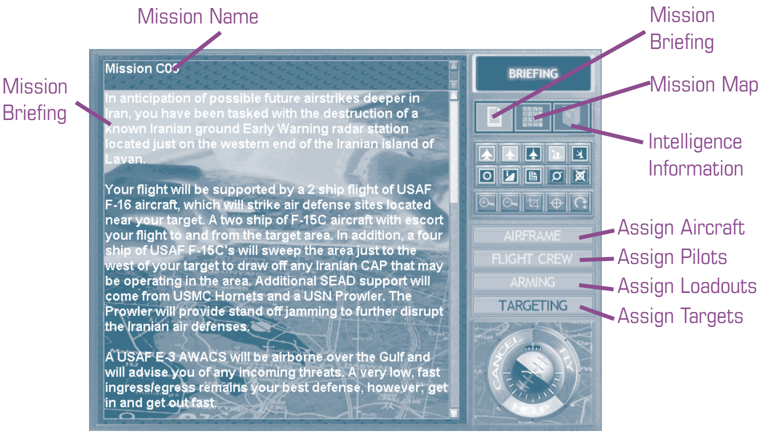
If you do not wish to view the video introduction, press any key to skip past it.

CAMPAIGN INFORMATION

Before the initial mission of a campaign, a brief history of the overall situation is described.

- Click CONTINUE to go to the Mission Briefing.

BRIEFING



The Briefing screen is where the mission is fine-tuned. All the available information can be read, the mission map can be viewed and even adjusted, and the squadron's aircraft can be prepped for flight.

MAIN

All the available information that Military Intelligence can provide is presented on the Main Briefing screen.

Mission Briefing

The mission and resources summary, as well as all recommendations, can be viewed from this screen.

Mission Map

All currently known situational information can be graphically viewed from the mission map. This includes locations of waypoints and the Bullseye, JSTARS and FACs, and any known threats.

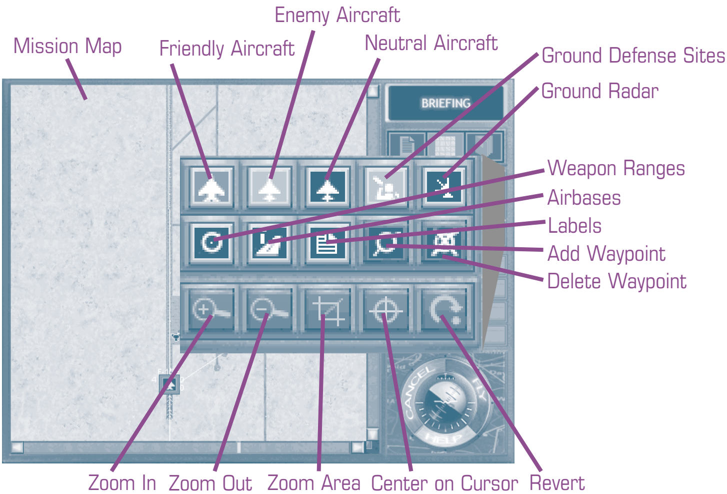
You may move, add or delete waypoints on the Mission Map, if you feel there would be an advantage.

Intelligence Information

All known enemy threats are listed, both air and ground. Not all threats found in the mission are listed, however.

Mission Map Controls

The three rows of buttons beneath the Mission Map Icon control the information shown on the Mission Map screen.



Friendly Aircraft. Toggle the friendly plane icons on/off.

Enemy Aircraft. Toggle the known enemy plane icons on/off.

Neutral Aircraft. Toggle the neutral plane icons on/off.

Ground Defense Sites. Toggle the known friendly and enemy AAA and SAM sites on/off.

Ground Radar. Toggle radar range circles on/off.

Weapon Ranges. Toggle the visual weapon detection circles (the effective range that SAMs can detect an aircraft) on/off.

Airbases. Toggle area airbase icons on/off.

Labels. Toggle mission labels on/off.

Add Waypoint. You may add waypoints to your mission. (You can also click-and-drag a pre-existing waypoint to move it.)

- Click on the ADD WAYPOINT button.
- Click on the waypoint just *before* the waypoint you want to add. If you are placing a waypoint before the current Waypoint 1, click on the aircraft itself.
- Click on the location of the new waypoint.

Delete Waypoint. You may delete waypoints from your mission.

- Click on the DELETE WAYPOINT button.
- Click on the waypoint to be deleted.

Zoom In. Zoom closer to the current center of the Mission Map.

Zoom Out. Zoom the Mission Map farther out.

Zoom Area. Select an area to view in the Mission Map.

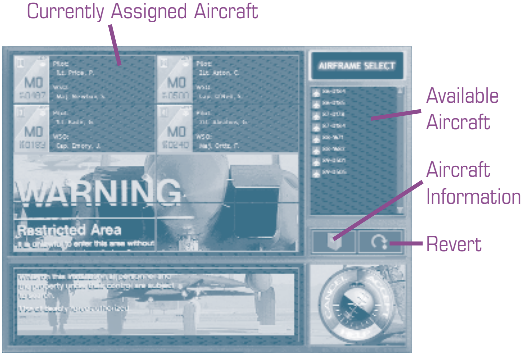
- Click on the ZOOM AREA button.
- Click-and-drag an area on the Mission Map.
- Release the mouse button. That area will fill the Mission Map screen.

Center On Cursor. Select an area to be centered on the Mission Map screen.

- Click on the CENTER ON CURSOR button.
- Click on the location on the Mission Map to be centered.

Revert. Return the map to the way it was, the last time it was saved. If it hasn't been saved, REVERT "clears" it.

AIRFRAME/ASSIGN AIRCRAFT



When you select an airframe, you are choosing the actual fighters you and your wingmen will fly. All the planes are F-15 Strike Eagles, and until they see combat and take damage they are identical, but each squadron only has a certain number of actual planes. If your wingman is flying the F-15 airframe 86-0183, and is shot down, then 86-0183 isn't going to be available again. If he's shot up, then 86-0183 is going to be damaged in the future.

The first two numbers refer to the year the aircraft was manufactured.

Different types of damage get repaired at different rates. It usually takes about two to five missions for a damaged plane to become available.

- Assign a plane by click-and-dragging a name from the Available Aircraft window to an empty slot in the Currently Assigned Aircraft screen.
- Replace a plane by click-and-dragging another aircraft to an occupied slot. The original plane will be returned to the Available Aircraft list.
- Remove a plane by click-and-dragging the Airframe off the Currently Assigned Aircraft screen.

There is a number in the top left of each airframe image in the Currently Assigned Aircraft area. You are #1. Your wingmen are numbered in succession.

Aircraft Information

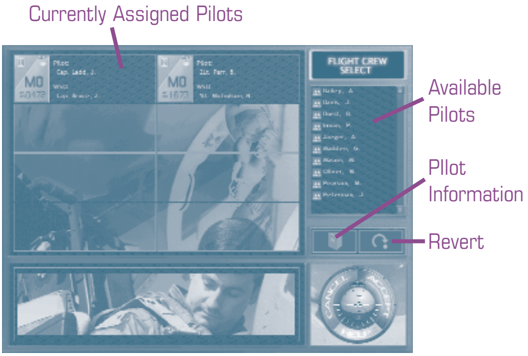
- Click AIRCRAFT INFORMATION.

Information on the status of each airframe in the entire squadron (OK, REPAIR, DESTROYED) will appear on the left side of the display.

Revert

- Click REVERT to return to the original airframe selection.

FLIGHT CREW/ASSIGN PILOTS



You can assign flight crew to fly the airframes you've selected (see above), or you can accept the default flight crew.

The selection process is identical to the method for assigning airframes.

- Assign a pilot by click-and-dragging a name from the Available Pilots list to an empty slot in the Currently Assigned Pilots screen.
- Replace a pilot by click-and-dragging another name to an occupied slot.
- Remove a pilot by click-and-dragging the name off the Currently Assigned Pilots screen.

To know which pilot is Wingman 1, 2, 3, etc., look at the number in the tail-fin graphic. You are #1. Your wingmen are numbered in succession.

Pilot Information

- Click PILOT INFORMATION.

Information on the status of all pilots will appear in the left side of the screen.

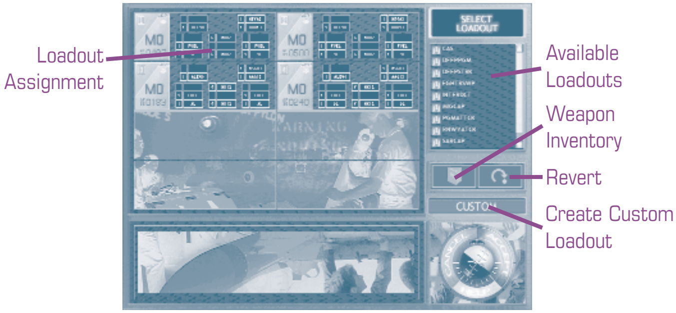
Rename a Pilot or Weapons Systems Officer

- Click on a name.
- Type a new name in the appropriate text box.
- Click OK.

Revert

- Click REVERT to return to the original Flight Crew selection.

ARMING/ASSIGN LOADOUTS



With the exception of being able to customize loadouts, the arming process is identical to the method for assigning airframes and pilots.

A number of the most commonly used loadouts are listed in the Available Loadouts window. These are combat-proven combinations maximizing the F-15E's capabilities in a variety of situations.

Loadout entries that are gray are not available because the ordnance inventory cannot provide a complete loadout as prescribed in the loadout specification.

- Assign a loadout by click-and-dragging a name from the Available Loadouts list to an airframe in the Loadout Assignment screen.

Different planes can carry identical loadouts, until the ordnance runs out. Ordnance conservation is an element of campaign strategy — it is important not to waste ordnance and risk running out when it's most needed.

Similarly, assigning complementary loadouts to different members of your strike package requires a strategic decision. The goal is to be prepared for any eventuality.

- Replace a plane's loadout by click-and-dragging a new loadout from Available Loadout to an occupied slot in the Loadout Assignment screen.
- Remove a plane's loadout by click-and-dragging the loadout off the Loadout Assignment screen.

Default Loadouts

There are a number of pre-designed loadouts, each recommended for different types of missions. Additionally, custom player-created loadouts can be added to this list via the CUSTOM button (see next page).

The exact configuration of these default loadouts can be viewed by opening them through the CUSTOM screen, or by click-and-holding the left mouse button down on a specific loadout in the Available Loadouts list (this provides a small representation of the loadout). See **Custom**, next page.

Arming Weapon Inventory

This provides a list of the squadron's current ordnance supplies. This is important in campaigns, where ordnance is limited.

To see a brief description of a particular weapon or round, click on its image.

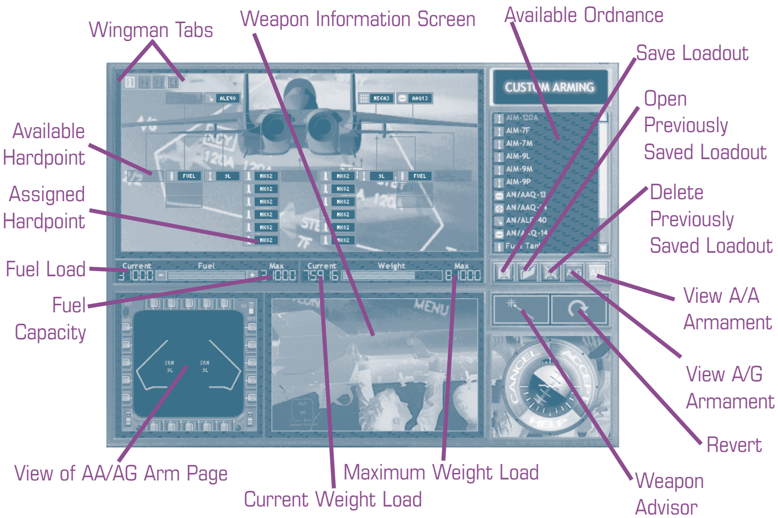
A "-" character in the quantity column indicates the squadron has unlimited access to that ordnance.

Revert

- Click REVERT to return to the original default loadout.

Custom

Although there are several suggested loadouts for various types of missions, it is also possible to create your own custom loadouts. These can be saved, and used at any time during the campaign, as long as the appropriate ordnance is available.



- Click CUSTOM.
- Click-and-drag weapons from the Available Ordnance window to an Available Hardpoint.

Positions that can accept that type of weapon will highlight when the weapon is selected. Weapon names which appear gray represent weapons which are currently depleted from inventory, and can't be dragged into an Available Hardpoint.

- Continue until the loadout is complete.

F-15 Fuel/Weight. The more ordnance is loaded on a plane, the heavier it becomes. When the weight exceeds the Maximum listed on the far right of the Weight indicator, the red bar under WEIGHT signals that the plane is overloaded.

However, in some situations, such as very short missions, fuel can be removed from the main fuel tank by using the "-" button to the left of the Fuel Load indicator, lightening the overall load and making it possible to add more ordnance.

MPD Display. This is a display of the appropriate AA or AG armament page (p. 2.26, p. 2.28), which is how you track your weapon status during the mission. Watching how the addition and deletion of ordnance is tracked on the MPD is a good way of familiarizing yourself with this feature.

Weapon Information Screen. When a weapon is highlighted in the Available Ordnance screen, a picture and brief summary are displayed in this window. The amount of this ordnance which is available also appears here.

Save Loadout. To give a custom loadout (currently displayed) a name, press the SAVE LOADOUT button and enter the name in the text box.

This loadout will now be available in the regular Available Loadouts screen for simple click-and-drag use.

Selecting ACCEPT will **not** automatically save your new loadout for future missions. It merely accepts the loadouts for the airframes, and there will not be a prompt asking if you want to save any of them for future use.

Open Previously Saved Loadout. To view or edit a loadout:

- Press the OPEN PREVIOUSLY SAVED LOADOUT button.
- Select a loadout from the scrollable list in the pop-up window.
- Select OK.

Delete. To delete the selected loadout, press DELETE PREVIOUSLY SAVED LOADOUT.

View AG Arm Page. This button brings up the Available Ordnance for all air-to-ground weapons.

View AA Arm Page. This button brings up the Available Ordnance for all air-to-air weapons.

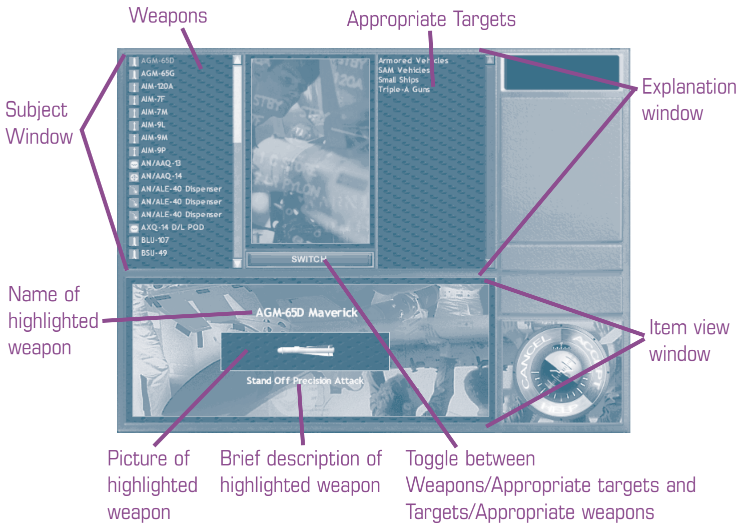
Cancel, Accept. Return to the Loadout screen by pressing CANCEL or ACCEPT; ignoring or accepting changes respectively.

Revert. Click REVERT to return to the previously saved version of the air-frame loadouts. All ordnance will return to the default.

Wingman Tabs. All loadout information can be specified for each wingman flying with you. The Wingman Tabs in the upper-left can be clicked to bring up their current loadouts.

Weapon Advisor

For a brief tutorial on what weapons are best for what types of targets, and likewise what types of targets call for which weapons, look at the **Weapon Advisor**, below.

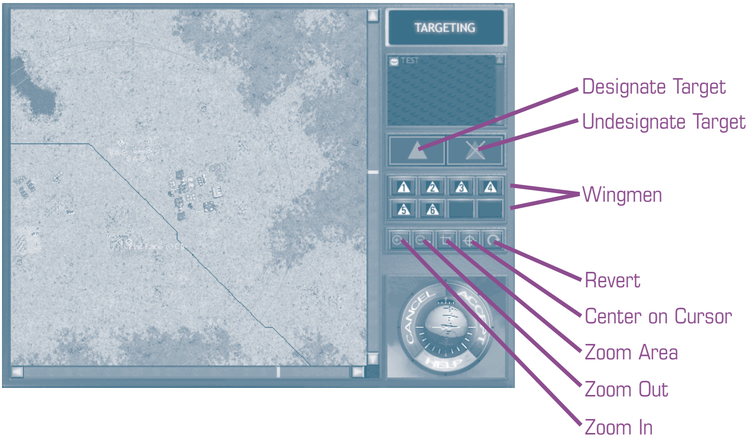


Any item in the Subject Window, when clicked on, will bring up information in the Explanation Window. If a weapon is selected in the Subject Window, the types of targets it is best used for will appear in the Explanation Window. If a type of target is selected in the Subject Window, the recommended types of weapons will appear in the Explanation Window.

- Click SWITCH to switch between types of targets and types of weapons in the Subject Window.

Whenever a weapon is selected, its picture and a brief summary will appear in the Item View window.

TARGETING/ASSIGN TARGETS



When a mission has a ground target, the TARGETING button on the Mission Briefing screen will be enabled. There will already be pilots assigned to certain targets — one target per waypoint per pilot. If you wish to adjust these target assignments, you may.

Delete a Target Assignment

- Click UNDESIGNATE TARGET and click on a target number to delete a pilot's assignment to that target.

Assign a Target

- Click DESIGNATE TARGET.
- Click the appropriate wingman's number.
- Click the target's icon (if aircraft) or white dot (if other object).

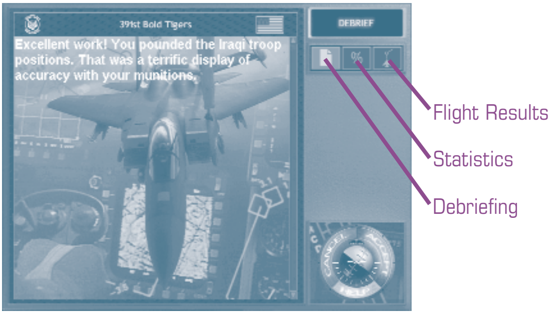
For further information on the other keys, such as Zoom In and Zoom Out, see p. 5.64.

FLY

Notice that in a mission briefing, instead of the blue ACCEPT button in the lower-right corner, there is a blue FLY button. When all the elements are arranged to your satisfaction, it is time to begin the mission.

- Click FLY to accept the mission and take off.

DEBRIEF



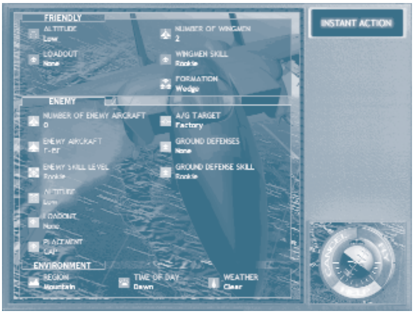
At the end of each mission a Debriefing screen appears. This includes information on how well you accomplished your goals, your overall performance, and the performance of the rest of your strike package.

Debriefing. Discusses the mission's accomplishments, or lack of them, waypoint by waypoint.

Statistics. Lists all applicable statistics, from total mission time to how much and what type of ordnance was expended.

Flight Results. Lists the accomplishments and failures of each aircraft in your strike package.

INSTANT ACTION



If you simply want to choose a type of mission, and then get out and fly it, Instant Action is for you. The computer creates a stand-alone mission from a few general parameters that you set. You can call for a simple in-and-out task, or you can set up complex missions involving multiple wings, difficult ground targets and crack air defenses.

Instant Action doesn't take the place of Training Missions, however. If you aren't sure how to handle an F-15, you might want to put some time into training before you try to put a Strike Eagle through her paces. (See **Training**, p. 1.3.)

Instant Action missions put you directly into the pilot's cockpit of an F-15 Strike Eagle. All you have to do is choose the parameters of the mission you want to fly, and you're good to go.

INSTANT ACTION PARAMETERS

If the text of a parameter is grayed out, it is not adjustable because a previous parameter precludes it. For instance, if you choose No Wingmen, you won't be able to assign them skills.

- Click on a parameter. (It will highlight when your cursor moves over it.)
- Click on an option within the parameter to select it.

FRIENDLY

Altitude. You can start the mission at low, medium, high or random altitude. Low is no problem for an F-15, but if you aren't familiar with the avionics, start off higher.

Loadout. You can choose any of the pre-determined loadouts, including ones that you have designed yourself. If you are interested in seeing exactly what is included in each loadout, or in creating your own, you'll need to go to the **Arming: Custom** section of **Campaigns** (p. 1.12).

Number of Wingmen. You can lone wolf it, or choose to have up to seven wingmen accompany you on your mission. Your wingmen will each have the same loadout as yours.

Wingman Skill. This determines how good your wingmen will be. A Rookie is more likely to make a mistake that will kill himself or fail the mission — and an Expert and Random are more likely to steal the air-to-air action.

Formation. Choose the formation that you and your wingmen will fly.

- "Wedge" is V-shape, except two aircraft (you and your wingman) may share the lead position.
- "Line" has all your wingmen flying parallel on one side of you, perpendicular to the Waypoint path.
- "Trail" has your wingmen flying in a line behind you.
- "V" is V-shape, with you at the front.

ENEMY

Number of Enemy Aircraft. The default is three, but you can have as many as eight.

Enemy Aircraft. You can choose from any aircraft available in the game. All enemy will have the same type of aircraft. For information on specific planes, see **Reference**, p. 1.22, or **Mission Builder: Type Aircraft**, p. 5.15.

Enemy Skill Level. Choose how good your opponents will be. The less skilled they are, the fewer offensive/defensive maneuvers they will be capable of.

Altitude. Set the starting altitude for your enemy. Since the default is low (to coincide with the default for your own F-15), this is particularly important to adjust if you choose a less maneuverable enemy plane.

Loadout. Since the enemy can be flying nearly any type of plane, "Loadout" does not determine *exactly* what the enemy will be carrying, but rather what *type* of ordnance.

- "None" has them flying with no weapons, only chaff and flares.
- "Guns" has them flying with only a full load of gun ammo.
- "Rear Aspect Heater" indicates heat-seeking missiles that are only efficient when fired at the tail of an enemy.
- "All Aspect Heater" indicates more sensitive heat-seeking missiles that can track their target regardless of direction.
- "Semi-Active Radar" indicates a missile with radar guidance requiring constant tracking from the firing aircraft.
- "Active Radar" indicates a fully active "fire and forget" missile.

Placement. You may limit the advantages of the enemy's location.

- "CAP" means the opposition will be on Combat Air Patrol.
- "Neutral" means that they will begin the same distance from the waypoint as you, and at approximately the same speed.
- "Advantage" means they will begin the mission on your tail.
- "Disadvantage" means the enemy will be ahead of you, and easier to pick up with your avionics.

A/G Target. Choose the type of ground targets that you must destroy. For more detailed information on types of targets, see **Mission Builder: Ground Object Type**, p. 5.25.

Ground Defenses. Determine the "density" of the ground defenses along your waypoint path and around your targets.

Ground Defense Skill. Determine the ground defense's accuracy.

ENVIRONMENT

Region. Select the type of terrain over which the mission will take place.

Time of Day. Determine the time of day when the mission starts.

Weather. Select the region's weather. F-15s can fly under any conditions, but the clearer the weather, the easier the mission.

FLY

Notice that instead of the blue ACCEPT button in the lower-right corner, there is a blue FLY button. When all the elements are arranged to your satisfaction, it is time to begin the mission.

- Click FLY to accept the mission and begin.

MULTIPLAYER

Jane's F-15 supports IPX/SPX network (LAN) play (up to eight players), TCP/IP network (Internet) play (up to eight players), and modem and direct serial play (two players).

- Click on the "wedge" of the type of multiplayer game you wish to play.

Or

- Click MAIN to return to the Main Menu.

Multiplayer (pp. 6.1-6.11) describes how to set up each type of connection and begin a mission.

SINGLE MISSION

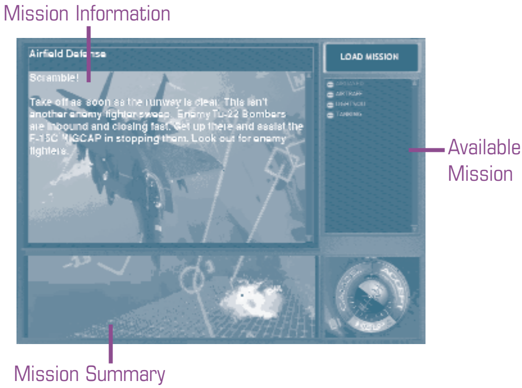
Single Missions include elements of both the Campaign Missions and the Instant Missions.

Like an Instant Mission, these are stand-alone tasks. There is no need to worry about ordnance conservation or how failure will affect future tasks. These are Get In, Get It Done, Get Out of There missions.

Load Missions. The pre-existing missions are realistic and challenging, and can be played in any order.

Mission Builder. You are not, however, restricted to the pre-existing missions. You can also choose to build your own missions with the Mission Builder. This gives you the ability to control every aspect of every object in the game — plotting exactly where it goes, at what time, what its objectives are, and how it reacts to other objects in the game. The Mission Builder is in fact the same editor that the game designers used to create the *Jane's F-15* Campaign and Single missions. It is a powerful tool and can be used to create missions every bit as complex as those found elsewhere in the game.

LOAD MISSION



Available Mission. There is a list of mission names in the scrollable Available Missions in the right side of the screen. The list of missions includes both pre-existing and player-created missions.

Any mission that has been created in the Mission Builder — and saved to the MISSION subdirectory of the game — will appear in the list of Available Missions, even if it is still under construction. Choosing an incomplete mission from the list is the best method of testing it to see how well it works.

- Click on a Mission name to view data on it.
- Double-click on a Mission name to jump immediately to that mission's briefing screen.

Mission Information. In the upper-left of the screen appears text describing the overall mission. Read the summary to determine if this is the type of mission you wish to fly.

Mission Summary. The lower-left window depicts what the mission will be like. If the fighter is alone, you will be flying without a wingman.

The object that is being destroyed indicates what sort of target you can expect: buildings, vehicles, structures, etc.

ACCEPTING THE MISSION

Once the mission has been accepted, the sequence of reviewing the information and adjusting the details is identical to the process described in **Campaigns: Briefing.**

Please refer to p. 1.6 for specifics.

MISSION BUILDER

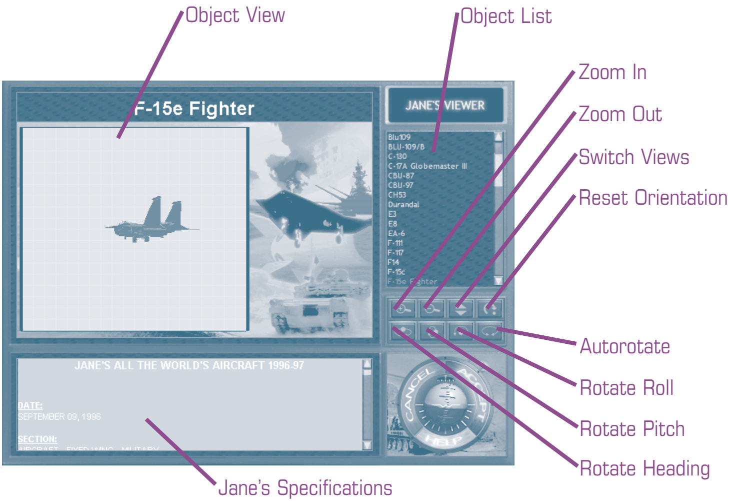
Creating your own mission is a multi-stage process that takes planning and practice, but allows you the freedom to create exactly the missions you'd like most to fly.

The tools are explained in detail in **Mission Builder**, pp. 5.1 — 5.65. Notes are provided to help fully explain their functions, and on pp. 5.1 and 5.6 you'll find recommendations on how to plan and build a realistic mission.

SQUADRON

Prior to non-Campaign missions, the SQUADRON button is available. This allows you to fly under a squadron's name, thus changing the tail insignia markings of your aircraft.

REFERENCE



You can get information on all the planes and weapons you will encounter in the game by choosing REFERENCE from the Main Screen. This takes you to the Reference screen, where you can view 3-D models and read information from Jane's Information Group.

- Click on the item you wish to view from the Object List.

Object List. This is a scrollable list of all the planes and weapons in the game.

Object View. This shows the image of the object as it appears in the game. Click-and-dragging on this image will rotate the object.

Jane's Specifications. This provides the Jane's Information Group's data on the highlighted object.

Zoom In. Zoom in to see a closer view of the object.

Zoom Out. Zoom out to see a more distant view of the object.

Switch Views. (Toggle) Switch the views in the two windows. It is helpful to have the Jane's information in the larger window when you are reading it.

Reset Orientation. Return the object to its original pitch after having rotated the image.

Rotate Heading. Rotates the object counter-clockwise (from a top-down perspective). This is primarily used when Autorotate has been turned off. Right-clicking on this button will rotate it in a clockwise direction.

Rotate Pitch. Rotate the pitch of the object, so that the nose of the plane is pulled down. Right-clicking on this button will rotate it in the opposite direction, so the nose is pulled up.

Rotate Roll. Rotate the object along its axis, so that it rotates clockwise (from a nose-on perspective). Right-clicking on this button will rotate it in the opposite direction.

Autorotate. (Toggle) Turn the object's rotation on or off.

Either ACCEPT or CANCEL will return you to the Main Menu.

COCKPIT

In this chapter, all keys are referred to by their names as they appear on the Custom Mapping screen. Key names are in all caps and bold — **VIEW_PILOT_FWD**, for example. If a keyboard key is given, that is the key in the default map; some of these you may have to add yourself.

The phrase "Multi-Purpose Display" and the abbreviation "MPD" are used collectively to refer to the F-15's four monochrome MPDs and three Multi-Purpose Color Displays (MPCDs), unless otherwise noted.

The buttons surrounding the MPDs and UFC are called pushbuttons, or PBs. They are numbered for reference in this chapter starting in the upper left and moving counterclockwise — "PB 5,"for instance, would be the fifth pushbutton from the left. For illustrations of this numbering convention, see **Multi-Purpose Displays (MPDs)**, p. 2.24 and **Up Front Controls (UFC)**, p. 2.64.

FRONT SEAT VS. BACK SEAT

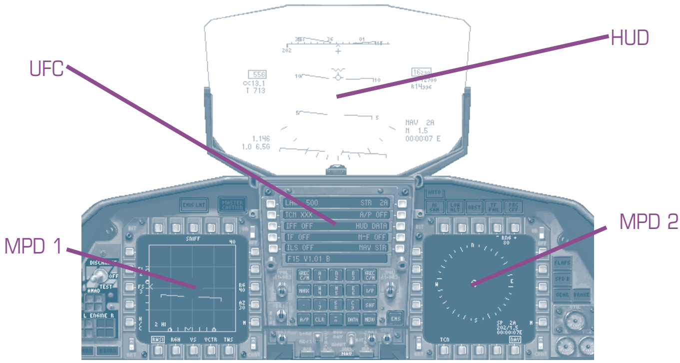
The F-15 has two cockpits — the front seat where the pilot sits, and the rear seat where the WSO (Weapons Systems Officer, pronounced "wizzo") sits. In real combat, the pilot has control of the aircraft and flight and deals with air opposition, while the WSO finds, designates and engages ground targets. Both officers are in constant communication with one another, and each can take over most of the functions of the other, should one of them become incapacitated.

In the game, you will perform most of the functions of both officers. You can "jump" from cockpit to cockpit using **VIEW_PILOT_FWD** F1 (default pilot's cockpit view and **VIEW_WSO_FWD** F3 (WSO's cockpit view). Almost all flight, targeting and weapons information is available in both cockpits; however, each of the Multi-Purpose Displays (MPDs) and Multi-Purpose Color Displays (MPCDs) in both cockpits can have a different page displayed. By setting up different pages in the MPDs and jumping back and forth between cockpits, you can keep a total of seven pages open at once.

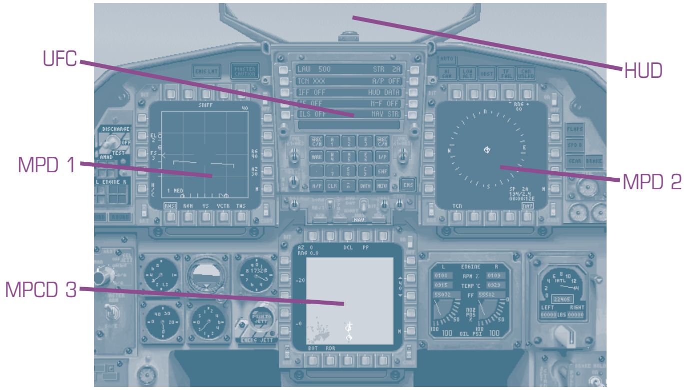
FRONT SEAT (PILOT)

The pilot's cockpit features a Head-Up Display (see **Head-Up Display (HUD)**, p. 2.5), Up Front Controls (see **Up Front Controls (UFC)**, p. 2.64) two monochrome MPDs, an MPCD and several conventional standby instruments in case of main systems failure (see **Standby Instruments**, p. 2.77).

In the *default pilot seat view* (**VIEW_PILOT_FWD** F1) you can only see the two MPDs.



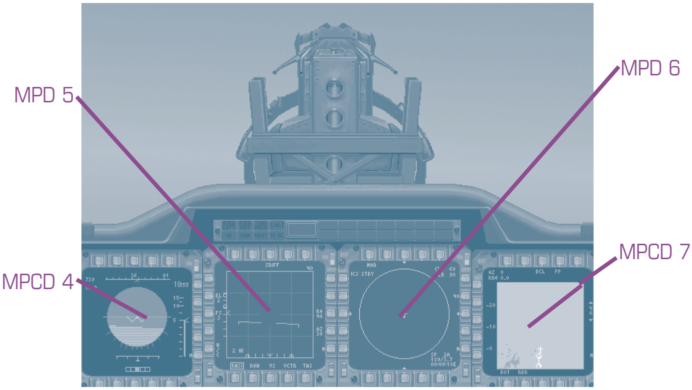
Switch to the *look-down pilot seat view* (VIEW_PILOT_MPD; F2) to see the bottom MPCD and your standby instruments.



MPD and MPCD pages are described under **Multi-Purpose Displays (MPDs)**, p. 2.24.

BACK SEAT (WSO)

Most notably, the WSO's cockpit lacks a HUD. It features two MPDs and two MPCDs, however. MPD and MPCD pages are described under **Multi-Purpose Displays (MPDs)**, p. 2.24.



MASTER MODES

Master modes tailor the F-15's avionics for a specific function. Buttons below the UFC indicate which master mode you are in. You can click on these buttons to switch modes, or use the following hot keys:

MASTER_MODE_CYCLE M	Cycle through master modes — A/A, A/G, NAV and INST.
MASTER_MODE_AA ⇧Shift 4	Switch to A/A (air-to-air combat) master mode. Required for air-to-air missile launches.
MASTER_MODE_AG ⇧Shift 5	Switch to A/G (air-to-ground combat) master mode. Required for air-to-ground weapons release.
MASTER_MODE_NAV ⇧Shift 6	Switch to NAV (navigation) master mode. Used for navigational reference on ingress and egress.
MASTER_MODE_INST ⇧Shift 7	Switch to INST (instrument) master mode. Provides HUD data, can be used if HUD damaged.

MASTER MODE MPD CONFIGURATION

The table below lists the MPD configuration for each master mode and any other limits or features adjusted by that mode.

MPDs are numbered from 1-7: 1 and 2 are the pilot's MPDs, numbered from left to right, and 3 is the pilot's MPCD. MPDs 4 and 7 are the WSO's MPCDs and 5 and 6 his MPDs, numbered from left to right.

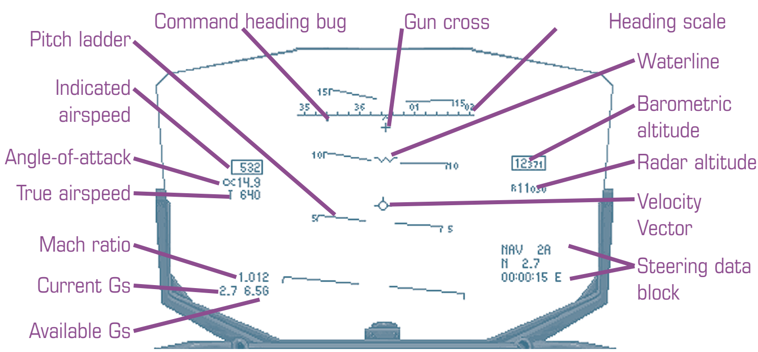
Master Mode	*Pilot pages*	*WSO pages*	*Other*
A/A	1. A/A Radar 2. TEWS 3. A/A Arm	4. A/A Arm 5. A/A Radar 6. TEWS 7. TSD	Removes steering data block from HUD (see p. 2.7).
A/G	1. A/G Radar 2. A/G Arm 3. TSD	4. A/G Arm 5. A/G Radar 6. TEWS 7. TSD	You can't fire A/A missiles.
NAV	1. A/A Radar 2. HSI 3. TSD	4. ADI 5. A/A Radar 6. HSI 7. TSD	Adds bank scale and vertical velocity to HUD (see p. XX). ILS symbology can appear (see p. XX).
INST	1. A/A Radar 2. HSI 3. ADI	4. ADI 5. A/A Radar 6. HSI 7. TSD	Adds bank scale and vertical velocity to HUD (see p. XX). ILS symbology can appear (see p. XX).

You can reset which pages appear in which MPDs for the A/A, A/G and NAV master modes — see **6. Master Mode Programming**, p. 2.37. The INST master mode is not reconfigurable.

HEAD-UP DISPLAY (HUD)

The HUD consists of computerized flight, targeting and weapon information that is projected onto a sheet of specially coated glass at the front of the cockpit. It is designed to keep the pilot from having to constantly look down at his instruments for flight information during a dogfight.

BASIC HUD SYMBOLOGY



Angle-of-Attack. Lists your current angle of attack. It will flash when you are above 28.4 units. For a more detailed explanation of angle-of-attack, see **Flight: Angle-of-Attack**, p. 3.2.

Barometric altitude. Indicates your altitude above sea level — the front cockpit standby altimeter provides the ADC (air data computer) with barometric pressure information, which is then used to compute barometric altitude.

CAUTION: *This is your* ***altitude above sea level*** *(ASL),* ***NOT*** *your* ***altitude above the ground*** *(AGL). AGL depends on the height above the terrain you are flying over, which is not taken into account in barometric altitude computations. For AGL information, see* ***Customizable Basic Symbology: Radar Altitude,*** *p. 2.9.*

Command heading bug. This small bar on the *heading scale* indicates the heading to the currently selected steer point. When this heading cannot be displayed onscreen, the bug moves to the edge of the heading scale closest to the steer point (i.e., the far left or right edge) and the correct heading is numerically displayed below it.

Current Gs. The number of Gs you are currently pulling. See **Flight: G-Forces**, p. 3.5, for an explanation of G-force.

Velocity Vector. (Also called a *Flight Path Indicator.*) Indicates the direction of your current flight path. In some situations — with heavy use of the rudder, for example — the nose of the aircraft (marked by the waterline) may be pointed in one direction, while the aircraft is actually side-slipping in another direction. In this case, the flight path indicator would mark the direction of side-slippage, which is the actual direction in which the aircraft is traveling.

Gun cross. Displayed on the HUD whenever master arm is on (see **Standby Instruments**, p. 2.77), regardless of HUD mode or weapon chosen. Marks the point through which bullets will pass at a range of 2250ft.

Heading scale. The heading scale is essentially a compass. North is 360° (abbreviated to 36), east is 90° (9), south is 180° (18) and west is 270° (27). The caret in the center of the scale remains fixed, marking your current heading.

Indicated airspeed. Displays your current *indicated airspeed* in knots. Indicated airspeed is the speed your aircraft would be traveling given your engine output if you were flying at sea level in still air. Changes in air pressure and wind affect your speed, so your *true airspeed* can be faster or slower than the speed listed here (see ***Customizable Basic Symbology*****: True Airspeed (T)**, p. 2.9). See **Flight: Airspeed**, p. 3.3, for a more detailed comparison of true and indicated airspeed.

Mach ratio. The mach ratio is your aircraft's speed in relation to the speed of sound *at the same altitude* — a mach number of 1 indicates that your aircraft is flying at the speed of sound. A mach number of .850 indicates your aircraft is flying at 85% the speed of sound.

Air density is less at higher altitudes, and thus your indicated airspeed will continue to decrease as you climb. The table below lists the indicated airspeed of aircraft traveling at Mach 1 at different altitudes. It gives an indication of just how much indicated airspeed may vary with altitude.

Altitude	*Indicated airspeed*
Sea level	661 knots
10,000ft	548
20,000	450
30,000	360
40,000	312
50,000	251
60,000	198

Above 30,000ft, pilots rely on the Mach number for speed information.

INTRO
TOC
INTERFACE
COCKPIT
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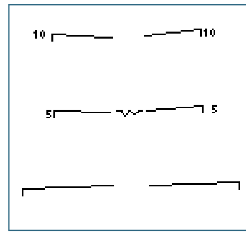
MISSIONS
MULTI
APPENDIX

Available Gs. The maximum number of Gs you can pull without potentially damaging the aircraft. See **Flight: G-Forces**, p. 3.5.

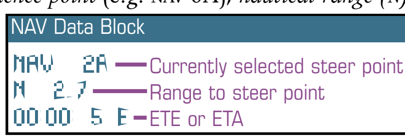
Pitch ladder. The pitch ladder is a series of paired, short lines in the center of the HUD.



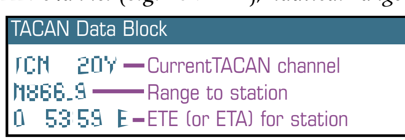
- Numbers next to the lines indicate pitch angles.
- The lines of the pitch ladder are tilted to half of the pitch angle they indicate — the 10° pitch line is angled 5°, the 60° pitch line is angled 30°.
- Positive pitch lines (i.e., those that mark pitch angles above 0°) are solid; negative pitch lines are dashed.
- The pitch ladder always remains perpendicular to the ground.

Steering data block. Displays navigational (NAV) or TACAN station (TCN) data if you are in NAV or INST master mode, depending on which option you choose with PB 6 of the UFC (see **Steering Data (NAV/TCN/TGT STR)**, p. 2.68). If you are in A/G master mode and have a target designated, target information is displayed here. If you are in A/A master mode, this information disappears altogether.

NAV Lists the *currently selected sequence point* (e.g. NAV 0A), *nautical range (N)* to this sequence point (distance to the sequence point in nm) and your *ETA or ETE* * (in hours:minutes:seconds).



TCN Lists the *currently selected TACAN channel* (e.g. TCN XXX), *nautical range (N)* to the corresponding TACAN station (distance to the station in nm), and your *ETA or ETE* * (in hours:minutes:seconds).



* Time displays can be toggled between Estimated Time of Arrival (ETA — time at which you will reach the steer point or station) and Estimated Time Enroute (ETE — amount of time you will be enroute to a steer point or station) via the UFC data menu. See **UFC Data Menu**, p. 2.72.

TARGET Data Block

TGT Lists the *ground range* (G), in nm, *current bomb mode* (CDIP, AUTO or AUTO LOFT) and one of the times below, depending on where you are in the launch sequence:

- *Time-to-target (TTGT)*. Counts down the time until you reach the area designated as your target. When this is displayed, your ground range is the range to this target point.
- *Time-to-pull (TPULL)*. Counts down the time until you need to pull up in an auto loft bombing sequence. (See **Combat: Auto Loft Bombing Mode**, p. 4.63.) Ground range lists the distance to the point on the ground over which this will occur.
- *Time-to-release (TREL)*. Counts down the time until the time the weapon should or will be released. Ground range indicates the distance to the point on the ground over which this will occur.

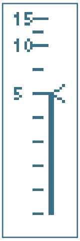
All times are displayed in minutes:seconds.

Waterline. Indicates where the aircraft's nose is pointed.

CUSTOMIZABLE BASIC SYMBOLOGY

You can add and remove this information from your HUD display by using the HUD options submenu of the UFC (see **HUD Options Submenu**, p. 2.69).

True airspeed (T). This is your velocity relative to the ground, taking into account additions and subtractions to your indicated airspeed due to altitude, temperature, head winds, tail winds, side slippage, etc. See **Flight: Airspeed**, p. 3.3, for a comparison of true and indicated airspeed.



Radar altitude scale. Graphically displays your altitude above ground level (AGL). Appears when you drop below 1500ft AGL. Numbers on the scale represent hundreds of feet — 5 = 500ft, 10 = 1000ft, 15=1500ft. The caret indicates the current LAW setting (See **1. Low Altitude Warning (LAW) Submenu**, p. 2.66). The top of the heavy vertical bar on the scale indicates your current altitude above the ground.

The radar altimeter measures the time it takes for a radar pulse to travel from the aircraft to the ground and back, and using this measurement calculates your altitude above the ground. Its antenna are located underneath the aircraft, and it can only function when pitch angle is ± 20° and bank angle is less than ± 60°. At all other times, the radar altitude scale is removed from the HUD.

Thrust XXX. Appears when you do not have a throttle wheel on your joystick or a seperate throttle device. When thrust is displayed, it appears underneath the current/available G's indicators on the HUD. It appears as follows: THRUST 60%. The number indicates the percentage of maximum thrust you are currently using. You can increase and decrease thrust with a throttle device or by using the following key commands:

THROTTLE_UP (+=)	Increase throttle setting
THROTTLE_DOWN (−)	Reduce throttle setting
THROTTLE_IDLE (Shift −)	Set throttle to idle
THROTTLE_MIL (Shift +=)	Set throttle to full military power
THROTTLE_AB (|\\)	Toggle afterburner on/off

ADDITIONAL HUD SYMBOLOGY

Selecting different master modes and weapons adds different symbology to the HUD. This additional symbology is described on the following pages.

A/A MASTER MODE SYMBOLOGY

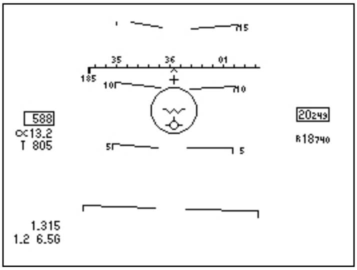
Selecting A/A master mode removes the steering data block from the HUD (See **Basic HUD Symbology: Steering Data (NAV/TCN/TGT STR)**, p. 2.68). Additional symbology is added to the HUD, depending on what radar acquisition mode you choose and which weapon is currently in priority. The following sections give an overview of this symbology. For more detailed, step-by-step instructions on finding, designating and engaging air targets, see **Combat: Getting In**, p. 4.11.

Auto-Acquisition (ACQ) Mode Symbology

In addition to manual acquisition (i.e., you click on a contact on your radar screen to designate it as your target) there are five target acquisition functions that the radar can run for you — Supersearch, Boresight, Long-Range Boresight, Vertical Scan and GUNS. (See also **Combat: A/A Auto-Acquisition Modes**, p. 4.28.) The symbology displayed on the HUD in these modes is explained here.

There is no mouse equivalent to these auto-acquisition mode functions. All but GUNS Acquisition must be assigned to a joystick button or key. GUNS Acquisition is activated automatically when you choose your gun while in A/A master mode and there is no current primary radar target.

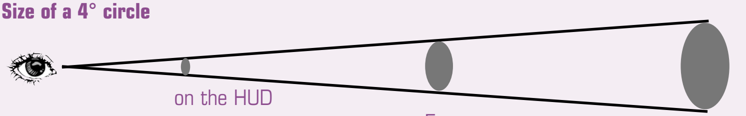
Boresight and Long-Range Boresight Symbology



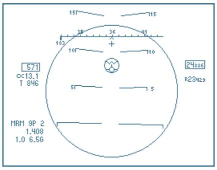
Boresight slaves the radar antenna to the radar boresight line (RBL), which is cued to the position of the waterline on your HUD. When you press either the boresight (**ACQ_BST** 6) or long-range boresight (**ACQ_LRBST** 7) key, a 4° circle (i.e., a circle with a diameter of 4° — see note on next page) is drawn on your HUD. In boresight mode, the radar locks up the first target within 10nm to pass inside the circle. In long-range boresight mode, the radar locks up the first target within 40nm to pass inside the circle.

Acquisition scan areas cover a cone of area — the farther away from your plane, the larger the area covered. Therefore, the size of each scan area is expressed in degrees (4° or 20°), to specify the angular width of the scan area cone.

Size of a 4° circle

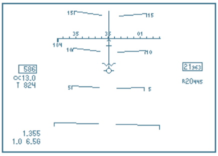


Supersearch Symbology



Supersearch (ACQ SS ; 5) is similar to boresight, except the circle is 20° in diameter. The radar designates the first target within 10nm to pass inside this circle.

Vertical Scan Symbology

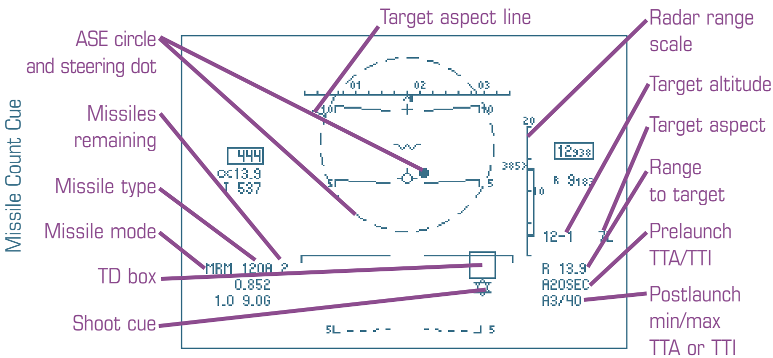


In vertical scan acquisition mode (**ACQ_VTS** 8), the radar searches for its target 5° to 55° above the RBL, but only 7.5° in azimuth (3.75° to the left and right of your aircraft's nose). The radar locks up the first target within 10nm to pass inside this area. This is the best mode to use if you are trying to acquire a target, you are tailing in a turning fight. A vertical line appears on the HUD to help you align your target in the radar's *field-of-view* (FOV).

GUNS Acquisition

GUNS acquisition is activated automatically when you choose your gun while in A/A master mode and there is no current primary radar target. It covers 60° of azimuth (30° to either side of aircraft's nose) and 20° of elevation (10° above nose, 10° down), out to a range of 5nm. No additional symbology appears on the HUD, however.

Missile Launch Mode Symbology



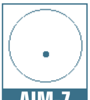
The F-15 can carriy two types of missiles — short-range (AIM-9s) and medium-range (AIM-7s and AIM-120s). Different parameters and symbology are required for the successful launch of each, so the system has two air-to-air missile launch modes — short-range missile (SRM) and medium range missile (MRM). Press **SRM_SELECT** [2] to select SRM launch mode and **MRM_SELECT** [3] to select MRM launch mode.

The following two sections give an overview of missile launch mode symbology; step-by-step instructions for firing air-to-air missiles are listed under **Combat: Engage with Missiles**, p. 4.33.

Medium-Range Missile (MRM) Launch Mode Symbology

The F-15 can carry two types of medium-range air-to-air missiles — AIM-7s and AIM-120s. The HUD symbology is almost identical for the two missiles, exceptions are noted below.


AIM-120


AIM-7

ASE circle and steering dot. The Allowable Steering Error circle and dot provide a steering reference when you are tracking your target with radar. This circle and dot indicate Lead Angle Error (LAE) — the circle represents the maximum steering error that is normally acceptable for missile launch, and you should steer to place the dot inside the circle before launching. The size of the ASE is a function of target range relative to R_{aero}, target altitude and target aspect angle. As you close in on your target, the ASE will increase in size to a certain point, then may decrease depending on target aspect.

The ASE is displayed on the HUD at all times, but is only for reference purposes if you do not have a currently designated radar target.

Break X. Appears in the center of the HUD when you are inside the priority missile's minimum range.

Degrees before break-lock. The number of degrees remaining before the radar lock on the currently designated target is broken. It appears directly over the waterline whenever the target's angle off the boresight reaches 50°. (Degrees before break-lock is also displayed in NAV master mode.) Break lock occurs beyond 60°.

Missile count cue. Appears as soon as you select MRM launch mode.

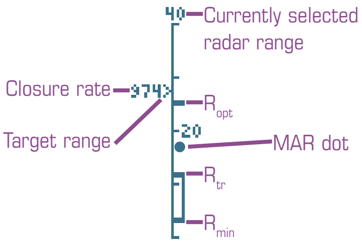
MRM	Indicates medium-range missile mode.
120A or 7F/M	Indicates which type of missile is in priority.
1 - 8	Number of this type of missiles remaining onboard.

Prelaunch TTA or TTI. Lists the *time-to-activate (A)* or *time-to-impact* for the missile currently in priority. TTA is displayed if the missile is an AIM-120 and target range is between R_{opt} and the range at which the AIM-120's seeker head will switch to an active radar search (missile active range or MAR). If the target is within missile active range, TTI will be displayed. TTI is always displayed for an AIM-7.

Postlaunch min/max, TTA or TTI. Describes time-to-activate and time to impact **for the missile in flight**.

AXX/XX	AIM-120 only — lists min/max TTA. (Min TTA would be for the missile hitting first, max for the missile hitting last. If only one missile is in flight, only one number is listed.)
XX/XX	AIM-120 only — lists min/max TTI, as above.
TXX/XX	AIM-7 only — lists min/max TTI, as above.
LSG/LSG	Appears if the predicted TTI exceeds the time it would take the missile to travel its R_{aero} (see *Radar range scale*, next page), indicating a losing missile status.
XXX/XXX	Appears when the missile's actual time-of-flight exceeds the predicted TTI, indicating a lost missile status.

Radar range scale. Appears as soon as you switch to MRM or designate a target, whichever comes last. The currently selected radar range, in nautical miles, is listed at the top of the scale — each tick mark represents 25% of that range. The following markers move up and down the bar.



R_{aero} bar	(Not visible.) Maximum aerodynamic range of the missile (always above the R_{opt} bar). Only useful against totally non-maneuvering targets — i.e., targets that maintain straight and level flight during the missile's entire time of flight.
R_{opt} bar	Optimum range of the missile against a target that flies straight and level until the missile has almost reached it, then performs a 4G terminal escape maneuver (always below the R_{aero} bar).
R_{tr} bar	Maximum range of the missile against a target that turns and runs as soon as the missile is launched (always below the R_{opt} bar). This is the range inside which a target can't escape (at least, not by running away).
R_{min} bar	Minimum range of the missile (always below the R_{opt} bar). The missile will not be able to hit a target inside this range.
Target range	This caret points to your target's current range.
Closure rate	The number beside the caret indicates your target's closure rate in knots. A positive closure rate indicates the speed with which the distance between you is decreasing, a negative closure rate indicates the speed with which the distance between you is increasing.
MAR dot	(AIM-120 only.) Missile activation range — range at which AIM-120 active seeker attempts to acquire the target.

Range to target (R). Lists distance to your target in nm.

Shoot cue. This flashing symbol appears beneath the TD box when your target is within weapon range. The AIM-7 cue is a triangle, the AIM-120 cue is a six-pointed star.

Target altitude. Lists target's altitude (ASL) in ft — for example, 10-0 means 10,000ft and 16-2 means 16,200ft.

Target aspect line. A radial line is displayed outward from the ASE circle to indicate target aspect. A line at 12:00 o'clock indicates tail aspect; 6:00 o'clock indicates nose aspect. The line is displayed in MRM and SRM modes whenever the HUD ASE is displayed.

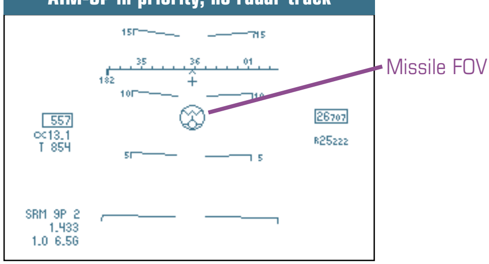
Target aspect angle. Indicates which aspect of the target is facing you, measured in degrees (the final zero has been dropped for brevity). An aspect of T indicates you're facing your target's tail (0°); H indicates you're facing his nose (180°). An aspect of 16R indicates you're facing a point between the aircraft's nose and its right wing. 9L indicates you're facing the pilot's left wing. See **Combat: Aspect Angle**, p. 4.71.

Target locator line. When the TD box is limited by the HUD FOV, a dashed target locator line is displayed. The target locator line extends from the water line symbol and points to the limited TD box.

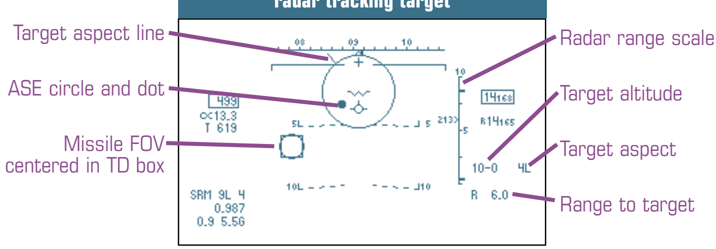
TD box. Appears around the current target, as soon as it is designated. When your target moves off of the HUD, the box is half-displayed at the edge of the HUD and marks the point you should turn toward to bring the target back in view. If you have IFF set to AUTO (or NORM and you send out a query), an X appears within the box if your target is friendly. (See **Identification Friend or Foe** (IFF), p. 2.67.)

Short-Range Missile (SRM) Launch Mode Symbology

AIM-9P in priority; no radar track



AIM-9P is missile in priority; radar tracking target



SRM symbology appears on the HUD when you press **SRM_SELECT** 2. Different symbols may appear, depending on whether an AIM-9L/M or an AIM-9P is in priority (i.e., next in line to be fired), whether you are tracking your target with radar, whether the missile seeker head is caged or uncaged (i.e., locked to the boresight or free to move around — see **Air-to-Air Armament Page (A/A ARM)**, p. 2.26) and whether the seeker head is currently locked on to its target.

The following features only appear in SRM launch mode when you are tracking your target with radar, but function in the same way as they do in MRM launch mode. See pp. 2.12-2.15.

Break X
Degrees before break-lock
Range to target
Shoot cue (triangle)
TD box
Target altitude
Target aspect angle
Target locator line

The following symbology is unique to SRM launch mode or behaves differently in SRM launch mode.

ASE circle and steering dot. Only appears when an AIM-9L/M is in priority *and* you are tracking a target with radar. Otherwise, it functions in the same way as the MRM launch mode ASE circle. See p. 2.12 for details.

Missile FOV. Appears whenever an AIM-9P is in priority or when an AIM 9L/M is in priority and you have no designated radar targets. When the missile seeker head is uncaged (i.e., free to move around and look for targets — see **Air-to-Air Armament (A/A ARM) Page**, p. 2.26) the missile FOV circle disappears and the missile FOV becomes roughly the size of the HUD FOV.

When the missile seeker head is caged, its FOV circle (field of view circle) also called the "missile boresight" — remains locked on the aircraft's waterline. This circle indicates where the missile seeker head is aimed and what it can "see" while it is caged.

An AIM-9 may end up tracking the sun if it falls within the missile's FOV!

Seeker head position. Appears whenever a AIM-9L/M is in priority, and indicates the direction the weapon's seeker head is currently "looking." It is smaller than the FOV circle. It remains on the HUD even when the AIM-9 seeker head is uncaged.

Missile count cue. Appears as soon as you select SRM mode.

SRM	Indicates you're in short-range missile mode.
9L, 9M or 9P	Indicates which type of AIM-9 the missile in priority is.
1-4	Number of SRM missiles remaining onboard.

Radar range scale. Appears if you are tracking your target with radar. It's the same as in MRM mode, but the following markers move up and down the bar: R_{max} bar, R_{min} bar, target range and closure rate.

R_{max} indicates the missile'smaximum range. All others function as they do in MRM mode. See p. 2.13. **Uncage cue (UNC).** When scan is selected on the A/A Arm page (see **A/A Arm Pushbuttons,** p. 2.27), the missile seeker head is uncaged and will attempt to lock on to your currently designated target. This target must be within the missile seeker head field of view (40° from the nose of the missile).

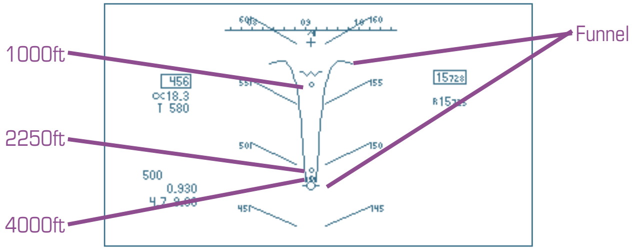
A/A Gun Sight Symbology

A/A FNL Sight Symbology

If you are in A/A master mode but do not have a designated target, Lead-Computing Optical Sight (LCOS) funnel symbology appears on the HUD when you press **GUN_SELECT** 1. The radar will also automatically switch to Gun auto-acquisition mode and attempt to acquire a target. (See **Auto-Acquisition (ACQ) Mode Symbology: Gun Acquisition**, p. 2.11.)

The funnel sight is the only sight available until the radar locks on to a target, at which point GDS and GDS funnel sights become available. (Pressing **GUN_SELECT** 1 will cycle through all three sights at this point.)

The funnel represents a 40ft wingspan target at ranges between 250ft (the wide end of the funnel) and 5000ft (the narrow end of the funnel). There are dots along the funnel marking 1000, 2250 and 4000ft ranges.



A/A GDS and A/A GDS FNL Sight Symbology

Once you have a target designated, three gun sights are available — FNL, GDS and GDS FNL. Press **GUN_SELECT** 1 to cycle through the three sights.

If you lose radar lock on the designated target, the gunsight will automatically revert to FNL, and the radar will switch to GUNS auto-acquisition mode and attempt to re-acquire the target.

The following symbology appears when GDS or GDS FNL sights are selected. GDS FNL is a combination of GDS symbology and the FNL sight.

GDS pipper. Indicates where bullets will fall at the targets current range. Align this pipper with the target.

Radar range scale, target altitude and **target aspect angle** function as in MRM mode. See p. 2.12.

Turn plane line. Represents the computed projection of the target's plane of motion. It is drawn from the gun cross through the reticle, to the edge of the HUD. You can use this line as a steering aid in a high-aspect attack.

A/G MASTER MODE SYMBOLOGY

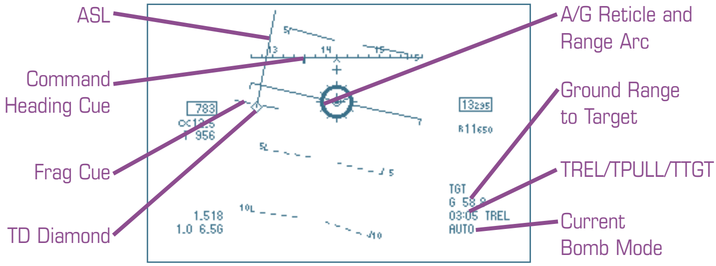
The following sections give an overview of the symbology displayed on the HUD for Air-to-Ground combat. For more detailed, step-by-step instructions on finding, designating and engaging ground targets, see **Combat: Taking Care of Business**, p. 4.51.

Selecting A/G master mode adds the **bomb mode cue** to the lower right corner of the HUD, which tells you which of the three bomb modes — CDIP, AUTO or AUTO LOFT — you are currently using. These bomb modes control what symbology is displayed on the HUD and how weapons are released. PB 5 of the A/G Arm page cycles through them (see **A/G Armament Page (A/G ARM)**, p. 2.28).

AUTO and AUTO LOFT Bomb Modes

AUTO bombing mode is a blind bombing mode. The HUD provides you with azimuth steering information, a target designator and countdown to release. AUTO LOFT mode employs the same symbology, but assumes a loft trajectory for the weapon.

A/G reticle and range arc. Appears when you switch to A/G master mode. In AUTO and AUTO LOFT bomb modes, it is centered on the flight path indicator. The tick marks and heavy arc on the perimeter of the A/G reticle display slant range to target — the range on a straight LOS from your aircraft down to your target — values between 0 and 23,000ft. The arc moves counterclockwise as range *decreases*. Each outer tick mark represents 1000ft, with the first revolution indicating 23,000 to 12,000ft and the second revolution 12,000 to 0ft. Target range is indicated by a tick mark on the inside of the bar. (The range arc is radar dependent — if EMIS LMT is activated, range information will not be available. See **Up Front Controls**, p. 2.64.)



ASL. The azimuth steering line (ASL) stretches from the TD diamond perpendicular to the horizon, providing a steering reference relative to the horizon. In the final phase of any run you should steer so that the ASL remains centered over the A/G reticle.

Command heading cue. This cue marks the aircraft aimpoint on the HUD heading scale. Steering toward the heading indicated by this cue keeps you on course toward your target.

ESL (AUTO LOFT only)**.** By keeping the elevation steering line (ESL) centered on the A/G reticle, you will provide the selected weapon with its maximum loft trajectory and therefore maximum standoff distance.

Frag cue. The frag cue represents the edge of the predicted frag envelope for the currently selected weapon (see p. 2.21).

Release cue. The release cue is a small line perpendicular to the ASL that appears when TREL (*time-to-release*, see below) reaches 10 seconds or less. It provides you with range and release anticipation cues. It first appears about 5° above the velocity vector and moves down to intersect the flight path indicator as TREL goes to zero. The release cue will disappear if your steering error is greater than 20° (in other words, if the ASL moves more than 20° to the left or right of the A/G reticle).

Press the pickle button down (**WEAPON_PICKLE** button 2 on your joystick) before TREL reaches zero and hold it down while the release cue crosses the flight path indicator — the weapon will be released at this point. If multiple weapons have been selected for release (see **A/G Arm Pushbuttons**, p. 2.29), *continue to hold down the pickle button* — the release cue is repositioned after each weapon release and the process is repeated until the last weapon is dropped. Once the last weapon is released, the release cue disappears and the A/G reticle begins to flash. Releasing the pickle button stops the reticle from flashing.

TD diamond. Regardless of the sensor used to acquire the target position, the CC computes the HUD position of the TD (target designator) diamond so that it represents LOS (line of sight) to the target.

TPULL (AUTO LOFT only)**.** The time-to-pull countdown (in minutes:seconds) indicates the time remaining before you must pull up to align the flight path indicator with the ESL in order to give the weapon its maximum loft trajectory. The ESL appears 5 seconds before the expiration of TPULL. The TPULL cue will disappear when steering error is greater than 20°.

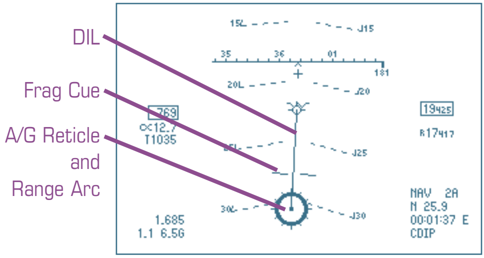
TREL. The time-to-release countdown (in minutes:seconds) begins when the target is within weapon range and the steering error is less than 20°.

TTGT. The time-to-target countdown (in minutes:seconds) is displayed in all A/G modes, whenever you have a target designated and steering error is greater than 20°.

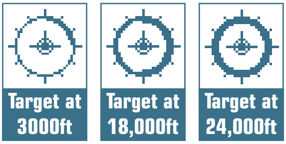
CDIP Bomb Mode

Continuously Displayed Impact Point (CDIP) bomb mode is a computed, manually initiated release mode. The computer constantly recalculates the point at which the weapon will impact and displays this on the HUD. (Variations in terrain altitude are figured into the computation of impact point — if you are flying over hilly or rough terrain, the CDIP will change constantly in reflection.) You control the timing of weapon release, and you do not have to have a target designated before you pickle.

When you press and hold the pickle button (**WEAPON_PICKLE**; joystick button 2), the position of the A/G reticle becomes your designated target, and the computer switches to AUTO bomb mode. The CC then begins to calculate TREL and ASL as described under **AUTO and AUTO LOFT Bomb Mode Symbology**, p. 2.18. You continue to control weapon release steering in case multiple bombs will be dropped. If you let up the pickle button, you re-enter CDIP mode.



Target designation is optional. If the target is designated, its position is computed as explained under the **AUTO and AUTO LOFT Bomb Mode Symbology**, p. 2.18. The range vector to the target is computed as the difference between the target position and the aircraft position. Your aircraft's altitude over the target's altitude is used to compute the bomb range and position the CDIP display.



A/G reticle and range arc. In CDIP bomb mode, the A/G reticle represents the weapon impact point. Press the pickle button when the center of the reticle is over the area you wish the weapon to hit. (If you have a target designated, you will want to align the A/G reticle with the TD diamond.) When you press the pickle button, the point marked by the reticle becomes the designated target and the reticle recenters on the flight path indicator.

The tick marks and heavy arc on the perimeter of the A/G reticle display slant range to target, as described under **AUTO and AUTO LOFT Bomb Mode Symbology** — see p. 2.18 for details and diagrams.

DIL. The Displayed Impact Line descends from the flight path indicator (see **Basic HUD Symbology**, p. 2.5) to the A/G reticle. The computer calculates a Displayed Impact Line (DIL) which appears on the HUD. You maneuver so that the line of your target's motion is along the DIL and then give the release signal as soon as the target crosses the pipper on the HUD. The Displayed Impact Line provides an azimuth steering reference to help you position the reticle over the target.

Frag cue. The frag cue represents the edge of the predicted frag envelope for the currently selected weapon. To avoid the frag envelope, make sure this frag cue is *below* the flight path indicator at the time of detonation. For most low-level deliveries, you will have to fly low enough that the frag cue is above the flight path indicator when you release your weapon — your exit maneuver must bring the frag cue back below your the flight path indicator before detonation, or you risk taking damage from your own weapon.

TD diamond. When you press the pickle button, the point marked by the reticle becomes your designated target. As you hold down the pickle, the A/G reticle snaps back to the flight path indicator and the computer enters AUTO bombing mode. The release cue and TREL appear, and the weapon release continues as described under **AUTO and AUTO LOFT Bomb Mode Symbology**, p. 2.18.

A/G Gun Sight Symbology

The CDIP sight is used to aim the gun while in A/G master mode. When you press **GUN_SELECT** [1] to select your gun while in A/G master mode, the CDIP symbology appears on your HUD. The **A/G reticle and range arc** and **TD diamond** function exactly as they do in CDIP bomb mode. The **DIL** and **frag cue** are not displayed.

AGM-65 Symbology

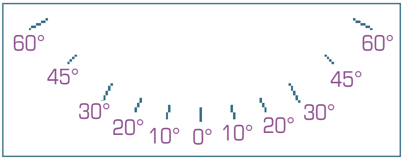
When you are in A/G master mode, have an AGM-65 as your currently selected weapon, and master arm is on, several symbols that are specific to the AGM-65 Maverick appear.

A/G reticle. Fixed near center of HUD to provide a reference to aim manually boresighted missile.

Station 2 LOS. Mavericks can be loaded on weapons stations 2 and 8 — a left and a right underwing station. The line-of-sight (LOS) for the seeker head of the missile currently in priority on station 2 (the left station) is marked by a hollow circle and indicates where the seeker head is looking. When AGM-65 cueing is set to AUTO (see **Weapon Video Page (AGM-65, GBU-15)**, p. 2.59), this circle will snap to the TD diamond for the currently designated A/G target.

Station 8 LOS. The line-of-sight (LOS) for the seeker head of the missile currently in priority on station 8 (the right station) is marked by a hollow square. It functions in the same way as the Station 2 LOS.

NAV AND INST MASTER MODE SYMBOLOGY



Bank angle scale. Indicates your current bank angle in degrees from horizontal. When the pointer points to the 0° tick mark, your wings are horizontal and you are flying straight and level. When it points 30° to the right of 0°, you are in a 30° banking turn to the left. (Your wings are tilted 30°, with the left wing down and the right up — this sends you to the left.)

ILS Symbology

The ILS (Instrument Landing System) projects additional information on your HUD to facilitate landing. ILS symbology appears on your HUD and your ADI when the ILS is activated and you are in NAV or INST master mode. To activate the system, go to the UFC main menu and press PB 5 until the text next to the button reads ILS ON. (See **UFC Main Menu**, p. 2.65.)

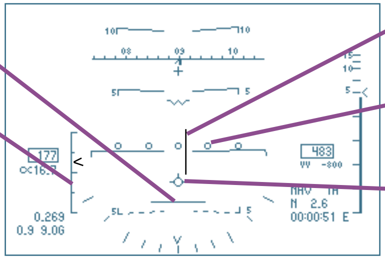
Glideslope Steering Bar. This horizontal line indicates your altitude relative to a 3° glideslope (the optimal angle for descent). If you are above this glideslope, the velocity vector will be above this line. If you are below this glideslope, the velocity vector will be below the line.

Glideslope Deviation Scale/Indicator. This scale on the left side of the HUD measures your deviation from the recommended 3° glideslope. A small, v-shaped caret shows your current deviation. The center of the scale marks the recommended glideslope. The top tick marks 1° above the glideslope, while the bottom tick marks 1° below.

Localizer Steering Bar. This vertical line indicates your horizontal lineup with the runway. If you are to the left of the runway, the velocity vector will be to the left of this line. If you are to the right of the runway, the velocity vector will be to the right of the line. This bar shows your position relative to the center line of the runway and doesn't depend on your heading.

Localizer Deviation Scale/Indicator. This row of dots in the center of the HUD measures your deviation from a dead-on (straight-ahead) approach to the runway. A vertical arrow marks your current deviation. The center circle marks a dead-on approach. The leftmost circle marks a 2.5° deviation to the left of the runway, and the rightmost circle marks a 2.5° deviation to the right.

For more information on using ILS information to land, see **Flight: Landing**, p. 3.18.



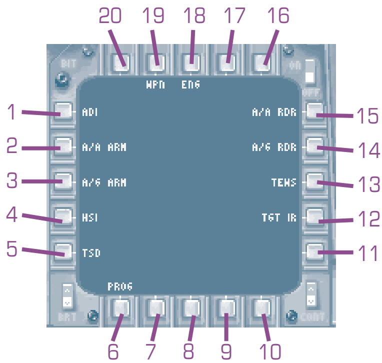
MULTI-PURPOSE DISPLAYS (MPDS)

A Multi-Purpose Display is a video display unit which provides information from aircraft and weapons systems on a series of interchangeable screens or "pages." From the MPD main menu, the pilot presses the buttons surrounding the unit (called "pushbuttons" or "PBs") to display different pages. For reference in this chapter, these PBs are numbered 1-20, starting in the upper left and moving counter-clockwise.

The Multi-Purpose Color Display (MPCD) units in the F-15 function in the same way as MPDs, but the display is in color. Air-to-Ground and Air-to-Air Radar information cannot be displayed on a color display, so these options are not available from the main menu of the MPCD.

MPD MAIN MENU

The MPD main menu is the top-level menu from which all other pages can be selected — from any of these pages, click PB 11 (marked by an M) to return to the MPD main menu. You can select MPD pages while the game is paused.



PB 1 (ADI) Attitude Director Indicator page (p. 2.25)

PB 2 (A/A ARM) Air-to-Air Armament page (p. 2.26)

PB 3 (A/G ARM) Air-to-Ground Armament page (p. 2.28)

PB 4 (HSI) Horizontal Situation Indicator page (p. 2.32)

PB 5 (TSD) Tactical Situation Display page (p. 2.34)

PB 6 (PROG) Master Mode Programming (p. 2.37)*

PB 12 (TGT IR) Targeting IR page (p. 2.38)

PB 13 (TEWS) Tactical Electronic Warfare System page (p. 2.42)

PB 14 (A/G RDR) Air-to-Ground Radar page — n/a on MPCDs (p. 2.45)

PB 15 (A/A RDR) Air-to-Air Radar page — n/a on MPCDs (p. 2.49)

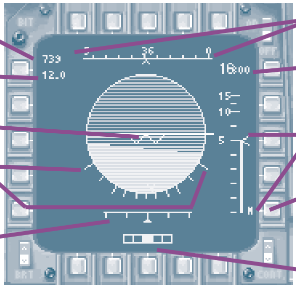
PB 18 (ENG) Engine Data page (p. 2.58)

PB 19 (WPN) Weapon Video page (p. 2.59)

**PB 6 does not call up a page — instead, it brings up a submenu.*

1. ATTITUDE DIRECTOR INDICATOR PAGE (ADI)

The Attitude Director Indicator (ADI) page displays information about your airspeed, angle-of-attack, altitude, turn rate, heading, etc. The symbology is the same as or similar to the symbology that appears on the HUD.



These features are described under **Basic HUD Symbology**, pp. 2.5:

Angle-of-Attack
Barometric altitude
Heading scale
Indicated airspeed
Waterline

The **radar altitude scale** is displayed on the ADI when it is displayed on the HUD. This feature is described under **Customizable Basic Symbology**, p. 2.9.

Although the **bank angle scale** only appears on the HUD when in NAV and INST master modes, it always appears on the ADI page. It is described under **NAV and INST Master Mode Symbology**, p. 2.23.

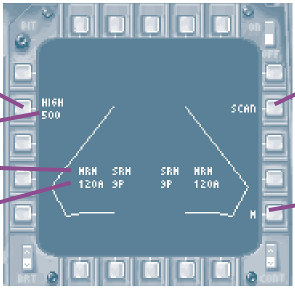
Slip indicator. Visually indicates how much your aircraft is drifting left or right, with reference to the aircraft's nose. If you are flying straight, your aircraft's nose is heading in the same direction as your flight path, and the ball on the slip indicator will be in the middle of the box. If the heading of your aircraft's nose is not the same as the heading for your flight path, then you are slipping, and the ball will indicate the position of your nose relative to your flight path (your flight path is the center of the slip indicator box).

Turn rate scale. Indicates your turn rate in degrees per second. The center tick mark indicates a turn rate of 0°/sec, and the tick marks to the right and left indicate turn rates of 10°/sec and 20°/sec to the right and left.

2. AIR-TO-AIR ARMAMENT PAGE (A/A ARM)

The Air-to-Air Armament page displays the placement, number and types of air-to-air ordnance loaded on your aircraft. The display presents a rough top-down view of your aircraft, with the nose of your aircraft oriented toward the top of the display. The large triangular "brackets" represent the wings of your aircraft.

The rough locations of the eight air-to-air ordnance stations on the underside of your aircraft are indicated, along with the type and status of weapon loaded at each station. (Only one weapon can be loaded at each station.)



A/A ARM SYMBOLOGY

Rounds remaining. This figure lists the number of gun rounds remaining.

Missile type. Lists the type of missile loaded at a station:

7F	AIM-7F	*9M*	AIM-9M	*9P*	AIM-9P
7M	AIM-7M	*9L*	AIM-9L	*120A*	AIM-120A

Missile status. Lists the status of each missile, according to the table below:

Status	*Criteria*
SRM/MRM	• Missile aboard — SRM indicates it is a short-range missile (AIM-9), and MRM indicates it is a medium-range missile (AIM-7 or AIM-120).
STBY	• You are in the correct missile launch mode (MRM or SRM) for the missile on this station
RDY	• A/G master mode is not selected • Master Arm switch is set to ARM • The missile is in priority
HUNG	• Missile aboard after launch command (i.e., missile has malfunctioned)
<BLANK>	• No missile aboard this station

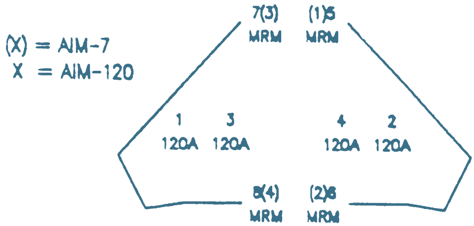
A/A ARM PUSHBUTTONS

PB 2 Toggle **gun rate** between HIGH (6000 rounds per minute) and LOW (4000 rounds per minute).

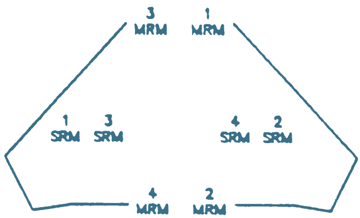
PB 14 (SCAN) Locks/unlocks the seeker head of the AIM-9 from the boresight. When uncaged, the seeker head attempts to lock onto the currently designated target. SCAN is boxed when the seeker head is uncaged.

MISSILE LAUNCH SEQUENCES

There are two possible launch sequences, depending on whether your load-out consists of all MRMs or a combination of MRMs and SRMs.



MRM MISSILE LAUNCH SEQUENCE



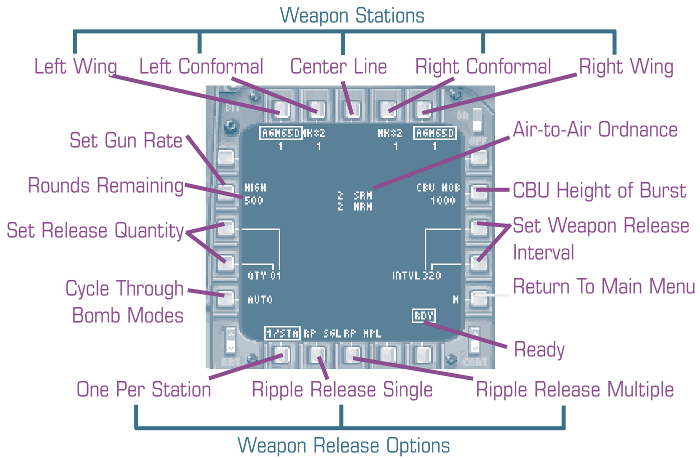
MRM/SRM LAUNCH SEQUENCE

In a mixed AIM-120A/AIM-7 loadout, all AIM-120s will be in sequence before AIM-7s. At any point in the sequence, you can press **MISSILE_REJECT** 4 to skip the missile in priority and pass over to the next missile in sequence. You must cycle through the rest of the missiles if you want to return to any skipped missiles, in their sequence.

3. AIR-TO-GROUND ARMAMENT PAGE (A/G ARM)

The Air-to-Ground Armament page gives you an overview of number and types of air-to-ground ordnance you're currently carrying, along with the currently selected weapon and gun rounds remaining. From this page you can set gun rate, the interval distance between bombs, and the number of bombs to be dropped.

A/G ARM SYMBOLOGY



RDY (READY). If RDY is boxed, weapons can be released. If RDY is not boxed, make sure master arm is on, A/G master mode is selected and the currently selected station(s) contains weapons.

Rounds remaining. This figure lists the number of gun rounds remaining.

Air-to-Air Ordnance. Lists the number and types of air-to-air weapons remaining on the plane. Switch to the A/A Arm page to get more detailed information about your air-to-air ordnance.

A/G ARM PUSHBUTTONS

PB 2 — Toggle **gun rate** between HIGH (6000 rounds per minute) and LOW (4000 rounds per minute).

PBs 3 and *4* — Control the total **quantity** of weapons released from all selected stations when either RP SGL or RP MPL weapon release option is active. This is the *total* number of weapons released — if the setting is 4 and two stations carrying four bombs apiece are selected, *four bombs are dropped, two from each station*. (See **Weapon Release Options**, p. 2.31.)

PB 3 controls the ones digit and PB 4 controls the tens digit. Quantities can range between 1 and 29, but the actual quantity dropped is limited by the number of weapons loaded on the selected stations.

PB 5 — **Cycle through bomb modes** — the current mode appears next to the button. Bomb modes control what symbology is displayed on the HUD to guide the pilot through weapon release, and how much of the release procedure is controlled by the computer.

CDIP — A calculated, manually initiated release. The point where the weapon will impact on the ground is continually re-calculated and projected onto the HUD, but you control release.

AUTO — The HUD provides you with azimuth steering information, a target designator and target information. The azimuth steering information helps you align with the target, while the computer calculates when to release the weapon and gives you a countdown. If you are pressing the release button (on your joystick) when the countdown reaches zero, the weapon(s) are automatically released.

AUTO LOFT — This mode is the same as AUTO mode, except it assumes you want a loft trajectory for the weapon released.

For more information on each of these bomb modes, see **Combat: Deciding What to Take**, p. 4.7.

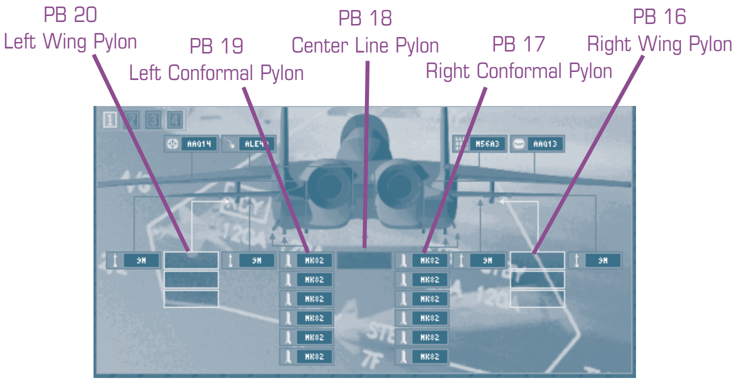
PBs 12 and 13 Control the **interval** between weapon release for RP SGL and RP MPL drops from the selected station(s). (See **Weapon Release Options**, next page.)

Intervals are given in feet of weapon range (i.e., how many feet from the first weapon the second weapon will impact the ground). PB 12 controls the tens digit and PB 13 controls the hundreds digit; interval settings can range from 0 to 990ft.

PBs 16-20 Select/deselect an **A/G weapon station**. Each button represents an A/G weapon station — beneath each is a list of the type and number of weapons loaded on that station. Click the PBs to select and deselect the stations — a box appears around the weapon type when a station is selected.

Multiple stations can be selected, but only if they are carrying the same type of ordnance.

The stations are set up as follows:



Weapon Release Options

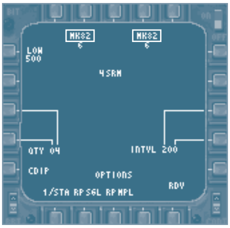
The following buttons control how weapons will be released from the currently selected weapons stations when the release signal is given. Only one can be selected at any given time — a box surrounds the currently selected option:

PB 6 (1/STA) When this option is selected, one bomb from each selected station will be released with each press of the pickle button. *Quantity* and *interval* settings (see above) are ignored — the number of weapons dropped with each release is controlled by the number of stations selected.

PB 7 (RP SGL) When the ripple single option is selected, bombs are released one at a time from each of the selected stations. The total number of bombs dropped is determined by the *quantity* setting and the distance between releases is determined by the *interval* setting.

PB 8 (RP MPL) When the ripple multiple option is selected, one weapon is released from all selected stations with each drop. The total number of bombs dropped is determined by the *quantity* setting, the number of bombs dropped with each release is controlled by the number of stations selected, and the distance between releases is controlled by the *interval* setting.

Example



The conformals (PBs 17 and 19) are loaded with six MK-82 bombs apiece. Both are selected. The release quantity is set to 4, and the release interval is set to 200. The following happens at release, depending on which weapon release option you have selected:

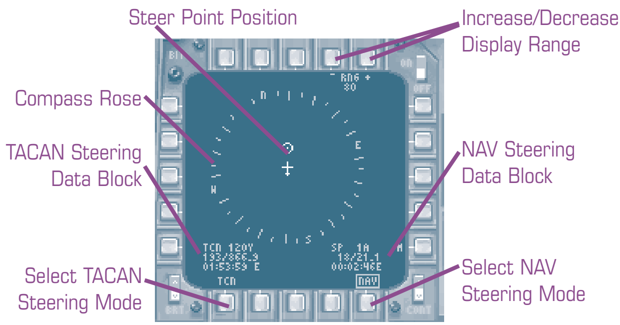
1/STA. Two MK-82s are released — one from the left conformal and one from the right — with each weapon release command. You can continue dropping weapons until there are no weapons left on the conformals.

RP SGL. One MK-82 is released initially. 200ft away, another MK-82 is released from the opposite conformal. 200ft away from this drop, another MK-82 is released. 200ft from the third drop, the fourth MK-82 is released. (Note only one weapon release command was issued.)

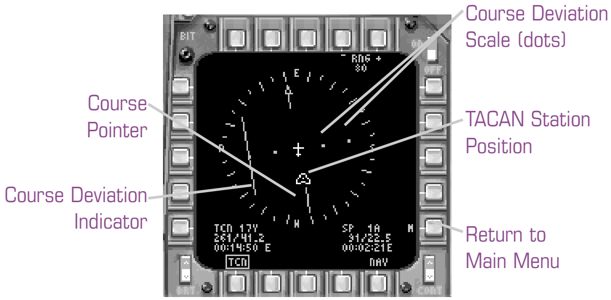
RP MPL. Two MK-82s are released — one from the left conformal and one from the right. Two hundred feet away, two more MK-82s are released, one from each conformal. (Again, note that only one weapon release command was issued.)

4. HORIZONTAL SITUATION INDICATOR PAGE (HSI)

The Horizontal Situation Indicator (HSI) provides azimuth information to help you orient towards steer points and TACAN stations. The autopilot also uses HSI information to maintain course when coupled steering is active on the A/P submenu of the UFC. (See **HSI Pushbuttons**, p. 2.33, and **Autopilot (A/P) Submenu**, p. 2.70.)



NAV Steering Mode



TACAN Steering Mode

HSI SYMBOLOGY

The HSI is a top-down view of the area around your aircraft (marked by the small aircraft symbol in the center of the display). Your nose is always oriented to the top of the display.

Compass rose. Indicates magnetic compass headings — north (N), east (E), south (S) and west (W) are indicated and the tick marks indicate 10° increments. The heading at the top of the display (i.e. the heading the aircraft symbol is "flying" toward) is your current heading. (As you turn and your heading changes, the compass turns around the aircraft symbol, which remains fixed.)

NAV AND TACAN steering data blocks. List *heading* (in degrees), *range* (in nm) and **ETA or ETE* (h:mn:sc) for the currently selected *steer point* (SP) or *TACAN station* (TCN), depending on whether TCN (PB 6) or NAV (PB 10) is currently selected. See **HSI Pushbuttons,** next page.

*ETA or ETE is displayed depending on which is selected on the UFC data menu. See **UFC Data Menu**, p. 2.72.

Steer point position. Marks the position of the currently selected steer point relative to the position of your aircraft, if that steer point is within range. PBs 16 and 17 increase and decrease display range.

TACAN station position. Indicates the position of the currently selected TACAN station, relative to your aircraft. This symbol will only appear when the currently selected TACAN station is within your current display range. PBs 16 and 17 increase and decrease display range.

HSI PUSHBUTTONS

PB 16 and 17 Cycle in each direction through **display ranges** — 10, 20, 40, 80 and 160nm. The currently selected range appears between the buttons.

PB 6 and 10 Choose **HSI steering** mode. Only one steering mode can be active at a time; a box surrounds the label of the currently active mode.

TCN (PB 6) Activate TACAN steering mode.
(In this mode, the steering data block provides information on the currently selected TACAN station, and autopilot steers toward this station when *coupled steering* is enabled.)

NAV (PB 10) Activate NAV steering mode.
(In this mode the steering data block provides information on the currently selected steer point, and autopilot steers toward this point when *coupled steering* is enabled.)
Steering modes can also be set with PB 6 of the UFC main menu. See **6. Steering Data (NAV/TCN/TGT STR)**, p. 2.68.

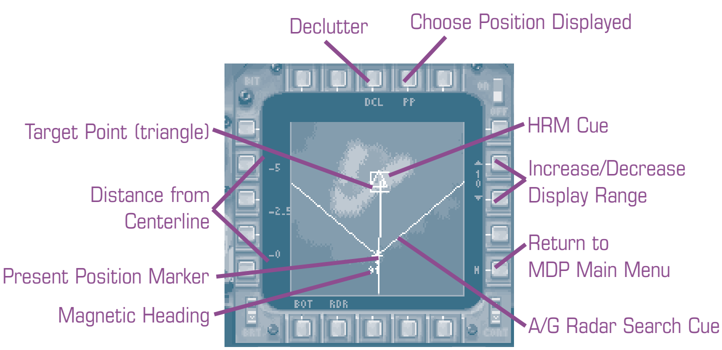
If you are unfamiliar with TACAN stations and how to select them, see **2. Tactical Aid to Navigation (TACAN) Submenu**, p. 2.66. If you are unfamiliar with steer points and how to select them, see **10. Steer Point (STR ...)**, p. 2.71. For more information on coupled steering, see **9. Autopilot (A/P) Submenu**, p. 2.70.

5. TACTICAL SITUATION DISPLAY PAGE (TSD)

The Tactical Situation Display (TSD) page displays a digitized satellite map of the area of operation. Superimposed on this map are steer point and flight path symbology. You can focus on your current position, or "look ahead" to upcoming steer points.

Unlike other displays, it is truly useful to display this in a color MPD (the bottom MPD in the pilot's cockpit, the right and left MPDs in the WSO's cockpit). When the terrain is displayed in color, it provides a valuable reference aid when compared to air-to-ground radar returns.

TSD SYMBOLOGY



A/G radar search cue. Indicates the area currently being scanned by the A/G radar. The cue appears when you select RDR with PB 7, and the A/G radar is in any mode other than High Resolution Map (HRM) mode. The cue is affixed to an LOS line extending out from the present position marker.

See **A/G Radar Modes**, p. 2.45, for details on the different A/G radar modes. See **TSD Pushbuttons**, p. 2.36 for details on switching between cues.

Azimuth (AZ). Gives azimuth position for the targeting IR or HRM cues. The number indicates degrees from the nose of your aircraft, L and R indicate whether the cue is to the left or right of the aircraft.

Distance from centerline. Indicates the distance (in nm) from the center of the display based on the selected TSD range setting.

Magnetic heading. Your aircraft's current heading.

HRM cue. The HRM (High Resolution Map) cue marks the position of the current HRM or "patch map." The cue appears when you select RDR with PB 7, and the A/G radar is in HRM mode. It is affixed to an LOS line extending out from the present position marker.

See **A/G Radar Modes**, p. 2.45, for details on the different A/G radar modes. See **TSD Pushbuttons**, p. 2.36, for details on switching between cues.

Present position marker. This symbol marks the current position of your aircraft — the larger of the two intersecting lines represents your wingline. You can adjust this symbol to appear either at the bottom or center of the display with PB 6 (see **TSD Pushbuttons**, p. 2.36).

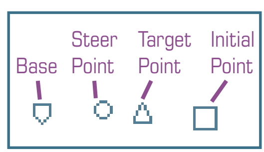
Range (R). Gives the distance of the targeting IR or HRM cue from your aircraft, in nm.

Range markers. Indicate the range scale (in nm) based on the selected TSD range setting. (**See TSD Pushbuttons**, p. 2.36.)

Targeting IR cue. Indicates the area currently being viewed by the targeting IR camera. The cue appears when you select FLIR with PB 7. It is affixed to an LOS line extending out from the present position marker. (See **TSD Pushbuttons**, p. 2.36.)

Sequence Points

Sequence point is a term used to describe F-15E navigation symbols. They are connected by a line which indicates your planned flight path. The shape used to indicate a sequence point varies according to the type of sequence point:



Base. Base is marked by a homeplate-shaped icon, indicating the position of the airbase you took off from at the start of the mission.

Steer points. Steer points are a series of geographical points that mark the route you are to fly. They are represented by small circles and are numbered in the order that you are to reach them.

Target points. Target points are marked by triangles, and indicate points of intended weapon delivery. Note that these are not targets in the sense of a moving ground vehicle or aircraft whose position is tracked by a sensor device — a target point is simply a steer point at which you will release weapons.

Initial points. An initial point indicates a steer point just prior to a target point. Initial points are square and follow the steer point numbering system.

TSD PUSHBUTTONS

PB 6 Toggle **position of present position marker** between the bottom (BOT) and center (CTR) of the display. The currently selected option appears above the button.

PB 7 Select which **sensor cue** is displayed — A/G radar (RDR) or targeting IR (FLIR). The currently selected option appears above the button. When RDR is selected, the HRM cue or the A/G radar search cue appears on the map. When FLIR is selected, the targeting IR cue appears instead. See **TSP Symbology**, above.

PBs 13 and *14* Cycle through **display ranges** in each direction — 10, 20, 40 and 80nm. The currently selected range appears between the two buttons.

PB 17 Cycle the **position displayed** between present position (PP) and follow-on steer points.

When PP is selected, the TSD displays the area surrounding the present position marker. Any steer points visible within the selected display range are also displayed.

Press PB 17 to "look ahead" through your follow-on steer points (i.e., the steer points you haven't yet flown to) in sequence. The TSD displays the area around the currently selected steer point (the number of this point appears below PB 17).

After cycling through the last steer point on your route, pressing PB 17 again returns you to PP (present position).

PB 18 (DCL) Declutter the display by removing all symbology except the present position marker, the sensor cue and the azimuth and range information in the upper left corner of the display. This option is boxed when it is selected; press PB 18 again to deselect it.

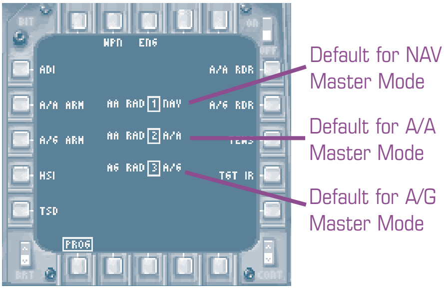
6. MASTER MODE PROGRAMMING

The master mode programming feature allows you to reconfigure which pages appear by default in an MPD when you switch to A/A, A/G or NAV master modes. INST master mode is not configurable.

If, for example, you find it's often useful to have the Targeting IR page up in MPD 4 (rightmost MPD in the WSO's cockpit) when you're in A/G master mode, then you probably want to program MPD 4 so that Targeting IR is the default page in A/G master mode.

You can pause the game to program MPDs.

To program an MPD:



1. Go to that MPD and press PB 11 (M) to jump to the main menu, if you are not already there.

2. Press PB 6 (PROG). A menu appears in the center of the main menu display (see graphic).

   This menu tells you the order in which you will choose pages for the display — first is NAV mode, second is A/A mode, and third is A/G mode. (In front of each number is the page displayed for the master mode; after the number is the master mode.)

3. Press a PB along the perimeter of the MPD to select the page you want to be displayed in this MPD for the NAV master mode (e.g., press PB 5 (TSD) to select the TSD page). The page listed in front of number 1 will change to the page you just selected.

4. Press a PB to select a default page for the A/A master mode.

5. Press a PB to select a default page for the A/G master mode.

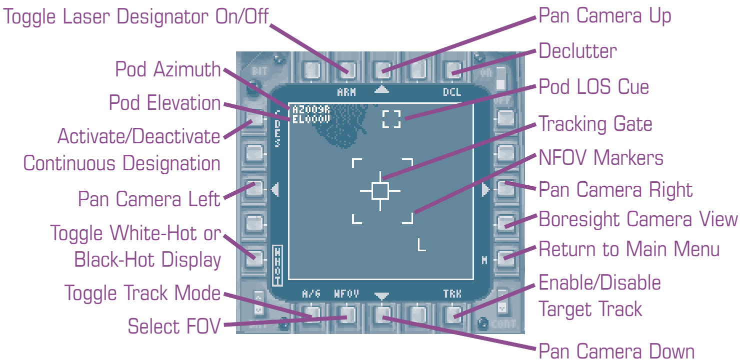
6. Press PB6 to end programming.

There is no way to skip ahead to the master mode you want to reprogram. Once you've pressed PB 6 (PROG) to begin the sequence, the first button you press is the default for NAV master mode, the second button is the default for A/A master mode, and the third is the default for A/G mode. If you wish to end the sequence at any point, press PB 6 (PROG).

12. TARGETING IR PAGE

The Targeting IR page displays video from the FLIR (Forward-Looking IR) camera housed in the AN/AAQ-14 pod of the LANTIRN system. You must have the AN/AAQ-14 pod loaded in order to use the Targeting IR page (see **Interface: Arming**, p. 1.10).

TARGETING IR PUSHBUTTONS



PB 1 (CDES) Activate/deactivate *continuous designation*. When active (i.e., CDES surrounded by a box), the current object or area being tracked by the targeting IR camera (TRK is boxed, see PB 10, next page) will be designated as the current A/G target. If nothing is being tracked (i.e., TRK is not boxed), the next object or area to be tracked will be designated as the new A/G target. (The word "DESIGNATE" will appear briefly in the display whenever the A/G target is designated in this manner.)

PB 5 Toggle between WHOT (white-hot) and BHOT (black-hot) displays; the currently selected option appears next to the button. On a white-hot display, the "hotter" an object is (i.e., the more heat it radiates) the brighter it appears on the display. Black-hot is the inverse of this — the hotter the object, the darker it appears.

PB 6 Toggle **track mode** between A/A and A/G; the currently selected option appears by the button.

- In A/A track mode, the targeting IR camera will track aircraft inside its FOV and provide an IR target TD box on the HUD, in addition to the radar target TD box.
- In A/G track mode, the targeting IR camera will track ground objects and positions only. No additional target designator is displayed on the HUD.

PB 10 (TRK) is used to initiate tracking in both cases.

PB 7 Cycle through **fields of view** — WFOV, NFOV or ENFOV; the currently selected option appears by the button. WFOV covers the greatest area with the least magnification, whereas ENFOV covers the least area with the greatest magnification — see the chart below for details.

FOV	Video Dimension	Magnification
WFOV	5.85° x 5.85°	2.3X
NFOV	1.67° x 1.67°	8X
ENFOV	.835° x .835°	16X

PB 10 (TRK) Enable/disable target track. When enabled (i.e., surrounded by a box), the targeting IR camera tracks the object or area inside the *tracking gate*. If CDES is also boxed (see PB 1, above), enabling TRK will also make the object or area within the tracking gate your A/G target. (The word "DESIGNATE" will appear briefly to signal you that an A/G target has been designated.)

PB 12 (BST) Return camera view to boresight (i.e., aiming at a point ahead of the aircraft's nose), if TRK is disabled (i.e., not boxed). If TRK is enabled, this button has no effect.

PB 16 (DCL) When declutter is active (i.e., surrounded by a box), the pod LOS cue, LOS cue local position, NFOV and ENFOV display size markers, the target position and the attack timer are removed from the display. Press PB 16 again to deactivate DCL and recall these features.

PB 19 Activate/deactivate the **laser designator**. Toggles between ARM (laser is deactivated, or "not lasing") and LASE (laser is actively lasing the target). SAFE appears if master arm is off; MASK appears if something is blocking the laser LOS.

The pushbuttons marked by arrows pan the camera, if TRK is disabled. If TRK is enabled, they have no effect. The key name for each action is listed in parentheses.

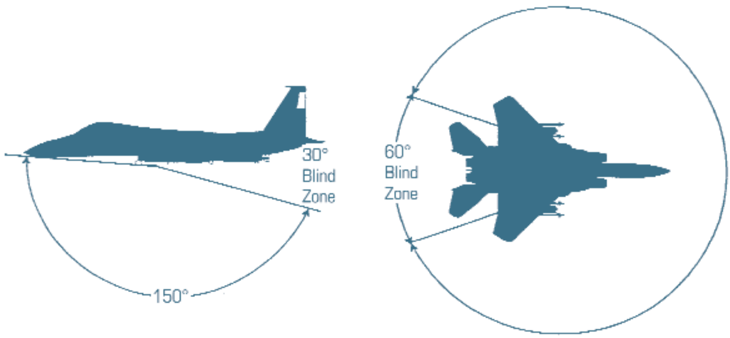
PB 3 Pan camera left (**TFLIR_LEFT** Shift ←)

PB 8 Pan camera down (**TFLIR_DOWN** Shift ↓)

PB 13 Pan camera right (**TFLIR_RIGHT**; Shift →)

PB 18 Pan camera up (**TFLIR_UP**; Shift ↑)

Maximum pan angle for the camera is 150° right/left and 150° up/down.



TARGETING IR SYMBOLOGY

ENFOV display size marker. This marker is only visible in NFOV and shows the area that will be visible in ENFOV. See **Targeting IR Pushbuttons: PB 7**, p. 2.38.

Laser designator. Indicates what the laser is doing:

SAFE Master arm is OFF and the laser cannot be used.

ARM Master arm is set to ARM and the laser is ready for use.

LASE Laser is lasing target.

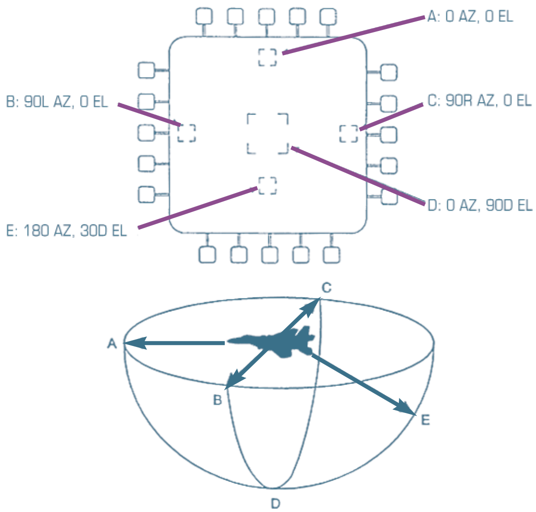
MASK Something is blocking the laser LOS (e.g., you have dropped into a valley and the target the targeting IR camera was tracking has disappeared behind a hill).

Laser range to target. Appears when laser is active, gives slant range (i.e., range along the LOS) to target, in feet.

Laser status. Indicates the status of the laser — L means the laser is ready to use or, if flashing, that the laser is in use. M indicates the laser is masked (see above).

NFOV display size marker. This marker, only visible in WFOV, shows the area that will be visible in NFOV. See **Targeting IR Pushbuttons: PB 7**, p. 2.38.

Pod LOS cue. This small dashed box provides a quick idea of the approximate azimuth and elevation of the targeting pod FLIR/laser LOS (line of sight) with respect to your aircraft. If you drew a line between the sighting index (your aircraft) and the pod LOS cue (the point at which the targeting pod is aimed) all objects crossing this line would be "seen" by the targeting pod. LOS is dependent on elevation as well as azimuth, however, so the cue provides only a visual approximation of LOS.



Pod azimuth (AZ). Gives the exact azimuth direction of the camera pod — in degrees to the left (L) or right (R) of center. This tells you how far to the left or right the camera is looking — 030R indicates the camera is looking 30° to the right of the nose, for example.

Pod elevation (EL). Gives the exact elevation in degrees up (U) or down (D) from your aircraft — for example, 110D indicates that the camera is looking 110° down from your aircraft (so far down, that it is actually pointing behind the aircraft — see the diagram above).

Tracking gate. The object or area inside this gate will be tracked when *target track* (TRK) is enabled (see PB 10, above). If CDES is boxed, this area or object will become your currently designated ground target (see **Targeting IR Pushbuttons**, p. 2.38).

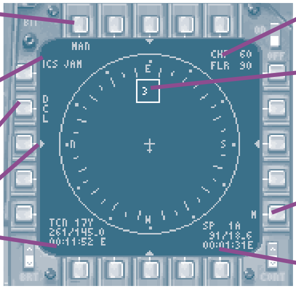
13. TEWS PAGE

The Tactical Electronic Warfare System (TEWS) combines four different defensive systems into one display page. The AN/ALR-56C Radar Warning Receiver (RWR) detects and displays threats. The AN/ALE-40 Countermeasures Dispenser (CMD) dispenses chaff and flares. The AN/ALQ-135 Internal Countermeasures Set (ICS) is the onboard radar jammer and is cued by the AN/ALQ-128 Electronic Warfare Warning Set (EWWS) receiver.

Chaff and flares will only be available if you load them. See **Interface: Arming**, p. 1.10.

TEWS SYMBOLOGY

The TEWS presents a top-down view of the area around your aircraft. Your aircraft is in the center of the display, marked by the aircraft symbol.



CMD status. Lists chaff (CHF) and flare (FLR) rounds remaining.

ICS status. Indicates the status of your jammer:

EMIS	EMIS LMT is on, disabling the jammer.
STBY	Standby — EMIS LMT is off, but the jammer is not currently emitting.
JAM	EMIS LMT is off, and the jammer is currently emitting.

The EMS button, which disables radar and jammer emissions, is on the UFC, to the right of the keypad. See **Up Front Control (UFC)**, p. 2.64.

Sector indicators. An indicator will light up when a high priority (i.e., locked-on or missile-guiding) emitter is within 5° of its azimuth. For example, if a threat has locked on to you, turning to place it 85°-95° to your right would cause the right sector indicator to light up. Use the indicators in this way to try breaking a radar-emitter's lock by "beaming" it (turning so that your flight path is perpendicular to the emitter).

TACAN and NAV steering data blocks. Same as the steering data blocks on the HUD — lists *heading* (in degrees), *range* (in nm) and *ETA or ETE* (h:mn:sc) for your currently selected TACAN station or sequence point. See **Basic HUD Symbology: Steering Data Block**, p. 2.7, for more details.

Threat symbols. The following symbols are used to mark threats. A circle around a symbol indicates that the threat has a radar lock on you. If a symbol is flashing, it is passing missile guidance commands to a missile (not necessarily a missile that is aimed at you, but you can never be too careful).

^ Air emitter □ Ground emitter ◇ Missile emitter

An alphanumeric code inside the symbol identifies the type of aircraft or ground threat. The Threat ID Code Table below lists all threat objects and their codes.

The TEWS will only display missiles if they have onboard active radar seekers (e.g., the AIM-120 and AIM-54). In any case, a missile displayed on the TEWS won't have an ID, merely an icon.

Threat ID Code Table

Air Emitter Codes

Code	Air Emitter	Radar System
14	F-14	AWG-9
15	F-15	APG-70
16	F-16	APG-68
18	F/A-18	APG-65
21	MiIG-21	Spin Scan
22	Su-22	High Fix
23	MiG-23	High Lark
24	Su-24	Orion A
25	MiG-25	FoxFire
27	Su-27	Slot Back
29	MiG-29	Slot Back
31	Su-30	Slot Back
35	MiG-35, Su-35	Zhuk-PH
40	F-111	APQ-169
41	Tornado	Doppler 72
42	TU-22	Tail gun radar
43	B-52	Tail gun radar
EW	AWACS	
F1	F1 Mirage	Cyrano IV
F4	F-4E	APQ-120
F5	F-5E	APQ-153

Ground Emitter Codes

Code	Ground Emitter	Radar System
EW	GCI	Bar Lock/ Flat Face
2	SA-2	Fan Song
3	SA-3	Low Blow
6	SA-6	Straight Flush
8	SA-8	Land Role
10	SA-10	Flap Lid
11	SA-11	Fire Dome (ACQ radar)
SD	SA-11	Snow Drift (search radar)
13	SA-13	Snap Shot
23	ZSU-4-23	Gun Dish
RO	Roland	
HA	Hawk	
S	OSA Missile Boat	Fire Control Radar
AA	AAA	Fire Can

THREAT LOCATION AND STRENGTH

The TEWS indicates a threat's azimuth position relative to yours, and how strong its signal is. The stronger a threat's emissions, the closer its icon appears to the marker representing your aircraft on the display. (See **Combat: Threat Location and Strength**, p. 2.44.)

TEWS TONES

In addition to visual symbology, the TEWS also provides audio cues in the form of different-pitched tones and warbles. A short, relatively low-pitched "boop" (.25 sec, 800 MHz) indicates a new radar spike has appeared on the display. A brief warble, alternating five times between a lower and higher pitch (800/1600 MHz, 2.5 sec total duration) indicates something has a radar lock on you. This warble will be repeated every 30 sec for the duration of the lock. When a threat is launching a missile at you, another, faster warble alternating much between a lower and higher tone will repeat continuously until the threat is gone or you're dead. (This could be the last sound you hear.)

TEWS PUSHBUTTONS

PB 2 (DCL) Declutter the display by removing the compass rose and all friendly emitters.

PB 20 Cycle through **CMDS/ICS control options** — manual (MAN), semi-automatic (SEMI) and automatic (AUTO). The currently selected option appears below the button.

MAN Chaff and flares must be dropped manually; one cartridge is dropped per command. Jammer must be enabled/disabled manually.

SEMI Chaff is dropped manually, but the computer determines the number dropped per command, according to the current situation. Flares are dropped as in manual (MAN) control. Jammer must be enabled/disabled manually.

AUTO TEWS controls all aspects of chaff release and jammer operation. *(**Note:** AUTO mode can use up chaff very quickly.)*

Flares are always released manually.

14. AIR-TO-GROUND RADAR PAGE (A/G RDR)

Although the F-15E has both Air-to-Air and Air-to-Ground Radar pages, the radar information displayed comes from the same radar system — the AN/APG-70. This powerful radar system can gather information on *either* ground or air targets, but it can't do both at the same time. For this reason, you cannot have both pages up at the same time. If you try to pull up the A/G Radar page when the A/A Radar page is open in another MPD, you will receive a RADAR IN USE error message. If you click the A/G RDR page button again, the A/G Radar page will open and the A/A Radar page will close automatically.

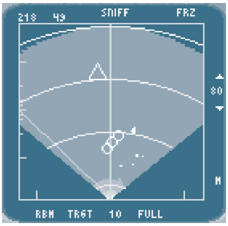
There are two exceptions. If you have a static "patch map" (HRM) up on the A/G Radar page, the HRM will remain up even if you call up the A/A Radar page in another MPD. (See **A/G Radar Modes**, below.) You won't be able to switch to another A/G radar mode until you close the A/A Radar page, however. If you are tracking a target with the A/A Radar page, you will not be able to open the A/G Radar page.

This section provides a basic overview of A/G Radar symbology and features. For a more detailed, step-by-step explanation of how to find and designate targets with the air-to-ground radar, see **Combat: Finding and Designating Targets**, p. 4.51.

A/G RADAR MODES

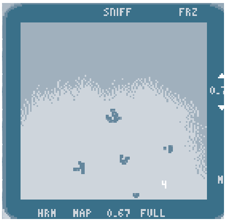
The F-15's air-to-ground radar has several modes designed to overcome the difficulties associated with radar surveillance of ground targets. It can provide static images which give a far more detailed picture of terrain features than conventional radar, for more accurate targeting. It can also track moving ground vehicles. You switch to different modes by using the PBs around the display — see **A/G Radar Pushbuttons**, p. 2.48.

RBM MODE



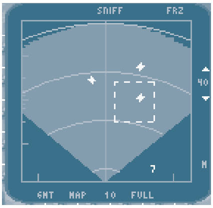
RBM, or Real Beam Map mode, is the basic A/G radar mode. It displays contact information for the arc in front of your aircraft (your aircraft is at the bottom center of the display). Real beam maps are low resolution — they are not useful for targeting as the designation may be off by hundreds of feet. However, they update quickly (with a sweep of 90° per second) and can be used to view upcoming terrain, or locate a general target area to be detailed in a High Resolution Map (HRM). RBM mode has a minimum range of 4.7nm and a maximum range of 80nm (actual ranges are dependent on radar LOS).

HRM MODE



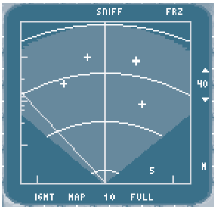
HRM (High-Resolution Map) mode provides a static, high-detail, top-down Synthetic Aperture Radar (SAR) image (also known as a "patch map") of a certain area. An HRM image can be called up from any other mode and is used to view an area with greater detail for targeting. Each HRM requires about 4-10 seconds to create. They have a minimum size of .67nm and a maximum size of 40nm.

GMT (GROUND MOVING TARGET) MODE



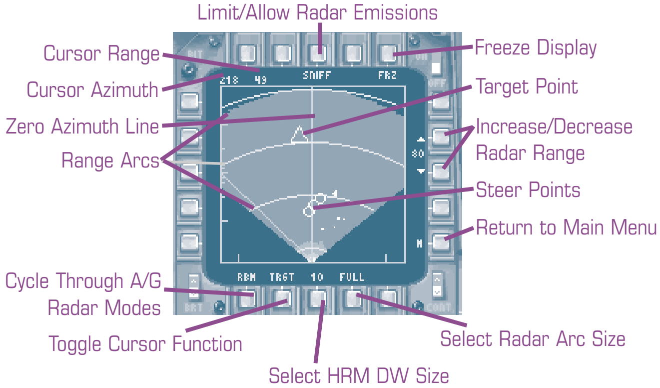
On this display, no terrain data whatsoever is displayed. Instead the positions of moving vehicles are marked by small "+"s. Moving targets cannot be detected beyond 32nm, regardless of the radar range that is selected. When engaging ground vehicles, you can use this mode to designate a target, then cue the targeting IR camera to that target.

IGMT (INTERLEAVED GMT) MODE



Interleaved GMT mode superimposes GMT target data over the RBM terrain map. Moving targets cannot be detected beyond 32nm, regardless of the radar range that is selected.

A/G RADAR SYMBOLOGY



Cursor azimuth and range. These figures indicate the cursor's position on the radar display with respect to your aircraft.

Display window (DW). The display window polygon appears when an HRM map is commanded, indicating the area to be mapped. An "X" through the display window indicates that no map can be generated for the cursor position requested.

Map time-to-go. This number is an estimate of how long it will take to construct an HRM map. It is displayed only when the cursor function is set to MAP (see **A/G Radar Pushbuttons**, p. 2.48), and the cursor is within mappable radar limits.

Range arcs. Range arcs are provided on RBM and GMT displays. They mark 25, 50, 75 and 100% of the selected range.

Sequence point symbology. *Sequence points* appear on the A/G Radar display when they fall within the currently selected radar range. A maximum of five can be displayed on the A/G radar at any given time.

The symbology is the same as that used on the TSD — see **Sequence Point Symbology**, p. 2.35, for an explanation of the terms below.

Base Steer point Target point Initial point

Zero azimuth line. This is the straight line that runs through the center of RBM, GMT and IGMT displays. The radar returns in these displays are stabilized for up to ±10° of drift, and this line can be used as a ground track reference.

In GMT and IGMT modes, this symbol is used to show moving ground vehicles.

A/G RADAR PUSHBUTTONS

PB 6 Cycle **radar mode** between RBM, GMT, HRM and IGMT. The currently selected mode appears above the button. (See **A/G Radar Modes**, p. 2.48.)

PB 7 Toggle **cursor function** between TRGT (target) and MAP. Both functions are available in any radar mode. The currently selected option appears above the button.

TRGT Click on an area to designate it as your target.

MAP Click on an area to create an HRM image of it.

You can choose a resolution for the map using PB 8, below. If you move your cursor to an area that is unmappable, an error message will appear in the bottom center of the display. See **A/G Radar Messages**, next page, for an explanation of potential error messages.

PB 8 Cycle through **HRM display window sizes** — .67, 1.3, 3.3, 4.7, 10, 20 and 40nm. The current DW size is displayed above the button.

This option controls how far an HRM map is zoomed in when one is commanded — when it is set to 1.3 for example, the HRM will be 1.3 x 1.3 nautical miles. It does *not* affect the range of an HRM that is already visible on screen. The range setting for the HRM affects where on the radar display you can command a map; see **A/G Radar Messages**, next page, and **Combat: HRM Limit Table**, p. 4.54.

PB 9 Cycle through RBM, GMT and IGMT **radar arc sizes** — FULL (50°, or 25° to either side of your aircraft's nose), HALF (25°) or QTR (12.5°).

Decreasing the arc size decreases the amount of time it takes the radar to scan, but limits the scan area. This option does not affect an existing HRM.

PB 13/14 Cycle through **RBM, GMT and IGMT mode radar ranges** in either direction — 4.7, 10, 20, 40 and 80nm for RBM or 4.7, 10, 20 and 32 for GMT/IGMT. The currently selected range is displayed between the two buttons.

PB 16 (FREEZE) Freeze/unfreeze the radar display (affects RBM, GMT and IGMT modes only). As long as the display is frozen, the radar information on the screen is not being updated. (The radar is also not actively emitting, so freezing makes you temporarily less visible.) The option is boxed when the radar is frozen; click PB 16 again to unfreeze it.

PB 18 (SNIFF) Limit/allow radar emissions. When boxed, the radar does not transmit, and data on the display is not updated.

A/G RADAR MESSAGES

The following messages are displayed in the bottom center of the radar screen.

BLIND ZONE. The map cursor is in the blind zone (within 8° to the left or right of the aircraft's nose). The radar cannot create an HRM image in this area.

DESIGNATE. Displayed for five seconds after a target designation is commanded.

DW RANGE LIMIT. The map cursor is outside the maximum or inside the minimum range limits. The radar cannot create an HRM image in this area. See **Combat: HRM Limit Tables**, p. 4.54.

GIMBAL LIMIT. The map cursor is outside radar gimbal limits (60° to the left and right of the aircraft's nose). The radar cannot create an HRM image in this area.

For more information on the azimuth and elevation limits to making an HRM, see **Combat: HRM Limit Table**, p. 4.54.

15. AIR-TO-AIR RADAR PAGE (A/A RDR)

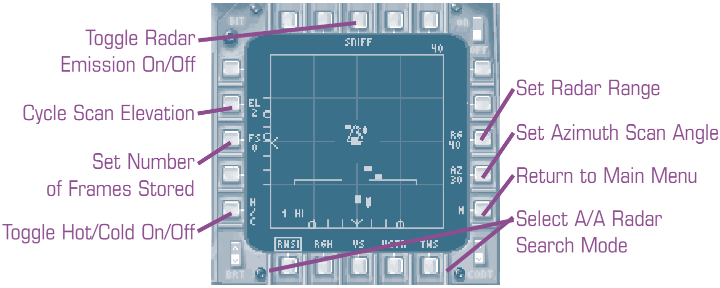
Although the F-15E has both Air-to-Air and Air-to-Ground Radar pages, the radar information displayed comes from the same radar system — the AN/APG-70. This powerful radar system can gather information on *either* ground or air targets, but it can't do both at the same time. For this reason, you cannot have both pages up at the same time. If you try to pull up the A/A Radar page when the A/G Radar page is open in another MPD, you will receive a RADAR IN USE error message. If you click the A/A RDR page button again, the A/A Radar page will open and the A/G Radar page will close automatically.

There are two exceptions. If you have a static "patch map" (HRM) up on the A/G Radar page, the HRM will remain up even if you call up the A/A Radar page in another MPD. (See **A/G Radar Modes**, p. 2.45.) You won't be able to switch to another A/G radar mode until you close the A/A Radar page, however. Also, if you are tracking a target with the A/A Radar page, you will not be able to open the A/G Radar page.

This section provides a basic overview of A/A Radar symbology and features. For a more detailed, step-by-step explanation of how to find and designate targets with the air-to-air radar, see **Combat: Detecting Aircraft beyond Visual Range**, p. 4.19.

A/A RADAR SEARCH MODES

The air-to-air radar has eight possible search modes, which are selected by pushbuttons. Only one mode can be active at a time. A box will appear around the label of the currently selected mode. The modes are described in the following sections.



PB 6 (RWSH/RWSM/RWSI) Cycle through Range While Search (RWS) modes, enabling the mode that appears above the button.

PB 7 (RGH) Enable Range Gated High (RGH) mode.

PB 8 (VS) Enable Velocity Search mode.

PB 9 (VCTR) Enable Vector mode.

PB 10 (DTWS/HDTWS) Toggle between **Track While Scan (TWS)** modes, enabling the mode that appears above the button.

High RWS Mode (RWSH)

In **High RWS mode**, the radar sends out a high pulse repetition frequency (PRF) emission. High PRFs are better at detecting high-closure contacts, but low- or no-closure contacts may not show up at all. This means a MiG racing in at you head-on can be detected from a great distance away, but a MiG flying in front of you at roughly your speed will vanish from the radar screen.

Medium RWS Mode (RWSM)

In **Medium RWS mode**, the radar sends out medium PRF emissions. Medium range PRFs are not as good at detecting aircraft at long ranges and they are prone to returning clutter, but they are better at showing low closure targets.

Interleaved RWS Mode (RWSI)

Interleaved RWS mode sends out both high PRF and medium PRF emissions, alternating between bars. This will be your primary search mode, for it provides the high PRF benefits of long-range, high-closure contact detection and the medium PRF benefits of better low-closure contact detection.

High closure means the distance between you and the contact is increasing or decreasing rapidly. Low closure means this distance is increasing or decreasing slowly.

Range Gated High Mode (RGH)

Range Gated High mode is another intermediate pulse repetition frequency mode. It emits at a single PRF between that of high and medium RWS modes, but evaluates data electronically to extract low- and high-closure targets. It may not detect all targets that RWSI might, but it may detect certain targets more quickly.

Velocity Search Mode (VS)

Velocity Search mode is best at detecting targets with a closure rate between 80-2400 knots at long range. However, it does **not** detect low- or no-closure targets at all. The velocity search mode display is different from that of any other mode — instead of sorting contacts by azimuth and range, as do other modes, it sorts them by azimuth and closure rate. See **Radar Symbology**, p. 2.54, for an illustration.

Vector Mode (VCTR)

The scan rate for **Vector mode** is about 35° per second — about half the normal scan rate. It takes about twice as long to complete a scan, but the computer's processor uses this additional time to enhance detection of objects with a low radar cross-section (RCS — a measure of an aircraft's visibility to radar). This mode will pick up lower RCS contacts (such as frontal and tail aspect targets) at greater distances.

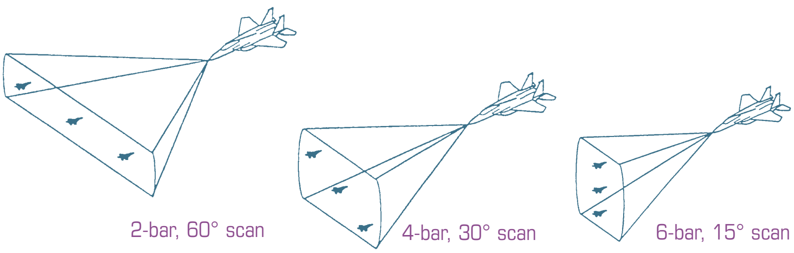
Track While Scan Modes

In **Track While Scan** modes, the radar can track the movement of targets while continuing to scan for contacts.

DTWS

In TWS mode, the radar looks at a much smaller area of the radar screen and tracks the movement of all contacts in that area. The targets' headings are indicated by a bar on the contact square. The area scanned is updated about every two seconds.

The size of the area scanned is determined by your azimuth setting — if the current setting is 60°, the radar performs a 2-bar, 60° scan. If the setting is 30°, the radar performs a 4-bar, 30° scan. See *scan elevation* and *azimuth scan angle* under **Other A/A Radar Pushbuttons**, next page.

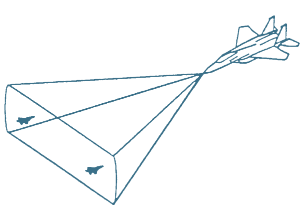


TWS mode is useful when you have a target designated, because it allows you to see other radar contacts. (In other modes, the designated target is the only target visible.) It also means your radar is painting several contacts in an area, rather than only painting your target — a situation much less likely to alarm that target.

HDTWS

High-Data rate TWS mode is the same as TWS mode except it scans only a 2-bar, 30° scan in about one second.

For more information on using TWS modes, see **Combat: Track While Scan (TWS)**, p. 4.31.



OTHER A/A RADAR PUSHBUTTONS

PB 2 (EL) Cycle **scan elevation** through 1, 2, 4, 6 and 8 bars. This controls the height of the radar scan — the radar scans one bar, moves up several degrees and scans another. The higher the setting, the more bars that are scanned, but scans take longer to complete. (Bars are set automatically in TWS based on the azimuth scan angle setting, below.) See **Combat: Set Search Scan Limits**, 4.21, for details.

PB 3 (FS) Cycle the **number of frames stored** for a display of radar history through 0, 1, 2 and 3. When set to a number greater than zero, that many old, fainter "blips" remain on the display to mark past positions of a contact as the radar updates.

PB 5 (H/C) Enable/disable **Hot/Cold** — a box appears around the label when enabled. Hot/Cold refers to a blip's closure rate — "hot" means a positive closure rate (i.e., the aircraft is coming toward you); "cold" means a negative closure rate (i.e., the aircraft is moving away from you). When H/C is enabled, targets that are closing in on you will be displayed with an arrow pointing toward you. Targets that are moving away from you will be displayed with an arrow pointing away from you. (Available in RWSH, RWSM, RWSI, RGH, and Vector search modes *only*.)

PB 12 Set **azimuth scan angle** to 60°, 30° or 15° to either side of your aircraft's nose. A wider angle returns information for a larger area, but increases the time it takes to make a scan.

PB 13/14 Cycle through radar ranges — 10, 20, 40, 60, 80 or 160nm. The currently selected range appears next to the button.

> Having the radar ranged out really far doesn't mean contacts at these ranges will necessarily be picked up. Your success in picking them up will depend greatly on their closure rate and the search mode you are in.

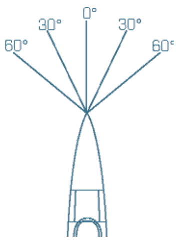
PB 16-17/19-20 Slew **TWS scan** area (TWS and HDTWS modes only). Normally, the TWS scan area is centered on your designated target or the contact the computer marks as primary. You can slew the area to be scanned to a different part of the screen to view contact information for that area. Arrows appear next to these pushbuttons when you are in TWS or HDTWS mode, indicating which way the antenna slews.

PB 18 (**sniff**) Limit/allow radar emissions. When boxed, the radar does not transmit, and data on the display is not updated.

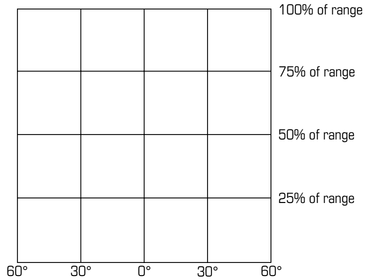
A/A RADAR SYMBOLOGY

A/A Radar Grid

All Modes Except Velocity Search



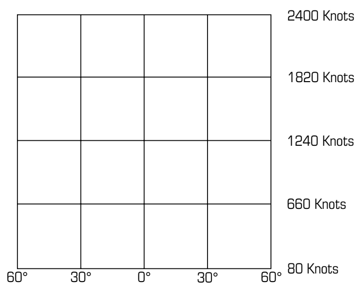
The A/A radar presents a top-down view of a cone of space in front of your aircraft. The nose of your aircraft is at the bottom center of the display. The horizontal lines on the grid represent range, and the vertical lines represent azimuth angles.



For example, if the display range is 80nm, then the top horizontal line on the grid represents 80nm, the next lower line represents 60nm, the next lower 40nm and so on.

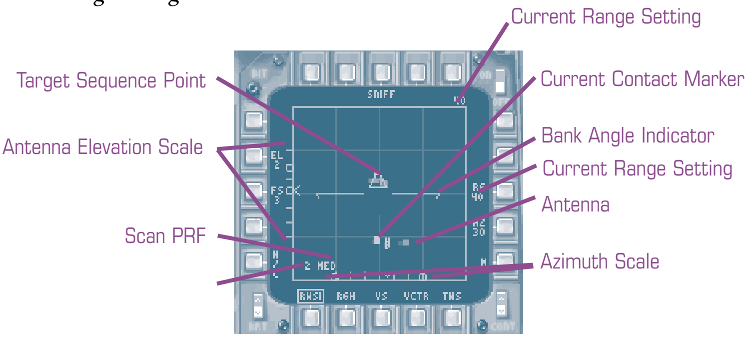
Velocity Search Mode

In velocity search mode, the vertical lines of the grid represent azimuth, as described above. Horizontal lines indicate a contact's speed. No range information is given; however, all contacts displayed are within the current radar range setting.



Symbology — No Target Designated

The following symbology displays on the radar at all times, whether you have a target designated or not.



Antenna azimuth scale. The scale at the bottom of the display marks the azimuth position of the radar antenna. The lines of the radar grid mark 60°, 30° and 0° of azimuth; a caret moves along the scale to indicate where the current azimuth direction is. Hollow circles mark azimuth limits, when the azimuth movement of the radar antenna has been limited with PB 12 (see **Other A/A Radar Pushbuttons**, p. 2.53).

Antenna elevation scale. The scale along the left side of the display indicates the antenna's current elevation. Tick marks call off 10,000-foot increments. Hollow circles mark elevation scan limits, and the caret marks the antenna's current position.

Bank angle indicator. Indicates the current angle of the horizon. This symbol means nothing with reference to the radar grid — it is simply a duplication of the horizon information provided by the pitch ladder. It tells you quickly which way you are turning without your having to look up from the radar screen.

Cursor position. Gives the current azimuth and range position of the cursor on the display. (Azimuth is on top.)

Current bar. Indicates which bar the radar is currently scanning. See the explanation of scan elevation under **Other A/A Radar Pushbuttons**, p. 2.53.

Current range setting. The current range setting is listed in the upper right corner of the display, as well as next to PB 13.

Scan PRF. Displays either HIGH or MED, indicating whether high or medium PRFs are currently being emitted. (See **A/A Radar Search Modes**, p. 2.50.)

Contact Symbology

 Half-intensity contact (e.g. an aged target position in a radar history)

 Full-intensity contact (current marker)

 Friendly contact. When an IFF query is sent out, friendly contacts will change from a square to a circle. See **3. Identification Friend or Foe (IFF),** p. 2.67.

 TWS contact. The heading vector points in the direction the contact is moving.

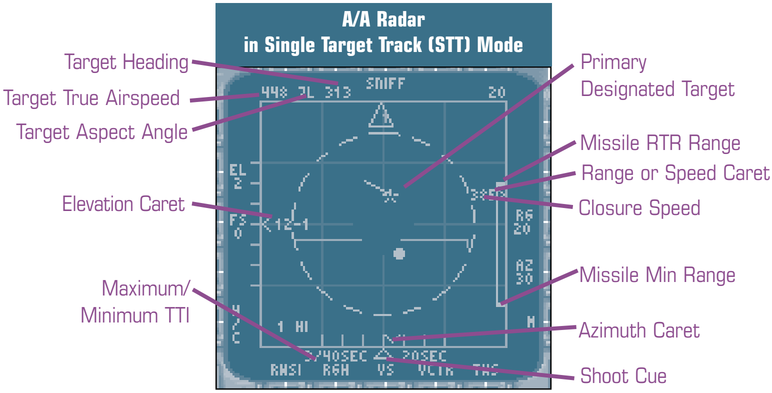
 Friendly TWS contact.

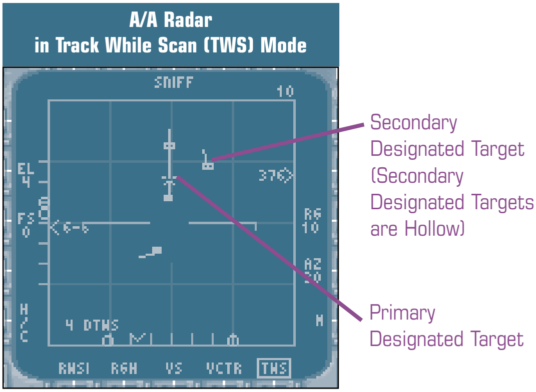
 Non-designated primary target. If you do not have a target designated when you switch to TWS mode, the computer will select the closest contact as a primary target and mark it with a star.

Symbology — Target Designated

When you designate a target in RWSI, RWSH, RWSM, RGH, VS or VCTR mode, all other contacts disappear from the screen — this is called Single Target Track (STT) mode. In TWS and HDTWS modes, contacts near the designated target will continue to be displayed after target designation.

(You can designate targets manually by clicking on a contact on the radar screen, or you can have one of the air-to-air radar's acquisition modes designate a target. To "undesignate" the target, re-select a search mode using one of PBs listed under **A/A Radar Search Modes**, p. 2.50. For more detailed information, see **Combat: Designate the Target**, p. 4.28.)





Azimuth caret. Marks your target's azimuth on the azimuth scale at the bottom of the display.

Elevation caret. Marks your target's ASL in feet — for example, 10-0 means 10,000 ft. and 16-2 means 16,200 ft.

Range caret. Marks your target's range on the right side of the radar grid. The target's closure speed is displayed numerically (in knots) next to the grid.

Speed caret. In Velocity Search (VS) mode, the caret on the right side marks the target's closure speed instead of range. The target's closure speed is given numerically (in knots) next to the caret.

Target aspect angle. Indicates which aspect of the target is facing you, measured in degrees (the final zero has been dropped for brevity). An aspect of T indicates you're facing your target's tail (0°); H indicates you're facing his nose (180°). An aspect of 16R indicates you're facing a point between the aircraft's nose and its right wing. 9L indicates you're facing the pilot's left wing. See **Combat: Aspect Angle**, p. 4.71.

Target heading. Lists your target's magnetic heading, in degrees. These numbers correspond to positions on the heading tape — 360 is north, 090 is east, 180 is south and 270 is west.

Target true airspeed. Lists your target's true airspeed (TAS) in knots.

Contact Symbology

Non-designated TWS contact. The heading vector points in the direction the contact is moving.

Non-designated friendly TWS contact. When an IFF query is sent out, all contacts returning a "friendly" response become circles. See **3. Identification Friend or Foe (IFF)**, p. 2.67.

Primary designated target (PDT). A heading vector is displayed for your designated target, no matter what mode you are in — it will be twice as long as a non-designated target's heading vector. If you send out an IFF query and your target returns a "friendly" reply, the symbol will "mipple," or flash, between a star and a circle.

Secondary designated target (SDT). You can designate multiple targets while in TWS mode. The first target you designate becomes your primary designated target. When you designate another target, the first target becomes a secondary target and the new target becomes your primary. You can have up to eight targets designated at a time. The heading vector for a secondary target is as long as the vector for a primary target — about twice as long as the heading vectors of non-designated targets.

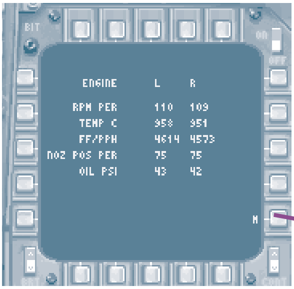
Missile Mode Symbology

The features listed below appear on the radar as well as on the HUD when you are in MRM launch mode, or when you are tracking a target with radar in SRM launch mode and an AIM-9L or AIM-9M is in priority. See **Medium Range Missile (MRM) Launch Mode Symbology**, p. 2.12, for a description of each.

ASE circle and steering dot
Postlaunch min/max TTA or TTI
Shoot cue
Prelaunch TTA or TTI
Radar range scale

Missile fly-out dots. In addition, once you've launched an AIM-120 or AIM-7, a tiny dot will appear at the bottom of your primary target's heading vector. It moves up the heading vector as TTI counts down to zero — when TTI is halfway to zero, the dot will be halfway up the vector. (Dots will not appear on the heading vectors of secondary targets when multiple weapons are in flight.)

18. ENGINE DATA PAGE (ENG)



The following data is listed for both engines. Out-of-limit parameters — parameters that fall above or below recommended levels — are boxed and also appear in yellow on a color display.

RPM PER. Measurement of the N_2 compressor RPM — can range between 0% and 110%.

TEMP C. Measurement of the fan turbine inlet temperature in degrees Centigrade — can range between 100°—1375°.

FF/PPH. Measurement of fuel flow from the fuel tanks, in pounds per hour.

NOZ POS PER. Lists how far the engine nozzles are open as a percentage of total. Zero percent is totally closed, 100% is totally open.

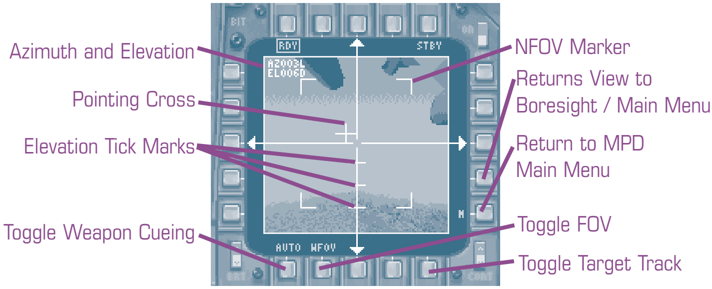
OIL PSI. Lists the oil pressure for each engine — between 0 and 100 PSI.

19. WEAPON VIDEO PAGE

This page displays video from the AGM-65 and GBU-15. This section gives an overview of the two displays and their features. For an explanation of how to engage a target with these weapons, see **Combat: AGM-65 Maverick**, p. 4.65, and **Combat: GBU-15**, p. 4.66.

WEAPON VIDEO: AGM-65

Video display ends as soon as an AGM-65 is fired. The video for the next AGM-65 (if there is one) immediately replaces it.



AGM-65 Symbology

Elevation tick marks. These three mark a 5°, 10° and 15° look-down angle.

Max/min range markers. Only displayed when AUTO weapon cueing is enabled and you have an A/G target selected. These tick marks represent the minimum and maximum effective ranges for the AGM-65. The numbers beside the max and min range markers list how much time before the weapon reaches max/min range in seconds. If no number is listed, the weapon is already within that range.

NFOV markers. Only visible in WFOV, these markers frame the area that would be visible if NFOV were selected.

Pointing cross. The pointing cross shows where the missile's seeker head is looking. (You cannot control this feature.) Coordinates for the **azimuth** (AZ) and **elevation** (EL) of the pointing cross appear in the upper left corner.

Range caret. Only displayed when auto weapon cueing is enabled and you have an A/G target selected. This caret marks the target's current range with respect to the max and min range markers. When this caret is between the two markers, IN RNG will appear beside it.

Targeting cross hairs. The targeting cross hairs are slewable if you have *manual weapon cueing (MAN)* selected. When you lock onto a target, the cross hairs center on it. See **AGM-65 Pushbuttons**, p. 2.60.

AGM-65 Pushbuttons

Most of the buttons below toggle between options. In these cases, the currently selected option appears next to the button.

PB 6 Toggle **weapon cueing** between AUTO and manual (MAN).

AUTO The weapon seeker head automatically cues to your designated A/G target.

MAN You cue the weapon seeker head to your designated target using the slew buttons (below).

PB 7 Toggle **display field of view** between WFOV (±30°) and NFOV (±15°). The currently selected option appears above the button.

PB 10 (TRK) Activate/deactivate **target track**. When enabled (a box appears around it) while in manual (MAN) weapon cueing mode, the missile seeker head will lock onto the object or area currently in the center of the cross hairs. If activated while in AUTO weapon cueing mode, the missile seeker head will lock on to whatever is currently in the cross hairs when you switch to manual (MAN) weapon cueing mode.

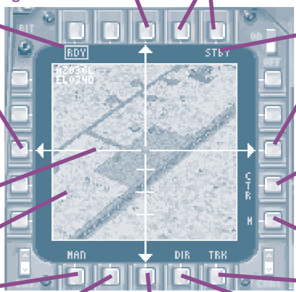
PB 12 (BST) If manual (MAN) weapon cueing is selected, and target track is not active (TRK is not boxed), this button will return the AGM-65 viewpoint to the boresight. Otherwise the button has no effect.

PB 3, 8, 13 and 18 Use these pushbuttons to **slew the targeting cross hairs**, if weapon cueing is set to manual (MAN) and target track (TRK) is not active.

WEAPON VIDEO: GBU-15

The GBU-15 has two launch modes — direct and indirect. In direct (Lock on Before Launch or LOBL) launch mode, you simply designate your target, aim the seeker head toward it as you would with an AGM-65, gain a lock and fire. No further video information is displayed after you fire.

In indirect (Lock on After Launch or LOAL) launch mode, you can steer the weapon after it is released using the video information displayed in the MPD. You must have an AN/AXQ-14 datalink pod mounted on your aircraft to do this — this feeds the steering information to the GBU-15.



GBU-15 Pushbuttons

PB 6 Toggle **weapon cueing** between AUTO and manual (MAN).

AUTO The weapon seeker head automatically cues to your designated A/G target.

MAN You cue the weapon seeker head to your designated target using the slew buttons (below).

PB 9 Toggle **launch mode** between direct (DIR) and indirect (IND).

DIR In direct launch mode, you designate your target and fire when you have a lock on it. You can slew the missile's seeker head before launch, but you have no control over it, and no video information is displayed for it, after launch.

IND In indirect launch mode, you can release the weapon without a target lock and steer it after release using the video information displayed in the MPD. (How much steering control you have over it depends on which *launch profile* you select).

For indirect launch mode to be available, you must have an AN/AXQ-14 datalink pod loaded on your aircraft.

PB 7 When you select indirect (IND) launch mode, pushbutton 7 becomes active, cycling through indirect mode launch profiles — normal (NORM), transitional (TRANS) and terminal (TERM). The profile you select determines how much control you will have over the seeker head and the nose of the weapon itself:

NORM In a normal loft profile, the weapon flies ballistically (i.e., as it would if it were an unguided projectile) for 1.75 seconds after release, then automatically enters a transitional loft profile.

TRANS A transitional loft profile is automatically entered shortly after you release a bomb with a normal launch profile. You can manually select a TRANS launch profile before launch by pressing PB 7. (TRANS will be boxed when it is selected.) With a TRANS loft profile selected, you can control the yaw of the weapon (its heading) after launch using PBs 8 and 13. You cannot control the weapon's pitch.

TERM With a terminal loft profile, the seeker head attempts to automatically lock on your target. You can use PBs 3, 8, 13 and 18 to control the weapon's pitch and yaw.

PB 10 (TRK) Activate/deactivate **target track**. When enabled (a box appears around it) while in manual (MAN) weapon cueing mode, the missile seeker head will lock onto the object or area currently in the center of the cross hairs. If activated while in AUTO weapon cueing mode, the missile seeker head will lock on to whatever is currently in the cross hairs when you switch to manual (MAN) weapon cueing mode.

PB 12 (BST) If manual (MAN) weapon cueing is selected, and target track is not active (TRK is not boxed), this button will return the AGM-65 viewpoint to the boresight. Otherwise the button has no effect.

PBs 8 & 18 Control **the seeker head** before launch and **the yaw** of the weapon after an indirect launch with a terminal launch profile.

PBs 3 & 13 Control **the seeker head** before launch and **the pitch** of the weapon after an indirect launch in a terminal launch profile.

PBs 16 & 17 Control **the yaw** of the weapon after an indirect launch in a transitional launch profile.

GBU-15 Symbology

Aiming cross hairs. These cross hairs represent the point at which the GBU-15's *seeker head* is pointed and can be slewed until you have a target locked. When you lock on a target, the cross hairs center on the target.

> The seeker head of a GBU-15 slews independently of where the missile's nose is pointing in NORM or TRANS launch modes. (Just because the seeker head has locked to its target, doesn't mean the nose is pointed toward the same spot.) In **direct mode**, you can slew the seeker head until you lock on to a target and release the weapon. You have no control over the missile after launch. In **indirect mode**, you can release the weapon before you have a target lock, and then steer the missile to target after it is launched. (See **Launch Modes**, p. 2.61.)

Min/max/optimum launch range. Only displayed after you have designated an A/G target. These marks represent the minimum and maximum ranges for the weapon. Launch ranges are determined by the aircraft altitude and airspeed. Optimum launch range is the range at which the bomb has maximum energy for reaching the target.

Nose index marker. This symbol marks the point at which the nose of the GBU-15 is aiming. Note that this point does not always coincide with where the seeker head is aiming. In direct mode you have no control over where the missile's nose is pointed. In indirect mode you may have control of this, depending on which launch profile you have chosen. (See **Launch Modes**, p. 2.61.)

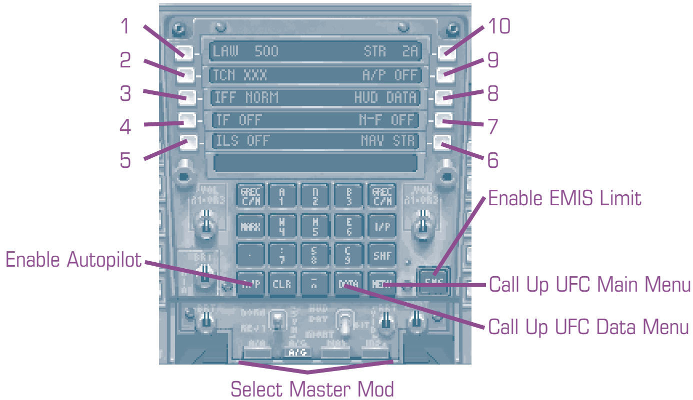
Range caret. Only displayed after you have designated an A/G target. The caret marks the current range to target with reference to the launch ranges. IN RNG appears next to the caret when you are within min and max ranges.

Time to min/max range. Only displayed after you have designated an A/G target. The numbers beside the max and min range markers give how much time before the weapon reaches max/min range in seconds. If no number is listed, the weapon is already within that range.

TOF counter. Indirect launch mode only — the *time of flight* counter counts the seconds that the missile is in flight, starting at weapon release (zero) and ending when the weapon impacts.

UP FRONT CONTROLS (UFC)

The Up Front Controls (UFC) consists of a keypad, six rectangular data display windows and ten pushbuttons. On the UFC main menu, the pushbuttons control functions or call up submenus. On the submenus, the pushbuttons control different functions. For reference in this chapter, the PBs are numbered from 1 to 10 moving counterclockwise from the top left.



The following buttons and switches on the UFC always control the same features, regardless of which menu is currently displayed.

MENU Call up the UFC main menu from any submenu or from the data menu (see **UFC Main Menu**, p. 2.65).

DATA Call up the UFC data menu from the main menu or any of its submenus (see **UFC Data Menu**, p. 2.72).

A/P Engage the autopilot.

EMS Limit/allow any emission that might give away the presence or position of your aircraft. When emissions are limited, the radar is placed in sniff mode and the ICS (jammer) in standby. The EMIS LMT indicator light comes on, EMIS appears on the TEWS page, and SNIFF is boxed on the radar display. When emissions are allowed, the EMIS LMT light goes off and the radar and jammer can freely emit — assuming they have been activated. (For details, see **Indicator Lights:** EMIS LMT, p. 2.73, **TEWS Symbology: ICS Status**, p. 2.42, and **A/A Radar Pushbuttons**, p. 2.53, or **A/G Radar Pushbuttons**, p. 2.48.)

UFC MAIN MENU

This is the default UFC display. Click the pushbuttons listed below to select the submenus described. Click the MENU button to return to the UFC main menu at any time. The submenus are described in more detail in the following sections, on the pages indicated.

PB 1 (LAW .../OFF) Call up the Low Altitude Warning (LAW) system menu. The number listed next to LAW is the current altitude setting for the system; LAW OFF indicates the system is inactive. See p. 4.13.

PB 2 (TCN ...) Call up the Tactical Aid to Navigation (TACAN) submenu. The currently selected TACAN channel is listed next to the button (e.g., 112X or 056Y). See p. 2.66.

PB 3 (IFF NORM/AUTO/OFF) Cycle through levels of Identification Friend or Foe (IFF) — OFF (no queries are sent), NORM (A/A radar contacts are queried when you press **IFF_INTERROGATE** [I]) or AUTO (A/A contacts are queried automatically when they are designated as targets). See p. 2.67.

PB 4 (TF NORM/OFF) Toggle the Terrain Following (TF) radar on (NORM) and OFF. You must have the AN/AAQ-13 pod of the LANTIRN system mounted on your aircraft in order to activate the TF radar. See p. 2.67.

PB 5 (ILS ON/OFF) Toggles the Instrument Landing System (ILS) ON and OFF. When on, ILS information is displayed on the HUD and ADI in NAV or INST master modes. See p. 2.68.

PB 6 (NAV/TCN/TGT STR) Cycle the current steering data between NAV, TCN and TGT. Note: There must be a TACAN station in range for TCN to be available, and you must have an A/G target designated for TGT to be available. See p.2.68.

PB 7 (N-F NORM-WH/NORM-BH/OFF) Cycles the HUD FLIR display through OFF (no FLIR imagery displayed), NORM-WH (FLIR imagery displayed, hottest areas appear white) and NORM-BH (FLIR imagery displayed, hottest areas appear black). See p. 2.69.

PB 8 (HUD DATA) Call up the HUD options submenu. See p. 2.69.

PB 9 (A/P OFF/ATT/ALT/HDG/NAV/TCN) Calls up the autopilot (A/P) submenu. The abbreviation next to A/P tells you if the system is inactive (OFF) or, if active, tells you which autopilot submode or combination of submodes is being used (ATT = attitude hold, ALT = altitude hold, HDG = heading hold, NAV = coupled steering to steer point, TCN = coupled steering to current TACAN station). See p. 2.70.

PB 10 (STR ...) Cycle through steer points. The currently selected steer point is listed next to STR. See p. 2.71.

1. LOW ALTITUDE WARNING (LAW) SUBMENU

When active, the Low Altitude Warning system alerts you if you fall below a certain radar altitude. On the LAW submenu, you can turn the system on and off and set the altitude at which the warning sounds.

PB 3 (DECREASE) Decrease the altitude at which the system warns you that you're flying too low, by 100ft per click.

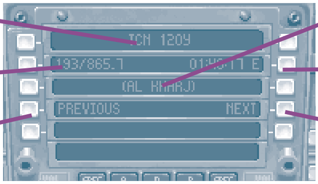
PB 8 (INCREASE) Increase the LAW altitude by 100ft per click.

PB 5 (ON or OFF) Toggle LAW system on and off. Current status appears next to the button.

The **current LAW altitude setting** is displayed next to PB 2.

2. TACTICAL AID TO NAVIGATION (TACAN) SUBMENU

Airfields and tanker aircraft use TACAN channels to provide pilots with position information. Each airfield or tanker has a different station ID and operates on a TACAN channel ranging between 001 and 023. Ground stations are identified with the letter "Y" after the channel number; aerial tankers are identified with the letter "X." You can select different channels via the TACAN UFC menu.



Current channel. Displayed between PBs 1 and 10.

Station ID. Name of the station using the current channel (between PBs 3 and 8).

Range (RNG). Distance in nm to this station.

Heading (HDG). Heading to the current station in degrees.

PB 4 (PREVIOUS) Switch to next lower TACAN channel.

PB 7 (NEXT) Switch to next higher TACAN channel.

PB 9 (ETA or ETE) Toggles between a display of your Estimated Time of Arrival (ETA) or your Estimated Time Enroute (ETE) for the currently selected station.

3. IDENTIFICATION FRIEND OR FOE (IFF)

Aircraft use "friend or foe" transponders to determine another aircraft's alignment. The transponders on allied aircraft will return a "friendly" message when queried by another allied aircraft.

There is no menu for the IFF system. The IFF button on the UFC main menu (PB 3) cycles through control options for IFF interrogation. The currently selected option appears next to the button:

OFF No IFF queries can be sent to A/A radar contacts.

NORM Currently displayed A/A radar contacts will be identified when you press **IFF_INTERROGATE** [I] (after a couple of seconds of processing delay).

AUTO The primary designated A/A radar target is automatically queried when the radar locks on to it.

See **Contact Symbology**, p. 2.55, for pictures of the symbols that mark friendly and enemy aircraft on the A/A radar display.

This option controls only IFF interrogation, not IFF response. Your aircraft will automatically respond to all IFF queries.

4. TERRAIN FOLLOWING (TF) RADAR

The Terrain Following radar calculates your above ground level (AGL) altitude from radar returns off of terrain. It can only be activated if the AN/AAQ-13 pod of the LANTIRN system, which houses the radar, is mounted on your aircraft before you take off. (For details on choosing a loadout with this option, see **Deciding What to Take**, p. 4.7.) There is no menu for the TF radar — the TF button (PB 4) on the main UFC menu toggles the radar on (NORM) and OFF.

LAW is automatically set to half of the TF altitude when TF is set to NORM. TF altitude is set to the altitude you are flying at when you engage the TF radar.

5. INSTRUMENT LANDING SYSTEM (ILS)

The ILS (Instrument Landing System) is a ground- or carrier-based system that adds vertical and horizontal alignment symbology onto your HUD and ADI to aid you when landing. There is no menu for the ILS system — The ILS button (PB 5) on the UFC main menu toggles the ILS on and off. For an explanation of ILS function and features, see **Additional HUD Symbology: ILS Symbology**, p. 2.23.

6. STEERING DATA (NAV/TCN/TGT STR)

PB 6 on the UFC main menu cycles through *steering modes* — NAV, TCN and TGT.

NAV When enabled, steer point data is displayed in the steering data block of the HUD. If coupled steering is enabled on the A/P Submenu of the UFC, autopilot (when enabled) will steer toward your currently selected steer point when it is enabled.

TCN When enabled, TACAN station data is displayed in the steering data block of the HUD. If coupled steering is enabled on the A/P Submenu of the UFC, autopilot (when enabled) will steer toward the currently selected TACAN station. (***Note:*** *A TACAN station must be within range for you to select this option*.)

TGT When enabled, data for your currently selected A/G target point is displayed in the steering data block of the HUD. If coupled steering is enabled on the A/P Submenu of the UFC, autopilot will steer toward this target point. (***Note:*** *You must have an air-to-ground target designated to select this option*.)

See **Basic HUD Symbology: Steering Data Block**, p. 2.7, for a detailed description of the steering data block, and **9. Autopilot (A/P) Submenu**, p. 2.70, for an explanation of coupled steering.

7. NAVFLIR (N-F)

The NAVFLIR system projects Forward-Looking IR camera imagery onto your HUD. It is essentially a night vision aid — it allows you to "see" an infrared image through the HUD. NAVFLIR is intended to help you with navigation — terrain features show up better against the sky at night when viewed with IR. You may also see the "hotter" returns of aircraft and vehicles, but the Targeting IR is somewhat better designed for tracking these (see **12. Targeting IR Page**, p. 2.38).

There is no menu for the NAVFLIR. Pressing the N-F button (PB 7) of the UFC main menu cycles the HUD FLIR display through OFF (no FLIR imagery displayed), NORM-WH (FLIR imagery displayed, hottest areas appear white) and NORM-BH (FLIR imagery displayed, hottest areas appear black).

You must have the AN/AQ-13 pod of the LANTIRN system loaded on your aircraft for NAVFLIR to be available. See **Interface: Arming**, p. 1.10.

8. HUD OPTIONS SUBMENU

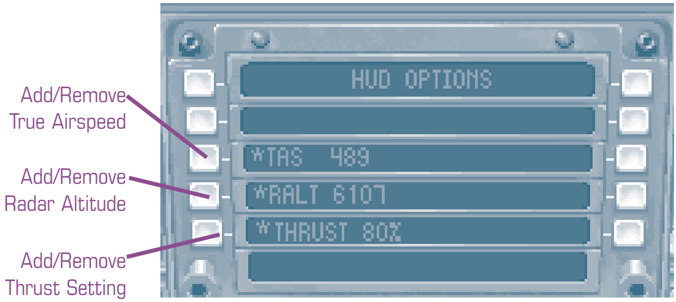
The HUD Options Submenu allows you to modify your HUD by adding and removing the data listed below. To add one of the options below to the HUD, click on its pushbutton until an asterisk appears in front of the option on the submenu. To remove the option from the HUD, click the pushbutton again and remove the asterisk.

PB 3 (TAS ...) Add/remove true airspeed info from the HUD. The number listed is your current TAS.

PB 4 (RALT ...) Add/remove radar altimeter from the HUD. The number listed is your current radar altitude.

PB 5 (THRUST) Add/remove thrust percent display from HUD.

For information on where these features appear and what they indicate, see **Customizable Basic Symbology**, p. 2.9.



9. AUTOPILOT (A/P) SUBMENU

The A/P submenu is displayed when you select PB 9 from the UFC main menu.

Selecting the A/P submenu is not the same as activating the autopilot — the A/P menu controls the features of the autopilot, but the autopilot will not take over control of the aircraft unless you activate it. Press **AUTOPILOT** A, or click the A/P button on the UFC keypad to toggle the autopilot on and off.

Current A/P mode is displayed in the window between PBs 1 and 10. The autopilot has five modes:

A/P OFF Autopilot is currently disengaged. Press **AUTOPILOT** A or click on the A/P button on the keypad of the UFC to toggle the autopilot on and off.

If you *manually select* one of the following modes, the autopilot will enter the selected mode when engaged. An asterisk marks an enabled mode on the submenu.

A/P STR Coupled steering is enabled — PB 2 (STR MODE) enables and disables this mode. When enabled, the autopilot alters your current flight heading to steer toward the currently selected TACAN station (STR MODE - TCN) or steer toward your current steer point (STR MODE - NAV).

A/P ALT Altitude hold is enabled — PB 4 (ALT HOLD) enables and disables this mode. When altitude hold is enabled, the autopilot alters your flight attitude and pitch so that your current altitude (barometric or radar) is maintained.

If neither of these modes is enabled, the autopilot will *automatically* enter one of the following modes when you press **AUTOPILOT** A or click on the A/P button on the keypad of the UFC. Which mode you enter depends on your bank angle:

A/P HDG *Heading hold mode* — entered if your bank angle is less than 7°. Autopilot maintains your current pitch and heading but levels your wings.

A/P ATT *Attitude hold mode* — entered if your bank angle is greater than 7°. Autopilot maintains your current pitch and bank angle.

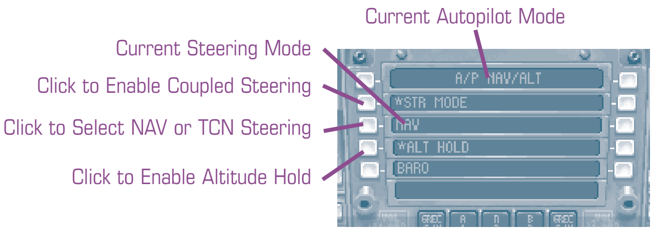
Pushbutton Features

PB 2 (STR MODE) Enable/disable coupled steering — see above.

PB 3 Toggle between NAV and TCN steering modes.

PB 4 (ALT HOLD) Enable/disable altitude hold — see above.

PB 5 Toggle **altitude source data** for the altitude hold feature between barometric (BARO) and radar altimeter (RDR).



10. STEER POINTS (STR ...)

Steer points are a set of points that mark your planned route. They are numbered and used to maintain course during a mission. Steer points that mark areas for weapons delivery are called target points and the points prior to target points are called initial points (TSD, A/G radar); all are considered steer points, however.

Normally, as you exit a steer point, the next steer point in sequence automatically becomes your currently selected steer point. PB 10 of the UFC main menu allows you to manually cycle through steer points.

UFC DATA MENU

The UFC data menu allows you to change certain symbology on the HUD and displays current position data. Click the DATA button on the UFC keypad to call up the UFC data menu.

PB 1 (NAV ...) Cycle through steer points. (See **10. Steer Points (STR ...)**, p. 2.71.)

PB 6 Toggle all **HUD time displays** between LOCAL and ZULU time. Local time is time with respect to the time zone you are in; ZULU time is time with respect to the Greenwich meridian. Time is given in hours:minutes:seconds.

PB 8 Toggle between **heading/range** and **fuel remaining** data for the look-ahead steer point. *Heading* is given in degrees and *range* in nautical miles. *Fuel remaining* is an estimate of the amount of fuel you will have left when you reach the steer point, in pounds, based on the current fuel flow.

PB 9 Toggle between a display of **ETA** and **ETE** for all steer point data blocks (on the HUD, on the HSI, etc.). *ETA* is Estimated Time of Arrival, or the time at which you will arrive at the steer point. *ETE* is Estimated Time Enroute, or the amount of time it will take you to get to the steer point. Time is given in hours:minutes:seconds.

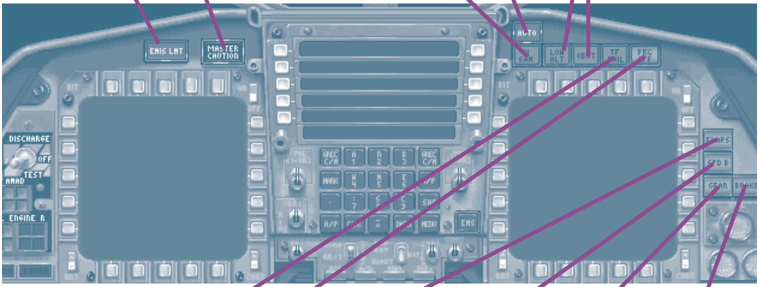
PB 10 Toggle between **heading/range** and **fuel remaining** data for the currently selected steer point, given as above.

TIME. Lists the current game time beside *PB 5*.

ADDITIONAL COCKPIT FEATURES

INDICATOR LIGHTS

These lights indicate the status of certain systems, or that you have exceeded certain flight parameters.



EMIS LMT. Indicates the ICS system (internal jammer) and the APG-70 are prevented from emitting. The EMS button on the keypad of the UFC toggles EMIS LMT on and off. See **Up Front Controls (UFC)**, p. 2.64, for details.

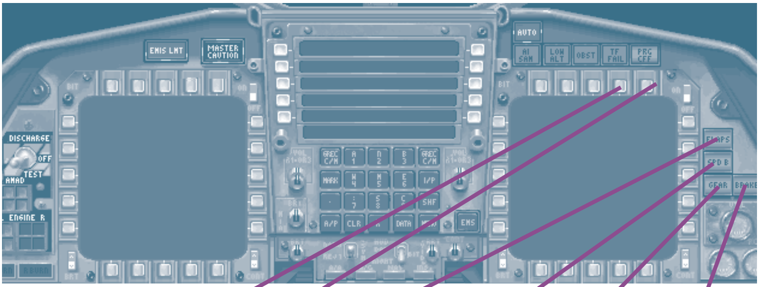
MASTER CAUTION. Indicates a warning light is on — click MASTER CAUTION to display a list of indicator lights for different systems. Lights that are on indicate damaged systems. See **Master Caution Panel**, next page.

AUTO. Indicates autopilot is active. Press the **AUTOPILOT** A, or click the A/P button on the UFC keypad to toggle the autopilot on and off. See **Up Front Controls (UFC)**, p. 2.64, for details.

AI/SAM. Indicates an airborne interceptor (aircraft) or SAM has locked onto you.

LOW ALT. Indicates you are flying below the altitude set for the Low Altitude Warning (LAW) system. See **1. Low Altitude Warning (LAW) Submenu**, p. 2.66, for details.

OBST. Indicates the terrain-following (TF) radar has detected a terrain obstacle in your flight path. If it is possible that the autopilot will not be able to pull up in time to avoid the obstacle, this light will flash — take manual control of the aircraft to avoid crashing!



Terrain-Following Radar Failure
Chaff Program
Flaps Extended
Speed Brake Extended
Gear Down
Wheel Brakes Applied

TF FAIL. Your TF radar system is no longer operational. (For, a description of the TF radar, see **4. Terrain-Following (TF) Radar**, p. 2.67.)

PRG CFF. When TEWS control is set to SEMI, this light indicates a chaff program is ready to be released. When TEWS control is set to AUTO, this light will flash when running a chaff program (i.e., chaff is being released).

FLAPS. Indicates your flaps are extended.

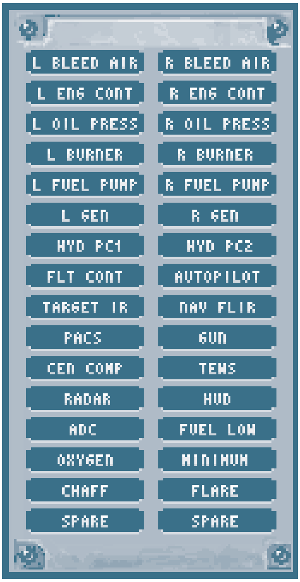
SPD B. Indicates your speed brake is extended.

GEAR. Indicates your gear is down.

BRAKE. Indicates your wheel brakes are applied.

MASTER CAUTION PANEL

The lights on this panel warn you of systems damage and malfunctions.



L/R BLEED AIR. Bleed air leak in the left (L) or right (R) engine. If you don't shut down the engine immediately, you run the risk of a fire starting.

L/R ENG CONT. Left or right engine control inoperative. You cannot afterburn, and your maximum engine thrust is reduced.

L/R OIL PRESS. Left or right engine oil pressure is low. If you don't shut down the engine immediately, you run the risk of a fire starting.

L/R BURNER. Left or right afterburner is inoperative.

L/R FUEL PUMP. Left or right fuel pump is failing or inoperable. If both lights are lit, descend below 30,000ft and do not exceed military power, or you risk flaming out your engines.

L/R GEN. Left or right generator is failing or inoperable. If both lights are lit, you've lose most displays (the ADI will continue to function via an emergency generator — see **Standby Instruments**, p. 2.77). You've also lose control of your speed brakes.

HYD PC1/2. Primary hydraulic circuit 1 or 2 is inoperable. When both lights are lit, you have no radar, no speed brake control and reduced flight control authority. (When the UTIL hydraulic gauge is red you have even less control — See **Standby Instruments**, p. 2.77.)

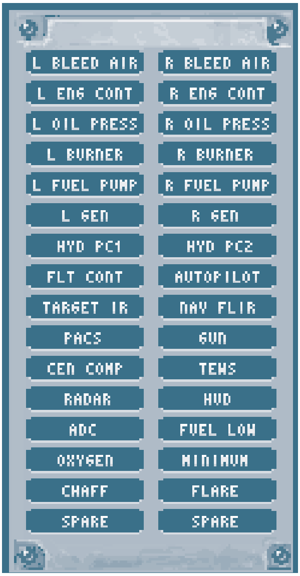
FLT CONT. When lit, the Control Augmentation System (CAS) is inoperable. See **Flight: Auto-Control Systems**, p. 3.11, for details on this system.

AUTOPILOT. Autopilot system inoperable.

TARGET IR. Target IR camera system inoperable.

NAV FLIR. NAV-FLIR system is inoperable.

PACS. When lit, you can't release weapons, except by jettison.



GUN. Gun inoperable.

CEN COMP. Central computer out. You will lose all displays — HUD, MPDs, UFC, etc.

TEWS. TEWS is inoperable. (You can still able drop chaff and flares manually.)

RADAR. Radar inoperable.

HUD. You've lost HUD display.

ADC. Air Data Computer damaged or inoperable. You lose pitch ratio, autopilot altitude hold and all HUD symbology except heading scale.

FUEL LOW. Lights up when total fuel is less than 2000 lbs.

OXYGEN. Oxygen is low. You will eventually black out if you do not reduce altitude below 10,000ft.

MINIMUM. Lights up when chaff or flares are low.

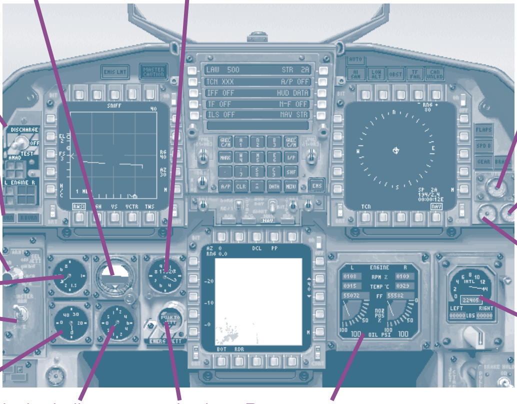
CHAFF. Flashes when you are dispensing chaff. Constantly on when chaff is at minimum.

FLARE. Flashes when you are dispensing flares. Constantly on when flares are at minimum.

STANDBY INSTRUMENTS

These are the analog counterparts to the computerized HUD system and can be relied upon in case of systems failure. Most are present in both cockpits, and only the angle-of-attack and vertical velocity indicator require main generator power. All others either require no power, or they are patched into both the main and emergency generators.

You will need to use **VIEW_PILOT_MPD** F2 view to see the standby instruments in the pilot's seat.



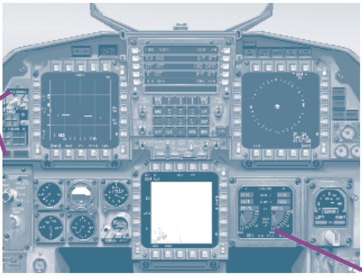
Airspeed indicator. The airspeed indicator operates off of pitot-static pressures and requires no power. It registers indicated airspeeds between 60 and 850 knots.

Altimeter. The standby altimeter operates from a static pressure source and requires no power. The setting on this altimeter sets the barometric pressure for the Air Data Computer (ADC), which is then used to compute barometric altitude for other systems, such as the HUD and ADI MPD.

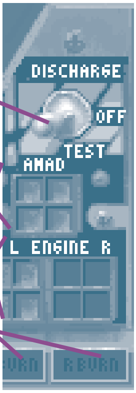
Angle-of-Attack indicator. The AoA indicator is located in the front cockpit only and is driven by electrical signals from the AoA probe. Angles from 0° to 45° are displayed. An OFF message is displayed if electrical power is lost, Air Data Computer (ADC) data is invalid, or the indicator itself fails.

Attitude Director Indicator (ADI). This is a self-contained, electrical gyro-horizon instrument that indicates the aircraft's attitude relative to the horizon.

Compass. This conventional magnetic aircraft compass is only located in the front cockpit.



Engine Monitor Display (EMD). Although not an analog instrument, this LED display duplicates data from the engine data MPD — RPM%, engine temperature, fuel flow, nozzle position and oil pressure. When engine data exceeds the display range of the EMD, that display window will go black. For an explanation of these features, see **Engine Data Page**, p. 2.58.



Fire warning panel/extinguisher. Consists of a switch, several buttons and lights.

The extinguisher switch has three settings:

DISCHARGE Discharges extinguisher into selected areas. Use AMAD and L ENGINE R buttons (described below) to select the areas where the extinguisher is dispensed. (Note that the more areas you select, the less extinguishing material reaches any given area.) The extinguisher can only be discharged once.

OFF Normal switch position.

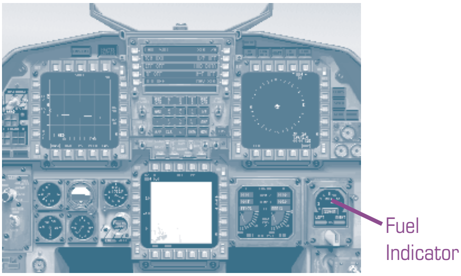
TEST Tests all lights.

The lights and buttons work as follows:

AMAD The lights on this display come on when there is a fire in the Airframe Mounted Accessory Drive (a device which connects the engine to generators and hydraulic pumps on the aircraft). Press the lights, then flip the extinguisher switch to DISCHARGE.

L ENGINE R These lights alert you to a fire in the left or right engine. Push the lights to select either or both engines, then flip the extinguisher switch to DISCHARGE.

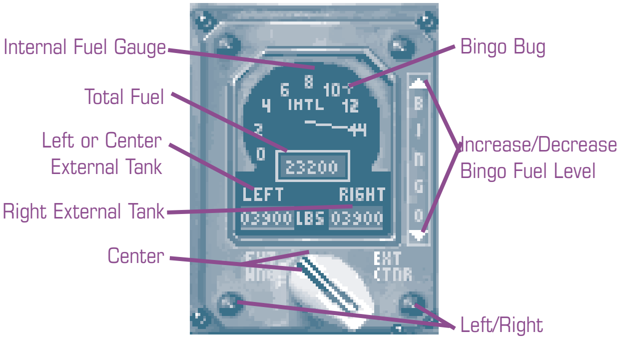
The *AB burn-through* lights indicate that a fire has been detected in the left or right afterburner can. To put out the fire, refrain from using your afterburners until the light goes out.



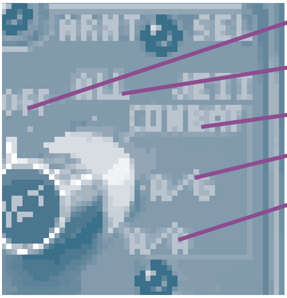
Fuel indicator. Indicates the level of fuel in internal and external tanks. The analog gauge at the top of the display shows the amount of fuel remaining in the F-15's internal tanks. The numerical gauge below this shows total fuel remaining. Below this, two numerical gauges show the amount of fuel in the two external wing tanks or the external centerline tank, depending on which is selected with the dial at the bottom of the display. (The right gauge reads 0000 when centerline is selected). All fuel readings are given in pounds.

A bingo bug on the analog gauge marks the current bingo fuel setting. When ***total fuel*** reaches bingo level, an audio warning will alert you. The bingo bug adjustment switch allows you to increase and decrease the bingo fuel setting. (Bingo fuel is the amount of fuel thought necessary for you to get back to base. If you have less than this amount, you may not make it.)

Fuel from the centerline tank is used first, then fuel from the wing tanks, then internal fuel.



Hydraulic gauges. Indicates current hydraulic pressure in each of the three hydraulic systems — 1, 2 and UTIL. See **Master Caution Panel:** HYD PC**1/2** (above) for details on what happens when these systems fail.



Jettison dial and button. The dial selects what will be jettisoned when you click on the pushbutton. (Master arm does not have to be ON for you to jettison.) Gun ammunition is never jettisoned.

OFF	No ordnance can be jettisoned
ALL	All ordnance
COMBAT	External fuel tanks
AA	Air-to-air ordnance (except missiles on wing stations, which cannot be jettisoned)
AG	Air-to-ground ordnance

Master arm switch. This switch has two settings — ON and SAFE. When master arm is set to SAFE, no weapons can be fired. When set to ON, all ordnance can be released. When master arm is ON, the gun cross appears on the HUD (in all master modes).

Vertical Velocity Indicator (VVI). The VVI operates by electrical signals from the ADC. It displays vertical velocity on a 0 to 6000ft./min. scale. An OFF message appears if power is lost or the display is malfunctioning.

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FLIGHT

Air combat is often a one-on-one fight to outmaneuver your opponent, point your nose at him and fire off your weapons first. Understanding how and why your aircraft maneuvers is essential for combat success.

Flight Physics (below) explains the basic physics principles of flight. **G-Forces** (p. 3.5) discusses the physics of turning, G-forces, **Flight Envelope** (p. 3.5) discusses aircraft limits, and **Flight Characteristics** (p. 3.9) covers how to maximize turn performance. **Flight Controls** (p. 3.7) describes some of the control surfaces of the aircraft and explains how to maneuver the aircraft. The final sections cover takeoffs and landings, stalls, spins and refueling.

FLIGHT PHYSICS

The following sections give a basic understanding of the forces at work behind flight. For technical references, please see **Appendices: Bibliography**, p. E.1.

Flight is the result of several forces acting upon an aircraft. The first is the aircraft's *weight*, or the gravitational force pulling it toward the ground. The second is *thrust*, the force produced by the engines that propels the plane through the air. This forward movement causes air to move over the wings, which in turn creates a *lift* force that counteracts the gravitational force. The final force acting on an aircraft is *drag*. Drag is a force that is generated in a direction opposite to flight.

Multiple forces can act on an object simultaneously, and in several directions. The individual forces are called *component forces*, while the overall effect of these forces is called the *net* or *resultant* force.

THRUST

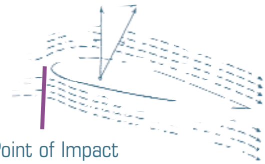
Generating thrust is the main purpose of an aircraft's engines. This force is what causes the aircraft to overcome *inertia* (an object's tendency to resist a change in motion). Thrust produces forward motion, allowing the aircraft's wings to create lift.

For aircraft, a common measure is the *thrust-to-weight* ratio. This is a ratio between an aircraft's total weight and its thrust capability. A ratio greater than 1:1 indicates that an aircraft can overcome gravity in a vertical climb. The F-15E's dual afterburning engines can each generate approximately 23,450 pounds of thrust (with the PW-220 engine).

When thrust is created, it propels the aircraft forward and causes air to move over and under the wing surface. This creates a pressure differential that pushes up on the wing (details are given in the following section). Thrust also brings about changes in velocity.

LIFT

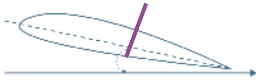
Lift is produced when an airfoil (the wing) moves through the air and splits it. Half of the air goes over the wing, and the other half travels under the wing. This air flowing around the wing separates at the *point of impact* (see diagram) and flows both over and under the exterior surfaces.



The top surface of the wing is more curved, and thus longer than the bottom surface (see diagram). Because of this, the air that goes *over* the wing has more surface area to travel than the air that goes *under* the wing.

Since air on top of the wing has a longer distance to travel, it must travel at a greater velocity than the air on the bottom. The faster airflow over the top surface of the wing creates a lower pressure on the top of the wing than on the bottom. This results in a *pressure differential*, or an imbalance of pressure forces between the top and bottom of the wing. The net force pushes upward, causing lift.

ANGLE OF ATTACK



The amount of lift produced by the wing varies according to the angle at which the wing hits the air. This is called the *angle of attack* (AoA). This should not be confused with an aircraft's *attitude*, or the pitch angle of the nose relative to the horizon. In the F-15, AoA is measured in units, while attitude is measured in degrees.

There is no single angle-of-attack on which you can rely all of the time — the desired angle varies with the situation. In some cases, you may want to maximize your aircraft's cruise range by keeping AoA around 14 units; this will deliver maximum range. In other cases, conserving energy during a turn may be the primary concern, and you might need an AoA of 16 - 22 to make an optimal, energy-sustaining turn. For acceleration, an AoA of 8-10 works best.

If the AoA is too high, an audio tone will activate in the cockpit, warning of an impending stall. To check your AoA, look at the symbol and number directly below the indicated airspeed on the left side of the HUD. This shows your angle of attack in units. See **Cockpit: Basic HUD Symbology**, p. 2.5, for more information.

DRAG

Drag is a force that causes an aircraft to resist movement in the direction of flight. Any object that moves through a fluid (and air is a type of fluid) produces friction. In aircraft, drag is caused by the friction of air against the wings as the aircraft moves forward, as well as a buildup of pressure due to air pushing against the aircraft's surfaces.

Induced drag is the rearward component of lift. As the wings produce more lift, they also produce more drag. *Wave drag* occurs as the aircraft approaches Mach 1. More pressure is created in front of the aircraft's wing than behind it, which creates a backward drag force. Finally, *parasitic drag* includes wind resistance and all other types of drag that are not lift-induced.

No matter what type of drag is encountered, the overall performance of an aircraft depends on the relationship of the *coefficient of drag* to the *coefficient of lift*. Different angles of attack yield differing amounts of lift and drag. Each aircraft has an ideal combination of angle-of-attack, thrust and lift, and different types of drag occur at different airspeeds.

AIRSPEED

As an aircraft travels through the atmosphere, air flows over the surfaces of the aircraft. This flow creates pressure. At higher altitudes, air is less dense, and less air flows over the aircraft's surfaces. By measuring the pressure of the airflow, the F-15's *pitot tube* allows the flight computer to compute airspeed.

Because of atmospheric density, a difference can exist in the computed airspeed of an aircraft flying at one altitude with a constant thrust and AoA, and the same aircraft travelling at a different altitude under the same thrust and AoA conditions. For this reason, an aircraft has both an *indicated airspeed* (apparent velocity, based on current air density and altitude) and a *true airspeed* (airspeed corrected for variations due to air density and altitude).

As an example, imagine you're in an aircraft flying at an altitude of 5000 feet at 350 knots (true airspeed), and a second aircraft is flying at 30,000 feet at the same true airspeed. Because the second plane is flying at a higher altitude (and through less-dense air), the pitot tubes on the two aircraft measure different indicated airspeeds. The upper aircraft registers a slower indicated airspeed than your aircraft at the lower altitude. If you and the other pilot are trying to arrive somewhere at the same time, you both need a reading that you can compare regardless of altitude. This adjusted reading is the true airspeed.

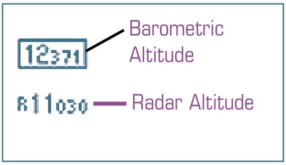
By comparing true airspeeds, you and the other pilot can figure out if one aircraft is actually traveling faster than the other. Even though the indicated airspeeds might differ, if the true airspeeds are the same, you'll arrive at your destination at the same time.

AoA and Airspeed

Although thrust is the force behind airspeed, the angle of attack (AoA) greatly affects airspeed. If you're trying to fly a level path, it's important to remember that you must accompany any change in AoA with a change in throttle to keep altitude constant. At very low speeds (i.e., during takeoffs and landings), the effect of AoA on speed is most pronounced.

As a guideline, first select your AoA using the flight stick, then adjust the throttle until you are flying. (In the game, your current indicated airspeed — in KIAS, or knots indicated air speed — appears in the rectangle on the left side of the HUD, as well as in the ADI MPD. See **Cockpit: Basic HUD Symbology**, p. 2.5.)

ALTITUDE



An aircraft gains altitude as a result of lift. As with airspeed, altitude can be expressed in several ways. The two most important altitude measurements in the game are the *indicated* (barometric) and *radar* altitudes. In the Up Front Control display, you can choose whether or not to display radar altitude. (See **Cockpit: Customizable Basic Symbology: Radar Altitude**, p. 2.9.)

Barometric altitude gives your altitude above sea level (ASL). *Radar altitude* indicates your altitude above the ground over which you are flying (AGL).

Altitude reduces engine performance as a result of lower atmospheric air pressure. As altitude increases, air becomes less dense. An aircraft's *critical altitude* is how high it can fly while maintaining normal engine power. There is a certain limit to how high an aircraft can fly with any efficiency. At 25,000 feet, an aircraft's jet engines are only producing about half the power they can at sea level.

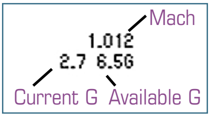
G-FORCES

The relationship between the forces of lift and weight can be described in terms of "G." 1G is equivalent to the gravitational force on an object at sea level. An airplane in level flight experiences 1G of force, as the earth pulls on it.

G-forces are most commonly felt during sharp turns or heavy accelerations, and can be positive or negative. Positive Gs during a turn push you back into the seat, while negative Gs exert a pulling effect. In high-G maneuvers, your heart must work harder to pump blood away from the direction of the pull.

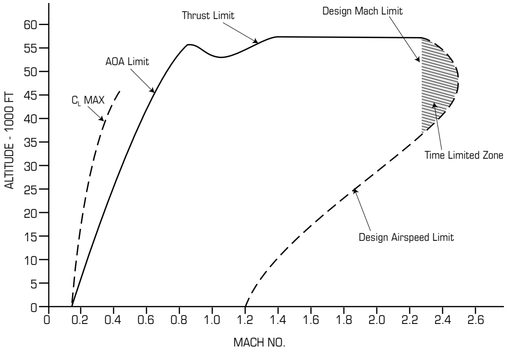
A well-trained pilot can endure about 9-10 positive Gs for a limited time — anything beyond that can cause tunnel vision or blackout. Blood collects in the lower torso and the legs, denying blood to the brain. Eyesight starts to "gray-out," and eventually you will black out. A similar condition called "red-out" occurs when the aircraft pulls too many negative Gs — blood collects in the upper regions of the body, and the blood vessels in the eyes swell. This causes your vision to go red. Usually, this starts occurring after several seconds of flying at -3Gs or greater.

The F-15E Strike Eagle has a superior airframe that can withstand more Gs than its pilot can. Both red-out and black-out effects are accurately simulated in the game. For this reason, you must pay attention to your current G-force level by checking your HUD. If you exceed your available G limit, an audio warning will sound in the cockpit.



THE FLIGHT ENVELOPE

Lift is a function of an aircraft's speed, altitude and angle-of-attack. All of these factors work together to produce flight, and all three must be considered together when talking about how airplanes maneuver. Their limits are graphically described by an aircraft's flight envelope.



Above is a flight envelope diagram for the *F-15* Strike Eagle. As G-forces change, the positions of the curves may change accordingly.

The fighter's altitude is on the vertical axis. Its speed measured in Mach numbers is on the horizontal axis. The curve plotted on the graph represents the envelope limits at 1G. This is a simple depiction of the F-15E's performance limitations; different weapon configurations require adjusted envelopes since they modify weight and drag.

ABSOLUTE LIMITS

Angle of Attack (AoA). Angle-of-attack is one of the most important considerations in the flight envelope. No matter what altitude, loadout or airspeed the aircraft has, AoA is a limiting factor. Generally, the safe operating AoA limit for the F-15E is 30 units. For maximum lift, the AoA should be about 17 units. If AoA becomes too steep, a high-pitched, 900-hertz audio tone will activate in the cockpit.

In the flight envelope, the solid, ascending part of the curve shows the maximum lift available at subsonic speeds. Toward the top of the curve (flight at higher altitudes and speeds), buffeting and other airflow-induced turbulence will occur.

In the game, the current AoA reading appears just below the indicated airspeed on the left side of the HUD.

Airspeed. The right section of the curve shows the F-15E's maximum airspeed at different altitudes. Higher airspeeds are possible at higher altitudes because the air is less dense, and therefore, less induced drag occurs. Exceeding the airspeed edge of the envelope can cause structural damage to the aircraft.

The F-15E's airspeed limit is about 800 knots, and its Mach limit is 2.5. These limits vary slightly according to weapon and fuel loads.

Mach number. The upper right section of the curve shows the maximum mach speed limits. Note the dashed area on the right tip of the graph — flight within that part of the envelope is time limited. Maintaining Mach 2.3+ speeds for longer than that can cause structural overheating.

Thrust. The flat, top part of the curve indicates the maximum airspeed that can be obtained at max thrust while maintaining a level flight path. Climbing to a higher altitude will reduce airspeed, and (if the AoA is too high) cause the aircraft to lose altitude and come back into the flight envelope.

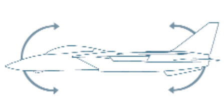
G-forces. The aircraft can sustain several negative Gs for about ten seconds, although this depends partly on the fuel and weapons load. The example envelope gives the flight envelope for 1G of force. If greater G-forces are incurred, the envelope changes shape. The aircraft's maximum G-force capability and current G-force reading appear on the HUD.

FLIGHT CONTROLS

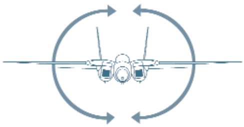
Lift is normally generated perpendicular to the wing. Movable control surfaces — ailerons, elevators and rudders — alter this lift to rotate the aircraft around its aerodynamic center. You use these controls to maneuver the airplane.

PITCH, ROLL AND YAW

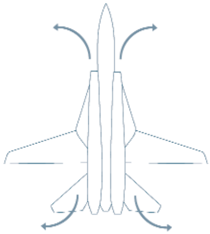
Aircraft maneuver in three dimensions: *pitch*, *roll* and *yaw*. These dimensions are always referenced from the pilot's point of view, regardless of the aircraft's orientation or flight attitude. When you move one of the aircraft's controls, you're providing *input*.



Pitch



Roll



Yaw

Pitch is the movement of an aircraft's nose up and down. Pitch is controlled by the aircraft's stabilitor— the flat, rear control surface on the F-15E (sometimes referred to as the elevator). During a pitch maneuver, the entire stabilitor surface angles up or down. This causes a difference in pressure above and below the stabilitor surface, and pitches the nose of the aircraft down or up, accordingly.

Roll is controlled by the aircraft's ailerons. Ailerons, like flaps, are hinged panels on an aircraft's wings. Unlike flaps, ailerons move in opposition to each other, increasing lift on one wing and decreasing lift on the other. This difference in lift causes one wing to dip down as the other rises, which rolls the aircraft about its nose-tail axis. The F-15E's rudder can also be used to induce roll.

Yaw is the sideways movement of an aircraft's nose. The attitude of the aircraft (angle of the nose) remains constant, while the aircraft pivots left or right. Yaw is controlled by the aircraft's tail rudders.

Combination movements that involve both pitch and yaw inputs result in *coupled motion*—motion that occurs along both the longitudinal and directional axes. By contrast, simple movements (yawing or pitching up) are non-coupled motion. Yaw can be coupled with pitch to create a banking turn or a rolling effect.

FLIGHT STICK

Moving the stick forward or backward moves the aircraft's stabilator and causes a change in pitch. Pulling the stick back, or *applying aft stick*, causes the aircraft's nose to rise. Pushing the stick forward — *applying forward stick* — causes the aircraft's nose to drop. Moving the stick right and left, or *applying lateral stick*, controls the ailerons. For example, moving the stick left causes the aircraft to roll left; moving it right rolls the aircraft to the right.

RUDDER PEDALS

The rudder pedals move the aircraft's rudders, controlling yaw. Applying right rudder yaws the aircraft's nose right. Pushing the left rudder yaws the aircraft's nose left. The F-15E has a rudder lockout at speeds greater than Mach 1. This means that above that speed, you can't apply any more rudder input. The lockout is a safety feature designed to keep the aircraft under control.

Rudder usage also induces roll. When using rudder, the aircraft will roll in the direction that rudder is applied. Rudders are primarily used for lining up shots and spin recovery. Control them with rudder pedals if you have them, or use the **RUDDER_LEFT** [,] or **RUDDER_RIGHT** [.] keystroke functions.

THROTTLE

The throttle controls the engine's thrust output. Pulling the throttle back decreases engine output. Pushing the throttle forward increases engine output. The engine's maximum output without using afterburners is called *mil power*. Afterburners increase engine thrust by dumping raw fuel into the engine's exhaust then igniting it. The increase in thrust is significant, but fuel is consumed much faster.

In the game, you control the throttle position with a throttle device as described below. Or, you can use the corresponding keyboard throttle functions to control your thrust.

Throttle Position	Effect	Keystroke Function
Move completely forward	Increase throttle to full /engage afterburners	**THROTTLE_AB** [\]
Move most of the way forward	Increase throttle to military power	**THROTTLE_MIL** [Shift][=]
Move slightly forward	Increase throttle	**THROTTLE_UP** [=]
Move slightly backward	Decrease throttle	**THROTTLE_DOWN** [–]
Move completely backward	Throttle to flight idle	**THROTTLE_IDLE** [Shift] [–]

To display the current throttle reading on the lower left corner of the HUD, see **Cockpit: Customizable Basic Symbology**, p. 2.5.

FLIGHT CHARACTERISTICS

Flight characteristics are a collective set of tendencies that reflect an aircraft's stability and maneuverability. An aircraft's shape, weight, external stores and built-in flight control systems determine it's basic flight characteristics in a specified flight envelope. As changes occur in the center of gravity, lift, speed and momentum, the flight characteristics may vary. A fully loaded aircraft traveling at Mach 2 at an altitude of 30,000 feet isn't going to act the same as a lightly loaded plane.

TURN PERFORMANCE

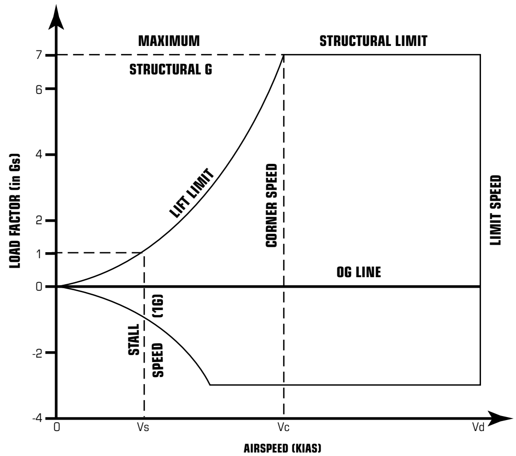
An aircraft's *turn performance* is its ability to change direction during flight. This is often referred to as maneuverability. The number of Gs an aircraft can pull in a turn is a general indication of how tightly it can turn.

An aircraft's maximum turn performance can be characterized in two ways — *instantaneous* and *sustained*. The acceleration felt during a turn is the *load factor*.

Load Factor. This is a component of the centrifugal acceleration created during a turn. Making a turn increases the aircraft's acceleration and adds G-force — this is called the *load factor*. The higher the airspeed, the greater the load factor during a turn.

Instantaneous Turn Capability. This refers to an aircraft's best turn performance at any one instant in time. As speed and altitude change, so does the aircraft's instantaneous-turn capability. The amount of lift an aircraft can produce relates directly to instantaneous-turn performance.

A V_n diagram is a graphical representation of the load factor versus the airspeed. Above the 0G line, the aircraft pulls positive Gs; below it, the aircraft pulls negative Gs. Lift limits for various airspeeds and load factors are also shown on the graph.

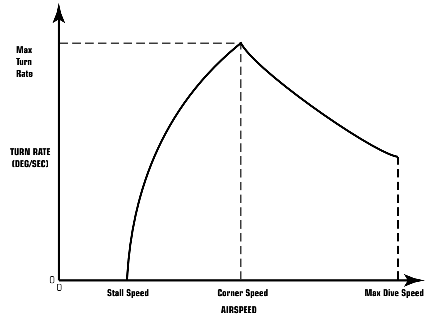


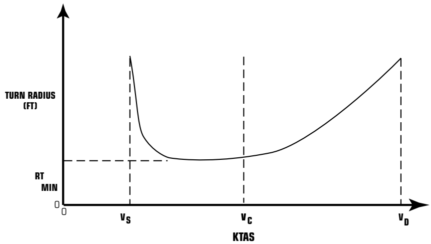
Sustained Turn Capability. In a sustained turn, the aircraft maintains a specific turn rate and radius for some time. The load factor must be at least 1G to maintain current lift and altitude. At higher load factors, turn performance improves, but drag increases. The overall sustained turn capability of an aircraft depends on its thrust-to-weight ratio and its lift capability.

Lower airspeeds yield optimal sustained turns — in general, the lower your airspeed (to a point), the more quickly you can execute a turn. This gives credence to the old fighter pilots' adage "Slow down, and get there faster."

Turn Rate and Turn Radius

Turn performance is measured in terms of turn rate and turn radius. *Turn rate* is the number of degrees per second a particular aircraft can turn. Higher airspeeds and smaller bank angles slow down the turn rate. *Turn radius* is the radial distance required to complete the turn. The radius increases with velocity and decreases with a more extreme bank angle. A high turn rate and a low turn radius yield the best turn performance.





Angle-of-attack (AoA) affects turn performance. During a *maximum turn* (the tightest turn possible), the AoA should be near (but not exceed) 30 units. In an *optimum turn* (the fastest turn possible), the intent is to save momentum while sacrificing turn radius. The AoA during this type of turn is less, usually falling inside the 16-22 unit range.

Corner Speed

For any given altitude, the speed at which maximum lift occurs without structural damage during a turn is known as the *corner speed*. The corner speed gives the best turn performance — that is, the highest possible turn rate with the lowest possible turn radius. At the corner speed, the aircraft experiences its maximum instantaneous turn performance.

The V_n diagram above shows corner speed. Note that the corner speed occurs at a velocity that provides maximum lift at the structural boundaries of the aircraft.

AUTO-CONTROL SYSTEMS

Each aircraft has unique handling capabilities that result from the aircraft's shape, size, weight and structural strength, and the F-15E is no exception. The Strike Eagle has several systems that assist you in handling the aircraft.

The first of these is the Control Augmentation System (CAS), which attempts to stabilize the G-forces the aircraft experiences during normal flight within the flight envelope. The CAS is designed to automatically modify your original pitch, roll and yaw inputs to account for varying flight conditions. If CAS is operating correctly, you can maintain a certain stick force and a certain G-force during flight, regardless of speed or load changes.

Another system used in the F-15E is the Pitch Trim Compensator (PTC), which automatically *trims* the aircraft's pitch. (The process of trimming involves using the aircraft's onboard computer to automatically make fine adjustments to maintain stable, 1G flight.)

Aircraft handle differently at higher Mach numbers and angles-of-attack, and it's easy to overcompensate with the flight controls. The F-15E's Automatic Flight Control System (AFCS) helps bridge this gap by modifying each control input you provide so that the adverse effects of changing speeds and AoA are minimized. This allows you to take advantage of the Strike Eagle's entire flight envelope.

The AFCS can adjust for unbalanced weapon and fuel loads and single-engine failure. It can also make certain adjustments when the aircraft is in its landing configuration. However, if the AoA is too high during these conditions (over 30), undesired yaw may occur.

FLIGHT DISRUPTIONS

While modern aircraft have overcome many aerodynamic limitations, they're still not completely immune to problems. If airflow is sufficiently disrupted by a steep AoA or yaw maneuver, the aircraft can depart from its normal flight path and enter a spin or stall. The next sections talk about adverse flight conditions under which disruptions might occur and describes how to recover from them.

Most flight disruptions have early cues that, if noticed, can be addressed before the situation becomes more severe. Under each discussion, you'll find cue and recovery entries — study these, and you'll be equipped to recognize problems as they occur. If you stay within the aircraft's limits, most problems can be avoided.

If the aircraft is not responding to any flight control inputs, it is out of control. Not much can be done to regain normal flight until the controls respond. In some cases, the only choice may be to bail out. Sometimes, you can use the flight controls to neutralize the undesired movement. Other times, it's best to leave the controls alone.

ADVERSE YAW (HIGH AOA)

Adverse yaw is the movement of the aircraft's nose (or rear) to one side, also known as *sideslip*. The nose points in a different direction than the aircraft is actually flying. This occurs naturally when you use the aircraft's ailerons to make a banked turn — the wing that dips during a left-hand bank incurs less drag than the opposite wing. This makes the airplane yaw to the right, even though the turn is to the left. In some aircraft, you must apply rudder in the direction of the turn to overcome undesired yaw and make a *coordinated turn*.

In the F-15, the CAS automatically compensates for adverse yaw by adding rudder input. However, during a high-speed, high-AoA turn, problems can result.

Cues. The slip indicator and/or velocity vector indicates sideslip in one direction. In a roll maneuver, the roll rate may decrease, or the roll may reverse direction.

Recovery. The AFCS automatically compensates for this. However, you can reduce AoA and apply more rudder in the direction of the turn until the slip ball in the HUD is centered.

DEPARTURE

Departure is a general term used to describe an undesired change in the aircraft's flight path. In most cases, departure occurs when AoA is high and directional stability (stability on the wing-wing axis) is disturbed by uneven weapon and fuel loads. Departures often occur at high altitudes and high AoA, when the center of gravity is too far forward, or when you give control inputs in the wrong direction while the aircraft is unstable.

Cues. High AoA can contribute to departure. The first indication normally resembles an early stall, and a yaw tone may sound. As departure occurs, the aircraft starts yawing or rolling to the right or left without any input from you. If you don't deal with this immediately, the aircraft may enter a spin.

Recovery. If you watch for early signs of a stall, you can usually prevent departure. If it does occur, quit pushing the flight stick sideways, and reduce AoA by pushing forward on the stick. You can apply additional rudder if the departure is severe.

AUTOROLL

True to its name, the autoroll is a prolonged roll that continues even after the flight stick and rudder are in neutral positions. This is one type of coupled motion, usually caused by starting a roll using the rudder while AoA is high and airspeed is between 200-300 knots. If all you do is reduce AoA, the roll simply speeds up.

Cues. The aircraft rolls and accelerates even after you neutralize the flight stick and rudder. AoA remains high, and the HUD registers a negative G-force.

Recovery. To prevent autorolling, don't apply sharp rudder while AoA is high, and don't make quick pitch/yaw motions. If it does occur, apply rudder in the direction opposite the roll and lower the AoA. Once the roll slows down, the nose will drop.

SPINS

A spin is a type of coupled motion that occurs when one wing (but not the other) loses a significant amount of lift. It is almost always preceded by departure. The wing drops, pulling the aircraft into a rotating, spiral dive that combines roll and yaw. A spin can consume several thousand feet of altitude per revolution, and spin recovery may require several revolutions. Spins at low altitude are extremely dangerous.

There are several different types of spins:

A *flat spin* is characterized by high negative G-forces (up to -4G). The yaw rate is between 75 and 135 degrees per second (a full circle every two to five seconds) and, for the most part, remains constant. AoA is low, accounting for the "flatness" of the spin.

An *oscillatory spin* resembles severe yaw, at least from your perspective as a pilot. One wing is stalled (or close to stalling), and control attempts fail. The yaw rate usually falls between 60 and 90 degrees per second (a full circle every four to six seconds), and AoA usually exceeds 70 units.

An *inverted spin* can occur if you stall while experiencing negative G-forces. Most often, this happens when you suddenly drop the nose by pushing the stick forward, then apply full rudder or roll inputs. The yaw rate nears 45 degrees per second (a full circle about every eight seconds) and remains constant, and AoA is usually around negative 60.

An *inadvertent nose high* or *nose low spin* occurs when you make a steep vertical climb at low airspeed. The aircraft loses speed and the controls fail until the aircraft falls back and regains airspeed through a dive.

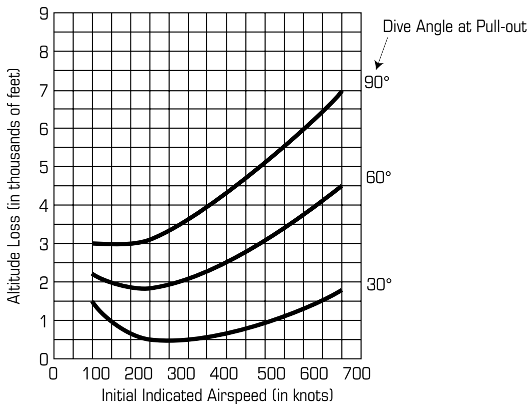
Spin Recovery

A spin used to be nearly unrecoverable. However, spin recovery procedures possible in the F-15 make most spin situations survivable. You'll need several thousand feet of altitude to recover from a spin, so make sure you've got room to try. (For major emergencies, you can command the **PILOT_EJECT** Shift E function.)

In the game, use the following steps if you find yourself in a spin:

1. Center your joystick. Using the ailerons to bank often aggravates the spin.
2. Apply full opposite rudder.
3. Push your joystick forward slightly to keep the nose down.
4. Maintain these stick and rudder positions until the aircraft stops spinning. You will generally find yourself in a low-speed dive — a perfect target for enemy aircraft. Increase throttle until you reach a speed of around 200 knots, gently pull out of the dive and return to normal flight.
5. If the aircraft is still unwilling to recover after the steps above, go through the procedure again.
6. If it still doesn't work, eject.

Dive Recovery — Emergency Pull-Out Chart



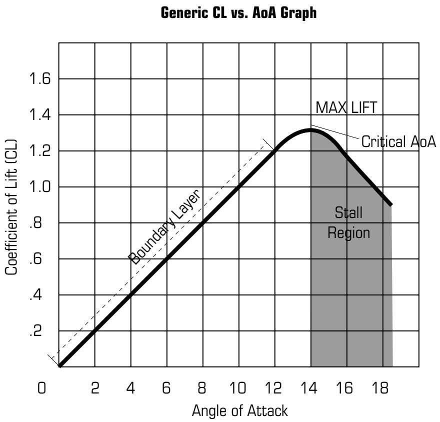
STALLS

A stall occurs when AoA exceeds maximum allowable levels and smooth airflow over the wings is disrupted. It is the condition under which any increase in AoA decreases lift.

As an aircraft flies straight and level, its wings meet airflow at a low AoA. As the airplane pitches up, AoA increases and thus lift increases — up to a point. If the angle becomes too steep, the force of the air pushing backward is greater than the force of the air pushing up. Called the *critical angle of attack*, this is the point past which the wings cease to create lift.

If AoA passes the critical point, the layer of air moving around the airfoil becomes turbulent. It no longer separates and flows around the wing in an optimal fashion. Stability is reduced, lift vanishes, and the aircraft can literally fall out of the sky. This is known as a *stall*. Increasing AoA in an attempt to pull out of a stall will aggravate the stall.

The adjacent generic graphic illustrates that increasing AoA will increase lift up to a point, called the "critical AoA." Beyond this point, the effective surface area on the top of the wing that is being used to create lift is reduced.



Stall Avoidance/Recovery

- Always monitor airspeed, especially if you're pitching above 45°. Watch your external stores as well. If you're carrying a full load of air-to-ground weapons, your aircraft will be heavier, and it will require more airspeed for adequate lift.
- Take particular care to avoid stalls at low speeds and altitudes. If you can't dive to regain speed, you're going to buy the farm.
- To recover from a stall, push the stick forward to reduce your angle-of-attack and add engine power.

TAKING OFF AND LANDING

This section introduces the basics of flight and teaches you how to take off and land in the F-15E. For information on the F-15E's cockpit, see **Cockpit**, Chapter 2.

The first rule to learn about takeoffs (and landings, for that matter) is that you should use your throttle, not necessarily the flight stick, to control your altitude. By throttling up or down, you can directly affect the amount of available lift.

TRAINING MISSIONS

The game's training simulator provides several missions that let you test your takeoff and landing skills.

To practice, select a mission and left-click ACCEPT. Read the briefing text, and when you're ready to practice, left-click FLY.

TAKEOFF

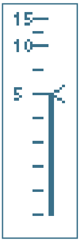
You can achieve a good takeoff by following a few simple guidelines:

- Make sure flaps are extended. (This is their default position at takeoff in the game.) When flaps are down (extended), the green flap indicator light on the right side of the console glows (**FLAPS** F).
- Release the wheel brakes (**WHEEL_BRAKES** B).
- Increase throttle to full by rolling your joystick's throttle device all the way forward (**THROTTLE_AB** \). (Afterburners automatically activate when you operate at full throttle.)
- Watch the boxed number on the left side of the HUD — this represents your current indicated airspeed. (See **Airspeed**, p. 3.3.) The number should be increasing.
- When you gain enough airspeed (see chart), pull back on the flight stick.

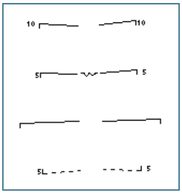
  Takeoff speed varies according to how much fuel you're carrying, and how many external weapons are loaded onto the aircraft. Lightly loaded aircraft require less airspeed, while heavier aircraft must travel faster to lift off the ground. The following chart gives general guidelines for takeoff speeds at various weights.

TAKEOFF SPEEDS - MAXIMUM THRUST (KIAS)			
GROSS WEIGHT (LBS)	ROTATION	NOSEWHEEL	LIFT-OFF
40,000	110	133	159
45,000	115	136	162
50,000	120	140	166
55,000	125	145	169
60,000	130	150	173

Three speeds are listed. The first is rotation speed, the point at which you initiate pullback. The second number indicates the speed at which you will experience nosewheel liftoff. The third number gives the speed at which you will become airborne. In between the first and second speeds, you should apply aft stick to maintain a pitch angle of about 12 degrees.



- After takeoff, relax the pressure on the flight stick to neutral. Keep an eye on your current radar altitude — the boxed number on the right side of the HUD.
- Pitch the nose up slightly (between 10° and 20°, but don't exceed 30°).
- Relative to the watermark, the horizontal ladder lines in the middle of the HUD display your current pitch (in degrees). The more angled the lines, the greater the pitch angle. The tiny brackets on the outside edges of each line point toward the horizon. Positive angles are solid, while negative angles are dashed.



Don't confuse pitch angle with AoA — the first compares the angle of the aircraft's nose relative to the horizon, while the second describes the angle at which the wing meets the air. AoA appears just below the indicated airspeed on the left side of the HUD. See **Angle of Attack (AoA)**, p. 3.2.

- Once you're sure that you're safely airborne, retract the landing gear (**LANDING_GEAR** G).
- Retract the flaps (**FLAPS** F).

Extending flaps increases lift during takeoff and landings, but also increases drag. Raising flaps after takeoff reduces lift and drag during normal flight.

- Reduce throttle to the desired cruise setting. The most efficient airspeed for climbing is around 300 to 350 knots.

LANDING

Landing is a challenging task, and a rewarding finale to a successful mission. If you want to practice landing, try flying the landing tutorial mission.

To make a safe landing, you must first make a good approach, flying in at the correct speed, altitude and direction. A number of factors come into play when landing.

Direction. Flying toward your last steer point should correctly orient you so that you're flying directly toward the airbase. When you can see the runway, make sure you're aligned with it.

Angle-of-Attack. Your current angle of attack appears on the left side of the HUD. Remember, during landing, use the *throttle* primarily to control AoA and altitude, not the flight stick. By throttling up or down, you can alter the amount of available lift, and therefore, your altitude. Be careful about pitching the nose up and down — at low airspeeds, this can be problematic and may cause a stall.

During the final stages of landing, keep the AoA steady between 20-22 units. Use the throttle to adjust this as necessary.

Instrument Landing System

To correctly align your aircraft with the runway — especially at night or under reduced visibility — you'll need to rely on the Instrument Landing System (ILS) and indicators on your HUD.

This system places horizontal and vertical "needle" indicators onto your HUD that help you line up with the runway. You can activate the ILS when you're about 10-20nm away from the runway.

Activating ILS

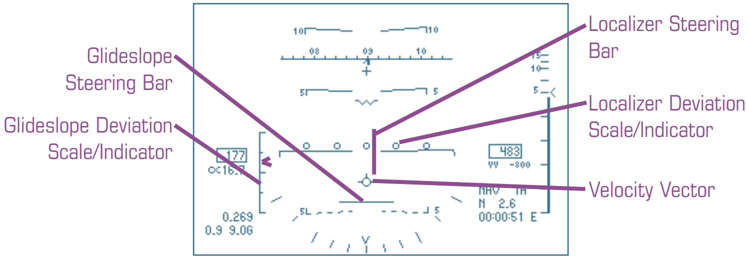
- Fly within approximately 10nm of the runway.
- Make sure Navigation or Instrument master mode is active.

  NAV or INST should be glowing yellow on the master mode pushbutton (near the bottom of the cockpit display — if not, left-click that button). You can also use the **MASTER_MODE_SELECT** M key.

- Press the ILS pushbutton (PB #5) in the UFC. (The text will then read ILS ON.)

  In this manual, the MPD and UFC pushbuttons are numbered 1-20, beginning in the upper left and moving counterclockwise. PB #5, for instance, refers to the bottom left UFC pushbutton. See **Cockpit: Multipurpose Displays (MPDs)**, p. 2.24 and **Up-Front Controls**, p. 2.64.

The ILS has several indicators that help you correctly line up. The idea is to maneuver so that the horizontal and vertical steering bar lines form a cross and fall on top of the velocity vector indicator. These indicators appear on the ADI as well.



Glideslope Steering Bar. This horizontal line indicates your altitude relative to a 3° glideslope (the optimal angle for descent.) If you are above this glideslope, the velocity vector will be above this line. If you are below this glideslope, the velocity vector will be below the line.

Glideslope Deviation Scale/Indicator. This scale on the left side of the HUD measures your deviation from the recommended 3° glideslope. A small, v-shaped caret shows your current deviation. The center of the scale marks the recommended glideslope. The top tick marks 1° above the glideslope, while the bottom tick marks 1° below.

Localizer Steering Bar. This vertical line indicates your horizontal lineup with the runway. If you are to the left of the runway, the velocity vector will be to the left of this line. If you are to the right of the runway, the velocity vector will be to the right of the line. This bar shows your position relative to the center line of the runway and doesn't depend on your heading.

Localizer Deviation Scale/Indicator. This row of dots in the center of the HUD measures your deviation from a dead-on (straight-ahead) approach to the runway. A vertical arrow marks your current deviation. The center circle marks a dead-on approach. The leftmost circle marks a 2.5° deviation to the left of the runway, and the rightmost circle marks a 2.5° deviation to the right.

Velocity Vector (Flight Path Indicator). The velocity vector is a circle that moves around on the HUD. It indicates the direction in which your aircraft is actually moving (which is often different from the direction in which your nose is pointing).

When landing, keep the velocity vector centered over the lined-up localizer and glideslope steering bars. Steer toward the center of the cross. This will give you the ideal landing approach.

Making the Landing

Follow these steps to make the final approach.

- Adjust thrust so that you've got about 300 knots of airspeed. If the throttle is about 25% power and you're still going too fast, use the speed brake to bleed off some airspeed.
- At 230 knots, lower the landing gear and flaps (**GEAR** G, **FLAPS** F).
- Use the throttle to keep the AoA between 20-22 units.
- Make slight throttle adjustments to gain or reduce airspeed and lift as necessary. Use the rudder if you need to make slight yaw adjustments to stay lined up with the runway.
- Overlap the horizontal and vertical ILS steering bars so that they form a symmetrical cross. Then, center the velocity vector over this cross. When this happens, you are descending at the correct glideslope angle (3°). Finally, use your throttle and rudder to keep the lines crossed and centered on top of the velocity vector.
- Check your pitch angle. Just prior to touch down, it should read about 12° or so, and your AoA should be approximately 21 units.
- At touch down, reduce throttle to idle (move the throttle device all the way back).
- (Optional) Activate the speed brake S. At the same time, maintain a pitch angle of 12° or so. This helps soften the nose wheel landing, and also uses wind resistance against the aircraft to bleed off some speed.
- When your speed slows to about 80 knots, drop the nose down onto the runway.
- Apply the wheel brakes (**WHEEL_BRAKES** B).

Aborting a Bad Landing

If you're too low, too high, too fast or too slow, you may not be able to correct your landing in time. If this happens, abort the landing and try again:

- Punch your throttle to 100% (move the throttle device all the way forward), but don't change course.
- Retract the flaps and speed brake (if active).
- Raise the landing gear.
- Climb back to an altitude of 6,000 feet.
- Make a wide 180° turn to the left, straighten out, and try a second approach from the original direction.

NAVIGATING

This section describes basic navigation terms and covers different navigational tasks that you'll use every time you fly. It also covers in detail the various navigational functions of important cockpit displays.

TERMS

Before exploring the wild blue, you should be familiar with the following navigational terms:

Sequence point. A set of coordinates denoting a geographic location. These points are stored in the aircraft's computer and collectively form your flight route. A graphical representation of these points appears in a cockpit display called the **Tactical Situation Display Page** (see p. 2.34).

Bearing. Lateral direction relative to your plane's nose, measured in degrees from 0° to 360°. An enemy directly to your right has a bearing of 90°, no matter what direction you're traveling.

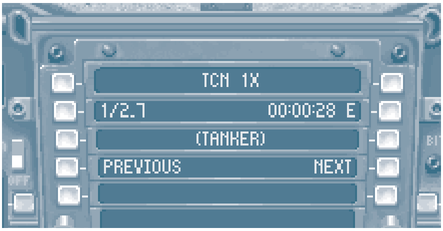
Heading. Direction relative to true north, measured in degrees from 0° to 360°. If you're heading north, your heading is 0°. If you're flying due south, your heading is 180°. If you're flying southwest, your heading is 225°. You can always determine what your current heading is from the heading scale (see p. 2.6).

TACAN. Tactical Aid to Navigation, which refers to signals broadcast by airbases and aircraft. These signals act as beacons and can aid in navigation.

TACAN SIGNALS

TACAN stands for Tactical Aid to Navigation, a system that many friendly ground stations and airborne tankers use to emit a signal broadcasting their position. TACAN channels provide pilots with positional information. Each TACAN object (such as an airfield or tanker) has a different station ID and operates on a unique TACAN channel.

Not all missions contain TACAN objects. In the ones that do, you can activate different TACAN channels in the UFC display via the TACAN submenu. To access this display, select the TCN pushbutton in the UFC (PB #2).



Initially, the selected channel defaults to the initial TCN channel, if one is available. (If not, "xxx" appears.) When one is available, a channel number will appear, followed by a letter. Ground stations have the letter "Y" after the channel number, while airborne aircraft have an "X."

To select a TACAN signal:

- Select the TCN pushbutton on the UFC display (PB #2).
- Cycle through available TACAN channels. To select the previous channel, click the PREVIOUS pushbutton (PB #4). To select the next one, click the NEXT pushbutton (PB #7).

  The station ID (name) of the current channel station appears in parentheses. Its bearing and range appear on the left above the name, and the estimated time-to-arrival (or time-on-route, if selected) appears on the right above the name.

Select the dark gray MENU pushbutton on the UFC keypad to return to the UFC main menu display.

To follow a TACAN signal:

- Select a TCN station as previously described.
- Switch to Navigation master mode, if it isn't already active, by selecting the NAV master mode pushbutton at the bottom of the screen.

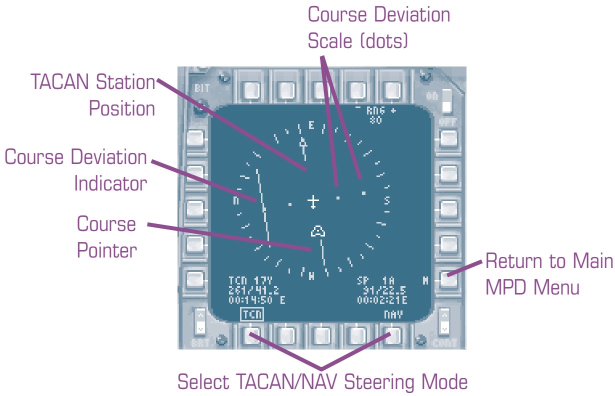
The Nav master mode activates the Air-to-Air Radar MPD (left display), Horizontal Situation Indicator (HSI) MPD (right display) and Tactical Situation Display (TSD) MPD (low, center display). In addition, it places a bank angle indicator and information about the current sequence point on the HUD.

- Select the TCN pushbutton (PB #6) in the HSI MPD or select the TCN STR pushbutton (PB #6) in the UFC display (see **Cockpit: Up Front Controls**, p. 2.64). This activates TACAN steering, meaning that the navigational system will now track TACAN signals instead of sequence points in the HSI.

Once you switch the tracking method, more information displays on the HSI. The line with the arrow is called the *course pointer* and points toward the physical location of the TACAN station. If the object is within HSI range, that station will appear on the HSI as an icon.

A second, parallel line called the *course deviation indicator* indicates how far off course you are relative to the course pointer. It drifts left or right, but should ultimately be centered on the course pointer.

The row of five dots is the *course deviation scale*, which remains perpendicular to the course pointer. Try to line up the course deviation indicator with the center dot. Each dot from the center represents 5° of error. If you have more than 10° error, the course pointer will be pinned to the edge of the compass rose.



- Adjust your heading so that the HSI course pointer arrow faces the top, and the course deviation indicator is directly on top of it. If you continue on this course, you'll be flying toward the TACAN signal.

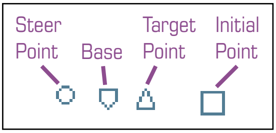
With TCN steering active, you can also select an autopilot mode that will automatically follow the chosen TACAN signal. See **Autopilot Modes**, p. 3.27, for details.

SEQUENCE POINTS

Sequence points denote navigational paths that are set before flight in the Briefing Screen and stored in the aircraft's computer. (See **Interface: Briefing**, p. 1.6.) Generally speaking, you fly to *steer points*, *initial points* and *target points* to complete your mission flight path. It isn't required that you visit points other than your target location, but the preplanned sequence points indicate the best probable path for accomplishing the mission.

A pictorial representation of them appears in your Tactical Situation Display (TSD) MPD. In the TSD, steer points, initial points and target points are connected by lines that indicate your planned flight path. You may be able to change some of these points before taking off.

The TSD and its navigation and color map information can be useful when navigating — see **Cockpit: Tactical Situation Display Page**, p. 2.34.



Base point. The original airbase from which you took off is marked by a homeplate-shaped *base* icon.

Steer points. Series of geographical points that mark the route you are to fly. In the TSD, they are represented by small, sequentially numbered circles.

Target points. Target points are marked by numbered triangles, and indicate areas at which air-to-ground weapons will be launched — see **Combat: Finding and Designating Targets**, p. 4.51.

Initial points. An initial point indicates a steer point just prior to a target point. Initial points are numbered squares.

Navigating Through Sequence Points

All sequence points — steer, target and initial points — are numbered, and may be followed by a letter (3A, for example). You follow the points in order. Once you are within range of a particular point, the navigation system automatically selects the next sequence point. You can manually change sequence points as well.

See **Cockpit: Steering Data**, p. 2.68, for more information about sequence point numbering.

To change the selected Sequence Point:

- Press the STR pushbutton (PB #10) in the upper right corner of the UFC.

The number of the currently selected navigation point appears to the right of STR. Each time you click the pushbutton, the number changes to reflect the next sequence point in order. You can also cycle through sequence points by assigning this function to the keyboard. (See **Cockpit**, p. 2.71, for details.)

To fly toward the next Sequence Point:

- Center the *command heading bug* on the heading scale.

> To see what direction you're currently flying, look at the heading scale at the top of the HUD. It gives your current heading in tens of degrees (36 indicates 360°, etc.).

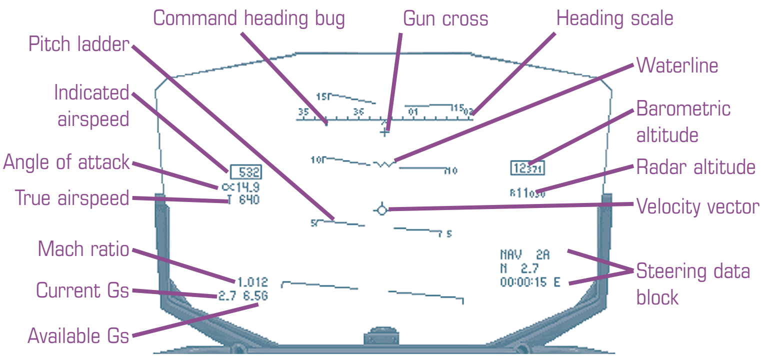
If you're already headed in the right direction, a small, heavy line will be directly underneath the heading scale. (See **Cockpit: HUD**, p. 2.5.) This line, called the *command heading bug*, indicates the heading of your current sequence point. Try to keep this line centered on the scale. Bank slightly if necessary.

If the bug moves off the scale, a small number appears to the right or left of the scale, indicating the heading for that sequence point. Bank toward the number until the command heading bug reappears in the HUD.

To view Sequence Point information on the HUD:

- Switch to NAV, A/G or INST master mode. (Press a master mode pushbutton just below the UFC keypad.)

When one of these master modes is active, the HUD displays three lines of text in the lower right corner. This text is collectively known as the steering data block and gives you information about your current sequence point. The top line gives the alphanumeric description (2A, for example). The second line gives the compass direction, followed by the range in nautical miles. The third line gives an estimated time of arrival (ETA) or estimated time en route (ETE). See **Cockpit**, p. 2.7.



Steering

You can select a steering mode in the Horizontal Situation Indicator (HSI) MPD by selecting a steering type (TCN — the system tracks TACAN signals, or NAV — the system tracks sequence points). See **TACAN Signals**, p. 3.22, for information about TACAN beacons.

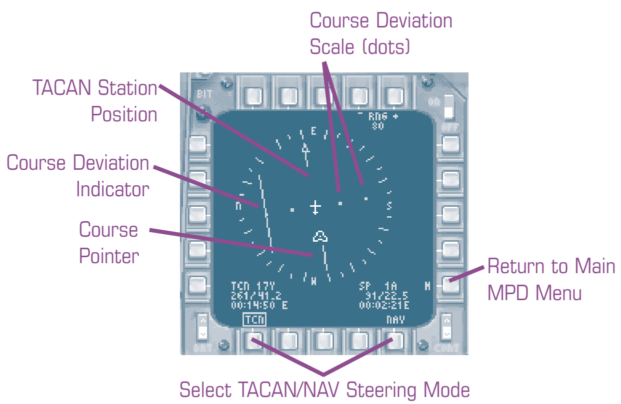
The HSI appears on the right MPD by default in Navigation master mode and shows a top-down view of the area around your aircraft. Your position is marked by the small aircraft symbol in the center of the display, with the nose always oriented to the top of the display. The current steering mode is boxed. To switch modes, select the TCN or NAV pushbutton (PB #6 or #10).

When NAV steering is active, your next scheduled sequence point appears as a circle. As you fly, the circle moves to reflect where you are in relation to that sequence point.

When TCN steering is active, a long line with an arrow (course pointer) gives you a constant idea of what heading adjustments you need to make to fly toward the TACAN signal. A second, parallel line (course deviation indicator) shows your horizontal alignment with respect to the TACAN signal — if it's not centered on the course pointer, you need to yaw or bank toward the signal. (See the picture below.)

No matter which steering mode is active, the bottom right corner displays range, bearing and estimated time-to-arrival information about the current sequence point. The bottom left corner displays the same information for the current TACAN signal, if one is active in that mission.

See **Horizontal Situation Indicator Page**, p. 2.32, for more information about this MPD.



AUTOPILOT MODES

The F-15E's autopilot system is complex and has several modes available. You activate autopilot by selecting the AUTO pushbutton (PB #9 in the UFC menu), and you set the mode using the UFC. You can also use the **AUTO_PILOT** function mapped to the keyboard (A).

If neither ALT HOLD or STR MODE autopilot is selected via the UFC (which is the default state), the autopilot automatically defaults to one of two modes. If you are banked beyond 7°, you automatically enter into an *attitude-hold* autopilot mode (which maintains your current pitch and bank angle). Otherwise, if your bank angle is less than 7°, you go into a *heading hold* autopilot mode (which maintains level wings, along with your current heading and pitch attitude).

Most autopilot modes deactivate automatically when AoA exceeds 20 units, bank angle exceeds ± 60°, pitch angle exceeds ± 45°, G-force exceeds available Gs or speed falls below 250 knots.

To switch modes:

- Press the A/P pushbutton (PB #9) in the UFC. This displays the autopilot submenu.
- Select a mode. An asterisk appears next to the active autopilot mode. You can select either ALT HOLD or STR MODE.

  STR MODE (Steering Mode) Puts autopilot in coupled steering mode, meaning that the autopilot will fly toward something. In the HSI, you can use pushbuttons (PB #6 and #10) to choose between TCN (flies toward the selected TACAN signal) or NAV (flies toward the selected navigational steer point). The currently selected steering mode appears on the next line as TCN or NAV. You can also switch steering modes by pressing PB #6 in the UFC main menu.

  ALT HOLD (Altitude Hold) Maintains your current radar (or barometric) altitude. The currently selected altitude type appears on the next line as RAD or BARO — you can toggle between them by pressing the pushbutton next to the name (PB #5).

AUTOPILOT AND TERRAIN-FOLLOWING RADAR

Whenever you activate terrain-following radar by pressing the TF pushbutton in the UFC (PB #4), it overrides any active autopilot functions and resets the autopilot mode to OFF. The reason this happens is that when you turn off terrain-following radar at low altitudes, you don't want to resume with an old autopilot mode active — especially if there's a mountain in front of you.

Terrain-following radar autopilot mode automatically deactivates if your airspeed falls below 375 knots.

REFUELING

If you're on a long mission, chances are that a tanker aircraft will be available for refueling. By locating and radioing a tanker, you can approach it and link up in mid-air to replenish your fuel supply. Be forewarned, however, that good refueling hookups take a lot of practice. Also, at higher difficulty levels, the allowable margin of error decreases.

You can use the game's ***Auto Refuel*** function to automatically refuel (**AUTO_REFUEL** Alt F). Or, you can follow these steps:

- Activate the HSI MPD, if it's not displayed. (Select HSI from the MPD main page.)
- Press the TCN pushbutton in the lower left corner of the HSI (PB #6). This activates TACAN tracking — see p. 2.66 for details.
- Locate a tanker and get its TCN bearing. Not all missions have tankers available. (Campaign missions will list tankers in the mission briefing.) You can locate tankers in one of two ways:

  Method 1. Select the TCN pushbutton in the UFC (PB #2). Keep clicking NEXT in the UFC until TANKER appears in the description field (see picture on p. 3.30). When this happens, you've got the tanker's TCN signal locked. The tanker's heading and channel appear below the name in the window.

  Method 2. Activate communications (**RADIO2_TRANSMIT** Shift Tab) and select AWACS. (Press the key corresponding to the number of the message.) If an AWACS aircraft is available, that message option will be bolded. Select REQUEST CLOSEST TANKER. The AWACS will radio the TACAN bearing of the closest tanker, if a tanker is also available in that particular mission.

- Once you have the tanker's TCN bearing, adjust your heading so that you're flying toward the tanker. The range and bearing of the tanker appear in the HSI.

  One quick way to approach the tanker is to activate TCN steering mode and use your aircraft's autopilot function. To do this, select A/P in the UFC, then STR MODE to set autopilot to follow a selected TCN signal. (See **Autopilot (A/P) Submenu**, p. 2.70, for more details on changing modes.) You can then activate autopilot by left-clicking the AUTO button on the cockpit console or you can use the keyboard command **AUTOPILOT** A. ***If you use this method, be sure to deactivate autopilot when you're within 5nm of the tanker.***

- When the range is about 15nm or so, activate communications and send a TANKER REQUEST message (**RADIO1_TRANSMIT** Tab).

The tanker will acknowledge your request and change its holding pattern to match your current bearing. It will relay its new bearing, current speed and refueling altitude in thousands of feet ("Angels 10," for instance, means 10,000 feet of altitude).

- Look for the tanker in your A/A Radar page (the default left MPD in Navigation master mode).
- Once you're about 5nm away from the tanker, set your radar to SNIFF mode (press the SNIFF pushbutton — PB #18) to disable the radar. The radar won't transmit, and existing data on the display is not updated. (Pressing the EMIS LIMIT E pushbutton accomplishes the same thing. The WSO will select EMIS LIMIT if you forget.)
- Change your altitude and heading as necessary to approach the tanker's position. The TCN display in the UFC provides up-to-date range and bearing information.
- Approach the rear of the tanker. Your altitude should be slightly lower than that of the tanker. Once you're within 100 feet or so of the tanker, you'll start receiving more specific cues from your WSO. After you are past the pre-contact position, he'll tell you to come left, right, etc.
- You'll see the boom in front of you. The nose of your aircraft should line up with the base of the tanker's right wing.
- Once the boom connects with your aircraft, follow the tanker's light cues to stay in position — the two light strips on the bottom of the tanker will display green lights for slight adjustments (detailed below), while red lights indicate more pronounced adjustments.

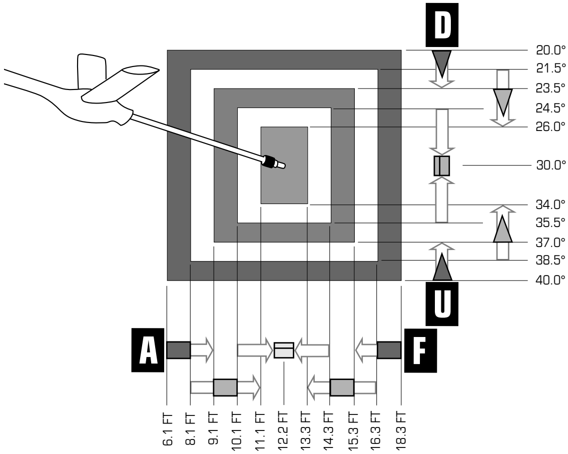
Right Strip — Aft/Forward Indicator Lights (A/F)

Solid red rectangle	You're too far back/forward. Move toward front/back of tanker.
Solid green rectangle	You're slightly too far back/forward. Move toward front/back of tanker.
Striped green rectangle	You're centered. Stabilize your forward position.

Left Strip — Down/Up Indicator Lights (D/U)

Red arrow	Your pitch angle is too high/low. Move vertically in direction of arrow.
Green arrow	Your pitch angle is slightly too high/low. Move vertically in direction of arrow.
Striped green rectangle	You're centered. Stabilize your vertical position.

The graphic at right shows the lights and their range indications. Since the constraint ranges for the outer and inner indicator lights overlap, more than one light may glow at once. This indicates the end of one light's range and the beginning of the next light's range.



For instance, you get a red arrow and green arrow when you're 6.5° to 7.5° off vertically. Pitch down a couple of degrees, and you see only one arrow. As you get closer to the optimal vertical position, you'll get a green arrow and a striped green rectangle. Finally, when you're aligned vertically, you see only the striped green light.

- Once you're in the correct position, the tanker will broadcast a "Stabilize" message. At this point, your altitude and airspeed should remain constant — don't change any of the flight controls.
- Wait. In a few moments, you'll receive a ***Refueling Success*** message, and the analog fuel gauge will read full.

COMBAT

The F-15E was designed as a strike fighter, with primary responsibility to deliver weapons against ground targets. Typically, a strike fighter's air combat is limited to self-defense on the way in and self-defense on the way out; however, the F-15E is well-equipped for such self-reliance. Getting in is typically the hardest part of any mission — the aircraft is at maximum weight, loaded with a full complement of air-to-ground ordnance and enough fuel to complete the mission. Air-to-air combat against nimble interceptors in these conditions is, needless to say, difficult. If you can fire off a few well-placed AIM-120s before the enemy even realizes you're there, you can probably get out of there quickly enough to make it to your target point. If you miss (or the opposition calls in backup) and it comes to a dogfight, you'll probably have to jettison your air-to-ground ordnance to survive. And even if you're able to dance your way out of this with your loadout intact, the fuel you expend afterburning in a combat-weight strike craft could leave you out of fuel before you've completed your mission.

This said, most F-15 missions can be divided into three phases, based on your objectives:

- **Getting In** — or your ingress to target, during which your primary objective is staying intact and hanging on to your ordnance.
- **Taking Care of Business** — or your time over target, during which your primary objective is your actual mission objective.
- **Getting Out** — or your egress from target, during which your primary objective is surviving and possibly (depending on how smoothly the first two phases went) conserving fuel.

Add to this a preliminary, but all-important **Combat Loadout** phase, in which you ensure you have the weapons and fuel necessary to make it through all three phases as they apply to the specific mission at hand, and you have the basic structure of this chapter.

Combat Loadouts, p. 4.3, gives an easy-reference chart of the weapons and targeting systems that can be loaded from the *Select Loadout* screen and a brief discussion of things to consider when loading your aircraft.

Getting In, p. 4.11, discusses the skills you need for a successful ingress:

- Avoiding detection
- Switching to A/A master mode
- Detecting aircraft beyond visual range (using the A/A radar and TEWS)
- Acquiring and tracking BVR targets (using the A/A radar)
- Engaging (with the M61A1, AIM-120As, AIM-7s and AIM-9s)
- Managing your flight

To further underscore the principle that a fully loaded strike aircraft was not meant to dogfight, air combat theory and maneuvers are described under **Getting Out**.

Taking Care of Business, p. 4.51, covers everything you need to know about delivering a payload to target:

- Switching to A/G master mode
- Finding and designating targets (using the A/G radar and the targeting IR camera)
- Selecting weapons and bomb modes (using the A/A Arm page)
- Engaging (with unguided weapons, AGM-65s, GBU-15s and Paveways)

Getting Out, p. 4.70, briefly discusses how the air-to-air skills described under **Getting In** apply on your egress from target — when your plane is lighter, but may have less ordnance and less fuel. Air combat theory and basic fighter maneuvers are described in this section.

COMBAT LOADOUTS

A successful mission begins with a successful loadout. You want to be sure the equipment you have meets the situation you're going to face. How do you know what you're going to face? Read your briefing. Read the intelligence files. Look at the briefing map. They're given to you for a reason — take advantage of them.

KNOW YOUR WEAPONS

This chart provides a quick reference for all of the weapons you can carry. For more in-depth information, see **Weapon Advisor**, p. 1.14.

Weapon. Lists the designation and name of the weapon as they appear on the *Weapon Inventory* screen.

MPD Name. Lists the abbreviation used for the weapon on the A/A Arm or A/G Arm MPD pages.

Max Loadout. Maximum number of weapons of this type you can have loaded on your aircraft. Loading the maximum of one type may preclude you from loading the maximum of another type — for example, if you have 8 AIM-120s loaded, you won't be able to load 4 AIM-7s. Also, your hardpoints limit the different sets of weapons you can load — you can't load 2 AIM-120s and 4 CBUs together on the same station, for example. See **Interface: Arming**, p. 1.10.

Guidance. Sensor used to guide the weapon to target. Laser- and datalink-guided weapons are guided by a laser-designator or datalink pod mounted on the launching aircraft. SARH missiles require the aircraft's radar for guidance until they reach the target. All other entries refer to the seeker mounted on the nose of the weapon itself.

Weapon Type. What the weapon is designed to do. (Preferred targets are listed in parentheses when they are not obvious.)

Weapon	MPD Name	Max Load	Guidance	Weapon Type
M61A1 [1]	n/a	500	Unguided	20mm cannon (aircraft/soft ground targets)
AIM-7F Sparrow	7F	4	SARH	Medium range anti-air
AIM-7M Sparrow	7M	4	SARH	Medium range anti-air
AIM-9L Sidewinder	9L	4	IR	Short range anti-air
AIM-9M Sidewinder	9M	4	IR	Short range anti-air
AIM-9P Sidewinder	9P	4	IR	Short range anti-air
AIM-120A AMRAAM	120A	8	Radar	Medium range anti-air
AGM-65D Maverick	AGM65D	6	IIR[2]	Stand off precision attack (armored vehicles)
AGM-65G Maverick	AGM65G	2	IIR[2]	Stand off precision attack (hardened targets)
BLU-107 Durandal	BLU107	12	Unguided	Taxiway/runway cratering
BSU-49 (MK-82 AIR)	BSU49	12	Unguided	Low altitude general purpose
BSU-50 (MK-84 AIR)	BSU50	7	Unguided	Low altitude general purpose
CBU-52	CBU52	12	Unguided	Anti-personnel/-materiel
CBU-58	CBU58	12	Unguided	Anti-personnel/-materiel
CBU-58A	CBU58A	12	Unguided	Anti-personnel/-materiel (incendiary)
CBU-71	CBU71	12	Unguided	Anti-personnel/-materiel
CBU-71A	CBU71A	12	Unguided	Anti-personnel/-materiel (incendiary)
CBU-78	CBU78	12	Unguided	Anti-armor
CBU-87	CBU87	12	Unguided	Anti-personnel/-materiel
CBU-89	CBU89	12	Unguided	Anti-armor
CBU-97	CBU97	12	Unguided	Anti-armor

Weapon	MPD Name	Max Load	Guidance	Weapon Type
GBU-10 Paveway I	GBU10	5	Laser	Precision attack
GBU-10E Paveway II	GBU10E	5	Laser	Precision attack
GBU-10G Paveway II	GBU10G	5	Laser	Precision attack (hardened targets)
GBU-12 Paveway I	GBU12	11	Laser	Precision attack
GBU-12D Paveway II	GBU12D	11	Laser	Precision attack
GBU-15 (v)-1	GBU15L	2	TV/Datalink[3]	Stand off precision attack
GBU-15 (v)-2	GBU15L	2	IIR/Datalink[2,3]	Stand off precision attack
GBU-15 (v)-31	GBU15S	2	TV/Datalink[3]	Stand off precision attack (hardened targets)
GBU-15 (v)-32	GBU15S	2	IIR/Datalink[2,3]	Stand off precision attack (hardened targets)
GBU-24 Paveway III	GBU24	3	Laser	Precision attack
GBU-24A Paveway III	GBU24A	3	Laser	Precision attack
GBU-28	GBU28	3	Laser	Precision attack (underground targets)
Mk 20 Rockeye II	MK20	12	Unguided	Anti-armor
Mk 82	MK82	12	Unguided	General purpose ground attack
Mk 84	MK84	7	Unguided	General purpose ground attack

[1] Mounted on aircraft and cannot be removed. Max Loadout lists maximum number of rounds loadable.

[2] Has imaging infrared (IIR) seeker head which transmits FLIR video to the launching aircraft before launch/release.

[3] If AN/AXQ-14 datalink pod loaded, can be steered after launch. Seeker head transmits normal (TV) or IIR video to the launching aircraft.

KNOW YOUR TANKS AND PODS

In addition to weapons, you can load sensor pods, extra fuel tanks, and countermeasures on your aircraft. You may or may not need these, depending on your mission.

CHAFF AND FLARES

Countermeasures are a valuable line of defense against surface-to-air missiles and enemy interceptors. They can help you escape a long-range engagement without a dogfight, plow through SAMs flanking a vital enemy target, or ward off undetected IR missiles if it does get down and dirty.

You have three options when it comes to countermeasures:

AN/ALE-40 (1)	120 chaffs/60 flares
AN/ALE-40 (2)	180 chaff/30 flares
AN/ALE-40 (3)	60 chaff/90 flares

AN/AAQ-13

This is the navigation pod of the Low-Altitude Targeting and Navigation Infra-Red (LANTIRN) system. It gives the F-15E nighttime and low-altitude flight capabilities. You must have this pod loaded if you want to:

- Use the terrain-following radar
- Use the NAVFLIR (navigation FLIR)

AN/AAQ-14

This sensor pod is the targeting pod of the LANTIRN system. It gives the F-15E its superior nighttime targeting and guidance capabilities. You must have this pod loaded if you want to:

- Use the targeting IR camera to view IR video of your targets
- Use laser-guided weapons (i.e., Paveways)
- Use automatic weapon cueing for AGM-65s or GBU-15s (see **Guided Weapons**, pp. 4.65-4.69)

AN/AXQ-14

When you have the AN/AXQ-14 datalink pod loaded on your aircraft, you will be able to steer a GBU-15 after launch, by using an indirect launch mode. See **Guided Weapons**, p. 4.68.

FUEL TANKS

The F-15E is capable of carrying three external fuel tanks in addition to its internal fuel — one on the centerline and two on the wings. You carry 23,200lbs internally and each external tank carries a maximum of 3,900lbs of fuel. With only the centerline tank loaded, you have a total of 27,100lbs of fuel. With all three tanks loaded, you have 34,300lbs of fuel. See **Combat Fuel Flow**, p. D.1.

DECIDING WHAT TO TAKE

PRESET LOADOUTS

Relying on the preset weapon loadouts isn't cheating. A real F-15 pilot wouldn't have control over what was loaded on his plane anyway, so you're actually that much closer to realism if you stick with the presets. And you can be sure that all of the sensor packages you need for each specific weapons loadout will also be loaded.

Also, if you like the CAS loadout (for example), but wouldn't mind switching out the MK-20s for CBU-87s, you can load the CAS package onto your plane and then click CUSTOM to fine-tune it all you want. See **Interface: Arming: Custom**, p. 1.12,

CUSTOM LOADOUTS

Many parameters affect what is necessary to win a given mission — ground opposition, air opposition, distance to the target area, local time, whether you have an element of surprise, etc. The following questions give you an idea of the types of considerations that go into planning a loadout. You should be able to find the answers to these in the briefing phase of any mission.

WEAPON ADVISOR SCREEN

This reference is accessible from the *Custom Loadout* screen. It can list either all of the targets a certain weapon can be effectively used against or all of the weapons that can effectively be used against a type of target. See **Interface**, p. 1.14.

Questions to Ask Yourself

What is your primary objective?

It's very important to match the durability of your target to the strength of the warhead. It would be impossible to destroy hardened C&C bunkers with small anti-personnel CBUs, for example. There's no sense fighting your way to a target if you're not very likely to be able to take it out when you get there. The Weapon Advisor (p. 1.14) lists preferred targets for different kinds of weapons.

If the objective is to do a great deal of damage somewhat indiscriminately at a target area, you'll want to think in terms of large numbers of weapons and CBUs. On the other hand, if you're assigned a very precise strike on a very particular target — say one building in a certain compound — you'll need a few precision-guided munitions to do the job.

When in a campaign, you'll also want to consider how difficult the mission is likely to be and how important the target is to the campaign overall. Your stores of guided munitions will be more limited than your stores of unguided ones.

What type of ground resistance is expected? What type of profile do you intend to fly? What type of weapon release profile do you intend to use?

Deciding a *flight profile* is perhaps the most important factor in determining the type and quantity of air-to-ground weapons to carry. A flight profile describes the relative altitude you take during ingress, at the target and on egress:

Hi-lo-hi. Used if the target is far away and enemy SAM/aircraft defense is minimal. You fly at high altitudes to and from your target to conserve fuel, but drop lower at the target area for more precise delivery. If you drop to a significantly lower altitude for delivery, you will want to use retarded bombs, such as the BSU-49 and -50, and the BLU-107 (for airfield/runway attacks), which are slowed down after release by small parachutes, enabling you to get out of the way before the weapon impacts the target. Likewise, if you are using CBUs, you want to be sure you release them from a altitude greater than their height of burst (HOB, set via the A/G Arm page, — see **Set CBU Height of Burst**, p. 4.61). If you release them below their height-of-burst they will explode almost immediately. Note that a low-level delivery may also prevent you from getting the LOS to target required to aim guided munitions, especially over rough terrain.

Lo-hi-lo. Used when SAM and air defense is heavy. You fly very low to avoid detection, but climb to a higher altitude when on target to deploy your weapons. If you have to climb quickly, you may not be able to get high enough soon enough for guided, stand-off weapons, such as the GBU-15. These weapons require you to maintain LOS to target while the entire time you are guiding them, and you will need to be at a fairly high altitude to do this.

Hi-hi-hi. Used in deep strikes. High-altitude flight conserves fuel so you can carry a heavier ordnance load. A high-altitude delivery can minimize ground threats — not only are you above AAA ranges, but since the ground range of most weapons increases the higher the altitude from which they are dropped, you can conceivably drop your ordnance, bank hard and get out without ever flying directly over your target and its attendant S-A defenses. (Your weapons will continue flying along your original flight path due to inertia.) However, higher altitudes also make it harder to hit a precise target — with unguided weapons you run the risk of collateral damage to nearby non-military structures.

Lo-lo-lo. A low-altitude delivery can get you in below minimum altitude for most SAMs and undetected by aircraft, but requires more fuel and can thus only be used when the target is nearby. Guidelines for weapon choice in a lo-lo-lo delivery are similar to those described above under hi-lo-hi. In addition, plan on making a high-speed delivery — you'll have to get in and out quickly to minimize your exposure to AAA.

In addition to flight profile, your *weapon release profile*, or the actual attitude of your aircraft when releasing weapons, also affects which weapons you use and vice versa. All weapons — guided, unguided, stand-off, retarded, etc. — can be released from level flight. *Level* and *loft* deliveries are the best choices for guided munitions. (In a *loft* delivery, you release weapons with a nose-up attitude. This gives the weapon an extra push upward for a greater glide distance — particularly effective with GBUs, which have fins designed to increase glide range. This also helps keep your aircraft from masking the laser-designator.) *Pop-up* and *dive* deliveries are best used in conjunction with CDIP bombing mode (see **Select a Bomb Mode**, p. 4.61) and unguided weapons. Pop-up deliveries consist of flying at very low levels, then popping up and rolling inverted to acquire the target, then diving to engage it. These are incredibly difficult to execute correctly, and they may mask the targeting pod. Dive deliveries may not maintain LOS long enough for guided weapons.

How much fuel do you need?

If it's a deep strike, and there's no chance of refueling, you may need all three tanks to get through the mission. However, when considering fuel requirements, you have to balance the increase in endurance time with the increase in weight and decrease in performance. The greater your weight, the more sluggish your aircraft, and the more fuel it requires to climb and maneuver. In addition, endurance varies greatly with altitude. The higher you fly, the less quickly you burn fuel and the greater your endurance. See **F-15 Fuel Flow**, p. D.1, for a chart illustrating the relationship between airspeed, altitude and fuel flow.

Depending on the situation, fuel conservation — flying slower than full military power, flying at high altitudes, and minimizing the use of your afterburners — is often better than adding fuel weight to your plane.

How much air opposition do you expect, and when?

If air opposition is heavy on ingress and egress, you may have to sacrifice some ground ordnance to take along a few extra air-to-air missiles. To make up for the loss in numbers, it may be worth it to take precision-guided weapons — you're going to have to make every shot count. Less ordnance means less weight, and added maneuverability.

How large is your flight?

Keep in mind you can set separate loadouts for yourself and the other aircraft in your flight. If you are on a strike mission and expecting heavy air opposition, you may need an "eight-ship" flight. You can give aircraft 5, 6, 7 and 8 (as numbered on the *Select Loadout* screen) air-to-air ordnance, and give the other four air-to-ground ordnance. While enroute, you can assign the division (which is comprised of aircraft 5, 6, 7 and 8) to cover you and take on air objectives, while you (aircraft 1), your wingman (aircraft 2) and aircraft 3 and 4 concentrate on your primary ground objectives. Keep in mind that the aircraft in your flight will work in pairs —1/2, 3/4, 5/6, and 7/8. It's a good idea to give a pair the same (or at least similar) ordnance.

Are you flying at night?

IR-guided weapons have a better chance of finding their targets at night. The FLIR video images of the AGM-65, GBU-15-2 and GBU-15-32 are enhanced. On the other hand, unaided vision is hampered — the conventional TV video of the GBU-15-1 and GBU-15-31 would be too dark to be useful and visual references for dropping unguided weapons in CDIP mode are less reliable.

Do you have the guidance systems you need?

Before you leave the loadout screen, make sure you have all of the systems you'll need in order to use the weapons you've loaded. For example, the GBU-15 requires an AN/AXQ-14 datalink pod if you want to steer the weapon after release. All of the Paveways require the AN/AAQ-14 targeting pod. If you're flying at night or nap-of-the-earth (NOE) you'll want the AN/AAQ-13 navigation pod with NAVFLIR and a terrain-following radar.

GETTING IN

This section deals with the skills and weapons systems you will need on your ingress to target. The ingress phase of a mission is often the phase in which you are most vulnerable. You are heavily loaded with both weapons and fuel, so it is harder for you to maneuver. If the enemy knows you're coming, or finds out along the way, you'll find yourself up against aircraft designed and loaded solely for air combat. And then of course there are SAMs ...

AVOIDING DETECTION

Surprise has never been a better ally — if they don't know you're coming, they won't try to stop you. Once you drop your ordnance, they'll have a pretty good idea where you are, but if you can get in and strike without being picked up by aircraft or GCIs (Ground Control Intercepts — ground-based warning and control systems) you'll be able to deal with them unencumbered once you've blown your cover.

STAY LOW

Flying at extremely low altitudes is the best way to remain hidden. Flying below 500ft puts you below the minimum detection altitude for most ground radar systems. Flying nap-of-the-earth (NOE), or hugging terrain contours, decreases the chance you will be detected by aircraft by making it difficult for radar to pinpoint and track your location among the "ground clutter."

NOE Flight with the Terrain Following (TF) Radar

Nap-of-the-earth flight is a challenge for fixed-wing aircraft flying several hundred knots. It's almost impossible without the terrain-following radar housed in the AN/AAQ-13 navigation pod of the LANTIRN system. This radar system sends signals down and in front of the aircraft and calculates your altitude above the terrain from the returns.

To use TF radar guidance for low-level flight:

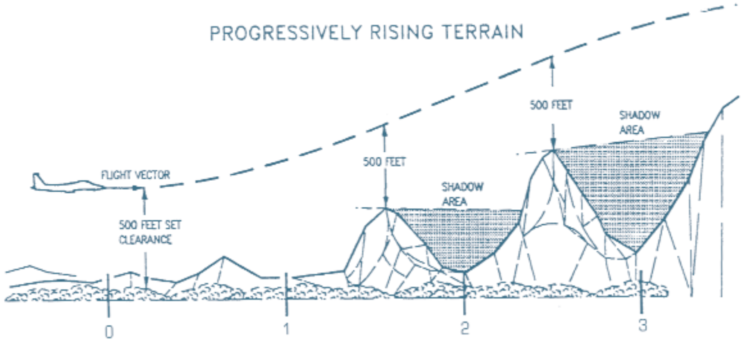
1. Drop down to the above-ground-level (AGL) altitude you want to maintain.
2. Press PB 4 (TFF NORM/OFF) on the UFC main menu until NORM appears beside the button. Activating the terrain-following radar also activates the autopilot. The autopilot will maintain the AGL altitude you are flying at when the TF radar is activated.

The absolute minimum AGL altitude you want to rely on the TF radar maintaining is 300 ft. Anything below that (and you will want to go below that) you'd better fly manually.

Even at 300 ft, you'll want to keep one eye on the autopilot. When the TF radar detects a terrain feature in front of you, the autopilot will attempt to climb above it and a FLY UP message appears in the center of the HUD. The autopilot cannot pull more than 2Gs to excute a climb. If more than 2Gs are required to avoid an obstacle detected by the TF radar, an OBSTACLE warning message appears on the HUD, reinforced by an audio warning, and the OBST light on the console lights up. This signals you to take control of the aircraft to avoid crashing.

You can steer somewhat while the TF radar is on and the autopilot engaged, but you should keep in mind that the TF radar is evaluating the terrain directly in front of you. If you bank too quickly, it may not be able to detect an obstacle quickly enough to avoid it.

Additionally, there are "shadows" in the TF radar returns. When faced with progressively rising terrain, the TF radar may not be able to drop you into all of the valleys along your flight path — see the illustration below for an example.



Manual NOE Flight

LAW System

The LAW system is also indispensable when flying at low altitudes. With this system you can set a minimum altitude and the aircraft will warn you (via both a LOW ALT light on the left side of the console and a verbal cue) when you've dipped beneath it. To set the altitude for the LAW system and enable it:

1. Click PB 9 (A/P ...) of the UFC main menu to call up the autopilot submenu (see **Cockpit: UFC Main Menu**, p. 2.65).
2. The current altitude setting for the LAW system is displayed next to PB 2. Press PB 3 (UP) or 8 (DWN) to increase or decrease this setting.
3. Click PB 5 to toggle the LAW system on (LAW ON) and off (LAW OFF).

See **Cockpit: 1. Low Altitude Warning (LAW) System Submenu**, p. 2.66)

Radar altitude scale. If you manually fly NOE, you will rely heavily on the *radar altitude scale*. This scale graphically represents your AGL altitude and appears on the HUD when you drop below 1500 ft AGL, as long as your pitch angle is less than ± 20° and your bank angle less than ± 60°. (These pitch and bank angle limits are a result of where on the aircraft the radar altimeter is mounted. See **Customizable Basic Symbology**, p. 2.9, for more details.)

NAVFLIR

If you're flying at night, you'll also want to activate the NAVFLIR (navigation FLIR camera). This system projects FLIR video imagery onto your HUD. Because terrain cools off more slowly than the air around it at night, terrain features will show up more sharply against the sky in this FLIR image than they will visually.

PB 7 of the UFC main menu cycles the NAVFLIR between N-F NORM-WH (white-hot — objects radiating the most heat appear brightest on screen), N-F NORM-BH (black-hot — objects radiating the most heat appear darkest on screen) and N-F OFF (no FLIR imagery is projected onto the HUD).

See **Cockpit: 7. NAVFLIR (N-F)**, p. 2.69.

LIMIT RADAR USAGE

When you are using your radar, you become instantly more visible to enemy ground and aircraft detection systems. Whereas their radar systems would normally have to rely on their own emissions bouncing off your aircraft in order to locate you, if your own radar is active you are broadcasting emissions for them like a beacon in the night. Limiting radar emission — i.e., preventing your radar from conducting a scan — helps you remain undetected.

Your radar continues to emit, even when both the A/A and A/G Radar pages are not visible. To prevent your radar from emitting, you must manually disable it using one of the methods listed below.

SNIFF

While flying without radar helps you remain undetected, it also blinds you. When you must use your radar, use it in short bursts, making a quick scan and then hitting the SNIFF button. (Of course, once you've been detected, you can use the radar more liberally — they already know where you are.)

To suspend radar emissions:

- Press PB 18 on the A/A Radar or A/G Radar page until SNIFF is boxed. Press again to remove the box and allow the radar to continue emitting.
- On the A/G Radar page, you can also press PB 17 until FRZ (freeze) is boxed. Freezing the radar display stops it from updating, so that the targeting or map cursor can be more accurately placed. Freezing has the added advantage of halting radar emission, making you temporarily less visible.

See **Cockpit: A/A Radar Pushbuttons**, p. 2.53; **Cockpit: A/G Radar Pushbuttons**, p. 2.48; and **Create an HRM**, p. 4.54.

To have your entire flight suspend radar emissions:

- Press the **FLT_TOGGLE_RADAR** key. Each aircraft will radio back standard acknowledgment (i.e., their flight number), indicating they have heard and complied. Press this key again to have them re-enable radar emission.
- Alternately, press the **RADIO_1_TRANSMIT** [Tab] key to call up a flight communications menu. Press [4] to choose **FLIGHT (SUBMENU)**, then press [2] to select RADAR ON/OFF. Each aircraft will radio back standard acknowledgment. Repeat the procedure to have them re-enable radar emission. (Note that an aircraft will not disable its radar if it is tracking a target.)

See **Flight Commands**, p. 4.44.

Jammer Control

Even when SNIFF is enabled, your jammer — which also produces detectable emissions — can continue to emit. Jammers are designed to "fool" radars and Radar Warning Receivers (RWRs) by sending out false and garbled radar returns. Other aircraft will be able to detect these emissions, but they will have a hard time pinpointing where and what they are coming from.

You can give the TEWS total control over the Internal Countermeasures Set (ICS, a.k.a. the jammer). In this case it will remain in standby mode and only emit when your RWR senses you are being tracked by a threat radar/SAM. You can also control the ICS manually. Depending on the situation, you may decide that turning your radar off but leaving ICS in standby provides you a welcome bit of protection.

To place the ICS on standby and control it manually:

- Click PB 20 (MAN/SEMI/AUTO) on the TEWS MPD page until MAN appears next to the button. This gives you manual control over the jammer — it will remain in standby until you press the **JAMMER** J key. Pressing this key again toggles the jammer back to standby.

To place the ICS on standby and give control to the TEWS:

- Click PB 20 (MAN/SEMI/AUTO) on the TEWS MPD page until AUTO appears next to the button. The jammer will remain in standby until the TEWS detects a threat painting you, at which point it begins to emit. It will continue emit until the TEWS no longer detects a threat.

See **Cockpit: 13. Tactical Early Warning System (TEWS) Page**, p. 2.42.

To have your entire flight suspend jammer emissions:

- Press the **FLT_TOGGLE_JAMMER** key. Each aircraft will radio back standard acknowledgment. Press this key again to have them re-enable jammer emission.

- Alternately, press the **RADIO_1_TRANSMIT** Tab key to call up a flight communications menu. Press 4 to choose FLIGHT (SUBMENU), then press 3 to select MUSIC ON/OFF. All aircraft will radio back standard acknowledgment. Repeat this procedure to have them re-enable jammer emission.

See **Flight Commands**, p. 4.44.

EMIS LMT

The EMS button on the keypad of the UFC enables and disables radar and jammer emission. Whenever the EMIS LMT light (right side of the console) is on, your radar and jammers cannot emit.

To prevent both the radar and jammer from emitting:

- Click the EMS button on the keypad of the UFC until the EMIS LMT light is lit. Click the button again to turn off the light and re-enable both systems.

See **Cockpit: Up Front Controls (UFC)**, p. 2.64, and **Cockpit: Indicator Lights**, p. 2.73.

USE AWACS AND JSTARS

AWACS (Airborne Warning and Control System) and JSTARS (Joint Surveillance and Target Attack Radar System) aircraft can also provide you with positional information for nearby targets, without your having to blow your cover. AWACS will report air threats; JSTARS will report ground targets. If things heat up, AWACS can also call in CAP and SEAD assistance, if it is available.

AWACS and JSTARS will give you positions in "BRA" format — bearing, range and altitude relative to your aircraft — or B/E format — bearing, range and altitude from the bullseye point. A bullseye point is used to radio positional information to a friendly unit without compromising the friendly unit's own position. The position of the Bullseye should be given in your briefing. For more information on the Bullseye, see **Mission Builder: Bullseye**, p. 5.50.

To request AWACS information:

1. Press the **RADIO_2_TRANSMIT** Shift Tab key. (Radio channel 2 lets you talk to airfields, tankers, JSTARS, AWACS, etc.)
2. A menu appears in the upper left corner of the screen. Press 1 to select **(1)** AWACS SUBMENU.

3. On the submenu, press one of the following keys:

1	(AWACS) REQUEST PICTURE	After a few seconds, the AWACs will list the positions of all enemy aircraft detected in your area. Positions are given in B/E format — bearing, range and altitude relative to the bull's-eye — if a bull's-eye point has been designated. Otherwise, positions are given in BRA format.
2	(AWACS) REQUEST BOGEY DOPE	After a few seconds, the AWACs will begin rattling off the position of the group of enemy aircraft nearest you. Position is given in BRA format.
3	(AWACS) REQUEST ASSISTANCE	If a Combat Air Patrol (CAP) wing is available, the AWACS will redirect to your area. If no wing is available, you will receive the message, "Negative. No assets are available." Note that while notified of the area to patrol, the CAP wing will find its own aircraft targets.
4	(AWACS) REQUEST WEASELS	If a Suppression of Enemy Air Defenses (SEAD) wing is available, the AWACS will redirect it your area. If no wing is available, you will receive the message, "Negative. No assets are available." Note that while notified of the area to patrol, the SEAD wing will find its own targets.
5	(AWACS) REQUEST NEAREST TANKER	If a tanker is available, the AWACS will list its coordinates in BRA format. If no tanker is available, you'll receive the message "Negative. No assets are available."

To request JSTARS information:

1. Press the **RADIO_2_TRANSMIT** Shift Tab key.

2. A menu appears in the upper left corner of the screen. Press one of the following keys:

2	(JSTARS) CHECK IN/OUT	When you check in with the JSTARS controller (choose this command for the first time in a mission), he will give you the ground target he'd like you to engage (in B/E format if there is a B/E; otherwise in BRA format). When you check out (choose this command for the second time) he'll know you are headed home, and won't assign you any more targets.
3	(JSTARS) TARGET REQUEST	The JSTARS controller will give you the location of a ground target he'd like you to take (in B/E format if there is a B/E; otherwise in BRA format).
4	(JSTARS) NEXT TARGET REQUEST	If for some reason you can't find or can't take the target he assigns you, this command will have him skip to the next on his list.

SWITCHING TO A/A MASTER MODE

A/A master mode configures all of your cockpit systems for air-to-air combat. The first thing you want to do when you expect trouble is switch to this mode. You can do this in any of the following ways:

- Press the **MASTER_MODE_CYCLE** M key to cycle through master modes.
- Press the **MASTER_MODE_AA** key to select A/A master mode.
- Click on the A/A master mode button beneath the UFC.

See **Cockpit: Master Modes**, p. 2.3.

The A/A Radar page, A/A Arm page and TSD page come up automatically in the pilot's cockpit. The A/A Radar page, A/A Arm page, TEWS page and TSD page come up in the WSO's cockpit. For information on changing these default settings, see **Cockpit: 6. Master Mode Programming**, p. 2.37.

DETECTING AIRCRAFT BEYOND VISUAL RANGE

If you can't make it to the target area undetected — perhaps the length of your mission requires you to fly at a higher altitude to conserve fuel — your next best strategy is taking out the air opposition with a single pass, before they have a chance to lure you into a dogfight. Doing this requires great skill and a thorough command of your air-to-air targeting weapons and engagement systems. It also requires cooperation with your wingman and intelligent leadership of your flight — rarely will you face just a single bandit.

Any successful engagement begins with finding the enemy — most preferably finding him (even a split second) before he finds you. Letting him catch you unawares could mean your untimely demise.

With the advent of longer-range missiles, air combat moved from close-range visually-guided combat to the engagement of targets that were beyond visual range (BVR). Systems that could detect and/or acquire BVR targets were invented, and the skillful use of these systems (such as radar and radar warning receivers) became the deciding factor in modern missile combat. These detection skills are discussed in this section.

USE THE A/A RADAR

Choose a Search Mode

Your radar has several possible air-to-air search modes, only one of which can be active at a time. Each has its strong points and limitations.

- **RWS High (RWSH) mode** emits high pulse repetition frequency (PRF) radar waves, which are better at detecting high closure contacts (contacts moving at great speed with respect to your aircraft), which return a stronger Doppler shift than low closure contacts. Low or no closure contacts (a contact moving roughly the same speed and direction as you are) may not show up at all, however. You would use this mode if you were expecting fast interceptors moving in head-on, but not to target a MiG you were tailing in a dogfight.
- **RWS Medium (RWSM) mode**, which emits medium PRF radar waves. These cannot detect high closure contacts at as great a range as high PRFs, but they are better at detecting low or no closure contacts.
- **RWS Interleaved (RWSI) mode** will most likely be your primary search mode. With each bar scanned, the radar alternates between high and medium PRFs, returning data on both high and low closure contacts. This is the best general-purpose search mode to use if you don't know exactly what's lurking out there — which is almost always the case unless you're warned in advance that certain high-speed interceptors or low-RCS aircraft will be zooming in over the horizon.
- **Range Gated High (RGH) mode** performs similarly to RSWI mode. It emits radar waves at a single intermediate PRF, but electronically processes the returns to extract data on both high- and low-closure targets.
- **Velocity Search (VS) mode** does not display low closure targets at all, and sorts targets according to their closure rate instead of according to range. You will only use this mode to find very high-closure targets. See **Cockpit: The A/A Radar Grid**, p. 2.54.
- **Vector (VCTR) mode** takes twice as long to complete a scan as the other modes, but uses this extra processing time to scan for smaller, stealthier aircraft. You would only use this mode if you were concerned about picking up frontal or tail aspect targets a great distance away. It only emits at high PRFs, however, and therefore has the same difficulty with low-closure targets as RWSH mode.
- **Track While Scan (TWS)** and **High Data TWS (HDTWS) modes** are used to search for contacts while you have a target designated (normally when you designate a target, all other contacts disappear from your screen).

You can use either to search for targets without having a target designated, but their scan areas are severely limited (4° and 2°, respectively). They are discussed in more detail under **Acquiring and Tracking BVR Targets**, p. 4.27.

How to Activate a Search Mode

You will activate all search modes by clicking on the pushbuttons surrounding the MPD. A box appears around the button's label indicates the currently selected search mode. Only one mode can be active at a time — selecting a mode deselects all other modes.

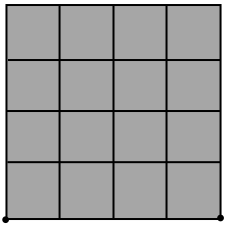
RWSH, RWSM** or **RWSI	Click PB 6 until the mode you want is boxed.
RGH	Click PB 7 to box RGH.
VS	Click PB 8 to box VS.
VCTR	Click PB 9 to box VCTR.
TWS** or **HDTWS	Click PB 10 until the mode you want is boxed.

Set Search Scan Limits

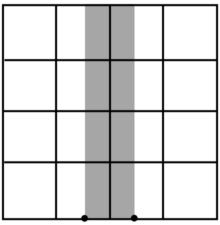
When setting the radar's scan limits, there is a trade-off between the area you can cover and the time it takes to complete a scan. Setting a very large scan area decreases your blind zone — the area to the sides, back, below and above your aircraft that are not scanned — and minimizes the chance that an aircraft will sneak up on you. A large scan area takes longer to scan, however; contact information is updated less frequently, therefore the positions of contacts on the radar screen are less reliable.

Azimuth Limit

Press PB 12 (**15/30/60**) on the A/A Radar MPD page to limit the radar azimuth scan to 15°, 30° or 60° to either side of the aircraft's nose, or a 30°, 60° and 120° total scan angle. Note that the scale of the radar grid does not change when you change the scan angle — the portion of the grid that is updating changes. The radar azimuth limit balls (hollow circles along the bottom of the grid) mark the boundaries of the portion that is updating.



Portion updated when scan angle is 60°

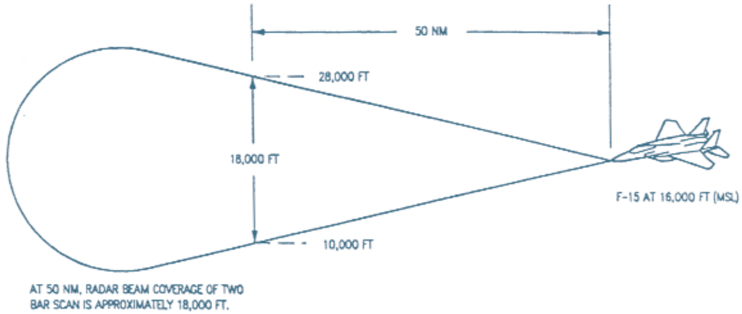


Portion updated when scan angle is 15°

Be careful — in the second example of the diagram at left, the outer columns of the grid aren't being updated. Yet even though they are blank, bandits could be lurking in this sector.

Elevation Limits

The elevation limit of a scan depends on the number of bars in the scan (which controls the vertical angle of the scan) and the radar range setting. Note that the elevation limit — the elevation of the scan at maximum range — dwindles down to zero as it approaches your aircraft. Another aircraft could be flying directly beneath you and you would never know.



PB 2 of the A/A Radar page cycles through elevation settings — 1-, 2-, 4-, 6- and 8-bar scans. (Elevation settings are predetermined for TWS modes, depending on which azimuth angle setting you've selected — see **Cockpit: A/A Radar Search Modes**, p. 2.50.)

Range Limits

Besides limiting elevation coverage, the range setting determines how far from the aircraft the radar scans. Note that this is not necessarily how far away aircraft are detected, however — for example, frontal and tail-aspect contacts (contacts with a low radar cross-section) may not be detected at 80nm.

PB 13 of the A/A Radar page cycles through available radar ranges — 10, 20, 40, 60, 80 and 160nm. The currently selected range appears next to the button.

The Blind Zone

As hinted at in the sections above, it's important to remember that the scan area for air-to-air radar is a *cone* that tapers back to the point of emission. At its widest azimuth angle it's a fairly wide cone, but it still leaves 240° to the sides and back of your aircraft totally "blind." However, as long as you remain conscious of the radar's limitations and know that the blips on the screen aren't always the only aircraft out there, the radar is an indispensable tool for picking enemy aircraft along your mission route.

USE THE TEWS

The Tactical Electronic Warfare System (TEWS) is a combination of four different defensive systems:

AN/ALR-56C Radar Warning Receiver (RWR)	Detects and displays threats
AN/ALE-40 Countermeasures Dispenser (CMD)	Dispenses chaff and flares
AN/ALQ-135 Internal Countermeasures Set (ICS)	Emits jamming frequencies
AN/ALQ-128 Electronic Warfare Warning Set (EWWS)	Cues the AN/ALQ-135

The AN/ALR-56C can also be used as an offensive tool to find enemy aircraft even though it was designed for defensive use. Using the RWR to detect enemy aircraft has one major advantage — it's a passive radar detection system that doesn't emit and therefore can't be picked up by enemy radar. In addition, the RWR returns information for an area 360° around your aircraft, and can pick up ground radar emissions as well. Of course, the RWR has one major drawback as well — it only picks up threats that are *actively* using radar. When they turn off their radar, they disappear from the TEWS display.

How the TEWS Displays Contacts

For more information, see **Cockpit: 13. Tactical Early Warning Display (TEWS) Page**, p. 2.42.

The TEWS presents a top-down view of the area around your aircraft. Your aircraft is in the center of the display with its nose always oriented toward the top.

Threat Symbols

The following symbols mark threats:

^ Aircraft   □ Ground threat   ◇ Missile

A **circle around a symbol** indicates a threat with a radar lock on you.

A **flashing symbol** indicates a threat launching a missile.

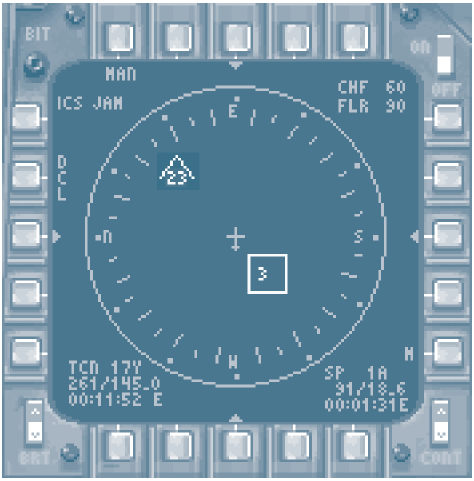
An alphanumeric code inside the symbol identifies the type of aircraft or ground threat. The **Threat ID Code Table** on p. 2.43 of the **Cockpit** chapter lists the alphanumeric code for all threat objects.

Only missiles with active radar seekers (like the AIM-120) will show up on the TEWS display. SARH missiles are guided by the launching aircraft, so only the launching aircraft will appear on the display (the aircraft symbol will flash while the missile is in flight, indicating that the aircraft is launching). Likewise, IR missiles won't show up — only the aircraft that launched them will (and they will only show up if and when they are emitting radar).

Threat Location and Strength

The TEWS indicates a threat's azimuth position relative to yours and how strong its signal is, but does not give any direct indication of how far the threat is from your aircraft. The stronger a threat's emissions, the closer its icon will appear to the marker representing your aircraft on the TEWS display. The weaker a threat's emissions, the further from your aircraft marker its icon is displayed. In some cases signal strength corresponds to range — the stronger the emission, the closer the object, etc. However, signal strength also varies according to the type of radar emitting — the radar on an AWACS aircraft is much more powerful than the radars on fighter aircraft, for example.

The picture below depicts an aircraft about 40° to the left of the nose of your aircraft. Its radar emissions are weaker than that of the ground threat, which is displayed closer to your aircraft marker, at about 130° to the right of your aircraft.



Using Countermeasures

In addition to providing information about radar threats, the TEWS also controls the way countermeasures — jammers, chaff and flares — are used.

Setting the Level of TEWS Control

You can give total control of countermeasures to the TEWS, or you can assume some control yourself. To set the level of countermeasure control, press PB 20 (MAN/SEMI/AUTO) until the level of control you desire appears below the button.

MAN Manual control gives you total control over countermeasures. You must press the **CHAFF** Del and **FLARES** Ins keys in order to drop them, and one cartridge is dropped per key press. The jammer must be enabled/disabled manually using the **JAMMER** J key.

SEMI Semi-automatic control gives you control over *when* chaff is dropped (again, you press the **CHAFF** Del key), but the TEWS determines *how many* are dropped with each key press. Flares are still dropped manually and one at a time with the **FLARES** Ins key. **JAMMER** J till controls the jammer as described above.

AUTO Automatic control gives the TEWS total control over when *and* how many chaff cartridges are released, and when your jammer is enabled or disabled. Flares must still be released manually. *(**Note:** Automatic release of chaff tends to use the cartridges up rapidly.)*

Dropping Chaff and Flares

Chaff cartridges release clouds of small metallic strips that can distort the radar waves guiding an SARH or active-radar-guided missile. The strips are made of Mylar film or fine glass particles covered with aluminum or zinc, and are cut to lengths that match the expected radar wavelengths.

CHAFF	Del	Drop a chaff cartridge. With manual control of the TEWS, one cartridge is dropped with each key-press. With semi-automatic control, the TEWS controls how many are dropped with each keypress. This key has no function when control of the TEWS is set to automatic.

Flares explode into hot, bright fireballs, creating an intense source of heat between an oncoming infrared missile and your aircraft. Since IR-guided missiles home in on heat sources, a well-timed and well-positioned flare has a chance of luring the missile away from your exhaust. Since IR-guided missiles aren't affected by jamming and do not show up on the TEWS display, flares and quick maneuvering are really the only defense against these deadly weapons.

FLARES Ins Drop a flare. One flare is dropped per keypress, regardless of the TEWS control setting. Flares must always be released manually.

The number of chaff (CHF) and flare (FLR) rounds remaining on your aircraft is marked in the upper right corner of the TEWS display.

Activating Your Jammer

Jammers reflect false radar returns to a radar source. Part of the TEWS's function is to vary the intensity, frequency and direction of the jamming transmission in order to best hide the exact position of your aircraft. With manual and semi-automatic control of the TEWS, you must enable and disable the jammer manually.

JAMMER J Enable/disable your jammer.

The status of your jammer is indicated in the upper left corner of the TEWS display:

JAM EMIS LMT is off, and the jammer is currently emitting.

STBY Standby — EMIS LMT is off, but the jammer is not currently emitting.

EMIS EMIS LMT is on, disabling the jammer.

Whenever the EMIS LMT light (right side of the console) is on, your radar and jammers cannot emit. Press the EMS button on the keypad of the UFC to re-enable radar and jammer emission. See **EMIS LMT**, p. 4.16.

ACQUIRING AND TRACKING BVR TARGETS

Whether you initially find BVR (beyond visual range) targets with the radar or the TEWS, you will need to pick them up with your air-to-air radar (or at least have the air-to-air radar active) before you can acquire, track and engage them. The following sections assume that you have already picked up contacts on your radar.

For a description of the grid and contact symbology used by the A/A Radar, see **A/A Radar Symbology**, p. 2.54.

SEND AN IFF SQUAWK

Before you consider engaging a target, you want to be certain it isn't a friendly aircraft. Aircraft use "friend or foe" transponders to determine another aircraft's alignment. The transponders on allied aircraft will return a "friendly" message when queried (or "squawked") by another allied aircraft.

You can manually control IFF interrogation or it can be automatic. Press PB 3 (IFF OFF/NORM/AUTO) on the UFC main menu to cycles through control options for IFF interrogation. The currently selected option appears next to the button.

OFF No IFF queries can be sent to other aircraft.

NORM Currently displayed A/A radar contacts will be identified when you press the **IFF_INTERROGATE** [I] key.

AUTO The primary designated A/A radar target is automatically queried when the radar locks onto it.

After an IFF squawk is sent, the contacts that return a friendly response will change from rectangles to circles on the radar display. Contacts that do not respond — either enemy or neutral aircraft — will remain rectangular.

 Denotes a friendly aircraft.

 Denotes an unknown aircraft — enemy or neutral.

DESIGNATE THE TARGET

You can acquire a target in one of two ways — designating one manually or having the radar designate one using one of five auto-acquisition modes.

Manual Target Designation

To designate a target manually, move your cursor over the radar screen and click on a contact. The contact becomes your *primary designated target* (PDT), and its contact symbol changes from a rectangle to a star. (If you have a friendly targeted and an IFF squawk has been sent either manually or automatically, the symbol will flash between a star and a circle. See **Send an IFF Squawk**, p. 4.27.)

Once you have a PDT, the radar automatically switches to a tracking mode — the default is Single Target Track (STT), but you can also select Track While Scan (TWS) tracking using PB 10 of the A/A Radar page. See **Track the Target**, p. 4.30.

A/A Auto Acquisition Modes

Four of the A/A auto acquisition modes are controlled by hotkeys. Pressing an acquisition mode key signals the radar to acquire a target, using the parameters set by the mode you've chosen.

ACQ_SS	5	Super Search acquisition mode
ACQ_BST	6	Boresight acquisition mode
ACQ_LRBST	7	Long-Range Boresight acquisition mode
ACQ_VTS	8	Vertical Scan acquisition mode

The fifth auto-acquistion mode, Guns acquisition mode, is enabled automatically when you are in A/A master mode, you do not have a designated target, and you press the **GUN_SELECT** 1 key.

Once the radar acquires its target, that target becomes your *primary designated target* (PDT), and its contact symbol switches from a rectangle to a star. (If you have a friendly targeted and an IFF squawk has been sent either manually or automatically the symbol will flash between a star and a circle. See **Send an IFF Squawk**, p. 4.27.) The radar then automatically switches to a tracking mode — the default is Single Target Track (STT), but you can also select Track While Scan (TWS) tracking using PB 10 of the A/A Radar page. See **Track the Target**, p. 4.30.

For more details on the symbology described below, see **Cockpit: Head-Up Display (HUD): Auto-Acquisition (ACQ) Mode Symbology**, p. 2.10.

Super Search

Super Search projects a 20° circle onto the center of the HUD. The radar acquires the first target within 10nm to enter this circle.

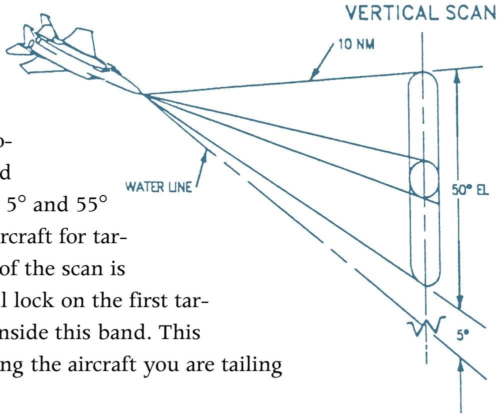
Boresight

Boresight projects a 4° circle onto the center of the HUD. The radar acquires the first target within 10nm to enter this circle.

Long-Range Boresight

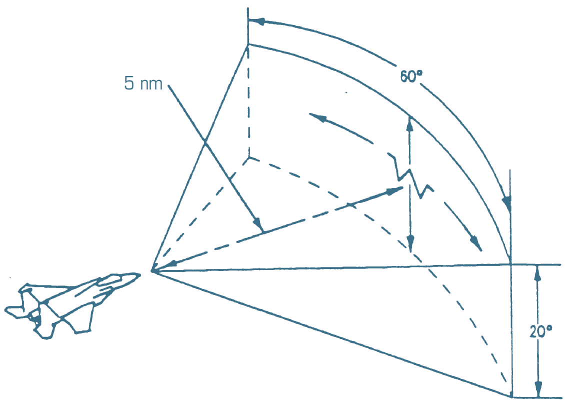
Long-Range Boresight also projects a 4° circle onto the center of the HUD. The radar acquires the first target within ***40nm*** to slip into this circle.

Vertical Scan



Vertical Scan mode changes the direction of the radar antenna. Instead of moving side-to-side, it now moves up and down, scanning between 5° and 55° above the nose of your aircraft for targets. The azimuth width of the scan is about 7.5°. The radar will lock on the first target within 10nm to slip inside this band. This mode is useful for targeting the aircraft you are tailing in a turning fight.

Guns



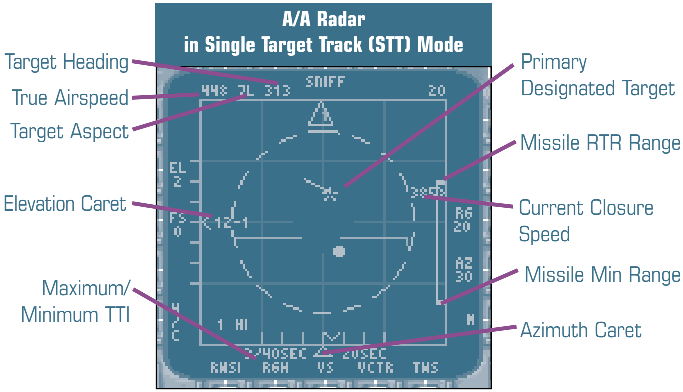
Guns acquistion mode covers a rectangle of roughly 60° azimuth (30° to either side of nose) and 20° elevation (10° above nose, 10° down), out to a range of only 5nm. The first target to enter this area is targeted.

TRACK THE TARGET

Once the radar has acquired a primary designated target (PDT), it begins to track it. By default, the radar uses Single-Target Tracking (STT) mode, tracking only the PDT. All other contacts disappear from the screen. This doesn't help you much if your target has company you want to keep an eye on, so there is a Track While Scan (TWS) mode in which the radar will track the PDT, but continue to update contact information in a small area surrounding it. You can choose this mode using PB 10 of the A/A Radar page.

Single-Target Tracking (STT)

In STT mode, the radar displays range, azimuth, altitude, closure rate, true airspeed, aspect and heading information for the PDT. A long heading vector on the PDT symbol visually indicates the direction the target is heading. When you are in an A/A missile mode, missile mode symbology, such as weapon range, shoot cues, etc., will also appear on the display.



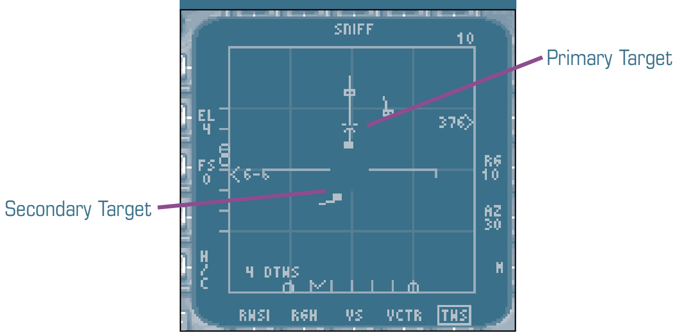
You must be in STT mode in order to launch an AIM-7.

For more information on the symbology used in this mode, see **Cockpit: Symbology — Target Designated**, p. 2.56, and **Cockpit: Missile Mode Symbology**, p. 2.58.

Track While Scan (TWS)

The symbology used to describe the PDT in TWS mode is the same as is the symbology used on the STT display. In addition, however, TWS modes display non-target contacts on a small portion of the radar screen, and you can designate additional *secondary designated targets* (SDTs, see instructions below). Small heading vectors on non-target contacts indicate the contacts' headings. The heading vectors on your primary and secondary designated targets are twice as long as the heading vectors for non-target contacts.

A/A Radar in Track While Scan (TWS) Mode



Using TWS Modes with a PDT

1. Designate your target using one of the methods described under **Designate the Target**, p. 4.28.

2. Select a TWS mode. Press PB 10 of the A/A Radar page to toggle between DTWS and high data rate (HD) TWS modes. Both are TWS modes; HDTWS simply scans a smaller area in a shorter amount of time than DTWS. When one of these modes is boxed, the radar is in a TWS mode.

3. Set the scan area size. In HDTWS, there is only one size — a 30°, 2-bar scan. In DTWS mode, you can cycle between a 2-bar, 60° scan (more useful for contacts flying at the same altitude); a 4-bar, 30° scan (more useful for contacts in stacked formation) or a 6-bar, 15° scan (more useful for targets widely separated by altitude) by changing the radar's azimuth setting (PB 12 of the A/A Radar page).

   See **Cockpit: Other A/A Radar Pushbuttons**, p. 2.53, for more information and diagrams of the HDTWS and DTWS scan area sizes.

Acquiring Secondary Designated Targets (SDTs)

TWS mode is particulary useful when used in conjunction with AIM-120s. In a TWS mode you can designate secondary designated targets (SDTs) as well as primary designated targets (PDTs). Multiple AIM-120s can be fired at all of these targets at the same time.

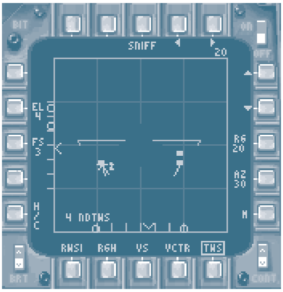
To designate SDTs:

1. Designate a target using one of the methods described under **Designate the Target**, p. 4.28.
2. Switch to a TWS mode, using the steps described under **Using a TWS Mode with a PDT**, above.
3. Click on another contact to designate it. This contact becomes the PDT, and the old PDT becomes an SDT. You can continue designating targets in this manner, to a total of eight (1 PDT and 7 SDTs).

For more information on engaging these targets with AIM-120s, see **Firing an AIM-120**, p. 4.34.

Using TWS Modes without a PDT

You can select a TWS mode before you designate a target. When you do so, the radar picks the closest contact and designates it as your primary non-designated target. Its symbol switches from a square to a star (or a flashing circle and star if you've made an IFF query and the contact returned a friendly response), but its heading vector remains the same size as that of non-target contacts. If you did not previously have a PDT, and you designate one while in TWS mode, you enter STT mode.



Undesignating a Target/Designating a New Target

To undesignate your target at any time, press the **UNDESIGNATE** Bksp key.

In STT mode, you will have to undesignate the target in order to designate another. In a TWS mode, clicking on another contact designates the new contact as a PDT and the old contact as an SDT (See **Acquiring Secondary Designated Targets**, above). If you want to designate a new PDT without making the old PDT an SDT, press the **UNDESIGNATE** Bksp key first, and then acquire your new target.

ENGAGING

When you are enroute to a strike target, taking out your opponent on the first pass (which is *always* the goal of an air attack) is crucial. Successfully detecting an enemy means acquiring him as your target by the time he is within your weapon range, but before you are within his weapon range. (This of course requires you to have longer-range weapons than his.) At this point you have the advantage, and if you destroy him, you can keep it. If you fail to destroy your opponent and are drawn into a dogfight, you will probably find yourself (as a strike aircraft loaded with ordnance and fuel) at a severe disadvantage. Thus your goal is to engage him from as far away as possible and avoid the dogfight.

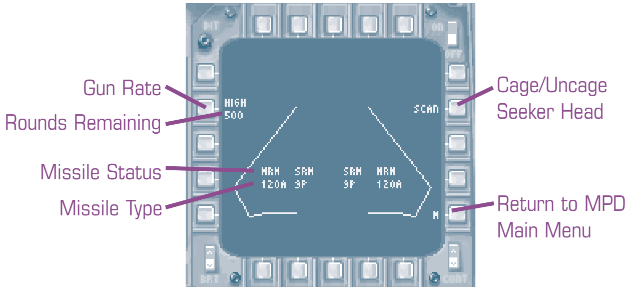
ENGAGE WITH MISSILES

The AIM-120A is by far your first line of defense. Not only does this missile have a longer range than the others, but it also has an onboard active radar seeker. Used in conjunction with the radar in a TWS mode, you can launch and update multiple AIM-120s toward multiple targets — several missiles can be in-flight maneuvering toward different targets at the same time. The shorter-ranged, SARH-guided AIM-7, on the other hand, requires you to keep a radar lock on a single target until the missile impacts.

The IR-guided AIM-9 is a true "fire-and-forget" missile — once it is launched, it homes in on the heat signature of its target. It has a much shorter range than the other two, however.

CHECKING YOUR MISSILE STORES

The A/A Arm page displays all of your air-to-air ordnance on a rough top-down view of your aircraft. The nose of your aircraft is oriented toward the top of the display. The large triangular "brackets" represent its wings. At the rough location for each of the eight air-to-air ordnance stations on the underside of your aircraft, the type and status of weapon loaded is indicated. (Only one weapon can be loaded at each station.)



The status of the missiles is indicated by the following:

MRM An AIM-7 or AIM-120 is loaded at this station.

SRM An AIM-9 is loaded at this station.

STBY You are in the correct mode to launch this missile (MRM or SRM), but the missile is not next in sequence.

RDY This is the next missile in sequence. It will launch when you press the pickle (joystick button 2).

HUNG The missile has malfunctioned, and remains on the rail after launch (it hasn't armed, so there's no danger of explosion).

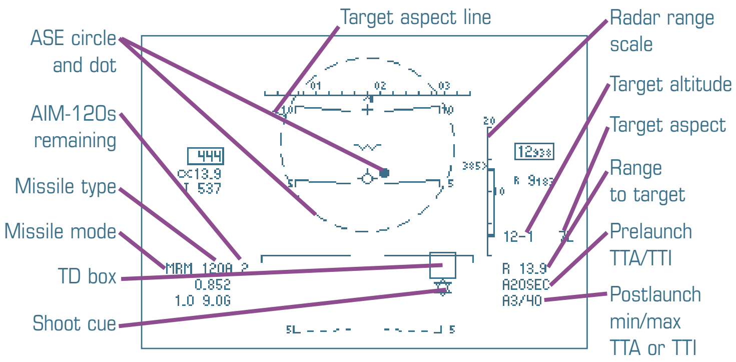
If nothing appears, there is no missile at this station.

For more information on the symbology of the A/A Arm page, **see A/A Arm Symbology**, p. 2.26.

Missile Modes and Launch Sequences

There are two missile launch modes — MRM (medium-range missile) and SRM (short-range missile). MRM mode is used to launch AIM-120s and AIM-7s; SRM is used to launch AIM-9s. For each mode there is a designated launch sequence. You can "step over" or skip a missile in the sequence, but you can in no other way alter it.

See the launch sequence diagrams under **Cockpit: Missile Launch Sequences**, p. 2.27.



Firing an AIM-120A

In order to fire an AIM-120A, an AIM-120A must be the next missile in sequence.

1. Acquire a target using one of the methods described under **Acquiring and Tracking BVR Targets**, p. 4.27. A TD box appears, tracking the position of this target on the HUD. (If this target has been queried by IFF and returned a friendly response, an X appears through this box.) If you want to fire at multiple targets, designate secondary targets according to the instructions under **Acquiring Secondary Designated Targets (SDTs)**, p. 4.32.

2. Press **MRM_SELECT** 3 to switch to MRM missile launch mode. Check to see that an AIM-120A is next in sequence. If not, step over your AIM-7s until you get back to an AIM-120 (press **MISSILE_REJECT** 4 to "reject" or step over a missile), or proceed with the instructions for the AIM-7.

3. An Allowable Steering Error (ASE) circle and dot appear on the HUD. When you have a designated target, this circle represents the maximum steering error for a normal launch. Steer toward the heavy dot to place it inside the large, dashed circle.

   This circle is essentially a function of target range relative to R_{aero} and target altitude, target aspect angle, and the difference in altitude between you and your target. It will increase in size as you move closer to your target, to a certain point, then may begin to decrease as target aspect angle changes.

4. Check the range scale on the right side of the HUD. The caret marks your target's current range and closure rate. The bars on the range scale delineate certain ranges. These will give you an idea of when to release your target.

   R_{aero} This marks the maximum aerodynamic range of the missile at your current altitude. A missile fired at a target within this range has a chance of hitting only if the target doesn't do anything to avoid the missile. It's probably better to hold on to the missile a little longer until you're in better range.

   R_{opt} This marks the optimum range of the missile at your current altitude, against a target that flies straight and level until the missile has almost reached it, then performs a 4G terminal escape maneuver. A missile fired at an unsuspecting target within this range has a chance of hitting, if the target doesn't realize a missile has been launched at him (or at least doesn't maneuver to avoid it) until the terminal phase of the missile's flight.

R_{tr} This marks the maximum turn-and-run range of the missile at your current altitude. Within this range, it is hard for the target to out-maneuver or out-run the missile, even if it begins evasive maneuvers as soon as you launch. (Of course, a target's use of mechanical and electronic countermeasures can still decrease the missile's chance of hitting.)

MAR dot Indicates missile activation range — the range at which AIM-120 active seeker attempts to acquire the target.

R_{min} Minimum range of the missile at your current altitude. The missile will not be able to hit a target inside this range.

On your radar display and on the HUD, the range between R_{tr} and R_{min} will be bracketed.

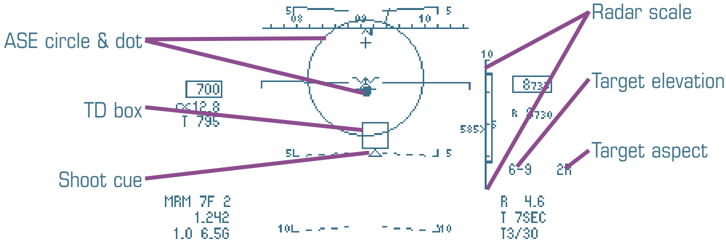
The shoot cue (a six-pointed star) appears under the TD box when your target is between R_{aero} and R_{min}. Depending on the situation, you may not want to fire until the target is within R_{tr} and R_{min}, at which point the shoot cue will flash.

Your decision should in part be influenced by whether the target has a positive or negative closure rate (displayed next to the caret marking the target's range on the range scale). If he has a positive closure, he's moving toward you, continually decreasing the distance the missile will travel and the time it has to lock on to the target and arm. If he's moving away from you, he's increasing the distance the missile will travel.

5. Press the **WEAPON_PICKLE** key or button (typically joystick button 2) to launch your missile. If you have multiple targets designated, continue pressing and releasing the **WEAPON_PICKLE** key or button to launch missiles at each of these targets.

If the target moves within your minimum missile range before you launch, a large X (called a "break X") appears on the HUD and the radar screen. You will have to switch to a shorter-range missile, or break off and reposition yourself for another launch.

For more information on AIM-120 symbology, see **Cockpit: MRM Symbology**, p. 2.12.



Firing an AIM-7

In order to fire an AIM-7, an AIM-7 must be the next missile in sequence.

1. Acquire a target using one of the methods described under **Acquiring and Tracking BVR Targets**, p. 4.27. A TD box appears, tracking the position of this target on the HUD. (If your target has been queried by IFF and returned a friendly response, an X appears through this box.)

   Do not switch to TWS once you've acquired your target. You must be in STT mode (entered automatically when you acquire a target) to fire an AIM-7.

2. Press **MRM_SELECT** 3 to switch to MRM missile launch mode. Check to see that an AIM-7 is next in sequence. If not, step over your AIM-120As until you get to an AIM-7 (press **MISSILE_REJECT** 4 to "reject" or step over a missile) or proceed with the instructions for the AIM-120A.

3. An Allowable Steering Error circle and dot appear on the HUD. When you have a designated target, this circle represents the maximum steering error for a normal launch. Steer toward the heavy dot to place it inside the circle.

   This circle is essentially a function of target range relative to R_{aero} and target altitude, target aspect angle, and the difference in altitude between you and your target. It will increase in size as you move closer to your target, to a certain point, then may begin to decrease as target aspect angle changes.

4. Check the range scale on the right side of the HUD. The caret marks your target's current range and closure rate. The bars on the range scale delineate certain ranges. These will give you an idea of when to release your target.

   R_{aero} This marks the maximum aerodynamic range of the missile at your current altitude. A missile fired at a target within this range has a chance of hitting only if the target doesn't do anything to avoid the missile. Its probably better to hold on the missile a little longer until your in better range.

   R_{opt} This marks the optimum range of the missile at your current altitude against a target that flies straight and level until the missile has almost reached it, then performs a 4G terminal escape maneuver. A missile fired a an unsuspecting target within this range has a chance of hitting, if the target doesn't realize a missile has been launched at him (or at least doesn't maneuver to avoid it) until the terminal phase of the missile's flight.

R_{tr} This marks the maximum turn-and-run range of the missile at your current altitude. Within this range, it is hard for the target to out-maneuver or out-run the missile, even if it begins evasive maneuvers as soon as you launch. (Of course, a target's use of mechanical and electronic countermeasures can still decrease the missile's chance of hitting.)

R_{min} Minimum range of the missile at your current altitude. The missile will not be able to hit a target inside this range.

On your radar display and on the HUD, the range between R_{tr} and R_{min} will be bracketed.

A triangular shoot cue appears under the TD box when your target is between R_{aero} and R_{min}. Depending on the situation, you may not want to fire until the target is within R_{tr} and R_{min}, at which point the shoot cue will flash.

Your decision should in part be influenced by whether the target has a positive or negative closure rate (displayed next to the caret marking the target's range on the range scale). If he has a positive closure, he's moving toward you, continually decreasing the distance the missile will travel and the time it has to lock on to the target and arm. If he's moving away from you, he's increasing the distance the missile will travel.

5. Press the **WEAPON_PICKLE** key (typically joystick button 2) to launch your missile.

6. ***You must maintain a radar lock on your target until the missile impacts***. Do not undesignate the target or allow it to move outside your radar cone.

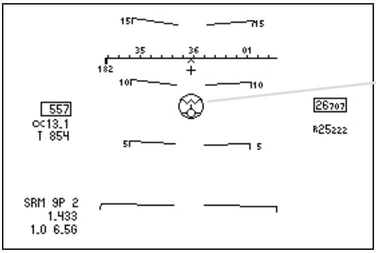
   On the radar screen, missile fly-out dots appear on the target's heading bar, signaling a missile in flight toward it. The estimated time-to-impact, or TTI, appears at the bottom of the radar display and in the lower right corner of the HUD.

If the target moves within minimum missile range before you launch it, a "break X" appears on the HUD and the radar screen. You will have to switch to an SRM, or break off and reposition yourself for another launch.

For more information on AIM-7 symbology, see **Cockpit: MRM Symbology**, p. 2.12.

Firing an AIM-9

The sysmbology displayed for the AIM-9L/M and AIM-9P differs slightly, because the AIM-9L/M is cued to the radar's boresight and the F-15's computer can track the movement of its seeker head on the HUD. The AIM-9P lacks this capability. Thus, the steps for firing an AIM-9 differ slightly, depending on whether an AIM-9M/L or AIM-P is selected, and whether or not you have a radar target designated.



Radar range scale

You can launch either AIM-9 at a target without designating the target, provided the it is within weapon range. Audio cues will tell you when the missile seeker head has gained an IR lock on the target, and this will be your signal to launch. If you fire without designating, your target's RWR will not alert him that he is being "painted," and he is less likely to suspect you are firing missiles at him.

To fire an AIM-9P:

1. a) *Optional:* Acquire a target using one of the methods described under **Acquiring and Tracking BVR Targets**, p. 4.27. If you designate a target, you will see range, altitude and closure information for the target. A TD box also appears, tracking the position of this target on the HUD. (If this target has been queried by IFF and returned a friendly response, an X appears through this box.)

   b) *Not optional:* Get behind your target. The AIM-9P is a rear-aspect only missile, so you will need to be at the rear of your opponent in order for the missile to gain a lock.

2. Press the **SRM_SELECT** 2 key to switch to SRM missile launch mode.

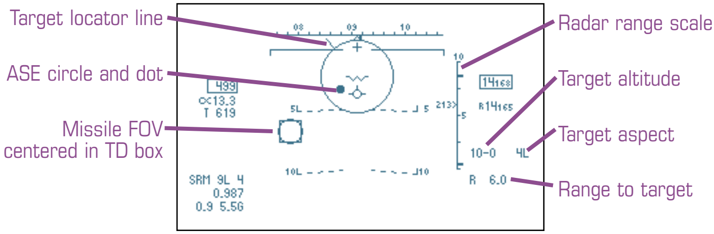
3. An FOV circle appears in the center of the HUD, locked onto the boresight. Steer so that your target is inside the missile FOV. When the missile has locked on to the target, it will generate an audio tone. The strength of this tone varies according to the target's distance, IR visibility and position in the missile's FOV — the louder the tone, the better the launch parameters.

4. Once you've achieved a solid lock, you can:

   a) Press the **WEAPON_PICKLE** key (typically joystick button 2) to launch your missile.

b) Click on PB 14 of the A/A Armament page or press the **AIM9_SCAN** U key until SCAN is boxed. The missile will uncage from the boresight and track the target — a continuous tone indicates successful tracking. When you are ready to launch, press the **WEAPON_PICKLE** key (typically joystick button 2).

If the target moves within minimum missile range, a "break X" appears on the HUD. You will have to switch to guns or break off and reposition yourself for another launch.



To fire an AIM-9L or M with a designated radar target:

1. Acquire a target using one of the methods described under **Acquiring and Tracking BVR Targets**, p. 4.27. A TD box appears, tracking the position of this target on the HUD. (If your target is a friendly, an X appears through this box.)
2. Press the **SRM_SELECT** 2 key to switch to SRM missile launch mode.
3. The missile's seeker head is automatically slaved to the radar antenna LOS (a small circle on the HUD indicates the current position of the seeker head — it may lag a bit from the TD box during heavy maneuvers as the seeker head readjusts).
4. When the seeker head has locked onto the target, you will hear a loud lock tone, and an Allowable Steering Error (ASE) circle and dot appear in the center of the HUD — keep the dot inside the circle.
5. Uncage the missile seeker head by clicking on PB 14 of the A/A Armament page or pressing the **AIM9_SCAN** U key until SCAN is boxed. This step is not always necessary, but it helps ensure that the seeker head continues to lock onto the designated target, as well as track it. When the seeker is uncaged and locked on, the ASE circle doubles in size.
6. Check your range cue to make sure the target is between the missile's maximum and minimum range. A triangular shoot cue flashes next to the TD box when the seeker head is locked on and the target is in range.
7. Press the **WEAPON_PICKLE** key (typically joystick button 2) to launch your missile.

If the target moves within minimum missile range, a "break X" appears on the HUD. You will have to switch to guns or break off and reposition yourself for another launch.

To fire an AIM-9L or M without a designated radar target:

The instructions are the same as those listed for the AIM-9P, except that a seeker head position will move around the HUD when the seeker head is uncaged. (This circle will always remain locked to the boresight when an AIM-9P is in priority, even if the seeker head is uncaged — the seeker head is still moving about, but the computer cannot track its position.)

For more information on AIM-9 symbology, see **Cockpit: SRM Symbology**, p. 2.15.

ENGAGE WITH THE M161A CANNON

Besides the raw thrill of shooting down your opponent at close range, a guns-only kills saves a missile, and you never know when you might need that missile. Still 500 rounds of ammunition won't last long, even with a low gun rate, and the gun requires you to get in close, which you want to avoid on your ingress to target.

Setting Gun Rate

You can set the gun's rate of fire from either the A/A Arm or A/G Arm MPD pages. PB 2 of either page toggles your gun rate between HIGH (6000 rounds per minute) and LOW (4000 rounds per minute). The currently selected rate appears by the button. The number of ammunition rounds you have remaining is listed below this rate.

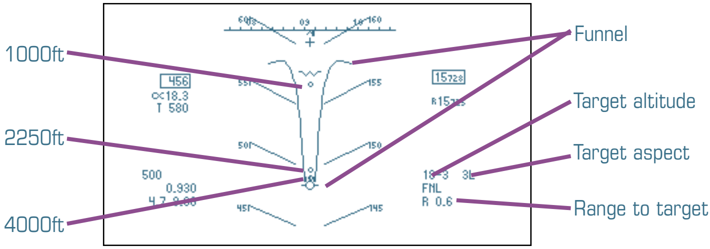
No Target Designated

A/A FNL is the only gun sight available when:

- You are in A/A master mode
- You do not have a target designated
- You press the **GUN_SELECT** 1 key to select your gun.

The radar will simultaneously switch to GUNS acquisition mode and attempt to aquire a target. See **A/A Auto-Acquisition Modes**, p. 2.10.

The funnel represents a target with a 40ft wingspan at ranges between 250 ft (the wide end of the funnel) and 5000 ft (the narrow end of the funnel). There are dots along the funnel marking 1000, 2250 and 4000 ft ranges. Bullets travel down the center of this funnel.



To engage a target with the A/A FNL sight:

1. Line the target up inside the funnel based on how far away you think it is.
2. Press the gun trigger (joystick button 1) to fire.

For more information on the symbology described here, see **Cockpit: A/A FNL Sight Symbology**, p. 2.17.

Target Designated

The GDS and GDS FNL gun sights become available when you are in A/A master mode, you have a target designated and you select your gun. If you designate your target before you select your gun, GDS symbology will appear by default. Otherwise, you are in A/A FNL and will have to cycle through gun sights to get to GDS. Once you have a target designated, all three sights are available, and the **GUN_SELECT** 1 key cycles through them. If you lose radar lock on the designated target, the gunsight will automatically revert to FNL, and the radar will switch to GUNS ACQ mode and attempt to re-acquire the target.

To engage a target with the GDS or GDS FNL sights:

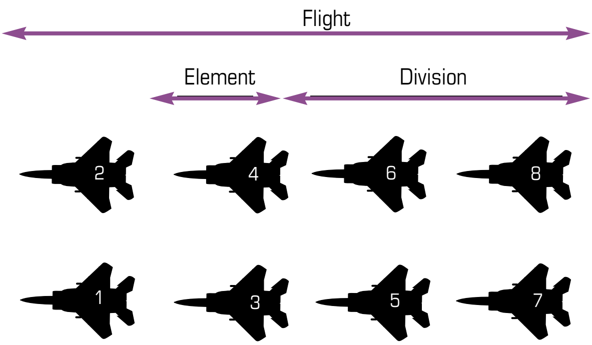
1. Line the target up with the center of the pipper. The GDS FNL provides the funnel for additional guidance.
2. A radar range scale is provided on the right side of the HUD — the caret indicates your target's current range and closure rate, and the tick mark indicates the gun's maximum range. Be sure that the target is inside the gun's maximum range.
3. Press the gun trigger (joystick button 1) to fire.

For more information on the symbology described here, see **Cockpit: GDS and GDS FNL Sight Symbology**, p. 2.17.

MANAGING YOUR FLIGHT

You are the flight leader for a flight of up to eight aircraft. Depending on the task at hand and expected level of resistance, you may want all eight aircraft to play similar roles in the mission, or (for example) you may direct some to take up escort duties while the others perform a strike. Whatever you decide, you will want to arm all of the aircraft in you flight accordingly. Once the mission is underway, their ability to carry out their part of the mission hinges in large part on your ability to effectively communicate with them.

THE STRUCTURE OF A FLIGHT



Before you can successfully manage a flight, you will need to understand its structure.

A flight can consist of up to eight aircraft. You, as flight leader, are always in aircraft 1, and your wingman is in aircraft 2. When you issue flight (**FLT**) commands, all aircraft in the flight will respond (see below).

An "eight-ship" or "six-ship" flight consists of two *divisions*. You are division leader of one of these, which consists of aircraft 1, 2, 3 and 4. Aircraft 5 is the division leader of the other, which consists of the remaining aircraft. You do not have control over the individual aircraft in aircraft 5's division, but his entire division will respond as a unit to any division (**DIV**) commands you give (see below).

Each division consists of one or two *elements*. As division leader, you have control over your element, and the element comprised of aircraft 3 and 4. When you issue element commands (**ELM**), only aircraft 3 and 4 will respond (see below). Your wingman will wait for direct wingman (**WN**) orders from you, and aircraft 5 has control over the elements in his own division.

FLIGHT COMMANDS

The general key commands listed in the table below can be used to control your wingman, the element, the division or the entire flight, depending on which prefix it has. **FLT_ENGAGE** tells the whole flight to engage, whereas **ELM_ENGAGE** orders only aircraft 3 and 4 to engage.

WN	Command controls aircraft 2 (wingman)
ELM	Command controls aircraft 3 and 4 (element)
DIV	Command controls aircraft 5, 6, 7 and 8 (division)
FLT	Command controls entire flight

Alternatively, you can access any of these commands by pressing the **RADIO_1_TRANSMIT** Tab key. A menu will appear in the upper left corner of the screen. Each of the menu options calls up a submenu, press the key corresponding to the number listed in front of an option to select it Unavailable options are grayed out.

1	1) WINGMAN (SUBMENU) (commands for aircraft 2)
2	2) ELEMENT (SUBMENU) (commands for aircraft 3 and 4)
3	3) DIVISION (SUBMENU) (commands for aircraft 5-8)
4	4) FLIGHT (SUBMENU) (commands for all aircraft)

GENERAL COMMANDS

The following list of commands can be used to direct your wingman, element, division or the entire flight, depending on which prefix the keyboard command name has or what menu the command is chosen from.

Menu Option. Lists the command options as they appears on the WINGMAN, ELEMENT, DIVISION and FLIGHT submenus described above. Press the key corresponding to the number listed in front of an option to select the option.

Key Command Suffix. Lists the keyboard function name suffixes for the same commands as they appear on the keyboard mapping screen. (The prefix to the commands — **WN**, **ELM**, **DIV** and **FLT** — indicates who responds to a command, while the suffix indicates what the response is.)

Action. Describes what the selected aircraft will do when you press the key command or choose the menu option.

Menu Option	*Key Command Suffix*	*Action*
ENGAGE BANDITS	**ENGAGE**	Engage any enemy air targets they find. If they can't find anything, they will radio you and continue normal flight. If they have acquired targets and want to engage, but you haven't given the OK, they will ask you for it.
SANITIZE RIGHT	**SANITIZE_RIGHT**	Fly out 90° to the right of your flight path, using air radar to search for targets. They will radio back the position of any they find. If they don't find any, they will return to formation. (Not available for **FLT** or from FLIGHT submenu.)
SANITIZE LEFT	**SANITIZE_LEFT**	Fly out 90° to the left of your flight path, using air radar to search for targets. They will radio back the position of any they find. If they don't find any, they will return to formation. (Not available for **FLT** or from FLIGHT submenu.)
COVER ME	**COVER**	Do one of three things — A) begin a CAP, if a CAP was assigned to them for this steer point; B) begin their escort, if escort is assigned for this steer point; C) cover you, otherwise. See **Steering Data**, p. 2.68, for an explanation of steer point assignments. (Not available for **FLT** or from FLIGHT submenu.)

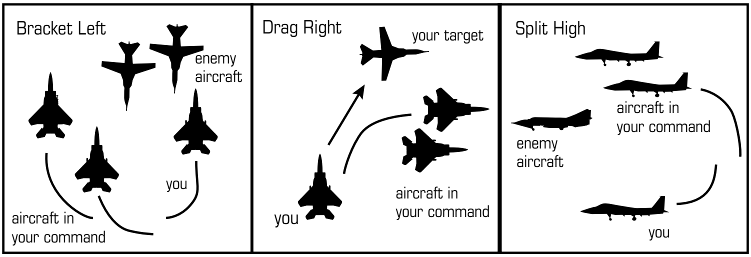
Menu Option	*Key Command Suffix*	*Action*
ORBIT HERE	**ORBIT**	Circle the area until you ask them to return to formation. They will not follow you if you go elsewhere. You can combine this command with another like **ENGAGE** to order aircraft to remain in one place and carry out a specific task. (Not available for **FLT** or from FLIGHT submenu.)
INTERCEPT		Call up the INTERCEPT submenu. (See below)
GROUND ATTACK	**ATK_ANY_GRND**	Call up the GROUND ATTACK sub-menu. (See below)
REJOIN FLIGHT	**REJOIN_FLIGHT**	Break off attack and return to formation.
RETURN TO BASE	**RETURN_TO_BASE**	Return to the airfield where you began your mission.

Intercept Submenu

None of these options are available for **FLT** or from the FLIGHT submenu.

Menu Option	*Key Command Suffix*	*Action*
BRACKET RIGHT	**BRACKET_RIGHT**	Pull to the right (while you pull to the left) of the group of enemy fighters currently targeted. If an element or division leader does not have a target, he will ask the aircraft under his control for a target. If no one under his control has a target, he will try and determine which target you wish him to bracket. If he cannot, he will radio this to you, and continue normal flight. (See diagram.)
BRACKET LEFT	**BRACKET_LEFT**	Pull to the left (while you pull to the right) of the group of enemy fighters currently targeted. Targets are chosen as described above.

Menu Option	*Key Command Suffix*	*Action*
SPLIT HIGH	**SPLIT_HIGH**	Climb above (while you dive below) the group of enemy fighters currently targeted. Targets are chosen as described for **BRACKET RIGHT.** (See diagram.)
SPLIT LOW	**SPLIT_LOW**	Dive below (while you climb above) the group of enemy fighters currently targeted. Targets are chosen as described for **BRACKET RIGHT**.
DRAW RIGHT	**DRAG_RIGHT**	Lead your target away to the right of you so you can get a better shot at him. Targets are chosen as described above. (See diagram.)
DRAW LEFT	**DRAG_LEFT**	Lead your target away to the left of you so you can get a better shot at him. Targets are chosen as described above.



Ground Attack Submenu

Menu Option	*Key Command Suffix*	*Action*
ATTACK PRIMARY GROUND TARGET	**ATK_PRIMARY**	Attack the primary mission objective (usually a ground target) as defined in the mission briefing.
ATTACK SECONDARY GROUND TARGET	**ATK_SECONDARY**	Attack the secondary mission objective (usually a ground target) as defined in the mission brieing.
ATTACK GROUND TARGETS OF OPPORTUNITY	**ATK_ANY _RND**	Attack whatever ground targets they find.

Wingman-Specific Commands

In addition to the general commands listed above, the following commands will help you work more closely with your wingman in a dogfight.

Menu Option	*Key Command*	*Action*
TACTICAL		Calls up TACTICAL submenu. (See below)
ATTACK MY TARGET	**WN_ATK_MY_TARGET** Ctrl A	Engage your designated air or ground target. If you don't have a target designated, he'll continue normal flight.
HELP ME	**WN_HELP** Ctrl H	Drop what he's doing and come to your aid *unless* he's in hot water himself, in which case he'll tell you you're on your own.

Tactical Submenu

Menu Option	*Key Command*	*Action*
BREAK RIGHT	**WN_BREAK RIGHT**	Turn hard right.
BREAK LEFT	**WN_BREAK_LEFT**	Turn hard left.
BREAK HIGH	**WN_BREAK_HIGH**	Turn hard up (vertical turn).
BREAK LOW	**WN_BREAK_LOW**	Turn hard down (vertical turn).

FLIGHT-SPECIFIC COMMANDS

In addition to the general commands listed above, there are several formation commands and information requests that you can only issue to the flight as a whole.

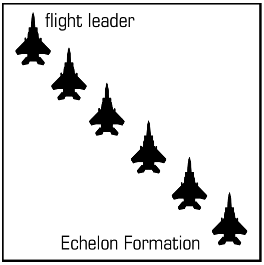
Menu Option	*Key Command*	*Action*
RADAR ON/OFF	**FLT_RADAR_TOGGLE**	Enable/disable radar emission. Note that an aircraft will not disable its radar if it is tracking a target.
MUSIC ON/OFF	**FLT_JAMMER_TOGGLE**	Enable/disable jammer emission.
REPORT CONTACTS		List off all contacts they see, without attempting to sort (see below).
SORT BANDITS	**FLT_SORT_BANDITS**	List off their targets. They will attempt to describe the targets in a way that will help you determine which blips on your radar screen they are referring to, using cardinal directions relative to your aircraft and lead, trail and middle 1, 2, 3, etc. to describe relative range within a group of fighters. If the situation is confusing, they'll list the type of aircraft they are targeting — Striker, CAP, etc.
STATUS (SUBMENU)	**FLT_STATUS** Ctrl A	Call up the STATUS submenu. (See below.)
CHANGE FORMATION		Call up the CHANGE FORMATION submenu. (See below.)

Status Submenu

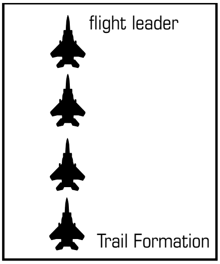
Menu Option	*Key Command*	*Action*
FLIGHT SYSTEMS CHECK	**FLT_STATUS** Ctrl S	Radio in just their flight numbers (if undamaged) or their flight numbers and amount of damage they've taken.
FLIGHT WEAPONS CHECK	**FLT_WEAPON_CHK** Ctrl W	List off their air-to-air ordnance.

Change Formation Submenu

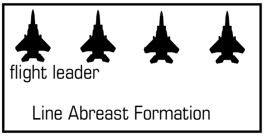
Menu Option	*Key Command*	*Action*
LOOSEN CURRENT FORMATION	**FLT_LOOSEN_FORMATION**	Move further apart in formation — doubling the current spacing.
TIGHTEN CURRENT FORMATION	**FLT_TIGHTEN_FORMATION**	Move closer together in formation — halving the current spacing.
WEDGE FORMATION	**FLT_WEDGE_FORMATION**	Form a wedge formation. (See diagram.)
LINE ABREAST FORMATION	**FLT_LINE_FORMATION**	Form a line formation. (See diagram.)
ECHELON FORMATION	**FLT_ECHELON_FORMATION**	Form an echelon formation. (See diagram.)
TRAIL FORMATION	**FLT_TRAIL_FORMATION**	Form a trail formation. (See diagram.)



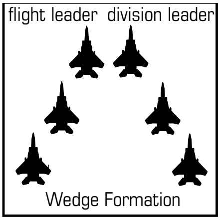
Echelon Formation



Trail Formation



Line Abreast Formation



Wedge Formation

TAKING CARE OF BUSINESS

This is the point at which you actually achieve the job you were sent out to accomplish — your Time Over Target (TOT). In some ways, the computer cues for dropped guided and unguided weapons are so extensive, and the smart bombs so smart, that it may seem like getting the whole package to the target is the hardest part of a mission. Still, your altitude, airspeed and flight attitude at the time of an air-to-ground drop affect the weapon's trajectory, and coordinating these while dodging AAA, SAMs and perhaps a few defensive aircraft is no mean feat.

SWITCHING TO A/G MASTER MODE

A/G master mode configures all of your cockpit systems for air-to-ground targeting and engagement. As you near your target area (perhaps when you reach the *initial point* just before the target point), you'll want to switch to this mode.

Press the **MASTER_MODE_CYCLE** [M] key to cycle through master modes ***or*** press the **MASTER_MODE_AG** key *or* click on the A/G button beneath the UFC to select A/G master mode.

See **Cockpit: Master Modes**, p. 2.3.

The A/G Radar page, A/G Arm page and the TSD page come up automatically in the pilot's MPDs. For information on changing these default settings and set defaults for the WSO MPDs, see **Cockpit: 6. Master Mode Programming**, p. 2.37.

FINDING AND DESIGNATING TARGETS

Air-to-ground target designation differs from air-to-air target designation in one crucial way — when you designate an air target, you make the ***object*** you intend to hit with your weapons your target; when you designate a ground target, you make the ***point on the ground*** you intend to hit with your weapons your target. For stationary targets like structures and relatively stationary targets like radar installations, finding the target involves finding the general target area and scanning an HRM of this area to locate the structures. For Ground Moving Targets (GMTs), finding your target involves scanning the general target area in GMT radar mode and cueing the targeting IR to an area of movement.

ORIENTING YOURSELF WITH THE TSD

The Tactical Situation Display (TSD) page displays a digitized satellite map of the area of operation. Superimposed on this map are steer point and flight path symbology. You can focus on your current position, or "look ahead" to other upcoming steer points. It provides mostly navigation and terrain information — even at its highest resolution (10nm) it cannot show individual structures. However it can give you a top-down reference indication of where in relation to your mission route you are currently scanning with radar, creating an HRM or aiming the Targeting IR camera.

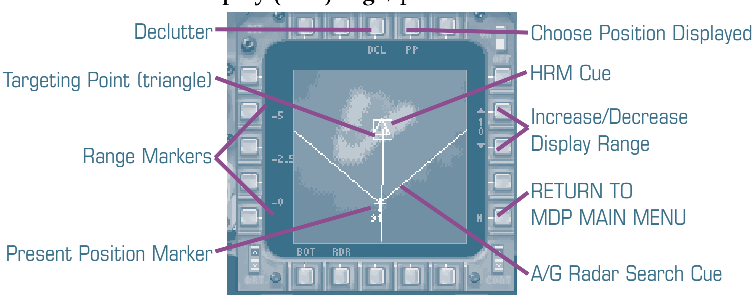
Your route is marked by a series of lines connecting sequence points. *Sequence point* is a term used to describe F-15E navigation symbols. Sequence points can be:

- *Steer points* Ordinary navigational waypoints along your mission route, represented by small circles.
- *Initial points* Steer points just prior to a target point, represented by squares.
- *Target points* Steer points where you are intended to deliver weapons, represented by triangles.

You can cycle forward and backward through TSD display ranges with PBs 13 and 14. Available ranges are 10, 20, 40 and 80nm — the currently selected range appears between the buttons.

To see where your sensors are currently looking, press PB 7 to choose the A/G radar (RDR) or targeting IR camera (FLIR). The selected option appears above the button, and the corresponding cue for this sensor will appear on the display. If you choose the RDR cue, and the A/G radar is in HRM mode, a polygon appears on the TSD, indicating the area displayed in the map. This polygon is connected to the aircraft present position marker by a line indicating the radar LOS. In any mode other than HRM, a "V" appears on the TSD, indicating the area currently being scanned by the A/G radar. If you choose the FLIR cue, an arrowhead indicates where the targeting IR camera is aimed. Again, the line extending from the arrowhead to the present position marker indicates the sensor's LOS to the scan area.

For additional information on TSD functions and symbology, see **Cockpit: 5. Tactical Situation Display (TSD) Page**, p. 2.34.



TARGETING STATIONARY GROUND TARGETS

Once you are within radar range of the target area, you will use the A/G radar in Real Beam Map (RBM) mode to scan the area and pinpoint a location you want to view in greater detail with a High Resolution Map (HRM). RBM mode is far too low-res for targeting — you could be off hundreds of feet, which, depending on the size of your target and munition, could result in your missing it entirely.

Make a Radar Scan of the Area in RBM Mode

For more information on the symbology used on the radar display, see **Cockpit: 14. Air-to-Ground Radar (A/G RDR) Page**, p. 2.45.

RBM mode displays radar returns bounced off terrain features in an arc in front of your aircraft (your aircraft is at the bottom center of the display). It updates with a sweep of 90° per second and has a minimum range of 4.7nm and a maximum range of 80nm (actual ranges are dependent on LOS).

To put the radar in RBM mode, click PB 6 (RBM/HRM/GMT/IGMT) of the A/G Radar page until RBM appears above it.

Setting A/G Radar Scan Limits

PB 9 Cycle through **azimuth scan angles** — FULL (50°, or 25° to either side of your aircraft's nose), HALF (25°) or QTR (12.5°). Lowering the arc size decreases the amount of time it takes the radar to scan, but limits the scan area.

PB 13/14 Cycle through **radar ranges** — 4.7, 10, 20, 40 and 80nm. The currently selected range is displayed between the two buttons.

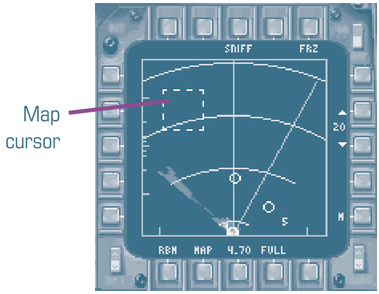
Freezing the Radar Display

Selecting FREEZE stops all data collection and RF transmission, saving the current state of the scan on the display. This can be useful when you are trying to accurately place the map cursor. Exact coordinates for the cursor position (azimuth and range from the aircraft) are given in the upper left corner (these do not freeze when the radar is frozen).

To freeze the radar display, press PB 19 (FREEZE). This option is boxed when the radar is frozen; click PB 19 again to unfreeze the radar.

Create an HRM

High-Resolution Maps (HRMs), or "patch maps," are static, high-detail, top-down Synthetic Aperture Radar (SAR) images. They are used to view an area in greater detail for targeting. Each HRM requires about 4-10 seconds to create.



To create a map:

1. Press PB 7 on the A/G Radar page to change the cursor function to MAP. (MAP appears above the button.)

2. Select the HRM display window (DW) size using PB 8. Available sizes are .67, 1.3, 3.3, 4.7, 10, 20 and 40nm; the current DW size is displayed above the button.

   This option controls how far an HRM map is zoomed in when one is commanded — when it is set to 1.33 for example, the HRM will be 1.33 x 1.33 nautical miles. (It does ***not*** affect the range of an HRM that is already visible on screen.)

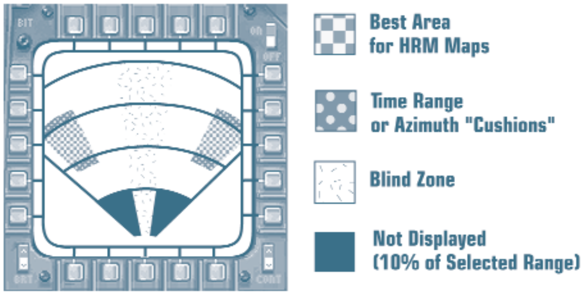
3. Position the mouse cursor over the radar display. The exact azimuth and range of the cursor with respect to your aircraft is displayed in the upper left corner of the A/G Radar page.

   An error message will appear at the bottom of the display if the cursor is not within mappable limits. **See Cockpit: A/G Radar Messages**, p. 2.49, for details on what these messages mean.

4. Left-click to command a map. A timer in the lower left corner counts down until the map is ready. When the timer reaches zero, the patch map you've created replaces the RBM display.

HRM Limits

Azimuth limits. Ideally, you should make patch maps in the area between 30° and 50° to the left and right of the nose. This are the HRM "sweet spots" — due to the nature of the Synthetic Aperture Radar, maps can be constructed more quickly and more accurately in these zones. You cannot make a map within 8° to the left or right of the nose (the HRM "blind zone") or more than 60° to the left or right of the nose (outside the radar's gimbal limits).



Altitude vs. range. Mapping from the ideal altitude for the range (to the area being mapped) produces an image of greatest quality. Fly too low and you could limit the air-to-ground radar's range. Fly too high and you could lose detail. The table below lists the maximum range of the radar (**Max R**, in nautical miles) at different altitudes above ground level (**Alt AGL**, in feet) over flat terrain. Note that these ranges are LOS-dependent — if the terrain is mountainous, you may have to climb significantly to afford the radar the same range.

Alt AGL	Max R	Alt AGL	Max R
50 ft	8.1nm	400	22.9
100	11.4	500	25.6
200	16.2	1000	36.2
300	19.8		

DW size vs. range. The display window size you have chosen for the HRM also limits the range at which you can map an area. Generally speaking, the smaller the DW size, the shorter the range at which the map must be commanded. If you attempt to create a map outside the range possible given the DW size setting, a "DW SIZE LIMIT" message will appear at the bottom of the radar display.

The table on the next page lists the **max** and **min cursor ranges** for different HRM display window sizes (**DW sizes**, in nautical miles). These are the maximum and minimum distances (in nm) where you can place a cursor on the display to command a map. (For example, if the radar range is set to 20nm, a cursor at 10nm of range would be in the middle of the display.) **Resolution** is the minimum size (in feet) an object must be to appear on the map. A resolution of 17ft, for example, indicates that objects under 17ft cannot be seen on this map.

DW size	Min cursor range	Max cursor range	Resolution	DW size	Min cursor range	Max cursor range	Resolution
.67	2.7	20	8.5	10	6	80	127
1.3	2.7	40	17	20	12	80	253
3.3	2.7	50	42	40	24	80	507
4.7	2.8	80	59				

Designate the Target

Once you have located your target, you can designate it using the radar or the HUD.

Using the Radar

It may take several HRMs to get a good picture of your target — you may have to climb, fly closer to the target and/or change your heading somewhat to get an image with a high enough resolution to find a specific structure or other target. Once you've found it, however, you can click on it to designate it.

1. Press PB 7 on the A/G Radar page to change the cursor function to target (TGT). (TGT appears above the button.)

2. Position the mouse cursor over the radar display. The exact azimuth and range of the cursor with respect to your aircraft is displayed in the upper left corner of the A/G Radar page.

3. Click on a point to designate it as your target point. Note that you are designating a point on the ground and *not* an object. When designating ground targets, you are simply giving the computer the coordinates of the point where you want to deliver weapons.

   A triangle appears over the point you have designated. It will show up on the A/G Radar page and the Targeting IR page, whenever range and LOS allow. A diamond marks the same target point on the HUD.

Using the HUD

If you can see the structure or area you wish to designate through your HUD, you can designate it by placing the cursor over the HUD and clicking.

1. Position the mouse cursor over the HUD.

2. Click on a point to designate it as your target point. Again, note that you are designating a point on the ground and *not* an object. When designating ground targets, you are simply giving the computer the coordinates of the point where you want to deliver weapons.

   A diamond appears on the HUD over the point you have designated. A triangle marks the same point on the A/G Radar page and the Targeting IR page.

TARGETING GROUND MOVING TARGETS (GMTS)

Finding moving ground targets is a bit trickier than finding stationary objects. The reason isn't simply because they are moving, for their speed in relation to yours is very small. Rather it is the relatively small size of mobile SAMs, tanks and trucks combined with their motion that renders them impossible to pick up on even the highest-rez HRM. Instead the A/G radar has two special modes — GMT and IGMT — designed to pick up motion. You can then cue the targeting IR camera to the source of this motion and examine it.

MAKE A RADAR SCAN OF THE AREA IN GMT OR IGMT MODE

In Ground Moving Target (GMT) and Interleaved GMT modes, the A/G radar is capable of detecting targets moving on the ground (e.g., trucks and Scuds). GMT mode has no map background; IGMT places the GMT information on the RBM map terrain. Even in GMT and IGMT modes, however, the radar isn't finding an actual object, so much as a geographical area where movement is occurring. Note too that finding and engaging ground moving targets (GMTs) is relatively close-range work — regardless of the current radar range, GMTs can only be detected up to 32nm away. Areas where motion is detected are marked by crosses on the display.

Click PB 6 on the A/G Radar page to cycle through radar modes until GMT or IGMT is boxed.

MAKE A PRELIMINARY TARGET DESIGNATION

The radar can only indicate where it detects movement — the position of the moving object could be off by hundreds of feet, and no information on the type or size of the object can be determined. The targeting IR camera allows you to get a better look at a GMT and the area surrounding it. To cue the IR targeting camera to a GMT, you must first designate it as your target.

1. Press PB 7 on the A/G Radar page to change the cursor function to target (TGT). (TGT appears above the button.)

2. Position the mouse cursor over over a GMT on the radar display.

3. Click to designate this area as your target point. (Note that you are designating a point on the ground and ***not*** the object.) A triangle appears on the radar display over the point you have designated. This triangle will also appear on the targeting IR page, marking the same point. If LOS allows, a diamond will mark the target point on the HUD.

View Area with Targeting IR Camera

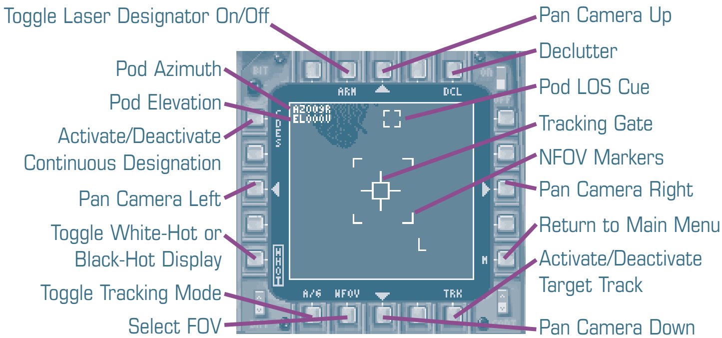
The IR targeting camera automatically cues toward your currently designated A/G target. You can then call up the Targeting IR page and pan the camera to look around.

1. From the MPD main menu, press PB 12 to call up the targeting IR camera.
2. Pan the camera to get a better look, if necessary; using the arrow pushbuttons (PBs 3, 8, 13 and 18) on the Targeting IR page. PB 12 re-centers the camera on the boresight (its unpanned position, aimed forward and aligned with the waterline on your HUD). Zoom the camera in and out using PB 7.

See **Cockpit: Targeting IR Pushbuttons**, p. 2.38.

Designate the Target

Once you're certain you've found your target, you can use the targeting IR camera to designate it.



1. Center your target in the tracking gate using the pushbuttons described above.
2. Enable target track (TRK) by pressing PB 10 on the Targeting IR page. (When enabled, TRK is surrounded by a box.) The camera will begin tracking the area or object in the center of the tracking box. (Note again that the camera tracks the target point you've designated, *not* the movement of the target.)
3. Activate continuous designation (CDES) by pressing PB 1. When active (CDES is surrounded by a box), the current object or area being tracked by the targeting IR camera (TRK is boxed — see PB 10, below) will be designated as the current A/G target.

For more information on the targeting IR camera, see **Cockpit: 12. Targeting IR Camera**, p. 4.58.

SELECTING WEAPONS AND BOMB MODES

Unlike air-to-air weapons, which are fired according to a predetermined launch sequence, you must set up the type and quantity of and intervals at which ground ordnance is released. You will need to take into consideration the size and number of your targets, how close together they are, how durable they are and what types of weapons you are using when determining the quantity and intervals for release. For each run you will:

- Select the stations to release ordnance.
- Choose how the weapons will be released.
- Set the number to be released and intervals at which they are released (ripple releases only).
- Set the height of burst (HOB — for CBUs only).
- Choose a bomb mode.

Most of the actions described below will be performed using the A/G Arm page. For more additional information on the symbology and pushbutton features of this page, see **3. Air-to-Ground Armament (A/G ARM) Page**, p. 2.28.

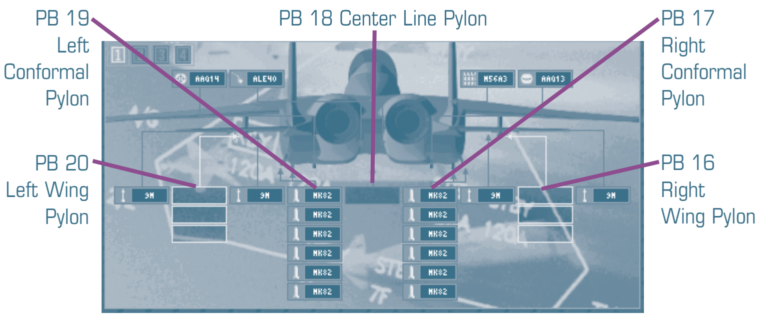
SELECT STATION(S)

1. From the MPD main menu, press PB 3 (A/G ARM) to call up the A/G Arm page.

   Pushbuttons 16-20 of this menu select and deselect air-to-ground weapon stations:

PB 16	Right wing pylon	*PB 19*	Left conformal pylons
PB 17	Right conformal pylons	*PB 20*	Left wing pylon
PB 18	Centerline pylon		

   Below each the quantity and designation weapons carried on that station are listed.



2. Press the PB for each station from which you wish to drop weapons. Multiple stations can be selected, but only if they are carrying weapons with the same designation (i.e., GBU-10, BLU-49, etc.). A box appears around the weapon designation when a station is selected. Press the button again to deselect this option.

CHOOSE A WEAPON RELEASE OPTION

Weapons can be released from the stations you have chosen in one of three different ways:

- **One weapon released per station (1/STA).** With each pickle (i.e., each time you press the **WEAPON_PICKLE** key or button), one weapon is dropped from each selected station. If two stations are selected, two bombs drop. If three stations are selected, three bombs drop.
- **Ripple single weapon (RP SGL).** With each pickle, the total quantity of weapons you have specified will be dropped one at a time at the interval you've set.
- **Ripple multiple weapons (RP MPL).** With each pickle, one weapon is dropped from each selected station at the interval you've specified until the total quantity of weapons you've specified has been dropped. In other words, if you have 2 stations (containing 4 weapons each) selected, and you've specified 8 weapons to be dropped, then once you press the pickle key, weapons will be released two at a time until all eight are released.

To choose an option, press its pushbutton on the A/G Arm page — PB 6 (1/STA), PB 7 (RP SGL) or PB 8 (RP MPL). Only one option can be selected at a time — the selected option is boxed on the display.

SET THE QUANTITY OF WEAPONS RELEASED

You must specify the *total* quantity of weapons released per pickle command when either RP SGL or RP MPL weapon release option is active. This quantity can range from 1 to 29, but the actual quantity dropped is limited by the number of weapons loaded on the selected stations. The current quantity setting appears between PBs 3 and 4 on the A/G Arm page.

PB 3 Controls the tens digit

PB4 Controls the ones digit

If 1/STA (one weapon per station) is your currently selected release option, this setting will have no effect on the total quantity of weapons released. Total quantity is instead determined by the number of stations you have selected.

SET THE INTERVAL BETWEEN RELEASES

You must specify an interval for weapon release when either the RP SGL or RP MPL is active. Intervals are determined in terms of feet of weapon range and can range from 0 to 990ft — an interval of 200 would mean a weapon was dropped every 200ft. The current interval setting appears between PBs 12 and 13 on the A/G Arm page.

PB 12	Controls the hundreds digit
PB 13	Controls the tens digit

If 1/STA (one weapon per station) is your currently selected release option, this setting will have no effect on the weapon release interval. All weapons are released at once.

SET THE CBU HEIGHT OF BURST

Cluster Bomb Units (CBUs) have different radii of effect, depending on the size and type and the height above the ground at which they explode. You determine the size and type when you choose which CBUs to release. You can set the height of burst on the A/G Arm page.

PB 14	Set height of burst (HOB) — cycle through 300, 600, 1000, 1500 and 2000ft above ground level. The higher the CBU explodes, the larger the area it will damage, but the less intense the damage.

SELECT A BOMB MODE

Bomb modes control what symbology is displayed on the HUD to guide the pilot through weapon release, and how much of the release procedure is controlled by the computer. PB 5 of the A/G Arm page cycles through these modes.

- **Continuously Displayed Impact Point (CDIP)** mode is perhaps most effective when combined with a dive or pop-up delivery. The point where the weapon will impact on the ground is continually re-calculated and projected onto the HUD, and a dive delivery (in which your aircraft is nose-down) or pop-up delivery (in which your aircraft is inverted) helps ensure that this impact point is visible on the HUD until the weapon is released. (In a level or loft delivery, the impact point can drop below the HUD FOV.)

- AUTO mode can be used with any type of delivery or weapon. The HUD provides you with azimuth steering information to help you align with the target, calculates when the weapon should be released and gives you a countdown. If you are pickling (i.e., pressing and holding the WEAPON PICKLE key or button before the countdown reaches zero, the weapon(s) are automatically released.

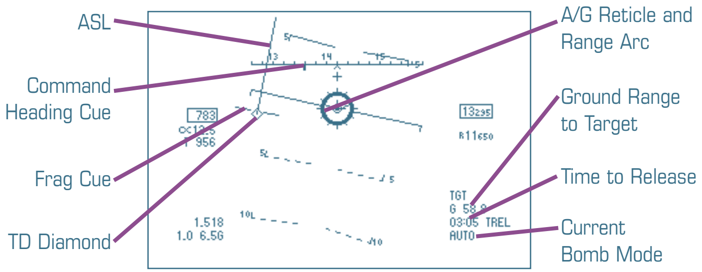
- AUTO LOFT mode is the same as AUTO mode, except it assumes you want a loft trajectory for the weapon released.

ENGAGING

UNGUIDED WEAPONS

AUTO Bombing Mode

AUTO bombing can be used with level, loft or dive deliveries. The HUD provides you with azimuth steering information, a target designator and information on when to expect the computer release of the bombs.



1. Designate a target, using one of the methods described under **Finding and Designating a Target**, pp. 4.51.

2. Make sure a weapon station is selected, and that the release option, quantity, interval and height of burst are set to your satisfaction. **See Selecting Weapons and Bomb Modes**, p. 4.59.

3. From the A/G Arm page, press PB 5 until AUTO appears next to the button. Steering symbology will appear on your HUD.

4. Steer toward the command heading cue to align yourself with the target. Center the Azimuth Steering Line (ASL) over the A/G reticle to fine-tune the alignment. When your steering error is less than 20° (i.e. your nose is positioned no more than 20° to the right or left of your target's azimuth position), time-to-release (TREL) is displayed at the bottom right of the HUD.

5. When TREL is at 10 seconds, a release cue appears on the ASL. It will move down to intersect the flight path indicator as TREL goes to zero. Press the **WEAPON_PICKLE** key or button *before* TREL reaches zero, and hold it down until TREL reaches zero.

6. When TREL reaches zero, the weapon is dropped. If multiple weapons have been selected for release, the release cue will reposition itself automatically and the process will begin again. Continue to hold down the pickle and center the ASL until all selected weapons have been released — the release cue will disappear, and the A/G reticle will begin to flash at this point.

If your steering error is greater than 20°, TREL and the release cue disappear from the screen. Re-align the ASL over the A/G reticle to bring them back. For more information on symbology, see **Cockpit: AUTO and AUTO LOFT Bomb Modes**, pp. 4.62-4.63.

AUTO LOFT Bombing Mode

AUTO LOFT is similar to AUTO bombing mode, except it assumes a loft trajectory for the weapon and provides steering symobology to help you achieve it. A loft trajectory gives the weapon a greater range.

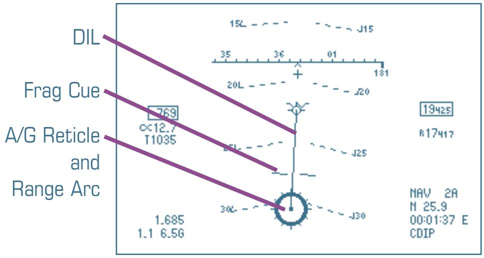
1. Designate a target, using one of the methods described under **Finding and Designating a Target**, pp. 4.51.
2. Make sure a weapon station is selected, and that the release option, quantity, interval and height of burst are set to your satisfaction. **See Selecting Weapons and Bomb Modes**, p. 4.59.
3. From the A/G Arm page, press PB 5 until AUTO LOFT appears next to the button. Steering symbology will appear on your HUD.
4. a) Steer toward the command heading cue to align yourself with the target. Center the Azimuth Steering Line (ASL) over the A/G reticle to fine-tune the alignment. Time-to-release (TREL) and time-to-pull (TPULL) are displayed at the bottom right of the HUD when the target is within weapon range. TPULL counts down the time you have left before you need to pull up to give the weapon its loft profile.

   b) The Elevation Steering Line (ESL, a horizontal bar) will appear five seconds before TPULL expires. Pull up until the ESL is centered over the A/G reticle.
5. Meanwhile, when TREL reaches 10 seconds, a release cue appears on the ASL. It will move down to intersect the flight path indicator as TREL goes to zero. Press the **WEAPON_PICKLE** key or button before TREL reaches zero, and hold it down until TREL reaches zero.
6. When TREL reaches zero, the weapon is dropped. If multiple weapons have been selected for release, the release cue will reposition itself automatically and the process will begin again. Continue to hold down the pickle and center the ASL and ESL until all selected weapons have been released — the release cue will disappear, and the A/G reticle will begin to flash at this point.

If your steering error is greater than 20°, TREL (or TPULL) and the release cue disappear from the screen. Re-align the ASL over the A/G reticle to bring them back. For more information on symbology, see **Cockpit: AUTO and AUTO LOFT Bomb Modes**, pp. 4.62-4.63.

CDIP Bombing Mode

CDIP bombing mode works best with a dive or pop-up delivery — the computer projects the impact point of the selected weapon onto your HUD, and this point often outside the HUD FOV (i.e., not visible on the HUD) unless you are nose-down or inverted.



1. *Optional:* Designate a target, using one of the methods described under **Finding and Designating a Target**, pp. 4.51. You do not have to have a target designated to use CDIP mode, but it is easier to align your run if you do.

2. Make sure a weapon station is selected, and that the release option, quantity, interval and height of burst are set to your satisfaction. **See Selecting Weapons and Bomb Modes**, p. 4.59.

3. From the A/G Arm page, press PB 5 until CDIP appears next to the button. Steering symbology will appear on your HUD.

4. In CDIP mode, the A/G reticle respresents the point where your weapon(s) will impact. Steer so that the A/G reticle is aligned along the azimuth with the TD diamond (if you have a designated target) or visual target, yet below it.

5. When the A/G reticle is directly over your target, press and hold the **WEAPON_PICKLE** key or button. The computer designates the point where the A/G reticle was at the time of pickle as your A/G target, then shifts to AUTO bombing mode to begin releasing weapons so they will strike this target.

6. *Continue to hold the pickle down* and center the ASL through each weapon release until all weapons are released — the A/G reticle will flash to signal you. If you let up on the pickle, the computer will revert to CDIP mode and the next press of the pickle button will designate a new target point.

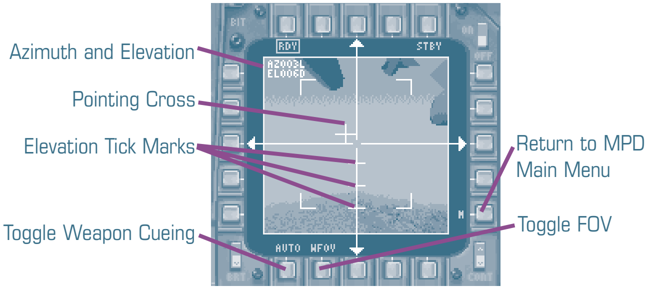
The frag cue represents the edge of predicted frag envelope for the currently selected weapon. To avoid the frag envelope, make sure your exit maneuver brings this frag cue **below** the flight path indicator before the weapon **detonates.**

GUIDED WEAPONS

AGM-65 Maverick

The AGM-65D/G has an imaging IR seeker head capable of automatically attempting to lock on to your currently designated target. You can also aim it manually before launch via a video display in the Weapon Video page. Needless to say, having the seeker cue automatically is much less of a hassle for you. Occasionally, however, the seeker for some reason won't be able gain a lock or you might decide to fire a Maverick without designating a target.

The Maverick is an air-to-ground missile. Once you have a lock, you simply fire the missile. You will not need or see any bombing mode symbology.



To aim an AGM-65 automatically:

1. Designate a target, using one of the methods described under **Finding and Designating a Target**, pp. 4.51.

2. Make sure an AGM-65 weapon station is selected. Only one AGM-65 can be released at a time. See **Selecting Weapons and Bomb Modes**, p. 4.59.

3. From the MPD main menu, press PB 19 to call up the Weapon Video page, and press PB 6 on this page until AUTO appears next to the button. The seeker head attempts to lock onto the target — when the targeting cross hairs are centered over the target, you have a lock.

4. Press and hold down the **WEAPON_PICKLE** key or button to launch the Maverick.

To aim an AGM-65 manually:

1. *Optional:* Designate a target, using one of the methods described under **Finding and Designating a Target**, pp. 4.51.

2. Make sure an AGM-65 weapon station is selected. Only one AGM-65 can be released at a time. See **Selecting Weapons and Bomb Modes**, p. 4.59.

3. a) From the MPD main menu, press PB 19 to call up the Weapon Video page, and press PB 6 on this page until MAN appears next to the button.

   b) Slew the targeting cross hairs to center them over your target, using PBs 3, 8, 13 and 18. (PB 7 Toggles between wide and narrow FOVs and may help you zero in on your target.)

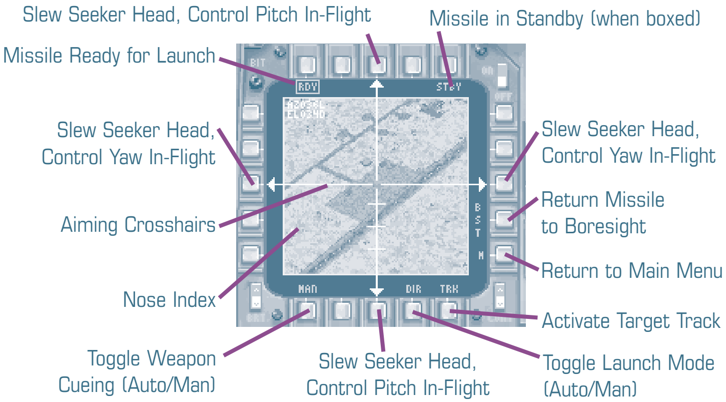
   c) When you have the cross hairs over your target, press PB 10 (TRK) to signal the missile to begin tracking this target.

4. Press and hold down the **WEAPON_PICKLE** key or button to launch the Maverick.

For more information on the symbology and pushbuttons used on this page, see **Weapon Video: AGM-65**, p. 2.59.

GBU-15

The GBU-15 has two launch modes — direct and indirect. In direct (Lock on Before Launch, or LOBL) launch mode, you simply designate your target, aim the seeker head toward it, gain a lock and release — the seeker head can be manually or automatically aimed to target. In indirect (Lock on After Launch or LOAL) launch mode, you can also steer the weapon after it is released using the video information displayed in the MPD. You must have an AN/AXQ-14 datalink pod mounted on your aircraft to do this — this feeds the steering information to the GBU-15.



To release a GBU-15 in direct mode with automatic weapon cueing:

1. Designate a target, using one of the methods described under **Finding and Designating a Target**, pp. 4.51.

2. Make sure a GBU-15 weapon station is selected — only one GBU-15 can be released at a time. Select a bombing mode — the GBU-15 was designed to be released from standoff range, so AUTO LOFT is the preferred bombing mode. See **Selecting Weapons and Bomb Modes**, p. 4.59.

3. a) From the MPD main menu, press PB 19 to call up the Weapon Video page. Press PB 9 on this page until DIR (direct launch mode) appears next to the button.

   b) Press PB 6 on this page until AUTO appears next to the button. The seeker head attempts to lock onto the target — when the targeting cross hairs are centered over the target, you have a lock.

4-6. Continue with steps 4 through 6 as described under **AUTO Bombing Mode** (p. 4.62), **AUTO LOFT Bombing Mode** (p. 4.63) or **CDIP Bombing Mode** (p. 4.64), according to which bombing mode you are in. (AUTO LOFT is the preferred mode for the GBU-15.)

To release a GBU-15 in direct mode with manual weapon cueing:

1-2. As above.

3. a) From the MPD main menu, press PB 19 to call up the Weapon Video page. Press PB 9 on this page until DIR (direct launch mode) appears next to the button.

   b) Press PB 6 on this page until MAN appears next to the button.

   c) Slew the targeting cross hairs to center them over your target, using PBs 3, 8, 13 and 18. (PB 7 toggles between wide and narrow FOVs and may help you zero in on your target.)

   d) When you have the cross hairs over your target, press PB 10 (TRK) to signal the missile to begin tracking this target.

4-6. Continue with steps 4 through 6 as described under **AUTO Bombing Mode** (p. 4.62), **AUTO LOFT Bombing Mode** (p. 4.63) or **CDIP Bombing Mode** (p. 4.64), according to which bombing mode you are in. (AUTO LOFT is the preferred mode for the GBU-15.)

To release a GBU-15 in indirect mode:

For indirect launch mode to be available, you must have an AXQ-14 D/L (datalink) pod loaded on your aircraft. See **AN/AXQ-14**, p. 4.6.

1-2. As on previous page.

3. a) From the MPD main menu, press PB 19 to call up the Weapon Video page. Press PB 9 on this page to select indirect (IND) launch mode.

   b) As soon as you select indirect launch mode, three launch profiles now become available. PB 7 cycles through them, and the currently selected mode appears above the button. The launch profile determines the amount of steering control you will have over the weapon after launch.

   NORM The weapon flies ballistically (i.e., with an unguided trajectory) for 1.75 seconds after release, then automatically enters a transitional (TRANS) profile.

   TRANS Transitional profile — you can control the weapon's yaw (heading), but not its pitch, after launch.

   TERM Terminal profile — you can control the weapon's pitch and yaw after launch.

   c) Slew the seeker head using PBs 3, 8, 13 and 18 until the aiming cross hairs are centered on the target.

   d) When you have the cross hairs over your target, press PB 10 (TRK) to signal the missile to begin tracking this target.

4-6. Continue with steps 4 through 6 as described under **AUTO Bombing Mode** (p. 4.62), **AUTO LOFT Bombing Mode** (p. 4.63) or **CDIP Bombing Mode** (p. 4.64), according to which bombing mode you are in. (AUTO LOFT is the preferred mode for the GBU-15.)

7. After launch, control the missile's yaw with PBs 3 and 13 (TRANS or TERM profiles). Control pitch with 8 and 18 (TERM profile only). Once the GBU-15 is locked onto a target, it will attempt to fly itself to that target.

For more information on the symbology and pushbuttons used on this page, see **Weapon Video: GBU-15**, p. 4.66.

Paveways

Paveways are laser-guided bombs. You release them as you would ordinary weapons, except that post-release and prior to impact you guide them to target using the laser-designator mounted in the targeting pod of the LANTIRN system.

AUTO bombing mode is the preferred mode for Paveways — in this mode, time-to-impact (TIMPACT) is displayed in the bottom right corner of the HUD (and mirrored on the bottom center of the Targeting IR page) after weapons are released. You will use TIMPACT to determine when to begin lasing your target.

1-6. Follow steps 1 through 6 as described under **AUTO Bombing Mode** (p. 4.62).

7. From the MPD main menu, press PB 12 to call up the Targeting IR page.

8. When TIMPACT is around 20 seconds or less, begin lasing the target. Click on PB 19 of the Targeting IR page to enable the laser designator — LASE appears next to the button when the laser is enabled. Keep an eye on this cue — if the word "MASK" appears, something is blocking the laser LOS and the target is no longer being designated. If the laser becomes masked, the Paveway will continue ballistically (i.e., in an unguided trajectory), and may or may not hit the target. If you are able to unmask the laser and re-lase the target, the missile may or may not be able to re-acquire the laser signal and re-orient to target.

M1A61 Cannon

The CDIP sight is used to aim the gun while in A/G master mode. When you press the **GUN_SELECT** [1] key to select your gun while in A/G master mode, this symbology appears on your HUD. Note that the gun is mainly a defensive weapon to be used against air threats. It is only effective against soft ground targets.

To engage a target:

1. Steer to position the A/G reticle over your target.
2. Wait until the target is within range — the range arc on the reticle marks your target's range in the same way as the range arc in CDIP bombing mode. Each tick mark on the reticle represents 1000ft of range — the range arc moves counter-clockwise as range decreases. When only half of the reticle is covered by the arc, the target is at the gun's maximum range of 6000ft. Minimum gun range is 0ft.
3. Press the gun trigger (joystick button 1) to fire.

GETTING OUT

The principle of getting out is the same as getting in — keep your aircraft intact. Now, however, you are not loaded down with air-to-ground ordnance and don't need to be so eager to avoid an air skirmish. This is a good thing, because those bombs you dropped gave everybody a really good idea where you are.

The only factors that might limit your desire to dogfight on egress are —

- You're out of A/A ordnance
- You're low on fuel
- You've taken significant damage already

In any of these cases, get strategic — check the systems status and air ordnance for the aircraft in your flight (press the **FLT_STATUS** Ctrl S and **FLT_WEAPON_CHK** Ctrl W keys, or press the **RADIO_1_TRANSMIT** Tab key to access the flight communications menu). Use your strongest and best-armed aircraft judiciously.

For a review of flight command hotkeys, see **Flight Commands**, p. 4.44.

If you are low on fuel, remember that flying at high altitudes conserves fuel, especially when flying at higher speeds. Flying at cruising speed at any altitude (Mach 0.8 or so) conserves fuel at any speed. See **Combat Fuel Flow**, p. D.1, for a chart of fuel flow at different altitudes and speeds.

COMBAT THEORY

The F-15E is called a Strike Eagle because it is primarily assigned "strike" — air to ground — missions. This means that for at least part of the mission, it is loaded down with ordnance, and should not be involved in any close-range fighting. The goal is to gain a good aspect angle (firing position) on your opponent while he is BVR (Beyond Visual Range). Once you have a positional advantage, you can fire missiles at the enemy from a prudent distance.

POSITIONAL GEOMETRY

Geometry plays a large role in air combat, even when you never achieve visual contact with your opponent. Positional geometry aids your missile in reaching its target, can keep you from entering a combat area prematurely, and can help get you out of a dangerous situation.

To develop a complete understanding of air combat, you need to know a few geometrical concepts: *angle-off*, *aspect angle*, *closure rate*, *turn rate/radius* and *corner speed*. All describe the differences in position, speed and flight path between your aircraft and an air target.

Aspect Angle

Aspect angle indicates which aspect of the target is facing you, and is measured in degrees. Think of it as a numerical way of expressing what part of the target you're looking at. With radar lock, the target aspect angle appears next to the altitude of the target.

A "9R" aspect angle means you are perpendicular to your target, facing its right wing. At "4R", you see the target's right wing as it crosses your flight path at a 40° angle. At "0" aspect angle, you are facing the aircraft's tail, and at 180°, you are facing its nose.

Closure Rate (V_C)

Closure describes your aircraft's speed relative to the speed of your target. The closure rate appears next to the Target Range caret. A positive closure means the target is approaching you; a negative closure means it is moving away. The larger the number, the faster the range is changing. A closure of -700 knots means the target is moving away from you very quickly while a closure of +70 knots means the distance is decreasing.

Closure also impacts weapon performance. At a high positive closure rate, the range to the target is rapidly decreasing. A missile doesn't have as far to fly, since the target reduces range by flying into the missile. If the closure rate is high and negative, the target is moving away and the missile must fly farther to overtake it.

Turn Rate/Radius

An aircraft's *turn rate* is the number of degrees it can pivot per second. An aircraft with a high turn rate can turn quickly. An aircraft's *turn radius*, is the distance it requires to turn. An aircraft with a low turn radius can turn sharply. Note that an aircraft can have a fast turn rate, but require a large turn radius, or vice versa.

PURSUIT CURVES

There are three types of pursuit — *lead*, *lag* and *pure*. While these are useful in close-range fighting, they can also be used to keep an appropriate distance from the enemy. Depending on the situation, you may find all three necessary.

Lead Pursuit

- To initiate lead pursuit, bank your aircraft so that your nose is headed for a point just ahead of your opponent's nose. (Keep in mind that tighter turns bleed off kinetic energy — continually turning will cause you to lose speed.

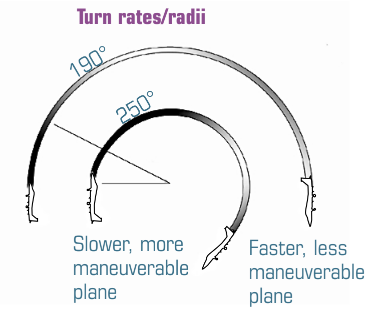
As its name implies, *lead pursuit* refers to predicting the flight path of a target. You guess where the threat will be in the immediate future, and then point your nose at that predicted position. By redirecting your flight path so that it crosses the target's flight path, you stand a better chance of striking the enemy with your weapons. Lead pursuit is the best position to be in for firing missiles; it doesn't have to adjust its course as much. Of course, the trick is to accurately predict where your opponent is going to go.

In an unencumbered F-15E, you are about mid-way down the charts regarding agility, i.e., you'll be able to out-turn about half the aircraft that are out there. If you're lucky enough to be in the aircraft with the smaller turn radius, lead pursuit tactics can give you a continuing advantage. By making sharper turns than your opponent, you cut across his flight path. This, in turn, reduces your target aspect angle, brings you closer to your opponent, and increases your closure rate. (If you're in a loaded Strike Eagle, you won't be able to out-turn anyone, and should avoid getting in a turning fight at all costs.)

Lag Pursuit

- To execute lag pursuit, pull back on the stick until the target aircraft is positioned just above the flight path indicator in your HUD. Then, ease up slightly on the stick to maintain the enemy's position in your HUD.

Lag pursuit is the exact opposite of lead pursuit. Instead of making a tight turn in the direction your opponent is headed, you use a "softer" turn with a larger radius to follow a point just behind the tail of the enemy aircraft. The potential advantages of lag pursuit are illustrated in the following example.



The diagram on the right compares the turn rates (measured in degrees per time allotted) of two aircraft. At the low speed needed for a 4G turn, the inner, more maneuverable aircraft obviously has a significant turn rate and turn radius advantage over the other aircraft.

Why shouldn't the outer pilot try to bring the inner aircraft into position with *lead* pursuit? If he does, he'll put a tremendous strain on his F-15, plus risk overshooting his opponent — thereby putting himself at risk. Additionally, his aircraft will rapidly bleed off speed as drag increases, wasting his initial velocity advantage. However, using *lag* pursuit would keep him from overshooting and conserve his energy (in the form of speed).

By using *lag pursuit*, the outer pilot is matching the other aircraft's turn rate. The end result is that you fly in a concentric circle *outside* the other plane's flight path, ending up directly on his tail.

Pure Pursuit

- Pure pursuit is a direct chase — simply point your aircraft directly at the target and follow its maneuvers as closely as possible.

Pure pursuit is most useful when firing weapons at close range, where you can place your sight directly over the target and fire. Don't overlook the danger of overrunning your opponent. In pure pursuit, if you pass by the enemy, you are the perfect position to be shot down: directly ahead of him.

SPEED VS. ALTITUDE

The energy elements of speed and altitude are the core components of aerial combat. Altitude is a measurement of the aircraft's potential energy, which can be converted to speed by diving. Speed is a measure of an aircraft's kinetic energy, which can be turned into altitude by climbing. Think of kinetic energy as energy in motion, and potential energy as energy in reserve.

At any given instant, an aircraft possesses both a certain amount of kinetic energy (speed) and a certain amount of potential energy (altitude). This energy translates directly into maneuverability. Air Combat Maneuvering, or ACM, is a game of managing energy to maximize maneuverability and defeat the enemy. Finding the balance between speed and altitude requires skill and timing.

Exchanging Energy

Potential and kinetic energy are exchangeable. An aircraft at high altitude and low speed has lots of potential energy, but little kinetic energy. By diving, the aircraft can convert its altitude into speed and increase its kinetic energy. Similarly, the aircraft can convert some kinetic energy back to potential energy by climbing. The aircraft slows down, but its altitude increases.

A cardinal rule of air combat is that an aircraft with energy has maneuvering options; an aircraft without energy becomes a target. Maneuvering uses energy, and every unnecessary maneuver you make "burns" kinetic energy. When it's gone, you can't easily get it back. "Low and Slow" is a deadly situation.

Because you want maximum maneuverability from your aircraft at all times, you must ration your energy use, always maintaining a sufficient supply for whatever maneuver you might execute. For example, don't go into a tight turn at a high speed if you can accomplish the same task with a slow turn. Before expending energy, determine whether what you get in return (such as a shot opportunity) is worth the loss of energy.

When you've got an enemy on your six that's about to fire at you, you need to extract every ounce of maneuverability possible from your airframe. And when you're out of energy, you have to get some back. You can do so by applying thrust, relaxing your turn radius or diving to gain airspeed. In some cases, you may even need to bleed off speed by climbing or pulling tight turns.

You can take one of two approaches when you find yourself in a combat situation — you can choose the energy fight or the turn fight. The F-15 is a workhorse much more adapted to an energy fight. Give real thought into who your opponent is before committing to a turning fight — and if you are carrying air-to-ground ordnance, don't even consider it.

CHOOSING YOUR ATTACK

Unarguably, the first few seconds of a fight are the most important and can often determine the outcome. Most dogfights last less than one minute, meaning that whoever gains the initial advantage usually wins. Every fight is different, and an aircraft designed for turn fighting may find itself better suited for an energy fight. How do you decide which to use?

First, estimate your turn performance versus your opponent's. Maintaining your corner speed (the optimal balance between turn rate and airspeed) means nothing if the bandit can out-maneuver your best turn.

Second, estimate your energy status. If you enter a fight 200 or 300 knots above your corner speed, don't waste all of that energy and decelerate to achieve your aircraft's corner speed. Instead, initiate an energy fight and make use of your power. A well-flown energy fight is difficult to beat.

Remember, it is easier to transition from an energy fight (high speed) to a turning fight (low speed) than the other way around.

The Energy Fight

In an energy fight, you take advantage of the F-15's superior speed and avoid unnecessary turning. Ideally, you want to start the fight in an advantageous position, such as directly behind the bandit in his 6 o'clock low blind spot. Most of the time, however, that's not an option. You must rely on your energy advantage and skills to overcome your adversary.

When you choose the energy fight, you basically concede turn performance to the enemy and rely instead on speed. With an F-15E that's a good choice, your speed is almost always going to be superior to your turning ability. You must keep your airspeed extremely high, minimizing the distance between you and your enemy's aircraft as you make a series of head-on attacks. The idea is to strike, then outrun your opponent's weapon range (not too difficult if the bandit has only guns or heat-seeking missiles). The Strike Eagle is a beautiful energy fighter, because it has powerful engines that can give it speed enough to attack and then get out of the range of most other aircraft.

While the bandit busily executes a high-G turn to enter the fight, you (as the energy fighter) zoom away in a spiraling dive or climb. Eventually, you can execute a wide turn (to conserve airspeed) and make another offensive pass.

If you execute the initial turn correctly, you'll remain outside your enemy's weapon envelope (range at which his weapons are effective) for nearly the entire fight. You choose when and where to engage, always bringing the fight on your terms. Thanks to your speed surplus, you can enter and exit the fight almost at will.

The energy fight requires discipline, though. One speed-bleeding turn, and you immediately lose your energy advantage.

The Turning Fight

The less optimal choice in combat is to enter a maneuvering fight and rely on your turn performance to win the day. Since the F-15E is less agile than it is fast, if you get caught in a turning fight it's usually the result of poor planning, being on the defensive, or misjudging your opponent.

The idea behind a turning fight is to reduce the amount of room in which the enemy can make a turn. You accomplish this during the merge (head-on pass) by minimizing lateral separation, or the horizontal distance that separates your aircraft from your enemy's.

The merge, or meeting the bandit head on, generally leads to one of two types of turning fights: one-circle or two-circle. You should choose a two-circle fight when you're flying a more maneuverable aircraft than your enemy. Use a one-circle fight if you have all-aspect missiles (or if you believe the enemy doesn't have them).

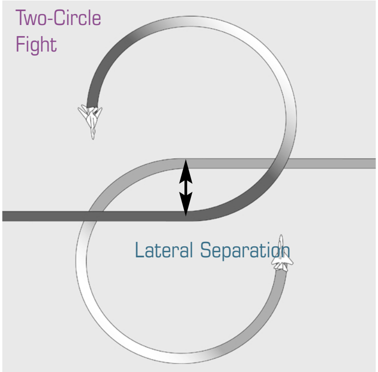
There are situations where a turning fight is could turn out well for an F-15, but usually only when your side outnumbers the enemy. It takes teamwork for an F-15E to make a turning fight work successfully against more nimble opponents.

APPROACH AN ENEMY HEAD-ON

Surprise is a decisive factor in successful air-to-air combat. The goal is to take out an intercept team before they've even spotted you, you save yourself a costly dogfight which you (usually an overloaded strike team) were likely to lose. Often however, you'll pick up a bandit closing in on you rapidly head-on at about the same time he's found you. You're in a race to get off a missile hit first, but if neither of you is successful on this crucial first pass, you're both going to have to loop around and try it again — or you take advantage of an opportunity to make a break for it. Remember, if you're on a strike mission your primary goal is delivering your air-to-ground ordnance to target. You want to avoid having to jettison this ordnance if at all possible.)

Sometimes, however, you'll find yourself in a turning fight regardless of your intention. In this case, take a moment to consider what aircraft you are pitted against. If it is your equal, or better, save yourself and jettison all your air-to-ground ordnance. You'll scrap the mission, but it's better than losing everything.

Two-Circle Fights



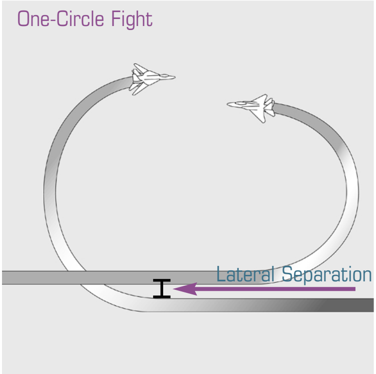
After you and your opponent pass each other (or *merge*), you both loop around in opposite directions, trying to get on each others' tail. The distance between your flight paths is turning room that both of you use. The turn radii of your aircraft overlap.

Two-circle fights rely more on turn rate than turn radius. You create only enough lateral separation at the merge point to allow for your full turn radius, and then rely on a superior turn rate to bring your nose back to bear on the threat. Two-circle fights keep your target in view at all times and tend to increase the lateral separation between the two aircraft.

In two-circle fights, always attempt to minimize lateral separation. If the enemy aircraft has substantially worse turn performance than you, don't give him any extra room to work with — keep lateral separation to the bare minimum you require for your turn.

Conversely, if the bandit has significantly better turn performance than your aircraft, deny him the chance to use it by closing in at maximum speed with as little lateral separation as possible.

One-Circle Fights



One-circle fights commence when you and your opponent loop in the same direction (instead of the opposite direction, as in two-circle fights). One of you loses lateral separation, relying instead on turn radius to outmaneuver the enemy. In general, only use the one-circle fight when you have a significant turn radius advantage over the bandit.

The one-circle fight tends to keep you and your target closer together than the two-circle fight. If you choose to turn away from your opponent, you'll momentarily lose sight of him as he crosses your tail. In fighters with poor rearward visibility, this loss of visual contact can be devastating. Since taking the one-circle approach surrenders the lateral separation to the bandit, you should minimize lateral separation during your next head-on approach.

Making the Initial Turn

Timing the initial turn in a head-on approach is critical to maintaining the advantage during a fight. Turning too soon pulls you across the bandit's nose, which not only gives him a snapshot opportunity, but also puts you on the defensive. Turning too late, on the other hand, puts you out of position and allows the bandit to gain a better target aspect angle on you.

A perfectly timed turn will deny the bandit any advantage while maximizing your own performance. However, while the initial turn is important, you may soon find yourself in a twisting, turning fight. When this happens, you need to apply additional air combat skills and maneuvers (discussed in the next section).

BASIC FIGHTER MANEUVERS

Although a loaded-down Strike Eagle is slow and unwieldy, an unencumbered F-15E in its own right is a perfectly fine fighter. In fact, as far as fighters go, it's about midway down the pecking order. You can hold your own against about half the fighters you might encounter, but you've got to watch out for the other half.

Call for help. For most of the combat you'll encounter, the most effective maneuver you can try is simply calling in the cavalry to take care of enemy fighters. There are usually F-15Cs flying Combat Air Patrols nearby, and they are the solution to most problem situations. When they don't arrive in time, however, you'll need to know the best ways to face down a bandit.

Firing Solution. In the world of combat, getting into position for a good shot is often called "achieving a firing solution." It can happen in half a second, or it may take several minutes. The manner in which you attain this position differs from conflict to conflict, so it's imperative that you develop a good reserve of combat maneuvers.

The following section examines various air-to-air maneuvers and describes how to use them to your advantage during combat. It is assumed that you have jettisoned any air-to-ground ordnance before you begin maneuvering.

BREAK TURN

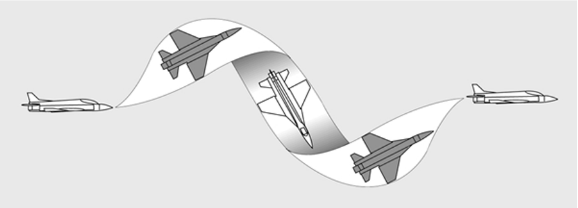
- Use the break turn to evade enemy fire. Follow with a turn in the opposite direction.
- Initiate a break turn by banking (push the joystick to one side, and then pull it sharply toward you).

The break turn is the most basic combat maneuver, for it rapidly increases the aspect angle (angle between you and your enemy's flight path) when a bandit is preparing to shoot you. It is a high-G maneuver that takes advantage of a maximum instantaneous turn rate and forces your attacker to take a high-aspect angle shot.

You can make a tight, instantaneous break turn (in which you lose speed, but increase aspect angle), or you can make a sustained break turn (in which you conserve speed, but may decrease aspect angle). Making a hard break turn bleeds airspeed, which in turn, can cause your enemy to overshoot. Generally, the closer you think the enemy is to firing, the harder you should turn.

Once you move through the break turn, immediately follow it with another maneuver. Sustaining a break turn too long is dangerous — it makes you a wide-open, predictable target. As a rule, your next maneuver should further remove you from the bandit's weapon envelope. Try an immediate scissors turn in the opposite direction. Your opponent will be going too fast to lead your turn, and you may be able to maneuver into a more advantageous position.

BARREL ROLL



- Offensively, use the barrel roll if you're overtaking an enemy too quickly.
- Defensively, use the barrel roll to force your attacker to overshoot and pass you.
- Initiate a barrel roll by rolling slightly and applying pitch. Keep the nose pitched to spiral around the axis of your flight path.

The barrel derives its name from the flight path the aircraft performs, circumscribing the shape of a barrel as the aircraft rolls around a central axis. It is an energy management maneuver possessing both offensive and defensive potential.

Offensive Barrel Rolls

If you find yourself traveling too fast, you may both overshoot your foe and fly directly into his gun envelope. This happens because your closure rate is too high, and you overtake your target. The barrel roll provides an effective solution by wasting speed.

If you can't bleed enough speed with a barrel roll, pull back harder on the stick and execute a roll opposite the direction of your current turn. The increase in pitch reduces airspeed, and the rollout turns you away from the target and keeps you from overshooting. As you complete the roll, you'll be back on your original course, but at a slower airspeed.

Defensive Barrel Rolls

Defensively, the barrel roll can be used to force a quickly approaching attacker to overshoot. It can also maintain enough angle-off-tail to put you out of his lethal cone of fire. Defensive barrel rolls must be carefully timed, however. Initiate the roll too soon, and the bandit will follow you through it. Start too late, and the bandit will have several shot opportunities before you begin the turn. Perfect timing requires that you both surprise the enemy and deny him sufficient reaction time.

SCISSORS

Scissoring occurs when an attacker overshoots, and the target reacts by making a reverse turn too early (before the attacker crosses his weapon envelope). You shouldn't try this against more maneuverable aircraft. The outcome will always favor the most agile competitor.

- Never purposefully enter a scissors fight — it bleeds off speed and altitude.
- To break a stalemate, roll 180° during one of the passes.

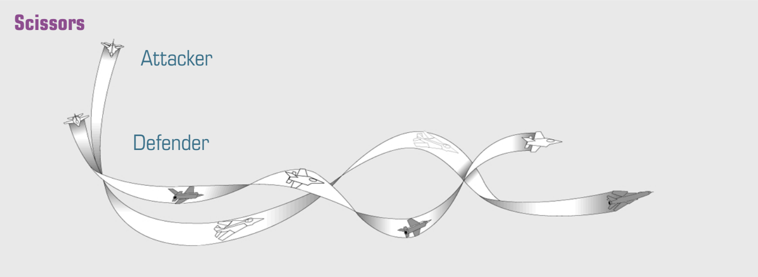
Scissoring refers to a series of reversing break turns in which two aircraft turn back and forth toward each other, each trying to force the other out in front. This usually begins when the attacker starts a late high yo-yo (see next page) or barrel roll and realizes he's going to overshoot his target. The defender, predicting the overshoot, reverses his turn. Although this is the right solution, he turns toward the attacker too soon, resulting in a fairly neutral pass and initiating scissors.

Scissor moves reduce the *forward velocity vector*, or the fighter's speed along the axis of its flight path. The aircraft turns across the flight path at varying speeds, reducing its average forward speed with every turn.

If you're an attacker, the only way you can get into a scissors duel is by starting a maneuver too late and overshooting. If you're on the defensive, you correctly predicted his overshoot, but reacted too quickly and compounded the attacker's error.

Once in a scissors, there's nothing to do but keep turning into the bandit. This bleeds off both speed and kinetic energy. The "winner" of a scissors match is usually whoever can conserve enough energy to force his opponent out front and bring the aircraft's nose around for a shot. More often than not, scissoring ends when one aircraft loses so much speed that it stalls out and plummets. If the other aircraft has any energy left, it can roll, dive and take a shot before the falling aircraft can recover.

Vertical Rolling Scissors



Alternatively, two pilots about to engage may begin a series of barrel rolls instead of break turns. The resulting vertical rolling scissors is a speed-reducing maneuver as well, draining kinetic energy during the series of climbs, reverse turns and overshoots. Each time the aircraft cross paths, they risk both collision and gunfire. Allowing too much lateral separation (passing too far apart) affords your opponent a shot opportunity, while passing too close may result in a crash.

In a guns-only environment, you may be able to escape scissors by executing a split-S (see p. 4.83) immediately after crossing your opponent's tail. Then, by rapidly increasing your speed, you can outrun his guns.

Don't try this if your enemy has IR missiles — the split-S invites a heat seeker up your exhaust pipe. If you can't get outside the bandit's weapon range, then you have to win the scissors fight. If you can't win the fight by out-turning the bandit, you're as good as dead.

HIGH-SPEED YO-YO

- Use the high-speed yo-yo to reduce target aspect angle and bring a target into your firing cone.
- Perform by relaxing a turn, then pulling up into a sharp climb. Invert, then apply pitch to slide back down onto the threat's tail at a reduced aspect angle.

The high-speed yo-yo is a basic component of offensive air combat and reduces target aspect angle at the cost of increasing the distance between you and your target. The yo-yo begins during a turning fight when you have assumed an aggressive position behind the bandit, but are stuck in lag pursuit and unable to bring your nose to bear. In this case, you can use gravity to your advantage.

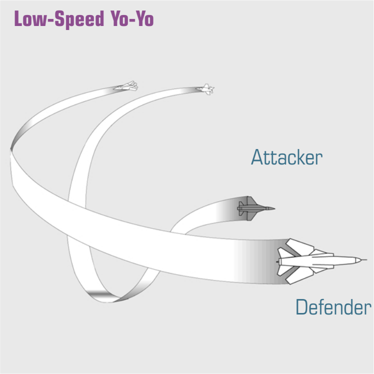
Roll out slightly when your enemy initiates a break turn (maintaining lag pursuit), then pull the nose up. At the apex of the climb, invert and roll back down onto your target's six o'clock position. You'll be further away from him, but in a better firing position.

Don't make the yo-yo too extreme. Once you commit to a large one, you'll be unable to respond to any sudden changes the bandit may make. Patiently work small yo-yos by bringing the nose just above the horizon.

ROLLAWAY

A variation of the high-speed yo-yo, the rollaway involves rolling *away* from the target's turn as you invert. By diving and reversing direction with a 180° turn, you can drop in behind the defender's tail as he ends his break turn.

LOW-SPEED YO-YO



- Use the low-speed yo-yo when you have a good firing angle but need to bring the target in range.
- This maneuver decreases range at the cost of increasing target aspect angle.
- Execute by diving inside of a target's turn and gaining airspeed. Then, pitch up and slide onto his tail once more.

The low yo-yo is the logical opposite of the high yo-yo, and achieves the exact opposite effect. While the purpose of the high yo-yo is to decrease target aspect angle (at the cost of increasing range), the low yo-yo is intended to decrease range (at the cost of increasing target aspect angle).

Use the low-speed yo-yo when you have a good shot opportunity, but you're still outside your weapon's maximum range. This often occurs in chases where the bandit has superior speed and is trying to run home in level flight. You're chasing him, but he remains just outside your weapon's effective envelope.

To get closer to your target, lower your nose below the horizon and dive. This increases speed, but almost always forces you into lag pursuit and increases target aspect angle. A low yo-yo, therefore, almost always requires an immediate high yo-yo to correct the angle problem generated by the increase in speed.

Be careful not to dive too steeply during this maneuver — you may be unable to bring your nose to bear on the target if it ends up too far above you.

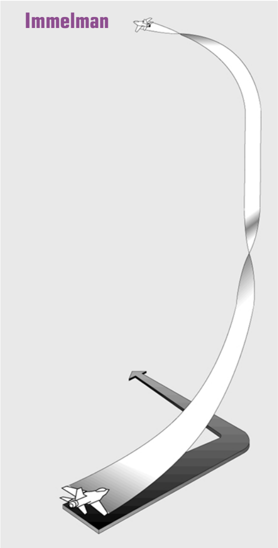
Countering a Low-Speed Yo-Yo

If you anticipate your attacker's low-speed yo-yo, try making a half-roll toward the end of your break turn, then roll out of the turn instead of carrying through with the original break turn. By rolling in the opposite direction, you face your attacker's nose as he emerges from his dive. This brings the fight back to a merge pass.

UPHILL TURN (IMMELMAN)

- Use this maneuver to increase altitude and reverse direction.

The Immelman is a high-thrust maneuver that changes your bearing and increases your altitude. By pitching the nose up and climbing, you can execute one-half of a loop. To terminate, you roll level. This leaves you flying in the opposite direction, but at a higher altitude.

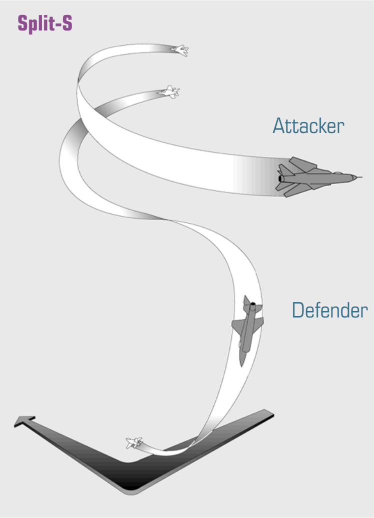


DOWNHILL TURN (SPLIT-S)

- Use the Split-S to increase airspeed or bleed off altitude.

A Split-S is a diving half loop used to disengage a threat. It requires a lot of vertical airspace, so make sure you're at least several thousand feet above the ground beforehand.

During a turn, invert by rolling, then immediately pull back on the stick to go into a dive. Your aircraft will rapidly accelerate and gain airspeed. Pull back on the stick until the aircraft levels out, then ease into level flight. You'll be un-inverted, and you'll have a higher airspeed and lower altitude.



The split-S has the advantage of providing a quick burst of speed. Additionally, rolling inverted adds the aircraft's lift vector to gravity, thus increasing the force of acceleration and adding speed. On the down side, however, this increased speed increases the vertical turning radius, making it hard to pull the nose up into level flight. Starting a split-S from low altitude, or maintaining too much speed during the dive, can prevent the aircraft from pulling out of the dive.

The split-S makes a great escape maneuver in a guns-only environment because the rapid speed gain moves you out of gun range. It's usually ineffective against missiles, though, since they have significantly longer ranges.

DESIGNING A MISSION

Before you start learning the nuts and bolts of mission design, take a step back for a minute and think about what you're trying to accomplish.

A great deal of time can be saved if a mission's design can be fully (or mostly, or even partially) thought out before the design implementation is begun. Many of the elements of design are interactive, and having an idea of what will happen in the mission will make it easier to design events in a logical order.

DESIGN QUESTIONS

The more that can be decided beforehand, the easier it is to create a mission. It is useful to have answers to at least the following questions.

- How many flights of what friendly aircraft?
- What type of loadouts?

  (Allied loadouts should complement yours, but not overwhelm it. You don't want other aircraft killing all the opposition before you get there.)

- What type of ground targets?
- How many?
- How many flights of enemy fighters?
- What type?
- What kind of loadout will they have?
- Where do you want the individual enemy flights to arrive?
- When?

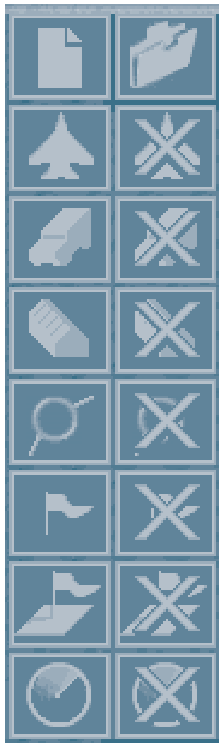
  (A common mistake is to have most of the enemies near the start of the mission, leaving the rest of the flight empty.)

- Will you have "non-threat" enemies, such as aircraft on bombing runs, that will ignore the player? Non-threat enemies means the player has to think more.
- How much thinking should the player have to do?
- How many "realism" details (i.e., non-mission specific aircraft and objects) do you want?
- What events do you want to be mentioned in the debrief?

TESTING QUESTIONS

- Does the mission work under "normal" circumstances? (I.e., in the correct waypoint order, default loadout, etc.)
- If you start it up, and don't play it for 20 minutes or so, do you get a "Mission Accomplished" message? You don't want the computer AI to be

MAIN SCREEN



New Mission p.5.12 — Open Mission p.5.13

Add Aircraft p.5.14 — Remove Aircraft p.5.21

Add Moving Vehicle p.5.21 — Remove Moving Vehicle p.5.24

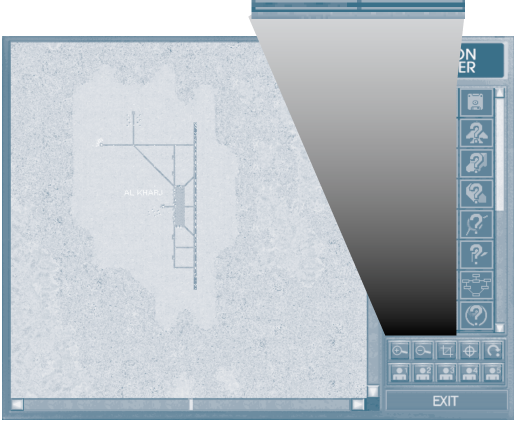
Add Ground Object p.5.24 — Remove Ground Object p.5.26

Add Waypoint p.5.27 — Remove Waypoint p.5.41

Add Goal p.5.41 — Remove Goal p.5.42

Add Area Goal p.5.43 — Remove Area Goal p.5.43

Add JSTAR p.5.50 — Remove JSTAR p. 5.50




Save Mission p.5.13
Aircraft Information p.5.21
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Zoom In
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Add Bullseye p.5.50

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Briefing p.5.52

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Environment p.5.56

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Add GCI Link p.5.58

Delete GCI Link p.5.59

Add TACAN p.5.61

Delete TACAN p.5.61

Add FAC p.5.62

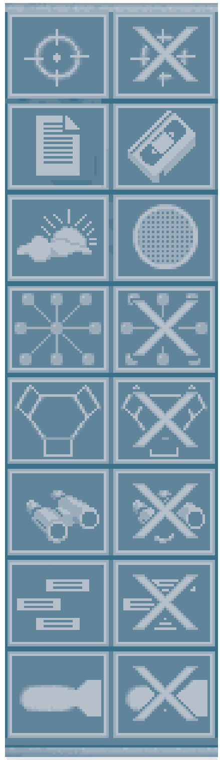
Delete FAC p.5.62

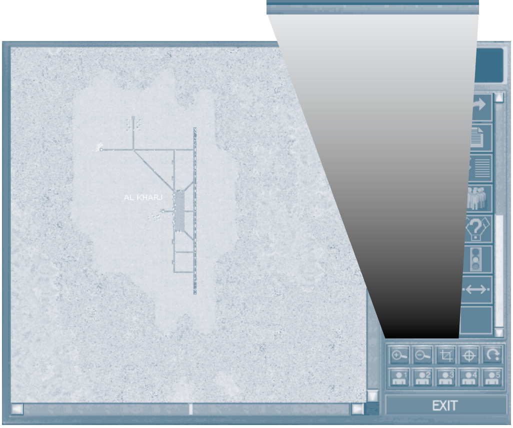
Add Mission Label p.5.63

Delete Mission Label p.5.63

Destroy This Object p.63

Undestroy This Object p.5.63





Alternate Path p.5.51

Mission Information p.5.56

Builder Options p.5.57

Groups p.5.59

TACAN Information p.5.62

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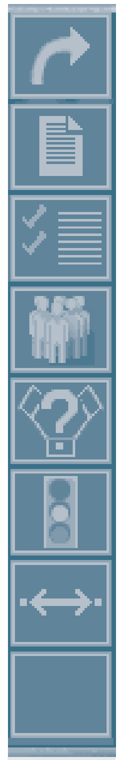
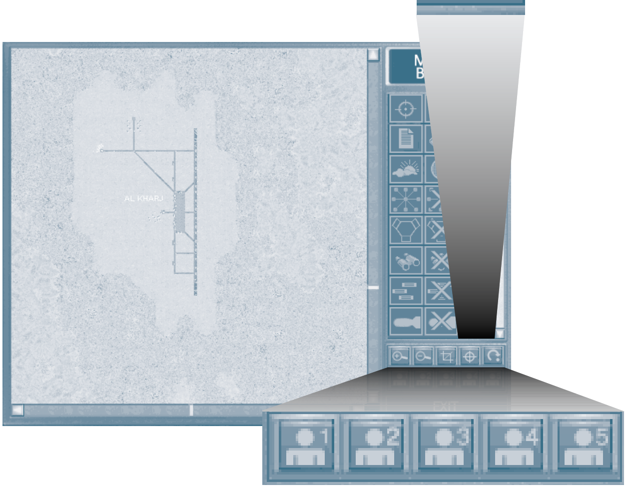
Distance Between Two Points p.5.63





Filters 1-5

SAMPLE MISSION CREATION ORDER

This is one way (out of many ways) to create a mission. Use it as an example of how you might proceed.

1. Place the player's aircraft. (**Add Aircraft**, p. 5.14)
2. Set up Initial Action (p. 5.21).

   Usually this is Takeoff. Put the F-15 on the runway, centered on one end so it has enough room to take off.

3. Place a ground object. (**Add Ground Object**, p. 5.24)

   Notice that objects placed by you have a black box around them.

   Ground objects are more important in Air-to-Ground type missions. If you're planning a CAP mission, ground objects have less importance.

4. Set Goal. Must Destroy. (**Goal**, p. 5.41)
5. Place Ground Defenses, SAM sites, Early Warning Radar. (p. 5.24)
6. Add GCI links as appropriate (p. 5.58).
7. Make sure filters are all on (p. 5.57).
8. Make Groups (**Add Group**, p. 5.59).

   It adds to the overall re-playability if you add a few Packages. For instance, Team 1 (40% Chance of Appearing), Team 2 (30%), and Team 3 (30%).

9. Add enemy aircraft.

   MiGs are always good enemy aircraft. Don't forget to change the Type to enemy.

10. Set the Initial Action (p. 5.21).

    CAP is a good one to start off with. Set direction and range. Make sure the Range is at least as long as the distance between that aircraft and a target or the player. Otherwise it'll never become part of the action.

11. Plot player's route into target. (**Add Waypoint**, p. 5.27)

    At least one waypoint should be over the target.

12. Set Action to Bomb (p. 5.31).

13. Set Aircraft 1 to bomb target.

The Bombing screen appears automatically when the Action Bomb Target is selected.

14. Set player's Altitude, etc. (p. 5.18).

15. Add friendly aircraft, assign Actions.

16. Place the rest of the Ground Objects.

Don't forget to place: a TACAN at player's home base, a tanker if the mission is more than 200 nautical miles, AWACS, etc.

17. Make a Briefing describing the mission's purpose (p. 5.52).

18. Make Debrief, based on goals (p. 5.53).

Debriefs are complex, but remember the game is just as fun if the debriefs are short, non-existent (or even incorrect). Concentrate on messages pertaining to the mission goals.

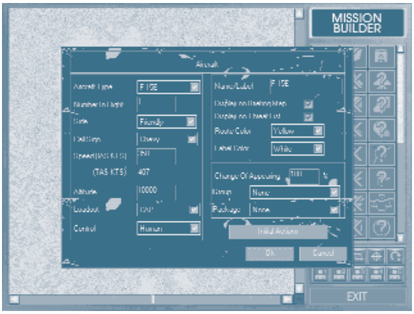
19. SAVE MISSION!

INTRO TO MISSION BUILDER

The Mission Builder function, available from the Single Main Screen, is the same program that *Jane's F-15* designers used to create the game missions. It is a powerful and complex tool that allows you to implement designs for custom missions.

- Select builder from the Single Mission main screen.

The Mission Builder interface is straightforward.



Screens, Windows and Maps. Throughout this section there will be references to *screens*, *windows* and *maps*.

Maps are the image of the mission terrain that appears to the left of the button panel.

Screens refer to the entire visible Mission Builder editor, and includes both the image of the mission terrain on the left, and the button panel on the right. The screen generally remains the same, but will change to accommodate complex design situations.

Windows are "pop-up" data entry interfaces.

OK and Cancel. These appear at the bottom of every information window.

Clicking OK at the bottom of a window will record all the new information, and return to the previous window or screen. Pressing Enter is usually, but not always, the equivalent of pressing OK.

Clicking CANCEL (pressing Esc) will close the window, and will erase any new information that was input while that window was open.

Drop Down Menu. A text box with a white triangle "arrow" indicates a drop down menu for choice selection. An example would be the Select Aircraft window. Clicking on a white arrow will show the list of all possible aircraft. Use the scroll arrows to see the entire list. To select an item from a list, double-click on it.

On/Off Toggle. A box beside an option (with or without a black check mark) indicates an element that can be either on or off, such as "Display on Briefing Map." When there is a black check mark in a box, that element is ON. Clicking on the black check mark turns it off, and the check mark disappears. Clicking on an empty box turns the option on, and displays the black check mark.

Text boxes. To make changes in a text box, click in the box and use Backspace to back over the default entry. Type in the new information.

Click-and-drag. An object that is placed on the Mission Map can be moved at any time by simply left-clicking on it, and dragging the cursor to the new location. (If there is a discrepancy between the icon and the cursor, the icon will "snap to" the place where the cursor is when the mouse button is released.)

Occasionally objects will be too small to "grab." In these cases, zoom closer and try again.

MISSION BUILDER FEATURES

The features of the Mission Builder fall roughly into four categories: Builder, Placement, Function and Mission Text.

Builder features are the buttons (such as New Mission and Open Mission) that are used in creating custom missions. They are tools to aid in the development stage, and will not appear in the mission.

Placement features allow you to put objects into the mission. Nearly everything that appears in the game, from fighters to storage sheds, is put there one at a time. Placement itself is a straightforward process, and can be done with a high degree of realism (including objects that have nothing to do with the mission you're designing) or with no more than the necessary objects to complete the mission.

Function features provide the action in the game. They are essentially "scripting", a kind of programming, where you designate what the situation is, how objects interact with one another, and when actions will occur. Like Placement, Function can be more or less realistic depending on your aspirations. In a realistic scenario, most of your time is spent working out the details of the mission's functions.

Mission Text give the player instructions and feedback on the mission. Any text that the player sees must be first entered by you. Although the game cannot spontaneously create text itself, it can vary what text is shown according to whether certain goals were accomplished during the mission. These variations need to be anticipated by you if they are going to seem authentic.

BUILDER

New Mission	Create a new mission template.
Open Mission	Open a previously saved mission template.
Save Mission	Save changes to the mission template.
Aircraft Information	Show list of the aircraft placed in the mission.
Moving Vehicle Information	Show list of the Moving Vehicles placed in the mission.
Ground Object Information	Create text that appears whenever you wants a list of the ground objects.
Waypoint Information	Show list of the Waypoints placed in the mission.
Goal Information	Show list of the mission goals.
JSTAR Information	Show information on any JSTARs in the mission.
Builder Options	Set up custom settings for the Mission Builder itself.
TACAN Information	Show list of the TACANs placed in the mission.
Distance Between Two Points	Gives the distance, in nautical miles.

PLACEMENT

Add/Remove Aircraft	Place/remove an aircraft on the map.
Add/Remove Moving Vehicle	Place/remove a ground vehicle on the map.
Add/Remove Ground Object	Place/remove a stationary ground object.
Add/Remove Waypoint	Place/remove a waypoint.
Add/Remove Goal	Place/remove a mission goal.
Add/Remove Area Goal	Define/remove an area goal.
Destroy/Undestroy This Object	Destroy the object, leaving a crater.

FUNCTION

Edit Aircraft	Provide details for the aircraft, including actions.
Edit Waypoint	Provide details for the waypoint, including actions.
Add JSTAR	Define what targets will be "called out" to the player.
Remove JSTAR	Remove a target from the game's list of "called out" targets.

Add/Remove Bullseye	Set/remove a secret reference point that the player and his computer allies will use to "code" locations.
Alternate Path	Simulate an emergency sub-mission that occurs during flight.
Debrief	Create the mission summary text that the player receives after the mission.
Environment	Choose the weather for the mission.
Filters	Select what is visible on the mission map to the player during the mission briefing.
Add/Remove GCI Link	Connect/disconnect radar stations GCI links that have been created for the mission.
Groups	Simulate random Aircraft appearances in missions.
Add/Delete TACAN	Place/remove "homing beacons" that feed location information to the player.
Add/Delete FAC	Place/remove a Forward Air Controller on the map that can tell the player precisely where targets are.
Rules of Engagement	Sets the rules of engagement for the mission.
Event	Set up actions that will occur whenever certain conditions are met.
Zoom In/Out/Area, Revert, Center	Adjusts the map view.
Filters	Makes certain objects "invisible" in the Mission Builder.

TEXT

Briefing	Create the explanatory text that the player reads during the Mission Briefing.
Mission Information	Create text that appears in the upper-left window of the Load Game screen when the Mission Name is highlighted.
Mission Label/Delete Mission Label	Create/delete a label for the mission. Appears in the Load Mission Screen, to provide some information on the mission the player is about to load.

COMMON INSTRUCTIONS

These instructions apply throughout the following instructions. Rather than repeating for each "Remove" or "Information" button, they're listed here, at the beginning, just once.

REMOVE ITEM

- Click the appropriate REMOVE button.
- Click on the icon of the item to be deleted.
- Confirm the deletion by clicking OK.

Removing items is only applicable to items that you have placed. (I.e., if the item appears on a brand-new map, it cannot be removed.) Designer-placed items are identifiable by the black box around each item. Upon selecting an item for deletion, a window will appear to confirm the item removal. It is not uncommon that the design map for a mission becomes cluttered with a variety of objects, so be sure to double-check before confirming deletion.

You cannot remove an item that has an assigned role in a mission (e.g., goal marker, etc.). Once you remove the role, you can remove the object.

ITEM INFO

View a list of all items assigned to the Mission Map by clicking the appropriate item INFO button.

Objects are listed in chronological order (i.e., the first object added is at the top of the list). The information includes the information typed in when the goal marker was assigned.

MISSION FEATURES

NEW MISSION

Clicking the NEW MISSION button gives a blank slate, so to speak, of the Middle Eastern area. What actually exists in real life (what you'd see on a satellite photo) has already been placed, but anything else must be added by you. Before a player will be able to do so much as fly around, some basic objects (such as an F-15 to fly) must be added to the blank map.

OPEN MISSION

Previously saved missions can be opened from the pop-up list, to be either completed or modified.

- Click the OPEN MISSION button.
- Double-click on the mission to be revised.

SAVE MISSION

- Click the SAVE MISSION button.
- Click on the MISSION folder.
- Click in the name field.
- Type in the name of the new mission.
- Click SAVE.

It's a good idea to save often during the process of creating a mission.

Save As. If there are no previously saved the mission designs, the pop-up window will be a "Save As" window. The new mission must be named at this point. Mission names can be difficult to read if longer than approximately 25 letters.

Saving with names longer than eight letters can cause error problems if you are saving to a network drive that only supports eight-character file names.

Save. If the mission has previously been saved, press Enter to save the mission.

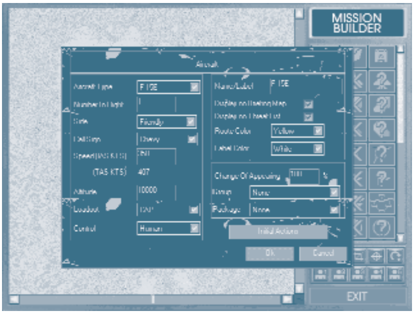
If a different name is entered before Enter is pressed, there will be two versions of the mission: one (with a new name) with all of the changes made since the last time you saved, and one (with the old name) with all of the changes made prior to the last save. (See below for how to delete a mission.)

DELETE MISSION

To delete a mission, exit the game entirely and go to the *F-15* Mission folder. (Double-click MY COMPUTER, F-15, MISSIONS.) Any custom missions will have a .MMP (Mission Maker) extension.

- Find the name of the mission to delete.
- Click on the file name to highlight it.
- Select DELETE from the File menu.

ADD AIRCRAFT



- Click on the ADD AIRCRAFT button.
- Click on the place on the map where the aircraft will begin the mission.
- Adjust elements in the Aircraft Selection window.
- Click OK.

Repeat the above procedure for each aircraft to be added.

Adding aircraft can be a simple or a multi-step process, depending on how much detail and realism will go into the mission.

There are 14 different elements to adding an aircraft, and although almost all of them may be skipped, the more elements that are included, the more "finished" the mission will look.

Any mission has to have at least one aircraft — the one the player flies. Most missions will include enemy aircraft to fly against or to add flavor to the environment. Enemy aircraft are not always necessary, since a mission's threats could be exclusively AAA and SAMs, but enemy aircraft can add a real challenge to a mission.

TYPE AIRCRAFT

Keep in mind that in *Jane's F-15*, the only aircraft the player can fly is an F-15E. Any other type of aircraft will be part of the environment, as an enemy, ally or neutral force.

Some Available Aircraft

707	Commercial passenger jet
A-50	AWACS (Airborne Warning and Control System); looks for air targets
AC-130	Ground support gunship
B-52G	Heavy strategic bomber
C-130	Cargo aircraft
C-17	Modernized cargo aircraft, designed to operate from smaller airfield
Cruise Missile	Missile that can fly long distances to target
E-3	AWACS (Airborne Warning and Control System); looks for air targets
E-8	JSTARS (Joint Surveillance Target Attack Radar System), battlefield command-and-control, side-looking radar; finds tanks
EA-6B	Escorts friendly strike packages, jams enemy radar, SEAD capable
EF-111	Escorts friendly strike packages, jams enemy radar
F/A-18	Naval fighter/bomber
F-111	Low-level precision attacker
F-117A	Stealth tactical fighter/bomber
F-14	Long-range air interceptor
F-15C	Air superiority fighter
F-15E	All purpose fighter/bomber (only aircraft the player can fly)
F-16	All purpose fighter/bomber; SEAD & Wild Weasel capable
F-4	Multi-role fighter/bomber
F-4G	SEAD, Wild Weasel
F-5	Lightweight day fighter
Il-76	Cargo aircraft
Jaguar	Tactical support aircraft, strike fighter
KC-135	Tanker refueler aircraft

Mi-17	Transport helicopter, one of the best in the world
MiG-21	Lightweight day fighter
MiG-23	High-speed sweep-wing air superiority fighter
MiG-25	High-speed interceptor/recon aircraft (set world speed record for fighter aircraft)
MiG-29	4th-generation lightweight fighter
Mirage F-1	Fighter/strike aircraft
Su-22	Fighter/bomber
Su-25	CAS (Close Air Support) aircraft
Su-27	4th generation air superiority fighter (same class as F-15)
Tornado	Low-level strike aircraft
Tu-22	Medium bomber

NUMBER IN FLIGHT

The Mission Builder will support up to eight aircraft per strike package.

The aircraft in any given flight will always be the same type of aircraft, but you can always have multiple flights of different aircraft flying along the same waypoints.

SIDE

- Choose whether the aircraft will be friendly, enemy or neutral.

It is not necessary to have enemy aircraft always aligned with the enemy side, but it certainly makes things more readily apparent to the player. If MiG-29s fly as allies, or F-16s fly for Iraq, it is a good idea to mention it prominently in the Mission Briefing.

Any aircraft, regardless of model, can be called a “friendly” aircraft. The computer doesn’t care what kind of aircraft it is. If it’s called “friendly” in the Mission Builder, it will be an ally in the game — i.e., you *can* assign MiGs to the American side, if you want.

Friendly and enemy computer aircraft will attack each other on sight, under the higher Rules of Engagement. The player doesn’t have to be in the area for combat to begin.

Available Sides

Enemy	Friendly	Neutral

CALLSIGN

Callsigns are dependent on the aircraft/object type. Certain types of objects get their callsigns from a specific list, and they can only be changed within those parameters.

Callsign groupings: SAR; FAC; JSTAR, AWAC & Tanker; F-15Es; Fighters, Bombers & Everybody Else.

If there is more than one aircraft in a flight, all aircraft use the same callsign, numbered in sequence (e.g., Dodge 1, Dodge 2, and so forth). The callsign by itself (without a number) refers specifically to the flight leader. In the player's strike package, the player is always #1.

Available F-15E Callsigns

Chevy	Edsel	Charger	Dodge
Firebird	Outlaw	T-Bird	Buick
Deputy	Packard	Stingray	Sheriff

SPEED (IAS KTS / TAS KTS)

There are two ways to specify an aircraft's speed: indicated airspeed and true airspeed. Both are measured in knots.

True airspeed is how fast an aircraft is moving, corrected for variations due to air density and altitude. This is the speed that can be manually adjusted. *Indicated airspeed* is how fast the aircraft is apparently moving, based on current air density and altitude.

Common sense should be applied when setting an aircraft's speed. If an aircraft is grounded at the time of the mission's start, it should have a speed of 0.

True airspeed could also be called "ground speed" — it's the speed of the aircraft's shadow. Indicated airspeed will decrease as altitude increases.

450 knots (the default) is a good cruising speed for fighter/strike aircraft. If a speed is too high for the aircraft, the simulation will automatically adjust it down.

ALTITUDE

Altitude sets the aircraft's height above sea level at the time the mission starts. Grounded aircraft can be placed at an altitude of zero, while most aircraft feel comfortable at anywhere from 5000 to 15,000 feet or more.

Some care must be taken in placing an aircraft in relation to its environment. If it is important to the mission design that friendly flights appear at a certain waypoint later in the game, don't start them off at a medium altitude in the middle of a SAM corridor. Likewise, don't give an aircraft an altitude of 500ft and expect it to make it across a nearby mountain range. The lower the altitude, the greater the risk of a computer pilot not being able to recover from an unexpected obstacle or problem.

The default altitude of 10,000ft is a good cruising altitude for most aircraft, although this might vary according to mission and type of aircraft.

For the F-15, 200ft or less is usually good to avoid detection on an attack run. If there are AAA *and* light SAMs, 8000ft or above is good. If there is ever a heavy SAM threat, stay under 200ft or use terrain to mask your approach.

LOADOUT

Loadouts vary with aircraft. Each aircraft has its own selection of loadouts to choose between.

Loadouts are used in assigning ordnance to non-player aircraft only. Loadouts assigned to the player will be overridden by the default loadout for that type of mission (although the player can always adjust his ordnance in the Briefing stage).

CONTROL

Aircraft control will always be Computer, except in the case of the player's aircraft. There can only be one human-controlled aircraft.

Available Controllers	
Human	Computer

NAME/LABEL

- Accept default.

Or

- Click in text box.
- Backspace over current label.
- Type in new label.

Labeling the items that are placed in the mission map is a way of keeping track of everything during the complex process of game design. Labels can be displayed next to the icon on the map, and are worth the few seconds it takes to type in some basic information. The most useful label information is what the aircraft is, and what it is going to do (e.g., F-15 tankplink). It needs to be short, however, as there is only a limited amount of room per label.

Labels appear in the Aircraft Info list, and next to the map icon.

DISPLAY ON BRIEFING MAP

- Toggle on/off.

Displays the aircraft on the Briefing Map.

The Briefing Map isn't supposed to show everything out there. That would clutter up the map and make the important objects difficult to locate and decipher.

The best approach is to only put those things on the map that are important to the mission about to be flown: player wingmen and waypoints, locations of known enemy bases, possible backup support and targets.

DISPLAY ON THREAT LIST

- Toggle on/off.

Displays the aircraft on the Threat List.

ROUTE COLOR

Having separate route colors for different items, flights, or for sides, is a convenient way to keep them easily identifiable. They are for design purposes only, and are visible to the player only when the aircraft is "Displayed on Briefing Map."

LABEL COLOR

The designated label (see **Name/Label**, p. 5.19) can be assigned different colors. In the same way that choosing separate route colors helps keep different aircraft's routes separate, Label Colors can keep different elements distinct in the editor. Labels are invisible to the player, and are only used in distinguishing different elements of the mission.

Although Labels can be chosen to correspond with Route Colors, they can be used to distinguish any number of elements, including type of aircraft or vehicle, type of mission, friendly vs. enemy, etc.

CHANCE OF APPEARING

- Click in the text box next to CHANCE OF APPEARING.
- Backspace over the text.
- Add the percent chance for that aircraft to appear.

Chance of Appearing is exactly what it sounds like: you are assigning a percentage chance of an aircraft appearing in the mission.

This is used primarily to give a mission replay value: aircraft won't appear in the same places every time a player flies through a certain area. Sometimes there may be MiGs lurking behind the mountains, other times they may encounter nothing more than a recon flight in the distance.

Any aircraft (or moving vehicle) that has a goal attached must, of course, have a 100% chance of appearing. The same goes for the player's aircraft: it must also be assigned a 100% chance. For more detail, see **Packages and Chance of Appearing**, p. 5.60.

When adding a Group aircraft, it will already have a percentage chance of appearing assigned to it, and this percentage will appear in the Chance of Appearing box. A Group aircraft's Chance of Appearing cannot be altered by changing the number in this box; the number will be fixed. To change a Group aircraft's Chance of Appearing, modify it in the Group window (p. 5.59).

GROUP

- Click on the white arrow in the GROUP box to view a drop-down menu of every group you've created. See **Group**, p. 5.59.
- Click on the name of the group to which the new aircraft will belong.

Package

Packages are sets of specific aircraft in groups, and are established during the process of creating a **Groups** (see p. 5.59).

- Click on the white arrow in the Package box to view the drop-down menu of packages created in that Group.
- Click on the name of the specific package to which the new aircraft will belong.

INITIAL ACTIONS

Initial Actions are identical to Waypoint Action choices (pp. 5.29-5.40).

Aircraft have actions associated with them at each waypoint. Initial Actions are only associated at the first waypoint. All other waypoint actions are simply called "Actions." Not all Actions are available as Initial Actions (e.g., Bomb Target), and are not listed.

EDIT AIRCRAFT

- Right-click on the aircraft's icon.

It is possible to return to the Aircraft window and adjust previously entered information.

REMOVE AIRCRAFT 

See **Common Command: Remove Item**, p. 5.12.

AIRCRAFT INFO 

See **Common Command: Item Information**, p. 5.12.

ADD MOVING VEHICLE 

- Click on the ADD MOVING VEHICLE button.
- Click on the place on the map where the vehicle will originate.
- Adjust elements on the Moving Vehicle Selection window.
- Click OK.

Repeat the above procedure for each aircraft to be added.

"Moving Vehicles" include all ground-based objects that *can* move, regardless of whether they actually *do* move. Only after a vehicle is assigned waypoints will it actually travel from one point to another.

Assign waypoints in the same way that you assign waypoints for aircraft. (See **Add Waypoint**, p. 5.27.)

VEHICLE TYPE

Choose the type of vehicle to be placed. There are a wide variety of types, including land-based vehicles and ships. There are also some aircraft available that can be used to simply taxi on a runway.

NUMBER

Choose how many (1-8) of the currently selected vehicle to appear.

SIDE

Choose whether the vehicle will be friendly, enemy or neutral.

CHANCE OF APPEARING

Reflects the package's percentage chance of appearing. This is determined when the Group is designed, and cannot be changed in the Add Moving Vehicle window. For details, see **Groups** and **Chance of Appearing**, pp. 5.59, 5.60.

A moving vehicle does not have to be assigned to a group or package, but that is the only way to assign a moving vehicle a percentage chance of appearing.

GROUP

- Click on the white arrow in the Group box to view a drop-down menu of every group you've created. See **Groups**, p. 5.59.
- Click on the name of the group to which the new vehicle will belong.

The GROUP button under ADD MOVING VEHICLE is for assigning a vehicle to a group, and placing it on the map. Before assigning it to a group, at least one group must have been created by using the GROUP button on the Mission Builder's main screen.

PACKAGE

- Click on the white arrow in the Package box to view the drop-down menu of packages you've created in that Group.
- Click on the name of the specific package to which the new vehicle will belong.

Packages are specific sets of vehicles in groups, and are established during the process of creating a Group (see p. 5.59).

Time

Set the time, in minutes, to elapse before the vehicle begins to move to its next waypoint. Zero minutes (default) sets it moving immediately.

Flag

Choose the event (see **Event**, p. 5.43) that will signal when the vehicle begins to move to its next waypoint.

Invisible Until Start

All objects in the group will stay invisible until the appropriate conditions (Starting Condition flags) are met.

DISPLAY ON BRIEFING MAP

This is the same as in Add Aircraft. See **Add Aircraft: Display on Briefing Map**, p. 5.19.

DISPLAY ON THREAT LIST

This is the same as in Add Aircraft. See **Add Aircraft: Display on Threat List**, p. 5.19.

NAME/LABEL

This is the same as in Add Aircraft. See **Add Aircraft: Name/Label**, p. 5.19.

ROUTE COLOR

This is the same as in Add Aircraft. See **Add Aircraft: Route Color**, p. 5.19.

LABEL COLOR

This is the same as in Add Aircraft. See **Add Aircraft: Label Color**, p. 5.20.

STARTING CONDITION

This is the same as in Event. See **Event: Starting Condition**, p. 5.46.

REMOVE MOVING VEHICLE

See **Common Command: Remove Item**, p. 5.12.

MOVING VEHICLE INFO

See **Common Command: Item Information**, p. 5.12.

ADD GROUND OBJECT

- Click ADD GROUND OBJECT button.
- Select the Ground Object Type, and other options.
- The object will be "attached" to the cursor.
- Click on the map to place the object.

Many Ground Objects are too small to be seen on the default view of the Mission Builder. Zoom in three or four times, until the Ground Object is visible.

Objects placed by the player have a black outline. Objects that "came with the map" cannot be deleted.

There are certain types of ground objects that cannot be placed next to other ground objects. If you have trouble placing an object on the map, try placing it farther away from other objects.

GROUND OBJECT TYPE

A Ground Object is any man-made structure that does not fall into the categories of Vehicle or Aircraft. Primarily, however, Ground Objects comprise offensive weapons such as AAA, SCUD and SAM sites.

See below for a brief explanation of types.

Some Possible Objects

AAA	*Oil Refinery*
Airfield	*Oil Tank Farm*
Ammo Depot	*Power Plant*
Armored Position	*Republican Guard Armored Position*
Artillery	*Ruin*
Artillery Site	*SAM Site*
Communications Relay Site	*Satellite Uplink*
Early Warning Radar/Operations	*SCUD*
Electric Substation	*Special Forces*
Factory	*Straight Flush*
Fire Trench	*Tank Park*
Oil Field	*Target*
Oil Pumping Station	*Warehouse*

SIDE

Label which side the object is on: friendly, enemy or neutral.

With a few notable exceptions of deep penetration forces, J-STARs, etc., it's best to keep the sides fairly straightforward. Objects in enemy territory should usually be enemy objects. Objects in the player's territory should generally be friendly. If there is going to be an Iraqi airfield allied with the player, it's best to make that clear in the Mission Briefing.

DISPLAY ON BRIEFING MAP

When deciding whether an object should appear on the Briefing Map, consider a few things.

Would military intelligence know about the object? If the object is a herd of camels, probably not. If it is a commercial airstrip, they've known where it is for years. If it is a SAM site, they probably know about some, and don't know about others, since they can be built quickly and under cover of darkness.

Is the object integral to the mission? If it is a target, definitely display it. If it is an empty airstrip, or off the beaten path, probably not.

It's generally a good idea to let the player know what sort of things to expect, such as the existence of AAA in the ingress corridor, but not to tell them how many. Surprises are half the fun in any mission.

DISPLAY ON THREAT LIST

A good general rule of thumb is that if an object is shown on the Briefing Map, and has offensive capabilities, it should be displayed on the threat list.

In other words, known SAM sites should be listed, but enemy factories may be omitted.

EDIT GROUND OBJECT

- Right-click on the Ground Object.

It is possible to return to the Ground Object window and adjust the previously entered information.

REMOVE GROUND OBJECT

See **Common Command: Remove Item**, p. 5.12.

GROUND OBJECT INFO

See **Common Command: Item Info**, p. 5.12.

ADD WAYPOINT

First Waypoint.

- Click on the ADD WAYPOINT button.
- Click on the icon of an aircraft or vehicle.
- Click on the location on the map where the aircraft/vehicle will go.

Subsequent Waypoints.

- Click on the ADD WAYPOINT button.
- Click on the last waypoint of the aircraft or vehicle.
- Click on the location on the map where the aircraft/vehicle will go.

Waypoints are defined destinations for vehicle and aircraft movement. At the beginning of the mission, the aircraft/vehicle appears where its icon was placed (see **Add Aircraft**, p. 5.14, or **Add Moving Vehicle**, p. 5.21). Unless it has been given other instructions (see **Actions**, p. 5.29), it will immediately proceed to the next waypoint, performing whatever actions have been specified.

You can move a waypoint, once placed, by click-and-dragging it to a new location.

Information about distance appears between consecutive waypoints: Nautical Miles and Estimated Time of Arrival (ETA).

Nautical miles. Nautical miles is a straight, as-the-crow-flies measurement of distance. If the terrain is hilly, the actual ground distance may be greater. Nautical miles is the most applicable unit of measurement for aircraft.

The notation of miles between waypoints is useful due to the necessity of zooming in and out during mission creation. Because neither the size of the aircraft (or vehicle) icons or the waypoint circles change size as the map zooms in and out, it can be difficult to gauge distance between two points by looking at the length of the waypoint line.

ETA. Estimated Time of Arrival for a waypoint is when that waypoint should be reached. It is calculated based on the assigned speed of the plane or vehicle and the total distance covered to reach that waypoint. It *does not* take into account any time delay assigned in Initial Action.

WAYPOINT DETAILS — ADDING/EDITING

- Right-click on the Waypoint circle on the Mission Map to bring up the Waypoint window.

Waypoints have two purposes: mid-mission aircraft destinations, and locations where specific events are assigned on an aircraft-by-aircraft basis.

Even with living, thinking pilots, mission briefings are never as simple as "get in your aircraft and fly in a big circle," or "go out and find some tanks and blow them up." Pilots need coordinates, destinations and specific targets. Computer pilots need much, much more. Waypoints, at their simplest and with no added details, are a way of saying "go here, then here, then here."

When details are added, you program the computer pilot's actions. Altitude and speed can be adjusted, and specific tasks assigned to take place at that location. Therefore, if an aircraft is going to accomplish a specific task, such as bombing a tank farm, a waypoint must be placed over the tanks themselves.

WAYPOINT

Waypoints are referred to by number, with an aircraft's first assigned destination being Waypoint 1. The information in the Waypoint field cannot be changed manually, but will automatically adjust as you add and delete waypoints.

AIRCRAFT

The type of aircraft is determined in the Aircraft window, and cannot be changed in the Waypoint window.

ALTITUDE

Altitude is how many feet above ground the aircraft is when it arrives at the waypoint. The default height is 10,000ft.

The plane gradually changes altitude while it is on the way to the waypoint. It is at the correct altitude when it arrives.

SPEED (IAS KTS/TAS KTS)

See **Add Aircraft: Speed** on p. 5.17.

JUMP POINT

A Jump Point is like a stop sign that can be assigned to a waypoint: it tells the player's aircraft where to stop after the aircraft "jumps" to that point. It's a good idea to check JUMP POINT for each of the player's waypoints, but it is not necessary for computer-controlled aircraft.

LABEL

Labels are invisible to the player, but can greatly help a designer keep track of what activities/events are planned for what locations.

EDIT IN BRIEFING

Edit in Briefing gives the player the opportunity to adjust waypoint details during the mission briefing.

This is a courtesy generally extended to the player, although not always. For instance, if the mission is a combat air patrol and all the challenges could be avoided by moving the waypoints around, you might decide that the waypoints not be movable.

Edit in Briefing is unnecessary when designing waypoints for computer-controlled aircraft. Computer pilots never ask to edit their upcoming missions.

ACTIONS

A well designed mission will give the appearance that there is a human-like intelligence guiding all the aircraft in the environment. This is the result of careful planning, however, not something that is automatically created when an aircraft is placed on the map.

Without the appropriate commands, a computer-controlled aircraft will blindly travel from Waypoint A to Waypoint B, although it will defend itself from threats. The careful assignment of actions is the first step to a realistic-looking mission.

Note that the computer always performs actions from top to bottom, exactly as they appear in the Actions list.

Alert Intercept

This action should only be used for aircraft on runways — it is specific to aircraft waiting for takeoff.

Reaction Range. This establishes the distance, in nautical miles, at which an aircraft will respond to an enemy threat. This can be set at any range, but a good average is forty nautical miles.

Alternate Path

This triggers an Alternate Path for the player.

An Alternate Path is a predetermined route for an alternative mission that overrides the original mission partway through flight. For example, the player might be en route to bomb a runway. Part way through the mission he is told that there are downed pilots needing air support. The new waypoints that appear, leading the player to the downed pilots, marks the Alternate Path.

Alternate waypoints will be invisible to the player until the Alternate Path is triggered. Once on an Alternate Path, the player will not be able to return to the primary path.

Assigning an Alternate Path to an aircraft is one part of a three-stage process. There must also be a flag set (See **Action Types: Alternate Path**, p. 5.30) to indicate when the player should be given the new assignment, and the Alternate Path waypoints must be created (**Alt Path**, p. 5.30).

Even though you know that the original mission won't be completed, all the Primary Path waypoints should be put in anyway, so that the Primary Path appears complete to the player in the briefing. Likewise, the Alternate Path should have an ending, i.e., a final waypoint and a landing site.

AWACS Pattern

This can only be assigned to an AWACS aircraft: they patrol a certain area and feed target information to nearby F-15s. Assigning an action of AWACS to an aircraft sets it on an orbital patrol around the waypoint.

Duration

Duration establishes how long the AWACS patrol will last. When the time elapses or the flag is set, the aircraft will proceed to the next waypoint.

Time

Time (in minutes) that the aircraft will perform the action.

Flag

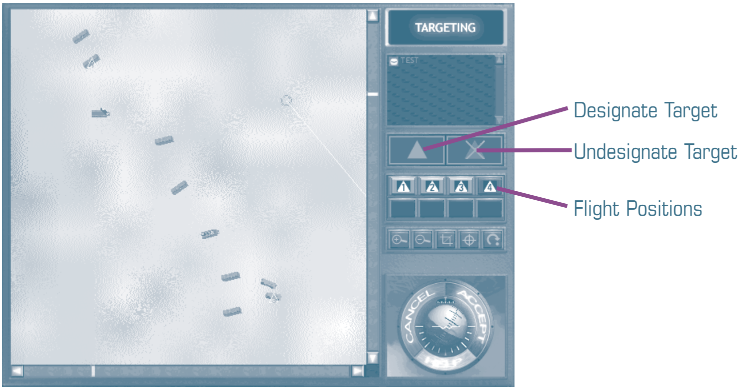
Certain events will signal the end of the action.

Indefinite — The action will continue until the end of the mission.

Ammo Depleted — action ends when all ammunition is spent.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

Bomb Target



When creating an aircraft with orders to bomb specific targets, it is best to first zoom in close enough that the intended target is clearly visible. The aircraft can always be dragged to the appropriate starting location after assigning its target.

When selecting Bomb Target, the Create Mission screen will change to a Bomb Target screen. The new screen is easily recognizable by the predominantly gray color, and eight large numbered buttons.

Note that an aircraft can only bomb one target per waypoint. You can send in multiple aircraft, each with its own assigned targets, and can also assign multiple aircraft to the same target.

Targeting

The exact target must be designated for each bomber. All potential targets have small white dots, and one of these dots must be selected to designate the bombing target. This is easier to do if the area is close enough to see individual objects clearly.

Designate Target

- Locate the target to be bombed in the Mission Builder window.
- Choose among those in your flight, 1 through 8. (Player is #1.)
- Click on the target (white dot) to be bombed.

Undesignate Target

- Click on the designated target to erase it as a target.

Bomb Profile

- Choose the method of bomb delivery.

In general, **Level** delivery is best if the bomber is approaching from a low altitude or is too big (like a B-52). **Loft** is best for bomb delivery in stand-off attacks, when you don't want to overfly the target. **Pop-Up** is best for delivery when you're in a low-attack profile against a target. **Dive** is best for high-altitude attacks.

Available Profiles

Level	Loft	Pop-Up	Dive

Add Label/Delete Label

Use the labels to keep track of which objects are targeted by which aircraft.

Flight Position

This button is used in conjunction with the DESIGNATE TARGET button to assign certain targets to certain wingmen. The numbers are wingmen numbers.

Zoom In/Zoom Out/Centering

For explanation, see **Zoom In** and **Zoom Out**, p. 5.64.

Exit

- Select EXIT when finished selecting a bombing target for the aircraft.

CAP

During Combat Air Patrol missions, there is no particular target, but rather a patrol over friendly territory searching for enemy aircraft to engage. An aircraft will continue this patrol for either the duration of the mission, or until an event occurs that triggers it to change mission plans.

Where the CAP is designated (either the starting position or a waypoint) an elliptical orbit is begun. If an aircraft encounters an enemy aircraft, it will engage in combat until either it or the enemy is destroyed.

Heading

- The heading establishes the long axis of an elliptical orbit. This should be set in the direction of the expect threat.

Available Headings			
North	East	South	West
North East	Southeast	Southwest	Northwest

Range

Range is how close an intruding aircraft must be before the CAP aircraft reacts, expressed in nautical miles.

Duration

Duration establishes how long the Combat Air Patrol will last. When the time elapses or the flag is set, the aircraft will proceed to the next waypoint.

Time

Time (in minutes) that the aircraft will perform the action.

Flag

Certain events will signal the end of the action.

Indefinite — The action will continue until the end of the mission.

Ammo Depleted — action ends when all air-to-air missiles are spent.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

CAS

Close Air Support is similar to a Combat Air Patrol, except that the goal is to protect allies on the ground by doing an advance sweep of the enemy, concentrating on ground targets.

On CAS, an aircraft will be less likely to chase more distant enemy aircraft, concentrating instead on preventing immediate threats to the ground troops.

Search Range

Search Range is the distance, in nautical miles, that the aircraft will be able to search for and attack enemy ground units.

Duration

Duration establishes how long the Close Air Support will last. When the time elapses or the flag is set, the aircraft will stop whatever it is doing and proceed to the next waypoint.

Time

Time (in minutes) that the aircraft will perform the action.

Flag

Certain events will signal the end of the search.

Indefinite — The action will continue until the end of the mission.

Ammo Depleted — action ends when all air-to-ground ammunition is spent.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

Destroy This Object

Assigns the aircraft to destroy all the aircraft in that flight. This guarantees that a specific object will be attacked, to provide an exciting environment or kamikaze effect.

Assigning a "Destroy This Object" Action to a Moving Vehicle can provide terrorist-type attacks.

Escort

This assigns an aircraft the task of safely escorting another aircraft through an area: the task of the escorting aircraft is to deter any air threats. The Waypoint path which the escort and escorted aircraft follow are double-lined. This will continue until the Action RELEASE ESCORT (p. 5.38) is assigned to a waypoint by the escorted aircraft.

Escort is only available during certain conditions: at least two aircraft must be on the map, and you must assign the action to the *last* waypoint of the escorting aircraft. (After the escort is over, the aircraft may do other things.)

- Right-click on the last waypoint of the escorting aircraft.
- Click ACTION.
- Select ESCORT.
- Click OK.
- Click on the aircraft to be escorted.
- Confirm by clicking OK.

Fighter Sweep

If a flight reaches a Fighter Sweep waypoint, the aircraft will search for any enemy aircraft in range *ahead of them* until the duration is over, or until they reach the next waypoint. This is similar to a mobile CAP, except that enemies *behind* the flight will not be engaged.

Search Range

Search Range is the maximum distance, in nautical miles, within which the aircraft will be able to detect enemy aircraft.

Duration

Time

Time (in minutes) that the flight will look for enemies, or engage in combat between this particular waypoint and the next. After the time is up, the flight will continue to the next waypoint.

Flag

Certain events will signal the end of the action.

Indefinite — action will not be called off, ever. It will continue until the end of the mission.

Ammo Depleted — action ends when all air-to-air missiles are spent.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

Form On

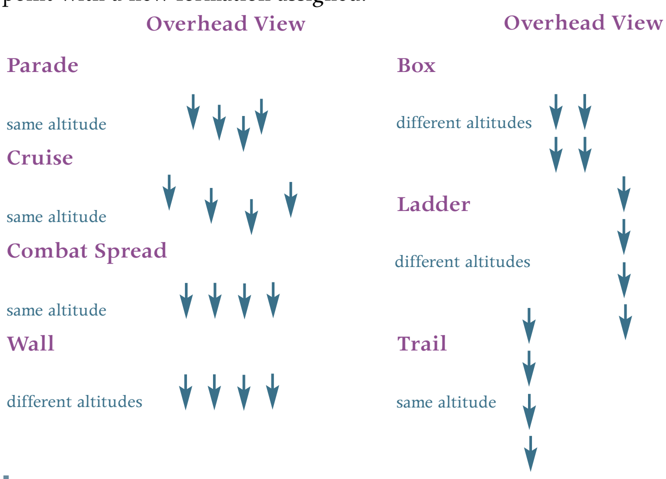
Form On is identical to Escort, except the "attached" aircraft will not break and attack any enemies — it will only accompany the "master" aircraft. The waypoint path which the master and following aircraft fly along are double-lined. This will continue until the Action RELEASE FORM ON (p. 5.38) is assigned to a waypoint.

Form On is only available during certain conditions: at least two aircraft must be on the map, and the action must be assigned to the *last* waypoint of the escorting aircraft. (After the escort is over, the aircraft is free to do other things.)

- Right-click on the last waypoint of the aircraft to "form on" the other's wing.
- Click ACTION.
- Select FORM ON.
- Click OK.
- Click on the aircraft to be followed.
- Confirm by clicking OK.

Formation

Aircraft with the Action of Formation will proceed through their waypoints in the chosen formation. The formation is changed when they reach a waypoint with a new formation assigned.



Land

An aircraft with the Action of Land will land at the nearest airstrip on its assigned course.

This is used primarily to give a feel of realism. Not all aircraft are starting their missions when the player enters the game. Some aircraft should begin in mid-mission, and others should be returning to base.

Only use this when the waypoint is near an airport.

Message

Messages can be text (maximum 320 characters), sound (any .WAV file) or both. They are usually triggered by the player coming within range of another aircraft, but they can also be triggered by a flag being set (see **User Flags**, p. 5.44).

Messages are the only "secondary" Action that can be assigned to an aircraft's waypoints.

Text Message

- Type in the message the player will see.

Sound File

- Type in the location of the sound file the player will hear.

Browse

If the exact location of the sound file is unknown, and therefore cannot be typed into the Sound File text box, browse for it by clicking the BROWSE button. Click through the directories until the appropriate file is found, then select it by double-clicking on it.

Orbit

The Orbit command tells an aircraft to circle over one location.

Duration

Time

Time (in minutes) that the aircraft performs the action.

Flag

Certain events will signal the end of the action.

Indefinite — action will not be called off, ever. It will continue until the end of the mission.

Ammo Depleted — action ends when all ammunition is spent.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

Or Until

None

Player Arrives — orbiting enemy aircraft will break and attack; orbiting friendly aircraft will fly to next assigned waypoint.

Escort Arrives — orbiting aircraft will fly to next assigned waypoint.

Form On — an aircraft that has been assigned a Form On Action arrives at the last waypoint of its "Form On" assignment.

Release Escort

This ends the escorting action of the attached aircraft, from that waypoint on.

Release Form On

This ends the "following" action of the attached aircraft, subsequent waypoints will have other assignments.

SEAD

Suppress Enemy Air Defense missions are the predecessors to airstrikes. Specialized aircraft are sent to take out as many SAM sites and AAA as can be found, making a corridor of relative safety for the slower bombers.

Search Range

Search Range is the maximum distance, in nautical miles, within which the aircraft will be able to perform the action.

Duration

Time

Time (in minutes) that the aircraft will perform the action.

Flag

Certain events will signal the end of pursuit.

Indefinite — action will not be called off, ever. It will continue until the end of the mission.

Ammo Depleted — action ends when all air-to-ground weapons are expended.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

Standoff Jammer

Tells a jamming aircraft (e.g., EA-6b Prowler) to attempt to jam ground defenses along a certain heading.

Heading

- Choose the heading it will concentrate its jamming on. The closer the ground defense, the more effective the jamming.

Duration

Time

Time (in minutes) that the aircraft will perform the action.

Flag

Certain events will signal the end of the action.

Indefinite — action will not be called off, ever. It will continue until the end of the mission.

Ammo Depleted — action ends when all ammunition is spent.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

Takeoff

Even during wartime, not all aircraft are in the air at all times. You can place aircraft on the ground (0 altitude) that either take off a certain amount of time after the mission begins, or in response to user flags.

The level of detail is up to you. Airstrips that the player will likely never see can be designed to have regularly departing air patrols, or they can be left empty. Aircraft can take off when enemy territory is bombed, when the player reaches certain waypoints, at the start of the mission, or any other Condition. The most realistic missions have grounded aircraft that respond to enemy activity.

When

Time

How long after the start of the mission, in minutes, before the aircraft takes off.

Be careful when using Time, rather than a specific User Flag, to establish when an aircraft's takeoff occurs. Sometimes the player will delay between starting the mission and actually taking off. If such a delay would cause the game's timetable to get out of synch (such as all the enemies having come and gone before the player's delayed arrival), it is better to use a flag, rather than a set time.

Flag

Immediately — the aircraft takes off as soon as the mission begins. See the caution, above, about using time rather than a user flag to establish takeoff time.

User Flag — the aircraft takes off as soon as a certain flag is set. (See **User Flags**, p. 5.44.)

Tanker Pattern

This can only be assigned to tanker aircraft: they orbit a certain area and provide a refueling opportunity to F-15s on longer missions. Assigning an action of TANKER PATTERN to an aircraft sets it on an orbital patrol around the waypoint.

Duration

Time

Time (in minutes) that the aircraft will perform the action.

Flag

Certain events will signal the end of the action.

Indefinite — action will not be called off, ever. It will continue until the end of the mission.

Ammo Depleted — action ends when all ammunition is spent.

User Flag — action ends when a certain flag is set. (See **User Flags**, p. 5.44.)

REMOVE WAYPOINT

See **Common Command: Remove Item**, p. 5.12.

When one waypoint is removed, the aircraft's path is automatically adjusted to go from the previous waypoint to the next consecutive waypoint. All subsequent waypoints are renumbered

WAYPOINT INFO

See **Common Command: Item Information**, p. 5.12.

GOAL

- Click the GOAL button.
- Click on the individual target's icon or targeting dot.

Goal

- Select whether the target must be destroyed, or must survive.

Label

- Type in a label to describe the goal.

This is important! See **Goal State (Change) Event** below and on p. 5.47.

- Click OK.
- Repeat until all are appropriate targets are labeled.

Goals are what give a mission purpose; it is justification for the time, expense and danger that a flight into enemy territory entails. Each time a player takes off, there should be a clear understanding of what should be accomplished (see also **Briefing**, p. 5.52). Should a truck be destroyed? Should a flight of MiGs be eliminated? Perhaps the mission is an escort — in that case, there must be a "target" aircraft designated as "must survive."

In the context of creating a mission, the goal — or purpose — of the mission is what the player is trying to accomplish. For instance, a mission's goal could be the destruction of a tank farm. In this case, there could be approximately 14 goal markers, one on each tank that must be destroyed.

It's possible to designate a target without assigning a goal, but in order to give the player feedback, you need to assign the target goal.

Goal Markers. By tagging an individual object with a goal marker, the mission designer is saying "this is part of the overall goal." There are two types of goal markers. A green flag with an "X" on it means that particular object must be destroyed for the mission to be successful. A green flag with a dot on it means that target must *not* be destroyed; the mission is only successful if it survives.

Ground vs. Airborne. Structures, vehicles and aircraft can all be targets. They are tagged with a goal marker in the same way, with one exception. Airborne and vehicular targets have icons that you select. Ground targets have white dots, one per target site, that must be selected.

Often, these white dots cannot be seen from the default view of the Mission Map, so you must zoom in on the individual target until the white targeting dots can be seen. Smaller targets, such as vehicles or structures, will have only one targeting dot per object. Larger objects, such as runways, may have a dozen or more.

Goal Labels. It is important to clearly label the goals. After goals have been assigned to the mission, you will set up Goal State Events. (See **Mission Events: Goal State (Change) Event**, p. 5.47.)

Setting events can get complicated, and it's worth the extra time to make goal labels understandable. One good way to label goals is to use short descriptions of the object, if it is friendly, and numbers to differentiate between similar targets. Example: tank goal, factory goal, MiG goal 1, MiG goal 2, friendly factory.

Essentially, a Goal State Event dictates that if the state of a specific goal is A, the game will respond one way, and if the state is B, the game will respond another way. For example, if the mission goal is to destroy a factory, you will want a message saying "Congratulations, you succeeded!" if the factory is destroyed, and a message saying "You failed, report back to base!" if the factory is not destroyed.

DELETE GOAL

- Click REMOVE GOAL.
- Click on the goal to be deleted — either the icon or the white dot.
- Confirm the deletion by clicking OK.

REMOVE GOAL deletes a previously placed goal marker.

If a goal is being used by an event or debrief condition, it cannot be deleted.

GOAL INFO

See **Common Command: Item Info**, p. 5.12.

AREA GOAL

- Click the AREA GOAL button.
- Click-and-drag on the Mission Map to place the Area Goal.

A mission can only have one Area Goal.

An Area Goal is a way of determining a player's proficiency. The computer keeps track of how much ordnance was used, and compares it to how much damage was inflicted. From that information is calculated the success ratio.

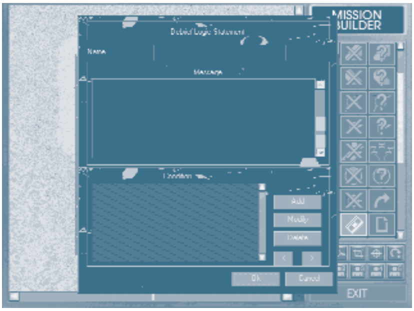
Different levels of success can be used to trigger different debriefs. (See **Event: Area Event**, p. 5.46 and **Debrief: Select the Conditions**, p. 5.54.) Rather than just win or lose, proficiencies can be cited. For instance, if the player uses two bombs to take out four targets, the debrief can be more positive than if the player dropped eight bombs and only hit one target.

DELETE AREA GOAL

- Click DELETE AREA GOAL.

Because there can be only one Area Goal on the Mission Map, simply clicking the DELETE AREA GOAL button is sufficient to remove it.

EVENT



Events are the heart of the Mission Builder. Designing Events into a mission makes things move, makes things happen at the right time, makes things react to what the player does. When a player gets the feeling of "reality" — that *Jane's F-15* is as close to a real combat situation as a computer game can get — it is the result of careful Event design.

An Event is essentially a way of saying "Make this *Action* happen, whenever that *Condition* occurs," in such a way that the computer program can understand it.

The interactivity of Events can quickly become a complex network of actions and reactions. You should expect setting up Events to take time, forethought and practice.

Before Setting Up Events

Events rely heavily on the mission environment. For example, it's impossible to make an aircraft react to the destruction of a target if either the aircraft or the target haven't been placed on the Mission Map. It is easiest to have everything ready before setting up the events.

Therefore, the probable order of design is:

- Place any aircraft, friendly and enemy, that will have an active role in the mission.
- Assign each of them waypoints.
- Place any other objects that will have an active role in the mission, particularly those that will be used as targets.
- Assign the Goals (including the Area Goal, if there is one) for the mission.
- Place other aircraft and objects to make the mission feel realistic.

USER FLAGS

A User Flag is a name assigned to an occurrence that you consider important to the mission. For instance, if you want a flight of MiGs to take off when a SAM site is destroyed, then the destruction of the SAM site could be labeled User Flag 1. Then, when assigning an action to the MiGs, you would select the action Take Off and then select User Flag 1 from the Flag drop-down menu.

(User flags start in the FALSE or OFF state. They can only be set to TRUE or turned on.)

- Click EVENT button.
- Click ADD to add a Mission Event.
- Select the type of Event — User Flags are usually, but not always, Goal State Events, since they tend to hinge on whether a goal has been destroyed. (See **Event Types**, next page)
- Fill out information specific to the type of event. (See **Event Types**, next page.)

Action — Set up User Flag "name"

- Click ADD under Action.
- Click on SET FLAG.
- Select a User Flag number.
- Set the Operator to "=".
- Set the Value to True.
- Click OK.

The User Flag name (User Flag 1, User Flag 2, etc.) which you have assigned should then have an event/condition assigned to it.

Condition — Set up event that triggers User Flag

The drop-down menu lists possible events (See **Condition Types**, p. 5.48). At the bottom of the list are the mission goals.

- Click ADD under Condition.
- Click on the check mark on the Goal/Flag menu to bring up a list of all possible events.
- Select the event that will trigger the new User Flag.

EVENT TYPES

- Click the EVENT button.
- Click ADD to add a Mission Event.
- Select the type of Event.
- Fill out information specific to the type of event.
- Select Actions. See **Event Action Types**, p. 5.47.
- Select Conditions. See **Condition Types**, p. 5.48.

Time Event

A time event says "When this *Starting Condition* is met, this *Action* will take place, if these *Conditions* are met."

(See also **Event Action Types**, p. 5.47, and **Condition Types**, p. 5.48)

Starting Condition

You have a choice of a starting condition of Time or a User Flag.

Time. Setting time as a starting condition is good if you want to have something happen at a certain time, regardless of where the player is. However, having an event hinge on the passage of a certain amount of time can be a problem if the player *must* be in a certain place at a certain time. Don't assume the player will take off the first moment of the mission, and fly in a straight line at a predetermined speed. It's usually better to set up a User Flag to act as the Starting Condition.

User Flag. Using a Flag to set off an event is a much better way of controlling when an event takes place. Of course, you must create a User Flag (**Event: User Flag**, p. 5.44) before it can be assigned as a Starting Condition.

Label. The Label for a Time Event doesn't have to outline everything that occurs, but it should be distinguishable from any other Time Event.

Timer. Setting a timer, in minutes, delays how long after the Flag and any Conditions are met before the action takes place. For example, the Flag is the destruction of two certain targets, the Condition is the death of the Wingman, the Action is that a MiG takes off — and the Timer is set to 10. Consider that the player destroys the targets 3 minutes into the mission, and then 8 minutes later his wingman is killed — 10 minutes after that, the MiG will take off.

Area Event

- Click the AREA EVENT button.
- Click-and-drag to establish a blue Area Event box.
- Enter the details, including Action and Condition.
- Click OK.

An Area Event says, "*When* the player enters the Area Event box, this *Action* will take place, if these *Conditions* are met."

(See also **Action Types**, p. 5.47, and **Condition Types**, p. 5.48.)

When. An Area Event is based on the player ENTERING or EXITING the designated Area Event box. EVERY TIME means that as long as the conditions are met, the Action will happen when the player enters *or* exits the area.

Label. The Label for an Area Event should make it distinctive from other Area Events.

Do not confuse the Area Event Box with the Area Goal. There can only be one Area Goal. There can be many Area Event boxes, each with one or more events associated with it.

Duration.

Always. The Action will occur every time the player enters (or exits) the Area.

1 Time. The Action will occur only the first time the player enters (or exits) the Area.

Goal State (Change) Event

An Goal State Event says, "When this *Goal's* state changes (such as no damage becomes 20% damage, or no damage becomes destroyed), this *Action* will take place, if these *Conditions* are met."

(See also **Action Types**, below, and **Condition Types**, p. 5.48.)

Goal. You choose the Goal whose state change will trigger an Action. Only targets that have been marked as Goals will appear in the drop-down menu.

Label. The Label for a Goal State Event should make it distinctive from other Goal State Events.

Extra care should be taken when labeling Goal State Events, as there will probably be more of these than any other kind of Mission Event.

Action Types (Event Action Types)

Do not confuse these with Aircraft Actions! Aircraft actions take place at waypoints. Event Actions take place at certain times, and under certain Conditions.

Event Actions (Actions that are assigned in the Events window) are what happens when all the given Conditions are met.

Message (Event Action Message)

Event Action Messages can be text, sound or both. They are triggered by a set of conditions, and are usually from allies either on the ground or in the air.

Event Action Messages can be spawned by any Condition. If User Flag 1 is "Pilot enters Area Goal," the message might be "Ready for Action!" If it is "Out of A/G," the message could be "I'm out of bombs, you guys are on your own." If it is linked to the destruction of your wingman, then it might be a death scream.

Text messages have a 320- character maximum.

Sound files must be .WAV format.

Text Message

- Type in the message the player will see.

Sound File

- Type in the location of the sound file the player will hear.

Browse

If the exact location of the sound file is unknown, and therefore cannot be typed into the Sound File text box, browse for it by clicking the BROWSE button. Click through the directories until the appropriate file is found, then select it by double-clicking on it.

Alternate Path

See **Action: Alternate Path**, p. 5.30.

Set Flag

This assigns a "name" to a set of conditions: User Flag 1, User Flag 2, etc. The User Flag is later named as a Condition for either an Aircraft or Event Action.

There are two reasons to use the Set Flag to name a set of conditions.

The most important one is that some drop-down menus only have the capability to choose from a list of User Flags. Therefore conditions must be named as User Flags before they can be chosen. (For example, you can't assign conditions for an aircraft to end an Orbiting Action unless those conditions are part of a User Flag. See **Orbiting Action**, p. 5.37.)

The second reason is that some sets of Conditions are used more than once, and it saves you the trouble of entering in the same Conditions over and over again.

FAC

The FAC, as an action, turns the FAC (Forward Air Controller — soldier locating valuable enemy targets) on. It keeps the FAC from talking constantly to the player from the beginning of the mission.

The FAC will stop broadcasting when the mission is successful, or the FAC object is destroyed.

EVENT CONDITION TYPES

Goal/Flag

User Flag

A set of conditions may be designated as a User Flag. (See **Events: User Flags**, p. 5.44. See also, **Action Types: Set Flag**, p. 5.48.) The User Flag can then be used as a Condition.

Out of A/G

Out of Air-to-Ground Ammunition usually signals the end of an aircraft's usefulness. Often this condition triggers a message (**Event Action Message**, p. 5.47) stating the situation.

Out of A/A

Out of Air-to-Air Ammunition, similar to Out of A/G (above), means an aircraft is helpless should it encounter opposition. This condition usually triggers a message (**Event Action Message**, p. 5.47).

Flight 1 (Player) Destroyed

The mission may not have failed, but the game is definitely over — except for any last message (**Event Action Message**, p. 5.47) the player can get out before the crash.

Flight 2 (Wingman) Destroyed

This can be accompanied by an Event Action message of his last words, comments by other flight members, or even an Alternate Path.

Flight 3 (through Flight 8) Destroyed

Same as above, for Wingman Destroyed.

Crossed Fence

Crossed Fence refers to crossing the line between friendly and enemy territory.

Mission Goals

Mission Goals are the most common sort of conditions, as they hinge on the actual purpose of the mission. At the end of the list of Event Conditions, the labels that were assigned to each Goal object, and whether they must be destroyed or must survive, appear in the order in which they were created.

Event Operator

There are only two operators in the Mission Event Conditions.

"=" means "equal to" the Value.

"!=" means "is not equal to" the Value.

JSTAR

- Click JSTAR.
- Click on a ground object.
- Repeat for every object the JSTAR will "see."

Assigning objects to a JSTAR is one part of a two-step process. You must also place a JSTAR aircraft somewhere on the map, within 200 nautical miles of its target.

A JSTAR (pronounced Jay-star) is a type of reconnaissance aircraft, fitted with a similar type of radar as an F-15E. The JSTAR flies over the combat theater, finds moving ground targets and relays the information, via radio, to the F-15E pilots.

In Desert Storm, the JSTARs were converted Boeing 707s designated as E-8s.

DELETE JSTAR

- Click DELETE JSTAR.
- Click on the object with the JSTAR marker.

JSTAR INFO

See **Common Command: Item Info**, p. 5.12.

BULLSEYE

- Click on BULLSEYE.
- Click the place on the map where this mission's Bullseye will be.

A mission can have only one Bullseye.

A Bullseye is a location on the Mission Map, determined prior to a mission and kept secret from everyone not having "need to know" status. It is used to help pilots refer to locations over radio, without having the enemy know where they are, where they are going, or where exactly the target is.

> The Bullseye should be in a noticeable location, near something the player will see, pass by or notice.

For instance, consider a fighter pilot who is shot down en route to Baghdad. He's on the ground and needs to use his radio to let Search and Rescue know where to find him. If he says "I'm five miles south of Baghdad," then any listening enemy — and they *are* listening — knows exactly where to find him. If the Bullseye is exactly 20 miles south of Baghdad, he can say "I'm fifteen miles north of Bullseye." Search and Rescue will know where he is, but listening enemies won't.

Bullseyes are changed daily.

If you set a Bullseye, don't forget to let the player know where it is during the Mission Briefing.

DELETE BULLSEYE

Selecting DELETE BULLSEYE automatically erases the current Bullseye from the mission. You don't have to click on the Bullseye itself, since there's only one.

ALT PATH

- Click ALT PATH.
- Click the location on the map where the replacement mission will start.
- Right-click the new waypoint.
- Add details to the new waypoint. See **Waypoint Details: Adding/Editing**, p. 5.28.
- Continue to add waypoints to complete the mission.

Also

- Create a Flag to trigger the Alternate Path. (See **User Flags**, p. 5.44)
- Create a Message to announce the Alternate Path. (See **Message Info**, p. 5.37)

Alternate Paths only affect the Player. You cannot assign an Alternate Path to a computer-controlled aircraft. Computer controlled aircraft can *respond* to the events that occur during an Alternate Path mission, but their waypoints will not change.

An Alternate Path is a predetermined route for an alternative mission that overrides the original mission partway through flight. For example, the player might be en route to bomb a runway. Part way through the mission he is told that there are some downed pilots needing air support. The new waypoints that appear, leading the player to the downed pilots, mark the Alternate Path.

Alternate waypoints will be invisible to the player until the Alternate Path is triggered. Once on an Alternate Path, the player will not be able to return to the primary path.

Assigning an Alternate Path to an aircraft is one part of a two-stage process. There must also be a flag set to indicate when the player should be given the new assignment (See **Action Types: Alternate Path**, p. 5.30).

Paths between the Alternate Path waypoints appear to you as dotted lines on the Mission Map. However, the path between the Primary Path and the Alternate Path will not appear, because the Alternate Path might be triggered by many things, and may not always start at the same place.

Alternate waypoints will be invisible to the player until the Alternate Path is triggered. Also, once on an Alternate Path, the player will not be able to return to the primary path.

Even though you know that the original mission won't be completed, all the Primary Path waypoints should be put in anyway, so that the Primary Path appears complete to the player in the briefing. Likewise, the Alternate Path should have an ending, i.e., a final waypoint and a landing site.

BRIEFING

- Click the BRIEFING button.
- Click in the text field.
- Type in the briefing information.
- Click OK to save the briefing text.

The Briefing is the what the player is told prior to the mission. It can be as brief or as detailed as you would like.

Minimal information should include what type of mission (CAP, SEAD, bombing run, etc.) is about to be flown. The player needs to know what to expect in order to choose the appropriate loadout.

A more detailed briefing would include possible enemy threats, the current military situation (are the player's allies about to make a strike? are they on the defensive?), and the goals the player is expected to achieve.

Of course, nothing limits the amount of information that can be given. Current weather conditions, time of day, recommended loadout, etc., can be included at your discretion.

EDIT BRIEFING

- Click the BRIEFING button.
- Edit the text.
- Click OK to save changes.

There is only one briefing per mission.

Most common text editor commands work in *Jane's F-15* text boxes.

[Backspace] deletes the letter directly before the cursor, or any highlighted text.

[Delete] erases the letter directly after the cursor, or any highlighted text.

Click-and-drag highlights text.

[↑][←][→][↓] move the cursor in one-space steps.

[↑][←][→][↓] + [Ctrl] move the cursor in one-word steps.

[Ctrl] + [C] copies text, [Ctrl] + [V] pastes text.

[Home]/[End] moves the cursor to the front/end of the text line.

[Ctrl] + [Home]/[End] moves the cursor to the start/end of briefing.

DEBRIEF

Creating a Debrief is essentially assigning a message to any (or each) of a long list of possible events. There are many different flags, and the first 50 or so are repeated for each of the 8 flights. It is up to you which of these Events deserve to be mentioned in the debriefing.

- Click the DEBRIEF button.
- Click ADD to create a new Debrief.

Stop Debrief

- Click the Condition in the Condition Statement list that will end the Debrief process.
- Click in the STOP DEBRIEF PROCESSING IF TRUE box.

Note that letting the debriefing process continue will often result in a more robust debriefing message. It is not necessary to halt the debriefing process.

- Repeat for any other Conditions that should halt the Debrief process.

While the mission is being played, as each specified Condition is achieved, a message is coded to the Debrief. When the mission is over, the player sees a debrief which has been built "behind the scenes." If you decide that with a certain Condition (such as the player being shot down) no more messages should be added, then the STOP DEBRIEF PROCESSING IF TRUE should be clicked for such Conditions.

DEBRIEF LOGIC GROUP

- Name the Logic Group.
- Click ADD to add Condition Statements.

DEBRIEF LOGIC STATEMENT

This is the meat of the Debriefing, where each Condition, or set of Conditions, is given a message to be read by the player after the mission is over. Debriefings will occur even in the event of the Player's destruction (unless you choose otherwise).

Name the Logic Statement

- Type in the name of the Logic Statement.

A Logic Statement is the name of a certain Condition or set of Conditions, and appears in the Logic Group List.

A Logic Statement name will usually be the same as the Condition, unless more than one Condition is selected. For example, if "Flight 2 Crew MIA" creates a debriefing statement of "You lost your wingman!" the Logic Statement might be named either "Flight 2 Crew MIA" or "Wingman MIA."

If you combine the Conditions that Flight 2 *and* Flight 3, 4 and 5 are all MIA, the Logic Statement might be named "All crew MIA" with a Logic Statement message of "You lost ALL your wingmen!"

Select the Conditions

- Click ADD to create a Condition Statement.

Goal/Flag

- Select the Condition(s) for that Condition Statement.

Note that each window of possible Goal/Flags is nine entries long. Clicking on the scroll bar (as opposed to the scroll arrows) scrolls down ten entries, and therefore every tenth Goal/Flag can be accidentally skipped.

Operator

- Add a message to appear to the player. Make sure the message is applicable to all conditions included in that Logic Group.

There are six possible Operators for the Debrief Conditions.

"!=" means "is not equal to."

"=" means "is."

"<" means "is less than."

">" means "is greater than."

"<=" means "is less than or equal to."

">=" means "is greater than or equal to."

Flag

In cases when the action is True or False (such as being Shot Down, Killed, or Crossed Fence Boundary), Flag should be used, and True or False chosen.

Value

In cases where there is a number involved (such as Number of Bombs, Neutral Aircraft kills, or A/G Bomb hit ratio), Value should be used, and a number typed into the field. For Instance the Number of Bombs could be less than or equal to 4, or the Hit Ratio could be greater than 50 (percent).

Message

The Messages are what the player actually sees at the end of a mission; all the logic groups and statements will be invisible.

All applicable Messages will appear on the Debriefing, in the order that the Conditions occurred.

MISSION INFO

After a mission is created, it will appear as a choice in the *Jane's F-15* Load Mission list. It is up to you to create the explanatory text that the player will see.

The Mission Info window is primarily for convincing players that they want to play the mission.

TITLE

The name of the mission. This will appear in the Load Mission list.

AUTHOR

This is who designed the mission. This is invisible to the player, and is mostly used in the event that changes will be incorporated into a mission by someone who did not originally create the mission. When only one designer is working on a mission, this is not a vital piece of information. However, when several people add details to the same mission, the Author should be the one who has overall design control.

MISSION SUMMARY DESCRIPTION

This serves as a brief summary of what the mission is about. When the player clicks on the Mission Title in the Load Mission list, this appears in the upper-left window.

COMMENTS

This is useful reminder when you feel that further design features would improve the mission, but cannot take the time to stop and implement them immediately. Comments are invisible to the player.

ENVIRONMENT

Time and weather add not only visual variety to the game, they change the mission itself. A night mission is a different thing entirely from a daytime mission, just as a Combat Air Patrol with cloudy skies provides more of a challenge than one with clear skies.

TIME OF DAY

Dawn is from 5am to 7am. Dusk is from 5pm to 7pm. Daylight is between Dawn and Dusk, Night is between Dusk and Dawn. Choosing a Time of Day sets the start of the mission at the start of the time period. Time then progresses throughout the mission.

WEATHER

The four choices are Clear, Partly Cloudy, Overcast and Stormy.

FILTER

- Put/remove check marks in the boxes to have those objects visible/invisible during the design process.
- Click SET.
- Click on a button to assign it to the chosen filter selection.
- Click OK.

Filters are a design tool that allows you to choose what objects are visible on the Mission Map at one time. By the time a mission is fully created, the map can be full of objects, icons and lines. Filtering out specific items makes it easier to concentrate on the task at hand.

The filter icons at the bottom of the Mission Builder panel will enable you to easily alternate between types of filters during the design process.

Remap Filter Icon. There are five filter icons at the bottom of the Mission Builder panel. These can be assigned to certain filters. For instance, one icon could make only friendly aircraft and objects visible, while another would show only enemy forces. Another icon could filter out everything but aircraft. It is up to you to decide what filters would be most useful.

Remember that all objects will appear in the game. Be careful not to filter something out and forget about it. The final check of a mission should have all the objects visible.

BUILDER OPTIONS

The Mission Builder is designed to give more or less information to you, the designer, according to what you find convenient. These customizations can be adjusted at any time during the design process.

ICON LAYOUT

Each aircraft icon can by surrounded by information about the aircraft it represents. Up to six pieces of data can be assigned locations around the icon: one piece of info on the top/bottom, and two on each side.

You cannot choose to have separate Icon Layouts for individual aircraft or waypoints. The layout applies to all aircraft.

Possible Aircraft Data	Possible Waypoint Data
None	None
Call Sign	Call Sign
Aircraft Type	Aircraft Type
Aircraft Name	Aircraft Name
Number In Flight	Waypoint Name
Altitude	Altitude
Speed	Speed
Heading	Jump Point
Control Group	Top Action (i.e., not a secondary Message Action)
Side	Waypoint Number
Loadout	
Top Action (I.e., not a secondary Message Action)	

GCI LINK

First

Place a series of Radar Stations (see **Add Ground Objects**, p. 5.24) on the Mission Map.

Next

- Click the GCI LINK button.
- Click on the first Radar Station (or radar-directed SAM/AAA site) to be linked.
- Click on the Radar Station nearest to the first to establish a link.

Continue connecting the Radar Stations until the GCI network is satisfactory.

Ground Control Interception is a way of coordinating the information between one radar station and the next. It's an air control information relay system, in which one station's information is passed on to all other radar stations in the network. The GCI sites coordinate the air defenses of that side; if one air-defense attacks an aircraft, the others know there's something out there. SAM sites can also be tied into the network and be alerted. There is no limit and no range — it's all modern telecommunications.

GCI links appear as thin black lines between Radar Stations.

DELETE GCI LINK

- Click DELETE GCI LINK.
- Click on the Radar Station that is to be removed from the network.

A Radar Station that is not on the GCI Link network can still pass information to local SAM and AAA sites, but it cannot pass the information to another radar station, and thus give the "advanced warning."

GROUPS

Groups can be either aircraft or ground vehicles. In the following description, the groups and packagesare composed of aircraft, but the same description applies to ground vehicles.

Create a group.

- Click the GROUP button.
- Click ADD to create a new group.
- Type the name of the group into the Name field at the top of the new window.

Add a package to the group.

- Click ADD to add a package (one or more aircraft) to this group.
- Type a brief description of the package.
- Assign a 1 - 100 percent chance of appearing.
- Click ACCEPT.
- Continue adding packages until the group is complete.
- Click DONE when the group is complete.

How many packages per group is a designer decision. There are no restrictions on how many groups can be created, or how many packages each can have. However, only one package per group will appear.

The purpose of using Groups is to add a random element to the mission. If a mission has no randomization, there will be no reason for the player to replay the mission — the same aircraft will arrive at the same place in the same way, every time the mission is played. When a Group is created, however, and packages are assigned to it, only one of those packages will appear per mission. That adds a random element to the enemy forces that the player faces each time he flies the mission.

NAMES

Giving groups simple, descriptive names helps keep their purposes separate. Some examples could be "MiGs from the south," "Iraqi tank ambush" or "Waypoint 3 scramble."

PACKAGES AND CHANCE OF APPEARING

Packages are assigned a percentage chance of appearing, and at the beginning of the mission the computer determines which will appear. The result of careful group planning is that sometimes enemies will arrive from the south, sometimes from the north, sometimes they'll be more dangerous than at other times, etc.

Packages can be made up of different types of aircraft, flying different missions. This way you can arrange that each package contains strike aircraft, their escorts, SEAD aircraft, tankers, etc.

If there is no Group assignment, the aircraft will always show up.

Only one package appears. Only one package per group will appear. If, for instance, there are three packages, each with a 40% chance of appearing, the computer will look at them in the order in which they were created. It will compute the first package's chance of appearing, and if it *does* appear, the computer will not check the other packages. If the first package does *not* appear, the computer will continue, and compute the second package's chance. If the second package is "chosen," then the third package will not be checked, and will not appear for that group.

100% chance to appear. If the first aircraft created is given 100% chance to appear, then it will always appear, and no other packages assigned to that group will ever be seen: it will have been wasted effort to put other aircraft in at all. However, if the second aircraft has 100% chance of appearing, you are guaranteeing that *something* will appear each time, either the first aircraft, or failing that, the second.

The last package. The percentage chance of a package increases when previous packages fail their chance to appear. The last package will have a 100% chance of appearing if all other packages fail to appear.

TACAN

- Click TACAN.
- Click on a ground object or (refueler) aircraft.

When an object has a TACAN assigned to it, the player receives information useful in approach.

Tactical Aid to Navigation is a UHF transmitter that sends out a constant message relaying distance and directional information. All military airports have them, and the signal lets the player know where he is in relation to the landing strip. It also enables the F-15 to create a graphical display of where friendly aircraft are in relation to each other, useful information to have during combat.

In general, TACAN stations have very wide ranges, and will usually extend far enough into enemy territory so as to preclude any gaps in the information. TACAN stations should be assigned to airstrips friendly to the player, and to tankers.

CHANNEL NUMBER

Each TACAN station operates on a unique channel. Assign a channel number from 1 to 123 to the station.

STATION ID

Each station needs an ID to make it more easily recognizable to the player. The ID can be either descriptive or numeric.

FIND NEXT AVAILABLE CHANNEL NUMBER

Select this button to have the computer scan through the TACAN information and offer the next available channel number. Click OK to accept.

DELETE TACAN

- Click DELETE TACAN.
- Click on the TACAN icon to be deleted.

Deleting the TACAN emitter from an object makes it more difficult for the player to approach it during the mission.

It can sometimes be difficult to click on the object when the view is zoomed out. Zoom closer to see details.

TACAN INFO

See **Common Command: Item Info**, p. 5.12.

FAC

- Click FAC.
- Click on a Mission Map object that will act as an FAC.

Placing an FAC is one part of a two-step process. After the FAC is placed, an Event must be designed to make it "work." See **Event: FAC**, p. 5.48. There's only one FAC per mission.

Forward Air Controllers are essentially soldiers with walkie-talkies. They can be in tanks, in buildings, or elsewhere. They are in enemy territory to find ground targets, then call the information in for an air strike.

When designing the mission, for realism's sake it's best to place the FAC near to one of the mission's goals. FACs don't usually have fancy equipment to help them see more than a couple of miles in any direction.

DELETE FAC

- Click DELETE FAC.
- Click on the FAC icon to be deleted.

RULES OF ENGAGEMENT

You can set the Rules of Engagement (when it's "legal" to fire) for each side.

It is described in military terms of "alerts."

Green (Alert) — Weapons Hold. It's a non-combative situation. Don't fire on anyone unless they fire on you first, or lock you up in preparation to fire a missile. (With Realistic TEWS the player would know this by the threat being closer to the center.)

Yellow (Alert) — Weapons Tight. Fire only on confirmed enemies.

Red (Alert) — Weapons Free. It's an emergency situation. Fire at will.

MISSION LABEL

- Click MISSION LABEL.
- Click on the location on the Mission Map where the label will be added.
- Enter the text that will appear.
- Click OK.

Important locations on the map may sometimes require a label to help the player recognize them. Bases, cities, anything that would be discernible from a cruising height can be labeled. This can be fine-tuned during the testing stage of mission creation.

Labels are up to your discretion.

DELETE MISSION LABEL

- Click DELETE MISSION LABEL.
- Click on the Mission Label to be deleted.

DISTANCE BETWEEN TWO POINTS

- Click on the first position on map.
- Click on the second position on map.

The distance in nautical miles between the two points will then be displayed.

DESTROY THIS OBJECT

- Click on DESTROY THIS OBJECT.
- Click on an object's white dot.

A war zone very rarely looks clean and unblemished. If you want to put down some battle-scars, he can use DESTROY THIS OBJECT to replace some objects with burned-out craters. This can be used both on objects that you have put down and on objects that are inherent to the map.

UNDESTROY

- Click on UNDESTROY.
- Click on the white dot in the center of a crater.

You can undo a Destroy This Object command, in case you change your mind.

ZOOM IN

- Click on the ZOOM IN button.

Each time the ZOOM IN button is clicked, the Mission Map scale approximately doubles in size. The closer the zoom, the more detail you can see, but the less actual territory is shown in the Mission Map window. The map can be zoomed in until the window display is approximately .75 nautical miles on a side.

The map zooms in on the center of the Mission Map window. To zoom in on a particular object, first center it using the CENTER button.

ZOOM OUT

- Click on the ZOOM OUT button.

The reverse of Zoom In, Zoom Out shows more map and less detail per click. The map can be zoomed out until the territory displayed is approximately 1,425nm on a side.

ZOOM AREA

- Click on the ZOOM AREA button.
- Click-and-drag the cursor to "box" an area.
- Click again to zoom.

This allows you to zoom in on a specific area in the Mission Map. The smaller the box, the greater the magnification.

CENTER ON CURSOR

- Click the TARGET button.
- Click on the Mission Map.

Centering an object in the Mission Map is primarily used in preparation to zoom in on it. When centering an icon, try to click as close to the exact center of the icon as possible. As the zoom increases, any deviation from clicking the *exact* center of the icon will be magnified, and the icon will begin to edge off the visible map.

REVERT

- Click on the REVERT button.

Returns the Mission Builder to the previous view.

FILTERS 1 - 5 

Turns predetermined filters on. See **Filters**, p. 5.57.

EXIT

Leave the Mission Builder and return to the Single Main Menu.

Any design information added subsequent to the last Save Mission will be lost! As such, when you click on EXIT, you will be prompted to confirm your decision to exit. Answer YES only if you have saved your work.

MULTIPLAYER

Jane's F-15 supports IPX/SPX network (LAN) play (up to eight players), TCP/IP network (Internet) play (up to eight players), modem and direct serial play (two players). **Multiplayer Connections** (below) describes how to set up each type of connection, while **Game Setup** (p. 6.10) explains how to set up and play a deathmatch mission once you have a connection.

MULTIPLAYER CONNECTIONS

To set up a multiplayer game, select one of the following options from the MULTI menu.

Serial	Set up a connection by linking two computers together with a direct serial cable. See **Direct Serial (Null-Modem)**, p. 6.2.
Modem	Set up a connection between two computers over a modem line. See **Modem**, p. 6.4.
IPX/SPX Network	Connect 2-8 computers over a LAN (Local Area Network). See p. 6.5.
TCP/IP Network	Connect up to 8 players with an Internet (dial-up) connection. See p. 6.6.
Main	Return to the Main Menu.

If you have problems connecting with another player, refer to **If You Can't Connect** (p. 6.3 for direct serial, p. 6.5 for modem, p. 6.5 for IPX/SPX network or p. 6.7 for TCP/IP network), or consult your network supervisor, Internet service provider or hardware/modem documentation.

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You can also get information on network and modem connections by going to the *Windows 95* START menu and clicking HELP:

- Click on the CONTENTS tab, then double-click HOW TO.
- For help with IPX/SPX connections, double-click USE A NETWORK.
- For help with modem setup, double-click SET UP HARDWARE, then SETTING UP A MODEM.
- For help with TCP/IP connections, click the INDEX tab and type INTERNET in the box. Relevant topics are highlighted in the large box below — click on a topic to view information about it.

DIRECT SERIAL (NULL-MODEM)

If you and another gamer don't own modems, you can use a serial connector cord to link two computers. Visit your local computer shop and purchase a null-modem connector (sometimes called a file transfer cable).

STEP 1 — CONNECTING YOUR MACHINES

A. Plug one end of the connector cable into a serial port on one machine, and the other end into a serial port on the second machine.

B. You must know *which* COM port on each machine that the cable is connected to. There may be a label on the computer next to the COM connector, or the documentation for the computer may have a connection diagram with communication ports labeled. COM ports are numbered starting at 1 and going up, i.e. COM1, COM2, COM3, etc.

STEP 2 — SELECT SERIAL PORT SETTINGS

A. From the *Multi* screen, select SERIAL.

B. A dialog box will appear asking if you want to HOST or JOIN. The first computer will select HOST and then create a game session (see pp. 6.9-6.10). The second computer may then select JOIN.

C. The *Serial Connection* dialog box will now appear. Select the correct COM port and use the default settings for the remaining boxes, e.g., 57600 baud, 1-stop bit, no parity and RTS/DTR flow control. When done, select **OK**.

D. The JOIN computer will now be in the Game Sessions screen and should select ACCEPT.

IMPORTANT: The HOST computer must complete Step C before the JOIN computer does Step D.

STEP 3 — CONFIGURING THE MISSION

See **Game Setup**, p. 6.10.

IF YOU CAN'T CONNECT

If you're having problems connecting, you may have a hardware conflict. (In other words, two devices may think they're occupying the same COM port.)

To check for port conflicts:

1. Click the *Windows 95* START button.
2. Click CONTROL PANEL, then double-click the SYSTEM icon.
3. Click the DEVICE MANAGER tab.
4. Click inside the circle next to ***View devices by connection***. Check to make sure only one device is listed next to the COM port your cable is connected to. If something extra is listed, delete it.

If your computer's settings, the game settings and the other player's settings are identical and you still experience problems, try selecting another Communications Port or lowering the baud rate (as described in **Step 2 – Serial Port Settings**).

CAUTION: Make sure you know exactly which COM port you're looking at and what you are deleting. (You don't want to delete anything important.) Please contact Microsoft or your hardware manufacturer for help with port conflicts.

MODEM

You can play another player across a 14,400-baud or faster modem.

STEP 1 — CONFIGURING THE MODEMS

Both players must be sure their modems are configured correctly to get a successful connection:

A. Exit to *Windows 95* and click START. Highlight SETTINGS, then CONTROL PANEL. Double-click on the MODEMS icon.

B. Click the PROPERTIES button. Make sure the maximum speed is set to the highest level for your modem (at least 57600 is recommended). Make sure that the ***Only connect at this speed*** box is not checked.

C. Click the CONNECTION tab, then click the ADVANCED button.

D. Make sure there is a check mark in the ***Use flow control*** box. If not, click in the box to put a check mark there.

E. Make sure there is a black dot next to ***Hardware (RTS/CTS)***. If not, click in the circle to put a dot there.

If you've made any changes to your modem settings in the steps above, go ahead and restart *Windows 95* before trying to connect. This ensures the changes will be saved.

STEP 2 — CONNECTING WITH ANOTHER MODEM PLAYER

A. From the *Multi* screen, select MODEM.

B. A dialog box will appear asking if you want to HOST or JOIN. The first computer will select HOST and then create a game session (see, pp. 6.9-6.10). The second computer may then select JOIN.

C. The JOIN computer will now be in the Game Sessions screen and should select ACCEPT.

D. The Modem Connection dialog box will now appear. The HOST should select ANSWER. The second computer should now enter the phone number of the HOST.

CONFIGURE

As long as your modem is configured through *Windows 95*, you should not have any trouble. If you do have difficulties, you can access the *Windows 95* (Modem) Properties by clicking CONFIGURE on the Modem screen.

If your modem is not configured properly, please consult your modem and *Windows 95* documentation.

STEP 3 — CONFIGURING THE MISSION

See, p. 6.10.

IF YOU CAN'T CONNECT

1. Make sure your modem is set up correctly under *Windows 95*, and that you don't have multiple modem drivers loaded.

2. Try connecting again, this time telling *Jane's F-15* what COM port your modem is using instead of running autodetect. To find out the port connection for your modem, follow Steps A and B under **Step 1 — Configuring Your Modems** (previous page). Look for your COM port number in the window that appears. Go through the steps under **Step 2 — Connecting with Another Modem Player** again, using this COM port number in place of autodetect when you get to **Step 3 — Configuring the Mission**.

IPX/SPX NETWORK

- From the *Multi* screen, select IPX/SPX. This takes you directly to the *Game Sessions* screen.

Two to eight players can "join" a specific game. Multiple sessions of *Jane's F-15* can run concurrently on a network without disrupting normal network activity. (During peak network hours, however, the game may run more slowly.)

IMPORTANT NOTE: You *must* have an IPX/SPX-compatible protocol loaded under *Windows 95* (such a protocol ships with *Windows 95*). To check, go to the START menu. Highlight SETTINGS, then CONTROL PANEL, and double-click the NETWORK icon. Scroll down in the box to see if any kind of IPX/SPX-compatible protocol is listed.

STEP 1 — CONFIGURING THE MISSION

See, p. 6.10.

IF YOU CAN'T CONNECT

If your computer can't find other players on the network, make sure you have an IPX/SPX protocol loaded. (See **Important Note** in **IPX/SPX Network**, just above.)

TCP/IP NETWORK

You must have an account with an Internet service provider, LAN with TCP/IP protocol, or other access to the Internet to play *Jane's F-15* through a TCP/IP connection.

All players will also need to exchange IP addresses with the host once they've logged on to the Internet. It is easiest to do this if everyone logs on to a chat zone. If you do not know how to get into a chat zone, contact your Internet service provider, or check their on-line help, if available.

If you have a web browser (e.g., *Netscape* or *Internet Explorer)* you can meet in the chat room of the Jane's Combat Simulations web page at http://www.janes.ea.com. To reach this room, click the COMMO switch on the left side of the Jane's home page (or the COMMO SHACK link, if your browser does not support frames). Click TEXT CHAT to get to the chat room.

STEP 1 — SETTING UP FOR INTERNET PLAY

A. Contact the other players (via chat board, telephone, etc.) and determine who has the fastest computer. This person should be the host.

- Also decide the number of players connecting.

B. The host will need to log on to the Internet, find out what his IP address is and communicate this address to the other players. (Each time you log on to the Internet you will have a different IP address, so the host will have to check this each time.)

- *Without logging off of the Internet*, double-click on *My Computer*.
- Double-click on the C: DRIVE icon, then the WINDOWS folder.
- Double-click on WINIPCFG.EXE (*Windows* IP Configuration*)*.
- Write down the number in the box next to IP ADDRESS.

C. Once the host knows his address, he must communicate this to the other players.

STEP 2 — CONNECTING WITH OTHER PLAYERS

Note: All participants must know the IP address of the host before setting up a network game. (See **Step 1**, facing page.)

A. Log on to the Internet. Minimize your browser window, and load *Jane's F-15* if you have not already done so.

B. From the *Multi* screen, select TCP/IP. This displays an IP address screen.

C. Type in the host's IP address. Click OK.

Or

D. Leave it blank to host a new game.

STEP 3 — CONFIGURING THE MISSION

See, p. 6.10.

IF YOU CAN'T CONNECT

You *must* have a TCP/IP-compatible protocol loaded under *Windows 95* (such a protocol ships with *Windows 95*). To check, go to the START menu. Highlight SETTINGS, then CONTROL PANEL, and double-click the NETWORK icon. Scroll down in the box to see if any kind of TCP/IP-compatible protocol is listed. (If one isn't listed, you probably won't be able to connect to your Internet service provider, either.)

If you have a TCP/IP-compatible protocol and are having no difficulty logging on to the Internet, but you are having trouble connecting with other players:

- Follow the steps on these two pages again, designating another computer as the host. (Try using the computer with the fastest Internet connection.)

DISCONNECTING

If you disconnect in any of the following ways, the game will continue, even if you're the host.

- Press any key during the connection process. (You will return to *Jane's F-15* Main Menu.)
- Exit the mission (Esc).

GAME SESSIONS SCREEN

On this screen, all of the current game sessions currently in progress are listed on the right side of the screen.

View Game Details

- Click on an entry to display game details (maximum and current number of players, and game options).

Changing Callsign

- Click on your callsign, at the bottom of the screen.
- Type in a new callsign.

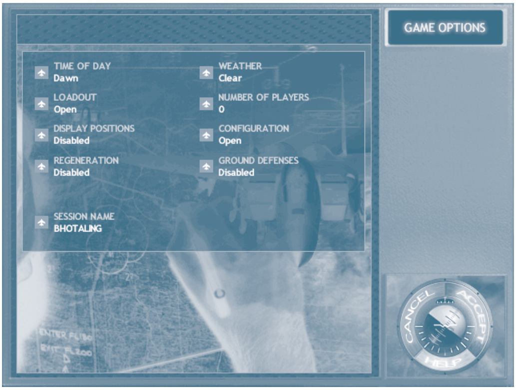
Join a Session

- Click on a game in the Current Games List.
- Click ACCEPT.

Create a Game

- Click HOST GAME.
- Choose the options in the Host Game screen.

HOST GAME SCREEN



The Host Game screen is where you establish all of the optional elements within which your game will play.

Time of Day. Choose from DAY, NIGHT, DAWN or DUSK. (See **Mission Builder**, p. 5.56.)

Weather. Choose from CLEAR, CLOUDY or STORMY.

Loadout of Weapons. You may choose to either restrict every pilot (including yourself) to a predefined loadout, or to allow all the pilots the opportunity to select their own custom loadout.

Number of Players. IPX/SPX and TCP/IP can have two to eight players. Modem and Serial can only have two.

Display Positions. If enabled, this allows other players to see where on the combat arena everyone starts.

Configuration. If locked, then each player's difficulty settings are established to be the same as the host player's settings. Otherwise, the other pilots may set their own difficulty selections.

Regeneration. If enabled, this allows downed aircraft and pilots to be restored to their original positions and fly again. If disabled, it makes the game a single-death elimination contest. The last surviving aircraft is the victor. Click ACCEPT when done.

Ground Defenses. If enabled, ground defenses are capable of targeting enemy aircraft.

Session Name. Choose the name of the game as it will appear to other players on the Game Session screen.

GAME SETUP

The battle arena, complete with eight different team boundaries, is displayed on the screen. Each geographical portion of the map represents a different "team" for which a pilot can fly. On the right side of the screen, a list of players is found, along with status indicators which identify the team the pilot is flying with, as well as the pilot's "ready" status.

Sides and Teams

You may change the "team" you are flying for by click-and-dragging your numeric icon on the map to a different area and releasing it. The team indicator on the list will update if any pilot chooses a different team.

Note that it is possible to play cooperative battles by having multiple pilots click-and-drag their own aircraft to a common team. Players on the same team have the same color in the game.

In the CURRENT PLAYERS screen is your name and a number. That number corresponds to your numbered icon on the Section Map. You may move your Number Icon anywhere on the map to establish your starting position.

Ready. The READY button provides a way for players to enter the game simultaneously. If previously agreed upon, each pilot can wait to enter the arena until all the pilots have indicated a "ready" status, implying that they have completed their aircraft setup.

On the pilot list, a red ball indicates "not ready." Once you press the READY button, the ball near your callsign will turn green.

The READY button does not have to be selected to enter flight, and is used only at your discretion.

Chat. You may toggle the Radio Speech chat box on and off by pressing CHAT.

ARMING

Unless the Arming option has been locked out by the host, arming is identical to the process of arming in Campaigns. See **Campaigns: Arming**, p. 1.10, for further explanation.

FLY

- Select FLY to enter the game.

You will jump into the game, already in flight, starting at the location of your numbered icon on the Section Map.

APPENDICES

APPENDIX A. CAMPAIGN BACKGROUNDS

DESERT STORM

Following the territorial invasion of Kuwait in November 1990, the UN Security Council authorizes the use of force to contain Iraq. The resulting buildup of forces on the Saudi-Iraqi border is dominated by 400,000 U.S. troops and coined Operation Desert Shield. Repeated warnings and an ultimatum from the UN go unheeded, and Saddam Hussein's gathering of forces along Saudi Arabia's border continues. Confrontation with Iraq seems inevitable, and on 17 January, 1991, the standoff is finally broken as coalition forces deliver stiff retribution. The Persian Gulf marks the combat debut for many weapon platforms, but most importantly, it becomes the proving ground for the F-15E Strike Eagle as a dual-role fighter.

The 335th and 336th Tactical Fighter Squadrons enter Saudi Arabia in early August 1990, flying sorties from the newly constructed Al Kharj airbase until the cease-fire on 28 February, 1991. Together, these units account for nearly 11 million pounds of ordnance. Each Strike Eagle's payload includes 24,000 pounds of external stores — Paveway II laser-guided bombs, Combined-Effect Munitions, Mk82 and Mk84 unguided bombs, AIM-9 Sidewinders and AIM-7 Sparrows. Because the F-15E is rushed to combat before fully completing development, few USAF Strike Eagles have the coveted AAQ-14 LANTIRN targeting pods for delivering guided munitions. Despite this, F-15Es still achieve most of their strategic missions, and by the end of the war, nearly all F-15Es have the AAQ-14.

While A-10s and F-16s pound tactical targets on clear days, the F-15Es strike around the clock in any weather, eliminating many of Iraq's most impenetrable targets. Facing concentrated AAA fire and SAMs, some pilots opt for medium-to-high loft approaches to avoid the hellish barrage below. Others dare the minimum-altitude flight for which the F-15E was designed, skimming the desert at 100 feet to thwart enemy radars and SAMs.

Initial missions concentrate the F-15E's firepower on ground-based SCUDs aimed at nearby Israel. SCUD-hunting attacks become standard fare for Strike Eagle pilots, who work in pairs alongside the Synthetic Aperture Radar-capable E-8A J-STARS. Later, the F-15E is adapted to "tank-plinking" (attacking armoured vehicles with laser-guided bombs) and "road recce" (striking fixed interdiction targets, such as bridges and roads). Several F-15Es operate in unexpected capacities, providing on-the-spot air support for ground units in trouble. One F-15E from the 335th even tallies an air-to-air kill against an enemy helicopter using a laser-designated bomb. No air-to-air F-15E losses are incurred, although two F-15Es and aircrews are lost to ground fire.

The F-15E then becomes a favored delivery tool for the Air Force, and is capable of precision, night-time attacks in hostile airspace. Pound-for-pound, it out-performs any other dual-role fighter in existence. Desert Storm marks the evolution of the F-15 from strictly an air-to-air machine to a dual-role fighter, and its accomplishments remain a menacing reminder to those who dare to oppose it.

IRAN

Despite a shaky peace, the turn of the century has not brought much change to the Gulf region. Most Arab states still harbor a strong anti-American sentiment, and Turkey, Jordan and Saudi Arabia have fallen under conservative rule. Intense pressure from Islamic religious leaders has compelled even these key U.S. allies to question an American presence in their territory.

To further complicate matters, the American military has been impaired by a reduction in force. U.S. bases in the Middle East have been closed or forcibly relocated to remote deserts, reflecting the mindset of a "smaller, smarter military." For the first time, the U.S. military finds itself in the highly vulnerable position of being unable to support dual conflicts.

In contrast to the fading U.S. presence, Iran has now become a very real threat to Gulf security. Obscured by the limelight of U.S.-Iraqi and U.S.-North Korean tensions, Iran has spent five years bolstering its military forces with aircraft, naval vessels and technical expertise. Increasingly offensive training exercises remain unchecked due to a lack of a watchdog force.

The region grows more susceptible to conflict after world attention is drawn to the far east, where border conflicts break out along the de-militarized zone (DMZ) between North and South Korea. The increasingly brash incursions are viewed as North Korea's desperate attempt to right its falling communist regime. Viewing this delicate situation as a preamble to war, U.S. and other allied military forces deploy to the area. Most units transfer from the Middle East, where a regional conflict is considered highly possible, but not imminent.

Iran seizes this opportunity in an alarming string of events and flexes its military might — first Iran's president is assassinated; then, the government is overthrown by conservative clerics that proclaim the Iranian military to be "the sword of God." Arab fears that Iran might use its new political position to invade its ill-armed neighbors turn out to be valid when Iran seizes the disputed islands of Abu Musa, Tunb and Sirri — strategically located at the mouth of the Gulf.

Diplomatic attempts by the United Arab Emirates fail, and several U.S.-flagged ships are attacked directly by missiles and indirectly by mines littering the Strait of Hormuz. Iran deploys its fleet of Kilo submarines and issues a string of threats describing armed, chemically tipped "Scud-B" missiles. In response, U.S. military forces in the region are placed on red alert, and a USAF squadron is deployed. Facing a lack of carrier support, F-15s comprise the major air arm in the region and must provide initial front-line support to oust Iran from its newly acquired position.

APPENDIX B. ACRONYMS AND ABBREVIATIONS

A/A	Air-to-Air
AAA	Anti-Aircraft Artillery.
AB	Afterburner capability; also Air Base
ACM	Air Combat Maneuvers.
ACQ	Acquisition
ADC	Air Data Computer
ADI	Attitude Director Indicator
A/G	Air-to-Ground
AGL	Above Ground Level
ALT	Altitude
AMRAAM	Advanced Medium-Range Air-to-Air Missile.
AoA	Angle of Attack.
A/P	Auto Pilot
ARMT	Armament
ASE	Allowable Steering Error
ASL	Above Sea Level.
AUTO	Automatic, an A/G weapons delivery mode.
AWACS	Airborne Warning And Control System.
AZ	Azimuth
BARO	Barometric
B-Hot	Black-hot FLIR polarity
BIT	Built-In Test
BRG	Bearing
BRST	Boresight
BRT	Brightness
BST	Boresight
BVR	Beyond Visual Range
CAP	Combat Air Patrol
CAS	Close Air Support
CBU	Cluster Bomb Unit

CC	Central Computer
CDIP	Continuously Displayed Impact Point.
CDES	Continuous Designation
CFT	Conformal Fuel Tank
CMD	Countermeasures Dispenser. Also Command
COMM	Communication
CONT	Contrast. Also Continuous
DCL	Declutter
DIL	Displayed Impact Line
DTWS	Designated Track While Scan
DW	Display Window
ECM	Electronic Countermeasures.
EL	Elevation
EMIS LMT	Emissions Limit
ESL	Elevation Steering Line.
EWWS	Electronic Warfare Warning Set
FAC	Forward Air Controller
FCC	Flight Control Computer
FCP	Front Cockpit
FLIR	Forward-Looking Infrared
FOV	Field of View
G	Gravity Force
GBU	Guided Bomb Unit. Also known as a Smart Bomb.
GCI	Ground Control Intercepts
GDS	Gun Director Sight
H/C	Hot/Cold
HDTWS	High Data Rate Track-While-Scan
HOB	Height of Burst
HOTAS	Hands On Throttle and Stick
HPRF	High Pulse Repetition Frequency
HRM	High Resolution Map
HSI	Horizontal Situation Indicator
HUD	Head-Up Display

Hz	Hertz, Cycles Per Second
ICS	Internal Countermeasures Set
IFF	Identification Friend or Foe
ILS	Instrument Landing System
IND	Indirect
INST	Instrument
INTVL	Interval
IR	Infrared
JETT	Jettison
JSTARS	Joint Surveillance Target Attack Radar System
KTAS	True Airspeed in Knots
KTO	Kuwait Theater of Operations
LAE	Lead Angle Error
LANTIRN	Low Altitude Navigation and Targeting, Infrared, for Night
LAW	Low Altitude Warning
LCFT	Left Conformal Fuel Tank
LCOS	Lead-Computing Optical Sight
LGB	Laser-Guided Bomb
LOS	Line of Sight
LPRF	Low Pulse Repetition Frequency
LR BST	Long Range Boresight
LSG	Losing
M	Menu
MAN	Manual
MAR	Missile Active Range
MAX	Maximum
MPD	Multi-Purpose Display
MPCD	Multi-Page Color Display
MPRF	Medium Pulse Repetition Frequency
MRM	Medium-Range Missile. E.g., AIM-7, AIM-120.
NAV	Navigation
NAVFLIR	Navigational FLIR
NDTWS	Non-Designated Track-While-Scan

N-F	Navigation FLIR
NFOV	Narrow Field of View
NOE	Nap-of-Earth
NM	Nautical Mile
NORM	Normal
OBST	Obstacle
PACS	Programmable Armament Control Set
PB	Pushbutton
PDT	Primary Designated Target
PGM	Precision Guided Munitions
RCS	Radar Cross Section
ROE	Rules of Engagement
PROG	Program
QTY	Quantity
RALT	Radar Altimeter
RBL	Radar Boresight Line
RBM	Real Beam Map
RCFT	Right Conformal Fuel Tank
RCP	Rear Cockpit
RDR	Radar
RDY	Ready
RGH	Range Gated High
RAERO	Maximum Aerodynamic Range
RMIN	Minimum Range
RNG	Ranging or Range
ROPT	Optimum Range
RP MPL	Ripple Multiple
RP SGL	Ripple Single
RTR	Range Turn and Run
RWR	Radar Warning Receiver
RWS	Range While Search
RWS-H	Range While Search – High
RWS-I	Range While Search – Interleaved

RWSM	Range While Search – Medium
SAM	Surface-to-Air Missile
SARH	Semi-Active Radar Homing
SEAD	Suppression of Enemy Air Defense
SP	Sequence Point
SRM	Short-Range Missile. E.g., AIM-9.
SS	Supersearch
STBY	Standby
STT	Single Target Track
T	True Airspeed
TACAN	Tactical Aid to Navigation
TAS	True Airspeed
TCN	TACAN
TD	Target Designator
TERM	Terminal
TEWS	Tactical Electronic Warfare System
TF	Terrain Following
TFR	Terrain-Following Radar
TGT	Target
TOF	Time of Flight
TOT	Time on Target
TPULL	Time-to-Pull
TREL	Time-to-Release
TSD	Tactical Situation Display
TTA	Time to Active
TTI	Time to Impact
TTGT	Time-to-Target
TWS	Track While Scan
UFC	Up Front Controls
UNC	Uncage
VCTR	Vector Scan
VSI	Vertical Speed Indicator
WSO	Weapons Systems Officer

APPENDIX C. GLOSSARY OF TERMS

Active. A radar missile currently using a self-guidance system to locate its target.

Airfoil. Curved wing or blade surface designed to produce lift when air passes over it.

Airframe. Basic construction of the aircraft (doors, landing gear, seats, cabin, etc.).

Angels. Altitude in thousands of feet. "Angels ten" indicates 10,000 feet of altitude.

Angle of Attack (AoA). Aerodynamic angle formed between the chord of an airfoil and the direction of the relative wind.

Aspect Angle. Angle from which a target is viewed – the number multiplied by 10. "9R" means a view of the target's right wing from a 90° angle.

Attitude Director Indicator. Shows attitude of airplane relative to horizon.

Azimuth. Indicates a position on a horizontal plane surrounding your aircraft.

Bandit. Confirmed enemy aircraft.

Barometric Altitude. Altitude above sea level, calculated from air pressure data.

Barrage Fire. Anti-aircraft fire that "floods" an area with ammunition rather than trying to specifically target and hit an aircraft.

Bent. An informative call indicating the identified equipment is inoperative.

Bingo. When your aircraft has just enough fuel to get back to base and land.

Blind. An informative call indicating loss of visual contact with friendly aircraft.

Bogey. Unidentified aircraft (radar or visual contact).

Bogey Dope. A request for target information from GCI/AWACS

Bracket. Fighter element attack geometry which places aircraft on opposing sides of the target either laterally or vertically.

Break (Up/Down/Right/Left). A directive call to perform an immediate maximum performance defensive turn in the direction indicated.

Buddy Spike (position/azimuth/altitude). An informative call indicating reception of friendly AI RWR.

Bullseye. Code word for a specific reference point from which the position of target aircraft are determined.

Chaff. Strips of metal film released to confuse and decoy radar-guided weapons.

Chord. Imaginary line that passes through the leading and trailing edges of an airfoil. See "Angle of Attack."

Closing. Range to the bandit/bogey/target is decreasing.

Closure. Relative velocity of one aircraft in relation to another.

Corner Speed/Velocity. Minimum airspeed at which the maximum allowable aircraft G is generated. I.e., speed at which an aircraft can turn the sharpest, given current altitude and attitude.

Designate. Use of aircraft systems to identify a ground objective/aircraft as a target for weapons employment.

Drag. Force that counteracts an object in motion through the air, such as air resistance.

Echelon. A call conveying groups/contacts/formation with wingmen placed 45° behind the leader's wingline.

Egress. The outbound (exit) portion of an A/G attack profile.

Element. A flight of two aircraft.

Flare. A pyrotechnic device dispensed to defeat IR missiles.

Frag. Fragmentary range and duration of an ordnance.

Furball. A turning fight involving multiple aircraft.

Guns. Air-to-Air or Air-to-Surface gunshot.

Heater. A slang term for an IR missile.

Hot. Air-to-Air: a GCI informative call that the target is heading toward the fighters. Intercept geometry which positions the fighters in front of the target. The leg of a CAP heading toward the anticipated threats. Air-to-Ground: ordnance employment is authorized, anticipated, or completed.

Hung. A/A or A/G weapon launch/release commanded, but the ordnance remained on the aircraft.

Indicated Airspeed. The speed you would be traveling (given engine performance) at sea level in still air. An aircraft flying at the same true airspeed will show different indicated airspeeds at different altitudes and under different wind conditions.

Ingress. The inbound (entry) portion of an A/G attack profile.

Interleaved. Radar search mode alternating medium and high PRF waveforms.

Initial Point. The location where aircraft turn to directly approach their target – the steer point just prior to a target point.

Jammer. Electronic countermeasure that emits microwaves to distort/confuse enemy radarscopes.

Knot. Measure of speed equal to one nautical mile per hour. (See Nautical Mile.)

Lag Pursuit. Refers to pointing an aircraft's nose just behind an enemy's flight path during a turn.

Lead Pursuit. Refers to pointing an aircraft's nose just ahead of an enemy's flight path during a turn.

Mach. Speed of sound at sea level (760ft/s) used to measure rapid flight (Mach I, Mach 2, etc.).

Mach Ratio. The ratio of your aircraft's speed to the speed of sound at the same altitude.

Mark-20. Canister bomb containing smaller bombs; used against armored targets.

Mark-82. 500-lb. general-purpose bomb.

Mark-84. 2000-lb. general-purpose bomb.

MiG. Common nickname for the Soviet designed fighter aircraft.

Mil Power. Maximum aircraft power, not using afterburner.

Nautical Mile. Aeronautical measurement of distance equal to 6,076ft.

Ordnance. Military weapons – including expendable armament, such as missiles and ammunition.

Padlocked. An informative call indicating the aircrew cannot take their eyes off the target without a significant risk of losing tally.

Patch Map. Radar image used for targeting.

Pickle. Act of pressing weapon release button.

Pipper. Visual aiming designator that appears on the HUD.

Point of Impact. Point along the leading edge of an airfoil where the air separates and flows over the top and bottom of the airfoil.

Radar Altitude. Altitude above ground level (AGL), in feet, calculated from terrain-following radar returns.

Radar Signature. Measure of an aircraft's visibility to radar; also called its radar cross section (RCS).

Rockeye. See Mark-20.

Roland. (French) Surface-to-Air missile; effective at low altitudes.

SAM ring. A circle designating the outer range of a SAM's threat to overhead aircraft.

Sanitize. A directive call to clear an assigned area with the radar searching for additional threats.

Scissors. Defensive maneuvering utilizing a succession of turn reversals attempting to achieve an offensive posture following an attacker's overshoot.

Scramble. Launch the aircraft as soon as possible.

Scud. Tactical surface-to-surface ballistic missile, medium-range, modified and used by Iraq.

Semi-Active. A missile/bomb guidance system where the missile receiver homes in on radiation/reflection from the target that has been sent by a source other than the missile itself. I.e., an aircraft (usually) bounces radar off the target, and the missile homes in on the target.

Sequence Points. A set of geographical points to be overflown, including steer points, initial points, and target points. Also known as Waypoints.

Sidewinder. An AIM-9 IR missile

Sparrow. An AIM-7 semi-active radar missile.

Stall. "Loss of lift" condition that occurs when the angle of attack is too steep or airspeed is too low for the airfoil to provide any lift. During a stall, the normally streamlined flow of air over the airfoil is disrupted.

Straight Flush. Acquisition radar unit for SA-6 Surface-to-Air missiles.

Tally. An informative call conveying visual contact with the bandit, the opposite of "No Joy."

Tankplink. Attack armored vehicles using laser-guided bombs.

Target Point. A steer point at which a pilot releases weapons.

Trailer. The last aircraft in a formation.

Triple-A. Unguided, ground-to-air gunfire (12.7 - 100mm).

True Airspeed. Velocity relative to the ground, taking into account additions and subtractions to your indicated airspeed due to altitude, temperature, wind direction and speed, side slippage, etc.

Turn Rate. Number of degrees per second a particular aircraft can turn. The higher the rate, the faster the turn.

Turn Radius. Radial distance required to complete a turn. The smaller the radius, the tighter the turn.

Weapon Envelope. Effective area of attack for a weapon. Enemies within this envelope are vulnerable to fire from the weapon.

Wilco. Will comply.

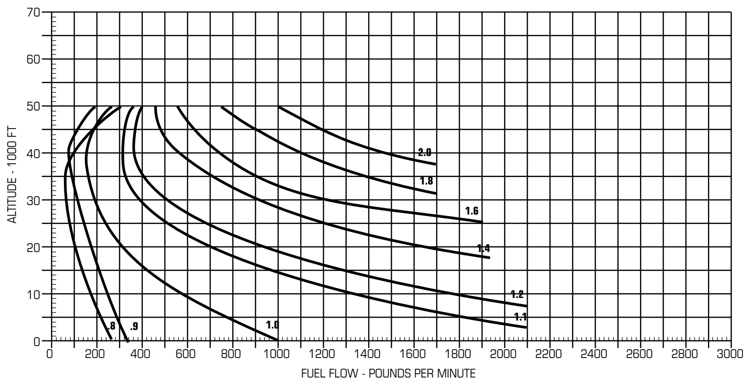
Wild Weasel. Aircraft (F-4Gs in Gulf War) that take out SAM sites in preparation for strike attacks.

APPENDIX D. F-15E FUEL FLOW

The Strike Eagle in *Jane's F-15* has a realistic fuel consumption model. Having an idea of how long your aircraft can stay airborne before needing to refuel is crucial both in flying longer missions and in designing them.

The chart below can be summarized by two basic concepts: the faster an F-15 flies, the more fuel it uses; the higher an F-15 flies the less fuel it uses.

Note: This chart does not apply to afterburner usage, which has a significantly higher fuel consumption.



Number to the right of curved line indicates Mach number.

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Jane's
COMBAT SIMULATIONS

EXPERT FLIGHT MANUAL

CHAPTER SUMMARIES

TABLE OF CONTENTS

From the TOC, click **purple links** to open a chapter and view a topic.

Each chapter has its own table of contents with some active text links. You can also click on bookmarks to view a topic in that chapter.

At any time, you can click the tabs on the right to view another chapter.

INTRO
TOC
INTERFACE
COCKPIT
FLIGHT
COMBAT
MISSIONS
MULTI
APPENDIX

ORIGIN Systems, Inc.
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Austin, TX 78730

SUMMARIES

For ease of use, this book is divided into seven chapters, each with its own tab marker. At the beginning of each chapter, you'll find a detailed table of contents. Page references include both the chapter and the page number — 2.25, for example, refers to Chapter 2, page 25.

Shaded Text Text in a gray box denotes additional information. Although useful, this information is not required to play the game.

Chapter Dividers Each chapter divider indicates a major chapter with one or more sections.

0. Introduction

How to Use (this section) tells you how to find the information you need in this book through a detailed table of contents that follows.

1. Interface

General Instructions (p. 1.1). There are some elements of the interface that remain the same throughout the pre-game screens and menus. These are explained in a general overview.

Main Menu (p. 1.2). The Main Menu is the first screen you see after the introduction; through it you can access all the different elements of gameplay. This section is a quick introduction to its use.

Training (p. 1.3). *Jane's F-15* has a variety of training missions that cover the basics of flying this fighter, from takeoff to full combat situations. *Training* covers how to select a pre-existing mission and learn the skills you'll need to know once you're in the cockpit of the Strike Eagle.

Campaigns (p. 1.4). The typical procedure of how to prepare for a mission is thoroughly explained in the Campaigns section from selecting pilots to fly with you, to assigning targets and determining the appropriate loadouts.

Instant Action (p. 1.16). When you just want to jump into combat, the fastest way is to fly an Instant Action mission. The customizable options are outlined and explained in this section.

Interface (cont.)

Single Mission (p. 1.20). Single Missions are stand-alone and pre-designed. They are similar to Campaign Missions in that you have the opportunity to adjust your loadouts, choose your wingmen, and so forth.

Reference (p. 1.22). This details how to use *Jane's F-15*'s object viewer, which features graphics and specifications on the major objects in the game. These specifications come directly from Jane's Information Group.

2. Cockpit

Front Seat vs. Back Seat (p. 2.1). This section points out the basic features of both cockpits, with references to the sections of this chapter that more fully describe them.

Master Modes (p. 2.3). Master modes focus the F-15E's weapons systems and avionics for specific tasks. This section explains how and when to select each of the four master modes.

Head-Up Display (HUD) (p. 2.5). The HUD consists of computer -generated symbology projected onto a sheet of glass in front of the pilot, minimizing his need to look down at his instruments. This section explains the symbology used on this display.

Multi-Purpose Displays (MPD) (p. 2.24). MPDs (and MPCDs) organize weapons, sensor and systems information into a series of "pages" that appear in video displays mounted in the cockpit. Elements of the displays and systems are controlled by pushbuttons surrounding the MPDs. This section explains how to select pages, and for each page describes the symbology and pushbuttons that apply.

Up Front Controls (UFC) (p. 2.64). The UFC sits in the middle of the pilot's cockpit and displays information in a series of menus and submenus. The features of these menus, and how to select and control them using UFC pushbuttons and the keypad, are explained here.

Additional Cockpit Features (p. 2.73). This section describes the indicator lights, standby instruments and other switches and dials that appear in the cockpit.

3. Flight

4. Combat

Loadouts (p. 4.3). Provides a chart of the weapons that can be loaded on your aircraft and lists questions to consider when planning your loadout.

Getting In (p. 4.11). Discusses all the skills you need to take out air opposition on your ingress to target: detecting aircraft beyond visual range, acquiring and targeting them, and engaging with missiles and guns.

Taking Care of Business (p. 4.51). Explains air-to-ground engagement — how to find and target stationary and moving ground targets, how to select weapons and weapon release features, and how to release unguided and guided weapons.

Getting Out (p. 4.70). Gives information on Air Combat Theory and Basic Fighter Maneuvers that can be used on your egress from target.

5. Mission Builder

Main Screen (p. 5.2). A brief introduction of the Mission Builder buttons, and the page numbers where the explanations can be found.

Sample Mission Creation/Designing a Mission (pp. 5.6/5.1). Some concepts to help you get started in the mission design process are outlined at the beginning of the Mission Builder section.

Introduction to Mission Builder/Common Instructions (pp. 5.8/5.12). This is a brief overview of the basic concepts and common functionality found in the Mission Builder.

Mission Features (p. 5.12). Each tool used in the creation of a custom mission is described, in order of appearance on the Button Panel.

6. Multiplayer

Multiplayer Connections (p. 6.1). The step-by-step instructions for connecting with other players are explained here. You can choose among using a direct serial cable (p. 6.2), modem (p. 6.4), Local Area Network (p. 6.5) or the Internet (p. 6.6).

Game Session Screen (p. 6.8). This is an explanation of the screen used to create or join a multiplayer game.

Game Setup (p. 6.10). The last steps of entering a multiplayer game are described.

7. Appendices

A. Campaigns (p. A.1). Information on the events that led to each military action.

B. Acronyms (p. B.4). This section gives the full name of objects and actions usually referred to by acronyms (capital letter abbreviations).

C. Glossary (p. C.9). Here some definitions are given for common military terms.

D. Fuel Flow (p. D.13). The specifics of fuel consumption under certain conditions is explained here.

E. Bibliography (p. E.14). This section provides a list of the books which were most helpful in the creation of the game.

F. Credits (p. F.16). This is a list of those people who either created the game or were otherwise indispensable during the creation process.

HOW TO USE THE ELECTRONIC MANUAL

For best performance. we recommend viewing the documentation with your monitor set to its highest resolution setting.

MANEUVERING IN THE DOCUMENT

Left-click on the bookmark text to jump directly to that section.
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Use the buttons at the top of the screen or the buttons in the Acrobat Toolbar on top of the screen to maneuver through the document.

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Choose File > Print. (Your printer must be connected and turned on.) If your print menu has a "Print colors as grays" option, select it. You must print each chapter individually.