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4. COCKPIT ELEMENTS

COCKPIT ELEMENTS

While flying, your immediate environment consists of a cockpit display, the Head-Up Display (or HUD) and a number of instrument windows that you can activate.

You can display the cockpit for added realism or hide it in order to increase your view of the world outside. Press [Backspace] to toggle the cockpit on or off, or use the PREF menu of the *In-Flight* menu bar to activate and de-activate it. If you display the cockpit, you can also choose to have rear-view mirrors from the *In-Flight* menu bar. Press [Esc] at any time to call up the *In-Flight* menu bar.
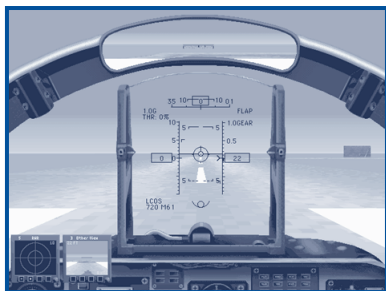
HEAD-UP DISPLAY

Critical flight and weapons information is projected onto the Head-Up Display (HUD), a transparent sheet between the pilot and the glareshield. The HUD reduces the need to look down at other instruments in the cockpit, allowing the pilot to concentrate on the combat situation.

You can dim or brighten the HUD with [Shift][[] and [Shift][]], or by choosing these options from the PREF menu of the *In-Flight* menu bar.

The HUD has two modes, Navigation and Weapons. The default is Weapons mode.

[N]   Toggle HUD between Weapons and Navigation modes.

You can determine what mode you're in by looking to the lower left of your HUD. If LCOS appears, you are in Weapons mode. If NAV or ILS appears, you are in Navigation Mode.

♦ **Constant HUD Features**, discusses features that are common to both modes, for aircraft in **General** (p. 78) and **Thrust Vectoring Aircraft** (F-22A, X-31 EFM and X-32 ASTOVL, p. 81; Su-35, p. 62; and STOVL aircraft, p. 82).

♦ **Additional Weapons Mode Features**, p. 83, discusses features specific to the HUD in Weapons mode.

♦ **Additional Navigation Mode Features**, p. 87, discusses features specific to the HUD in Navigation mode.

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Constant HUD Features — General

Heading tape — Current heading
Waypoint caret — Flaps extended
G-meter — Air brakes extended
Autopilot/thrust indicator — Gear lowered
Corner velocity indicator — Arrestor hook lowered
Airspeed tape — Altitude tape
Flight path indicator — Above ground level (AGL) indicator
Current weapon indicator — Pitch ladder
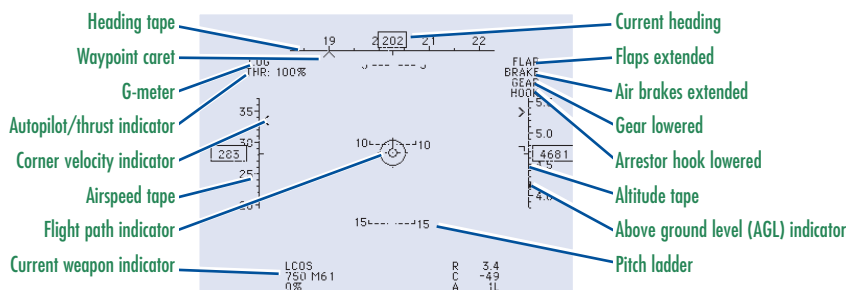
Above Ground Level (AGL) Indicator. This bar on the altitude tape indicates your altitude above the terrain. As you fly over land, ground level changes. For example, when flying over a mountain, you could be 5,000 feet above sea level but only 200 feet above the ground. Pay particular attention to the AGL when flying in clouds or fog.

Airspeed Tape. The airspeed tape scrolls up and down, indicating changes in airspeed. On more modern aircraft, your current airspeed is also displayed numerically at the center of the tape. Indicators show your maximum and mini-mum (i.e., stall) speeds.

In *Fighters Anthology*, your airspeed indicator measures *true airspeed* and not *indi-cated airspeed*. The actual speed of your aircraft is affected by changes in air pres-sure. Indicated airspeed gives the speed the aircraft would be travelling if it were at sea level on a standard day. It is the reading normally found on an airspeed indicator. True airspeed is the speed the aircraft is actually travelling; the flight computer returns this measurement by correcting indicated airspeed to reflect current temperature and air pressure conditions.

Altitude Tape. The altitude tape scrolls up or down, indicating changes in alti-tude ASL (Above Sea Level). On more modern aircraft, your current altitude is displayed numerically at the center of the tape.

When the Instrument Landing System (ILS) is engaged, additional marks indi-cate your current vertical speed (how fast you are diving or climbing) and the maximum advised vertical speed for landing. For more information on the ILS, see **Additional Navigation Mode Features**, p. 87. For a detailed guide to using the ILS, see **Landing**, p. 66.

Auto. Indicates that the autopilot is engaged and steering your aircraft to the current waypoint.

[A]   Turn autopilot on/off

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Bay, Brakes, Flaps, Gear and Hook. The upper right-hand corner of the HUD indicates the bay, brake, flap, gear and hook status. If FLAPS, GEAR, BRAKE or HOOK appears in the upper right corner, then the specified device is extended. If the word does not appear here, the device is retracted. If BAY appears, the weapons bay is open; otherwise, it is closed.

O — Toggle weapons bay open/closed (F-117, B-52, X-32 and F-22A only)

B — Toggle brakes

F — Toggle flaps

G — Toggle landing gear

H — Toggle the arrestor hook (if aircraft can land on a carrier)

Brakes. See **Bay, Brakes, Flaps, Gear and Hook**.

Corner Velocity Indicator. The corner velocity (or speed) indicator shows your corner speed at your current altitude. If the bar is *below* the numeric airspeed readout, you're flying faster than corner speed. If it is *above* the numeric readout, you're flying slower than corner speed.

Flying at your current altitude's corner speed gives you maximum turn performance. For more details, see **Corner Speed**, p. 58.

Current Weapon Indicator. Indicates the current weapon and the number of rounds left.

[,] — Cycle through weapons

Flaps. See **Bay, Brakes, Flaps, Gear and Hook**, above.

Flight Path Indicator. The Flight Path Indicator shows which direction the aircraft is actually moving, regardless of where its nose is pointed (which is always the center of the HUD). When you pitch down at high speed, your nose is pointed toward the ground, but you maintain some momentum in the direction you were headed previously. Your actual flight path is between where your nose is now pointed and where it was previously.

G-Meter. The G-meter shows how many G's the aircraft is currently pulling. For more on the role of G-force in maneuvers, see **G-Forces**, p. 55.

**Gear.** See **Bay, Brakes, Flaps, Gear and Hook**, above.

Heading Tape. The heading tape is your compass. It scrolls right and left, from 1° to 360° with tick marks every 10°. On more modern aircraft, your current heading is displayed numerically at the center of the tape.

| 0° | Due north | 180° | Due south |
| 90° | Due east | 270° | Due west |

Hook. See **Bay, Brakes, Flaps, Gear and Hook**, above.

Pitch Ladder. The pitch ladder indicates the aircraft's pitch and roll relative to the horizon.

Positive pitch lines
Horizon line
Negative pitch lines
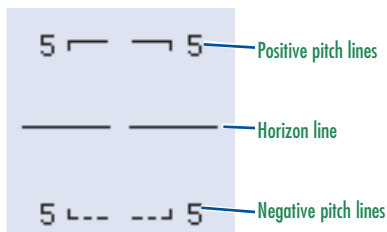
The center of the HUD is always in line with where the nose of your aircraft is pointing. Each pitch ladder line represents 5° above or below the horizon. Positive pitch lines — indicating that the nose is pointed above the horizon — are solid. Negative pitch lines — indicating that the nose is pointed below the horizon — are represented by dashed lines. The ends of the pitch lines always point toward the horizon.

The pitch ladder lines also act as an artificial horizon. Think of them as representing your wings — when the lines are horizontal (relative to the bottom of your screen), your wings are parallel to the horizon. When the lines are vertical, your wings are perpendicular to the horizon.

Thrust Indicator. The thrust indicator shows the engine's current throttle setting as a percentage of maximum possible engine output. AFT indicates that afterburners have been lit. The following *keyboard* keys control thrust:

1	0% thrust	5	100% thrust
2	25% thrust	6	100% thrust plus afterburners
3	50% thrust	7	Decrease thrust by 5%
4	75% thrust	8	Increase thrust by 5%

Time Compression Level. Rate of time compression appears in the upper right corner when time compression has been activated. During time compression, your stick inputs are reduced so your airplane is still controllable.

C	Cycle through time compression rates.
Shift C	Switch to slow motion (1/2 of normal speed).
C	Change from slow motion back to normal speed.

Waypoint Caret. The waypoint caret moves along the underside of the heading display, marking the direction to the selected waypoint. When the indicator is centered on the heading tape, you are flying directly at the next waypoint. For more information, see **Additional Navigation Mode Features**, p. 87.

Stability Indicator

This indicator appears at the bottom of the X-29's, X-31's and X-32's HUDs:

Normal   ← Increasing Stability
Decreasing Stability →   Stall imminent

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Constant HUD Features— Thrust Vectoring Aircraft

There are two types of thrust vectoring in *Fighters Anthology* — thrust vectoring controlled by strake flaps, and thrust vectoring controlled by rotating engine nozzles. Strake-flap thrust vectoring is used to alter an aircraft's pitch and/or yaw in mid-flight. Rotating engine nozzles are used in STOVL aircraft, primarily for short-runway or vertical takeoff and landing.

The table below lists the *Fighters Anthology* aircraft with thrust vectoring capabilities:

AIRCRAFT	STOVL	VECTOR PITCH	VECTOR YAW
F-22A / F-22N		✔	
X-31 EFM		✔	✔
X-32 ASTOVL	✔	✔	
AV-8B Harrier	✔		
Sea Harrier FA.2	✔		
Su-35		✔	
Yak 141	✔		

F-22A, F-22N, X-31 EFM, X-32 ASTOVL, Su-35

The strake flaps on the engine outlet nozzles of these aircraft redirect the engine's thrust to change the pitch or yaw of the aircraft's nose without moving control surfaces or dipping the aircraft's wings. The ASTOVL and F-22 can use vector thrust to maneuver on the pitch axis; the X-31 can maneuver on the pitch and yaw axes.

Ctrl + ←, →, ↑, ↓   Control the direction of vectored thrust.

VCTR

Original flight path indicator

Position of nose
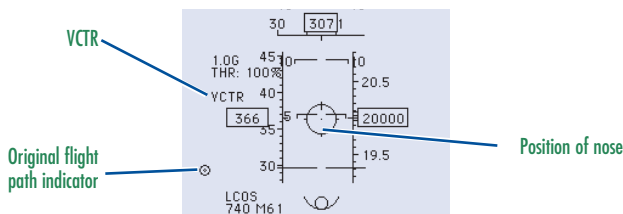
VCTR. Appears in the upper right of the HUD when the thrust angle does not equal 0° (i.e., straight back at a normal flight angle).

Original Flight Path Indicator. This small circle appears on your HUD when you begin to vector thrust. It marks the direction of your original flight path, before you began to vector thrust. To return to normal flight, reposition your nose (represented by the large circle in the center of your HUD) over the original flight path indicator to resume normal flight.

X-32 ASTOVL, AV-8B Harrier, Sea Harrier FA.2 and Yak 141 Freestyle

The main engine nozzles of the AV-8B, Yak-141 and Sea Harrier can be rotated downward to provide added lift for short takeoffs and landings within limited runway space. In addition to strake flaps that vector engine thrust to alter pitch in flight, the ASTOVL features a lift fan that helps launch the aircraft off of the ground.

Note: These aircraft cannot achieve vertical takeoffs when fully loaded — you must first remove weapons and fuel. In combat, vertical takeoff is not advisable, as it uses a great deal of fuel and decreases your available weapons load.

Vector Angle. Indicates the angle of the vector nozzles. At 0°, the nozzles point straight back (normal flight position). At -90°, they point straight down.

X	Rotate nozzles -10° (downward)
Shift X	Rotate nozzles to -90° position; press again to rotate to -100° (120° in the X-32)
Z	Rotate nozzles +10° (upward and backward)
Shift Z	Rotate nozzles to 0° position; press twice if starting from 100° (120° in ASTOVL)

The Horizontal Situation Indicator (HSI), appears on the HUD when you are in Navigation mode and drop below stall speed. It comprises two elements that indicate the craft's movement: vertical velocity bars and a horizontal velocity marker.

Vertical Velocity Bars. Ticks on the vertical velocity bars move up and down, indicating your climb and sink rate. The lower edge of the vertical bars marks the point at which you begin to stall rather than sink. The centerline markers indicate the "zero sink rate" position, the point at which the craft can hover.

Horizontal Velocity Marker. This circle indicates forward/back and side-to-side movement. The cross hairs in the center indicate zero horizontal velocity — that is, the point at which the aircraft hovers. If the circle is centered on the cross hairs, the aircraft hovers. When the circle slips to the side, forward or back, the aircraft is traveling in that direction. The radius of the circle represents movement at 10 knots in any direction. For example, if the forward edge of the circle moves over the center of the cross hairs, then the airplane is drifting backwards at 10 knots.

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Additional Weapons Mode Features

Weapons mode provides you with targeting symbology needed to designate and engage targets. Weapons mode is the default mode for the HUD; press N to toggle between Weapons and Navigation mode.

IR/Laser TD box
R/V TD box
IR/Laser target brackets
Current weapon indicator
Target range
Quantity
Closure speed
Hit probability
Aspect angle

Aspect Angle. Indicates a targeted aircraft's aspect angle in degrees. The aspect angle is the angle between the target's tail and your airplane's line of sight. See diagram under **Aspect Angle**, p. 136.

Closure Speed. Shows the target's speed relative to yours. A positive closure means you are gaining on the target; negative closure means it is moving away.

Current Weapon Indicator. Displays the number and type of the currently selected weapon.

[or]　Cycle through weapons

Shift 8　Displays the number remaining for all weapons

Hit Probability. Shows the weapon's current hit probability. The percentage takes into account all factors which may affect the missile's overall chance to hit, such as weather and distance to target, but does not consider enemy maneuvering. IN RNG appears next to the hit probability when the target is within the weapon's minimum/maximum range.

Note: A guided missile must have a lock — not just a minimum hit percentage — in order to have any chance of hitting its target.

IR/Laser Target Brackets. If IR/LASER ADVANCED TARGETING is active, these brackets will appear on the HUD around all targets detectable by your IR sensor.

Offscreen Target Marker. The Offscreen Target Marker, which appears as "XX" on the perimeter of the screen, marks where to turn in order to bring your current target back into view.

Target Range. Indicates the range to the target in nautical miles (nm).

TD Box (R/V or IR/Laser). A Target Designator box surrounds your currently selected target. If IR/LASER ADVANCED TARGETING (see p. 112) is active, a rectangular box marks your IR/Laser target and a square marks your R/V target.

Missile and Guided Bomb Elements

When you select a missile, the HUD shows not only the missile type and number remaining, but information that's useful in achieving the best launch conditions for the weapon.
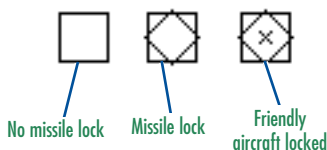

Missile seeker lock

Aspect angle

Aiming reticle

Weapon range scale
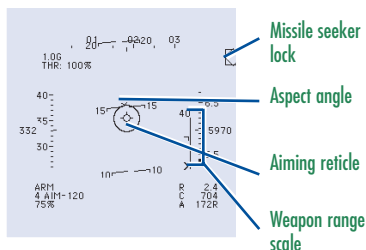
Aiming Reticle and Aspect Angle. The center of the HUD displays the aiming reticle, which is the center of the missile seeker's field of view. (The seeker head on a missile is the IR, radar, laser or HARM homing device implanted in the nose of the missile which directs the missile to its target). This circle remains fixed while the aspect angle indicator moves around it. The aspect angle indicator illustrates the angle between the target's flight path and your line of sight to the target.

If the aspect angle indicator is at the top of the aiming reticle, the target is heading directly toward you. If it's at the bottom of the aiming reticle, the target is heading directly away from you. If the indicator is on either side, you are flying perpendicular to your target. For hints on using the aspect angle to your advantage, see **Combat Tactics: Aspect Angle**, p. 136.

Weapon Range Scale. The vertical scale to the side of the aiming reticle shows your weapon's minimum and maximum range. The scale range is listed at the top of the indicator. The target marker indicates where the current target falls within the missile's range. If the target is outside of the missile's range, the target marker does not display.


Maximum range — 40

Target marker —

Minimum range — 30
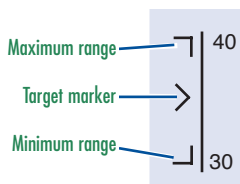
Missile Seeker. An IR or Active Radar missile seeker is represented by a floating diamond on the HUD. When the missile seeker acquires the target, a diamond appears in the TD box. This indicates the missile is tracking the target and can be fired, but does not indicate whether you are in a good firing position.

No missile lock   Missile lock   Friendly aircraft locked

For a step-by-step explanation, see **Firing a Guided Missile**, p. 126.

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Unguided Bomb Elements

CCIP

CCIP stands for Continuously Calculated Impact Point, meaning that as you fly over your target, the point at which the bomb will impact is constantly re-calculated and projected onto your HUD. The HUD displays all the symbology necessary to accurately strike ground targets with unguided bombs.
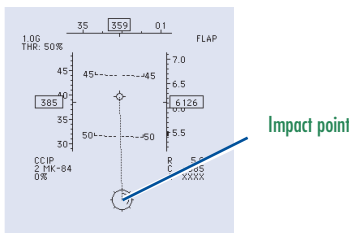
Impact point

The dotted line extending from the center of the HUD indicates which path the bomb will follow upon release, and the impact point pipper shows where the bomb will land. In level flight, you often can't see the pipper on your HUD; to see the pipper, you must either dive or significantly increase speed. The slower you fly, the steeper your dive must be to keep the CCIP pipper on the screen.

An arcing line moves inside the CCIP pipper. This circle measures range from your current position to the drop point. When the inner arc forms a complete circle the target point is 10,000 feet or more away. When the inner arc forms a half-circle, the target point is 5,000 feet away. Accuracy reduces as range increases, effectively limiting bombs to a 2nm (approx. 10,000 ft.) range. Beyond this range your chances of hitting the intended target are very low.

## High-Altitude Bomb Camera (B-2 and B-52 only)

The B-2 Spirit has a High Altitude (HA) bomb camera that allows you to visually track your target and release your bomb without diving. If you have an unguided bomb selected as your weapon, the HA bomb camera view automatically appears in your Target Window. (The window will open if it is not open already; if you switch to a guided weapon the normal Target Window view replaces the camera view.)

Through this window, you are looking at the ground beneath and to the front of your aircraft. If you fly directly over the target, it will appear in the window. Drop the bomb when your target is in the center of the window.

For a step-by-step explanation, see **Dropping an Unguided Bomb**, p. 125.

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Gun Elements

When your gun is selected, the HUD shows the number of rounds left in your internal gun and provides a gunsight which works with radar or visual targeting.
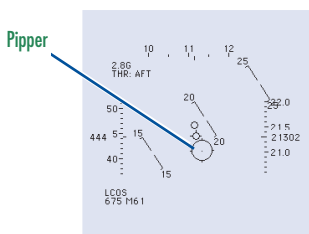
Pipper

Bullets fall vertically due to gravity as they are propelled horizontally towards their target. Therefore you will need to use the pipper, or gunsight, on the HUD to aim your gun for greatest accuracy. The pipper can indicate two different things, depending on whether you're attacking with radar on or radar off.

When your radar is off, the pipper is set to indicate where a bullet will be when it is 1,000 feet away from your airplane. If a target is beyond this distance, you need to lead the target more — that is, you need to aim the gun farther in front of your target. If the target is less than 1,000 feet away from you, you need to lead it less.

With radar on and a bogie targeted, the pipper changes range to match that of the target and automatically calculates lead requirements. Your active radar also provides your gun computer with range information. This makes life simpler for you — just orient your plane so that the pipper is on the target and fire.

R   Toggle your radar

Target at minimum range   Target at 50% of maximum range

As you close in on your target, a thick arc moves along the perimeter of the pipper. This arc indicates your distance to the target based on your gun's maximum range. When the arc is absent, the target is outside of gun range. When the arc is halfway around the pipper, the target is at 50% of your gun's maximum range. When the arc has surrounded the pipper, you are within 100ft of the target.

The guns on the AC-130U automatically aim at your selected target, provided your target is at the correct angle (on the left side of the AC-130U for all guns). Since these guns are radar-guided, your radar *must* be active in order for your guns to be accurate, if you're flying an AC-130U.

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Additional Navigation Mode Features

Navigation mode provides you with the information you need to fly to pre-established waypoints and make successful landings. To toggle between Weapons mode and Navigation mode, press N.

Glide slope indicator

Velocity indicators

Localizer deviation bar
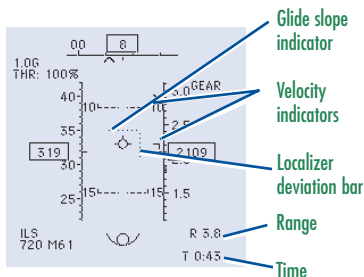
Range

Time

Range. The distance to the current waypoint in nautical miles (nm).

Time. The time to the next waypoint based on your current airspeed in minutes:seconds.

Instrument Landing System

You cannot call up the Instrument Landing System manually. It appears automatically under the following conditions:

♦ HUD in Navigation mode

♦ Gear (and hook, if landing on a carrier) down

♦ Within 5nm of a carrier or runway

♦ Under 4,000 feet of altitude

For more information on ILS operation and landings, see **Landing Guidance**, p. 67.

Glide Slope Indicator. Horizontal dotted line that appears in the center of the HUD, indicating your height above the runway. The dots are tightly spaced when following a good approach and loosely spaced when outside approach parameters.

Localizer Deviation Bar. Dotted vertical line that appears on center of HUD, indicating how well you are lined up with the runway. The dots are tightly spaced when following a good approach and loosely spaced when outside approach parameters.

Note: When the dotted lines form a cross in the center of your HUD, you're on the glide path for a correct landing.

Velocity Indicators. These brackets appear on the airspeed tape, marking the range of speed advisable for a safe landing.

INSTRUMENT DISPLAY WINDOWS

Instrument Display Windows let you display important instruments, views and information in the corners of your screen. You select which windows you need in your current situation; closing unnecessary windows increases your view.

To make the windows smaller, deselect LARGE WINDOWS from the **PREF** menu.

A maximum of four windows can be open at any given time. If four are already on screen and you open another, the new window will replace one of the older windows. With LARGE WINDOWS off, more windows can be open at once.

View Windows

Front View Window

Since you can't always look ahead during a dogfight, you can open the

Front View Window to display the forward (F1) view when you've got your head turned.
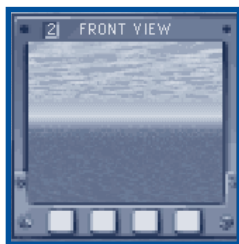
Shift 2   Toggle Front View Window

If IR/Laser Advanced Targeting is Active ...

If IR/LASER ADVANCED TARGETING is active (on the **PREF** menu of the *In-Flight* menu bar) and you have an IR target designated, a camera view of your target appears in this window. (If the Front View Window is already up, this camera view will replace it.) This window corresponds to the Target Window ((Shift 4)), which tracks only radar, HARM and visual targets when IR/LASER ADVANCED TARGETING is active. The same symbology is used in both windows, see **Target or Radar/Visual Target Window**, p. 101, for more details.
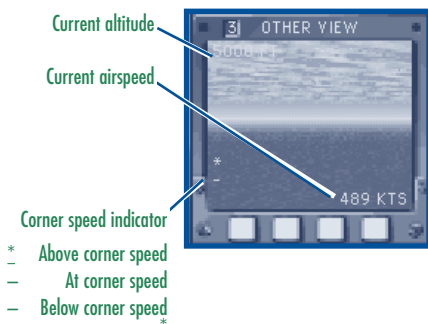
Note: When using laser-guided bombs, the view from the weapon is displayed in this window until the weapon explodes. Don't switch targets or fire another weapon until you see the explosion; otherwise, the weapon will lose its lock.

Other View Window

You can display any view in the Other View Window — default is the [F2] Back view.

[Shift][3]   Toggle Other View Window

Current altitude

Current airspeed

489 KTS

Corner speed indicator
* Above corner speed
– At corner speed
– Below corner speed

To set the window's view:

1. Switch to another camera view ([F2] – [F12]).

2. Press [V] to set the view as your Other View.

3. The Other View Window automatically appears.

4. Switch back to Forward View (or any other view).

Status Windows

Weapons Status Window

The Weapons Status Window displays the number and type of weapons the aircraft currently carries and how many chaff pods and flares remain. (Your HUD only indicates the number remaining for the active weapon.)

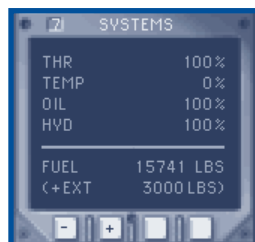[Shift][8]   Toggle the Weapons Status Window

You can change your current weapon using the square bracket keys ([[] and []]) Alternatively, you can change current weapons by clicking on the [+] and [–] buttons at the bottom of the Weapons Status Window.

Current weapon

8 WEAPONS

> 750 M61
  2 AIM-120
  2 AGM-65

50 CHAFF   50 FLARE
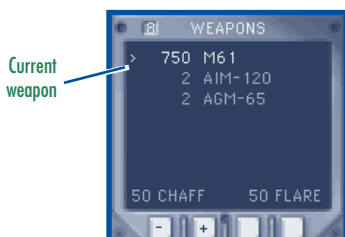
System Status Window

The System Status Window displays throttle, engine temperature, oil pressure and hydraulic pressure. (100% is normal, except for temperature — at 0%, temperature is normal.) This view is useful for assessing systems damage and viewing fuel levels.

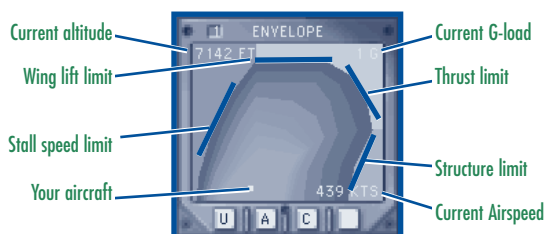[Shift][7]   Toggle the System Status Window

7 SYSTEMS

THR   100%
TEMP   0%
OIL   100%
HYD   100%

FUEL   15741 LBS
(+EXT   3000 LBS)

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Flight Information Windows

Flight Envelope Window

The flight envelope is basically a series of graphs showing the aircraft's minimum and maximum speed and turn performance at different altitudes.

Shift 1   Toggle the Flight Envelope window.

Current altitude

Wing lift limit

Stall speed limit

Your aircraft

Current G-load

Thrust limit

Structure limit

Current Airspeed

With the Flight Envelope Window, you can graphically see how your aircraft is performing within the following limits:

Stall Speed Limit. The stall speed curve graphs the speed at which stalls occur for each altitude. If the dot representing your aircraft moves toward the left side of the envelope, toward this stall speed curve, you need to pick up speed or a stall is imminent.

Wing Lift Limit. The wing lift limit curve represents the aircraft's ceiling. The aircraft can't climb above this altitude because the air is too thin — not enough lift can be generated to overcome the airplane's weight. You won't stall if the dot representing your aircraft hits this upper limit; however, since you're in your 1G envelope (see **G-load**, below), you won't be able to maneuver much.

Thrust Limit. The thrust limit curve represents the limit of your engines at high altitude. Above the tropopause (36,600), your engines can't produce enough thrust to go beyond certain speeds. If the dot representing your aircraft hits its thrust limit, nothing will happen — you simply can't go any faster.

Structure Limit. The structure limit curve represents the maximum speed your airframe can handle. Go too far beyond this limit and your wings will tear off. If the dot representing your aircraft approaches this limit, think about slowing down immediately.

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G-Loads

Each flight envelope is defined by the number of G's your aircraft can pull. G-loads measure your aircraft's turning. G-loads are explained in detail under **G-Forces,** p. 55. However, the window can be explained here briefly. To simplify, the more G's you're pulling, the harder you're turning. If you are engaged in a turning fight with an enemy, you may want to be in your highest G envelope in order to out-maneuver him.

The number of G's you can pull are limited by the following factors:

ALTITUDE At higher altitude, where the air is significantly thinner, the wings cannot generate as much lift. As a result, you can pull fewer G's at high altitude than at low altitude.

SPEED The faster you're going, the fewer G's you can pull.

STRUCTURE An aircraft is built to endure only a certain amount of G-force. Beyond that range, the airplane's structure is fatigued to the point that the wings crack.

PILOT Humans can only tolerate a certain amount of G-force stress. Too many seconds of +9G maneuvering and you black out. Maneuver too long at -5G and you experience "red out."

LOAD Amount of ordnance and fuel you're carrying. The more weight on your airplane, the fewer G's you can pull.

The Flight Envelope Window shows the number of G's available to you at any time. If you get involved in a turning fight with an opponent, you typically want maximum G's in order to out-turn him. Depending on the combat situation, you may want to be in the smallest (highest G) envelope in the window. When used with the Corner Speed Indicator on the HUD, you can determine what speed will give you the best turn performance and what you need to do in order to achieve it. To pull more G's than would be normally possible, choose EXTRA G'S from the **CHEAT** menu of the *In-Flight* menu bar.

Note: The G's shown in the Flight Envelope Window are for "clean" aircraft, not loaded down by ordnance. Since weapons increase both weight and drag, you may not be able to pull the maximum G shown, depending on your weapons load.
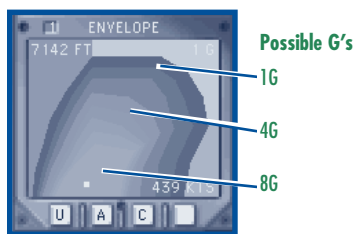
Flight Envelope Window Modes

The Flight Envelope Window has three buttons along the bottom which modify the flight envelope display.

Flight Envelope Window in current curve mode

Current curve

All curves

Compare curves

Current Curve. Displays the envelope for the G-load currently being experienced by your aircraft. For example, when flying straight and level at 450 knots and 1G, the 1G curve is displayed. When flying at 450 knots and 3G, the 3G curve is displayed.

All Curves. Displays the flight envelopes for all G-loads your aircraft is capable of. This mode is useful for seeing how close you are to the "next" envelope and gives you a clue as to how you can increase G. For example, if the dot appears on the far left side of the graph, you're moving too slowly to pull much G — you should add thrust and/or sacrifice altitude for speed. If the dot appears near the top, you're already at maximum altitude — decrease altitude quickly (via a Split S, for example — see **Air Combat Maneuvers**, p. 145). If the dot appears near the right side of the graph, you're moving too fast to pull more G's — climb or deploy your brakes (press B).

Compare Curves. Displays your flight envelope over that of your currently selected target, providing you with a quick comparison of aircraft performances. Areas where the opponent holds the advantage are shaded red.

*Note: You must have a target lock to use the Compare Curves display mode. For more information on locking a target, see **Targeting**, p. 112.*

Nav Window

The Nav Window shows bearing and range to waypoints along with the estimated time of arrival (ETA) in minutes:seconds. The currently selected waypoint is always highlighted. Waypoints must be manually selected unless autopilot is active.

[Shift][6]   Toggle Nav window

[W]   Switch to the next waypoint

[Shift][W]   Switch to the previous waypoint

Alternatively, you can change waypoints by clicking on the [+] and [−] buttons at the bottom of the NAV Window.

```
        6    NAV INFO
 A. SE VECTOR POINT
    154°, 11.9 NM
 B. MARSHALL POINT
    174°, 7.5 NM
 C. LAND
    63°, 1940 FT

      ETA XX:XX
 [ - ] [ + ] [  ] [  ]
```

Current waypoint — A. SE VECTOR POINT
Bearing — 154°
Distance — 11.9 NM

Bearing and Distance. Beneath each waypoint is your bearing and distance to that waypoint. "Bearing" is not the heading you must fly, but the number of degrees you must turn in order to fly directly at the waypoint. If the bearing is negative, turn left. If the bearing is positive, turn right. When the bearing reads zero, you are flying directly toward the waypoint.
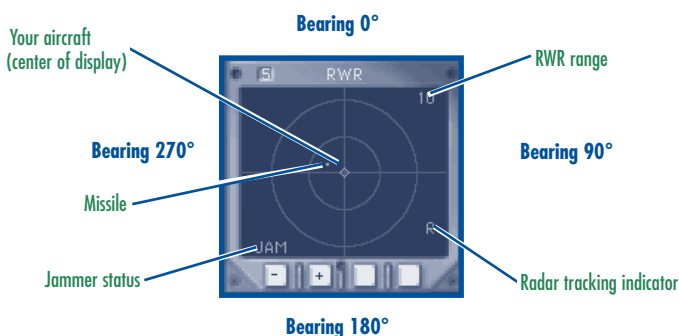
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Passive Radar Windows

Radar Warning Receiver (RWR) Window

The Radar Warning Receiver (RWR) Window displays all active radar sources around your aircraft.

Shift 5   Toggle the RWR Window

The center cross hairs represent your aircraft, with the top of the display indicating what's in front of you and the bottom of the display indicating what's behind you.

Your aircraft (center of display)

Bearing 0°

RWR range

Bearing 270°

Bearing 90°

Missile

Jammer status

Radar tracking indicator

Bearing 180°

RWR Range. The selected range is displayed in nautical miles in the upper right corner. Press > to decrease RWR range. Press < to increase RWR range. Maximum RWR range on any aircraft in *Fighters Anthology* is 50nm.

Radar tracking indicator. When an active radar source is detected, a small "R" is displayed in the lower right corner of the RWR. A bright "R" indicates that the aircraft has a lock on you and may fire on you soon. If the "R" begins to flash, a missile is currently locked on you and in flight. *Release chaff when this happens by pressing* Insert.

Infrared tracking indicator. Your RWR also gives you other information not available in the real world: it can detect infrared seekers, indicated by a small "I" in the lower right corner. The "I" functions identically to the "R" — a bright "I" means an IR-homer is locked on you, and a flashing "I" means a missile is headed for you. *Release flares when this happens by pressing* Delete. *Afterburners greatly increase an IR missile's hit probability; turn them off if they're lit.*

Jammer status. Lastly, the RWR shows the status of your jamming equipment, displaying "JAM" when your ECM gear is activated. J toggles your jammers.

Radar Sources. Radar-emitting sources are displayed on the HUD with the symbols below.

Ground object	■
Ground object painting you	Square turns bright
Ground object tracking you	Square flashes
Friendly aircraft	◇
Enemy aircraft	◆
Aircraft painting you	Diamond turns bright
Aircraft firing on you	Diamond flashes
Missile	▪
Missile locked on you	Dot flashes

Note: *Your missiles will also appear on the RWR, so pay attention — don't confuse one of your missiles for an enemy one.*

Radar Cross-Section (RCS) Window

Like the RWR Window, the RCS Window provides a top down view of the active radar sources surrounding your aircraft. You are at the center of the crosshairs. The RCS Window uses the same symbology as the RWR, and contacts that are at 0° are directly in front of you, contacts at 180° are directly behind you, etc.

The curved, outlined shape on the window represents your current radar cross-section (RCS). Radar emitters outside of this shape have less of a chance of detecting you than those within it. The larger the shape, the easier you are to detect. If an emitter is within the shape, you may be able to turn so that he is outside the RCS "bubble," minimizing his ability to pinpoint you.

Shift 0   Toggles the RCS Window.

RCS is a measure of your radar signature (how much radar your airplane is reflecting back to the radar-emitting source). The smaller an aircraft's RCS is, the stealthier it is. An aircraft's vertical surfaces are crucial to its RCS, because radar waves reflect off of a surface at an angle equal and opposite to their incoming angle. When cruising, aircraft generally fly level, and their radars emit waves directly out in front of them. The vertical surfaces of aircraft in front of them return a stronger and more easily pinpointed signal than the non-vertical surfaces. Increasing vertical surface by diving, banking, extending gears and flaps, opening bay doors, lowering gear increases RCS, as does active radar and jammers use.
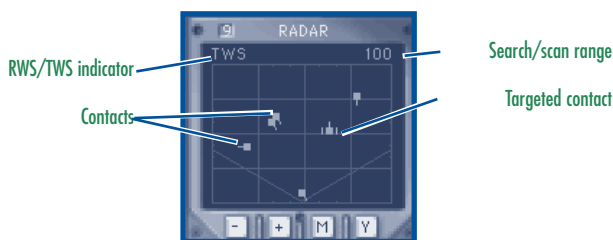
For more information, see **Stealth**, p. 229.)

Radar and Targeting Windows

Radar Window

The Radar Window displays your radar scope (in a two-seater, that of your RIO or WSO).

Note: This window will appear only if your radar or IR sensor is active.

RWS/TWS indicator

Contacts

Search/scan range

Targeted contact

To open the window:

1.	Press [R] to activate your radar.

2.	Press [Shift][9] to open the Radar Window.

To close the window:

1.	Deactivating your radar (press [R] again) automatically closes the Radar Window.

2.	Pressing [Shift][9] again also closes the Radar Window (although the radar remains on until you turn it off).

Your radar only illuminates objects that are in front of your aircraft. On the radar scope, the nose of your aircraft is in the center of the bottom edge of the window. The top edge represents far edge of radar coverage. Contacts appear as squares on this grid. Air targets have "flags" to indicate their bearing; the aircraft is heading in the direction the "flag" is pointing. When a contact is targeted, lines appear on either side of it.

Your radar will only detect objects traveling faster than 90knots — aircraft, for the most part. To find slower-moving ground vehicles, see **Switching Between Air and Ground Radar**, p. 99.

RWS/TWS Indicator

The RWS/TWS Indicator indicates whether the radar is in Range While Search (RWS) or Track While Scan (TWS) mode. The first is used to find targets at a distance and the second tracks a target at close range. Your radar switches between modes automatically.

Range While Search (RWS) mode uses continuous wave emissions to provide contact range and bearing at extremely long ranges. Primarily a scanning mode, RWS cannot provide detailed tracking information. *You cannot use your Radar Window to target a contact while in RWS mode*. RWS mode engages automatically when you increase radar range past maximum tracking range.
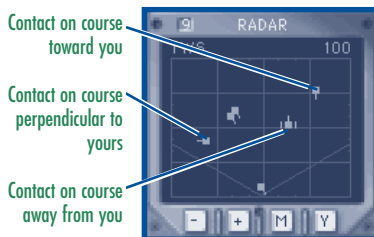
Track While Scan (TWS) mode uses pulse-Doppler radar to target a designated contact, thereby providing detailed tracking information, while still providing scanning of other nearby contacts. TWS mode automatically engages when you decrease radar range to within maximum tracking range.

Note: if you are having difficulty targeting an object, check to make sure you are in TWS mode and if not, decrease your radar range (by pressing `>.` *) until you are.*

Press `>.` to decrease, or `<,` to increase radar range.

Radar Contacts

Aircraft appear as small squares. In TWS mode, a small "flag" on the target indicates the direction in which the contact is moving (relative to your heading). Large surface targets appear as single-pixel dots.

Contact on course toward you

Contact on course perpendicular to yours

Contact on course away from you

You can target a contact by moving the mouse cursor onto the Radar Window and clicking that contact. Two vertical lines, called "captain's bars," surround your current target.

Track range: 100nm

Contact at 75nm
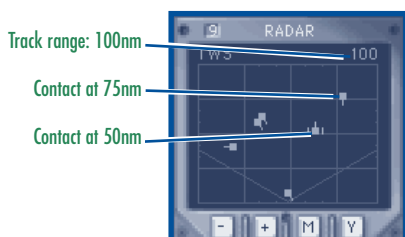
Contact at 50nm

Contacts appear on a grid based on their range from your aircraft. With a 100nm track range, a contact at 50nm is in the middle of the display, and a contact at 75nm is near the top. If you decrease track range to 50nm, the 75nm contact disappears and the 50nm one moves to the top.

At long range, radar may be unable to distinguish between multiple targets flying closely together. Beware of single contacts: they may unexpectedly multiply!

Standard Radar CRT vs. Authentic Radar CRT and Seeker

The *Fighters Anthology* Radar Window can display data in two ways. You can choose between these two types of radar at any time with the PREF menu on the *In-Flight* menu bar, which you can call up by pressing [Esc].

The standard radar CRT (Cathode Ray Tube) display presents a top down view of what's in front of your airplane. This is the display featured in all of the pictures on the previous two pages. Authentic radar is slightly different. It's basically a graph with vertical lines indicating angles off your airplane's nose and horizontal lines indicating range.

**Contacts Displayed on Authentic Radar CRT**
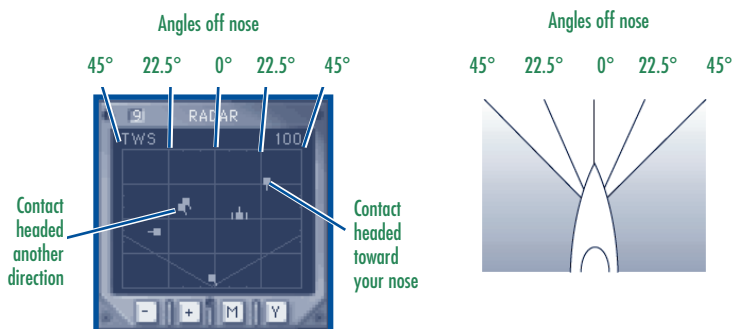
On an authentic radar CRT, in order to figure out where a contact is, you must count over horizontally to its approximate angle off your nose, and then go up to determine range. Contacts are also displayed differently on the Authentic Radar CRT. The "flag" indicating the contact's flight path is relative to its angle off your nose. For example, a contact with its flight path "flag" pointing down is headed directly for your nose.

When AUTHENTIC RADAR CRT AND SEEKER is active, the seeker heads in your radar-guided missiles will also behave more realistically:

♦ If a locked target leaves view, the lock is broken and must be re-acquired.

♦ There is a delay when you switch targets after the seeker head has locked. This is because the seeker head must re-orient on the new target.

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Target Elevation & Azimuth

Two arrows move along the left and bottom edges of the Radar Window. These arrows mark the targeted contact's elevation and azimuth, relative to your aircraft. (The same indicators are used on both authentic and standard radar CRTs.)

Target elevation (above aircraft)

Targeted contact

Target azimuth (to right of aircraft)
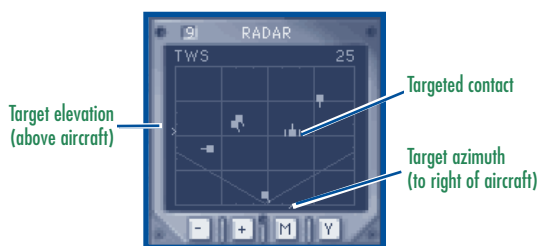
Elevation indicator. The arrow along the left edge of the scope shows the target's altitude relative to your own. If the target is beneath the plane of your nose, the elevation indicator moves below center. If the target is above the plane of your nose, the elevation indicator moves above center.

Azimuth indicator. The arrow on the bottom of the scope indicates target azimuth, or horizontal displacement. If the target is left of your nose, the azimuth indicator moves left of center and vice versa.

Historical Mode

Press Y or click the Y button at the bottom of the Radar Window to activate your radar system's historical mode. In historical mode, your radar displays a series of dots behind each contact. The dots represent the "history" of the contact's movement over time. Press Y again to exit this mode.

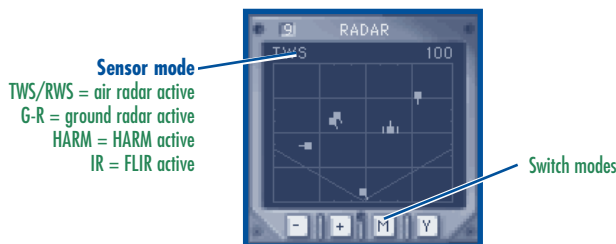## Switching Between Air and Ground Radar

Your radar has separate air and ground modes. In air mode, the radar ignores anything traveling slower than 90 knots. In ground mode, it ignores everything traveling *faster* than 90 knots.

R   Activates air radar (deactivating all other sensors) and opens the Radar Window (if closed)

Ctrl R   Activates ground radar (deactivating all other sensors) and opens the Radar Window (if closed)

G-R appears in the upper left corner of the Radar Window when ground radar is active.

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Switching to IR and HARM sensors

IR and HARM information can also be displayed in your Radar Window. You can cycle through sensors by clicking on the M button at the bottom of the Radar Window, or press R for radar, I for IR or M for HARM. Only one sensor can be active at a time — switching one on automatically switches off the previous sensor.

Sensor mode
TWS/RWS = air radar active
G-R = ground radar active
HARM = HARM active
IR = FLIR active

Switch modes

HARM mode. If your aircraft is carrying HARM missiles, you can view information from the missile's seeker head inside the Radar Window. You must first select a HARM missile as your weapon and switch to HARM sensor mode. HARM appears in the upper left corner of the Radar Window when it is in HARM mode.

I or J — Cycle through your weapons to a HARM missile

M — Turn off your radar or IR sensor and activate the HARM missile seeker head

HARM missiles seek enemies employing radar. Designate targets as you normally would on your active radar.

For more details on HARM modes, see **Weapon Guidance Systems**, p. 117.

IR mode. Airplanes that are equipped with the AAS-38 FLIR sensor or have a FLIR pod attached to a hardpoint can detect target objects based on their infrared, or heat, signatures. The IR sensor has two advantages — it allows you to detect ground targets, and enemies are not aware that you've targeted them. Unfortunately, it's less effective in bad weather than radar, and its short range limits you to close engagements.

Information from your IR sensor will only display in the Radar Window if IR/LASER ADVANCED TARGETING is not active on the **PREF** menu of the *In-Flight* menu bar. (See **IR/Laser Advanced Targeting**, p. 112.

I — Turn off your radar or HARM seeker and activate the IR sensor

Information from the IR sensor now appears in the Radar Window. Designate targets with the IR sensor exactly as you would with your active radar. For more information on IR targeting, see **Weapon Guidance Systems**, p. 117.

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Target or Radar/Visual Target Window

The Target Window lets you view your currently selected target and see data on its skill and activities. When IR/LASER ADVANCED TARGETING is active on the PREF menu, this window becomes the Radar/Visual Target Window and only displays radar, visual and HARM targets.

Shift 4   Toggle the Target Window
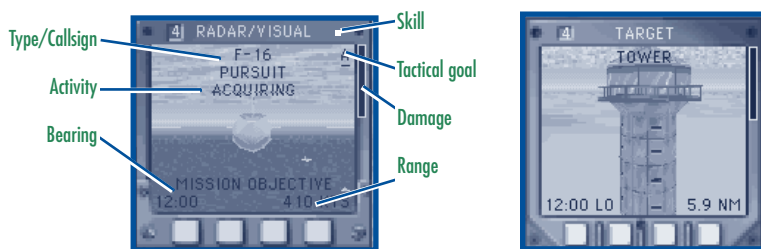
Activity. A target's *activity* tells you what specifically he's doing in order to complete his Tactical Goal (e.g., SEARCHING, ACQUIRING, PURSUING, etc.)

Bearing. The target's *bearing* is represented by hours on the clock, with 12 o'clock being the nose of your airplane and 6 o'clock being your tail. Hi and Lo provide a general idea of the target's altitude relative to your own.

Damage. *Damage* to the target is indicated by the vertical bar on the right side of the window. White represents damage to the target. When the bar is completely black, the target has taken no damage. When the bar is completely white, the target is destroyed. Damaged computer opponents suffer reduced turn performance and reduced thrust.

Tactical Goal. A target's *tactical goal* can be one of six things:

A	Attack something other than you	A	Attack you specifically
E	Evade something other than you	E	Evade you specifically
N	Neutral — follow waypoints and fulfill mission	T	Take off
C	Crash	L	Land

Range. The distance of the target from you, measured in nautical miles (nm).

Skill. The pilot's skill is marked by the number of dots displayed:

0	Novice	An easy target. Don't expect fancy maneuvers from this guy.
1	Average	Hard to tell if this guy's an earthworm or an eagle.
2	Experienced	Don't expect an easy fight. This guy's got some cards up his sleeve.
3	Ace	A pro. He'll turn and burn with you until one of you earns yourself a nylon letdown.

Type/Callsign. Identifies the type of target and/or callsign of the pilot.

IN-FLIGHT NAVIGATION MAP

The in-flight navigation map looks just like the map in the *Mission Map* screen. It displays the objects that were on your brief map, objects you've detected with radar or RWR, your original, assigned waypoints and the threat ranges of any known SAMs. You can activate the map at any point in a mission.

Shift M   **Toggle in-flight navigation map**

↑ ↓ ← →   **Scroll map display**

+ , −   **Zoom in and out**

If you have friendly sentry aircraft and haven't already activated the download toggle, you can do so from the map:

Shift A   **Toggle remote air targeting. Air targets are automatically downloaded while this link is active.**

Shift G   **Toggle remote ground targeting (J-Stars and Recon drone only). Ground targets are automatically downloaded while this link is active.**

If you have an object selected when you enter the in-flight map, the object has a white selection box around it.
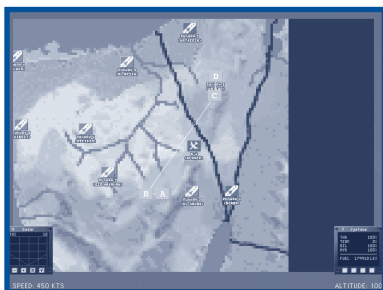
Note: The RWR downloads only general information on objects in range — such as "fighter" or "bomber."

The radar provides more specific information — such as "MiG-29."

The MAP menu of the In-Flight menu bar has three options:

PAUSES FLIGHT?   If *active*, the game pauses whenever you open the map, **if** you are in a single-player missions. (It has no effect on multi-player missions.) If this option is *inactive*, however, the map updates itself as objects move in real time.

DISPLAY WINDOWS?   Allows your Instrument Display Windows to appear on screen while you're in map mode. (This is useful when you're in the nav map and aren't using PAUSES FLIGHT.)

SHOW?   Displays certain types of items on the map. (See **Hiding/Displaying Objects — The Show Menu**, p. 201.)

VIEW CONTROLS

The fanciest flying in the world will still get you killed if you don't know where the bandit is. Keeping visual contact, or "tally," on the bandit is arguably the most critical aspect of aerial combat.

The view keys allow you to "move your head" in different directions to keep a visual lock on what's after you or what you are after. Getting to know these keys well enough to switch between them rapidly can make all the difference in a dogfight, when you don't have time to think.

Key	Name	Description
F1	Forward	Look ahead. This is your normal view — when in doubt, press F1.
F2	Back	Look over your tail at what's behind you. This is your "check six" key.
F3	Up	Look above the standard F1 view. This is useful in a turning dogfight.
F4	Tracking	This view follows the current target within the bounds of normal head rotation.
F5	Player → Threat	External view of your aircraft, facing the closest inbound missile.
F6	Player → Wing	External view of your aircraft, facing your wingman.
F7	Player → Target	External view of your aircraft, facing your current target.
F8	Target → Player	External view of your current target, facing your aircraft.
F9	Fly By	External view of your aircraft from a fixed point as it flies by.
F10	External View	External view of your aircraft.
F12	Missile → Target	External view of your missile, facing its current target.

You can also choose views from the VIEW menu of the *In-Flight* menu bar, which you can call up at any time by pressing Esc.

View Panning and Zooming

The Forward, Back, Up and External views can be rotated or panned. Hold down the right-hand [Shift] key and move your joystick, or press [←][→][↑][↓]. (If you're flying with the keyboard, hold down [Shift] and press [←][→][↑][↓].)

[Shift] + joystick   Pan/rotate view (also [←][→][↑][↓])

[+] or [−]   Increase and decrease view magnification

View Reference Keys

The [Alt] and [Ctrl] change which object your view is referenced from:

[Alt] + view key   Make view relative to your target instead of your aircraft

[Ctrl] + view key   Make the current view relative to your last launched missile instead of your aircraft

Pressing any camera view key alone will switch the view to its normal mode.