

“There is no differences for the airplane
who you are, ‘a general’ or ‘a lieutenant’.
It will not forgive you your mistakes.
Learn how to fly.”

- *Yuri Prikhodko, MiG-29 test pilot*

MiG-29 Fulcrum™ User Manual



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Introduction

In 1939, the Soviet Union under the control of Joseph Stalin recognized Nazi Germany's intentions to build for war. With the hasty urgings from the Commissariat of the People for the Aviation Industry, an experimental construction bureau named Polikarpov OKB started work on the prototype of the MiG-1 fighter plane, so named for its principal designers Artyom Ivanovich Mikoyan and Mikhail Iosifovich Guryevich. By 1940, the first MiG rolled out armed with a 12.7mm UBS machine gun with 300 rounds, two 7.62-mm ShKAS machine guns with 375 rounds per gun and two 50-kg FAB-50 bombs. By March of 1942, the bureau was reorganized within factory no. 155 in Moscow and was well on its way to becoming the Soviet's premier fighter plane production plant.

30 years later, the Soviet Union began the process of creating a replacement for the MiG-21 and MiG-23. They needed a fourth generation fighter jet that could compete with the new western fighters such as the F-16 and the F/A-18. Characterized as "integral aerodynamic design", the architecture of this new plane was capable of carrying a great deal of weight while maintaining superior maneuverability. The new MiG-29 was first piloted in 1977 and entered official service in 1984.

The modern **MiG-29 Fulcrum** remains one of the world's most maneuverable fighter jets. Unlike the MiG-29, western "Fly-By-Wire" planes limit their pilots' control of the plane with Hard Limits. Capable of breaching soft limits, MiG pilots can push the plane to its extremes and handle remarkable moves such as the Tailslide and Cobra Maneuver. The **InfraRed Search and Track** with laser targeting system allows these stealthy hunters to approach their targets without having to emit position compromising Radar signals. Exported to nearly 30 airforces, the MiG-29 continues to be a strong world presence in air superiority.

The entire staff of NovaLogic wishes to thank you for purchasing **MiG-29 Fulcrum**. We hope that you enjoy our collective efforts to bring you the most exciting and authentic MiG-29 flight simulator. We would like to offer our special thanks to Yuri Prikhodko, former cosmonaut and MiG-29 test pilot whose extensive consultation was absolutely invaluable.

Chapter 1:

Installing MiG-29 Fulcrum

Welcome to **MiG-29 Fulcrum**. This chapter of the manual will help you get the program installed on your computer, and will walk you through the configuration of your system. The next chapter is a **Quick Start** section, for those of you with significant flight sim experience, or for those who want to jump right in and learn by doing.

In order to play **MiG-29 Fulcrum**, you must first install the game files onto your computer's hard drive. You should also calibrate your joystick before beginning play.

Game Installation

Your gateway to installing and running **MiG-29 Fulcrum** is the AutoRun program. AutoRun will automatically load itself and run each time you insert the **MiG-29 Fulcrum** CD into your CD-ROM drive. **MiG-29 Fulcrum** uses an Install Wizard to place the necessary files on your hard drive.

The AutoRun Program

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

- 1) Place the game CD into your CD-ROM drive and close the drive door. The AutoRun program will now take over. If you have turned off the AutoRun feature or if the Autorun fails to launch automatically, double-click on the **"My Computer"** icon on your desktop and then double-click on your computer's CD-ROM drive letter. This should launch the **MiG-29 Fulcrum AutoRun**.
- 2) Click the mouse on one of the menu choices, or type the letter corresponding to the underlined hot key. The AutoRun menu gives you the following choices:

Start MiG-29 Fulcrum—Select this option to play the simulation. You will first have to install the program on your hard drive.

Install MiG-29 Fulcrum—Select this option to install the simulation onto your hard drive. You must install the game before you can play. This will also automatically install the Mission Editor at the same time.

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

Start Mission Editor—Select this option to create new missions for your MiG-29. To learn how to use the Mission Editor, please refer to the Adobe Acrobat file included on the CD.

Explore CD—This CD also contains informational files and demos of other NovaLogic games. Use this option to see the contents of the CD.


Install DirectX—Make this selection to install DirectX™ onto your hard drive. You must have DirectX 3 or greater installed on your machine to play **MiG-29 Fulcrum**. Multiplayer games require DirectX 5.0 or greater. Windows NT requires Service Pack 3 (obtained at the Microsoft Website) to play single player and Internet multiplayer.

Exit—Exits the AutoRun program.

When you are ready, select **Install MiG-29 Fulcrum**.

Installing MiG-29 Game Files

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

- 1) At the beginning of the installation program you are given the opportunity to select a destination folder for the game. A default destination is typed in the window for you. Press the  key to select the default destination. Otherwise, select your own folder name. If the folder you specify does not already exist on your hard drive, the Install program will create it for you. Further installation instructions will appear onscreen.
- 2) If there is enough free hard drive space at the destination site, the program will copy the files from your **MiG-29 Fulcrum** CD-ROM. An on-screen progress meter displays the completion percentage as the program transfers the files.
- 3) The install procedure automatically adds a **NovaLogic** folder to your **Windows® 95/98 Start Menu** under the

Programs heading. The **MiG-29** sub-folder within the NovalLogic folder contains an application short-cut icon for the game. The install also places a **MiG-29** shortcut icon on your desktop.

4) If your system does not already have DirectX installed, you will need to install it now. Select **Install DirectX** from the AutoRun program, then follow the on-screen instructions. You will need to restart your computer to activate DirectX before you can play **MiG-29 Fulcrum**.

3Dfx™ Users

If the game appears too bright or washed out in 3Dfx™ mode, we recommend that you check the Gamma control of your 3D fx™ card. You can do this by going to the Displays in your computer's Control Panel Settings under the Start Menu.

Calibrating the Joystick

If you haven't done so already, you will need to calibrate your joystick in **Windows 95/98** for it to work properly in **MiG-29 Fulcrum**. Follow these steps:

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

Starting the Game

If your computer is already turned on and the **MiG-29 Fulcrum** CD is in the CD-ROM drive, double-click on the **MiG-29 Fulcrum** shortcut, or go to the directory containing the simulation or Start Menu and double-click on the **MiG-29 Fulcrum** program icon.

If your computer is on, but the program CD is not in the drive, insert the **MiG-29 Fulcrum** CD into the drive and select **Start** from the AutoRun screen. If no screen appears when you insert the CD, double-click on the **"My Computer"** icon on your desktop, then double-click on the icon for your computer's CD-ROM drive. You can then choose **Start** from the AutoRun screen. You may also use your computer's **Find** feature to locate and launch the program.

Enjoy!

Chapter 2:

Quick Start

For those of you who want to jump right into the simulation, select **Quick Mission** from the **Main Menu**. Click **Accept** to get to the **Mission Briefing** and **Accept** again to start the mission. Your MiG-29 will have an appropriate weapons load. To abort the mission, press the **esc** key. In order to utilize the number pad on your keyboard, you will want to make certain that the **num lock** is on.

Press the **pause key if you need to pause the simulation between the steps listed below or at anytime.**

10 Easy Steps to Getting Up In The Air

1) The mission will begin with the camera positioned on the exterior of your MiG-29 Fulcrum. Press **F1** to enter the virtual cockpit. Press it again for an alternate view of the cockpit. Press **F2** if you prefer to use the MiG-29's HUD (Head-Up Display) view.



2) Hit the **backspace** to engage your forsazh (afterburners) You will begin to accelerate down the runway. At around 215 KPH (located in the box at the right side of the HUD), pull up into the air. This could take longer depending on your aircraft's total weight.

3) Press the **G** key to raise your landing gear only if you have changed your Landing Gear to Manual in the Options screen. Climb to a comfortable altitude (generally around 6000 meters). The Altitude Above Ground Level (AGL) is in the right hand box of your HUD. Adjust the engine power with **7** **8** **9** **0** keys or pour on the speed with the "Forsazh" or afterburner (**backspace**) key.) Cut your afterburner to conserve fuel.

4) Now is the time to practice flying. Try making turns and rolls with your arrow keys or joystick. If you are having trouble stabilizing, use the **L** key to auto level the plane. With all aircraft maneuvers, you should try to be deliberate and precise.

5) Level out and take the time to look around your aircraft. This would be a good time to hit **[pause]**. The entire number pad (and hatswitch on some joysticks) allows you look about the cockpit. "Check your Six" (look behind you) by pressing the **[+]** on the number pad. Press **[F3]** to see the exterior of your aircraft. While holding the **[ctrl]** key down, you can move the camera angle with your arrow keys. Pressing the **[S]** and **[X]** keys will zoom the view in and out respectively.

6) Hit **[F2]** to check your HUD for your next Turn Point (a preprogrammed navigational reference point), then proceed there. The caret "^" in the top of your HUD points to your next navigational Turn Point. If you desire, you may press the **[A]** key and the autopilot will direct the MiG-29 there for you.

7) Hitting the **[R]** key will toggle your radar on and off. Radar is used to select a target.

8) Cycle through your weapons with the **[~]** key (or joystick button 3).

9) When you have your target acquired and are in range, press the **[spacebar]** (or joystick button 2) to launch or fire your weapon. At any time you can fire your 30 mm cannon by pressing the **[Z]** button (or joystick trigger).

10) Press the **[O]** key to view your mission objectives. After completing all of them you will be prompted to end your mission. Do so by pressing the **[E]** key. You are not required to land your airplane to complete most missions, but will get a higher score if you do.

10 Easy Steps to Getting Back on the Ground

1) Press the **[H]** key to have the navigational computer guide you directly toward the Initial Approach Turn Point (about 25 kilometers from the runway).



2) When you are facing the correct direction towards this Turn Point, reduce throttle to 70% by pressing **[B]**. Get to an altitude of 1500 meters AGL, with a speed of 740 KPH. Use your air brakes (**[B]**), if you are going too fast.

3) When you get to the Initial Approach Turn Point, begin reducing speed and altitude. When you hit the Final Turn Point (about 8 kilometers from the runway), you should be around 450 meters AGL and flying no more than 460 KPH.

4) Press **G** to lower your landing gear.

5) Align yourself with the center of the runway. Avoid sharp banks and sudden turns. Level your wings, use the **L** key as needed.

6) You should be flying at about 300 KPH. Use your air brakes (**B**), if you are going more than 325 KPH.

7) Check the HUD pitch Ladder. Adjust your pitch to be about 10 degrees.

8) Keep your aircraft aligned with the runway centerline.

9) Just before touchdown, "flare" (pitch) your aircraft's nose up.

10) Press **home** to open your chute, press **Z** to cut engines to idle, and press the **B** key to apply brakes until the plane stops. Congratulations, you may now end the mission.

Chapter 3:

The Menu



The MiG-29 Menu System gives you access to all game features, including campaigns, missions, multiplayer options, and information about the simulation itself. Each session of **MiG-29 Fulcrum** begins at the **Main Menu**, from which you can make the following selections by pressing the underlined key or using your mouse:

Quick Mission

Select **Quick Mission** when you simply want to fly, without the long term considerations of a campaign. **MiG-29 Fulcrum** provides you with a set of missions designed especially for this feature. In addition, whenever you complete a mission in a campaign, that mission is added to the Quick Mission list, so you will be able to select it for replay whenever you want.



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

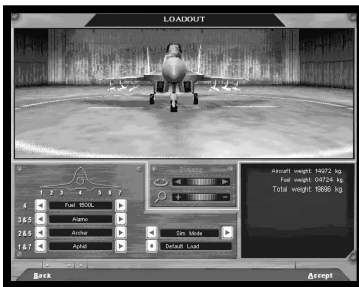


Mission Briefing

When you are given a mission, either because you selected it from the **Quick Mission** list or because you have been assigned a task as part of a continuing **Campaign**, the first element is always a **Mission Briefing**. The briefing details the tasks you must complete before

the mission can be considered over. You are required to achieve all the mission's primary objectives before you are allowed to end the mission.

The **Mission Briefing** screen lets you determine some of the conditions under which you will fly the mission, including the ammunition loadout you will take into the air, the amount of fuel you will carry, and the Map route you will follow to accomplish your goals. Click on **Loadout** to view or change the mission default munitions and fuel aboard, and click on **Map** to check out the battle zone and set your flight route for this mission. Click on the **Accept** box to begin the simulation, or click on **Back** to return to the **Quick Mission** screen.



Loadout

Click on **Loadout** to select what armaments your MiG-29 will carry for this mission. This brings up the **Loadout Options** screen. Here you will see your plane sitting in the hangar awaiting ordnance. As you load the MiG-29, the armament will be placed on the appropriate

stations. You can use the center dials or keyboard arrow keys to walk around or zoom toward the aircraft.

You select your ordnance on the lower left side of the screen. Each station is marked by a number that corresponds with the diagram of the plane. Use the arrow buttons to scroll through the possible armament for each station.

The lower center column contains two options. The first one allows you to choose between **Normal Mode** and **Double Mode**. Normal Mode will limit your aircraft to an authentic Loadout maximum. The Double Mode will double your existing weaponry



without adding the extra weight. Pressing the **Default Load** button will automatically load your MiG-29 with a balanced inventory recommended for this specific mission by the mission designers. If you are undertaking a **Campaign** mission, the number of weapons available is the total number you can have for the entire campaign, unless friendly transport aircraft or convoys bring in more. If the transports in a particular campaign get shot down, you may face ammunition shortages in that Campaign.

The lower right side displays important Loadout information, including the weight of your fuel and ordnance. In Normal Mode, you will not be able to exceed the maximum weight allowance of the MiG-29 (17,700 kilograms).

The heavier your aircraft is, the longer it will take to achieve liftoff. Also with increased drag, your in-air maneuverability will be diminished. However, remember that as you expend fuel by flying, your aircraft will start to become lighter.

When you have finished, click on **Accept** to give yourself the weapons load you have selected and return to the **Mission Briefing**. Click on **Back** to return to the Mission Briefing screen without choosing a Loadout.



Map

Every mission begins with a series of **Turn Points** already entered on the map. Turn Points are locations that your on-board navigational computer can use to give directions to your Autopilot. They are also handy for manual navigation. Your HUD (Head-Up Display) in the front of the cockpit

will direct you toward any selected Turn Point. This simplifies navigation enormously, particularly under conditions where you find it difficult to locate landmarks below, such as at night.

You can move most of the Turn Points on the map, changing the designated mission route. Simply click on a Turn Point and hold the mouse button down while you drag the icon to a new location. Release the mouse button to place the Turn Point in its new location. You will not be able to move the last two Turn Points. These are your **Initial** and **Final Approach** Turn Points, which help you land your airplane. Click on the **Turn Point** buttons to select the next or previous Turn Point. Use the arrow buttons at the right to scroll the map, and click on the **Zoom** buttons to zoom the map in

and out. You can instantly return to the mission default Turn Points settings by pressing the **Default** button.

When you have thoroughly examined the terrain over which you will be flying, and have arranged the mission Turn Points to your satisfaction, click on **Accept** to save your choices and return to the **Mission Briefing** screen. Clicking on **Back** will return to the **Mission Briefing** screen without saving your changes.

Ending a Mission

If you run low of ammunition or fuel on a mission, you may return to your base to pick up more. You will have to land at your base and bring the aircraft to a complete stop before you can be rearmed and refueled. Damage to the aircraft, however, will not be repaired while you are still on this mission.

You must complete all your assigned primary mission objectives before your mission can be considered a success. If, for example, your **Mission Briefing** orders you to shoot down a transport, eliminate its escorting fighters, and bomb its base, and you shoot down the transport and a few fighters, you will still have to accomplish the rest of your primary mission goals to have a successful mission. During a mission, press the **[M]** key to view the list of mission objectives. To get credit for a completed mission you will have to achieve all your primary mission goals. Secondary and bonus goals are only recommended, not required to succeed.

When you complete all the assigned primary goals in a mission, you will receive a text message across the top of your screen, giving you clearance to end the mission by pressing the **[E]** key. This will bring up the **Mission Statistics Screen**, which analyzes your mission performance. In all missions you will receive a score, so you will know how well you did on the flight. To get the most points possible for a mission, do not press the **[E]** key as soon as you have accomplished the mission goals. Wait until you have taken your aircraft back to base and landed it before pressing **[E]**. That way you will receive the **Landing Bonus**, a large addition to your score, awarded once each mission for successfully landing the aircraft back at base.

You may abort any mission at any time by pressing the **[ESC] key. When you abort a mission you will be taken directly to the Mission Statistics screen.**

Campaigns

Choose **Campaigns** to start a new campaign game with a new pilot or continue a campaign in progress with an established pilot. You can have up to ten pilots/campaigns at one time. Use the mouse to select the slot with the callsign of the pilot who will be flying your campaign and press **enter**.



If you wish to edit a pilot's callsign, highlight it, then click on **Edit Name**. You will be able to enter a new callsign for your pilot. To remove a pilot from the list and free up a campaign slot, highlight your pilot's callsign and then click on **Delete Slot**. This will permanently remove that pilot's career from your system. A warning screen will appear to ensure that you wish to complete this action.

On the right side of the screen is the **Pilot Stats**, where you can view your overall performance ratings and score. Press the arrows to see the **Pilot Awards** you have accumulated. The game rewards successful completion of all the missions in a single campaign with a Medal. The Air Force recognizes your hard work and accomplishments; wear your medals with pride. Pressing the arrows again will bring you to the **Campaign Stats**, where you can select which campaign to play. Feel free to switch to a new campaign at any time

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

The Campaigns

MiG-29 Fulcrum consists of five separate Campaigns which you can play in any order. Campaigns are made up of a series of missions linked to a common story line. Actions taken in one mission affect some of the conditions for the next. The goals for subsequent missions can be changed by your success (or lack thereof) in an earlier one. If, for example, you bomb a factory in one mission, it will still be destroyed when you fly over it on your next mission. Similarly, if you allow enemy fighters to destroy your AEW&C plane, it will not be available for the remainder of that campaign



unless another one is sent in. When you are conducting a campaign, you do not select your own missions. MiG-29 will assign missions based on what you have achieved so far in the campaign, and on what the overall campaign requires.

You may also have restricted Loadout choices. Each campaign allows your unit only a certain number of bombs and guided missiles, though supplies may be replenished by friendly transports. You must therefore pay attention to some of the logistical factors in a campaign. If you shoot a lot of R-77 radar-guided missiles, for example, you may run out of them, leaving you only R-73s and your 30mm cannon to combat enemy aircraft until new missiles can be flown in.

Kurile Islands

Russian ultranationalists have created military bases within the Kurile Island chain and are threatening to attack anyone who won't give in to their political demands. The resulting disruption in sea and air traffic is problematic for all the countries in the area, but the belligerent nature of the extremists makes Japan, Russia and the US want to eliminate them. Your Russian squadron will be part of an effort to put an end this boisterous group.

Uganda

Seeking to finally win their 11 year war against the government of Uganda, the People's Resistance Army has begun a major assault on key government positions. Using an influx of funds from outside sources, the PRA has been substantially strengthened with both conventional weapons as well as some chemical and biological weapons. Alarmed over this escalation, Uganda has requested help from other African countries. Kenya and the Democratic Republic of the Congo have agreed to lead an Organization for Peace and Cooperation in Africa (OPCA) force to aid Uganda.

Somalia and Ethiopia

After years of internecine fighting between the various warlords and their clans in Somalia, the Somaliland National Front (SNF) managed to defeat its rivals and unify the country. While the international community was happy to see the long years of bloody struggle end, many voiced suspicions about the number and types of weapons used by the SNF. Upon the full pacification of northern Somalia, the SNF began exploitation of the natural gas and oil deposits discovered by the UN during operations there in the early 1990s. When the deposits were discovered to be very limited, the SNF started to make claims on the known oil reserves in Ethiopia.

Following a swift build-up in its military capability, the SNF has crossed into Ethiopian territory. The international community was quick to condemn this brutal invasion. In cooperation with the member states of the Organization of African Unity and the United States, the Russian Federation has dispatched forces to help roll back this invasion.

Burma (Myanmar)

The most powerful drug lord of the Golden Triangle has managed to unify the disparate drug armies and seize control of Burma. After defeating the Burmese government he consolidated his power and is now threatening to take over parts of Thailand, Laos and even China in order to control all areas of Opium production. Both ASEAN and the UN have authorized a US led peacekeeping force to stabilize the region. MiG-29s from the Malaysian AF and Russia will be operating in assistance of coalition forces.

Tajikistan

After several years of quiet in the Tajikistan civil war, Tajik militants backed by an influx of foreign funds have begun a large-scale assault on the legitimate government. Still trying to rebuild its economy from the years of civil war, the government of Tajikistan is unprepared to fight off this latest unprovoked aggression. In a speech before the United Nations the President of Tajikistan asked for international assistance to defend his country. In an internationally televised address from the Kremlin, the presidents of the Russian Federation and Tajikistan announced the mobilization of a joint CIS effort to defeat the forces which threaten to destabilize Tajikistan.

Multiplayer

MiG-29 Fulcrum allows for the exciting possibility of fighting against up to 128 opponents on NovaWorld and the challenge of facing the F-16 Multirole Fighter™ and F-22™ Raptor™ in **Integrated Battle Space**. See **Chapter 9: Multiplayer** for more details.

Options

The **Options** selection lets you choose a variety of game-related parameters, allowing you to set up the game for best performance on your system. It also gives you options concerning some of the features you can include in a MiG-29 game. Access the configuration features via the **Options** choice on the **Main Menu**. Press **Accept** to accept changes and return to the **Main Menu** screen.

Video Options

Game Fullscreen

Select **No** from the **Game Fullscreen** option to run the game inside a **Windows** window. Selecting **Yes** gives you a full-screen view of the simulation. When you are playing the simulation you may also toggle between the choices by pressing both **[ctrl] + [V]**.



Game Resolution

Choose the screen resolution that is most suitable for your computer. The options are **640 x 480**, **800 x 600**, and **1024 x 768**. The higher the resolution, the finer the graphical detail will be, however the game will play slower.

3D Card

Select **Enabled** if you wish to use your 3D card to enhance the graphical representation of the simulator. If your system does not have a suitable 3D card or lacks the appropriate drivers, then only the **Disabled** option will be available. Select the **Video Information** button below to see the specific set up of your system.

Menus Fullscreen

Select **No** to display the pre-game menus inside a **Windows** window. Selecting **Yes** gives you a full-screen view of the menus. Depending on your system, you may need to have this option enabled to connect to NovaWorld.

Video Information

Pressing the question mark will have **MiG-29 Fulcrum** auto-detect your systems configuration.

Audio Options

Sound FX Volume

Use the mouse to slide the bar to an appropriate volume level for game sounds.

Music Volume

Use the mouse to slide the bar to an appropriate volume level for the menu music.

Menu Music

Disabling this option will override the **Music Volume** control and turn the menu music off.

Avionic Sound Cues

Select **Enable** to hear indicator tones and beeps given off by your MiG-29's computer.

Voice Dialog in Russian

Select **Enabled** to hear voice dialog, such as your Wingman, in Russian. This option helps to immerse you in the realism of flying a MiG-29, but may be unhelpful to players who are not fluent in Russian. **Disabled** will play dialog in English.

Voice Dialog Volume

Use the mouse to slide the bar to an appropriate volume level for game dialog.

Control/Performance Options

Joystick

When you select **Enabled**, your joystick will be the primary flight control device for the simulation. If you select **Disabled**, the keyboard's arrow keys are the only way to fly the MiG-29.



Joystick Type

This option provides you with a list of joystick types to choose from. Select the one that matches your joystick. If your joystick brand is not listed, use the **Standard** option.



Throttle Controller

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

Rudder Pedals

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

Ground Steering

This selection lets you determine what method of steering control you use when on the ground. Your selections are **Stick** or **Rudder Pedals**. Selecting **Stick** means that the joystick (or the arrow keys if you have no joystick installed) steers the aircraft while it is on the runway. Select **Rudder Pedals** if you want to steer the aircraft with rudder pedals or the rudder keys  and . In this mode, the arrow keys will not affect ground steering.

Texture Distance

This slide controller allows you to set the distance at which the MiG-29 simulation will apply textures to the terrain. Players with slower machines should move the slider to the left to speed up the graphical presentation.

Memory Usage

Your choices are **High**, **Medium**, and **Low**. Select **High** if your system is well equipped with RAM. Select **Low** if you have a small amount of RAM.

Flight Model Options

Blackouts/Redouts

Sharp turns and rapid acceleration can cause severe G-force consequences to an aircraft's pilot. High-G turns, for example, cause blood to drain from the pilot's head, leading to blackouts. Similarly, maneuvers that bring about negative-G situations can cause the body's blood supply to rush to the head, filling the eyes with blood and causing a redout. If you do not want this degree of realism in a MiG-29 mission, turn this selection to **Off** before you fly.



Shoot List

Auto creates a shootlist whenever you have targets available. If you select **Manual**, you will have to press the **enter** key to have your aircraft create a shootlist.

Joystick Mapping

Your joystick's **Cannon Priority Default** configuration is described in **Chapter 4: Joystick Buttons**. Select **Weapon Priority** to shift all of the buttons down one so that the Trigger will now fire your currently selected weapon. In this configuration, hold down button 4 to move the camera angle around. The **Weapon Priority** configuration is generally preferred for 2 button joysticks.

Landing Gear Up

Select **Auto** to have your MiG-29 automatically raise its landing gear after takeoff and lower them when you slow to less than 465 kph while landing. **Manual** means you perform this task yourself.

Unbalanced Loadouts Effects

If you select **Enabled**, your plane will list/roll when your loadouts are unbalanced by firing ordnance from only one wing. With this feature set to **Disabled**, your plane's balance is not affected by unbalanced loadouts.

Flameouts

In certain circumstances, the engines of the MiG-29 can lose all power in a flameout. The engine will try to re-ignite itself, but may not be successful. Select **Enabled** if you want this level of authenticity. Choosing **Disabled** will not allow the MiG-29 to experience flameouts.

Flatspins

In rare cases, a wrong maneuver can throw the aircraft into the dangerous flatspin. Recovering from this predicament is nearly impossible. Select **Enabled** if you want this level of authenticity. Choosing **Disabled** will not allow the MiG-29 to experience flatspins.

Map Keyboard and Joystick



You have the ability to alter any of the Keyboard commands and Joystick buttons to suit your tastes. Using the mouse, click on the command that you would like to change. When the **Status** bar indicates that input is on for that command, type the key or push the button that you would like to be used for that command. If the message in the Status bar

indicates that "Input is off", then nothing will be changed if you hit a key or button. The Status bar will also indicate if there is a conflict with another command sharing the same key.

Use the left-hand scroll bar to see all possible Keyboard and Joystick commands. Select the **Revert All** button to change all keys or buttons back to your last saved configuration. Pressing the **Default All** button will change all of the keys or buttons back to the original configuration set by NovaLogic. Under this is a **Default** button to reset only the selected command back to the original configuration and a **Delete** button to remove all keys or buttons associated with the corresponding command. This is useful in avoiding conflicts.

Overview

This section highlights key points of the **MiG-29 Fulcrum**.

Credits

Make this selection to learn more about the people who created the **MiG-29 Fulcrum** simulation.

Exit

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



Menus

Chapter 4:

Controls

The Joystick

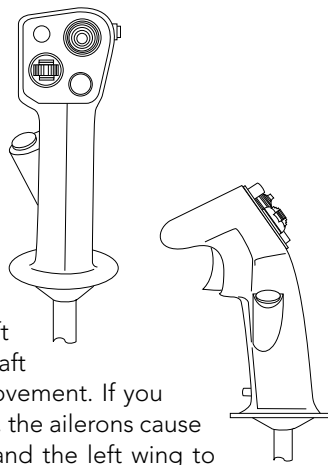
All game controls can be found on the keyboard, however the preferred flight control device for the **MiG-29 Fulcrum** simulator is the joystick. With a little practice, using the joystick will help immerse you into the aircraft's cockpit. When flying, try to make your stick movements definite and purposeful. A good pilot is always in positive control of the aircraft.

The Stick

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

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

Sharp turns increase the G forces exerted on the aircraft, which may cause it to lose both airspeed and altitude or begin to shake as its airframe becomes compromised. High G stresses can also cause the pilot to become unconscious. Save your extreme maneuvers for times you really need them, like when you are trying to dodge a missile or get behind an enemy aircraft.



Joystick Buttons

MiG-29 supports joysticks with up to sixteen buttons, and includes a number of custom joystick configuration files. You can reconfigure the joystick buttons in the **Options** screen.

The Cannon Priority Default configuration for the joystick buttons is as follows:

- **Button 1**—The **Trigger** button fires several rounds from your 30mm cannon.
- **Button 2**—Fires or launches your selected weapon.
- **Button 3**—Cycles through all the targets on your Shootlist.
- **Button 4**—Cycles through your available weapons.
- **Hat Switch**—The four hat switch positions perform the following functions:

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

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

Left—Look out the cockpit to the left.

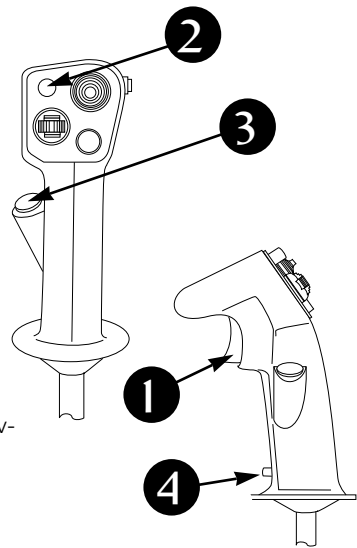
Right—Look out the cockpit to the right.

Use the Options screen to select your specific joystick type or reconfigure the joystick buttons.

Rudder Controls

The rudders cause the airplane’s nose to swing to the left or right (this motion is called “yaw”). Modern aircraft integrate the rudder into the operation of the joystick, automatically applying the proper amount of rudder to enhance the operations of the ailerons.

You can use rudder inputs to make your flight maneuvers more extreme, which can be useful in combat. Use the rudder to exaggerate your other control motions. Step on the right rudder, for example, when you are making a right-hand turn with the joystick. The actions of the rudders will bring the nose of the



aircraft around more quickly than the effect of the ailerons and elevators alone. You can also use the rudders to make flight inputs in the opposite direction from your other controls. If you can control the instability of the flight path, it will make it difficult for an enemy to stay with you.

Throttle Controls

To better simulate the MiG-29, you have the option of attaching an external throttle controller. Pushing the throttle forward will increase the engine's thrust. Moving the throttle all the way forward equates to using full afterburners. In the **Options** screen, you can reverse the direction of the throttle device.

Keyboard Controls

MiG-29 Fulcrum uses the keyboard to control many of the on-board systems in the airplane, and to control a wide variety of camera views. The keyboard also gives you alternate methods of exercising flight control, and provides a means of communicating with your wingman. In addition, you use the keyboard for game functions not specifically related to flying the MiG-29.

General Game Controls

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

esc **Exit Mission**—Press the **Escape** key to abort your current mission. You will have the option to change your mind before the mission aborts.

pause **Pause**—Use this key as a toggle to halt/resume the current mission. This key does not function in multiplayer games.

ctrl **Reverse Cycle**—Used in combination with some other keys, **Control** will reverse the direction of a cycling list. For example, if you press **Control** with **Tab**, you will cycle through your targets in the reverse order.

? **Keyboard Help**—Use the **Question Mark** key to bring up an on-screen key control summary. Press **?** again to remove the list from the screen.

O **Mission Objectives**—Press **O** to toggle a list of your mission goals and their status.

Y **Recent Messages**—Keeps a list of the most recent dialog from the computer and other players.

ctrl V Window/Full Screen—Use this key combination to toggle your screen mode from **Full Screen** to **Windowed** and back.

E End Mission—Press the **E** key to end the current mission and receive an evaluation of the mission's success or failure. You can only use this key when you have completed all the primary objectives in your current mission or when you have failed a mission.

Keypad Views

MiG-29 provides an extensive series of perspectives from which to operate or view the simulation. Use the various points of view offered to increase your situational awareness. If there is one single rule for success in fighter aircraft, it is, "keep your head moving". You must always be looking around for threats and opportunities.

With the exception of **keypad 8**, the below views are static. You cannot pan, tilt, or zoom the image. When in one of the perspectives, pressing the key a second time will return you to the screen from which you entered the view. You must have **Number Lock** on in order to utilize the keypad on the side of your keyboard.

Keypad 1 Flap/Gear Indicator—Press this key to look down at your lower left-hand instruments.

Keypad 2 Look Down—Press this key to look down at the lower center gauges.

Keypad 3 Radar Warning—Press this key to look down at your lower right-hand instruments..

Keypad 4 Left Console—Press this key to view the instruments on the left side of the cockpit.

Keypad 5 Center Console—Press this key to view the center controls.

Keypad 6 Right Console— Press this key to view the instruments on the right side of the cockpit.

Keypad 7 AOA/G Indicator—Press this key to look at the upper left side of the cockpit.

Keypad 8 Virtual Cockpit—Press this key to view the entire virtual cockpit. Using Control and arrow keys will shift the perspective from here.



Keypad [9] Radar/IRST—Press this key to look at the upper right side of the cockpit including your Radar Scope.

Keypad [7] Look Left—Press the **slash** key to look out the left side of your aircraft's cockpit.

Keypad [*] Look Right—Press the **asterisk** key to look out the right side of the cockpit.

Keypad [-] Look Forward—Press the **minus** key on the keypad to look straight ahead out of the cockpit.

Keypad [+] **Check Six**—Press the keypad **plus** key to quickly look behind you. Use this key often.

Camera Controls

You can control the position of the camera while in the virtual cockpit view and external camera view.

[S] Zoom In Slow—Press this key to magnify your camera view or display range and zoom in on the object you are viewing.

[ctrl] [S] Zoom In Fast—As above, but faster.

[X] Zoom Out Slow—Press this key to expand your camera view or display range and zoom your perspective out.

[ctrl] [X] Zoom Out Fast—As above, rapidly.

[ctrl] [↑] Tilt Up—Pressing the up arrow while holding down on the control key will move the perspective up.

[ctrl] [↓] Tilt Down— Moves the camera perspective down.

[ctrl] [→] Pan Right—Moves the camera perspective to the right.

[ctrl] [←] Pan Left— Moves the camera perspective to the left.

Perspectives Controls

The Function Keys will control the various camera views in **MiG-29 Fulcrum**.

[F1] Virtual Cockpit View—Press the **F1** key to place yourself in the cockpit, looking forward through the Head-Up Display. Press again to zoom closer to the HUD. This is the most common perspective from which to operate the MiG-29.


[F2] HUD View—Pressing the **F2** key puts you in a perspective similar to that available via the **F1**, but removes the cockpit frame from the screen, giving you a little better view of the terrain outside your aircraft.

- F3 External View**—Press the **F3** key to show an external view of your aircraft. You can move or zoom the camera perspective. Press again to see alternate external views. See the **Camera Controls** section for how to change the camera point of view.
- F4 Fly-By View**—Pressing the **F4** key puts you at a fixed point outside your aircraft, watching it fly past your location.
- F5 Target Padlock View**—If you have a target designated, pressing the **F5** key will keep the target centered in your field of vision, regardless of where it moves.
- F6 Wingman External View**—Brings up an external view of your wingman's plane. This view is movable.
- F7 Missile Toggle**—Press this key to watch your missile fly past a fixed location. Press the **F7** key again to get a movable external camera view of your missile. The **F7** key now toggles you between these two perspectives.
- F8 Target View**—Press this key to access a movable external camera view of your current target.
- F9 Cobra View**—This key will give you a unique view of the MiG-29 geared towards practicing the Cobra Maneuver.
- F10 HUD On/Off**—Toggle your Head-Up Display on and off with this key.
- F11 Attack Display**—Toggle an overlay view of your Situational Awareness Mode on and off with this key.
- F12 Time compression**—The MiG-29 simulation allows you to “speed up” the passage of time by using the **F12** key. Moving the aircraft or pressing this key again will return back to normal speed. This key does not function during multiplayer games.

Engine Power Settings







The throttle controls regulate the amount of thrust being produced by your engines. Higher power settings increase your thrust, but they also increase fuel consumption alarmingly. Keep your eye on the amount of fuel you have remaining. Use the number keys at the top of the keyboard to control the engines.

Since the MiG-29 has two engines, you can control each one independently. To do so, hold down the **shift** for **Left Engine** only or **ctrl** for **Right Engine** only settings in addition to pressing the appropriate key.

- 6 **0% Power; Engine Off**—Press this key to shut down your engines.
- 7 **35% Power; Taxi**—Press the **7** key to turn your engine on and idle. If on the ground, you will begin taxiing.
- 8 **70% Power; Landing**—Press this key to bring your engine to the suggested amount of thrust for landing.
- 9 **85% Power; Cruise**—Press this key to set your engine output to 85% for normal flying.
- 0 **100% Power; Full Military Power**—The **zero** key on the keyboard puts your engine power to 100%, useful for most combat engagements.
- **Decrease Thrust**—Pressing the **minus** key decreases your engine power in small increments.
- = **Increase Thrust**—Pressing the **equals** key increases engine power slightly each time you press it.
-  **Forsazh**—Press the keyboard's **Back Space** key to engage your “Forsazh” or afterburner. Using the Forsazh gives you a large boost in engine power, but uses fuel at an astonishing rate.

General Flight Controls

The following keys control flight operations and some of the airframe systems aboard the MiG-29. Some of these keys duplicate the functions of other flight control devices, such as a joystick or rudder pedals.

-  **Pitch Down**—Press this key to pitch the nose of your aircraft downwards.
-  **Pitch Up**—Press the **Down Arrow** key to pitch the nose of your aircraft upwards.
-  **Roll Left**—Press this key to bank your wings and roll the aircraft to the left.
-  **Roll Right**—Use the **Right Arrow** key to bank to the right.
-  **Right Rudder**—Press this key to yaw the nose of your aircraft to the right.
-  **Left Rudder**—Yaws the nose of your aircraft to the left.

G **Gear Up/Down**—The **G** key raises and lowers your landing gear. A small “G” appears at the lower right of the screen when the gear is down. The landing gear will automatically raise when your airspeed goes over 465 kph and lowers when you approach the landing field below 465 kph.

B **Air and Ground Brakes**—Press the **B** key when in flight to extend the MiG-29’s air brakes. On the ground, pressing **B** engages the craft’s wheel brakes, allowing you to come to a stop. A small “B” appears at the lower right of the screen when you apply air or wheel brakes. The brakes will disengage when you release the key.

ctrl **B** **Brakes Toggle**—Press **B** and the **Control** key at the same time to toggle brakes on and off. The brakes will remain engaged until you press these keys again.

F **Flaps Up/Down**—To slowly bleed off speed and increase lift, use the **F** key to move your aircraft’s flaps. A small “F” appears at the lower right of the screen when you have your flaps extended.

home **Drag Chute**—Press this key when you touchdown to deploy the drag chute. This will help to rapidly slow down the MiG-29. A small “C” will appear in the lower right of the screen to indicate that your chute has been deployed.

ctrl **E** **Eject**—Use this key combination to exit a stricken airplane. Ejection from an aircraft in the inverted flight position at very low altitudes may be fatal.

< **HUD Dim**—This key decreases the contrast/brightness of your HUD display.

> **HUD Bright**—This key increases the contrast/brightness of the HUD display.

Navigation Controls

These keys control some of the navigational capabilities of the MiG-29, mainly to allow hands-off flight control and allow you to get back to base quickly and easily.

A **Autopilot**—Use this key to engage your Autopilot. When engaged, the autopilot will take your aircraft automatically to the next selected turn point. Exercising any of the manual flight controls, or pressing the **A** key again, will disengage the autopilot.

- [N] Cycle Turn Point**—Press the **N** key to cycle through your mission's Turn Points. When you engage the Autopilot, it will automatically head for the next selected Turn Point.
- [L] Auto-Level**—Pressing the **L** key will immediately put your MiG-29 in straight and level flight.
- [H] Home**—Pressing the **H** key engages the Autopilot to take you to the initial approach point of your home runway.

Weapon Controls

The following keys allow you to select weapons and countermeasures aboard your MiG-29. You will quickly become very familiar with these controls, or you will be dead. Use the keyboard (not the keypad) number keys to control the appropriate functions.

- [~] Cycle Weapons**—Press the **Tilde** key to cycle through your available ordnance.
- [1] Nav**—Press this key to deselect all weapons.
- [2] Cannon**—Press this key to ready the GSh-301 30mm cannon. The cannon does not require radar for use, but when you select the 30mm cannon, the MiG's radar will only target air objects.
- [3] Air to Air Missiles**—This key cycles through all of your available Air To Air Missiles.
- [4] Air to Ground Missiles**—Press this key to cycle through all of your available Air to Surface Missiles.
- [5] Bombs**—Press this key to cycle through all of your bombs.
- [spacebar] Fire Selected Weapon**—Press the **Space Bar** to fire or drop the selected weapon or fuel pod.
- [Z] Fire Cannon**—Press the **Z** key to fire your 30 mm cannon.
- [C] Chaff**—Press this key to release a bundle of chaff to throw off an enemy missile's radar lock.
- [D] Flares**—Press the **D** key to deploy a series of flares to confuse an enemy heat-seeking missile.
- [ctrl][J] Jettison Stores**—Press these keys to immediately drop all ordnance and fuel pods with the exception of Air to Air

Missiles. This emergency only technique will drastically lessen your aircraft's weight in just a few seconds to give you additional speed and maneuverability. All weapons will jettison unarmed.

ctrl **K** **Jettison Current**—This key combination will jettison only the currently selected ordnance.

Radar Controls

Your radar is instrumental in tracking targets for many of your weapon systems.

R **Radar On/Off**—Use this key to toggle your APG-68 radar from **Standby** to **On** and back. A small "R" will appear at the lower right of the screen when you have the radar turned on.

enter **Build Shootlist**—If you have disabled the Auto Shootlist in the **Options**, you will need to press this key to create a list of available targets.

tab **Cycle Targets**—Press this key to cycle through all detected objects that are in the forward arc of your aircraft and less than 74 kilometers away.

L **Select Previous Target**—Use the **Left Bracket** key to cycle backwards through the targets currently on your shootlist.

J **Select Next Target**—Press the **Right Bracket** key to cycle forward through the targets currently on your shootlist.

' **Boresight**—Press the **Single Quote** key to target the nearest object directly ahead of your aircraft.

insert **Previous Radar**—This key is used to cycle your radar through all of its possible modes.

page up **Next Radar**—Press this key to cycle your radar through all of its possible modes.

scroll lock **IRST On/Off**—Press this key to toggle your Infrared Search and Track system on and off. A small "I" will appear in the lower right of the screen when you have your IRST activated.

M **Tactical Map**—This full screen grid map is highly useful in Multiplayer games. Use the grid coordinates to communicate your location to teammates.

Wingman Controls

These keys allow you some control over the actions of your Wingman. Your flight companion has a large degree of freedom when it comes to carrying out these directives.

- W** **Wingman Command Menu**—Brings up a list of commands you can give your Wingman.
- ctrl 0** **Wingman Cover**—Pressing the Ctrl **zero** key combination directs your wingman to form up on your right wing. Your wingman will maintain this formation until ordered otherwise.
- ctrl 1** **Evasive Maneuvers**—Directs your wingman to maneuver to avoid incoming missiles.
- ctrl 2** **Wingman Engage**—Press these keys to order your wingman to engage targets at will.
- ctrl 3** **Wingman Attack My Target**—Your wingman will immediately engage the target you have locked on radar.
- ctrl 4** **Break Right and Engage**—Orders your wingman to make a sharp turn to the right and engage at will.
- ctrl 5** **Break Left and Engage**—As above, but to the left.
- ctrl 6** **Engage My Target's Attacker**—If you have a friendly aircraft locked into your targeting system you can use this command to order your wingman to engage any enemy aircraft that attempts to attack the friendly.
- ctrl 7** **Escort My Target**—Again, if you have a friendly aircraft in your targeting system, you can order your wingman to accompany that friendly aircraft and guard it from attack.
- ctrl 8** **Cover Me**—Directs your wingman to engage any hostile aircraft with a radar lock on your aircraft.
- ctrl 9** **Wingman Patrol Home Base**—Press these keys to order your wingman to return to your home base. Once there, your wingman will begin a Combat Air Patrol, keeping enemy aircraft away from your base.

Multiplayer Keys

Certain keys only have value in Multiplayer games.

- **T** **Chat Mode**—Press the **T** key to send a text message.
- **Shift T** **Squadron Chat**—Press the **Shift** and **T** key together to send a private message to your squadron only.
- **P** **Player List**—Lists all players currently in the game.
- **Q** **Show Squadron**—Lists all members of your squadron who are currently playing in your game.
- **;** **Top 8 Players**—Use this key to see which players are leading the game.

Mouse Controls

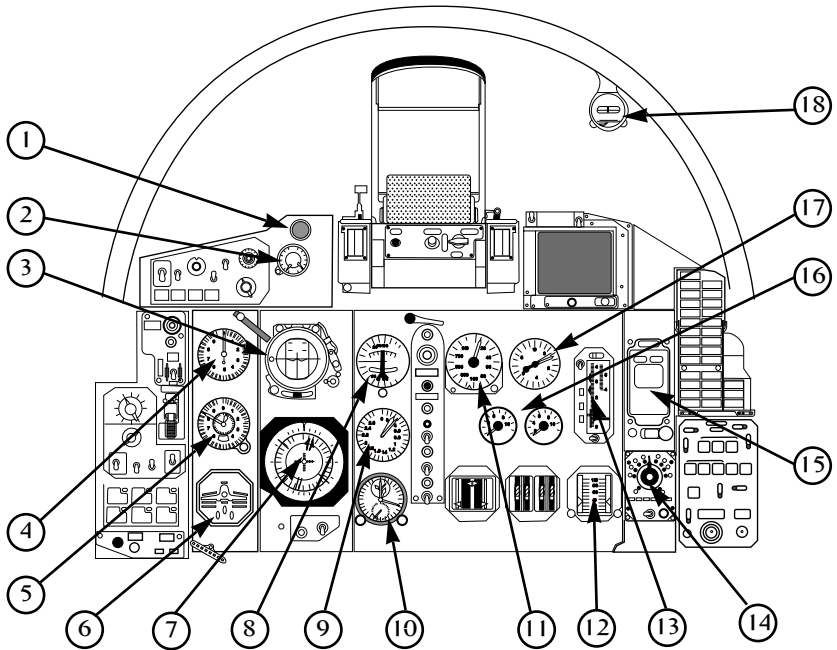
There are several areas on the MiG-29's virtual cockpit where you can zoom in by pressing the mouse button. When the mouse encounters one of these hot spots, its icon will change.

Chapter 5:

Displays

The Cockpit Instruments

Your cockpit contains a wealth of information to help you fly the MiG-29. You should familiarize yourself with the various functions and their uses.



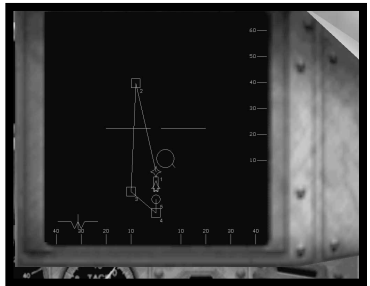
- 1) **Master Caution** – Flashes when there is an instrument warning.
- 2) **AoA/G Indicator** – Left dial reads from zero to positive 30 degrees Angle of Attack. Right dial indicates positive gravitational force (from 0 g – 9 g).
- 3) **Attitude Indicator** – aircraft's relative position compared to its internal gyroscopic readings.

- 4) **Airspeed Indicator** – measured in kilometers per hour.
- 5) **Barometric Altimeter** – ASL (Above Sea Level) measured in meters.
- 6) **Flap/Gear Indicator** – Green lights indicate when your gear is down and locked.
- 7) **Heading Situation Indicator** – Heading of the MiG in degrees (0-360).
- 8) **Turn and Slip Indicator** - When the outer dial is pointing directly left the vertical velocity is at zero meters per second. It can measure clockwise to 200 meters per second or counter clockwise to negative 200 meters per second. The center dial shows the plane's deviation from north heading.
- 9) **Mach Meter** – measures from zero to 2.8 mach.
- 10) **Clock** – Main dial displays current time. Small upper dial measures elapsed mission time. Small lower dial measures time to next turn point.
- 11) **Radar Altimeter** – AGL (Above Ground Level) in meters. Display pins at 1000 meters.
- 12) **Ramp Indicator** – Each engine nozzle measures from zero to 100 percent open.
- 13) **Fuel Gauge** – displays remaining fuel.
- 14) **Threat Warning** - Red light will appear in the direction of a radar emitting potential threat.
- 15) **EKRAN Panel** – Instrument warnings will appear on this screen.
- 16) **FTIT** – Temperature gauge for each engine, measures from zero to 1100 degrees Celsius.
- 17) **Tachometer** – One needle for each engine, measures from zero to 110%.
- 18) **Standby Compass** – Heading measures from zero to 360 degrees.



Radar/IRST Scope

This right hand display is very useful in tracking enemies and following turn points. The numbered Turn Points and connecting lines are set up exactly like the Map in the Mission Briefing. This display has two modes, Radar mode and Infrared Search and Track mode. Enemy targets will appear as triangles, Friendlies will appear as circles and unidentified targets show up as squares. A small line attached to the symbol will indicate which direction they are heading. Your selected target will be encased in a circle. The centerline indicates the roll of your aircraft. The ticks at the end of these lines will point towards the horizon to indicate whether you are diving or climbing. Information regarding your Turn Point can be found in the bottom corner. Use the **[S]** key to zoom in and the **[X]** key to zoom out. Use the **[insert]** and **[page up]** keys to cycle through the radar modes. Your scope has three modes which it can be set to:



NAV Mode

This mode will identify Turn Points, AEW&C support information, predetermined bombing targets and other aircraft at your maximum sensor range.

Air To Air Mode

This mode will only show AEW&C support information and aircraft targets within your sensor's combat range.

Air To Ground Mode

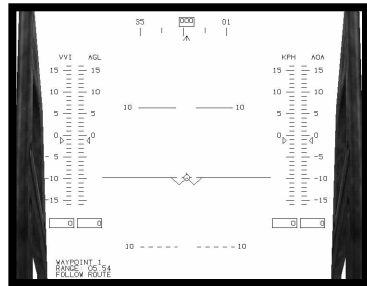
This mode will only show preprogrammed ground targets such as buildings and SAM sites.

Warnings

Your onboard computer will warn you of most hazardous conditions. Receiving the **WARNING** or **CAUTION** message indicates that you should check your instrument panel for possible system failures. Unless you are in the process of landing, you will hear an **ALTITUDE** warning when your MiG-29 dips below 120 meters. The warning **STALL** denotes that your speed is too low for the Angle of Attack you are attempting.

Head-Up Display (HUD)

The MiG-29's Head-Up Display (HUD) projects the most useful data onto a transparent screen in front of the pilot. This allows you to view important information without having to take your eyes off where you are going. The HUD displays information from many sources, including the avionics systems, radars, and weapons systems aboard your aircraft, all in an accessible and compact format.



1. **Selected Turn Point** – Gives the number of the selected Turn Point. Cycle through the Turn Points for the mission with the **N** key.
2. **Turn Point Comments** – Any special instructions associated with the selected Turn Point will appear here.
3. **Range to Next Turn Point** – The distance to the currently selected Turn Point, in kilometers.
4. **Vertical Velocity Indicator (VVI)** – Listed in meters per second.
5. **Altimeter (AGL)** – At the left of the HUD is a scale and a box containing the aircraft's current altitude, in meters AGL (Above Ground Level).
6. **Selected Weapon Indicator** – At the bottom left of the HUD your MiG-29 displays the currently selected weapon and the number of weapons or rounds available. Use the keyboard **[~]** keys to cycle through the weapons.

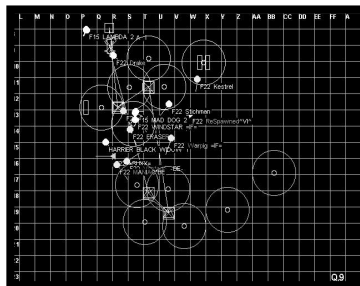


7. **Turn Point Cue** – The “caret” (^) marker indicates the direction to steer to reach the next Turn Point.
8. **Compass Heading Tape** – At the top center of the HUD screen is a magnetic tape indicating the current compass heading of the aircraft.
9. **Pitch Ladder** – The horizontal lines bisecting the center of the HUD are part of the Pitch Ladder. The numbers at the end of the pitch ladder lines show the pitch angle of the nose of your aircraft. Positive numbers represent angles above the horizon, while negative numbers indicate that your nose is pointing below the horizon.
10. **Airspeed Indicator (KPH)** – Measures the indicated airspeed for your MiG-29 in kilometers per hour.
11. **Angle of Attack (AoA)** – This is a measurement of the angle between the chord line of your wing and the angle at which the wing bites into the air measured in degrees. High angles of attack can lead to loss of lift. A negative angle of attack means that the front of your wing slants downward towards the ground, while an angle of 0 (zero) degrees means you are in level flight.
12. **Flight Path Indicator** – The small circle with the vanes extending from its top, bottom, and sides is the Flight Path Indicator. At any given moment the Flight Path Indicator points directly to where your aircraft would wind up if all flight parameters remained the same. If you are flying straight and level the Flight Path Indicator should rest right on the center peak of the “W” of the Watermark.
13. **Watermark** – In the middle of the HUD is a “flying W” shape, called the Watermark. This shape represents your airframe in relation to the horizon. The center peak of the “W” is the top of your aircraft, while the “wings” that extend the shape represent the bottom of your plane. If it appears as an “M”, then you are flying upside down.
14. **Selected Turn Point** – Shows the number of the selected Turn Point. Cycle through the Turn Points with the **[M]** key.
15. **Range to Next Turn Point** – Gives the distance in kilometers to the next selected Turn Point.
16. **Turn Point Instructions** – Any special preprogrammed instructions associated with the selected Turn Point will appear here.

17. **Target ID** – The top line of this section gives you the target type for the current target, and assigns that target a unique identifier.
18. **Velocity of Closure** – The VC represents the rate at which your aircraft and your target are approaching one another in kilometers per hour. A negative number indicates that your target is moving away from you.
19. **Range to Target** – The range to the selected target in kilometers.
20. **Target Box** – When the selected target is within your radar orIRST range, it will appear as a solid box. A diamond with this box indicates that the target has been acquired by your weapon system and you may fire. All other targets appear as dashed boxes.
21. **Impact Point** – The bomb fall line and Impact Point will appear when you have a bomb as your selected ordnance. It shows you where a bomb would hit the ground when released.

Tactical Map

Press **M** to bring up the Tactical Map. This God's Eye view is extremely useful for coordinating attacks in Multiplayer games. Refer to the grids to effectively communicate your location to teammates.



Chapter 6:

Flying MiG-29

Tutorials

You can fly any available MiG-29 mission whenever you wish, but we recommend that you begin your experience with this simulation by undertaking the **Tutorial Missions**. It won't take long, and even if you are an experienced flight sim pilot, you will come out of the experience better able to control the MiG-29.

The MiG-29 Tutorial Missions are part of the Quick Mission set, available from the Main Menu.

Mission #1—Introduction to the basic workings of the aircraft.

Mission #2—Practice Landing.

Mission #3—Introduction to Air Combat Maneuvers.

Mission #4—Basics of combined arms exercises focusing on Air to Ground Combat.

Mission #5—This mission has no enemies or other distractions, and is designed to give you a place to practice flying the MiG-29.

Prepare for Takeoff

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

- Check your HUD. Note the altitude of the runway and the direction you are pointing. When you return to base you will want to know this information. In the lower right of the screen you should see the letters **G**, **F**, **B**, **I**, and **R**. They indicate that your landing gear is down, your flaps are extended, your brakes are engaged, and your IRST and radar is on.
- Turn on the engines. Press the keyboard **[7]** to turn your engines on and set them to idle.

Takeoff

Once you are cleared for takeoff, you will need to quickly bring the aircraft up to speed before you can achieve liftoff. Takeoff velocity in the MiG-29 is approximately 215 kph (kilometers per hour), depending mainly on the loadout weight of your aircraft.

- Set your engines to Full Military Power (100%). Press the **0** (zero) key to bring up maximum normal thrust. Your MiG-29 will start to accelerate down the runway, rapidly picking up speed. Keep your eye on the Airspeed Indicator at the right of the HUD. It should reach 215 kph about one-third of the way down the runway unless you have an exceptionally low or high loadout weight.
- If you need to get in the air quicker, use your “forsazh” or afterburner by pressing **backspace**.
- When the Airspeed Indicator reaches 215 kph, you are ready to “rotate,” or liftoff from the runway. Pull back gently on the stick, and keep a little back pressure on. Pitch the nose of your aircraft up about 20 degrees (use the HUD Pitch Ladder to determine your pitch.) Gain some altitude as soon as possible, just in case an engine should fail or some other in-flight emergency occurs. You do not want to be too close to the ground if that happens.

Climb Out to Mission Altitude

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

- As soon as you are airborne, it's safe to raise your landing gear. If you selected Manual Landing Gear in the Options, press the **G** key. The small “G” at the lower left of your HUD should disappear, indicating that the gear is up. Your landing gear can not handle the pressures of high speed and become in danger of tearing off at airspeeds greater than 465 kph.
- At this point, you should reduce thrust to save on fuel. Press the keyboard **9** key to put your engines on Cruise setting. You will hear a distinct difference in the sound of the engines.
- Maintain a steady climb, keeping your pitch angle at about 20 degrees. Your Altimeter, in the box on the left side of the HUD, gives you the altitude of your aircraft, in meters Above Ground Level (AGL).

- When you reach an altitude of about 7500 meters, level off. You can do this manually by using the joystick, or you can just press the **[L]** key. This automatically puts the MiG-29 in straight and level flight. You are ready to continue with your mission.

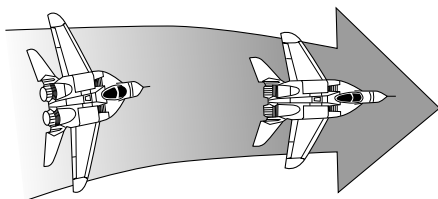
Basic Flight Maneuvers

Your piloting skills will improve with understanding and practice only. You should take ample time to master each of the Basic Flight Maneuvers (BFM) listed below. This fundamental understanding is key to your survival.

Always know where you want to put the plane. You should make deliberate and controlled movements to get it there.

Turns

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

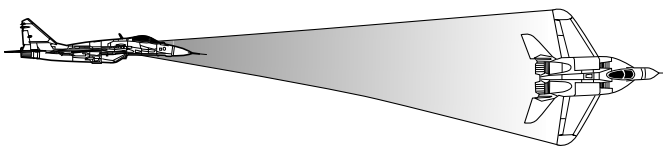


- Start this series of turns from level flight. You will not, of course, always be in level flight when you initiate a turn, but for this practice session start from straight and level. Use the **[L]** key to level your aircraft if you have trouble keeping it stable.
- Note the direction you are flying. Check the compass indicator in the box at the top of your HUD to determine your compass heading.
- Note your speed and altitude. The boxes at the side of the HUD will tell you your airspeed and altitude above sea level.
- Now make a 120 degree turn to the left. Push the handle of your joystick part way to the left, and at the same time pull back on it slightly. Hold your aircraft in this flight attitude until your compass heading is 120 degrees left of your original direction, then use the joystick to bring the aircraft back to straight and level on the new course. Use the **[L]** key if you have to.

- Check to see if you have lost any speed or altitude in the turn. Anytime you maneuver in the air you potentially lose energy, so always keep an eye on your speed and altitude. Lose too much of either of these and you'll wind up dead.
- Practice turning. The farther you push the stick to the right or left during a turn, and the farther back you pull on it, the faster the turn will be. Practice both sharp and gentle turns. Strive to make your turns crisp and precise, so that you come out of the turn facing the direction you want to be going. Make each turn a definite movement, with a clear objective.
- When you have spent some time practicing turns, and you are ready to go on, check your fuel supply to be certain you have enough jet fuel to continue. Make sure you have plenty of altitude. You'll need it for this next session.

The Break Turn

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



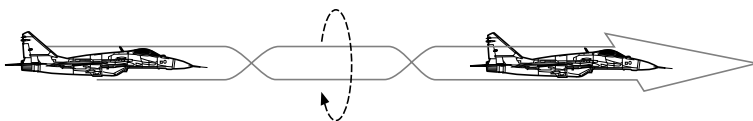
- To start practice, get straight and level, then note your speed, heading, and altitude.
- Break right! Quickly push the stick all the way to the right, and pull it back all the way. Perform this as one quick and precise move. Roll your aircraft to the right until its wings are perpendicular to the ground and at the same time pull back on the stick sharply to cause a very rapid turn. Watch the Pitch Ladder on your HUD to determine when you have rolled the aircraft sufficiently far to the right to make the turn crisp.
- Try to maintain the turn through at least 90 degrees of heading. Note how much speed and altitude you are losing in this turn. Never hold a break turn for so long that you are unable to maneuver (have little speed or altitude) when you come out of it.



- Break turns place extreme G-forces on the plane and pilot, and can lead to Blackouts from sustained high G force. The MiG-29's flight control computers do not limit the amount of G the aircraft will pull (generally between -3.0 G to + 9.0 G), but if you hold a break turn too long and the screen begins to go dark, relax the joystick to reduce the tightness of the turn, or use the **[B]** key to activate your Air Brakes to reduce the aircraft's speed through the turn. Don't forget to deactivate the air brakes when you no longer need them. You can choose whether you wish to have MiG-29 simulate blackouts from high-G turns and Redouts from negative-G situations. Go to **Options** on the **Main Menu**, and check **Blackouts/Redouts**.
- Practice break turns. As with any aircraft control movement, strive to make your breaks crisp and precise, with a definite purpose in mind. When you are good at break turns, you will be able to come out of one heading in precisely the direction you want to go. Watch your speed and altitude whenever you are performing break turns.

Roll

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

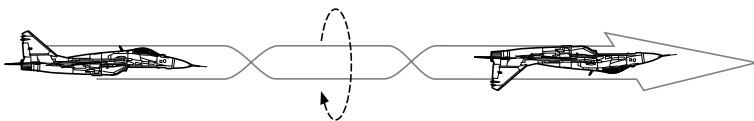


- Make sure you have plenty of altitude and airspeed, then get into level flight and check your airspeed, heading, and altitude for reference.
- Roll left. Push the stick to the left, without any forward or backward pressure. Hold the stick to the left as you roll through inverted flight and back to your original orientation, then level off. You should be headed in the same direction you were when you started the roll, and you should not have lost very much speed or altitude. If you did lose a lot of speed or height, that probably means you were performing the roll too slowly.

- Practice rolls. Always try to make your motions smooth and definite, with a precise objective in mind. Practice rolling until you can perform the maneuver without causing too much change in the direction your aircraft is headed.

Half-Roll

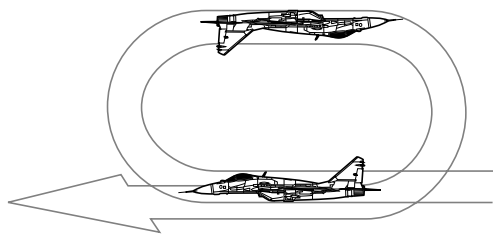
The full roll is not really a very useful maneuver. After all, you wind up right back where you started. The Half-Roll, on the other hand, is quite handy. It is an important component of several of the more complex flight maneuvers, like the Immelmann and the Split-S.



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

Loop

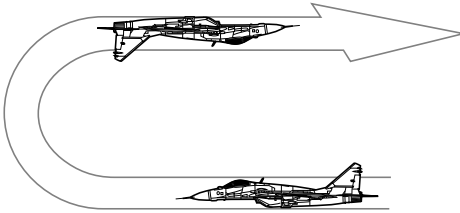
The Roll was a motion without any forward or backward pressure on the stick. The Loop is a maneuver that requires no right or left pressure. Properly done, a loop will deliver your aircraft back to where it began, with nearly the same heading, altitude, and airspeed that you had when you initiated the loop. MiG pilots find the loop on a 45 degree axis to be a very effective combat maneuver.



- Check airspeed, altitude, and heading for reference. You won't be able to tell if you have performed the loop properly unless you know where you started the maneuver.
- Get up a little airspeed by going into a shallow dive.
- Loop your aircraft. Pull back on the stick and hold it back while the airplane goes through a complete circle, then push the airplane back to level when you approach normal flight attitude again. Stay aware of where your airplane is during the loop, and keep a close eye on your altitude and airspeed indicators. Try to keep the Pitch Ladder rungs horizontal through the loop. When you are coming out of the loop, make your control motions definite and precise. You should be headed the same direction you were when you began the loop, and your altitude and airspeed should be pretty much the same as when you started.
- Practice looping. Try to visualize the movement of your aircraft through the air so you always know where you are in the loop, and can come out of the movement easily and under control. Perform loops at various speeds, and note how much altitude or speed you lose. You should always know the energy price of any maneuver you undertake.
- When you are satisfied with your loops, regain any altitude you may have lost then check your fuel supply before going on.

Half-Loop

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

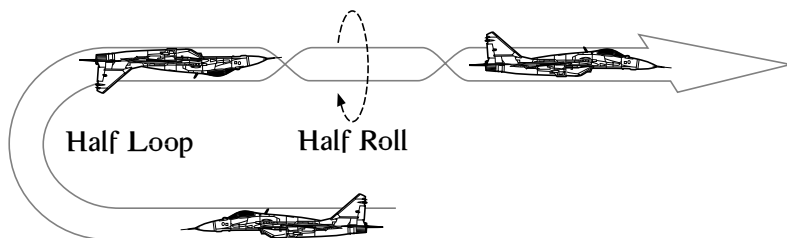


- As usual, check your altitude, airspeed, and heading before starting.
- Perform a half-loop. Pull back on the stick until you are flying inverted, on an opposite course from that with which you began the maneuver. Use the HUD Watermark to keep aware of where you are in the turn, and to help keep your wings level through the movement. Hold yourself in inverted flight for a few moments. Note how much speed or altitude you have lost by half-looping.
- Practice half-loops. Enter the maneuver at various speeds, and make your half-loops of different sizes by pulling back softer or harder on the stick when you are initiating the motion. Stay under control at all times, and stay aware of where you are in the maneuver. Practice breaking out of the half-loop quickly and cleanly, ready for the next movement.
- When you can reliably perform a half-loop, check your fuel supply, and then regain mission altitude to continue.



The Immelmann

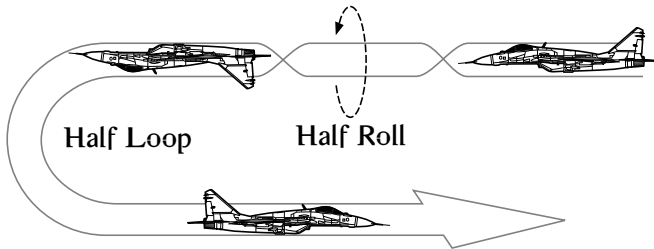
An Immelmann turn is a combination of a Half-Loop and a Half-Roll. It is an excellent way to simultaneously gain altitude and lose speed, which can be just what you want when you are getting ready to enter an air combat engagement. An Immelmann is also a good way to reverse direction to throw off an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



- Check initial heading, airspeed, and altitude.
- Perform a half-loop, then a half-roll, so you wind up flying right side up, in the opposite direction from your previous course and at a higher altitude. Start the half-loop by picking up a little speed, then half-loop into inverted flight. When inverted, and flying on the opposite course, half-roll the aircraft back upright.
- Practice Immelmann turns. Concentrate on making your control movements with authority, putting the aircraft exactly where you want it to go. Also practice coming out of the turn. When you are half-rolling out of an Immelmann you can break the half-roll at any point, or hold it longer than normal, so that you come out of the Immelmann on any course you desire. The main idea of the Immelmann turn is that you will make a significant course change, and wind up at a higher altitude.
- When you are good at Immelmanns, check your fuel supply, and then regain mission altitude to continue.

The Split-S

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



- Check your altitude, airspeed, and heading.
- Do a Split-S. Half-roll to the inverted position, then pull back on the stick and do a half-loop until you are right side up and flying level again. Keep an eye on the HUD Pitch Ladder rungs to stay informed about your attitude, and stay aware of how much altitude you are losing. You should wind up on a course close to the opposite of the one with which you started.
- Practice the Split-S. If you find that you are losing a lot of altitude with this maneuver, try slowing down before you initiate the movement, or deploy your air brakes (use the **B** key) to reduce your speed through the half-loop. Don't forget to retract the air brakes when you have finished the turn. With practice, you should be able to come out of a Split-S on any desired course, so pay attention to your heading as you come out of the maneuver, and leave the half-loop whenever you need to in order to assume the course you want.
- Keep an eye on your fuel supply. If you still have plenty after getting good at the Split-S, continue with flight practice. Otherwise, turn to the section on landing the MiG-29 to return to base for more fuel.

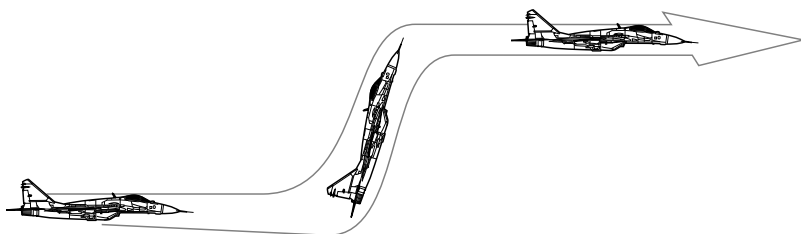
Advanced Flight Maneuvers

The highly agile MiG-29 can readily perform certain maneuvers that western planes can only dream about. While some would argue fancy flying is only appropriate for air shows, it is a good idea for MiG pilots to know exactly what their aircraft is capable of.

The MiG-29 is best in close combat, take advantage of your superb agility.

The Cobra Maneuver

As an example of the MiG-29's outstanding agility the Mikoyan Test team developed the Cobra Maneuver. In this move, the MiG-29 pitches its nose upwards to temporarily alter its forward hemisphere, then snaps it back without ever having changed bearings. This effectively pushes the Angle of Attack beyond the soft limits of the fighter. Because of the tremendous loss of airspeed however, the maneuver is impractical for most combat scenarios and is reserved primarily for air shows. However, some MiG pilots maintain that it is an effective maneuver for quickly turning to get behind or shoot at your enemy.



- Achieve a level flight at a medium altitude with your forsazh. Check your airspeed, heading, and altitude for reference.
- Kill engines by closing the throttle, press **[G]** and hold down the airbrakes **[B]**.
- When the engines have cut out, pull back on the stick without any left or right pressure until you are just about at a 90 degree angle with the ground. You will have a very short amount of time to take advantage of your radar facing and/or launch a missile.
- Release the brake and immediately reverse your pitch by pushing the stick forward (you may want to use the **[L]** key on your first couple of attempts).
- When you are almost level again, turn your throttle back up. You should be headed in the same direction you were when you started the Cobra.

- Take time to practice the Cobra, it is not an easy trick to learn. Try to make your motions quick and precise. Practice the Cobra until you can perform the maneuver without causing too much change to the direction and altitude of your aircraft.

The Tailslide

Another maneuver specific to the MiG-29 is the Tailslide (also known as the **Kolokol** or “**The Bell**” in Russian), where the aircraft falls backward at the apex of a vertical climb, then recovers with full power. There is little if any combat value to a Tailslide, but it is an impressive maneuver nonetheless.

- Check your heading, altitude and airspeed.
- Pitch up to a 90 degree angle to the horizon.
- Cut thrust (press **[6]**).
- Before coming to a complete halt, pitch nose slightly forward (with stick or **[↓]** Key).
- Come to a complete stop. You are now at the apex of your climb.
- As you start to fall, throw the stick completely forward. As you descend, your nose should be pitching forward.
- When you are flat with the horizon, kick in full forszh but do not level out. Continue to pitch down until you get enough speed to pull out of the fall.

Landing the Aircraft

When you land your MiG-29 during missions, the ground crew will re-arm and refuel you. They will not have time, however, to fix any damages you may have incurred. In this simulation, simply bringing your MiG-29 to a successful stop on the landing strip will refresh your fuel and ordnance. Although most missions do not require that you land the aircraft, you will receive a significant mission score bonus if you do. It is generally a good idea to bring the aircraft home after finishing your mission.

When you are ready to land, press the **[H]** key. This will activate the Autopilot and guide your aircraft directly to the Initial Approach Turn Point. At this point the navigation system updates the autopilot with the next Turn Point, the Final Turn Point. From the Final Turn Point you proceed directly to the runway. Going through the Initial and Final Approach Turn Points keeps you clear of any other traffic that may be flying near the runway, and gives you a chance to get your MiG-29 set for landing.





Be careful about using the autopilot while there are still enemies active in the area. The autopilot is only capable of directing the aircraft to preprogrammed Turn Points; it is not designed to avoid SAMs and enemy fighters while on route. Take manual control of the plane if there are still enemies around. Cycle through your Turn Points with the **[N]** key until the Initial Approach Turn Point appears, then use the Turn Point caret at the top of the HUD to help you steer to the direction you need to go.

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

Landing can be the most dangerous part of controlling an aircraft. You are flying low and slow, with little margin to correct an error should something go wrong. Pay attention to the landing process, and keep focused on what you are doing.

At the Initial Approach Turn Point

Your Initial Approach Turn Point is usually about 25 kilometers from the runway. Its purpose is to get you to the vicinity of the runway, yet still leave you time to get set for landing. Approach the Turn Point at an altitude of about 1500 meters AGL, with a speed of around 740 kph. Well before you reach the Turn Point you should reduce engine power to Landing speed (**[8]**) to slow yourself down gradually. It is better to allow your airspeed and energy to bleed off slowly rather than have to use your airbrake to reduce speed.

At the Final Approach Turn Point

The Final Approach Turn Point is normally about eight kilometers from the runway. By the time you reach this Turn Point you should be at an altitude of around 450 meters AGL, with an airspeed no greater than 460 kph. Your main task now is aligning yourself properly with the runway.

Locate the centerline of the runway and use your stick to bring the nose of the aircraft into alignment with it. Avoid sharp banks and sudden turns. Gradually reduce both your altitude and airspeed.

When you are aligned with the runway centerline, check your airspeed to make sure that you are at about 215 kph. This gives you a little airspeed to play with if anything goes wrong. Press the

G key to lower the landing gear. You will notice a distinct drop in airspeed as the landing gear deploys and locks into place.

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

- Check to see that the traffic pattern is clear.
- Check to see that your wings are level. Use the Artificial Horizon Indicator if necessary.
- Check to see that your landing gear is extended. The flaps on the wings of your MiG-29 will extend with the landing gear, providing you with extra lift. If you try to land without lowering your landing gear, you will receive an audio warning.
- Check your airspeed. It should be between 275 and 325 kph. Do not extend your airbrakes if your speed is within this range.
- Check the HUD Pitch Ladder. Your pitch angle should be about 10 degrees.

Touchdown

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

Just before touchdown, pitch the nose of your airplane up slightly. This maneuver is known as a "flare." Use a flare to make sure that your rear wheels are always the first to make contact with the ground. If your nosewheel hits the ground first it can cause the MiG-29 to nose into the ground and crash.

When your wheels touch down you will hear the squeal of the tires. Press **home** to open your drag chute. Apply brakes with the **B** key to bring the aircraft to a gradual halt. Once the aircraft has completely stopped, wait to be re-armed to takeoff again or press the **E** key to finish the mission and start the post-mission performance analysis. You are home, and safe. Congratulations!



Stalls

A Stall can happen any time a wing surface can no longer provide enough lift to keep an airplane flying. Low speeds and high Angles of Attack are the most common causes of stalls. The most dangerous time to experience a stall is when you are flying low and slow, like when you are landing.

The MiG-29's stall speed in any given situation depends on a number of factors, such as the weight of the aircraft, its speed, the angle of attack of the wings, and whether or not it has its flaps and gear extended. In general, you should consider 225 kph too slow a speed for safe flight at low altitudes. To avoid stalls when landing, keep your airspeed above 260 kph and your angle of attack low.

If you do manage to stall the MiG-29, immediately drop your nose to reduce the angle of attack, raise the landing gear, and hit the forsazh (the `backspace` key) to maximize engine thrust. Keep your wings level. As your airspeed increases, you will get more lift from the wings, which will allow you to fly out of the stall.

Chapter 7:

Air Combat

With seven external stations for housing ordnance, the MiG-29 can readily perform a number of different combat functions. Pilots must be aware of the full capability of the aircraft and its loadout if they are to enter the dangerous arena of air combat.

Radars

Situational awareness is the first and most important trait of a pilot. The N-019/RP-29 (Sapfir 29) pulse Doppler radar can track multiple aircraft at a range of approximately 148 km. Known to NATO as Slot Back 1, this radar is not quite as sophisticated as Western radar, but the MiG-29 has a card up its sleeve, the Infrared Search and Track system (IRST). While hunting heat signatures at a range of about 74 km, the pilot does not need to give away his position by using conventional radar signals.

Many **MiG-29 Fulcrum** missions provide the player with an Mainstay AEW&C (Airborne Early Warning and Control System) aircraft, usually a modified Beriev/Ilyushin A-50u with radar mounted on top of the fuselage. The AEW&C automatically downloads radar data to your airplane's computer system, giving you excellent radar coverage without having to turn on the MiG-29's internal radar set. The AEW&C provides 360 degree coverage around your MiG-29, and can reach more than 75 kilometers from your aircraft. If your mission provides you with an AEW&C, guard it well. It is a very useful tool, and if you let it get shot down you will be unable to take advantage of its radar coverage. Unlike your N-019, the radar signal from an AEW&C does not give away the location of the MiG-29.

Air-to-Air Weapons

The MiG-29 Fulcrum has four different air-to-air weapons systems, each with unique characteristics, designed to engage targets under different conditions. You can fire at targets up to 148 kilometers away with your R-77 radar-guided missile. With your IRST, you can target up to 29 kilometers with your R-73 or close to 11 kilometers for your R-60MK. As a last resort, there is always the GSh-301 30mm Cannon for very close battles.



The R-60MK



NATO Designation: AA-8 Aphid

Type: Air to Air Missile

Guidance: Heat

Range: 11 kilometers

Weight: 43 kilograms

Developed by the Molniya design bureau (formerly known as OKB-4) the tiny R-60 warhead weighs a mere 3.5 kg, about half the weight of western heat-seeking missiles such as the AIM-9M Sidewinder. Its lethality and range are modest by the standards of current IR-guided weapons, but impressive for such a small missile.

The R-73 A/E



NATO Designation: AA-11 Archer

Type: Air to Air Missile

Guidance: Heat

Range: 29 kilometers

Weight: 105 kilograms

When the Molniya design bureau was tasked with developing the Buran Space shuttle, work on the AA-11 Archer was reassigned to the Vypel bureau. Probably the best dogfight missile in the world, the AA-11 was the first in-service air to air missile to combine aerodynamic and thrust-vectoring control systems. This feature provides superior maneuverability, allowing the missile to be fired at targets in almost any direction from a maneuvering aircraft. The seeker is able to lock onto targets up to 45 degrees off boresight and can even be fired rearward to protect the rear hemisphere of the MiG-29.

R-77



NATO Designation: AA-12 Adder

Type: Air to Air Missile

Guidance: Radar

Range: 148 kilometers

Weight: 175 kilograms

Dubbed the 'Amraamski' by Western journalists, the AA-12 Adder is the Russian equivalent to the AIM-120A AMRAAM missile with its fire-and-forget guidance system and terminal homing, active-radar seeker. In the early 1990s, the Russians sought to build a low radar cross-section missile with superb range and enhanced turning capability. The AA-12 Adder exceeded these expectations and gave western countries an abrupt wake up call regarding missile superiority.

GSh-301 30mm Cannon

Type: 30mm single barreled cannon

Range: 4 kilometers

The lightweight GSh-301 30mm Cannon is extremely valuable in close range dogfighting, where it is too close to properly engage missiles. What the gun lacks in barrel life and ammunition capacity, it makes up for in accuracy due to a combination of laser ranging and well-written software algorithms. The bullet rate is so rapid that the gun sounds like a raspy hum when fired.

To engage in gun combat you must first select the GSh-301 30mm cannon by pressing the **[2]** key. The GSh-301 has a maximum range about 4 kilometers, but for effective shooting you should close to under 2 kilometers. The ammo drum has a 150-round capacity.

Air-to-Surface Weapons

Although the MiG-29 is primarily an air to air fighter, it can be equipped with a large variety of Air-to-Surface missiles and bombs.

The Kh-25ML



NATO Designation: AS-10 Karen

Type: Air to Surface Missile

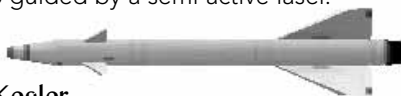
Guidance: Semi-Active Laser

Range: 20 kilometers

Weight: 300 kilograms

Developed back in the late 1960s, this surface to air missile is capable of reaching a maximum speed 860 meters per second. Small but effective, the AS-10 is capped with a 90 kg warhead. The present version of the AS-10 guided by a semi active laser.

The Kh-25MP



NATO Designation: AS-12 Kegler

Type: Anti-Radar Missile

Range: 60 kilometers

Guidance: Passive Radar

Range: 59 kilometers

Weight: 300 kilograms

Essentially a variation of the AS-10 Karen missile, the Kegler is guided by an inertial/passive radar enabling it to strike radiation emitting sources at significant range.

The Kh-29L



NATO Designation: AS-14 Kedge

Type: Air to Surface Missile

Guidance: Semi Active Laser

Range: 11 kilometers

Weight: 660 kilograms

With a 250 kg general purpose bomb as its warhead, the AS-14 strikes ground targets with devastating force. Developed in the early 1980s, the Kedge could be outfitted with interchangeable laser spot/electro-optical tracking heads.

The Kh-29T



NATO Designation: AS-14 Kedge

Type: Air to Surface Missile

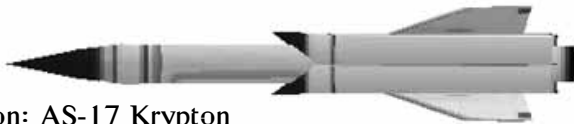
Guidance: Television Radar

Range: 11 kilometers

Weight: 680 kilograms

Same as the Kh-29L, except with television guidance system.

The Kh-31P



NATO Designation: AS-17 Krypton

Type: Anti-radar Missile

Guidance: Passive Radar

Range: 148 kilometers

Weight: 650 kilograms

Built by the Zvezda team, under the direction of Khokhlov, the AS-17's combined inertial/passive radar head was designed for attacking non-maneuvering aircraft, such as AWACS. After being accelerated to Mach 1.8, the solid propellant rocket booster is jettisoned and the missile sustained at Mach 3.0 by its ram-jet propulsion system.

The KAB-500KR Bomb



Type: Guided Bomb

Guidance: Television

Range: 14 kilometers

Weight: 560 kilograms

Used by the Russian Air Force in Afghanistan and Chechnya sorties, the KAB-500 delivers a serious blow to hardened bunkers and buildings. Guided by an electro-optical head, the bomb locks onto a target before launch.

The FAB bomb



Type: Fuel Air Bomb

Guidance: None

Range: 14 kilometers

Weight: 250-500 kilograms

Inexpensive and unguided, this Russian Fuel Air Bomb comes in two sizes, the 250 kg and the 500 kg.

Chapter 8:

Strategy and Tactics

If you don't want to be dead, you must learn various strategies and tactics. This section will go over some of the fundamental issues regarding flight altitude, speed, avoiding detection and incoming missiles as well as working with teammates. However, textbooks can only teach you so much. First class pilots learn from experience which tactics work best for them.

Push the Limits

Unlike western fighters, the MiG-29 has no hard limits.

What makes the MiG-29 a superior close combat fighter is its ability to ignore soft limits. In a very tight situation, expert pilots can push their plane beyond what is considered safe flying. By applying more pressure to the stick you can go beyond 26 degrees AoA and 9 g. This allows you to get out of tight spots in an emergency and enables you to perform difficult maneuvers like the Cobra. However defeating the soft limits seriously risks over-stressing the aircraft and the pilot. Be extremely careful whenever you depart from standard flight procedures.

Altitude

The MiG pilot likes to keep his options open by flying at a middle range in altitude.

A fair amount of altitude gives you the ability to maneuver at will, comfortable in the knowledge that there is a large reserve of empty air below. Without having to worry about close terrain and sudden hills, you will have more time to process information displayed on your cockpit instruments. An aircraft at high altitude can see farther and detect targets at greater ranges, yet at the same time exposes itself. A normal MiG-29 mission altitude should be between 3000-6000 meters.

Flying at a higher altitude gives an aircraft a defensive advantage. It can see enemy missiles coming from far away, and can maneuver to avoid them. Missiles climbing to high altitude will take longer to arrive than those fired at targets closer to their own level,

and will be moving more slowly, making them even easier to detect and avoid. Many surface-to-air missiles (SAMs) cannot reach aircraft flying at great heights (over 10,500 meters). You will be able to cruise over certain SAM sites with impunity, so long as you stay high in the air. However, that invulnerability can quickly disappear in a dogfight. A few break turns and a Split-S or two can seriously compromise this high altitude leverage.

High altitude flight provides offensive advantages as well. Altitude provides a convenient reserve of energy, which you can convert to speed at any time. Like missiles, enemy aircraft must approach “uphill,” slowing their speed. This means enemy targets will spend longer time inside the MiG-29’s missile radius. A place where the MiG-29 can strike them, and they cannot hit back.


Speed

Your optimal speed is around 650 kph. Flying too slowly makes it harder to avoid enemies and their missiles.

One of the most important factors to consider when entering an engagement is the airspeed of your MiG-29. The velocity at which you are flying has tremendous effect on many of the Basic Maneuvers necessary during combat. For most flight configurations that speed will probably be somewhere near 650 kph. Here you have the option of slowing down to take advantage of the MiG’s low speed maneuverability, or pour on the “forsazh” or afterburner to jump into high speed.

At low velocities the MiG-29 is one of the world’s most agile fighters, but low speed maneuvers quickly compromise both velocity and altitude. In a normal aircraft, impending loss of control would signal a dangerous flight condition. In the MiG-29 you will not lose control, and so may fail to notice that, for example, your airspeed is down to around 200 kph, and that your aircraft is actually falling through the air rather than flying. This is an especially dangerous situation when you are in the middle of air combat, and might not have time to make regular speed and altitude checks. Since combat maneuvers usually cause loss of speed and altitude, you can suddenly find yourself in the undesirable position of going very slow at a low altitude. Flying too slowly can interfere with your ability to dodge missiles, because you cannot physically move the airplane fast enough to avoid the missile.

There are a few disadvantages of flying too fast. For one, you go through fuel more rapidly. At higher velocities your turns will be much larger and your breaks less crisp. But the biggest danger is



exceeding safe speeds. As you approach your Vmax (Velocity maximum), you will begin to experience turbulence. Your MiG-29 will explode if subjected to speeds over 1,500 kph.

To get the most out of your airplane, practice maneuvering it at various speeds, until you know what kind of response you can expect.

Emission Control (EMCON)

Radar helps you locate enemies, but also compromises your position. Don't always leave it on, use it when needed. Remember, one of the MiG-29's greatest advantages is the emission-free IRST.

When your radar is turned on you increase the chances that an enemy will be able to spot your aircraft. When your radar is turned off you cannot acquire targets for your best missiles, and, if there is no AEW&C available, you may not even be able to spot other aircraft until they get too close. Herein lies the dilemma of when to use your radar and when to leave it off.

The solution lies in practical thinking. Use your radar when you are required, and turn it off when you do not need it. You must have your radar on to acquire targets for your R-77, so definitely turn it on when you have confirmed enemy aircraft inside the R-77 range envelope. After you have fired your missiles and are certain the R-77 is active, turn the radar off. If you are flying with AEW&C support, this may be the only time you need to use your radar.

The Infrared Search and Track allows you to accurately locate and rangefind targets without giving away your position. As a drawback, its range is less than that of your radar. Use the radar deliberately to perform the tasks for which it was designed, then turn it off until you need it again. When flying a combat mission, turn on the radar every once in a while and make a 360 degree turn, keeping the nose of the aircraft pitched downward a bit while you turn. When you have scanned all around your location, turn off the radar and resume course, or take steps to deal with whatever your radar has turned up.

Wingman Tactics

Remember to use your Wingman during missions. He's there to assist you.

Never forget your comrades. Your wingman is perhaps your most valuable asset in combat situations; he can double your firepower

and watch your back. Don't let him go soft by just tagging along behind you, put him to the test. Your wingman should always have something important to do.

One of the most useful things you can instruct your wingman to do is cover your back. Your wingman will engage any object that targets you. When you are in the thick of things, it is often reassuring to know someone is looking out for potential threats you may have missed. Your Wingman will vigilantly look for enemies attempting to sneak up on you. As soon as the enemy turns on targeting radar, your wingman will attack, hopefully forcing the enemy to deal with the new threat rather than maintain the attack on you.

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

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

Missile Avoidance

The best way to avoid a missile is to stay out of your enemy's firing envelope. Your best strategy is to get behind your target as much as possible.

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

The first step in avoiding a missile is detecting it. Your Radar Warning Receiver will track incoming missiles for you, giving you the opportunity to set yourself up to avoid them. Press keypad **[3]** to check this display often.



Your systems will audibly warn you with a series of beeps when your aircraft has been illuminated by someone else's radar systems. As soon as you are warned of an incoming missile, execute a break turn, release chaff and flares and try to find your attacker. Chaff tries to confuse radar locks, while Flares seek to decoy heat seeking missiles. Even if you don't know exactly where the missile is, it's a good bet that it knows where you are, so change things as rapidly as you can by maneuvering.

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

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

Chapter 9:

Multiplayer

There are many options to consider when selecting to play a Multiplayer game. You will need to decide whether you will **Host** the game or whether you will **Join** someone else's game. You can join a multiplayer game at any time, and leave whenever you wish. That means unless you are the Host, you do not have to be present at the initiation of a MiG-29 game to join in, and if you leave in the middle of a mission, the other players can continue to play without you.



To begin a multiplayer game session, first select **Multiplayer** from the **Main Menu**. Select **Host** to go to the Host Game screen (described later in this chapter). Choose **Back** to return to the Main Menu.

Click on the **Callsign** box at the upper left of the screen to type in the callsign/handle of your pilot

and press **enter**. From the Multiplayer page, you may type in the **Squadron** name to be part of a team during a deathmatch. A squadron is a group of players who fly together, cooperating to reach common goals. They can also chat privately (**shift** **T**) while in the game. If your squadron has a Password, click on the **Squadron Password** box button and enter the password. Under this, you can choose a Connection Type. Click on the arrows in the **Connection Type** box to cycle through the five possible connection types:

Connection Types

NovaWorld

Compete with up to 128 opponents per game in **Integrated Battle Space** on NovaWorld. The NovaLogic servers automatically host the games located on its servers. NovaWorld can be accessed through your Internet browser by selecting **Default Browser**. Select **Mini Browser** in the **Connect Via** box if your web browser cannot open NovaWorld (for example certain versions of AOL do not support NovaWorld). The mini-browser has less functionality than most browsers (lacking the ability to use our JAVA based chat room for example). However, its small size and single purpose dedication allows it to load quicker than more powerful browsers. You should use the Mini Browser if you have set your browser so that it won't accept "cookies". Select **Join** to enter NovaWorld.

NovaLogic is dedicated to periodically updating NovaWorld with new features and enhancements. Every time you log onto NovaWorld, it will automatically check to see if you have the latest software and prepare an update, if needed.



LAN/IPX

Up to 16 players can simultaneously play over a LAN/IPX network. Select **Host** to start a game from your computer or **Search** to find a game. Once you have located a game to play, press **Join**. You will need to type in the correct password if the Host has opted to password protect the game.

Internet

Up to 16 players can simultaneously play over an Internet connection without being part of NovaWorld. Select **Host** to start a game from your computer. If you wish to find a game, you must first type in the IP Address of the host's computer in the **Internet Address** box, then hit **Search** to find the game. Once you have located a game to play, press **Join**. You will need to type in the correct password if the Host has opted to password protect the game.



Serial Cable

You can play **MiG-29 Fulcrum** against a single human opponent by using a **Serial Cable** (commonly referred to as a “null-modem cable”) to direct connect your two computers. You will need to tell the program which **Com Port** you will be using. Select **Host** to start a game from your computer or **Search** to find a game. Once you have located a game to play, press **Join**.



Modem

Two players can play **MiG-29 Fulcrum** over a **Modem** connection. If you wish to host the game, simply press the **Host** button to go to the next screen. Your computer will then wait for the other player to call in. If you intend to join a game on someone else’s computer, type

in the phone number of the host in the **Phone #** box, then press **Join**.

Multiplayer Game Types

There are two types of multiplayer games in which you may participate. **Deathmatch** games are you and your MiG-29 against the world, where the only object is to down as many of your fellow players as possible. **RAW** games require the participants to work together to accomplish common mission goals. The **Host** of a given game selects which type it will be.

Deathmatch Games

A **Deathmatch** game is just that, a fight to the finish, with every pilot seeking only to kill or be killed. A **Deathmatch** game differs from a normal MiG-29 mission in several respects:

- All players start on different airfields, typically inside an imaginary circle about 125 kilometers across.
- All players are invulnerable for 45 seconds after takeoff.
- There are no Ground Targets in Deathmatch play.

- You can rearm and refuel your MiG-29 by landing it at any runway. Unlike the single player version, ground crews will repair all damage. You must bring the aircraft to a complete stop to have this take effect.
- You cannot Pause the game.
- You cannot Eject from a crippled airplane. Hit **enter** to restart at base.
- If you are killed in any way, the game removes one kill from your total.
- You will not have a Wingman.

RAW

The object of a RAW game is to bomb the opposing team's base completely. When you start the game, it will ask you to select which side to join and whether you would like your loadout to be that of a bomber or a fighter. Most of the rules are the same as with Deathmatch, except:

- Each team is given an AWACS to provide radar coverage. Destroying the other teams AWACS is a valuable tactic.
- The players are responsible for flying CAP around their base, protecting their AWACS, escorting bombers, and intercepting enemy forces.

Hosting a Game

To host a multiplayer **MiG-29** game, press the **Host** button at the bottom of the Multiplayer screen. This brings up the **Host Options**. If you are the host, other players will have to **Join** your game. You have a number of choices to make:

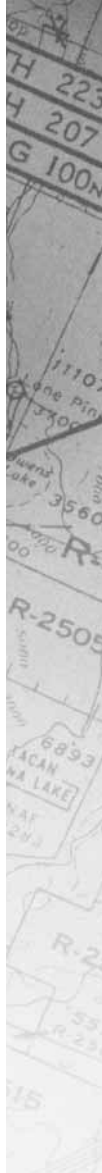


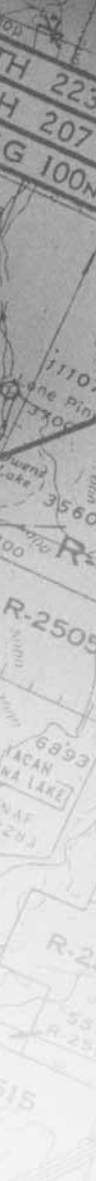
- **Game Name**—Enter a unique name to identify your game. When other player's search for your game, they will see this name in the **Sessions** on their Multiplayer screen.
- **Session Password**—If you wish to restrict access to your game, enter a **Session Password** here. Only players who know the password will be able to **Join** a password-protected game. You do not have to require a password. Leave this box empty if you do not want players to have to enter a password to join your game.

- **Server Type**—Choose **Serve Only** or **Serve and Play**. If you will be playing in games you host on your computer, choose **Serve and Play**. The host should always be the person with the fastest computer setup. If you will have a dedicated server for hosting the game, choose **Serve Only**. The game will play faster with a separate unused computer acting as the server. Once you hit **Accept**, you will see a server only screen with various relevant information. Hit **[ESC]** to exit this screen.
- **Game Type**—Select a **Deathmatch** or **RAW** game type for this game. See **Multiplayer Game Types** earlier in this chapter for a description of these choices.



- **Status**—This box tells you if your other players are logged in.
- **Max. Players**—Use the arrow buttons to increase or decrease the **Maximum Number of Players** allowed to **Join** this game. This varies depending on the type of connection you establish.
- **Blackouts**—Choose the Blackouts/Redouts option to be either **Enabled** or **Disabled** for all players, regardless of their personal option selection.
- **Spin Only Deaths**—For **Deathmatch** games only. Choose **Yes** or **No**. Normally, pilots shot down in a Deathmatch game find themselves back on a random runway, ready to get back into the fray. If you select **Yes**, aircraft hit in the air will go into a spin for a few seconds, then revert to player control, all damage repaired. However these aircraft will still be spinning, so you'll have to pull out of the spin manually. Choosing **No** here puts pilots back on the ground when they are shot down, with a brand new airplane.
- **GPS Guidance**—For **RAW** games only. Select disable if you want to turn off the bomb's targeting box on the HUD.
- **Time of Day**—Pick the Time of Day at which you want this mission to be flown.
- **Region**—Cycle through the list of Regions to play in, such as desert and glacial.





- **Terrain Sequence**—Select **Cycle Regions** to have the computer switch to the next region on the region list when the Terrain Changes. **Cycle Times** will change only the Time of Day. With **Random** selected either the Region or the Time of Day will shift randomly during Terrain Changes.
- **Rounds Until Terrain Change**—After the goal of the current round is met, the host will automatically start a new round. Select how many rounds will be played before the terrain changes. When it changes, it will do so according to the order you have selected in Terrain Sequence.
- **Kills per Round**—For **Deathmatch** games only. Choose how many kills a player has to achieve to end the current round. When any player reaches this total, the round will end.
- **Bombers get SRM**—For **RAW** games only. Allows planes configured to be bombers to also carry a light load of air-to-air missiles for self-protection.
- **SRMs**—If you have selected a **Deathmatch** game, choose the number of short range missiles each aircraft in the game will carry. This choice is not available in **RAW** games.
- **MRMs**—In **Deathmatch** games, you must choose how many medium range missiles each plane will carry. This choice is not available in **RAW** games.
- **Side Selection**—For **RAW** games only. **Enabled** allows players to choose which side of the battle they fight for. **Disabled** means that the computer will assign teams.

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

Integrated Battle Space

Integrated Battle Space is a revolutionary multiplayer gaming environment where you play MiG-29 games with people who own compatible products by NovaLogic, such as **F-16 Multirole Fighter** and **F-22 Raptor** (with purchased update). This not only adds an exciting challenge to your gaming experience, but also allows you to experience the strategic advantages each aircraft has over the others in a true combat situation. Additional products will be announced on NovaWorld and the NovaLogic Website (www.novalogic.com).

Glossary

A

AAA- Anti-Aircraft Artillery. Pronounced "triple-A," this term refers to anti-aircraft guns.

AA-8 Aphid- A short ranged heat seeking missile in the MiG-29's arsenal. Known to Russian pilots as the R-60.

AA-11 Archer- Noted as the best close air to air short ranged missile. Known to Russian pilots as the R-73.

AA-12 Adder- Sometimes called the Amraamski, this medium ranged air to air missile relies on radar tracking. Known to Russian pilots as the R-77.

AAM- Air-to-Air Missile. A missile designed to be fired from an airplane, with the intention of hitting another airplane.

AB- Non-US Air Base.

ACM- Air Combat Maneuvers. The basic movement techniques of air fighting, including the Immelmann and the Split-S.

ADA- Air Defense Artillery. Ground units that operate AAA.

AEW&C- A powerful and sophisticated suite of radars and communications gear carried aboard an aircraft. An AEW&C aircraft controls air combat operations over a wide area.

Afterburner- A device for pumping raw fuel directly into the engine exhaust, dramatically increasing both engine power and fuel consumption. Known as the Forsazh in Russia.

AGL- Above Ground Level. One way to measure altitude, in units from the surface of the earth directly below.

AGM- US Air-to-Ground Missile. A missile fired from an aircraft at a target on the ground.


Ailerons- Control surfaces on an aircraft's wings that allow it to roll about its longitudinal axis.

AIM- Air Intercept Missile. The type prefix for U.S. air-to-air missiles, such as AIM-9 and AIM-120.

Airspeed- The velocity of the plane in relation to the surrounding air.

Altimeter- An instrument that measures altitude by monitoring differences in air pressure.





AMRAAM-Advanced Medium Range Air-to-Air Missile. The AIM-120 AMRAAM uses Active Radar Homing (ARH), so it is a “fire and forget” missile. Used by the F-16 and F-22.

Anti-radiation missile- A missile that locks onto radio frequency radiation, such as the Kegler.

AoA- Angle of Attack. The angle between the aircraft’s wings’ mean chord line and the relative wind.

Armstrong- Weapons are armed.

AS-10 Karen - Air to surface missile guided by a semi-active laser. Known to Russian pilots as the Kh-25ML.

AS-12 Kegler - Anti-radar missile guided by passive radar. Known to Russian pilots as the Kh-25MP.

AS-14 Kedge - Short range air to surface missile. Known to Russian pilots as the Kh-29L (laser guided) or the Kh-29T (TV guided).

AS-17 Krypton - Medium range anti-radar missile. Known to Russian pilots as the Kh-31P.

ASL- Above Sea Level. Another way to measure altitude, in units above sea level. Sometimes referred to as MSL (Measured from Sea Level).

Aspect angle- The angle between the flight path of an attacking aircraft and that of its target.

ATO- Air Tasking Order. A schedule of what targets are to be hit, who is to hit them, and with what.

Autopilot- Flight control system feature, allowing the computer to fly the plane toward the next programmed Turn Point.

Avionics- Electronic gear aboard an aircraft. Specifically refers to devices that help fly or navigate the aircraft.

B

Bandit- An aircraft positively identified as an enemy.

Bank- Rolling your aircraft to the left or right such that your lift vector is not vertical.

BARCAP-Barrier Combat Air Patrol. Combat aircraft positioned to act as a barrier against enemy aircraft passing through or past a given area.

BDA- Bomb Damage Assessment. A post-strike report on the damage caused to a particular target.

Beaming- An aircraft approaching from the side is said to be beaming.

Bear-NATO code name for the Russian Tu-95 turboprop bomber.

Bearing- Relative direction, in degrees. The front of the aircraft is always 0 degrees, so a target bearing 270 degrees is directly to the left.

BFM- Basic Flight Maneuvers. The standard air maneuvers that every pilot should know. They include the turn, break, loop, and roll.

Bingo- An aircraft with only enough fuel to return to base is at bingo fuel.

Blackjack-NATO code name for the Russian Tu-160 high speed low altitude bomber.

Blackout- Loss of vision due to high positive-G forces. Blood draining from the eyeballs causes this condition.

Blip- An image on the radar screen annotating a detected object.

Bogey- An aircraft whose identity has not yet been positively established.

Bull's eye-A bull's eye is an arbitrary predetermined map coordinate used as a navigational point of reference by friendly forces.

BVR- Beyond Visual Range. A target that is too far away to be seen with the naked eye. Also refers to missiles designed to engage such targets.



C

Callsign- A code name given to a particular fighter pilot for reasons of identification.

CAP- Combat Air Patrol. A defensive flight over a particular location.

CAS- Close Air Support. The practice of using aircraft to attack enemy ground forces in conjunction with friendly troops.

C3I- Command, Control, Communications, and Intelligence. The basic functions of battlefield management.

Chaff- Metallic strips dropped from a fighter that can interfere with missile radar signals.

Check fire- Cease firing, or don't fire.

Closure- Rate at which two objects are approaching one another.

Coaler- NATO code name for the An-72P maritime patrol aircraft.

Cold- Retreating. A bandit is cold if it is leaving the combat zone.

COMMS- Communications.

Contrails- Vapor trails generated from an aircraft during high G maneuvers.

Corner velocity- The speed at which an aircraft's fastest turning rate is achieved (depending on altitude).

Cossack- NATO code name for the mammoth An-225 cargo plane, the world's largest aircraft.

CSAR- Combat Search and Rescue. The process of locating and recovering downed pilots in a combat zone.

D

Dead-reckoning- To navigate without the assistance of instruments.

Death dot- The small aiming mark in the center of a target reticule. Also referred to as the "pipper".

Ditch- To put an airplane down in the water. Alternately, to eject, especially over water.

Dry thrust- The power of an aircraft's engines, without afterburner. Measured in units of weight, as in "81 kiloNewtons of thrust."

E

ECM- Electronic Counter Measures. Electronic means of interfering with an enemy radar or radio transmission. Jamming is a form of ECM.

Egress- To exit. The route an aircraft takes out of the area after striking a target.

Engage- Begin Air Combat Maneuvers against the enemy.

Envelope- Effective range and positioning of aircraft or missiles.

F

Falcon- Designation for the F-16. Sometimes referred to as the Fighting Falcon or the Viper.

Fantan- NATO code name for a Chinese-built fighter-bomber.

FEBA- Forward Edge of the Battle Area. Modern term for “the front lines”.

Fire and forget- Indicates a self-guided weapon that does not require the pilots attention after being launched.

Flak- Nickname for antiaircraft gunfire. Derived from Fliegabwerkanon, German WW II antiaircraft gun.

Flanker- NATO code name for the Russian Su-27 air superiority fighter.

Flaperons- Control surfaces on the F-16’s wings that allow it to roll about its longitudinal axis.

Flare- A pyrotechnic released from an airplane to fool the infrared sensors on heat-seeking missiles.

Flaps- Hinged surfaces on the wings of an aircraft used to generate extra lift.

Flogger- NATO code name for the MiG-27 fighter-bomber.

FLOT- Forward Line of Own Troops. A line behind which friendly forces are operating, and beyond which only enemies roam.

Fly-by-wire- Computer system that controls the plane based on input from the pilot’s flight stick. The MiG-29 is not a Fly-By-Wire aircraft.

FOB- Forward Operating Base. A temporary base close to the combat zone set up to support flight operations.

Forsazh- The Russian term for Afterburners. A device for pumping raw fuel directly into the engine exhaust, dramatically increasing both engine power and fuel consumption.

Foxbat- NATO code name for the MiG-25 fighter.

Foxhound- NATO code name for the MiG-31 interceptor.

Fulcrum- NATO code name for the MiG-29 air superiority fighter.

Full grunt- Full Military Power; throttle setting of 100% thrust.

Full Military Power- 100% thrust.

Fur ball- A frantic multiple-aircraft engagement at close ranges.

G

G- Pressure exerted by gravitational force. Standing on the ground equals 1 G.

G suit- A suit designed to help the pilots counter blackouts during high G maneuvers.

GPS- Global Positioning System. Satellite-based navigation system that allows a receiver to locate itself within a few meters.

Guard- Listen to the common radio frequency. You will often be asked to "monitor guard" to pick up vital information.

H

HARM- High Speed Anti-Radiation Missile. A missile used by the F-16 that tracks a radar emission, and attacks the transmitter.

Havoc- NATO code name for the Russian Mi-28 ground-attack helicopter.

Heat signature- The image of an aircraft as seen on infrared systems.

Heater- Pilot slang for an infrared homing (heat-seeking) missile.

Heading- Direction of flight, in compass degrees. Due east is a heading of 90 degrees.

Helix- NATO code name for the Russian Ka-29 light attack helicopter.

Hot- Bandit is approaching, or entering the combat zone.

HUD- Head-Up Display. A flight information technique that places most flight and combat information on a transparent panel directly in front of the pilot.

I

Ingress- To enter. The route followed to approach a strike target.

IP- Initial Point (or Ingress Point)-The map location where a strike package begins its approach to a target.

IR- Infrared. A band of radiation just below visible light in frequency. Infrared radiation is associated with heat sources, and so can be used to track objects with heat signatures.

IRST- Infrared Search and Track. A tracking system used by the MiG-29 to locate a target using only the heat signature from the target's engines.

J

Jinking- A series of erratic maneuvers designed to throw off an enemy gun attack.

K

Kh-25ML- Air to surface missile guided by a semi-active laser. Known to NATO as the AS-10 Karen.

Kh-25MP- Anti-radar missile guided by passive radar. Known to NATO as the AS-12 Kegler.

Kh-29L- Short range air to surface laser guided missile. Known to NATO as the AS-14 Kedge.

Kh-29T- Television guided Kh-29.

Kh-31P- Medium range anti-radar missile. Known to NATO as the AS-17 Krypton.

KPH- Kilometers per hour, a unit of speed.

L

LO- Low Observable. An aircraft designed not to reflect radar energy or visible light. Stealthy.

Lock on- To acquire a target with radar with the intent to fire a weapon.

LZ- Landing Zone. A temporary landing place, usually for helicopters or short-field aircraft, directly in a combat area.



M

Mach- The speed of sound at sea level. Approximately 230 meters/second. This value changes with relative air pressure.

Mainstay- NATO code name for the Russian A-50u airborne warning aircraft.

Mayday- An emergency call, from the French m'aidez—"help me."

Military power- 100% thrust.

MSA- Minimum Safe Altitude. Altitude below which you are asking for trouble.

MSL- Measured From Sea Level. Also referred to as ASL (Above Sea Level)

Muzzle flashes-AAA fire.

N

N-091- The radar aboard the MiG-29.

NATO- North Atlantic Treaty Organization formed in 1949 for purpose of collective defense against aggression.

Nautical mile- One-sixtieth of a degree of latitude, measured at the equator, which is one-sixtieth of a degree of longitude, or 1856 meters.

Negative- A non-affirmative response; no. The opposite of "roger".

No joy- No visual or radar contact with enemy aircraft. The opposite of "tally-ho!"

NOE- Nap-of-the-Earth flying- Flying as low as possible to avoid radar detection.

O

OTH- Over the Horizon. Usually refers to targets masked by the curve of the earth, or to missiles that can strike such targets.

P

Padlocked- Being unable to take one's eyes off a target for fear one will be not be able to find it again.

Pipper- The small aiming mark in the center of a target reticule. Also referred to as the "death dot."

Pitch- Measure of aircraft motion around its lateral axis. The elevators control pitch.

Pop-up- A sudden climb from low altitude, usually as part of the bomb delivery process. Also called popping.

Punch out- Pilot slang for eject.

R

R-60- A short ranged heat seeking missile in the MiG-29's arsenal. Known to NATO as the AA-8 Aphid.

R-73- Noted as the best close air to air short ranged missile. Known to NATO as the AA-11 Archer.

R-77- Sometimes called the Amraamski, this medium ranged air to air missile relies on radar tracking. Known to NATO as the AA-12 Adder.

Radar- Radio Detection and Ranging. A device which detects objects by bouncing a beam of microwave energy off them, then timing the return.

RAM- Radar Absorbing Material. Materials that reduce the amount of energy reflected from their surface.

Raptor- Code name for the F-22 air superiority fighter.

Red-out- A temporary blindness caused by blood forced into the eyeball by negative-G conditions.

ROE- Rules of Engagement. A set of instruction detailing the conditions under which a pilot may engage in combat.

Roger- Affirmative; yes. A positive comment. The opposite of "negative."

Roll- Measure of aircraft motion around its longitudinal axis. Roll is controlled by the aircraft's Ailerons.

Rookie – A pilot with very little actual flying experience.

RTB- Return to Base. Radio call indicating that the current mission has been aborted, and that all pilots should come home.

RWR- Radar Warning Receiver. A device which detects hostile radars.

S

Saddled- In a stable flight relationship alongside another aircraft.

SAM- Surface-to-Air Missile. A missile fired from the ground against an air target.

SAR- Search and Rescue. The process of finding and recovering downed flyers.

Scramble- A rapid takeoff, usually as the result of an alert or other emergency situation.

SCUD- A medium-range ballistic missile of Russian design. Not very accurate, but cheap.

SEAD- Suppression of Enemy Air Defenses. The process of destroying or otherwise degrading an enemy air defense system by means of strikes directed against radars, SAM sites, and AAA defenses.

Signature- The electronic parameters of a radio or radar or heat from an engine.

Silk approach- The act of bailing out of an airplane.

Six- Directly to the rear. Check your six to keep from being surprised by enemy fighters sneaking up behind you.

Shack- Pilot slang for a bomb that impacts directly on its intended target.

Slick- Clean or smooth. Refers to an aircraft with no external ordnance or equipment that could create drag or increase its radar cross-section.

Smoke in the air- Incoming missiles.

Sortie- A combat mission.

Splash- Indicates an air-to-air kill or weapons impact on a ground target, as in, "splash one F-16."

Stall- The separation of airflow from the upper surface of a wing, resulting in full or partial loss of lift. Aircraft that stall are no longer flying, they are falling.

Strike package- A group of different aircraft assigned a particular mission.

Strip- Peel off; break from the formation.

Su-34- Russian fighter-bomber.

Su-35- Russian air-superiority fighter. Most deadly aircraft in the Russian inventory.

T

Tally- To get a visual sighting of something.

Tally-ho!- Confirmed target sighted. Opposite of “no joy”.

Taxi- To steer an aircraft while it is on the runway.

Tracers- Cannon or machine gun projectiles with a phosphor coating that ignites on firing, allowing the shooter to follow the path of the bullets.

Triple-A- Antiaircraft Artillery; AAA.

Turbulence- Violent shaking that occurs when your aircraft approaches its Vmax or encounters conflicting winds.

Turn Point- The MiG-29 pilot's preferred term for a fixed reference point entered into the aircraft's autopilot and navigational computers. Also referred to as Waypoint.

U

USAF- United States Air Force.

V

Vc- Velocity (closure). Speed at which two objects are approaching one another.

Vne- Velocity (never exceed). Speed at which you begin to risk structural damage to the aircraft.

Vmax- Velocity (maximum). The maximum safe speed for a particular altitude. An aircraft will experience turbulence as it approaches its Vmax.

Vector- A direction, expressed in compass degrees; to send someone in a particular direction.

Vertical velocity- Rate of change in the altitude of an aircraft.

Viper- Nickname given by pilots to the F-16.

W

Waterline- The artificial horizon line.

Waypoint- Another word for Turn Point. A fixed reference point entered into the aircraft's autopilot and navigational computers.

Weapons free- Freedom to fire weapons within a given airspace.





Weapons hold- The opposite of weapons free. Cease firing or withhold fire.

Wingman- Companion plane. Combat fighters usually fly in pairs.

WVR- Within Visual Range.

Y

Yaw- The motion of an aircraft around its vertical axis, controlled by the rudders. A yaw is an inherently unstable flight attitude.

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U.S. Patent #s 5,625,759 and 5,550,959. Printed in the U.S.A.

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Technical Support Line: (818) 878-0325

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