**Mikoyan MiG-29**

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| **MiG-29** |
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| A Hungarian Air Force MiG-29UB at Koksijde Airshow in 2005 |
| **Role** | Air-superiority fighter, multirole fighter |
| **National origin** | [Soviet Union](http://en.wikipedia.org/wiki/Soviet_Union)[Russia](http://en.wikipedia.org/wiki/Russia) |
| **Manufacturer** | [Mikoyan](http://en.wikipedia.org/wiki/Mikoyan) |
| **First flight** | 6 October 1977 |
| **Introduced** | August 1983 |
| **Status** | Active service |
| **Primary users** | [Russian Air Force](http://en.wikipedia.org/wiki/Russian_Air_Force)[Indian Air Force](http://en.wikipedia.org/wiki/Indian_Air_Force)[Ukrainian Air Force](http://en.wikipedia.org/wiki/Ukrainian_Air_Force)[Luftwaffe](http://en.wikipedia.org/wiki/Luftwaffe) |
| **Produced** | 1982–present |
| **Number built** | 1,600+ |
| **Unit cost** | US$29 million  |
| **Variants** | [Mikoyan MiG-29M](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M)[Mikoyan MiG-29K](http://en.wikipedia.org/wiki/Mikoyan_MiG-29K)[Mikoyan MiG-35](http://en.wikipedia.org/wiki/Mikoyan_MiG-35) |

The **Mikoyan MiG-29** ([Russian](http://en.wikipedia.org/wiki/Russian_language): Микоян МиГ-29; [NATO reporting name](http://en.wikipedia.org/wiki/NATO_reporting_name): **Fulcrum**) is a [4th-generation](http://en.wikipedia.org/wiki/Fourth_generation_jet_fighter) [jet fighter aircraft](http://en.wikipedia.org/wiki/Fighter_aircraft) designed in the [Soviet Union](http://en.wikipedia.org/wiki/Soviet_Union) for an [air superiority](http://en.wikipedia.org/wiki/Air_superiority_fighter) role. Developed in the 1970s by the [Mikoyan](http://en.wikipedia.org/wiki/Mikoyan) design bureau, it entered service with the [Soviet Air Force](http://en.wikipedia.org/wiki/Soviet_Air_Force) in 1983, and remains in use by the [Russian Air Force](http://en.wikipedia.org/wiki/Russian_Air_Force) as well as in many other nations. The NATO name "Fulcrum" was sometimes unofficially used by Soviet pilots in service.

The MiG-29, along with the [Sukhoi Su-27](http://en.wikipedia.org/wiki/Sukhoi_Su-27), was developed to counter new American fighters such as the [McDonnell Douglas F-15 Eagle](http://en.wikipedia.org/wiki/McDonnell_Douglas_F-15_Eagle), and the [General Dynamics F-16 Fighting Falcon](http://en.wikipedia.org/wiki/General_Dynamics_F-16_Fighting_Falcon).

**Development**

In 1969 the existence of the [United States Air Force](http://en.wikipedia.org/wiki/United_States_Air_Force)'s "F-X" program, which would result in the [McDonnell Douglas F-15 Eagle](http://en.wikipedia.org/wiki/McDonnell_Douglas_F-15_Eagle), became public knowledge. At the height of the [Cold War](http://en.wikipedia.org/wiki/Cold_War), a Soviet response was necessary to avoid the possibility of a new American fighter becoming a serious technological advantage over existing Soviet fighters, thus the development of a new air superiority fighter became a priority. The Soviet General Staff issued a requirement for a *Perspektivnyy Frontovoy Istrebitel* (*PFI*, translating directly as "Perspective Frontline Fighter", roughly "Advanced Frontline Fighter"). Specifications were extremely ambitious, calling for long range, good short-field performance (including the ability to use austere runways), excellent agility, Mach 2+ speed, and heavy armament. The aerodynamic design for the new aircraft was largely carried out by the Russian aerodynamics institute [TsAGI](http://en.wikipedia.org/wiki/TsAGI) in collaboration with the [Sukhoi](http://en.wikipedia.org/wiki/Sukhoi) design bureau.

However, in 1971 Soviet studies determined the need for different types of fighters. The PFI program was supplemented with the *LPFI* (*Perspektivnyy Lyogkiy Frontovoy Istrebitel*, or "Advanced Lightweight Tactical Fighter") program; the Soviet fighter force was planned to be approximately 33% PFI and 67% LPFI. PFI and LPFI paralleled the USAF's decision that created the "Lightweight Fighter" program and the [General Dynamics F-16 Fighting Falcon](http://en.wikipedia.org/wiki/General_Dynamics_F-16_Fighting_Falcon) and [Northrop YF-17](http://en.wikipedia.org/wiki/Northrop_YF-17). The PFI fighter was assigned to Sukhoi, resulting in the [Sukhoi Su-27](http://en.wikipedia.org/wiki/Sukhoi_Su-27), while the lightweight fighter went to Mikoyan. Detailed design work on the resultant Mikoyan *Product 9*, designated *MiG-29A*, began in 1974, with the first flight taking place on 6 October 1977. The pre-production aircraft was first spotted by [United States](http://en.wikipedia.org/wiki/United_States) [reconnaissance satellites](http://en.wikipedia.org/wiki/Reconnaissance_satellite) in November of that year; it was dubbed *Ram-L* because it was observed at the [Zhukovsky](http://en.wikipedia.org/wiki/Zhukovsky) flight test center near the town of [Ramenskoye](http://en.wikipedia.org/wiki/Ramenskoye). Early Western speculations suggested that the Ram-L was very similar in appearance to the YF-17 and powered by [afterburning](http://en.wikipedia.org/wiki/Afterburner) [Tumansky R-25](http://en.wikipedia.org/wiki/Tumansky_R-25) [turbojets](http://en.wikipedia.org/wiki/Turbojet).

MiG-29 fighter parked on the ramp after a demonstration flight at the Abbotsford Air Show, 1989.

Despite program delays caused by the loss of two prototypes in engine-related accidents (third prototype on 15 June 1978 and the fifth prototype on 31 October 1980) , the *MiG-29B* production version entered service in August 1983 at the [Kubinka](http://en.wikipedia.org/wiki/Kubinka) air base. State acceptance trials were completed in 1984, and deliveries began the same year to the Soviet [Frontal Aviation](http://en.wikipedia.org/wiki/Soviet_Air_Force).

The workload split between TPFI and LPFI became more apparent as the MiG-29 filtered into front line service with the [Soviet Air Forces](http://en.wikipedia.org/wiki/Soviet_Air_Forces) (Russian: *Voenno-Vozdushnye Sily* [VVS]) in the mid-1980s. While the heavy, long range Su-27 was tasked with the more exotic and dangerous role of deep air-to-air sweeps of NATO high-value assets, the smaller MiG-29 directly replaced the MiG-23 in the frontal aviation role. The MiG-29 was positioned relatively close to the front lines, tasked with providing local air superiority to advancing Soviet motorized army units. Rugged landing gear and protective intake grates meant the MiG-29 could operate from the damaged or under-prepared airstrips Soviet war planners expected to encounter during a rapid armored advance. The MiG-29 was also tasked with escort duties for local strike and interdiction air packages, protecting vulnerable ground attack aircraft from NATO fighters such as the F-15 and F-16. Frontal aviation MiG-29s would ensure Soviet ground forces could operate under a safe air umbrella, moving forward with the troops as they advanced.

MiG-29UB trainer

In the West, the new fighter was given the [NATO reporting name](http://en.wikipedia.org/wiki/NATO_reporting_name) "Fulcrum-A" because the pre-production MiG-29A, which should have logically received this designation, remained unknown in the West at that time. The MiG-29B was widely exported in downgraded versions known as *MiG-29B 9-12A* and *MiG-29B 9-12B* (for [Warsaw Pact](http://en.wikipedia.org/wiki/Warsaw_Pact) and non-Warsaw Pact nations, respectively), with less capable [avionics](http://en.wikipedia.org/wiki/Avionics) and no capability for delivering [nuclear weapons](http://en.wikipedia.org/wiki/Nuclear_weapon). Total production was about 840 aircraft.

**Improved versions**

In the 1980s, Mikoyan developed the improved MiG-29S to use longer range [R-27E](http://en.wikipedia.org/wiki/Vympel_R-27) and [R-77](http://en.wikipedia.org/wiki/Vympel_R-77) air-to-air missiles. It added a dorsal 'hump' to the upper [fuselage](http://en.wikipedia.org/wiki/Fuselage) to house a jamming system and some additional fuel capacity. The weapons load was increased to 4,000 kg (8,800 lb) with airframe strengthening. These features were included in new-built fighters and upgrades to older MiG-29s.

Refined versions of the MiG-29 with improved avionics were fielded by the Soviet Union, but Mikoyan’s multi-role variants, including a [carrier-based](http://en.wikipedia.org/wiki/Aircraft_carrier) version designated [*MiG-29K*](http://en.wikipedia.org/wiki/Mikoyan_MiG-29K), were never produced in large numbers. In the post-Soviet era, MiG-29 development was influenced by the Mikoyan bureau's apparent lesser political clout than rival Sukhoi. Some more advanced versions are still being pursued for export, and updates of existing Russian aircraft are likely. New fighter versions called [*MiG-29M/M2*](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M) and [*MiG-29SMT*](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M#Variants) have been developed. Furthermore, development of the MiG-29K carrier version has been resumed for the [Indian Navy](http://en.wikipedia.org/wiki/Indian_Navy)'s [INS *Vikramaditya*](http://en.wikipedia.org/wiki/INS_Vikramaditya) aircraft carrier.

The Soviet Union did not assign official names to most of its aircraft, although nicknames were common. Unusually, some Soviet pilots found the MiG-29’s NATO reporting name, "Fulcrum", to be a flattering description of the aircraft’s intended purpose, and it is sometimes unofficially used in Russian service.

**Design**

**Features**

MiG-29UB of [Swifts aerobatic team](http://en.wikipedia.org/wiki/Strizhi)

Because it was developed from the same basic parameters laid out by [TsAGI](http://en.wikipedia.org/wiki/TsAGI) for the original PFI, the MiG-29 is aerodynamically broadly similar to the [Sukhoi Su-27](http://en.wikipedia.org/wiki/Sukhoi_Su-27), but with some notable differences. It is built largely out of [aluminum](http://en.wikipedia.org/wiki/Aluminium) with some [composite materials](http://en.wikipedia.org/wiki/Composite_material). It has a mid-mounted [swept wing](http://en.wikipedia.org/wiki/Swept_wing) with blended [leading-edge root extensions](http://en.wikipedia.org/wiki/Leading_edge_extension) (LERXs) swept at around 40°. There are swept tailplanes and two vertical fins, mounted on booms outboard of the engines. Automatic [slats](http://en.wikipedia.org/wiki/Leading_edge_slats) are mounted on the [leading edges](http://en.wikipedia.org/wiki/Leading_edge) of the wings; they are four-segment on early models and five-segment on some later variants. On the [trailing edge](http://en.wikipedia.org/wiki/Trailing_edge), there are maneuvering flaps and wingtip [ailerons](http://en.wikipedia.org/wiki/Aileron). At the time of its deployment, it was one of the first jet fighters in service capable of executing the [Pugachev Cobra maneuver](http://en.wikipedia.org/wiki/Pugachev%27s_Cobra).

The MiG-29 has [hydraulic](http://en.wikipedia.org/wiki/Hydraulic) controls and a SAU-451 three-axis [autopilot](http://en.wikipedia.org/wiki/Autopilot) but, unlike the Su-27, no [fly-by-wire](http://en.wikipedia.org/wiki/Fly-by-wire) control system. Nonetheless, it is very agile, with excellent instantaneous and sustained turn performance, high [alpha](http://en.wikipedia.org/wiki/Angle_of_attack) capability, and a general resistance to spins. The airframe is stressed for 9-[*g*](http://en.wikipedia.org/wiki/G-force) (88 m/s²) maneuvers. The controls have "soft" limiters to prevent the pilot from exceeding the *g* and alpha limits, but these can be disabled manually.

**Powerplant**

Main article: [Klimov RD-33](http://en.wikipedia.org/wiki/Klimov_RD-33)

RD-33 on display at the Air Force Museum of the Bundeswehr

The MiG-29 has two widely spaced [Klimov RD-33](http://en.wikipedia.org/wiki/Klimov_RD-33) [turbofan](http://en.wikipedia.org/wiki/Turbofan) engines, each rated at 50.0 kN (11,240 lb) dry and 81.3 kN (18,277 lb) in [afterburner](http://en.wikipedia.org/wiki/Afterburner_%28engine%29). The space between the engines generates lift, thereby reducing effective [wing loading](http://en.wikipedia.org/wiki/Wing_loading), to improve maneuverability. The engines are fed through wedge-type [intakes](http://en.wikipedia.org/wiki/Intake) fitted under the [leading-edge extensions](http://en.wikipedia.org/wiki/Leading_edge_extension) (LERXs), which have variable ramps to allow high-[Mach](http://en.wikipedia.org/wiki/Mach_number) speeds. As an adaptation to rough-field operations, the main air inlet can be closed completely and alter using the auxiliary air inlet on the upper fuselage for takeoff, landing and low-altitude flying, preventing ingestion of ground debris ([foreign object damage](http://en.wikipedia.org/wiki/Foreign_object_damage) [FOD]). Thereby the engines receive air through louvers on the LERXs which open automatically when intakes are closed. However the latest variant of the family, the [MiG-35](http://en.wikipedia.org/wiki/MiG-35), eliminated these dorsal louvers, and adopted the mesh screens design in the main intakes, similar to those fitted to the Su-27.

**Range and fuel system**

MiG-29 with drop tanks receiving fuel transferred from an [Il-76](http://en.wikipedia.org/wiki/Il-76) tanker

The internal fuel capacity of the original MiG-29B is only 4,365 [liters](http://en.wikipedia.org/wiki/Litre) distributed between six internal [fuel tanks](http://en.wikipedia.org/wiki/Fuel_tank), four in the fuselage and one in each wing. As a result, the aircraft has a very limited range, in line with the original Soviet requirements for a [point-defense fighter](http://en.wikipedia.org/wiki/Point-defense_fighter). For longer flights, this can be supplemented by a 1,500-litre (330 Imp gal, 395 US gal) centerline [drop tank](http://en.wikipedia.org/wiki/Drop_tank) and, on later production batches, two 1,150-litre (253 Imp gal, 300 US gal) underwing drop tanks. In addition, a small number have been fitted with port-side [inflight refueling](http://en.wikipedia.org/wiki/Aerial_refueling) probes, allowing much longer flight times by using a [probe-and-drogue system](http://en.wikipedia.org/wiki/Aerial_refueling#Probe_and_drogue). Some MiG-29B airframes have been upgraded to the "Fatback" configuration (*MiG-29 9-13*), which adds a dorsal-mounted internal fuel tank. Advanced variants, such as the MiG-35, can be fitted with a [conformal fuel tank](http://en.wikipedia.org/wiki/Conformal_fuel_tank) on the dorsal spine, although none of them have yet entered service.

**Cockpit**

MiG-29 cockpit, 1995

The cockpit features a conventional [center stick](http://en.wikipedia.org/wiki/Centre_stick) and left hand throttle controls. The pilot sits in a [Zvezda K-36DM](http://en.wikipedia.org/wiki/NPP_Zvezda) zero-zero [ejection seat](http://en.wikipedia.org/wiki/Ejection_seat) which has had impressive performance in emergency escapes.

The cockpit has conventional dials, with a [head-up display](http://en.wikipedia.org/wiki/Head-Up_Display) (HUD) and a Shchel-3UM [helmet mounted display](http://en.wikipedia.org/wiki/Helmet_mounted_display), but no [HOTAS](http://en.wikipedia.org/wiki/HOTAS) ("hands-on-throttle-and-stick") capability. Emphasis seems to have been placed on making the cockpit similar to the earlier MiG-23 and other Soviet aircraft for ease of conversion, rather than on [ergonomics](http://en.wikipedia.org/wiki/Ergonomics). Nonetheless, the MiG-29 does have substantially better visibility than most previous Russian jet fighters, thanks to a high-mounted [bubble](http://en.wikipedia.org/wiki/Bubble_canopy) [canopy](http://en.wikipedia.org/wiki/Canopy_%28aircraft%29). Upgraded models introduce "[glass cockpits](http://en.wikipedia.org/wiki/Glass_cockpit)" with modern [liquid-crystal](http://en.wikipedia.org/wiki/LCD) (LCD) [multi-function displays](http://en.wikipedia.org/wiki/Multi-function_display) (MFDs) and true HOTAS.

**Sensors**

The baseline MiG-29B has a [Phazotron](http://en.wikipedia.org/wiki/Phazotron) RLPK-29 (*Radiolokatsyonnui Pritselnui Kompleks*) [radar](http://en.wikipedia.org/wiki/Radar) [fire control system (FCS)](http://en.wikipedia.org/wiki/Fire_control_system) which includes the N019 (Sapfir 29; NATO: 'Slot Back') [look-down/shoot-down](http://en.wikipedia.org/wiki/Look-down/shoot-down) coherent [pulse-Doppler radar](http://en.wikipedia.org/wiki/Pulse-Doppler_radar) and the Ts100.02-02 digital computer. Tracking range against a fighter-sized target was only about 70 km (38 nmi) in the frontal aspect and 35 km (19 nmi) in the rear aspect. Range against bomber-sized targets was roughly double. Ten targets could be displayed in search mode, but the radar had to lock onto a single target for [semi-active](http://en.wikipedia.org/wiki/Semi-active_radar_homing) homing (SARH). The MiG-29 was not able to reliably utilize the new [Vympel R-27](http://en.wikipedia.org/wiki/Vympel_R-27)R (NATO: AA-10 "Alamo") long-range SARH missile at its maximum ranges.

MiG-29 nose showing radome and IRST

These performance deficiencies stemmed largely from the fact the N019 radar was not, in fact, a new design. Instead, the system was a further development of the architecture already used in Phazotron's Sapfir-23ML system, then in use on the MiG-23ML. During the initial MiG-29 design specification period in the mid-1970s, Phazotron NIIR was tasked with producing a modern radar for the MiG-29. To speed development, Phazotron based its new design on the work undertaken by NPO Istok on the experimental "*Soyuz*" radar program. Accordingly, the N019 was originally intended to have a flat [planar array](http://en.wikipedia.org/wiki/Planar_array_radar) antenna and full [digital signal processing](http://en.wikipedia.org/wiki/Digital_signal_processing), giving a detection and tracking range of at least 100 km against a fighter-sized target. Given the state of Soviet avionics technology at the time, it was an ambitious goal. Testing and prototypes soon revealed this could not be attained in the required timeframe, at least not in a radar that would fit in the MiG-29's nose. Rather than design a completely new, albeit more modest radar, Phazotron reverted to a version of the twisted-polarization [Cassegrain antenna](http://en.wikipedia.org/wiki/Cassegrain_antenna) used successfully on the Sapfir-23ML to save time and cost. This system used the same analog signal processors as their earlier designs, coupled with a NII Argon-designed Ts100 digital computer. While this decision provided a working radar system for the new fighter, it inherited all of the weak points of the earlier design. This reliance on 1960s-era technology continued to plague the MiG-29's ability to detect and track airborne targets at ranges available with the [R-27](http://en.wikipedia.org/wiki/Vympel_R-27) and [R-77](http://en.wikipedia.org/wiki/R-77) missiles, although new designs like the digital N010 *Zhuk-M* address the serious signal processing shortcomings inherent in the analog design. Most MiG-29 continue to use the analog N019 or N019M radar, although *VVS* has indicated its desire to upgrade all existing MiG-29s to a fully digital system.

MiG-29UB on display, showing gunport

The N019 was further compromised by Phazotron designer [Adolf Tolkachev](http://en.wikipedia.org/wiki/Adolf_Tolkachev)’s betrayal of the radar to the [CIA](http://en.wikipedia.org/wiki/CIA), for which he was executed in 1986. In response to all of these problems, the Soviets hastily developed a modified N019M *Topaz* radar for the upgraded *MiG-29S* aircraft. However, *VVS* was reportedly still not satisfied with the performance of the system and demanded another upgrade. The latest upgraded aircraft offered the N010 [*Zhuk-M*](http://en.wikipedia.org/wiki/Zhuk_radar), which has a planar array antenna rather than a dish, improving range, and a much superior processing ability, with multiple-target engagement capability and compatibility with the Vympel R-77 (or RVV-AE) (NATO: AA-12 'Adder'). A useful feature the MiG-29 shares with the Su-27 is the S-31E2 KOLS, a combined [laser rangefinder](http://en.wikipedia.org/wiki/Laser_rangefinder) and IRST in an "eyeball" mount forward of the cockpit canopy. This can be slaved to the radar or used independently, and provides exceptional [gun-laying](http://en.wikipedia.org/wiki/Gun_laying) accuracy.

**Armament**

A [Ukrainian Air Force](http://en.wikipedia.org/wiki/Ukrainian_Air_Force) MiG-29 with armaments laid out

Armament for the MiG-29 includes a single [GSh-30-1](http://en.wikipedia.org/wiki/Gryazev-Shipunov_GSh-30-1) 30 mm cannon in the port wing root. This originally had a 150-round magazine, which was reduced to 100 rounds in later variants. Original production MiG-29B aircraft cannot fire the cannon when carrying a centerline fuel tank as it blocks the shell ejection port. This issue was corrected in the MiG-29S and later versions. Three pylons are provided under each wing (four in some variants), for a total of six (or eight). The inboard pylons can carry either a 1,150-litre (300 US gal) fuel tank, one *Vympel* [R-27](http://en.wikipedia.org/wiki/Vympel_R-27) (AA-10 "Alamo") medium-range air-to-air missile, or unguided bombs or rockets. Some Soviet aircraft could carry a single nuclear bomb on the port inboard station. The outer pylons usually carry [R-73](http://en.wikipedia.org/wiki/Vympel_R-73) (AA-11 "Archer") dogfight missiles, although some users still retain the older [R-60](http://en.wikipedia.org/wiki/Molniya_R-60) (AA-8 "Aphid"). A single 1,500-litre (400 US gal) tank can be fitted to the centerline, between the engines, for ferry flights, but this position is not used for combat stores. The original MiG-29B can carry [general-purpose bombs](http://en.wikipedia.org/wiki/General-purpose_bomb) and unguided rocket pods, but not [precision-guided munitions](http://en.wikipedia.org/wiki/Precision-guided_munition). Upgraded models have provision for [laser-guided](http://en.wikipedia.org/wiki/Laser-guided_bomb) and electro-optical bombs, as well as [air-to-surface missiles](http://en.wikipedia.org/wiki/Air-to-surface_missile).

**Operational history**

The Soviet Union exported MiG-29s to several countries. Because 4th-generation fighter jets require the pilots to have extensive training, air-defense infrastructure, and constant maintenance and upgrades, MiG-29s have had mixed operational history with different air forces.

**Soviet Union and Russia**

MiG-29UB at the 1988 [Farnborough Airshow](http://en.wikipedia.org/wiki/Farnborough_Airshow)

The MiG-29 was first publicly seen in the West when the Soviet Union displayed the aircraft in [Finland](http://en.wikipedia.org/wiki/Finland) in July 1986. Two MiG-29s were also displayed at the [Farnborough Airshow](http://en.wikipedia.org/wiki/Farnborough_Airshow) in [Britain](http://en.wikipedia.org/wiki/United_Kingdom) in September 1988. The following year, the aircraft conducted flying displays at the 1989 Paris Air Show where it was involved in a non-fatal crash during the first weekend of the show. The Paris Air Show display was only the second display of Soviet fighters at an international air show since the 1930s. Western observers were impressed by its apparent capability and exceptional agility. Following the disintegration of the Soviet Union, most of the MiG-29s entered service with the newly formed [Russian Air Force](http://en.wikipedia.org/wiki/Russian_Air_Force).

In 1993 two MiG-29s of the [Russian Air Force](http://en.wikipedia.org/wiki/Russian_Air_Force) collided in mid-air and crashed away from the public at the 1993 [Royal International Air Tattoo](http://en.wikipedia.org/wiki/Royal_International_Air_Tattoo) (UK). No one was hurt on the ground. The two [pilots](http://en.wikipedia.org/wiki/Aviator) [ejected](http://en.wikipedia.org/wiki/Ejector_seat) and landed safely. Investigators later determined that a pilot error was the cause, after one pilot did a reverse loop and disappeared into the clouds, the other one lost sight of his [wingman](http://en.wikipedia.org/wiki/Wingman) and aborted the routine.

On 20 April 2008, [Georgian](http://en.wikipedia.org/wiki/Georgia_%28country%29) officials claimed a Russian MiG-29 [shot down a Georgian](http://en.wikipedia.org/wiki/2008_Georgian_spy_plane_shootdowns) [Hermes 450](http://en.wikipedia.org/wiki/Hermes_450) [unmanned aerial vehicle](http://en.wikipedia.org/wiki/Unmanned_aerial_vehicle) and provided video footage from the ill-fated drone showing an apparent MiG-29 launching an air-to-air missile at it. Russia denies that the aircraft was theirs and says they did not have any pilots in the air that day. [Abkhazia](http://en.wikipedia.org/wiki/Abkhazia)’s administration claimed its own forces shot down the drone with an [L-39](http://en.wikipedia.org/wiki/Aero_L-39_Albatros) aircraft "because it was violating Abkhaz airspace and breaching ceasefire agreements." UN investigation concluded that the video was authentic and that the drone was shot down by a Russian MiG-29 or Su-27 using a [R-73](http://en.wikipedia.org/wiki/Vympel_R-73) heat seeking missile.

The [Russian Air Force](http://en.wikipedia.org/wiki/Russian_Air_Force) grounded all its MiG-29s following a crash in [Siberia](http://en.wikipedia.org/wiki/Siberia) on 17 October 2008. Following a second crash with an MiG-29 in east Siberia in December 2008, Russian officials admitted that most MiG-29 fighters in the Russian Air Force were incapable of performing combat duties due to poor maintenance. The age of the aircraft was also an important factor as about 70% of the MiGs were considered to be too old to take to the skies. The Russian MiG-29s have not received updates since the collapse of the Soviet Union. This is because the Russian Air Force chose to upgrade the Su-27 and [MiG-31](http://en.wikipedia.org/wiki/Mikoyan_MiG-31) instead. On 4 February 2009, the Russian Air Force resumed flights with the MiG-29. However, in March 2009, 91 MiG-29s of the Russian Air Force required repair after inspections due to corrosion; approximately 100 MiGs were cleared to continue flying at the time. In 2008 the Russian Air Force bought 24 new MiG-29SMTs to replace older MiG-29s. The Russian Air Force started an update of its early MiG-29s to the more current MiG-29SMT standard.

**India**

MiG-29 of the [Indian Air Force](http://en.wikipedia.org/wiki/Indian_Air_Force)

[India](http://en.wikipedia.org/wiki/India) was the first international customer of the MiG-29. The [Indian Air Force](http://en.wikipedia.org/wiki/Indian_Air_Force) (IAF) placed an order for more than 50 MiG-29s in 1980 while the aircraft was still in its initial development phase. Since its induction into the IAF in 1985, the aircraft has undergone a series of modifications with the addition of new avionics, sub-systems, turbofan engines and radars. The upgraded Indian version is known as *Baaz* ([Hindi](http://en.wikipedia.org/wiki/Hindi_language) for *Hawk*) and forms a crucial component of the second-line offensive aircraft-fleet of the IAF after the [Sukhoi Su-30MKI](http://en.wikipedia.org/wiki/Sukhoi_Su-30MKI).

Indian MiG-29s were used extensively during the 1999 [Kargil War](http://en.wikipedia.org/wiki/Kargil_War) in [Kashmir](http://en.wikipedia.org/wiki/Kashmir) by the Indian Air Force to provide fighter escort for [Mirage 2000s](http://en.wikipedia.org/wiki/Mirage_2000), which were attacking targets with [laser-guided bombs](http://en.wikipedia.org/wiki/Laser-guided_bomb). According to Indian sources, two MiG-29s from the IAF's No. 47 squadron (Black Archers) gained [missile lock](http://en.wikipedia.org/wiki/Missile_lock-on) on two F-16s of the [Pakistan Air Force (PAF)](http://en.wikipedia.org/wiki/Pakistan_Air_Force) which were patrolling close to the border to prevent any incursions by Indian aircraft, but did not engage them because no official declaration of war had been issued. The Indian MiG-29s were armed with beyond-visual-range air-to-air missiles whereas the Pakistani F-16s were not.

The MiG-29’s good operational record prompted India to sign a deal with Russia in 2005—2006 to upgrade all of its MiG-29s for [US$](http://en.wikipedia.org/wiki/US%24)888 million. Under the deal, the Indian MiGs were modified to be capable of deploying the R-77RVV-AE (AA-12 'Adder') air-to-air missile, also known as the *Amraamski*. The missiles had been successfully tested in October 1998 and were integrated into IAF's MiG-29s. IAF has also awarded the MiG Corporation another US$900 million contract to upgrade all of its 69 operational MiG-29s. These upgrades will include a new avionics fit, with the N-109 radar being replaced by a Phazatron *Zhuk-M* radar. The aircraft is also being equipped to enhance beyond-visual-range combat ability and for air-to-air refueling to increase endurance. In 2007, Russia also gave India’s [Hindustan Aeronautics Limited](http://en.wikipedia.org/wiki/Hindustan_Aeronautics_Limited) (HAL) a license to manufacture 120 [RD-33 series 3](http://en.wikipedia.org/wiki/RD-33_series_3) turbojet engines for the upgrade. The upgrade will also include a new weapon control system, cockpit [ergonomics](http://en.wikipedia.org/wiki/Ergonomics), air-to-air missiles, high-accuracy air-to-ground missiles and "smart" aerial bombs. The first six MiG-29s will be upgraded in Russia while the remaining 63 MiGs will be upgraded at the HAL facility in India. India also awarded a multi-million dollar contract to [Israel Aircraft Industries](http://en.wikipedia.org/wiki/Israel_Aircraft_Industries) to provide avionics and subsystems for the upgrade.

In March 2009, the Indian Air Force expressed concern after 90 MiG-29s were grounded in Russia. After carrying out an extensive inspection, the IAF cleared all MiG-29s in its fleet in March 2009. In a disclosure in Parliament, Defense Minister A. K. Antony said the MiG-29 is structurally flawed in that it has a tendency to develop cracks due to corrosion in the tail fin. Russia has shared this finding with India, which emerged after the crash of a Russian Air Force MiG-29 in December 2008. "A repair scheme and preventive measures are in place and IAF has not encountered major problems concerning the issue," Antony said. Despite concerns of Russia's grounding, India sent the first six of its 78 MiG-29s to Russia for upgrades in 2008. The upgrade program will fit the MiGs with a [phased array radar](http://en.wikipedia.org/wiki/Phased_array_radar) (PESA) and in-flight re-fueling capability. In January 2010, India and Russia signed a US$1.2 billion deal under which the Indian Navy would acquire 29 additional MiG-29Ks, bringing the total number of MiG-29Ks on order to 45. The MiG-29K entered service with the Indian Navy on 19 February 2010. The upgrade of all IAF MiG-29 "Baaz" to latest MiG-29SMT standard is in process, which will include latest avionics, Zhuk-ME Radar, engine, weapon control systems etc., enhancing multi-role capabilities by many-fold.

**Yugoslavia**

A Yugoslav MiG-29

[Yugoslavia](http://en.wikipedia.org/wiki/Socialist_Federal_Republic_of_Yugoslavia) was the first European country outside the Soviet Union to operate the MiG-29. Yugoslavia received 14 MiG-29Bs and two MiG-29UBs from the USSR in 1987. MiG-29s were put into service with the 127th Fighter Aviation Squadron, based at [Batajnica Air Base](http://en.wikipedia.org/wiki/Batajnica_Air_Base), north of [Belgrade](http://en.wikipedia.org/wiki/Belgrade), [Serbia](http://en.wikipedia.org/wiki/Serbia).

Yugoslav MiG-29s saw little combat during the breakup of Yugoslavia, and were used primarily for ground attacks. Several [Antonov An-2](http://en.wikipedia.org/wiki/Antonov_An-2) aircraft used by Croatia were destroyed on the ground at [Čepin](http://en.wikipedia.org/wiki/%C4%8Cepin) airfield near [Osijek](http://en.wikipedia.org/wiki/Osijek), [Croatia](http://en.wikipedia.org/wiki/Croatia) in 1991 by a MiG-29, however there were no MiG-29 loses.

The MiG-29s continued their service in the subsequent [Federal Republic of Yugoslavia](http://en.wikipedia.org/wiki/Federal_Republic_of_Yugoslavia). Because of the United Nations [arms embargo](http://en.wikipedia.org/wiki/Arms_embargo) against the country, the condition of the MiG-29s worsened. Before [Operation Allied Force](http://en.wikipedia.org/wiki/Operation_Allied_Force) began in 1999, Yugoslav MiG-29s were over 10 years old, short of spare parts and proper maintenance. By March 1999, the Yugoslav Air Force had 11 MiG-29s considered operational.

A total of six MiG-29s were shot down during the [Kosovo War](http://en.wikipedia.org/wiki/Kosovo_War), of which four were shot down by USAF F-15s, one by a USAF F-16 or friendly fire and one by a Dutch F-16. Another four were destroyed on the ground. Some Russian sources claim that a MiG-29 shot down an F-16 on 26 March 1999, but this kill is disputed, as the F-16C in question was said to have crashed in the US that same day.

Most historians attribute the downing of a [F-117](http://en.wikipedia.org/wiki/F-117) as being shot down by SAM commander [Zoltan Dani](http://en.wikipedia.org/wiki/Zoltan_Dani). Some sources claimed it was shot down by a MiG-29 piloted by Lt. Col. Gvozden Đukić, which was the [nom de guerre](http://en.wikipedia.org/wiki/Nom_de_guerre) of Zoltan Dani.

The [Air Force of Serbia and Montenegro](http://en.wikipedia.org/wiki/Air_Force_of_Serbia_and_Montenegro) continued flying its remaining five MiG-29s at a very low rate after the war. In spring 2004, news appeared that MiG-29 operations had ceased, because the aircraft could not be maintained. In 2007, all five MiG-29 were sent to Russia to be refurbished, and upgraded. In 2008, the MiG-29s began returning to service with the [Serbian Air Force](http://en.wikipedia.org/wiki/Serbian_Air_Force).

**Germany**

[*Luftwaffe*](http://en.wikipedia.org/wiki/Luftwaffe) MiG-29G over [Gulf of Mexico](http://en.wikipedia.org/wiki/Gulf_of_Mexico).

The [German Democratic Republic](http://en.wikipedia.org/wiki/German_Democratic_Republic) (also known as East Germany) bought 24 MiG-29s (20 MiG-29As, four MiG-29UBs), which entered service in 1988—1989. After the fall of the [Berlin Wall](http://en.wikipedia.org/wiki/Berlin_Wall) in November 1989 and [reunification of Germany](http://en.wikipedia.org/wiki/Reunification_of_Germany) in October 1990, the MiG-29s and other aircraft of the East German [*Luftstreitkräfte der NVA*](http://en.wikipedia.org/wiki/Luftstreitkr%C3%A4fte_der_NVA) were integrated into the West German [*Luftwaffe*](http://en.wikipedia.org/wiki/Luftwaffe). After upgrades by [DaimlerChrysler Aerospace](http://en.wikipedia.org/wiki/DaimlerChrysler_Aerospace) (now [EADS](http://en.wikipedia.org/wiki/EADS)) for NATO compatibility, they were designated *MiG-29G* and *MiG-29GT*. In March 1991, one of the MiG-29s in German service was transferred to the USAF for evaluation, along with several [Su-22s](http://en.wikipedia.org/wiki/Su-22) and MiG-23s.

A *Luftwaffe* MiG-29

The [Federation of American Scientists](http://en.wikipedia.org/wiki/Federation_of_American_Scientists) claims the MiG-29 is equal or better than the F-15C in some areas such as short aerial engagements because of the Helmet Mounted Weapons Sight (HMS) and better maneuverability at slow speeds This was demonstrated when MiG-29s of the *Luftwaffe* participated in joint [DACT](http://en.wikipedia.org/wiki/DACT) exercises with U.S. fighters. The HMS was a great help, allowing the Germans to achieve a lock on any target the pilot could see within the missile field of view, including those almost 45 degrees off [boresight](http://en.wikipedia.org/wiki/Boresight). In contrast, the U.S. aircraft were only able to lock onto targets in a narrow window directly in front of the aircraft’s nose. It was not until late 2003 that the USAF and [US Navy](http://en.wikipedia.org/wiki/United_States_Navy) achieved Initial Operational Capability of the [Joint Helmet Mounted Cueing System](http://en.wikipedia.org/wiki/Joint_Helmet_Mounted_Cueing_System).

Since 1993 the German MiGs were stationed with 1./JG73 "*Steinhoff*" in [Laage](http://en.wikipedia.org/wiki/Laage) near [Rostock](http://en.wikipedia.org/wiki/Rostock). During the service in the *Luftwaffe* one MiG-29 ("29+09") was destroyed during an accident on 25 June 1996 due to pilot error. By 2003, *Luftwaffe* pilots had flown over 30,000 hours in the MiG-29. In September 2003, 22 of the 23 remaining machines were sold to the [Polish Air Force](http://en.wikipedia.org/wiki/Polish_Air_Force) for the symbolic price of €1 per item. The last aircraft were transferred in August 2004. The 23rd MiG-29 ("29+03") was put on display at Laage.

**Poland**

Polish MiG-29A

The first 12 MiG-29 (nine MiG-29As, three MiG-29UB) were delivered to Poland in 1989-1990. The aircraft were based at [Mińsk Mazowiecki](http://en.wikipedia.org/wiki/Mi%C5%84sk_Mazowiecki) and used by the 1st Fighter Aviation Regiment, which was reorganized in 2001 as [*1 Eskadra Lotnictwa Taktycznego*](http://en.wikipedia.org/wiki/1_Eskadra_Lotnictwa_Taktycznego) (*1. elt*), or 1st Tactical Squadron (TS). In 1995, 10 used examples were acquired from the Czech Republic (nine MiG-29As, one MiG-29UB). After the retirement of its MiG-21s and -23s in 2003, Poland was left for a time with only these 22 MiG-29s in the interceptor role.

In 2004 Poland received 22 ex-*Luftwaffe* MiG-29s. A total of 14 of these were overhauled and taken into service, equipping the 41st Tactical Squadron (*41. elt*) and replacing its MiG-21s. At present Poland has 32 active MiG-29s (26 MiG-29As, six MiG-29UB) which will serve at least until 2012–2015. They are currently stationed with the 1st Tactical Squadron at the [23rd Air Base](http://en.wikipedia.org/wiki/23rd_Air_Base) near [Mińsk Mazowiecki](http://en.wikipedia.org/wiki/Mi%C5%84sk_Mazowiecki) and the 41st TS at the [22nd Air Base](http://en.wikipedia.org/wiki/22nd_Air_Base) near [Malbork](http://en.wikipedia.org/wiki/Malbork). As of 2008, Poland is the biggest NATO MiG-29 user. The possibility of modernizing the fighters to enable them to serve until 2020–2025 is being contemplated, depending on whether cooperation with [Mikoyan](http://en.wikipedia.org/wiki/Mikoyan) can be established.

From 2007, MiGs are supported by Block 52+ F-16s from 3rd TS (replacing MiG-21) and 6th TS (replacing Su-22), from 2008 F-16s will also be used in 10th TS (replacing MiG-21).

There have been unconfirmed reports that Poland had at one point leased a MiG-29 from their own inventory to [Israel](http://en.wikipedia.org/wiki/Israel) for evaluation and the aircraft has since been returned to Poland, as suggested by photographs of a MiG-29 in Israeli use.

**United States**

A Polish MiG-29 in company with a [USAF](http://en.wikipedia.org/wiki/United_States_Air_Force) [F-16](http://en.wikipedia.org/wiki/F-16_Fighting_Falcon).

In 1997, the United States purchased 21 [Moldovan](http://en.wikipedia.org/wiki/Moldova) aircraft under the [Nunn-Lugar Cooperative Threat Reduction](http://en.wikipedia.org/wiki/Nunn-Lugar_Cooperative_Threat_Reduction) program. Fourteen were MiG-29Ss, which are equipped with an active radar jammer in its spine and are capable of being armed with nuclear weapons. Part of the United States’ motive to purchase these aircraft was to prevent them from being sold to "rogue states", especially Iran. This purchase could also provide the United States Air Force with a working evaluation and data for the MiG-29. Such information may prove valuable in any future conflicts and can aid in the design and testing of current and future weapons platforms. In late 1997, the MiGs were delivered to the National Air and Space Intelligence Center (NASIC) at [Wright-Patterson Air Force Base](http://en.wikipedia.org/wiki/Wright-Patterson_Air_Force_Base) near [Dayton, Ohio](http://en.wikipedia.org/wiki/Dayton%2C_Ohio), though many of the former Moldovan MiG-29s are believed to have been scrapped.

**Iraq**

MiG-29s saw combat in the 1991 [Persian Gulf War](http://en.wikipedia.org/wiki/Gulf_War) with the [Iraqi Air Force](http://en.wikipedia.org/wiki/Iraqi_Air_Force). Five MiG-29s were shot down by USAF F-15s. Some Russian sources, citing unspecified Iraqi sources, claim that at least one [Panavia Tornado](http://en.wikipedia.org/wiki/Panavia_Tornado), *ZA467*, was shot down in northwestern Iraq by a MiG-29. However this Tornado, was recorded as having crashed on 22 January on a mission to [Ar Rutbah](http://en.wikipedia.org/wiki/Ar_Rutbah).

Similar claims of Iraqi air-to-air kills are reported in Russian sources for other cases of combat damage known to have occurred due to other causes, such as the B-52 "In HARM's way", which was hit by friendly fire, a [AGM-88](http://en.wikipedia.org/wiki/AGM-88_HARM) High-speed, Anti-Radiation Missile (HARM) that homed on the fire-control radar of the B-52's tail gun; the jet was subsequently renamed, "In HARM's Way". Another Russian claim was that a MiG-29 shot down an F-14, but the US Navy affirms it was shot down by a SAM.

In all of the above-mentioned cases of claimed combat damage by MiG-29s USAF, USN and RAF have concluded the losses and damage to have occurred due to different causes than Iraqi MiGs. Evidence in the form of gun camera footage, witness reports, wreckage analysis or interviews of the pilots that supposed scored the kills have not been made available. Instead, interviewed Iraqi fighter pilots denied the confirmed kills of coalition aircraft.

After the war Iraq's original fleet of 37 MiG-29s was reduced to 12 due to the loss of 16 aircraft during the war, one damaged and the evacuation of four to Iran where their aircraft now serve in the [Iranian Air Force](http://en.wikipedia.org/wiki/Iranian_Air_Force), which now buys MiG-29s from Russia as well. These final 12 aircraft were withdrawn from use in 1995 due to the engines reaching the TBO and Iraq could not send them to overhaul.

**Other countries**

A [Cuban](http://en.wikipedia.org/wiki/Cuba) MiG-29UB shot down two [Cessna 337s](http://en.wikipedia.org/wiki/Cessna_337) belonging to the organization [Brothers to the Rescue](http://en.wikipedia.org/wiki/Brothers_to_the_Rescue) in 1996, after the aircraft approached Cuban airspace.

A MiG-29A of the [Slovak Air Force](http://en.wikipedia.org/wiki/Slovak_Air_Force)

According to some reports, in the 1999 [Eritrean-Ethiopian War](http://en.wikipedia.org/wiki/Eritrean-Ethiopian_War), a few [Eritrean](http://en.wikipedia.org/wiki/Eritrea) MiG-29s were shot down by [Ethiopian](http://en.wikipedia.org/wiki/Ethiopia) [Su-27s](http://en.wikipedia.org/wiki/Su-27) piloted by Russian mercenaries. There are also some other reports of Eritrean MiG-29s shooting down two Ethiopian MiG-21s and three MiG-23s.

There are reports that on 14 September 2001 two [Syrian](http://en.wikipedia.org/wiki/Syria) Air Force MiG-29s were shot down by two IDF/AF F-15C while the MiGs were intercepting an Israeli reconnaissance aircraft off the coast of [Lebanon](http://en.wikipedia.org/wiki/Lebanon). However, both Syria and Israel deny that this occurred.

Russia moved to expand its growing military influence in the Middle East when it announced it is giving Lebanon 10 fighter jets, in the most significant upgrade of Lebanon's military since the civil war ended almost two decades ago. Russia's defense ministry said it was giving the secondhand MiG-29s to Beirut free of charge. The gift was part of a defense cooperation deal that would see Moscow train Lebanese military personnel.

There have been occasional claims regarding the use of [Sudanese](http://en.wikipedia.org/wiki/Sudan) Air Force MiG-29s against insurgent forces in [Darfur](http://en.wikipedia.org/wiki/Darfur). However, whereas [Mi-24](http://en.wikipedia.org/wiki/Mil_Mi-24) 'Hind' combat helicopters as well as [A-5](http://en.wikipedia.org/wiki/Nanchang_Q-5) 'Fantan' or, more recently, [Su-25](http://en.wikipedia.org/wiki/Su-25) "Frogfoot" ground-attack aircraft have been spotted and photographed on Darfurian air fields, no MiG-29s have been observed. On 10 May 2008, a Darfur rebel group, the [Justice and Equality Movement](http://en.wikipedia.org/wiki/Justice_and_Equality_Movement) (JEM) mounted an [assault](http://en.wikipedia.org/wiki/2008_attack_on_Omdurman_and_Khartoum) on the Sudanese capital. The JEM claims to have shot down during this action a [Sudanese Air Force](http://en.wikipedia.org/wiki/Sudanese_Air_Force) MiG-29 with 12.7 mm and 14.5 mm heavy machine gun fire while it was attacking a convoy of vehicles in the [Khartoum](http://en.wikipedia.org/wiki/Khartoum) suburb of [Omdurman](http://en.wikipedia.org/wiki/Omdurman). The aircraft was supposed to be piloted by a Russian mercenary. He was claimed to have been killed in action as his parachute did not open after ejecting. The Sudanese Government has denied the loss.

**Civilian flights**

The MiG-29 is available for flights of civilian passengers. Civilian flights started due to financial problems on [Gromov Flight Research Institute](http://en.wikipedia.org/wiki/Gromov_Flight_Research_Institute) in the Russian city [Zhukovsky](http://en.wikipedia.org/wiki/Zhukovsky_%28city%29). Those flights in [Mikoyan-Gurevich MiG-21](http://en.wikipedia.org/wiki/Mikoyan-Gurevich_MiG-21), [Mikoyan-Gurevich MiG-23](http://en.wikipedia.org/wiki/Mikoyan-Gurevich_MiG-23), [Mikoyan-Gurevich MiG-25](http://en.wikipedia.org/wiki/Mikoyan-Gurevich_MiG-25), MiG-29 and [Sukhoi Su-27](http://en.wikipedia.org/wiki/Sukhoi_Su-27) stopped in July 2006, when civilian flights in MiG-29 and [Mikoyan MiG-31](http://en.wikipedia.org/wiki/Mikoyan_MiG-31) started from [Nizhny Novgorod](http://en.wikipedia.org/wiki/Nizhny_Novgorod).

**Variants**

There are currently several upgrade programs conducted by the Russian Air Force for MiG-29 fighters which envisage: upgrading of the avionics suite to comply with NATO / ICAO (www.icao.int) standards, extension of the aircraft service life to 4,000 flight hours (40 years), upgrading combat capabilities and reliability, safety enhancements. In 2005 the Russian Aircraft Corporation “MiG” started production of new unified family of multi-role fighters of the 4++ generation (aircraft-carrier based MiG-29K, front-line MiG-29M and MiG-35 fighters).

[Romanian Air Force](http://en.wikipedia.org/wiki/Romanian_Air_Force) MiG-29 "Fulcrum-A". The Romanian air force has withdrawn its MiG-29s from service.

MiG-29 (Product 9.12)

Initial production version; entered service in 1983. NATO reporting code is "Fulcrum-A".

MiG-29B-12 (Product 9.12A)

Downgraded export version for non-[Warsaw Pact](http://en.wikipedia.org/wiki/Warsaw_Pact) nations. Lacked a nuclear weapon delivery system and possessed downgraded radar, ECM and IFF. NATO reporting code is "Fulcrum-A".

MiG-29UB-12 (Product 9.51)

Twin seat training model. Infra-red sensor mounted only, no radar. NATO reporting code is "Fulcrum-B".

MiG-29S

The MiG-29S is similar in external appearance to older MiG-29B [airframes](http://en.wikipedia.org/wiki/Airframe), except for the dorsal hump behind the cockpit canopy. Differences start with the improvements in the flight control system. Four new computers provide better stability augmentation and controllability with an increase of 2° in [angle of attack](http://en.wikipedia.org/wiki/Angle_of_attack) (AoA). Its improved mechanical-hydraulic [flight control system](http://en.wikipedia.org/wiki/Aircraft_flight_control_systems) allows for greater control surface deflections. The MiG-29S's dorsal hump, earning it the nickname "Fatback" in service, was originally believed to be for additional fuel, but in fact, most of its volume is used for the new L-203BE Gardenyia-1 [ECM](http://en.wikipedia.org/wiki/Electronic_countermeasures) system.

The MiG-29S can carry 1,150 liter (304 US gallon, 2,000 lb) drop tanks under each wing and a centerline tank. Inboard underwing [hardpoints](http://en.wikipedia.org/wiki/Hardpoint) are upgraded to allow for a tandem pylon arrangement for a larger payload of 4,000 kg (8,820 lb). Overall maximum gross weight has been raised to 20,000 kg (44,000 lb). The GSh-30-1 cannon had its expended round ejector port modified to allow for firing while the centerline tank is still attached. Improvements also allow for new longer-range air-to-air missiles like the R-27E (AA-10 "Alamo") and R-77 (AA-12 "Adder").

Initially, the avionics of the MiG-29S only added a new IRST sighting system combined with a better imbedded training system that allowed for IR and radar target simulation. However, the final MiG-29S improvement kit also provides for the Phazotron N019M radar and more [built-in test equipment](http://en.wikipedia.org/wiki/Built-In_Test_Equipment) (BITE) (especially for the radar) to reduce dependence on ground support equipment; [MiG MAPO](http://en.wikipedia.org/wiki/MAPO) calls this model the *MiG-29SD*. Revised weapon system algorithms in the MiG-29S's software, combined with an increase in processing capacity, allows for the tracking of up to 10 targets and the simultaneous engagement of two with the R-77 missile.

The MiG-29S also has a limited ground-attack capability with unguided munitions, but in order to transform the MiG-29 into a true multi-role fighter, MAPO designed the *MiG-29SM* variant with the improved avionics necessary to carry and employ precision-guided weapons. The "SE/SD/SM" improvements in the MiG-29S, combined with the development money made available for the naval MiG-29K, gave MAPO the incentive to forge ahead with the multirole [MiG-29M "Super Fulcrum"](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M).

Flight performance of the MiG-29S is but slightly reduced due to the additional weight of the additional fuel and avionics. Only 48 MiG-29S new-built airframes were produced for the Russian VVS before funding was cut. Of this number, it is unknown how many are the standard air-superiority "S" version and how many are the multi-role "SM" version. NATO reporting code is "Fulcrum-C".

MiG-29S-13 (Product 9.13)

MiG-29 variant similar to the 9.12, but with an enlarged fuselage spine containing additional fuel and a *Gardeniya* active jammer. Product 9.13S is also version with the same airframe as the 9.13, but with an increased external weapons load of 4,000 kg, and provision for two underwing fuel tanks. Radar upgraded to N019ME, providing an ability to track 10 targets and engage 2 simultaneously. Compatible with the [Vympel R-77](http://en.wikipedia.org/wiki/Vympel_R-77) (AA-12 "Adder") [air-to-air missile](http://en.wikipedia.org/wiki/Air-to-air_missile) (similar to the [AIM-120 AMRAAM](http://en.wikipedia.org/wiki/AIM-120_AMRAAM)). NATO reporting code is "Fulcrum-C".

MiG-29SM (Product 9.13M)

Similar to the 9.13, but with the ability to carry guided [air-to-surface missiles](http://en.wikipedia.org/wiki/Air-to-surface_missile) and TV- and [laser-guided bombs](http://en.wikipedia.org/wiki/Laser-guided_bomb). NATO reporting code is "Fulcrum-C".

German MiG-29GT

MiG-29G/MiG-29GT

It was an upgrade standard for the German Luftwaffe's MiG-29 / 29UB, inherited from the former East Germany to the NATO standards. Works was done by MiG Aircraft Product Support GmbH (MAPS), a joint venture company form between MiG Moscow Aviation Production Association and [DaimlerChrysler Aerospace](http://en.wikipedia.org/wiki/DaimlerChrysler_Aerospace) in 1993.

MiG-29AS/MiG-29UBS (MiG-29SD)

Slovak Air Force performed an upgrade on their MiG-29/-29UB for NATO compatibility. Work is done by RAC MiG and Western firms, starting from 2005. The aircraft now has navigation and communications systems from Rockwell Collins, an [IFF](http://en.wikipedia.org/wiki/Identification_friend_or_foe) system from BAE Systems, new glass cockpit features multi-function LCD displays and digital processors and also fitted to be integrate with Western equipment in the future. However, the armaments of the aircraft remain unchanged. 12 out of 21 of the entire MiG-29 fleet were upgraded and had been delivered as of late February, 2008.

MiG-29 *Sniper*

Upgrade planned for [Romanian Air Force](http://en.wikipedia.org/wiki/Romanian_Air_Force), by Israeli firms. First flight occurred on 5 May 2000. The program was halted along with the retiring of Romanian MiG-29s in 2003. The latter occurred because of high maintenance costs, which led to the [Romanian Government](http://en.wikipedia.org/wiki/Romanian_Government)'s decision to halt the MiG-29 program and further invest in the MiG-21 LanceR program.

MiG-29M

MiG-29M / MiG-33 (Product 9.15)

Main article: [Mikoyan MiG-29M](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M)

Advanced multi-role variant, with a redesigned airframe, mechanical flight controls replaced by a [fly-by-wire](http://en.wikipedia.org/wiki/Fly-by-wire) system and powered by enhanced RD-33 ser.3M engines. NATO reporting code is "Fulcrum-E".

MiG-29UBM (Product 9.61)

Two-seat training variant of the MiG-29M. Never built. Effectively continued under the designation 'MiG-29M2'.

MiG-29K at МАК 2007

MiG-29K (Product 9.31)

Main article: [Mikoyan MiG-29K](http://en.wikipedia.org/wiki/Mikoyan_MiG-29K)

Naval variant based on MiG-29M, the letter "K" stands for "Korabelnogo bazirovaniya" (Deck-based ), with equipment such as folding wings, arrestor gear, and reinforced landing gear. Originally intended for the [*Admiral Kuznetsov* class](http://en.wikipedia.org/wiki/Admiral_Kuznetsov_class_aircraft_carrier) aircraft carriers, had even received series production approval from Russian Ministry of Defense but was later grounded in 1992 due to shift in military doctrine and state financial difficulty. MiG Corporation restarted the program in 1999 and made vital improvement to the previous design. On 20 January 2004, Indian Navy signed a contract of 12 single-seat MiG-29K and four two-seat MiG-29KUB. Modifications were made for Indian Navy requirement, now standard for all current production. Current production MiG-29K and MiG-29KUB also share a two-seater size canopy. The MiG-29K has radar absorbing coatings to reduce radar signature. Cockpit displays consist of wide HUD and three (seven on MiG-29KUB) color LCD MFDs with a [Topsight E](http://en.wikipedia.org/wiki/Topsight_E) helmet-mounted targeting system. It has a full range of weapons compatible with the MiG-29M and MiG-29SMT. NATO reporting code is "Fulcrum-D".

MiG-29KUB (Product 9.47)

Identical characteristic to the MiG-29K but with tandem twin seat configuration. The design is to serve as trainer for MiG-29K pilot and is full combat capable. The first MiG-29KUB developed for the Indian Navy made its maiden flight at the Russian Zhukovsky aircraft test center on 22 January 2007. NATO reporting code is "Fulcrum-D".

MiG-29SMT (Product 9.17)

The [MiG-29SMT](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M#Variants) is an upgrade package of the first-generation MiG-29s (9.12 to 9.13) containing many enhancements intended for the MiG-29M. Additional fuel tanks in a further enlarged spine provide a maximum flight range of 2,100 km (on internal fuel). The cockpit has an enhanced HOTAS design, two 152 × 203 mm (6 × 8 inch) color liquid crystal MFDs and two smaller monochrome LCDs. The upgraded Zhuk-ME radar provides similar features to the MiG-29M. The power plant are upgraded RD-33 ser.3 engines with afterburning thrust rated the same at 8,300 kgf (81.4 kN) each. The weapons load was increased to 4,500 kg on six underwing and one ventral hardpoints, with similar weapon choices as for the MiG-29M variant. The upgraded aircraft has also a painted path for non-Russian origin avionics and weapons.

MiG-29UBT (Product 9.51T)

SMT standard upgrade for the MiG-29UB. Namely users, Algeria and Yemen.

MiG-29UPG

The design is a new modification intended for the MiG-29s used by [Indian Air Force](http://en.wikipedia.org/wiki/Indian_Air_Force). It made its maiden flight on 4 February 2011. The standard includes the new radar [Zhuk](http://en.wikipedia.org/wiki/Zhuk)-M, new avionics, a IFR probe as well as new enhanced [RD-33](http://en.wikipedia.org/wiki/RD-33) series 3 turbojet engines. The modernization is part of a $900 million contract to upgrade the 69 fighters fleet.

MiG-29M2 / MiG-29MRCA

Two-seat version of [MiG-29M](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M). Identical characteristics to MiG-29M, with a slightly reduced ferry range of 1,800 km. RAC MiG presented in various air shows, to name a few, Fifth China International Aviation and Aerospace Exhibition (CIAAE 2004), Aero India 2005, MAKS 2005. It was once given designation MiG-29MRCA for marketing purpose and now evolved into the current MiG-35.

MiG-29OVT on display

MiG-29OVT

The aircraft is one of the six pre-built MiG-29Ms before 1991, later received thrust-vectoring engine and fly-by-wire technology. It served as a thrust-vectoring engine testbed and technology demonstrator in various air shows to show future improvement in the MiG-29M. It has identical avionics to the MiG-29M. The only difference in the cockpit layout is an additional switch to turn on vector thrust function. The two RD-133 thrust-vectoring engines, each features unique rotating nozzles which can provide thrust vector deflection in all directions. However, despite its thrust-vectoring, other specifications were not officially emphasized. The aircraft is being demonstrated along with the MiG-29M2 in various air shows around the world for potential export. The aircraft is usually used as an aerobatic demonstrator.

MiG-35

Main article: [Mikoyan MiG-35](http://en.wikipedia.org/wiki/Mikoyan_MiG-35)

A recently unveiled mature development of the MiG-29M/M2 and MiG-29K/KUB. NATO reporting code is "Fulcrum-F".

**Operators**

Main article: [List of Mikoyan MiG-29 operators](http://en.wikipedia.org/wiki/List_of_Mikoyan_MiG-29_operators)

Operators of the MiG-29 in blue (former operators in red)

Ex-[Czechoslovakian](http://en.wikipedia.org/wiki/Czechoslovakia) MiG-29 of the [Polish Air Force](http://en.wikipedia.org/wiki/Polish_Air_Force)

Hungarian Air Force MiG-29A

Cuban MiG-29UB

[Peruvian Air Force](http://en.wikipedia.org/wiki/Peruvian_Air_Force) MiG-29 on display

**Current**

* [Algeria](http://en.wikipedia.org/wiki/Algeria) - 35 MiG-29s in service as of December 2010.

* [Azerbaijan](http://en.wikipedia.org/wiki/Azerbaijan) - 49 in inventory as of December 2010.

* [Bangladesh](http://en.wikipedia.org/wiki/Bangladesh) - 14 MiG-29SEs and two MiG-29UBs in service.

* [Belarus](http://en.wikipedia.org/wiki/Belarus) - 41 MiG-29s in inventory as of January 2010.

* [Bulgaria](http://en.wikipedia.org/wiki/Bulgaria) - 14 MiG-29S and 4 MiG-29UB, modernized in 2009.

* [Cuba](http://en.wikipedia.org/wiki/Cuba) - 4 MiG-29s in inventory as of January 2010.

* [Eritrea](http://en.wikipedia.org/wiki/Eritrea) - 7 MiG-29s in service as of January 2010.

* [Hungary](http://en.wikipedia.org/wiki/Hungary) - had 12 in service as of January 2010. The last of them was retired in December 2010.

* [India](http://en.wikipedia.org/wiki/India)

* + [Indian Air Force](http://en.wikipedia.org/wiki/Indian_Air_Force) has 69 MiG-29s in service as of December 2010. All MiG-29s are to be upgraded to the *MiG-29UPG* standard.
	+ [Indian Naval Air Arm](http://en.wikipedia.org/wiki/Indian_Naval_Air_Arm) has 4 MiG-29Ks in service with 39 on order as of December 2010.
* [Iran](http://en.wikipedia.org/wiki/Iran) - 35 MiG-29s and 4 MiG-29UBs in inventory as of January 2010.

* [Kazakhstan](http://en.wikipedia.org/wiki/Kazakhstan) - 40 in use as of January 2010.

* [Malaysia](http://en.wikipedia.org/wiki/Malaysia) - 10 MiG-29s in service as of January 2010. To be retired.

* [Myanmar](http://en.wikipedia.org/wiki/Myanmar) - 10 MiG-29Bs and two MiG-29UBs in service as of November 2008. Ordered 20 more MiG-29SMT fighters in 2009.

* [Peru](http://en.wikipedia.org/wiki/Peru) - 19 in service as of January 2010.

* [North Korea](http://en.wikipedia.org/wiki/North_Korea) - 40 in service as of January 2010. 12 initially bought from Belarus in 1995 and a follow up order of 18 MiG-29SE plus 3 new from Russia in 1996. Two were lost in accidents.

* [Poland](http://en.wikipedia.org/wiki/Poland) - 36 in service as of January 2010.

* [Russia](http://en.wikipedia.org/wiki/Russia) - 447 in use as of January 2010.

* [Serbia](http://en.wikipedia.org/wiki/Serbia) - 4 MiG-29s in service as of January 2011.

* [Slovakia](http://en.wikipedia.org/wiki/Slovakia) - 21 MiG-29s received, 12 in service as of January 2010.

* [Sudan](http://en.wikipedia.org/wiki/Sudan) - 12 ordered, and 12 in service as of January 2010.

* [Syria](http://en.wikipedia.org/wiki/Syria) - 19 MiG-29s in operation as of January 2010.

* [Turkmenistan](http://en.wikipedia.org/wiki/Turkmenistan) - 24 MiG-29s in operation as of January 2010.

* [Ukraine](http://en.wikipedia.org/wiki/Ukraine) - [Ukrainian Air Force](http://en.wikipedia.org/wiki/Ukrainian_Air_Force) had 80 MiG-29s in use as of January 2010. Began upgrading MiG-29 9-13s to MiG-29MU1s.

* [United States](http://en.wikipedia.org/wiki/United_States) - Evaluation only

* [Uzbekistan](http://en.wikipedia.org/wiki/Uzbekistan) - 60 MiG-29s in operation as of January 2010.

* [Yemen](http://en.wikipedia.org/wiki/Yemen) - 18 MiG-29SMTs and 1 MiG-29UBT in service as of January 2010.

**Former**

* [Czechoslovakia](http://en.wikipedia.org/wiki/Czechoslovakia) - Received 18 MiG-29 and two MiG-29UB aircraft. Six Czechoslovak MiG-29s were capable of delivering nuclear weapons but equipment needed for carrying these weapons was removed as part a CFE treaty. All passed onto successor states.

* [Czech Republic](http://en.wikipedia.org/wiki/Czech_Republic) - Inherited nine MiG-29 and one MiG-29UB. All sold to Poland in 1995 in exchange for 11 [W-3A Sokol](http://en.wikipedia.org/wiki/PZL_W-3_Sok%C3%B3%C5%82) helicopters.

* [East Germany](http://en.wikipedia.org/wiki/East_Germany) - 24 absorbed into the *Luftwaffe* upon reunification

* [Germany](http://en.wikipedia.org/wiki/Germany) - One crashed, one on display, 22 sold to Poland

* [Iraq](http://en.wikipedia.org/wiki/Iraq)

* [Israel](http://en.wikipedia.org/wiki/Israel) - leased from an unknown country, used for aggressor training.

* [Moldova](http://en.wikipedia.org/wiki/Moldova) - not operational, six MiG-29S in storage.

* [Romania](http://en.wikipedia.org/wiki/Romania) - 17 MiG-29 and five MiG-29UB were delivered in 1989—1990. Withdrawn from service in 2003.

* [Soviet Union](http://en.wikipedia.org/wiki/Soviet_Union)

* [Yugoslavia](http://en.wikipedia.org/wiki/Socialist_Federal_Republic_of_Yugoslavia)

**Aircraft on display**

There are several museums in Russia that display MiG-29s:

* Three are displayed at the [Central Air Force Museum](http://en.wikipedia.org/wiki/Central_Air_Force_Museum) in [Monino](http://en.wikipedia.org/wiki/Monino) near Moscow. The first two are a prototype and an early production model (both with ventral fins), and the third is a MiG-29KVP
* MiG-29 "9-13" is on display of the [Museum of the Great Patriotic War, Moscow](http://en.wikipedia.org/wiki/Museum_of_the_Great_Patriotic_War%2C_Moscow) on the [Poklonnaya Hill](http://en.wikipedia.org/wiki/Poklonnaya_Hill)
* A MiG-29 is on display at the [Central Armed Forces Museum](http://en.wikipedia.org/wiki/Central_Armed_Forces_Museum) in [Moscow](http://en.wikipedia.org/wiki/Moscow)

Several MiG-29s are on display in Europe:

* One MiG-29 is on display at the [Muzeum Wojska Polskiego](http://en.wikipedia.org/wiki/Muzeum_Wojska_Polskiego) in Warsaw, Poland.
* [Polish Aviation Museum](http://en.wikipedia.org/wiki/Polish_Aviation_Museum) in [Kraków](http://en.wikipedia.org/wiki/Krak%C3%B3w) has a MiG-29, which served in the [Polish Air Force](http://en.wikipedia.org/wiki/Polish_Air_Force).
* One MiG-29 is on display in Germany. The only remaining German MiG-29G (29+03) was on display in Laage before being moved to the [Luftwaffenmuseum der Bundeswehr](http://en.wikipedia.org/wiki/Luftwaffenmuseum_der_Bundeswehr) in Berlin's [Gatow Airport](http://en.wikipedia.org/wiki/Gatow_Airport) in 2006 as part of the exhibition "50 Jahre Luftwaffe".
* No. 67 (MiG-29 Sniper proto) is on display at the Romania Muzeul Aviatiei, Bucharest.
* The second MiG-29UB prototype (9-52) is on display at the Riga Aviation Museum, in [Riga](http://en.wikipedia.org/wiki/Riga), [Latvia](http://en.wikipedia.org/wiki/Latvia). After 213 test flights around Moscow between 23 August 1982 and 10 April 1986, it was disassembled and parts of the wings and tails were re-used in prototype (9-16). The remains were shipped to Riga Military Aviation Engineers High School, and later handed over to the Riga Aviation Museum in 1994, where it is currently displayed. The remains of this prototype is in a very bad condition, with open fuselage panels and a partly broken canopy and open cockpit that exposes the airframe to inclement weather.

MiG-29s are currently on display in the [United States](http://en.wikipedia.org/wiki/United_States) at the following locations:

* [Goodfellow AFB](http://en.wikipedia.org/wiki/Goodfellow_Air_Force_Base) in Texas
* [NAS Fallon](http://en.wikipedia.org/wiki/NAS_Fallon) Airpark in Nevada
* Two MiG-29s in Soviet and Moldavian colors are on display at [Nellis AFB](http://en.wikipedia.org/wiki/Nellis_AFB) in Nevada. One MiG-29 in better shape, is inside a hangar alongside a MiG-23.
* For several years an early MiG 29A (s/n 2960516761) was stored in a restoration hangar at the [National Museum of the United States Air Force](http://en.wikipedia.org/wiki/National_Museum_of_the_United_States_Air_Force) near [Dayton, Ohio](http://en.wikipedia.org/wiki/Dayton%2C_Ohio). In June 2007 the aircraft was put on display in the Cold War Gallery of the Museum and continues to receive minor upgrading while on display. It was formerly assigned to the 234th Gvardeiskii Istrebitelnii Aviatsionnii Polk (234th Guards Fighter Aviation Regiment) stationed at [Kubinka (air base)](http://en.wikipedia.org/wiki/Kubinka_%28air_base%29) near [Moscow](http://en.wikipedia.org/wiki/Moscow). This aircraft was one of six MiG-29s that made a good will visit to [Kuopio-Rissala](http://en.wikipedia.org/wiki/Kuopio-Rissala), [Finland](http://en.wikipedia.org/wiki/Finland), in July 1986, an event that marked the first public display of the MiG-29.
* One former Moldovan MiG-29S is currently on display at the [National Museum of the United States Air Force](http://en.wikipedia.org/wiki/National_Museum_of_the_United_States_Air_Force) at [Wright-Patterson Air Force Base](http://en.wikipedia.org/wiki/Wright-Patterson_Air_Force_Base) in [Dayton, Ohio](http://en.wikipedia.org/wiki/Dayton%2C_Ohio).
* A MiG-29 is on display near the entrance at the Pima Air Museum in Tucson, Arizona.
* One MiG-29 is on display at [NAS Fallon](http://en.wikipedia.org/wiki/Naval_Air_Station_Fallon).
* One MiG-29 is on display minus its canopy at [MacDill AFB](http://en.wikipedia.org/wiki/MacDill_AFB).
* A MiG-29 from the former Moldovan group is on display at the [Evergreen Aviation and Space Museum](http://en.wikipedia.org/wiki/Evergreen_Aviation_and_Space_Museum) in McMinnville, Oregon, painted in Russian markings.
* One MiG-29UB is on display at the NASIC headquarters at [Wright-Patterson Air Force Base](http://en.wikipedia.org/wiki/Wright-Patterson_Air_Force_Base) in [Dayton, Ohio](http://en.wikipedia.org/wiki/Dayton%2C_Ohio).

**In private ownership**

* MiG-29UB (civilian registration N29UB) is owned by the [Historic Flight Foundation](http://en.wikipedia.org/w/index.php?title=Historic_Flight_Foundation&action=edit&redlink=1) in [Seattle, Washington](http://en.wikipedia.org/wiki/Seattle%2C_Washington), [USA](http://en.wikipedia.org/wiki/United_States). The aircraft was obtained from Eastern Europe in early 2009. The aircraft has an FAA approved maintenance program and is flyable. The Historic Flight Foundation plans to fly the aircraft at air shows, as well as provide support services for other MiG-29s that become operational in the U.S.
* A private collector, Don Kirlin, has two MiG-29s purchased from [Kyrgyzstan](http://en.wikipedia.org/wiki/Kyrgyzstan). The aircraft are located at the [Quincy Regional Airport](http://en.wikipedia.org/wiki/Quincy_Regional_Airport) in [Quincy, Illinois](http://en.wikipedia.org/wiki/Quincy%2C_Illinois), [USA](http://en.wikipedia.org/wiki/United_States). As of 2010, they have an FAA approved maintenance program and are flyable, operated as part of Kirlin's "Red Air" operation.
* [Carlos Slim](http://en.wikipedia.org/wiki/Carlos_Slim) has bought a MiG-29UB during a business trip in Russia regarding as a collection item for his mansion in Moscow.
* Two additional MiG-29UB in flying condition were offered for sale from Eastern Europe in spring 2009. These aircraft come from the same source as the flyable aircraft owned by the Historic Flight Foundation.

**Specifications (MiG-29)**

3-view drawing of MiG-29

*Data from* MiG specifications,

**General characteristics**

* Crew: 1
* Length: 17.37 m (57 ft)
* [Wingspan](http://en.wikipedia.org/wiki/Wingspan): 11.4 m (37 ft 3 in)
* Height: 4.73 m (15 ft 6 in)
* Wing area: 38 m² (409 ft²)
* [Empty weight](http://en.wikipedia.org/wiki/Manufacturer%27s_Weight_Empty): 11,000 kg (24,250 lb)
* Loaded weight: 16,800 kg (37,000 lb)
* [Max takeoff weight](http://en.wikipedia.org/wiki/Maximum_Takeoff_Weight): 21,000 kg (46,300 lb)
* Powerplant: 2× [Klimov RD-33](http://en.wikipedia.org/wiki/Klimov_RD-33) afterburning [turbofans](http://en.wikipedia.org/wiki/Turbofan), 8,300 kgf (81.4 [kN](http://en.wikipedia.org/wiki/Newton_%28unit%29), 18,300 lbf) each

Performance

* [Maximum speed](http://en.wikipedia.org/wiki/V_speeds#Vno): [Mach](http://en.wikipedia.org/wiki/Mach_number) 2.25 (2,400 km/h, 1,490 mph) At low altitude: Mach 1.25 (1,500 km/h, 930 mph)
* [Range](http://en.wikipedia.org/wiki/Range_%28aircraft%29): 1,430 km (772 nmi, 888 mi) with maximum internal fuel
* [Ferry range](http://en.wikipedia.org/wiki/Ferry_range): 2,100 km (1,800 mi) with 1 drop tank
* [Service ceiling](http://en.wikipedia.org/wiki/Ceiling_%28aeronautics%29): 18,013 m (59,100 ft)
* [Rate of climb](http://en.wikipedia.org/wiki/Rate_of_climb): initial 330 m/s average 109 m/s 0-6000 m (65,000 ft/min)
* [Wing loading](http://en.wikipedia.org/wiki/Wing_loading): 442 kg/m² (90.5 lb/ft²)
* [Thrust/weight](http://en.wikipedia.org/wiki/Thrust-to-weight_ratio): 1.01

**Armament**

* 1 x 30 mm [GSh-30-1](http://en.wikipedia.org/wiki/Gryazev-Shipunov_GSh-30-1) cannon with 150 rounds
* 7 Hard points: 6 x pylons under-wing, 1 x under fuselage
* Up to 3,500 kg (7,720 lb) of weapons including six air-to-air missiles — a mix of [semi-active radar homing](http://en.wikipedia.org/wiki/Semi-active_radar_homing) (SARH) and [AA-8 "Aphid"](http://en.wikipedia.org/wiki/Molniya_R-60), [AA-10 "Alamo"](http://en.wikipedia.org/wiki/Vympel_R-27), [AA-11 "Archer"](http://en.wikipedia.org/wiki/Vympel_R-73), [AA-12 "Adder"](http://en.wikipedia.org/wiki/Vympel_R-77), FAB 500-M62, FAB-1000, TN-100, ECM Pods, S-24, AS-12, AS-14

**Avionics**

* [Phazotron](http://en.wikipedia.org/wiki/Phazotron) N019, [N010](http://en.wikipedia.org/wiki/Zhuk_radar) [radars](http://en.wikipedia.org/wiki/Radars)

**See also**

* [4th generation jet fighter](http://en.wikipedia.org/wiki/4th_generation_jet_fighter)

**Related development**

* [Mikoyan MiG-29M](http://en.wikipedia.org/wiki/Mikoyan_MiG-29M)
* [Mikoyan MiG-35](http://en.wikipedia.org/wiki/Mikoyan_MiG-35)

**Comparable aircraft**

* [F/A-18 Hornet](http://en.wikipedia.org/wiki/F/A-18_Hornet)
* [F-16 Fighting Falcon](http://en.wikipedia.org/wiki/F-16_Fighting_Falcon)
* [Dassault Mirage 2000](http://en.wikipedia.org/wiki/Dassault_Mirage_2000)

**Related lists**

* [List of military aircraft of the Soviet Union and the CIS](http://en.wikipedia.org/wiki/List_of_military_aircraft_of_the_Soviet_Union_and_the_CIS)
* [List of fighter aircraft](http://en.wikipedia.org/wiki/List_of_fighter_aircraft)
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