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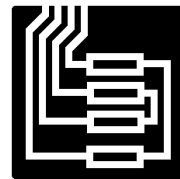
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Mikoyan MiG-21

Outlook

- Croatia retiring MiG-21 in favor of Western aircraft

Note: Icons indicate area(s) of current and potential retrofit/modernization activity



Orientation

Description. Single-engine, single-seat, multirole combat aircraft.

Current Status. Out of production.

Total Produced. Approximately 8,680 aircraft produced.

Application. Interceptor, air-to-ground, tactical reconnaissance; two-seat conversion trainer also available.

Price Range. Dependent on specific upgrade(s) selected.

Contractors

Prime

Russian Aircraft Corp MiG (RAC MiG)

<http://www.migavia.ru>, Bldg 7, 1st Botkinsky proyezd, Moscow, 125284 Russian Federation, Tel: + 7 499 795 80 10, Fax: + 7 495 250 19 48, Email: mig@migavia.ru, Prime

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Mikoyan MiG-21

Technical Data

(MiG-21bis)

Design Features. Delta-wing design with squared-off tips, mid-fuselage mounted. Circular section fuselage features significant dorsal spine; swept tail features large vertical surfaces plus a ventral fin.

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Fuselage length	12.285 m	40.25 ft
Height overall	4.10 m	13.47 ft
Wingspan	7.15 m	23.5 ft
Weight		
Max TOW with two R-3S missiles	8,725 kg	19,235 lb
Performance		
Max level speed at 13,000 m	Mach 2.05	Mach 2.05
Max range, clean, at 11,000 m	1,225 km	660 nm
Service ceiling	17,500 m	57,400 ft
Takeoff run	830 m	2,725 ft

Propulsion

MiG-21 (1) Tumansky R-25-300 augmented turbojet, 69.58 kN (15,650 lbt) with afterburning.

Armament

One twin-barrel 23mm cannon with 200 rounds. Four underwing pylons accommodate air-to-air missiles, rocket packs, bombs, and/or air-to-surface rockets.

Program Review

Development of the MiG-21 to fill the short-range interceptor mission began in 1953, and the definitive design was selected for production in 1956. Full-scale production was authorized in 1958, and initial deliveries were made at the end of that year.

Variants of the MiG-21, which carried the NATO code name "Fishbed," have equipped the air arms of approximately 38 nations, and further developed versions designated F-7 and J-7 have been produced in the People's Republic of China.

Variants

The following are the more recent variants. These would be candidates for retrofit and modernization programs.

MiG-21PFM. Extensively redesigned version, powered by uprated (13,129 lbt) Tumansky R-11 turbojet. Produced 1966-68.

MiG-21R. Tactical reconnaissance version, produced 1965-71.

MiG-21S. Interceptor version of R model, fitted with improved avionics. Produced 1965-68.

MiG-21SM. Similar to S model but powered by 14,300-lbt Soyuz Gavrilov turbojet. Produced 1968-74.

MiG-21M. Export version of SM model, but fitted with R-11F2S-300 turbojet. Produced 1968-71. Manufacture

subsequently transferred to Hindustan Aeronautics Ltd in India, where production continued from 1973 to 1981.

MiG-21MF. Similar to M model but powered by R-13-300 turbojet and featuring avionics similar to those of SM model. Produced 1970-75.

MiG-21MT. Similar to M model but with dorsal spine extended to rear to house additional fuel. Fifteen built in 1971.

MiG-21SMT. Similar to SM model but fitted with R-13F-300 turbojet and featuring additional fuel capacity of MT model. Produced 1971-72.

MiG-21bis. Third-generation, multirole version fitted with uprated Tumansky R-25-300 turbojet. When

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compared with MF model, featured improved construction and larger dorsal fairing.

MiG-21U. Tandem two-seat trainer version, produced 1962-68.

MiG-21US. Redesigned vertical tail surfaces, dorsal fin deleted. Dorsal spine enlarged for additional fuel. Produced 1966-70.

MiG-21UM. Similar to U.S. model but with updated avionics and cockpit.

MiG-21RPV/DP. Rumored optionally manned variant. The aircraft could be flown as a standard MiG-21 or piloted to a target remotely, at which point it would switch to autopilot and fly into the target like a guided bomb.

J-7. Initial Chinese model, based on MiG-21F and powered by Wopen-7 engine.

J-7-I. Initial Chinese-built model produced from 1967.

J-7-II. Improved version with Wopen-7B engine; first flight in 1978.

F-7M. Improved F-7 with Western avionics and modified Wopen-7B engine.

F-7P. Derivative of M model for Pakistan.

F-7MP. Improved F-7M with updated cockpit and navigation system. Rockwell Collins avionics package included ARN-147 VOR/ILS receiver, ARN-149 automatic DF, and Pro Line DME-42 distance measuring equipment (DME).

J-7-III. All-weather J-7 version powered by Wopen-13. Four underwing stations; developed jointly by Guizhou and Chengdu. First flight in April 1984.

JJ-7/FT-7. Two-seat trainer versions of J/F-7 models. First flight in July 1985.

Milestones

<u>Year</u>	<u>Major Development</u>
1953	Development begins
1956	Ye-4 prototype first flight
1958	Full-scale production authorized; initial deliveries
1962	Agreement concluded for licensed production in India
1966	First flight of Chinese J-7
1984	Production of F-7M variant approved

Worldwide Distribution/Inventories

Operator	Designation	Quantity	Average Age
Angola Air Force	MiG-21bis	18	39.00
Angola Air Force	MiG-21UM	4	49.00
Azerbaijan Air Force & Defense	MiG-21	5	45.00
Bulgaria Air Force	MiG-21bis	10	32.00
Bulgaria Air Force	MiG-21UM	3	45.00
Cambodia Air Force	MiG-21bis	2	42.00
Cambodia Air Force	MiG-21UM	2	42.00
Croatia Air Force	MiG-21bis	12	43.00
Croatia Air Force	MiG-21UM	4	41.00
Cuba Air Force	MiG-21bis	5	45.00
Cuba Air Force	MiG-21UM	6	40.00
Egypt Air Force	MiG-21MF	19	46.00
Egypt Air Force	MiG-21PFM	9	45.00
Egypt Air Force	MiG-21R	12	50.00
Egypt Air Force	MiG-21UM	1	45.00
Ethiopia Air Force	MiG-21	18	47.00
Ethiopia Air Force	MiG-21U	3	47.00

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Operator	Designation	Quantity	Average Age
India Air Force	MiG-21bis	117	45.00
India Air Force	MiG-21MF	33	39.00
India Air Force	MiG-21UM	33	49.00
Korea (North) Air Force	MiG-21	46	40.00
Korea (North) Air Force	MiG-21U	36	40.33
Laos Air Force	MiG-21FI	12	45.00
Laos Air Force	MiG-21U	2	48.00
Libya Air Force	MiG-21MF	15	39.00
Madagascar Air Force	MiG-21	8	42.00
Mali Air Force	MiG-21	11	45.00
Mongolia Air Force	MiG-21	10	33.00
Romania Air Force	MiG-21	64	42.00
Romania Air Force	MiG-21U	8	47.00
Serbia Air Force	MiG-21bis	10	45.00
Serbia Air Force	MiG-21UM	2	41.00
Sudan Air Force	MiG-21PF	17	41.50
Sudan Air Force	MiG-21U	2	49.00
Syria Air Force	MiG-21bis	20	39.50
Syria Air Force	MiG-21PF	70	48.00
Syria Air Force	MiG-21SMB	40	40.50
Syria Air Force	MiG-21U	20	46.00
Uganda Air Force	MiG-21bis	5	45.00
Uganda Air Force	MiG-21UM	1	45.00
Vietnam Air Force	MiG-21bis	99	47.00
Vietnam Air Force	MiG-21U	13	46.00
Yemen Air Force	MiG-21	17	45.00
Yemen Air Force	MiG-21U	3	45.00
Zambia Air Force	MiG-21	12	44.00
Zambia Air Force	MiG-21U	2	44.00

Identified Retrofit & Modernization

Electronics

Phazotron NIIR	http://www.phazotron.com , Electrichesty per., 1, Moscow, 123557 Russian Federation, Tel: + 7 7095 253 0495, Fax: + 7 7095 253 0495, Email: phaza@aha.ru (Development)
Russian Aircraft Corp MiG (RAC MiG)	http://www.migavia.ru , Bldg 7, 1st Botkinsky proyezd, Moscow, 125284 Russian Federation, Tel: + 7 095 207 04 76, Fax: + 7 095 207 07 57, Email: mig@migavia.ru (Upgrade)

Opportunities

India's protracted upgrade of 125 MiG-21s was wrapped up at the end of 2006, and we now believe Angola has completed its upgrade as well.

Despite the recent upgrade, India has crashed more than 30 MiG-21s since mid-2004 and is looking for a replacement, though Hindustan Aeronautics Ltd's Tejas Light Combat Aircraft (LCA) program has been continually delayed, with its first flight and its first delivery separated by 14 years. Furthermore, Indian Air Force leaders reportedly have little faith that the new LCA will adequately replace the MiG-21; the Indian Air Force has only ordered 50 of the new aircraft, rather than the 200 fighters required to fully phase out the MiG-21, or 240 to meet the nation's LCA requirements. In recent years, India has become committed to a large-scale, military-wide modernization, and it is likely to order more Tejas aircraft should the initial 50 prove satisfactory. According to a 2014 report, the nation may purchase up to 294 aircraft, enough to equip 14 squadrons.

A growing number of MiG-21 operators are retiring or selling off their vintage MiG fighters. Many current operators simply do not have the funds required for upgrade programs, and some of these have replaced the aircraft with later marks of MiGs acquired from a variety of sources. India lost seven aircraft in 2009 alone, and Romania may purchase F-16s to replace its own fleet.

The window of opportunity for further MiG-21 upgrades is closing.

ELECTRONICS

Mozambican Upgrade. An upgrade performed by Aerostar to modernize eight fighter jets for the Mozambique Air Force. Work began in mid-2013 and was concluded in mid-2014. The aircraft were converted either to the MiG-21UM trainer (2) configuration or the MiG-21bis single-seat (6) configuration.

Both variants also received a GPS and digital flight data recorder.

IAF MiG-21-93 Upgrade. Russia's VPK MAPO was designated the prime contractor to upgrade 125 Indian Air Force MiG-21bis aircraft to MiG-21-93 standard. The IAF selected a number of Western systems for incorporation, including the TOTEM INS from Sextant Avionique of France (featuring ring-laser gyros and an imbedded GPS receiver) and an integrated electronic warfare (EW) suite (believed to be either the EL-8222 or EL-8224) from Israel's Elta Electronics.

The aircraft are also being fitted with the Kopyo multifunction radar developed by Russian electronics firm Phazotron. This system can detect fighter-size targets at ranges out to 31 nautical miles, and its processor can count the number of aircraft within a target group. The MiG-21B is also receiving a new digital computer as well as updated cockpit instrumentation.

Two Russian-developed prototypes returned to India at the end of 2000. By then, about 10 aircraft were undergoing the upgrade in India. The first Indian-upgraded MiG flew in August 2001, and the first 12-unit contingent became operational at the end of 2002.

This program has been hit by numerous delays due to funding constraints in New Delhi, while program costs have escalated – from the original \$125 million estimate to about \$375 million. India's insistence on the use of some Western systems has been cited as a major factor in the rising costs. The upgrade had originally been slated for completion in late 1999, but due to protracted negotiations and economic problems in Russia, it was not completed until 2006.

Croatian Upgrade. Croatia has sent seven MiG-21s to Ukrspetsexport for repair and upgrade, at a total cost of around \$13.7 million. This upgrade is considered a stop-gap effort rather than a permanent solution as Croatia evaluates replacement aircraft, including the JAS 39 Gripen and F-16 Falcon.

This upgrade is likely a mid-life avionics and structural modernization, given its cost and the age of the aircraft involved.

According to Croatian news reports, 12 Croatian MiG-21s were in Odessa during the Russian invasion of Crimea in 2014, which forced a stand-down of all military aircraft in the immediate region. It remains unclear when these aircraft will be allowed to fly again. Note that these aircraft include five undergoing refurbishment before transfer to Croatia, in addition to the seven sent for upgrade.

Croatia has now announced plans to retire the MiG-21 entirely in favor of a new fighter, possibly the F-16 or JAS 39 Gripen. A selection will be made by the end of 2015, with contract signing in 2016. Though it's tempting to jump to conclusions about the MiG-21 upgrade program, the retirement seems more political than technical. Croatia is engaged in a larger military "Westernization," through which the nation will replace any Russian equipment with Western equivalents.

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Avionics Upgrade. In 2001, Nigeria held talks with RAC MiG/Sokol and Aerostar regarding an upgrade of its MiG-21s, but no contract was subsequently announced.

In mid-2004 it was announced that the entire fleet was expected to undergo an avionics upgrade by RAC MiG and Israel Aircraft Industries (IAI) – now Israel Aerospace Industries. No program timetable or cost estimate was announced.

The Nigerian fleet of MiG-21s has since been grounded, and, as such, we do not believe this program will ever begin.

RPV Conversion. Russia has allegedly assisted other nations, including Iraq and Syria, in converting surplus MiG-21 aircraft into remotely controlled chemical

warfare drones. While these programs are classified and details are sparse and unconfirmed, Western and Israeli intelligence agencies may have had a chance to examine an optionally manned variant when a Syrian pilot defected to Jordan in mid-2012. Tellingly, the Syrian government put pressure on Jordan to return the aircraft, which it had not done in the case of earlier defectors.

The modified MiG-21 is believed to work like a guided missile rather than an attack aircraft; a pilot remotely directs the aircraft to a target location, then autopilot takes over and guides the entire aircraft and its payload directly into the target.

Due to the classified nature of this program, we are unable to provide a cost estimate or production forecast at this time.

FI's Opportunity Outlook

ELECTRONICS													
		High Confidence				Good Confidence			Less Confidence				
Status		Thru 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Estimated Potential Candidates	850	Mozambican Upgrade <- MiG-21											
Planned/In Progress		8	0	0	0	0	0	0	0	0	0	0	0
Speculative			2	2	2	2	2	2	2	2	2	2	20