

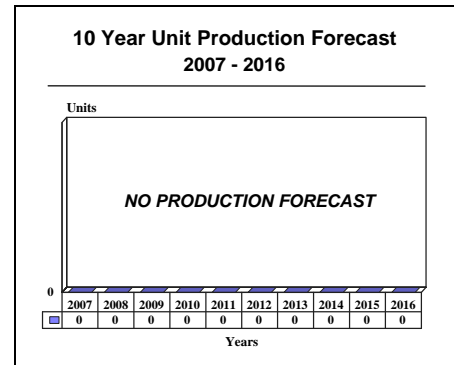
ARCHIVED REPORT

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Yakovlev Yak-42/MS-21 - Archived 5/2008

Outlook

- Introduction of the new MS-21 is now planned for 2015; its future remains uncertain
- New variant of Yak-42D trijet with D-436 engines is being developed



Orientation

Description. The Yak-42 is a short/medium-range, three-engine, narrowbody commercial jet transport aircraft. The MS-21 is a proposed twin-engine derivative.

Sponsor. Russian Ministry of Transport.

Status. Production of the Yak-42D, Yak-42A, and Yak-142. Development of the MS-21.

Total Produced. Through 2006, approximately 184 Yak-42 series aircraft had been produced.

Application. Passenger and cargo transport.

Price Range. Yak-42D, \$10 million in 2003 U.S. dollars.

Contractors

Prime

Saratov Aviation Plant Joint Stock Company	ploshchad Ordzhonikidze 1, Saratov, 410015 Russia, Tel: + 7 8452 44 81 52, Fax: + 7 8452 44 39 02, Prime
Yakovlev Design Bureau	http://www.yak.ru , Leningradsky Prospekt, 68, Moscow, 125315 Russia, Tel: + 7 095 158 34 32, Fax: + 7 095 787 28 44, Email: yakokb@cityline.ru, Prime
NOTE(S): Above contractors apply to Yak-42.	

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Yakovlev Yak-42/MS-21

Technical Data

(Yak-42)

Design Features. Cantilever low/mid-wing monoplane with a t-tail, two empennage-mounted turbofan engines, and a single turbofan engine mounted above the aft fuselage and under the tail section. Engine exhaust is ducted in a manner similar to that of the Rolls-Royce RB211-powered Lockheed L-1011. Flight controls are hydromechanical. Landing gear is hydraulically actuated tricycle type with four-wheel main and twin-wheel nose units.

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Wingspan	34.20 m	112.20 ft
Overall length	36.38 m	119.36 ft
Fuselage diameter	3.80 m	12.47 ft
Overall height	9.80 m	32.15 ft
Cabin length	19.89 m	65.26 ft
Cabin height	2.08 m	6.82 ft
Cabin maximum width	3.60 m	11.81 ft
Weight		
Maximum TOW	54,000 kg	119,048 lb
Normal payload	10,500 kg	23,148 lb
Maximum payload	14,500 kg	31,966 lb
Capacities		
Maximum fuel	23,330 liters	6,163 U.S. gallons
Baggage volume	29.3 cu m	1,035 cu ft
Performance		
Cruise speed	750 kmph	405 kt
Range with normal payload	1,530 km	826 nm
Propulsion		
Yak-42/142	(3)	ZMKB Progress D-36 three-shaft turbofan engines rated 63.74 kN (14,330 lbst) each.

Seating

Yak-42/142: Crew of two plus a flight engineer position and 90-126 passenger seats.

Variants/Upgrades

Yak-42. Standard aircraft, the first of which flew in March 1975. The Yak-42 entered scheduled service with Aeroflot approximately five years later. The Yak-42D version was introduced in 1989, incorporating higher fuel capacity and greater range.

Yak-42F. Variant for electro-optical research.

Yak-42E-LL. Propfan testbed with starboard-mounted D-236 counter-rotating turbopropfan engine. First flight occurred in March 1991.

Yak-142. Also known as the Yak-42D-100, this version is similar to the Yak-42D but is equipped with Honeywell avionics, a larger port-side cabin door, flight-deployable wing spoilers, and redesigned engine

air intakes. It is the production version of the experimental Yak-42A aircraft displayed at the 1993 Paris Air Show. (The Yak-42A designation is now used for a different aircraft; see below.)

In addition to the standard Yak-142 transport model, a 39-passenger VIP version is also available.

Yak-42-200. Proposed 6-meter stretched version. The -200 would carry 150 passengers and have a maximum takeoff weight of 65,000 kilograms (143,300 lb).

Yak-42T. Proposed freighter version featuring a 2.5 meter x 2.0 meter cargo door and a maximum freight load of 12,000 kilograms (26,455 lb). It could accommodate six over-floor pallets and eight under the floor.

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Yak-42A. Derivative of the Yak-42D. This version has improvements such as drop-down oxygen masks, increased wing fuel-tank capacity, enclosed luggage racks, and a larger passenger door. It also has acoustic lining on the engine nacelles for noise reduction, and new avionics to permit Category 2 automatic landings. Intermediate positions have been added to the trailing edge flaps for better field performance in hot-and-high conditions. At its maximum takeoff weight of 57,500 kilograms (126,764 lb), the Yak-42A is able to carry 120 passengers over 1,500 nautical miles. Production of the Yak-42A began in 1998.

Yak-42D-90. The 90-passenger Yak-42D-90 can be produced as a new-build aircraft, while existing Yak-42Ds can be modified to this new configuration. The Yak-42D-90 incorporates a number of changes, including a new flap-deflection mechanism, in-flight-operable spoilers, and drop-down oxygen masks for passengers. The aircraft has a range of 4,000 kilometers (2,159 nm) and a cruise altitude of 9,754 meters (32,000 ft).

Yak-42M. Abandoned and replaced by the Yak-242 (see below). The Yak-42M employed an entirely new wing, a digital fly-by-wire flight control system, a CRT-equipped flight deck, a stretched Yak-42 fuselage, a DC-10-type center engine installation with cruciform tail, and three D-436M turbofan engines.

Yak-242. Similar to the Yak-42M, which it replaced. The Yak-242 program was halted in 1997. The aircraft

was powered by two PS-90A12 turbofans rated 118 kN (26,525 lbf) each. Maximum takeoff weight was 64,600 kilograms (142,415 lb), and estimated range with maximum fuel (CAR reserves) was 5,000 kilometers (2,700 nm). The Yak-242 was to carry 130-180 passengers.

Approximately 30 percent of the design work had been completed when the program was halted.

Yak-46. Two Yak-46 versions have been proposed: one would be powered by two D-727 turbofans in the 139-kN (31,244-lbf) class, and the other would be a propfan-equipped version with twin D-27 propfan engines. Seating for up to 168 has been planned, with four separate interior configurations for each version.

Program Review

Background. The first of three Yak-42 prototypes made its initial flight in March 1975. After some configuration changes, an initial series of production Yak-42s was built to replace Aeroflot Tu-134s. The Yak-42 entered scheduled service with Aeroflot in 1980.

New Versions. The Yak-242 was a twin-engine design using PS-90A12 turbofan engines, as compared to the earlier proposed Yak-42M, which retained the trijet configuration of the basic Yak-42 (though the M version was to use more powerful engines than the basic aircraft). Otherwise, the Yak-242 configuration was generally similar to that of the Yak-42M.

Yak-242 Program Abandoned

Work on the Yak-242 was halted in mid-1997. Two prototypes were to have been produced. Although the Yak-242 was to initially be powered by PS-90A12 engines, other powerplants might have eventually been

used, including the International Aero Engines (IAE) V2500 and the CFM International CFM56.

The initial Yak-142, a converted Yak-42, was completed in 1995. This aircraft was purchased by LUKoil, a Russian oil conglomerate. The green Yak-142 was delivered in March 1995 to Hunting Aviation in East Midlands, U.K. Interior components for the aircraft were manufactured by Aircraft Modular Products, Miami, Florida, and were shipped in kit form to Hunting for installation. The interior, which was in a corporate configuration, included 16 executive seats, 18 high-density seats, three galleys, and a stateroom. The aircraft's AlliedSignal avionics had been installed previously for Russian certification testing. Trace International Group, Torrance, California, coordinated the interior installation, which was done to U.S. Federal Aviation Administration (FAA) standards.

Yakovlev Yak-42/MS-21

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Mar	1975	First flight of Yak-42
	1980	Enters scheduled service with Aeroflot
	1987	Development of Yak-42M begun
Mar	1991	First flight of propfan-powered Yak-42E-LL testbed
	1993	Yak-42M effort abandoned and replaced by Yak-242
	1997	Yak-242 program halted
	1998	Production of Yak-42A begun

Forecast Rationale

MS-21 Schedule Slips

Development work is continuing on the new MS-21 family of twin-engine, 130- to 170-seat narrowbody airliners. However, in mid-2006, introduction of the new airliner series was postponed to 2015. A previous program schedule had called for certification in 2011, with initial deliveries in 2012.

A joint program of Yakovlev and Ilyushin, the MS-21 is derived from the defunct Yak-242. Also involved in the MS-21 effort are Aviastar, Irkut, SmAZ, Tupolev, VASO, the leasing company Ilyushin Finance, and the National Reserve Bank. The MS-21 is envisioned as a family of three models. The baseline model is the 156-passenger MS-21-200. It measures 37 meters (121.5 ft) in length and has a maximum takeoff weight of 68,500 kilograms (151,015 lb). Range is listed as 4,500 kilometers (2,430 nm).

The MS-21-200 is to be followed by a shrunk, 132-passenger model called the MS-21-100 and a stretched, 174-passenger variant dubbed the MS-21-300. The -100 is 33.95 meters (111.4 ft) in length. Maximum takeoff weight is 63,500 kilograms (139,995 lb). Range is 4,000 kilometers (2,160 nm).

The stretched MS-21-300 has an overall length of 39.5 meters (129.6 ft), a maximum takeoff weight of 69,000 kilograms (152,120 lb), and a range of 3,500 kilometers (1,890 nm).

Long-range versions of all three models are also planned. Range of the MS-21-100LR is 6,000 kilometers (3,240 nm). The MS-21-200LR has a range of 5,500 kilometers (2,970 nm), and the MS-21-300LR is to be capable of 4,300 kilometers (2,322 nm).

Freighter and combi versions are also planned. The twin-engine MS-21 is to be powered by an as-yet-unselected engine in the 24,200-26,400-lb class.

Under consideration are the AI-436T-12, the PS-12, the V2500, and the TECH56 upgrade of the CFM56.

The development cost of the MS-21 is currently estimated at \$600 million, up from an earlier estimate of \$460 million. The Russian government is providing the program with \$210 million of the \$600 million total. Program officials estimate the potential market for the MS-21 at 650 aircraft by 2028, including 400 for domestic use and 250 for export. The planned production rate is 30-36 aircraft per year.

Overall, though, the future of the MS-21 is somewhat uncertain. The aircraft will compete for sales with the successful Boeing 737 and Airbus A320 series, or the new and improved successor narrowbody families being developed by Airbus and Boeing to replace them. Indeed, should the new United Aircraft Company (OAK in the Russian acronym), of which Yakovlev and Ilyushin are becoming part, become involved in either of the new Airbus or Boeing narrowbody programs, the MS-21 could well be scrapped.

In the meantime, Tupolev and Ilyushin Finance have proposed a pair of enhanced Tu-204 models, dubbed the Tu-204SM family, in an attempt to fill the market gap left by the delay in the MS-21 program schedule. The proposal has the support of OAK. Tupolev and Ilyushin Finance have also suggested that some Russian government funding intended for the MS-21 be shifted to the new Tu-204SM models.

Improved Yak-42 Variant

Meanwhile, an improved version of the Yak-42D is being developed. Features of the new model include three D-436 turbofan engines, increased takeoff weight, higher cruise speed, and greater flight altitude. The aircraft is also to have lower specific fuel consumption, increased range, and better hot/high performance.

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Introduction of this improved model could potentially breathe some new life into the Yak-42 program. However, it is quite possible that the last Yak-42 has been built. Further news regarding the Yak-42 and the MS-21 is awaited.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Aircraft	(Engine)	High Confidence Level			Good Confidence Level			Speculative			Total 07-16		
		thru 06	07	08	09	10	11	12	13	14		15	16
YAKOVLEV YAK-42/142	D-36	184	0	0	0	0	0	0	0	0	0	0	0
Total Production		184	0	0	0	0	0	0	0	0	0	0	0