AEROSPACE SYSTEMS

export catalogue

Rosoboronexport

Aerospace Systems
Export Catalogue

This Catalogue has been prepared by the Rosoboronexport Air Force Department and Media & PR Service with valuable support of Russian aerospace enterprises.

Additional information on the equipment described within can be requested at the Rosoboronexport central office and its representations abroad.

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GLOSSARY

AD ..... Air Defence
ASM ..... Air-to-Surface Missile
ASW ..... Anti-Submarine Warfare
ATGM ..... Anti-Tank Guided Missile
AWACS ..... Airborne Warning & Control System
CEP ..... Circular Error Probability
ECCM ..... Electronic Counter-Countermeasures
ECM ..... Electronic Countermeasures
ET ..... External Tank
EW ..... Electronic Warfare
FCS ..... Fire Control System
GLONASS ..... Global Navigation Satellite System
GPS ..... Global Positioning System
HE ..... High Explosive
HF ..... High Frequency
hp ..... horsepower
HUD ..... Head-Up Display
ICAO ..... International Civil Aviation Organisation
ICBM ..... Inter-Continental Ballistic Missile
IFF ..... Identification Friend or Foe
IR ..... Infra-Red
ISA ..... International Standard Atmosphere
kW ..... kilowatt
LCD ..... Liquid Crystal Display
LV ..... Launch Vehicle
M ..... Mach
MFD ..... Multifunction Display
NAVSTAR ..... Navigation Satellite Timing & Ranging
NBC ..... Nuclear, Biological & Chemical
NVG ..... Night Vision Goggles
RCS ..... Radar Cross Section
RPV ..... Remotely-Piloted Vehicle
RMS ..... Root Mean Square
RWR ..... Radar Warning Receiver
SAM ..... Surface-to-Air Missile
SAR ..... Search-and-Rescue
SHF ..... Super High Frequency
SNS ..... Satellite Navigation System
STOL ..... Short Take-Off & Landing
TNT ..... Trinitrotoluene
TVC ..... Thrust Vector Control
UAV ..... Unmanned Air Vehicle
UHF ..... Ultra High Frequency
VHF ..... Very High Frequency
WCS ..... Weapons Control System

FOREWORD

The revised edition of the "Aerospace Systems" catalogue gives brief descriptions of Russian military/dual-use air and space systems and services offered for export by the Rosoboronexport State Corporation. It covers most important defence-related aerospace technologies developed in Russia, namely:

- Aircraft
- Helicopters
- Unmanned air systems
- Flight simulators
- Aeroengines
- Avionics
- Armament
- Airfield equipment
- Ground Monitoring Equipment
- Life support equipment
- Space systems and services

The catalogue embraces both major military aviation air systems and support facilities, including manned and unmanned aircraft, airborne munitions, ground support equipment, engines, avionics, simulators, etc. The Corporation ensures proper operation of the equipment supplied, its maintenance, spare parts supply, servicing and upgrading, as well as personnel training, organisation of license production, repair and servicing, assistance in constructing airfields, air traffic control systems and command posts. It also offers customer-defined research and development projects, joint production and promotion of aviation materiel to foreign markets, upgrading of the vintage equipment and armament, etc.

Rosoboronexport markets Russian space technologies under strict state control of the missile non-proliferation regime observance. Offered for export are Earth remote sensing, space communication/navigation systems, and development projects for customer-defined space-based systems, as well as services rendered by Russia's space infrastructure (cosmodromes, space control centres, launch vehicles) in putting customer payloads into orbit.

The item list of the catalogue is by no means exhaustive, but rather indicative of the major aerospace areas where products and services are available for export.

The Rosoboronexport catalogue "Aerospace Systems" is intended for foreign Air Force commanders and defence procurement experts as a reference publication.

AEROSPACE SYSTEMS

AIRCRAFT

Tu-22M3E

Long-Range Missile-Carrying Bomber

Mission

The Tu-22M3E aircraft is intended to carry out missile and bomb attacks against mobile and stationary targets in land and sea theatres of operation. It is capable of stand-alone and group operations in hostile air defence and ECM environments.

In land theatres of operation the Tu-22M3E is capable of engaging installations of public and military administration, defence industry targets, power supply systems and communications networks; rendering ineffective air force bases and paved airfields; as well as enemy manpower and materiel concentration areas. The aircraft can penetrate enemy air defences at different flight altitudes and speeds, depending on the situation.

In sea theatres of operation, the Tu-22M3E can engage groups of ships, including carrier battle groups, and can also be employed in water zone and fairway minelaying operations.

Basic specifications	
Length, m	*42.46*
Wingspan, m	*27.70/34.28*
Height on the ground, m	*11.05*
Max take-off weight, kg	*124,000*
Combat load, kg:	
normal	*12,000*
maximum	*24,000*
Max air speed, km/h	*2,000*
Cruising air speed, km/h	*900*
Service ceiling, m	*10,200 - 14,000*
Tactical radius, km	*2,200*
Take-off run, m	*2,000 - 2,100*
Landing roll, m	*1,200 - 1,300*
Powerplant	*2 x NK-25 afterburning turbojets*
Crew	*4*

Armament

The airplane carries up to three Kh-22E missiles. Up to 24,000kg free-fall munitions, distributed between the weapons bay, two fuselage and two underwing multi-shackle racks, can comprise up to sixty-nine 250kg bombs, forty-two 500kg bombs, or eight 1,500kg bombs.

A 23mm gun installed in the aft offers the rear hemisphere protection.

Equipment

The onboard defence system comprises active ECM pods to jam enemy ground/airborne radars, and also chaff and flare dispensers.

The avionics suite ensures automatic navigation, aiming and piloting when flying a pre-programmed or in-flight programmed mission. It also provides bomb dropping and missile launch control.

Su-32

Fighter-Bomber

Mission

The two-seat Su-32 fighter-bomber is designed to destroy ground (surface) targets, including point and multiple, stationary and mobile, as well as air targets under normal and adverse weather conditions in hostile air defence and ECM environments; to conduct aerial reconnaissance and neutralize enemy's AD weapon control systems.

The aircraft features high combat payload capacity and survivability, low-altitude terrain-following flight and employment of high-precision guided air attack weapons against ground, sea-surface and air targets, and unguided air attack weapons from high and low altitudes with high precision over flat and mountainous terrains.

Equipment

The avionics suite ensures highly automated mission accomplishment in the entire range of operating conditions. It incorporates a phased-array radar that detects air targets with cross section of 3 sq meters at a range of at least 120 km. Thus, providing up to 10 targets tracked simultaneously and up to 4 – engaged at a time. Whereas the ground (surface) target acquisition range is from 30 to 100 km. The avionics system also includes a laser-TV station and a powerful automated ECM system. The two-seat side-by-side arrangement provides a direct contact between crew's members and avoids duplication of controls and instruments. Modern instrumentation and comfortable cockpit conditions significantly facilitate crew's operation in duration flights. The air conditioning system allows crew members to operate in cockpit without oxygen masks up to an altitude of 10 km. There is a rest area inside deep fuselage section aft of cockpit, where crew's members can stand up to their full height, take food, etc.

Armament

The Su-32 combat payload is carried on 12 hardpoints and includes guided weapons: R-27R1(ER1), R-27T1(ET1), R-73E, RVV-AE AAMs; Kh-59ME, Kh-31A (P), KH-29TE (L) ASMs; KAB-500L (Kr), KAB-1500L (Kr) laser-guided bombs, as well as unguided weapons: S-8, S-13 and S-25 rockets 250- and 500-kg calibre air bombs. The aircraft is armed with a built-in GSh-301 gun with 150 rounds.

Basic specifications	
Dimensions, m:	
length	*23.34*
height	*6.085*
wing span, m	*14.7*
Take-off weight, normal, kg	*38,240*
Service ceiling, km	*15*
Combat load, kg	*8,000*
Max airspeed, km/h:	
ground-level	*1,400*
high-level	*1,900*
Combat radius, km	*1,100*
Powerplant	*2 x AL-31F turbofaws*
Crew	*2*

Su-39
Aircraft

Mission

The Su-39 aircraft, equipped with Kopyo radar is a profound upgrading of the baseline Su-25 ground attack airplane. It is intended specifically for counteraction to small-size, well-protected targets (including new-generation NATO tanks), by day and night in all weather conditions.

Equipment

The onboard SUV-25T Voskhod weapons control system is designed to identify and automatically track mobile small-size targets (tanks, vehicles, boats, etc.), provide target designation and automatic missile guidance and control for missile/gun/rocket. The Shkval-M optical-TV sighting system performs target search and identification in the scanning mode. Automated navigation and target attack procedures enable a group of Su-39s to strictly maintain prescribed time intervals, and, as a result, a well-coordinated group attack from different directions. The Su-39 automatically flies to the target area, and its pre-directed TV system is activated 10-12 km away from the target. The pilot monitors automatic target selection, lock-on, and switching to the autotracking mode. After the first target run the aircraft can either automatically complete a second run or return to home base, if the pilot so decides (manual control can be resumed only before landing).

Another novelty in the aircraft's avionics is the pod-mounted Kopyo-25 radar.

Basic specifications	
Length (with airspeed boom), m	*15.33*
Wingspan, m	*14.52*
Height, m	*5.20*
Max take-off weight, kg	*19,500*
Combat load, kg	*4,000*
Max air speed, km/h	*950*
Service ceiling, m	*10,000*
Ferry range, km	*2,500*
Take-off run (soil/concrete), m	*750/680*
Landing roll (soil/concrete), m	*750/650*
Powerplant	*2 x R-195 turbojets*
Crew	*1*

The navigation system is supplemented with the A-737 satellite navigation unit, which enables automatic target acquisition with up to 15m position accuracy regardless of the distance to the target.

The upgraded EW system comprises both built-in equipment and externally-mounted pods.

The airplane's protection has also been increased: the total weight of onboard survivability assets amounts to 1,115 kg. A pressurised cockpit offers an increase in the maximum combat altitude to 12,000 m from the baseline aircraft's 7,000 m.

Armament

The Su-39 weaponry fixed on ten external wing hard-points includes 16 Vikhr (Vikhr-M) supersonic antitank missiles, Kh-29T air-to-surface TV homing missiles or Kh-25ML, Kh-29L and S-25L laser homing missiles, as well as 500kg KAB-500Kr bombs. The ordnance includes Kh-58E or Kh-31P anti-radiation missiles.

The aircraft can also carry R-73E, R-27R1 and R-27ER1 air-to-air missiles; up to eight B-8M1 or B-13L rocket pods (with 20 S-8 rockets and five S-13 rockets each respectively); and up to eight S-24 or S-25 rockets. The free-fall ordnance includes bombs of 100-500kg calibre. Eight KMGU cluster bomb pods can be additionally fitted for use against area targets.

The aircraft carries one built-in NPPU-8 mount with the 30mm GSh-30 gun (200-round ammunition).

Variants

The twin-seat combat trainer **Su-25UBK** is designed for mastering piloting skills.

MiG-21-93

Fighter Modernisation Programme

Mission

The MiG-21-93 modernisation programme aims to considerably improve the MiG-21 aircraft combat capabilities with minimum expenditures. Modernisation package includes improvements of the baseline fighter design, equipment and controls, and introduction of new weapons.

Equipment

The modernisation programme also implies installation of a new weapons control system built around the Kopyo multifunction radar, helmet-mounted target designation system, multifunction LCDs and head-up display, navigation, communication, ECM, and video recording systems; as well as the Karat integrated monitoring and flight data recording system.

The MiG-21 baseline flight control, electric power supply, air conditioning, fire-fighting, and cockpit management systems are also upgraded.

The MiG-21-93 upgrade can mount optional foreign-made armament and equipment. For example, the upgraded MiG-21bis UPG fighter of the Indian Air Force features French-made navigation and video recording systems, an Israeli-made passive jamming system, and indigenous communications, navigation and ECM systems.

The upgraded canopy features a frameless windshield and a modified hinged portion cover for improved field of view.

The MiG-21-93 upgraded fighter is equipped with a new WCS ensuring simultaneous tracking of up to eight targets, and simultaneous attack of two most dangerous ones. The Kopyo radar provides missile guidance in the forward and aft hemispheres and against the Earth's background, with target acquisition at low altitudes down to 30m above ground. Dogfighting is supported by a special radar operation mode "Vertical". In the mapping mode the radar is capable of conducting tactical reconnaissance, detecting radar-contrast ground and sea-surface targets, and engaging them with guided and free-fall ordnance.

The BVP-21 chaff/flare dispensers provide self-defence against air-to-air missiles and Stinger-type heat-seeking man-portable air defence systems.

The MiG-21-93 upgrading programme enhances its combat efficiency to the level of the fourth-generation fighters making it comparable with that of F-16 and Mirage 2000.

Upgrading may also include extension of the aircraft's service life.

Armament

The MiG-21-93 upgrade mounts new armament, including RVV-AE, R-27T1, R-27R1 and R-73E air-to-air missiles and KAB-500Kr guided bombs, retaining the organic weapons mix of the MiG-21bis.

Basic specifications	
Length, m	*15.0*
Wing span, m	*7.15*
Height, m	*4.125*
Take-off weight, kg:	
normal	*9,200*
maximum	*10,400*
Max combat load, kg	*1,500*
Max air speed, km/h:	
ground level	*1,300*
high-level	*2,175*
Service ceiling, m	*17,000*
Range, km:	
low-level	*840*
high-level	*1,350*
Max g-load	*+8*
Powerplant	*1 x R25-300*
	afterburning turbojet
Crew	*1*

MiG-31E

Interceptor

Mission

The MiG-31E interceptor aircraft is designed to intercept and destroy air targets at low and high altitudes, in the forward and aft hemispheres, both in the lookup and lookdown modes, in all weather conditions, despite target manoeuvring and active/passive ECM. The aircraft can operate alone or within a group in the continuous or discrete field of control and guidance commands. It is capable of semi-autonomous or fully autonomous operations against manoeuvring and ECM-protected targets. The MiG-31E is designed for employment as part of the nation's air defence system. It is capable of long-endurance patrolling and engaging any airborne threats, including cruise missiles, helicopters and high-altitude reconnaissance aircraft. The MiG-31E can interoperate with various aircraft and provide target designation for up to three fighters, such as the MiG-21-93, MiG-23, MiG-25, MiG-29, and Su-27, and mask their attack.

Basic specifications	
Length (with airspeed boom), m	*21.620*
Wing span, m	*13.456*
Height, m	*6.465*
Max take-off weight, kg	*46,200*
Max air speed, km/h:	
ground level	*1,500*
high-level	*3,000*
Service ceiling, m	*20,600*
Interception range, km:	
M=2.35, H=18,000 m	*720*
M=0.8, H=10,000 m	*1,450*
M=0.8, H=10,000 m with one flight refuelling	*2,250*
Take-off run, m	*1,200*
Landing roll, m	*800*
Required runway length, m	*2,500*
Max g-load	*5.0*
Powerplant	*2 x D-30F6*
	afterburning turbofans
Crew	*2*

Equipment

The MiG-31E weapons control system is built around a phased array radar. It can simultaneously track up to 10 air targets and attack up to four. The surveillance, tracking and attack envelope is limited by ± 70 deg in azimuth and +70...-60 deg in elevation. The radar can detect a target with a 19 sq.m radar cross section at 200 km.

The WCS also includes an IR system providing concealed target acquisition and designation, and operation in severe ECM environment.

The aircraft provides excellent interoperability within a group owing to the onboard radar and data transmission equipment ensuring automatic data exchange between four interceptors at a range of up to 200 km. The group leader assigns targets to his wingmen. A group of four MiG-31Es is capable of controlling an 800-900km-long frontline.

The aircraft features EW assets operating both in the radar and IR frequency bands.

Armament

The basic MiG-31E weapons mix includes four R-33E long-range missiles carried on a semi-recessed pylon under the fuselage, and R-40TD-1 and R-60MK missiles under the wing. The aircraft also has one GSh-6-23M six-barrel gun with the 260-round ammunition allowance.

MiG-29

Light tactical fighter

Mission

The MiG-29 light tactical fighter is designed to intercept and defeat air targets day and night under normal and adverse weather conditions in free air space and against ground surface in natural clutter and ECM environment, using air-to-air missiles with semi-active radar/IR seekers, as well as to destroy ground targets with unguided weapons in conditions of visual flight rules. It operates over friendly territory and in the near-operative and tactical zones of the enemy.

The aircraft features high combat effectiveness, outstanding maneuverability, high reliability and flight safety, and easy operation.

The MiG-29 and MiG-29UB aircraft are baseline models for upgrades of varied complexity, including the MiG-29SE, MiG-29SMT, MiG-29UBT modifications.

The aircraft has its air intakes closed to prevent foreign object damage of engines when moving on the ground, especially on poorly organized airfields and aprons.

Equipment

The weapons control system consists of a radar targeting system with the N-019 radar and an electro-optical targeting/navigation system with an air target acquisition, lock-on and tracking optical locating system including an IR search-and-track system and a laser rangefinder, as well as a helmet-mounted target designation system.

A unique avionic system has been created thanks to the radar, optical locator and helmet-mounted sight data fusion and algorithms integration. Data exchange between the optical locator and radar has helped to notably enhance noise immunity of the aircraft targeting system as a whole. The MiG-29 helmet-mounted target designation system is used for quick locking-on to air targets visually detected by the pilot through the cockpit glass allowing him to designate a target within one second to the radar, optical locating station or directly to the missile seeker, with an accuracy adequate enough for effective weapons employment.

Armament

The aircraft weapons include the GSh-301 built-in gun, as well as the R-27R1 and R-73E air-to-air guided missiles, rockets and bombs suspended under six external stores hardpoints.

Variants

The **MiG-29UB** is designed for instructing and training pilots to fly the aircraft, intercept air targets and engage air and ground targets within the MiG-29's altitude/airspeed combat envelope. It can also perform separate combat missions autonomously and within a MiG-29s group.

The MiG-29UB differs from the combat fighter mainly by its two-seat cockpit, absence of the targeting radar and R-27R1 guided missiles.

The aircraft and its engines, flight-navigation system, armaments, communication aids and in-cockpit warning systems can be managed from both cockpits. The instructor's cockpit accommodates a failures simulation console and a switching console to imitate operation of the radar targeting system during air target interceptions with simulated R-27R1 missiles.

An interactive training system and simulators are used for on-ground formation of the flying and technical personnel.

Basic specifications

	MiG-29	MiG-29UB
Take-off weight, kg:		
normal	*14,900*	*14,600*
max	*18,000*	
Powerplant	*RD-33*	
Afterburning thrust, kgf	*2 x 8,300*	
Max g-load	*9.0*	
Max airspeed, km/h:		
ground-level	*1,500*	*1,450*
high-level	*2,400*	*2,230*
Service ceiling, km	*18.0*	*17.5*
Flight range, km:		
w/o EFT	*1,500*	*1,460*
with 1 x EFT / with 3 x EFT	*2,100/2,900*	*2,000/2,800*
Max external payload, kg	*4,000*	*2,500*

MiG-29SE

Light Tactical Fighter

Mission

The MiG-29SE light tactical fighter is designed for engagement of air targets, as well as ground and maritime targets.

The fighter features high combat effectiveness, outstanding maneuverability, high reliability, and flight safety. The MIG-29SE is simple and economical in operation, being maintained on condition. It has an increased flight life in excess of 3,000 flying hours and a service life of 30 years with possible prolongation.

Equipment

The aircraft is equipped with the integrated weapons control system including the NO19-ME upgraded radar ensuring multiple target engagement with the RVV-AE air-to-air missiles, optical locating station, and helmet-mounted target designation system.

The aircraft is fitted with an in-flight refuelling system allowing it to receive fuel from both Russian and foreign air tankers.

An interactive training system, simulators and the MiG-29UB aircraft are used for on-ground formation of the flying and technical personnel.

The aircraft can be equipped and armed with systems and munitions of foreign origin.

Armament

The upgraded weapons system includes the R-27ER1, R-27ET1, R-27T1, R-27R1, R-73E air-to-air missiles, GSh-301 built-in gun, air bombs and rockets.

Basic specifications	
Take-off weight, kg:	
normal	*15,300*
max	*20,000*
Powerplant	*RD-33*
afterburning thrust, kgf	*2 x 8,300*
Max g-load	*9.0*
Max airspeed, km/h:	
ground-level	*1,500*
high-level	*2,400*
Service ceiling, km	*17.75*
Flight range, km:	
w/o EFT / with 3 x EFT	*1,500/2,900*
with 3 x EFT and one in-flight refuelling	*more than 5,400*
Max external payload, kg	*4,500*

MiG-29SMT

Light Multirole Fighter

Mission

The MiG-29SMT is the latest comprehensive upgrading of the MiG-29 tactical fighter. It is to provide the fighter with entirely new combat capabilities by increasing its combat radius (flight range and endurance) at a minimal cost. As a result of the modernization, the aircraft has acquired high combat efficiency in air-to-air and air-to-surface missions. The aircraft has excellent manoeuvrability with reliability and flight safety enhanced.

As a result of the modernization, the fighter's service life reaches 4,000 hours (or 40 years – with on-condition maintenance).

Equipment

The aircraft features an open-architecture avionics suite, up-to-date information/control cockpit environment with two multifunctional button-fitted liquid-crystal colour indicators, and HOTAS arrangement. System integration effected in compliance with the MIL-STD-1553B standard enables mounting of any equipment on the aircraft at customer requests.

The MiG-29SMT is fitted with modern weapons control system including a modified radar targeting system with the new Zhuk-ME multifunctional radar featuring increased range, multi-channel fire capability and advanced air-to-surface operational modes. The optical locating station and helmet-mounted target designation system make the avionics suite functionally complete. Integration of the targeting and navigational equipment on the basis of the modern computing system has resulted in much greater target acquisition range and sighting angles while the number of targets simultaneously engaged is increased to four.

The aircraft is fitted with new navigation and communication facilities, electronic countermeasures equipment, monitoring and recording systems, as well as optronic pods.

An interactive training system, simulators and the MiG-29UBT combat trainer aircraft are used for on-ground formation of the flying and technical personnel.

Armament

The aircraft guided weapons include the RVV-AE, R-27ER1, R-27ET1, R-27R1, R-27T1, R-73E air-to-air guided missiles, GSh-301 built-in gun, Kh-31A, Kh-31P, Kh-29T(TE), Kh-35E air-to-surface guided missiles, and KAB-500Kr corrected bombs. If fitted with an optronic/laser pod, the fighter can employ the Kh-29L guided missiles and KAB-500L guided bombs. It can also deliver unguided weapons – rockets and bombs.

Basic specifications	
Take-off weight, kg:	
normal	*15,800*
max	*20,300*
Powerplant	*RD-33 series 3*
afterburning thrust, kgf	*2 x 8,300*
Max g-load	*9.0*
Max airspeed, km/h:	
at ground-level	*1,500*
at high altitude	*2,400*
Service ceiling, km	*17.7*
Flight range, km:	
w/o EFT / with 3 x EFT	*1,800/3,100*
with 3 x EFT and one in-flight refuelling	*more than 6,000*
Max external payload, kg	*5,000*

MiG-29K/KUB

Shipborne Multirole Fighter

Mission

The MiG-29K/KUB ship-borne multirole fighter is designed to perform naval groupings' air defence tasks, to gain air superiority, to engage surface and ground (coastal) targets, including small-size ones, with precision-guided weapons, by day and night, in any weather conditions. The fighter is optimized for basing on aircraft carriers of medium displacement.

The MiG-29K fighter is a new-generation MiG-29. It differs from the latest MiG-29SMT upgrade by increased internal fuel load, upgraded engine with increased thrust and smokeless combustion chamber, digital multi-channel fly-by-wire control system, and stores stations number increased to 8. For operations on the aircraft carrier the aircraft has an arrester hook and a reinforced landing gear. Its flight life and service life are also increased – to 6,000 flying hours and 30-40 years correspondingly. The aircraft is maintained on condition.

Equipment

The aircraft has an open-architecture avionics suite based on the MIL-STD-1553B multiplexing bus enabling integration of onboard equipment and weapon systems of Russian and foreign origins at customer requests.

The MiG-29K aircraft is equipped with the modern weapons control system including the Zhuk-ME new multifunctional radar with enhanced operational range, multi-channel fire capability and modern air-to-ground modes of operation. The optical locating station and helmet-mounted targeting system make the avionic suite of the aircraft functionally complete. Integration of the targeting and navigational equipment on the basis of the modern computing system has resulted in much greater target acquisition range and sighting angles while the number of targets simultaneously engaged is increased to four.

Armament

The weapons mix of the aircraft includes the RVV-AE and R-73E air-to-air guided missiles, air-to-surface guided weapons, such as the Kh-35E and Kh-31A anti-ship missiles, Kh-31P anti-radiation guided missiles and KAB-500Kr guided bombs. Unguided weapons include the FAB-500 air bombs and rockets. The aircraft is armed with the GSh-301 built-in gun.

Variants

The **MiG-29KUB** ship-borne combat trainer is designed for naval aviation pilots' training and mastering flying skills, monitoring their techniques of flight management, navigation and combat employment, as well as pilot transition to the MIG-29K aircraft. In terms of its combat mission, the MiG-29KUB performs the entire scope of MiG-29K assigned combat tasks.

The MiG-29KUB has a high degree of design commonality with the MiG-29K aircraft. It is also equipped with the Zhuk-ME airborne radar and carries the same weapons mix. The aircraft can be a baseline model for creation of reconnaissance, target designation, electronic countermeasures, and flight refuelling modifications.

The MiG-29K and MiG-29KUB aircraft have an integral in-flight refuelling system and are equipped with the UPAZ suspended universal refueling unit providing for in-flight refuelling of both internal and external fuel tanks.

An interactive training system and simulators are used for on-ground formation of the flying and technical personnel.

Basic specifications

	MiG-29K	MiG-29KUB
Take-off weight, kg:		
normal	*18,550*	*18,650*
max	*24,500*	
Powerplant	*RD-33MK*	
Afterburning thrust, kgf	*2 x 9,000*	
Max g-load	*8.0*	
Max airspeed, km/h:		
at ground level	*1,400*	
at high altitude	*2,100*	*2,100*
Service ceiling, km	*17.5*	
Flight range, km:		
w/o EFT	*2,000*	*1,700*
with 3 x EFT	*3,000*	*2,700*
Max external payload, kg		
with 3 x EFT and one in-flight refuelling, kg	*6,500*	

MiG-29M/M2

Multirole Fighter

Mission

The MiG-29M/M2 multirole fighter is designed to defeat air and ground/surface targets by day and night in fair and adverse weather conditions, and in complex jamming environment.

The aircraft features high combat effectiveness, outstanding flight performance characteristics, and easy operation.

Thanks to a second crewmember (on M2 version), certain combat missions, especially attacks against ground targets, operations within a group of MiG-29s, operations in jamming conditions, can be accomplished more effectively. The aircraft is equipped with an in-flight refuelling system.

The MiG-29M aircraft is a new-generation MiG-29. It differs from the latest MiG-29SMT upgrade by the increased internal fuel load, upgraded engine with increased thrust and smokeless combustion chamber, digital multichannel fly-by-wire control system, stores stations number increased to 8. The aircraft has a reinforced landing gear. Its flight life and service life are also increased to 6,000 flying hours and 40 years correspondingly.

The aircraft is maintained on condition. The MIG-29M/M2 fighter is unified with the MiG-29K/KUB by 95%.

Equipment

The MiG-29M/M2 avionics suite has an open architecture based on the MIL-STD-1553B multiplexing bus enabling integration of the onboard equipment and weapon systems of both Russian and foreign origins at customer request.

The MiG-29M aircraft is equipped with the advanced weapons control system including the new Zhuk-M multi-function radar with enhanced operational range, multi-channel fire capability and modern air-to-ground modes of operation. The optical locating station and helmet-mounted targeting system make the avionic suite of the aircraft functionally complete. Integration of the targeting and navigational equipment on the basis of the modern computing system has helped to notably increase target acquisition range and sighting angles, as well as the number of targets simultaneously engaged (up to four).

Armament

The weapons control system manages the RVV-AE, R-27ER1, R-27ET1, R-27R1, R-27T1, R-73E air-to-air guided missiles, Kh-29T(TE), Kh-29L, Kh-31A, Kh-31P, Kh-35E air-to-surface guided missiles, KAB-500Kr, KAB-500L corrected bombs, unguided rockets, bombs and the GSh-301 built-in gun.

An interactive training system and simulators are offered for on-ground formation of the flying and technical personnel.

Basic specifications

	MiG-29M	MiG-29M2
Crew	*1*	*2*
Take-off weight, kg:		
normal	*17,500*	*17,800*
max	*22,400*	*23,700*
Powerplant	*RD-33MK*	
Afterburning thrust, kgf	*2 x 9,000*	
Max operational g-load	*9.0*	
Max airspeed, km/h:		
at ground-level	*1,500*	
at high altitude	*2,400*	*2,200*
Service ceiling, km	*17.5*	
Flight range, km:		
w/o EFT /		
with 3 x EFT	*2,000/3,200*	*1,700/2,700*
with 3 x EFT and one		
in-flight refuelling, kg	*more than 5,500*	
Max external payload, kg	*6,500*	

Su-27SKM

Multirole Fighter

Mission

The Su-27SKM is a highly maneuverable single-seat multirole fighter. It is designed to gain air superiority, defeat air and ground targets in all weather with guided and unguided weapons, while operating self-sustained or within an air group.

Equipment

The aircraft is equipped with the surveillance/sighting (radar and optronic) systems that provide engagement of air and ground (surface) targets, day and night, under fair and adverse weather conditions. The built-in laser range-finder ensures efficient employment of high-precision weapons.

The radar mapping of ground (water) surface and target tracking provide pre-launch target designation and employment of missiles and air bombs in any weather, day and night.

The high-performance ECM equipment is installed on fighter to destroy the hostile radars by anti-radiation missiles. The navigation system provides high-accuracy navigation in all stages of flight. The cockpit instrumentation facilitates the pilot to operate effectively using a combination of the large-size colour LC multifunctional displays. The in-flight refuelling system enables to increase the fighter's flight endurance restricted by physical ability of a pilot.

Basic specifications	
Length	*21.9*
Wing span, m	*14.7*
Height, m	*5.9*
Take-off weigh, kg	
normal	*23,430*
max	*33,000*
Max combat load, kg	*4,430*
Max airspeed:	
ground-level, km/h	*1,400*
high-level, Mach number	*2.15*
Service ceiling, km	*18,500*
Flight range, km:	
high-altitude	*3,530*
low-altitude	*1,340*
Take-off run, m	*450*
Landing roll (with drogue chute), m	*620*
Max g-load	*9.0*
Powerplant	*2 x AL-31F*
Crew	*1*

Armament

The Su-27SKM combat load is carried on ten external hardpoints and includes R-27 air-to-air missiles of all modifications, R-73E and RVV-AE AAMs, as well as Kh-31A, Kh-31P, Kh-29T (TE, L) ASMs and KAB-1500Kr and KAB-500Kr guided bombs. The unguided weapons comprise S-8, S-13 and S-25 rockets and up to 500-kg calibre air bombs.

The aircraft is also armed with a built-in GSh-301 gun with 150 rounds of ammunition.

A combination of outstanding flight performance and highly-efficient weapons mix makes the Su-27SKM the most flexible, highly agile and powerful multirole fighter.

Su-30MK

Multirole Fighter

Mission

The Su-30MK is a highly maneuverable multirole two-seat fighter manufactured by the Irkut Corporation. It is designed to gain air superiority, defeat ground and surface targets with guided and unguided air-launched weapons, and operate within an air group.

The fighter's integrated configuration with canard surfaces and movable thrust vector incorporated into the control loop facilitates decreasing minimum flight speed and performing aerobatics at low (up to zero) air speeds with no limits to angle of attack.

Equipment

Advanced avionics suite includes a fire control radar, an optronic targeting/navigation radar with high-precision navigation aids, electronic countermeasures equipment of container-type, an IFF system, communications equipment, a recording and monitoring system allowing the fighter to perform efficiently missions assigned.

The phased array antenna radar can track while scan up to 15 air targets in automatic mode. Acquisition range for a fighter-type target (with the radar cross section of 3 m^2) is 120 km in free space and 100 km against the earth background. There is an option of attacking radar-contrast ground targets while continuing air space scanning. The fire control radar can classify up to 10 types of air targets. The optronic locator can detect targets at a distance of up to 90 km and find range to them up to 3.5 km. A helmet-mounted sight, supplying target designation to missiles' IR seekers, greatly improves fighter's effectiveness in close air manoeuvring combat. The rear and front cockpits are equipped with multifunctional colour control consoles to manage the avionics systems and weapon systems of the aircraft. A digital ground map with associated operational/tactical information can also be displayed on the indicator.

Basic specifications	
Length	*21.9*
Wing span, m	*14.7*
Height , m	*6.4*
Take-off weight, kg:	
normal	*26,090*
max	*34,000*
Max take-off weight, kg	*38,800*
Max combat payload, kg	*8,000*
Max airspeed:	
at ground level, km/h	*1,350*
at high altitude, Mach number	*1.90*
Service ceiling, km	*17,300*
Flight range, km:	
high-altitude w/o refuelling	*3,000*
with one refuelling	*5,200*
Take-off run, m	*550*
Landing roll (with drogue chute), m	*750*
Max g-load	*9.0*
Crew	*2*

Armament

The Su-30MK combat load is carried on 12 hardpoints and includes air-to-air and air-to-surface guided missiles, corrected bombs, unguided air bombs and rockets.

The fighter can launch all modifications of the RVV-AE and R-27 medium-range air-to-air guided missiles and R-73E close-range agile missiles providing high target kill probability and possibility of simultaneous launches against four targets.

Employment of the Kh-31P, Kh-31A, Kh-59ME, Kh-29T (TE) high-precision air-to-surface guided missiles with passive and active radar, TV and command guidance systems and KAB-1500Kr and KAB-500Kr (OD) corrected bombs allows the fighter to defeat with high precision a wide range of ground and surface targets.

The Kh-29L missiles with semi-active laser seekers and KAB-1500LG corrected bombs can be employed by the fighter fitted with a thermal-vision/laser targeting system.

Unguided weapons include rockets of S-8, S-13 and S-25 types and up to 500-kg air bombs.

The aircraft is fitted with the 30 mm GSh-301 built-in gun with highly effective ammunition of different types.

Su-30MK2

Multirole Fighter

Mission

The Su-30MK2 is a highly manoeuverable multirole fighter. It is designed to destroy air and ground targets in all weather conditions with guided and unguided weapons, operating alone and as part of an aircraft group in favour of gaining air superiority.

The fighter's two-seat configuration enhances its combat effectiveness and helps pilots to master their piloting and combat employment skills.

Equipment

The Su-30MK2 is equipped with the surveillance/targeting (radar and optronic) systems that provide engagement of air and ground (surface) targets, day and night, under fair and adverse weather conditions. The built-in laser range-finder ensures efficient employment of high-precision weapons.

The radar mapping of ground (water) surface and target tracking provide pre-launch target designation and employment of missiles and air bombs in any weather, day and night.

The high-performance ECM equipment is installed on fighter to destroy the hostile radars by anti-radiation missiles . The navigation system provides high-accuracy navigation in all stages of flight. The cockpit instrumentation facilitates the pilot to operate effectively using a combination of the large-size colour LC multifunctional displays. The in-flight refuelling system enables to increase the fighter's flight endurance/combat radius, restricted by physical ability of a pilot.

Basic specifications	
Length	*21.9*
Wing span, m	*14.7*
Height , m	*6.4*
Take-off weigh, kg	
normal	*24,900*
max	*34,500*
Max combat load, kg	*8,000*
Max airspeed:	
ground-level, km/h	*1,400*
high-level, Mach number	*2.00*
Service ceiling, km	*17,300*
Flight range, km:	
high-altitude	*3,000*
low-altitude	*1,270*
Take-off run, m	*550*
Landing roll (with drogue chute), m	*750*
Max g-load	*9.0*
Powerplant	*2 x AL-31F*
Crew	*2*

Armament

The Su-30MK2 combat load is carried on ten external hardpoints and includes R-27 air-to-air missiles of all modifications, R-73E and RVV-AE AAMs, as well as Kh-35E, Kh-59MK, Kh-59ME, Kh-31A, Kh-31P, Kh-29T (TE, L) air-to-surface missiles, and KAB-1500Kr and KAB-500Kr guided bombs.

The unguided weapons include S-8, S-13 and S-25 rockets and up to 500-kg calibre air bombs.

The aircraft carries one built-in GSh-301 gun with 150 rounds of ammunition.

Su-35

Multirole Fighter

Mission

The Su-35 is a super maneuverable single-seat multirole fighter. It is designed to destroy air and ground targets in all weather with guided and unguided weapons and operating alone and as part of an aircraft group in favour of gaining air superiority.

Equipment

The Su-35 avionics suite includes: an up-to-date multi-channel long range radar (up to 400 km against air targets with RCS=3 m^2), providing high resolution in the 'air-to-surface' mode, as well as joint operation both in 'air-to-air' and 'air-to-surface' modes, as well as

- highly integrated avionics with overall control from open architecture data control system providing intelligent support to the pilot
- multi-channel (against air and ground targets) highly sensitive and jam-proof optical location system
- cockpit data management field with optimal representation of displayed data and controls, and with implementation of HOTAS
- high-accuracy navigation system
- in-flight refuelling system, increasing flight range
- thrust vector-controlled engines boasting the aircraft unsurpassed manoeuvrability and giving the Su-35 its full capability.

Armament

The fighter carries an impressive armament suite comprising a wide range of close-air combat, short-, medium- and long range weapons with different types of guidance mode.

The Su-35 organic weapons, installed on 12 hardpoints include: R-27R1, R-27ER1, R-27T1, R-27ET1, R-27P1, R-27EP1, R-73E and RVV-AE AAMs; long-range ASMs; long-range anti-ship missiles; Kh-59MK, Kh-31A, Kh-31P, Kh-29T (TE, L), as well as KAB-1500Kr(LG) and KAB-500Kr(OD) guided bombs.

The unguided weapons include S-8 S-13 and S-25 rockets and up to 500-kg calibre air bombs.

The aircraft also has a built-in GSh-301 gun with 150 rounds of ammunition

Basic specifications	
Length	*21.9*
Wing span, m	*15.3*
Height, m	*5.9*
Take-off weight, kg	
normal	*25,300*
max	*34,500*
Max combat load, kg	*8,000*
Max airspeed:	
ground-level, km/h	*1,400*
high-level, Mach number	*2.25*
Service ceiling, km	*18,000*
Flight range, км:	
high-altitude	*3,600*
low-altitude	*1,580*
Take-off run, m	*400 to 450*
Landing roll (with drogue chute), m	*650 to 700*
Max g-load	*9.0*
Powerplant	*2 x 117C*
Crew	*1*

Su-33

Shipborne Fighter

Mission

The Su-33 aircraft is designed to protect aircraft carrier forces and warships against air attacks by rotary- and fixed-wing aircraft, UAVs, and cruise missiles, as well as to engage surface targets with guided and unguided weapons. The aircraft is capable of self-sustained and group operations by day and night, in any weather, over international and enemy water areas. The Su-33 is also capable of providing support for naval aviation operations, conducting air reconnaissance, and carrying out buddy refuelling.

The Su-33 has canards, modified high-lift wing devices, in-flight refuelling equipment, and special airborne communications and navigation equipment that ensures above-water flights and arrested landings. The aircraft takes off from aircraft carrier's ramp, and lands using the arresting hook. Its outer wing and horizontal stabiliser panels are folding. The K-36 ejection seat with increased inclination ensures automatic low-altitude ejection in emergency situations.

Basic specifications	
Length (with airspeed boom), m	*21.185*
Wing span, m	*14.70*
Height, m	*5.72*
Take-off weight, kg:	
normal	*25,000*
maximum	*33,000*
Max combat load, kg	*6,500*
Max high-level air speed, km/h	*2,300*
Service ceiling, m	*17,000*
High-level service range, km	*3,000*
Max g-load	*8.0*
Powerplant	*2 x Al-31F 3rd series afterburning turbofans*
Crew	*1*

Equipment

The aircraft's weapons control system features a pulse Doppler radar operating in track-while-scan and search-and-track modes against the earth/sea-surface background. The Su-33 carries an optronic target acquisition system with a helmet-mounted target designator, a quadruple-redundant fly-by-wire system, and an automatic angle-of-attack/g-load limiting system.

Armament

The Su-33 weaponry is carried on 12 external hardpoints, and includes R-27R1(ER1), R-27T1(ET1) and R-73E air-to-air missiles, rockets, and guided bombs of up to 500kg calibre.

Fitted with a ventral UPAZ flight refuelling system, the aircraft will be able to transfer up to 6,000 kg of fuel to other fighters in mid-air. The Su-33 carries one built-in GSh-301 gun with 150 rounds of ammunition.

Yak-130

Combat Trainer

Mission

The Yak-130 is designed for basic and advanced training of military flight school cadets, for retraining pilots to fly combat fighters in manoeuvre units, and as a light combat aircraft.

The Yak-130 trainer is one of the major components of the integrated flight training system, which comprises ground training assets, simulators, a basic training aircraft, and a training management system. All these components are combined by common open-architecture software allowing further build-up of the system's capacities.

The Yak-130 trainer is capable of providing sufficient pilot training to fly any fourth- or fifth-generation jet fighter, including the Su-30 and MiG-29 family aircraft, as well as Mirage 2000, F-15, F-16, Eurofighter Typhoon, F-22, and F-35 warplanes.

The Yak-130's high versatility facilitates its integration into different national air forces, as far as its technical specifications and operational characteristics are concerned.

Equipment

The Yak-130 is fitted with a digital fly-by-wire system, which functions as an active flight safety system and allows the instructor to adjust stability and controllability parameters to those of the aircraft being simulated. The aircraft cockpits are equipped with electronic displays completely identical in layout to those of fifth-generation aircraft.

The aircraft can carry an integrated Osa or Kopyo radar, or an electro-optical station. If used jointly with the Pchela RPV, the Yak-130 can deliver standoff pinpoint strikes demonstrating increased combat efficiency, especially in mountainous areas.

Armament

Eight underwing pylons and one ventral pylon are used for carrying up to 3,000 kg of payload such as air-to-air and air-to-surface missiles, rockets, bombs, external fuel tanks, and specialised (weapon guidance, reconnaissance, ECM) pods. It is equipped with the refuelling probe considerably enhancing the aircraft combat capabilities.

Basic specifications	
Length, m	*11.493*
Wing span, m	*9.72*
Height, m	*4.76*
Take-off weight, kg:	
max	*9,000*
normal, trainer version	*5,700*
Max combat load, kg	*3,000*
Max air speed, km/h	*1,060*
Service range, without external fuel tanks, km	*2,000*
Service combat radius, km:	
without external fuel tanks	*525*
with external fuel tanks	*915*
Operational g-load	*+8/-3*
Flight attack angles, deg	*up to 40*
Take-off speed (trainer version), km/h	*195*
Landing speed (trainer version), km/h	*180*
Powerplant	*2 x Al-222-25 or DV-2S turbofans*
Crew	*2*

MiG-AT

Combat Trainer

Mission

The MiG-AT aircraft is a classic configuration monoplane with a low mid-wing, two-seat tandem cockpit and two bypass turbojet engines.

The aircraft's aerodynamic layout and parameters allow it to perform flights practically in all subsonic flight modes characteristic of modern and prospective combat aircraft.

Two Larzac 04R20 engines provide high steady-maneuvering loads, takeoff characteristics and rate of climb.

Basic specifications	
Weight, kg:	
normal/max take-off	*5,210/8,150*
max fuel	
in internal tanks	*1,680*
in external tanks	*2 x 470*
Powerplant	*2 x Larzac 04R20*
Take-off thrust (ISA), kgf	*2 x 1,440*
Airspeed, km/h:	
max level speed	*850*
take-off (with full fuel load)	*183*
landing	*175*
Max flight altitude, m	*14,000*
Max flight range, km	*2,000*
Operational g-load	*+8/-3*
Service life, flying hrs	*15,000*
Dimensions:	
length	*12.01*
wing span	*10.16*
height	*4.01*

Equipment

The aircraft is equipped with integrated fly-by-wire control system with digital and analogue parts redundancy. It provides required characteristics of stability and controllability, automatic limitation of angle of attack; engine thrust control, pre-selected radio altitude hold, spin recovery and bringing of the aircraft to straight and level flight.

The MiG-AT combat trainer ensures effective high-quality preparation of flight personnel within the short time thanks to its design simplicity, high reliability of its airframe, power plant and systems, long service life and low-cost life cycle, high maintainability, and excellent flight characteristics.

An interactive training system and simulators are offered for on-ground formation of flying and technical personnel.

IL-114P

Patrol Aircraft

The IL-114P patrol aircraft is designed for aerial patrolling of exclusive economic zones, ports and sea coast, as well as air pollution control and environmental monitoring.

The IL-114P searches for and detects surface vessels, identifies and locates them, determines their movement parameters; reveals cases of state border/economic area trespassing and provides target designation of trespassers. The aircraft can also be used for search, rescue and evacuation of casualties, and cargo transportation.

The IL-114P is capable of autonomous operation in adverse weather conditions, day and night, in a variety of climates. The aircraft and its systems are operated according to the "on-condition" maintenance scheme.

The onboard electronic equipment includes surveillance radar, IR and television imaging systems, managing computer system, recording equipment, communication and automatic data transmission equipment, and environmental monitoring and photography system.

External equipment includes searchlight and loudspeaker pods, gun pod, and survival equipment containers.

IL-114MP

Multi-Purpose Patrol Aircraft

The IL-114MP multi-purpose patrol aircraft is designed for aerial patrolling in littoral and blue water zones, and provides detection, identification, tracking and destruction of underwater and surface targets. The IL-114MP gathers electronic reconnaissance data on underwater and surface vessels. It can also be employed in SAR operations in emergency cases. The crew locates missing persons with the help of the onboard detection systems, and airdrops survival equipment. The IL-114MP is capable of engaging enemy surface vessels from a standoff range. Its ASW capabilities include submarine detection, tracking and engagement, as well as planting of linear mine barriers. The avionics suite includes radar, sonobuoys, magnetic anomaly detection equipment, managing computer system, IR and television imaging system and electronic reconnaissance system. Modular design of the ASW system enables further build-up of additional equipment, including installation of any equipment or subsystems meeting the MIL-STD-1553B standard.

Basic specifications

	IL-114P	IL-114MP
Length, m	*27.40*	*29.654*
Wing span, m	*30.00*	*30.00*
Height, m	*9.186*	*9.186*
Max take-off weight, kg	*26,000*	*30,000*
Patrol speed, km/h	*350-400*	*350-400*
Patrol altitude, m	*100-8,000*	*500-8,000*
Patrol duration at a range of up to 300 km, hrs	*8-12*	*9-12**
Take-off run, m	*800*	*1,300*
Landing roll, m	*500*	*1,000*
Powerplant	*2 x TV7-117 series 2 turboprops*	*2 x AI-20D series 5 turboprops*
Crew	*2*	*2*
Operators	*2-4*	*2-4*

** - at a range of 370 km*

IL-76MD/IL-76MF

Medium-Range Military Transport Aircraft

Mission

The IL-76MD/IL-76MF aircraft are designed to airdrop troops, transport ground forces and materiel (including medium-weight tanks) with crews, deliver urgent cargos to troops, and transport casualties.

Variants

The IL-76MD is capable of airlanding combat materiel (with crews), cargoes, or fuel in special tanks in the pressurised cargo hold. The twin-deck version of the aircraft is capable of accommodating 225 personnel (145 people - without the second deck).

Its medevac modification can evacuate 114 casualties.

The IL-76MF is a derivative of the IL-76MD, with a new engine control system. The communications instrument panels and controls have been rearranged to enable flights without the radio operator. The crew has been cut down to four people - two pilots, navigator, and flight engineer.

The aircraft avionics ensure airdropping by day and night, in good and adverse weather, in hostile air defence environment. The avionics include navigation/targeting system, long-range navigation system, satellite navigation system (on customer request), radio communications equipment, mid-air collision avoidance system, and flight data recorder.

The aircraft can carry four UAK-10 or nine UAK-5 aircraft containers, or four UUK-20 ground/sea containers.

The IL-76MF is capable of transporting up to 305 persons (in the twin-deck version), or 150 casualties, or military hardware with crews, or fuel in special containers, as well as airdropping troops (186 persons), materiel and cargoes.

Both aircraft can be operated from soil airfields, and are superior to foreign counterparts in terms of cargo hold volume and autonomous operation capability.

Basic specifications

	IL-76MD	IL-76MF
Length, m	*46.60*	*53.19*
Wing span, m	*50.50*	*50.50*
Parked height, m	*14.42*	*14.42*
Cargo hold dimensions, m:		
length	*25.54*	*31.14*
height	*3.40*	*3.40*
width at floor	*3.45*	*3.45*
Max take-off weight, kg	*190,000*	*210,000*
Max payload, kg	*47,000*	*60,000*
Cruising air speed, km/h	*780-800*	*780-800*
Cruising altitude, m	*9,000-12,000*	*9,000-12,000*
Service range, km:		
with max payload	*4,200*	*4,200*
with 40,000 kg	*7,200**	*5,400*
Take-off run, m	*1,700*	*1,800*
Landing roll, m	*1,000*	*990*
Powerplant	*4 x D-30KP-2 turbofans*	*4 x PS-90A turbofans*
Crew	*6*	*4*

** - with 20,000 kg*

IL-78MK

Convertible Flight Refuelling Tanker

Mission

The IL-78MK flying tanker is designed for air refuelling of tactical and heavy aircraft, and also for ground refuelling of tactical aircraft. Air refuelling can be carried out by day and night with visual approach and contact.

The IL-78MK is a derivative of the IL-78 aircraft providing increased fuel transfer at refuelling ranges. It is capable of transferring up to 74,000 kg of fuel at a refuelling range of 1,000 km, and up to 30,000 kg at 3,500 km. The IL-78MK can refuel one heavy aircraft from the rear fuselage refuelling pod, or two tactical aircraft from the wingtip refuelling pods.

By removing the fuselage fuel tanks and refuelling pods, the IL-78MK can be converted into a transport version capable of airlifting up to 70 people or up to 48 tonnes of cargo.

Equipment

The IL-78MK mounts special equipment for in-flight and ground refuelling. Two auxiliary removable fuel tanks with a total capacity of 45,928 litres are mounted in the fuselage, and two standard UPAZ refuelling pods at the wingtips. The PAZ-1M refuelling pod is carried on a special portside pylon in the rear fuselage. The aircraft can be fitted with an upgraded refuelling system adapted to foreign aircraft.

In place of the standard pressurized gunner station in the rear fuselage a refuelling operator station with refuelling pod controls is arranged.

The aircraft is maintained with the use of the organic ground equipment of the IL-76MD aircraft, auxiliary equipment for hoisting the refuelling pods to the underwing and fuselage pylons, containers with ground refuelling hoses, and the refuelling pod maintenance suite.

Basic specifications	
Length, m	*46.60*
Wing span, m	*50.50*
Parked height, m	*14.76*
Max take-off weight, kg:	
concrete runway	*210,000*
soil airfield	*157,500*
Max landing weight, kg:	
concrete runway	*155,000*
soil airfield	*138,000*
Max payload, kg:	
concrete runway	*43,000*
soil airfield	*33,000*
Max transferred fuel weight, kg	*74,000*
Cruising air speed, km/h	*750-840*
Cruising altitude, m	*8,000-11,000*
Refueling air speed, km/h	*440-600*
Refueling altitude range, m	*2,000-9,000*
Ferry range, km	*9,500*
Take-off run (max take-off weight), m	*2,200*
Powerplant	*4 x D-30KP-2 turbofans*
Crew	*7*

IL-76P

Fire-Fighting Aircraft

Mission

The IL-76P is designed to fight fires by dumping extinguishing liquids on fire areas.

The liquids dispenser can be mounted on any Il-76 transport without its extra retrofitting.

Equipment

Two VAP-2 tanks contain 42,000 litres of water or special extinguishing liquids. The tanks are attached to the cargo hold floor by the organic mooring chains. A four-person team can load and moor one tank within 1.5 to 2 hours. It takes 10-12 minutes to fill the VAP tanks with the extinguishing liquid.

The aircraft is capable of dumping 40,000 litres of water from an altitude of 50 m in four seconds. Dumped consecutively or simultaneously from two tanks at the airspeed of 280 km/h and the altitude of 80 m, water covers an area of 600x80 m with the density exceeding five litres per square metre in the centre and gradually decreasing towards the periphery. In about eight seconds all water can be dumped from both tanks.

One IL-76P employed intermittently for three to four hours against a strong ground-level forest fire on an area of 50 hectares can reduce firefront expansion rate by two to three times. The most efficient technique consists in employing two to three IL-76P aircraft in turns to deliver the OS-5 extinguishing liquid. Fire-fighting operations can be started by new line unit crews after only a short training course.

Basic specifications	
Water dispersing speed, km/h	*260-400*
Water dispersing altitude, m	*50-100*
VAP tanks total capacity, m^3	*40,000*
Covered zone length, m	
with the extinguishant density	
on the ground of over 2 l/m^2	*450-900*

An-74

Multi-Purpose Transport Aircraft

Mission

The An-74 aircraft is designed to transport cargoes, equipment, and passengers, carry out SAR, patrol, and reconnaissance missions, and deliver shift teams at geological expedition sites and gas/oil fields. Customised aircraft versions are also available.

Equipment

The aircraft can perform short take-offs and landings at steep angles on substandard mountainous runways. The integrated flight navigation and radio communications systems allow for all-weather, day-and-night operation.

A large cargo hatch meets size requirements of most cargoes transported in containers, on pallets, and in bulk, and accommodates easily self-propelled and towed machinery. A sliding cargo hatch ramp reduces loading/unloading time.

The An-74T-100 and An-74T-200 are transport versions with enhanced payload capacities.

The An-74TK-100 and An-74TK-200 are cargo, passenger (52 persons), and passenger/cargo transports.

The An-74-200D is an administrative aircraft. Its second cargo hold can accommodate a light-weight vehicle.

Basic specifications

	An-74T-100 An-74T-200	An-74TK-100 An-74TK-200
Length, m	*28.068*	*28.068*
Wing span, m	*31.89*	*31.89*
Parked height, m	*8.65*	*8.65*
Cargo hold size, m:		
length with ramp	*10.50*	*10.50*
height	*2.20*	*2.20*
width at floor	*2.15*	*2.15*
Take-off weight, kg	*34,800*	*36,500*
Max payload, kg	*10,000*	*10,000*
Cruising air speed, km/h	*650-700*	*650-700*
Cruising altitude, m	*10,800*	*10,800*
Service range, km:		
with max payload	*2,000*	*1,500*
with full fuel tanks	*4,500*	*4,800*
Powerplant	*2 x D-36 turbofans*	
	series 3A	*series 2A*
Crew	*2-4*	*2-4*

An-38

Multi-Purpose Transport Aircraft

Mission

The An-38 transport aircraft is designed to transport passengers and cargoes (in containers too) on local routes. The An-38 can also be employed for aerial photography, geological surveys, patrol missions, fire-fighting operations, personnel and cargo airdrops, maritime reconnaissance, and medical evacuation.

Basic specifications	
Length, m	*15.67*
Wing span, m	*22.063*
Parked height, m	*5.050*
Cargo hold dimensions, m:	
length	*9.00*
height	*1.60*
width at floor	*1.55*
Max take-off weight, kg	*9,500*
Max payload, kg	*2,500*
Cruising speed, km/h	*340-380*
Cruising altitude, m	*3,000-4,200*
Range (H=3,000 m, ISA), km:	
with max payload	*990*
with max fuel load	*1,790*
Runway length required, m	*895*
Powerplant	*2*
	TPE-331-14GR-801E turboprops
Crew	*2*
Passenger seats	*27*

Equipment

Different versions may have different passenger/cargo combinations. Cargoes up to nine meters long can be loaded through the rear cargo hatch.

The An-38 can be operated from short unpaved and ice/snow-covered runways, from mountainous airfields situated at up to 2,600 m above the sea level, and is operational within the ambient temperature range of -50º to +45ºC.

The integrated flight navigation system enables all-weather, day-and-night operation.

The aircraft is maintained on condition, without overhauls throughout the entire service life.

The An-38 is certificated in compliance with the Russian AP-25 flight standards.

The An-38-100 version is powered by the TPE 331-14GR-801E.

Su-80GP

Multi-Purpose Transport Aircraft

Mission

The Su-80GP multi-purpose transport aircraft is designed to transport passengers and cargoes in the pressurised cargo hold. The aircraft can operate in any geographic area by day and night, in fair and adverse weather conditions.

The Su-80GP can also be employed for medical evacuation, environment monitoring, mapping and aerial photography, patrol/transport, training, and airmobile missions.

The Su-80GP features high cost/efficiency of passenger and freight transportation. The ramp in the rear fuselage facilitates cargo loading/unloading.

Equipment

The integrated avionics suite provides flight control and navigation, monitoring of aircraft systems and equipment, and presentation of data on colour LCDs.

The Su-80GP can be operated autonomously for 50 flight hours, or for 15 days, from non-equipped airfields and soil runways, in the near-ground air temperatures ranging from -50ºC to +45ºC.

Basic specifications	
Length, m	*18.26*
Wing span, m	*23.17*
Parked height, m	*5.52*
Max take-off weight, kg	*14,000*
Max payload, kg	*3,300*
Max cruising air speed, km/h	*470*
Max altitude, m	*7,600*
Range, km:	
with 30 passengers	*1,400*
with 1,950-kg payload	*2,450*
Take-off run, m	*840*
Landing roll (with thrust reversal), m	*460*
Powerplant	*2 x CT7-9B turboprops*
Crew	*2*
Passenger seats	*30*

An-3T

Multi-Purpose Transport Aircraft

Basic specifications	
Length, m	*14.029*
Wing span, m	*18.176*
Parked height, m	*5.00*
Cargo hold dimensions, m:	
length	*4.20*
height	*1.85*
width at floor	*1.65*
Max take-off weight, kg	*5,800*
Max payload, kg	*1,800*
Cruising air speed, km/h	*220-255*
Service ceiling, m	*4,400*
Cruising altitude, m	*2,000*
Service range with 1,500 kg, km	*550*
Runway length required, m	*500*
Airfield altitude	
above sea level, m	*up to 2,000*
Powerplant	*1 x TVD-20-03 turboprop*
Crew	*2*
Passenger seats	*12*

The An-3T aircraft is designed to transport passengers and cargoes on local routes. A derivative of the An-2 aircraft, it can be realised in transport, convertible cargo/passenger, agricultural, firefighting, airmobile, and medevac versions.

The turboprop engine of the aircraft provides increased payload capacity, and outstanding take-off/landing characteristics. The aircraft features modern flight navigation and electric equipment, central warning system, and air conditioning/heating system for the cockpit and cargo hold.

The An-3 is certificated in compliance with the Russian AP-23 flight standards.

Be-103

Multi-Purpose Amphibian

The Be-103 light amphibious aircraft is designed for passenger and cargo transportation; medical evacuation; fire prevention, surveillance, and maritime environmental monitoring operations; recreational flights; and agricultural applications.

Basic specifications	
Length, m	*10.65*
Wing span, m	*12.72*
Height, m	*3.757*
Cargo hold dimensions, m:	
length	*3.65*
height	*1.23*
width	*1.25*
Take-off weight, kg	*2,270*
Payload, kg	*385*
Max air cruising speed, km/h	*260*
Service ceiling, m	*up to 3,000*
Max range, km	*1,250*
Take-off run (water/surface), m	*440/310*
Landing roll (water/surface), m	*320/240*
Wave height, m	*up to 0.5*
Powerplant	*2 x TCM-IO-360ES piston engines*
Crew	*1*
Passenger seats	*5*

The Be-103's amphibious capability allow it to operate in areas with sufficient water surface (rivers, lakes) and remote regions where runway construction is either impossible or economically unfeasible.

Certificated in compliance with the AP-23 requirements, the Be-103 also got the ICAO certificate in Dec. 2001.

The aircraft is fitted with integrated flight navigation and communications systems enabling operation in adverse weather conditions, by day and night. On customer request the aircraft can be fitted with autopilot, satellite navigation system, and weather radar. All versions can be equipped with a copilot (instructor) flight control station.

Be-200

Multi-Purpose Amphibian

Mission

The Be-200 amphibious arcraft is designed to fight forest fires, to transport passengers and cargoes, to carry out SAR operations.

Equipment

The aircraft's integrated flight navigation and communications systems enable operations by day and night, in any weather conditions, and in any season. The aircraft can be flown from sea and internal water strips at least two metres deep.

Variants

The Be-200 fire-fighting version is designed to dump water on fire sites from the onboard tanks. The tanks are emptied simultaneously, or one by one in a crew-selected sequence. Given an airfield-to-fire range of 100 km and an airfield-to-reservoir range of 10 km, the Be-200 is capable of delivering up to 270 tons of water to the fire zone without refuelling. Its high climb rate is a most valuable characteristic for fire-fighting in mountainous terrain and water scooping/dumping near obstacles, such as trees or hills.

If fitted with special dispersers, the Be-200 can also be employed to put out burning fuel, extinguish ship fires, and disperse oil absorbers in operations to remove oil film from water surface.

The Be-200 SAR version is designed for visual and instrumental search, rescue and evacuation of casualties in areas of man-made and natural disasters. This version is fitted with maritime search and surveillance equipment. The aircraft is capable of transporting up to 50 rescue troops, or up to 60 seated casualties, or up to 30 stretcher casualties.

The Be-200 transport version is capable of transporting up to 7.5 tonnes of cargo. The cargo hold is fitted with all the necessary equipment for transporting cargoes in bulk or on standard pallets. The crew can convert the aircraft into a passenger version within one hour. Depending on the passenger cabin configuration, the aircraft is capable of transporting 32 to 64 passengers.

The Be-200 passenger/cargo version is capable of simultaneously transporting 19 passengers and up to 3,000 kg of cargo. The administrative version can transport 18 to 24 passengers.

Basic specifications	
Length, m	*31.43*
Wing span, m	*32.78*
Parked height, m	*8.90*
Cargo hold dimensions, m:	
length	*17.00*
height	*2.60*
width at floor	*1.90*
Max take-off weight, kg	*43,000*
Tank capacity, cu. m:	
water	*12.00*
chemicals	*1.50*
Max cruising air speed, km/h	*710*
Service ceiling, m	*8,000*
Max range, km	*3,600*
Take-off run, m:	
water	*1,000*
surface	*700*
Landing roll, m:	
water	*1,300*
surface	*950*
Sea State	*3*
Wave height, m	*up to 1.2*
Water intake time when gliding, sec	*14*
Powerplant	*2 x D-436TP turbofans*
Crew	*2*

M-55 GEOFIZIKA

High-Altitude Aircraft

Mission

The M-55 Geofizika high-altitude aircraft is designed for stratosphere research (at altitudes of up to 20 km), surveillance, and radio communications missions.

The M-55 can perform the following monitoring missions: atmospheric control, including vapour and aerosol contamination studies; water area control, including surface monitoring, fishery supervision, and waterway navigation control, including detailed mapping and evaluation of damage caused by catastrophes and natural disasters, by day and night, in conditions of poor visibility; support of search-and-rescue operations, harvest forecasting, and aerial monitoring of construction sites.

Basic specifications	
Length, m	*22.868*
Wing span, m	*37.464*
Parked height, m	*4.83*
Max take-off weight, kg	*24,500*
Payload, kg	*up to 2,200*
Cruising air speed, km/h	*750*
Service ceiling, m	*20,500*
Patrol endurance, hrs	*6.0*
Take-off run, m	*970*
Landing roll, m	*820*
Powerplant	*2 x D-30V12 turbofans*
Crew	*1*

The M-55 can fly six-hour-plus high-altitude missions with a 1,500-2,000kg equipment payload used for direct measurements and analysis of the ambient environment, as well as for remote chemical and microphysics research at a range of several kilometres. Within one hour the aircraft can monitor at least 100,000 sq.km.

The M-55's unique altitude characteristics and excellent lifting capacity make it a valuable asset for high atmospheric research. Its two engines provide enhanced flight safety: with one engine failed the M-55 can continue flight at an altitude of 12-14 km and safely land at home base. The M-55 can be operated from airfields situated at up to 4,000 m above the sea level, in ambient temperatures of -40 to +60ºC.

Equipment

The M-55 is a versatile high-altitude air platform with a wide mission scope. The overall volume of its equipment compartment equals 11 cu.m. Optional external containers can house extra 1.2 cu.m of equipment.

The aircraft's baseline design and the capabilities of its systems and power plant ensure normal operation of radar, optical, and radio relay equipment sets.

IL-22-M11RT

Airborne Command Post and Radio-Relay Aircraft

The IL-22-M11RT airborne command post and radio-relay aircraft is designed to ensure reliable and uninterrupted communication when ground communication is disrupted. It can operate both as a command post and as a radio-relay station.

The aircraft is equipped with the 83т035AM radio-relay and communications equipment ('Selena-AME' code).

Its range, mobility and characteristics of combat readiness of troops control networks are unavailable for the ground analogues of such systems and this is very important under dynamic and unprepared conditions of war conflicts.

The aircraft provides radio-relay and communication links via radio-relay, MW, DM and DMW channels, using equipment for cryptographic protection and against falsified data entry. It can relay information on a 'from any direction-to-any direction' principle.

Basic specifications	
Number of communication channels	*19*
Number of radio-relay channels	*9*
Crew	
technical group	*4*
operational group	*6*
Time of flight, hrs	*more than 9*

Yak-42D

VIP Administrative Aircraft

The Yak-42D administrative aircraft has a VIP passenger cabin comprising VIP lounge, conference hall, first class compartment, and aides compartment.

The VIP lounge is fitted with a swivel armchair, a two-seat sofa that can be converted into a bed, a folding desk, and a wardrobe. The lounge is adjacent to a personal bathroom.

The conference hall has four movable swivel armchairs, a conference table, and two seven-seat sofas. The conference hall is fitted with a satellite communications system and a video system.

The first class compartment features four twin seats and two folding tables in the aisle.

The aides compartment accommodates 18 business class seats.

The aircraft is additionally fitted with kitchen appliances. The VIP version can be fitted with Russian- or foreign-made integrated flight navigation and radio communications systems.

The aircraft has a corresponding flight certificate.

Basic specifications	
Length, m	*36.38*
Wing span, m	*34.88*
Max take-off weight, t	*57.5*
Cruising air speed, km/h	*810*
Max cruising altitude, m	*9,600*
Service range, km	*5,585*
Runway length required, m	*2,200**
Max airfield altitude above sea level, m	*1,920*

** - ISA, +35ºC*

Tu-214

Business Aircraft

The Tu-214 mid-range passenger aircraft is designed to carry passengers, luggage and cargo on domestic and international trunk routes to a distance of up to 7,200 km. The aircraft can accommodate up to 210 passengers.

The Tu-214 features improved aerodynamic characteristics, low fuel consumption, reasonable operating costs and lower physiological workload on the crew. The airplane's high aerodynamic efficiency ensures impressive and safe cruising flight and landing at low speeds. The automatic flight control and navigation system provides accurate aircraft navigation along the entire envelope of assigned flight paths. The improved comfort level of the cabin helps the passengers to withstand long flights. The aircraft completely meets ICAO noise and emission requirements.

On customer request the aircraft can be powered by the Rolls-Royce engines and fitted with Honeywell, Allied Signal or Litton avionics.

Basic specifications	
Length, m	*46.16*
Wing span, m	*41.8*
Max take-off weight, t	*110.75*
Cruising air speed, km/h	*850*
Max cruising altitude, m	*12,600*
Max service range, km	*7,200*
Powerplant	*2 x PS-90A turbofans*

IL-96-300

Business Aircraft

The IL-96-300 long-range wide-body airliner is designed to carry passengers, luggage and cargo on domestic and international trunk routes to a distance of up to 13,500 km. The aircraft has a maximum take-off weight of 250 tonnes, and can accommodate up to 289 passengers or almost 40 tonnes of commercial payload, with fuel consumption up to 7.3 tonnes per flight hour.

The IL-96-300 features advanced digital avionics, inertial navigation system and satellite navigation tools, as well as fly-by-wire controls. The airliner is able to perform landings in weather conditions of ICAO IIIA category.

The IL-96-300 VIP-version's interior is made on the basis of original design concepts with the use of certified materials supplied by leading producers. The cabin interior improvements provide maximum comfort and fully meet international requirements for VIP cabins.

Basic specifications	
Length, m	*55.35*
Wing span, m	*60.105*
Max take-off weight, t	*240*
Cruising air speed, km/h	*850*
Max cruising altitude, m	*12,000*
Service range, km	*10,000*
Powerplant	*4 x PS-90A turbofans*

AEROSPACE SYSTEMS

HELICOPTERS

Mi-35/Mi-35P

Combat Transport Helicopters

Mission

The Mi-35/Mi-35P helicopters are designed to provide close air support to ground troops, engage small-size armoured and unarmoured ground and sea targets, escort troops on the march, airlift and provide close air support to airborne and special operations teams, and carry out medevac, reconnaissance and other operations.

The helicopters can airlift eight air assault troops with side arms, or four casualties plus one medical attendant, or 1,500kg cargo in the cargo compartment, or 2,400 kg on a sling.

Basic specifications	
Take-off weight, kg:	
normal	*11,200*
maximum	*11,500*
Payload, kg:	
normal (cargo compartment)	*1,500*
maximum (underslung)	*2,400*
Air speed, km/h:	
maximum	*320*
cruising	*280*
Hovering ceiling, m	*1,750*
Service ceiling, m	*4,500*
Range, km	*450*
Ferry range, km	*1,000*
Powerplant	*2 x TV3-117VMA turboshafts*
Crew	*2*

Equipment

The helicopter's avionics and instruments enable all-weather, day/night operations in any climate.

Armament

The Mi-35s can carry up to eight Ataka/Shturm ATGMs, up to 128 S-5 rockets in UB-32 pods, up to 80 the S-8 rockets in B8V20-A pods, up to four S-24 rockets, UPK-23-250 gun pods, pods with grenade launchers or machine guns, 50 to 500kg bombs, two KMGU-2 small-size cargo containers, and incendiary tanks weighing up to 500 kg.

The gun armament comprises one USPU-24 swivelling cannon turret with one four-barrel YakB-12.7 machine gun (Mi-35) or one NPU-30 gun mount with the twin-barrel 30mm GSh-30 cannon and 250 rounds of ammunition (Mi-35P). Either combat version is equipped with a self-defence and survivability enhancement system.

Mi-35M

Upgraded Combat Transport Helicopter

Features

The Mi-35M upgraded helicopter features enhanced combat efficiency thanks to improved flight performance, round-the-clock employment capability, and modernised weapons systems.

The upgraded helicopter is capable of carrying out a wider range of combat missions, including air reconnaissance with real-time target location and designation, by day and night, in all weather conditions.

The upgraded helicopter is fitted with new main and tail rotors, a new swash plate assembly, a shorter modernised wing with an integrated cargo lifting system, a non-retractable landing gear, increased-capacity external fuel tanks, and an upgraded power plant. These measures increase the helicopter's hovering ceiling up to 4,000 m and its service ceiling up to 5,700 m, enhance survivability and flight safety, and render maintenance much easier.

Equipment

The Mi-35M is equipped with advanced avionics and night vision systems, including night vision goggles, operated at night with subdued cockpit instrument lighting; GOES-342 electro-optical system with a laser range finder, GLONASS/NAVSTAR satellite navigation system, electronic multifunction displays, onboard computer, and jam-proof communications equipment. The upgraded avionics suite enables ground surveillance (with 20 to 25m standard deviation), round-the-clock low-altitude flights with visual observation of underlying terrain, take-offs from/landings at unequipped sites, day/night reconnaissance with target location and designation, and attacks against ground and air targets in any combat environments.

Armament

The helicopter's round-the-clock combat efficiency is enhanced thanks to installation of eight highly effective ATGMs, four Igla-V air-to-air missiles, up to 10 S-13 rockets, the GSh-23 cannon with 450-round ammunition load, and improved weapons control system, computer system, and software.

On customer request the helicopter modernisation programme can be carried out in several stages.

Basic specifications	
Take-off weight, kg:	
normal	*10,900*
maximum	*11,500*
Payload weight, kg:	
normal	*1,500*
maximum (underslung)	*2,400*
Air speed, km/h:	
maximum	*315*
cruising	*260*
Hovering ceiling, m	*4,000*
Service ceiling, m	*5,700*
Range, km:	
without extra fuel tanks	*415*
with extra fuel tanks	*1,085*
Powerplant	*2 x VK-2500 turboshafts*
Crew	*2*

Mi-28NE

Combat Helicopter

Mission

The Mi-28NE gunship is designed to engage armoured and soft-skinned ground, sea and air targets, provide close air support to ground troops, escort tactical airborne troops, conduct air-to-air combat and air reconnaissance in all weather conditions, during stand-alone and group missions with automated target designation and distribution.

The Mi-28NE is capable of automated terrain-following at low and very low altitudes (10 to 25 m), employing its radar and electro-optical surveillance and sighting systems. Excellent power-to-weight ratio allows for operations in alpine terrain, at high ambient temperatures. The Mi-28NE is capable of performing combat manoeuvres with vertical overload of up to 2.6 g, sideways and tail-first flights at a speed of up to 100km/h, and helicopter aerobatics.

Equipment

The integrated avionics suite includes a high-precision navigation system (comprising the inertial, satellite, and geophysical orientation systems); a stabilised sighting system with optical/IR/TV channels featuring video/radar image quality improvement and synthesis subsystems; a thermal imaging system with a laser rangefinder; a mast-mounted radar; helmet-mounted target designation and display systems; an onboard computer; an electronic display system with MFDs; an automated data transfer system; a self-defence system; an automated control system; and a flight mission data processing system.

The Mi-28NE is the world's best helicopter in terms of battlefield survivability. Its automated control system restores proper engine operation after firing-induced stalls, thus extending the unguided weapons delivery range to cover the entire combat altitude and airspeed envelope.

Armament

The Mi-28NE armament includes up to 16 Ataka-V ATGMs, up to eight Igla missiles, up to 80 S-8 rockets in B8V20-A pods, up to 20 S-13 rockets in B13L1 pods, and up to four KMGU-2 small-size cargo containers. The helicopter carries a built-in NPPU-28N swivelling gun mount with one 30mm 2A42 cannon (250-round ammunition load), and UPK-23-250 gun pods.

Basic specifications	
Take-off weight, kg:	
normal	*11,000*
maximum	*12,100*
Air speed, km/h:	
maximum	*305*
cruising	*270*
Hovering ceiling, m	*3,600*
Service ceiling, m	*5,700*
Range, km:	
normal	*450*
ferry	*1,100*
Powerplant	*2 x TV3-117VMA turboshafts*
Crew	*2*

Ka-50

Single-Seat Combat Helicopter

Mission

The Ka-50 combat helicopter is designed to engage armoured and unarmoured materiel, low-speed air targets, and personnel on the battlefield. The helicopter is capable of conducting autonomous operations from unprepared sites for a long period of time.

The Ka-50's unique flight performance enables efficient combat operation in rugged, alpine, and urban terrain, and gives the helicopter a clear advantage in highly manoeuvrable dogfights. The helicopter boasts excellent controllability, especially in the airspeed envelope of up to 100 km/h, irrespective of the ground wind direction and speed, and can be efficiently used in hovering ambushes.

Equipment

The onboard avionics suite supports all-weather, round-the-clock flight control, navigation, and weapons delivery.

The helicopter's high battlefield survivability is provided by the innovative design, armoured cockpit capable of withstanding 12.7mm round hits, and ECM assets. The Ka-50 pilot is provided with an ejection seat.

Armament

The Ka-50 armament comprises 12 Vikhr ATGMs, four Igla-V missiles, up to 80 S-8 rockets in B8V20-A pods. The helicopter carries one built-in 2A42 restricted-swivel cannon with 460-round ammunition load.

Basic specifications	
Take-off weight, kg:	
normal	*9,800*
maximum	*11,300*
Max combat load weight, kg	*2,500*
Air speed, km/h:	
maximum	*300*
cruising	*275*
Climb rate, m/s	*13*
Hovering ceiling, m	*4,200*
Range, km	*450*
Powerplant	*2 x TV3-117VMA turboshafts*
Crew	*1*

Ka-50-2

Tandem-Seat Modification of Ka-50 Combat Helicopter

Mission

The Ka-50-2 combat helicopter is designed to engage armoured and other surface and air targets; provide close air support to ground troops on the battlefield; escort tactical airborne troops; conduct air-to-air and air reconnaissance missions, provide real-time information support to ground troops and target designation to airborne and ground weapons systems.

The Ka-50-2 is a tandem two-seat derivative of the Ka-50 combat helicopter featuring 85 per cent commonality with the baseline model in terms of design, power plant, systems, and equipment.

Equipment

The avionics suite comprises an integrated flight navigation system, a helmet-mounted target designation system, a sighting system with a laser-beam-riding channel, the Arbalet radar, an onboard digital computer, and a multiplex data bus.

The multifunction avionics suite provides digital terrain map-based navigation; very low-altitude terrain-following/obstacle avoidance flight; acquisition and designation of ground, surface and air targets, and their engagement in any combat environment. The avionics suite manages employment of all types of onboard weapons; presentation of target, flight, and navigation data on multifunction displays and the helmet-mounted target designation/display system; and provides target designation to other combat helicopters and ground-based gun/missile systems.

The electro-optical system detects and pinpoints targets at a range of up to 8 kilometres by day and up to 7 kilometres at night and provides target designation to the onboard weapons systems. The radar can detect ground targets at a range of up to 12 km in the air-to-surface mode and air targets at a range of up to 25 km in the air-to-air mode. The radar can simultaneously track up to 20 targets.

Armament

The Ka-50-2 armament comprises 12 Vikhr ATGMs, four Igla-V missiles, up to 80 S-8 rockets in B8V20-A pods. The helicopter carries one built-in 2A42 restricted-swivel cannon with 460 rounds of ammunition.

Basic specifications	
Take-off weight, kg:	
normal	*9,800*
maximum	*11,300*
Air speed, km/h:	
maximum	*300*
cruising	*275*
Climb rate, m/s	*13*
Hovering ceiling, m	*4,200*
Normal range, km	*450*
Powerplant	*2 x TV3-117VMA turboshafts*
Crew	*2*

Mi-171Sh

Combat Transport Helicopter

Mission

The Mi-171Sh is an upgrade of the Mi-171 helicopter designed to engage small-size ground/surface targets and personnel; to transport military cargoes and troops; to carry out search-and-rescue operations and evacuate casualties.

Variants

The Mi-171Sh combat version is fitted with various weapons, a self-defence system, transportation and medical equipment, avionics and instruments enabling all-weather, all-climate, day/night operations. The helicopter can be converted into the assault/medevac versions in the field.

The Mi-171Sh helicopter can carry up to eight Ataka/Shturm ATGMs, up to four B8V20-A pods with S-8 rockets, up to two UPK-23-250 gun pods, and 7.62mm PKT machine guns mounted on the swivelling nose gun mount. Troops can fire their side arms through six swivelling portholes in the side windows and doorway.

The transport version can airlift up to 20 troops or various cargoes (inside or under the fuselage). The medevac version can transport up to 12 stretcher casualties and a medical attendant.

The Mi-171Sh has the LPG-150 winch with a crane jib for hoisting personnel and cargoes, and the SU-R device for rapid troop downroping in the hovering mode.

Survivability is increased thanks to the use of exhaust screens, flare dispenser, removable armour plates, and protected fuel tanks.

On customer request the Mi-171 helicopters can be modified into the Mi-171Sh variants with installation of Russian- or foreign-made equipment.

Basic specifications	
Take-off weight, kg:	
normal	*11,100*
maximum	*13,000*
Max lifting capacity, kg:	
cargo hold	*4,000*
underslung	*4,000*
Air speed, km/h:	
maximum	*250*
cruising	*230*
Hovering ceiling, m	*3,980*
Service ceiling, m	*6,000*
Range, km:	
without auxiliary tanks	*580*
ferry (with auxiliary tanks)	*1,065*
Powerplant	*2 x TV3-117VM turboshafts*
Crew	*3*

Mi-17-1V

Transport/Assault Helicopter

Mission

The Mi-17-1V transport/assault helicopter is designed to perform transportation tasks with a capability of engaging soft-skinned materiel and manpower. The Mi-17-1V is capable of air-lifting materiel and ammunition to operational assault positions of the troops carrying out independent operations, airdropping tactical air assault forces, landing special operations teams, and evacuating combat casualties. The helicopter can provide fire support to infantry and airborne troops and conduct air reconnaissance on the battlefield.

Additionally, the helicopter can conduct almost entire scope of the tasks accomplished by its civil prototype, by being fitted with search-and-rescue, fire-fighting, parachute jumping (paradropping) and air photographic equipment.

The Mi-17-1V helicopter is manufactured in transport/assault, transport and medevac versions.

Basic specifications

Take-off weight, kg:		
normal	*11,100*	
max	*13,000*	
T/O weight	**normal**	**max**
Airspeed, km/h:		
max (from 0 to 1,000 m)	*250*	*230*
cruise (from 0 to 1,000 m)	*220 to 230*	*205 to 215*
Hovering ceiling, m	*3,980*	*1,500*
Service ceiling, m	*6,000*	*4,800*
Payload, kg:		
normal	*2,000*	
max	*4,000*	
Flight range, km:		
with main fuel tanks	*650*	*615*
with one extra fuel tank	*900*	*850*
with two extra fuel tanks	*1,150*	*1,110*
Number and type of engines,		
engine power, hp	*2 x TV3-117VM / 2,200*	
Crew	*3*	
Dimensions overall (length x height x width), m:		
helicopter	*25.3 x 5.54 x 4.5*	
cargo compartment	*5.34 x 2.34 x 1.8*	
Rotor diameter, m	*21.3*	

Equipment

The avionics suite provides flight and employment of weapons during day and night under standard and adverse weather conditions.

The avionics suite includes electronic display and navigation high-precision system, satellite navigation system, night vision systems (night vision goggles and optronic system of full-time operation), weather radar, searchlight and other types of both Russian and foreign instruments.

The survivability system includes the exhaust jet IR screens, chaff (IR and radar) dispenser, jammer and a set of removable armour plates. The helicopter is equipped with the tanks that are self-sealed by the foam polyurethane filler.

Variants

The Mi-17-1V transport version can carry up to 36 troopers or cargo, including wheeled vehicles of up to 4,000 kg in the cargo compartment or up to 5,000 kg on the external store. The helicopter allows airdrop of up to 22 troops or air-

landing of cargoes and up to 20 troops by means of a roll-type cargo hoist, i.e. rappelling.

The transport/assault version uses unguided weapons (up to 80 unguided air-to-surface missiles of the S-8 type or up to 192 of the S-5 type), bombs of up to 500 kg in caliber and incendiary tanks. Guns include universal two or four UPK-23-250 gun pods with the 23 mm GSh-23 guns. The helicopter nose and stern compartments accommodate PKT or PKTM machine guns that can be remotely controlled. The weapon control system provides the use of weapons in any mix using the beam holders (up to 10 versions of helicopter payload using six beam holders and up to 9 versions employing 4 holders).

The helicopter cargo compartment is equipped with six swivel pads to allow troopers to fire small arms of the AKM, RPK and PK types.

The helicopter's rescue version is provided with the SLG-300 (or LPG-150M) winch to lift or lower cargo of up to 300 (150) kg as well as to lift or lower two (one) men by means of a special rescue hoist when the helicopter is hovering at an altitude of 50 to 55 (35 to 40) meters above ground.

The helicopter ambulance (medevac) version is equipped with 12 stretchers for wounded and sick and with first aid kits. A mixed version is also provided for evacuation of wounded and sick (on stretchers and on seats). During evacuation, all wounded and sick receive medical treatment.

Features

The Mi-17-1V avionics and instruments ensure day-and-night flights and weapons delivery in fair and partly-adverse weather conditions. In order to boost the helicopter's full day-and-night capability, it can be fitted with the following systems:

- electronic navigation and display system
- GOES-321M gyrostabilised optical electronic system
- GEO-ONV-1 night vision goggles
- adaptation of its lighting facilities to night vision goggles.

The electronic navigation and display system provides flight dead reckoning and coordinates correction using satellite navigation data; storage of navigation points, routes and ground digital map in the non-volatile memory; reception, processing and display of survey information and its transmission to interfaced systems, as well as display of flight-navigation information on multifunction dispays.

The GOES-321M gyrostabilised optical electronic system provides under standard and adverse weather conditions: mapping, search, detection and identification of targets, terrain features, obstacles against video images on the screen of the multifunction display, guidance of laying mark and measuring a slant range to the target, as well as targeting the organic helicopter armament.

Mi-19

Airborne Command Post Helicopter

Mission

The Mi-19 heliborne command and control center provides higher reliability and better continuity, survivability and mobility of command and control.

The heliborne command and control center is used for automated and non-automated control over formations and units both directly and via ground control posts while in-flight and on the ground, and also as an automatic radio-relay station.

The center elements are as follows:

- Mi-17V helicopter
- helicopter technical equipment.

Crew:

- flight crew - 3
- tactical HQ – 5
- communication operators – 2.

Equipment

The data transmission and communications system:

- two R-163-10V, two R-800L2E, E805KZ, and R-888 radio stations, multiplexer, R-098 (data transmission equipment), 'Olen' and 'Kardan' encryption protection equipment, 'Termit' communication channel switch, and P-515 interphone facilities
- automation equipment system based on personal computer, computer-aided workstations, interfaces, and documentation equipment
- antenna feeder assembly set.

The command and control center can also be equipped with the MT-3E terminal of the data communication airborne system.

Basic specifications	
Mi-17V helicopter	
Crew	*9 or 10 (3 pilots, 2 communication operator and 4-5 tac HQ officers)*
Take-off weight, kg:	*12,200*
Airspeed, km/h	
max	*230*
cruise	*210*
Flight altitude, m	*5,000*
Endurance, hrs	*3*
Flight range, km	*535*
Types of communications:	
open voice	
secure voice	
secure data transmission	
Communication range *at flight altitude of 1,000 m, km:*	
in decameter (DMW) band	*up to 1,000*
in decimeter (DW) band	*up to 550*
in meter (MW, MW-DW) band	*up to 400*

Mi-26/Mi-26T

Heavy Transport Helicopters

The Mi-26 helicopter is designed to airlift troops and materiel, and transport cargoes inside or outside the fuselage. The transport, troop-carrying, medevac, flight refuelling tanker and fire-fighting versions are available.

The transpoort Mi-26 is loaded through the rear cargo hatch fitted with a lowering ramp. Two 1,500kg winches and 6,000kg electric hoists are used to load non-self-propelled cargoes.

The troop-carrying Mi-26 is capable of transporting up to 82 troops, who can conduct fire through portholes fitted with swivelling mounts for small arms.

The medevac version can accommodate up to 60 stretchers.

The tanker version has a refuelling system mounted in the cargo hold.

The fire-fighting version mounts four water tanks in the cargo hold or drain tank on a sling.

The Mi-26T is a civil version with auxiliary radio communications, navigation, and mission-specific equipment.

Basic specifications	
Take-off weight, kg:	
normal	*49,600*
maximum	*54,000*
max with external cargo	*56,000*
Payload weight, kg:	
normal	*15,000*
maximum	*20,000*
Air speed, km/h:	
maximum	*295*
cruising	*255*
Hovering ceiling, m	*1,520*
Service ceiling, m	*4,600*
Range, km:	
with 20-tonne cargo	*590*
with full fuel tanks	*800*
ferry	*1,920*
Crew	*5*
Troops	*82*
Casualties on stretchers	*60*
Powerplant	*2 x D-136 turboshafts*

Ka-32

Utility Helicopter

The Ka-32 utility helicopter is a civil version of the Ka-27 shipborne helicopter. It inherits the baseline machine's manoeuvrability, high controllability, excellent power plant characteristics, small size, high airframe resistance to aggressive sea water environment, high flight automation, ditching capability, and all-weather flight operations, including operation in icing environment. The following versions are available:

Ka-32T transport version;

Ka-32A utility version of the Ka-32T;

Ka-32S shipborne version.

The Ka-32A is designed for transportation of personnel and cargo in the cargo compartment, and large-size cargo on external hardpoints, medical evacuation, search-and-rescue, ship loading/unloading, ice reconnaissance, offshore gas/oil pipelines servicing, construction and assembly.

Basic specifications	
Take-off weight, kg	*11,000*
Underslung payload weight, kg	*5,000*
Casualties on stretchers	*4*
Passengers	*16*
Air speed, km/h:	
maximum	*250*
cruising	*230*
Hovering ceiling, m	*3,500*
Service ceiling, m	*6,000*
Range, km	*900*
Powerplant	*2 x TV3-117VK (TV3-117VMA) turboshafts*
Crew	*1-3*

Ka-27PS

Search-and-Rescue Helicopter

Mission

The Ka-27PS helicopter is designed to carry out maritime search-and-rescue and salvage operations in any season, by day and night, in good and adverse weather at Sea State 5.

The Ka-27PS is a SAR version of the shipborne ASW helicopter with a new fuel system and an upgraded radar. The radar is interfaced with specialised equipment to detect surface targets fitted with radar transponders. Speedboat-type targets are detected at a range of up to 25 km, and radar transponders at a range of up to 100 km.

Basic specifications	
Normal take-off weight, kg	*10,900*
Air speed, km/h:	
maximum	*270*
cruising	*230-240*
Climb rate, m/s	*up to 14*
Hovering ceiling, m	*3,700*
Range, km	*800*
Max endurance, hrs	*5*
Powerplant	*2 x TV3-117VMAP turboshafts*
Crew	*3*
Casualties on stretchers	*4*

Equipment

The onboard integrated flight navigation system provides stabilised flight, automatic preprogrammed and radar-assisted high-precision navigation to a pre-selected area with automatic hovering there.

The helicopter carries a salvage jib with a lifting capacity of 300 kg. Up to 3,000 kg of cargo can be transported under external pylons. The Ka-27PS is outfitted with a life boat and auxiliary lighting equipment. It can additionally carry individual man-portable oxygen bottles for first aid purposes. Ditching is facilitated by inflatable ballonets.

To enhance flight safety in icing conditions the helicopter is equipped with electrothermal deicing systems for main rotor blades, engine air intakes and cockpit canopy.

Ka-28

ASW Helicopter

Mission

The Ka-28 helicopter is designed to search for, detect, track, and engage surfaced and submerged submarines moving at a speed of up to 75 km/h, at a maximum depth of 500 m. The Ka-28 is capable of long endurance maritime ASW missions with no reference waypoints, in any climate and season, by day and night, in all weather conditions, at a range of over 200 km, at Sea State up to 5.

The Ka-28 is capable of autonomous operation from light displacement vessels, and group operation from aircraft carriers. Main rotor blades are folded for shipborne parking. The Ka-28's landing gear is designed for taking off from/landing on a rocking deck. Ditching is facilitated by inflatable ballonets.

The helicopter can be configured to operate in the search, search/attack, or attack variants.

Equipment

The helicopter's avionics suite includes an integrated flight navigation system and a sighting system (a surveillance radar and a sonar system). The avionics suite provides navigation of the helicopter to a preset area in any weather conditions; submarine detection with the help of the sonar system and the magnetometer; weapons control; return flight to the mother ship; and landing approach. A special receiver/display unit is used for automatic monitoring of sonobuoys on the water surface. The unit provides surface and underwater target search, detection, and location.

Armament

The Ka-28 armament includes APR-3E ASW missiles, OMAB-25-12D and OMAB-25-8N marine marking bombs.

Basic specifications	
Max take-off weight, kg	*12,000*
Air speed, km/h:	
maximum	*270*
cruising	*210-220*
Service ceiling, m	*3,500*
Range, km:	
search/attack version	*900*
search version	*1,160*
Search endurance, hrs	*2.15*
Powerplant	*2 x TV3-117VMAR turboshafts*
Crew	*3*

Ka-29

Combat Transport Helicopter

Mission

The Ka-29 combat transport helicopter is designed to airlift armed marines from warships, provide close air support to airborne troops, engage naval and ground targets (including armoured ones), and transport cargo. It can be operated from various ship types and airfields in all latitudes, by day and night, in any weather.

Basic specifications	
Take-off weight, kg:	
normal	*11,000*
with external cargo	*12,600*
Lifting capacity, kg:	
normal	*1,850*
maximum underslung	*4,000*
Cruising air speed, km/h	*235*
Hovering ceiling, m	*3,700*
Service ceiling, m	*4,500*
Range, km	*460*
Powerplant	*2 x TV3-117VMAR turboshafts*
Crew	*2*

Variants

The Ka-29 can be configured into a combat or cargo version. The conversion can be performed directly in service units.

Armament

The Ka-29 combat version is equipped with the onboard sighting system supporting employment of the following weapons: up to eight Shturm ATGMs; up to 80 S-8 rockets in the B8-V20-A pods, air bombs, incendiary tanks, and the UPK-23-250 gun mounts.

The transport version carries a 7.62mm nose machine gun with 1,800-round ammunition load. The cargo compartment accommodates up to 16 troops with side arms, or four stretcher casualties and seven sitting casualties with one medical attendant, or up to 2,000kg cargo.

The helicopter can also be fitted with rescue equipment for maritime search-and-rescue operations.

Up to 4,000kg cargo can be carried on external hardpoints.

Ka-31

Radar Picket Helicopter

Mission

The Ka-31 radar picket helicopter is designed for airspace and sea-surface radar surveillance; detection of surface vessels, fixed- and rotary-wing aircraft, including low-altitude air targets; target tracking; and automatic data transmission to command and control posts. The Ka-31 is capable of operating from ships, airfields and unprepared sites in any season, by day and night, in all weathers.

Equipment

The avionics suite enables detection of surface and air targets, target identification, and transmission of target-relevant data to command and control posts. It comprises a surveillance radar and an IFF system. The radar provides omnidirectional airspace surveillance with a 10sec scanning cycle, automatic and semi-automatic target detection, and determination of the target's coordinates and trajectory parameters. The radar is capable of acquiring and simultaneously tracking 20 to 40 targets (fixed- and rotary-wing aircraft) at a range of 100-150 km, and surface vessels within the radar coverage.

The onboard integrated flight navigation system is used to generate and display flight data, stabilise the helicopter's altitude and angles of attack, hover and descent modes. It can automatically guide the machine to the mother ship or home base, provide automatic navigation along typical routes in patrol areas, continuously measure the helicopter and ship positions, guide the helicopter along a pre-programmed route with automatic return to the home base. The onboard communications system ensures telecode communications and tactical data transmission to command and control posts at a minimum range of 150 km from altitudes of 1,500 to 3,500 m.

Basic specifications	
Max take-off weight, kg	*12,500*
Air speed, km/h:	
maximum	*220*
patrolling	*100*
Max patrolling altitude, m	*3,500*
Patrol endurance, hrs	*2.5*
Powerplant	*2 x TV3-117VMAR turboshafts*
Crew	*2*

Ka-60/Ka-62

Utility Helicopters

The Ka-60 utility helicopter is designed to carry out reconnaissance operations, transport 10 to 12 airborne troops, ship ammunition and other cargoes to combat operation areas, evacuate casualties, fly surveillance, patrol, and search-and-rescue missions, and as a training asset. The helicopter can operate by day and night, in all weather conditions.

Basic specifications

	Ka-60	Ka-62
Max take-off weight, kg	*6,500*	*6,250*
Max payload, kg:		
inside fuselage	*2,000*	*2,000*
underslung	*2,750*	*2,500*
Air speed, km/h:		
maximum	*300*	*300*
cruising	*265*	*270*
Hovering ceiling, m	*2,100*	*3,000*
Service ceiling, m	*5,150*	*5,500*
Range, km	*700*	*780*
Powerplant	*2 x RD-600V turboshafts*	*2 x RD-600V turboshafts*
Crew	*1-2*	*1-2*
Troops/passengers	*14*	*16*

The Ka-60 design provides maximum safety for crew and transported troops. Its avionics suite depends on the helicopter version, the assault/transport being the basic one.

In the single-seat vesion the pilot's seat is installed in the starboard half of the cockpit. Wide side doors facilitate troops mounting/dismounting and cargo loading. Side wing panels can carry various types of weapons.

The **Ka-62** is a civil version of the Ka-60 helicopter.

Ka-115

Utility Helicopter

Basic specifications

Max take-off weight, kg	*1,970*
Max cargo weight, kg:	
inside the fuselage	*700*
underslung	*1,000*
Max air speed, km/h	*250*
Cruising airspeed, km/h	*230*
Climb rate, m/s	*11.5*
Hovering ceiling, m	*2,350*
Service ceiling, m	*5,200*
Max range, km	*780*
Powerplant	*1 x PW206D turboshaft*
Crew	*1*
Passengers	*5*

The Ka-115 utility helicopter is designed to airlift personnel and cargoes in the cargo compartment, transport underslung cargoes, perform search-and-rescue, patrol, and medevac operations, charter flights, etc.

Its design provides maximum comfort and safety for the crew and passengers. Cargo is loaded and unloaded through the side doors and rear hatch. The helicopter is capable of transporting large-size cargoes up to four metres long.

Ka-226

Utility Helicopter

The Ka-226 utility helicopter features modular design accommodating a dismountable passenger/cargo cabin or varied mission-specific modules under the central compartment behind the cockpit. The helicopter can be easily modified to address any operational conditions and customer requirements.

Apart from the baseline passenger/cargo model, the following versions are available: search-and-rescue (for the Russian Ministry of Emergency Situations), gas/oil-field servicing, air ambulance, police, fire-fighting, flying crane, trainer, and VIP. The helicopter can also be employed for various military missions.

Basic specifications	
Max take-off weight, kg	*3,400*
Max payload, kg:	
inside the fuselage	*1,400*
underslung	*1,500*
Air speed, km/h:	
maximum	*205*
cruising	*195*
Hovering ceiling, m	*2,500*
Service ceiling, m	*6,200*
Max range, km	*600*
Powerplant	*2 x Allison 250-C20B turboshafts*
Crew	*1*
Passengers	*9*

ANSAT

Utility Helicopter

The Ansat utility helicopter is designed to transport passengers and cargoes. The following versions also can be developed: administrative, patrol, medevac, search-and-rescue, fire-fighting, agricultural, training, and various military mission-specific modifications, including combat reconnaissance two-seater featuring small mid-section capable of carrying a variety of weapons.

The pilot's seat is installed in the starboard half of the cockpit; the portside seat is intended for passenger, or for trainee in the training version. The passenger/cargo compartment behind the cockpit is equipped depending on the helicopter version. The pilot and passenger seats are energy absorbing. Cargo is loaded and unloaded through two side doors and a rear hatch. The helicopter can be fitted with either wheeled or ski-type landing gear.

The helicopter mounts an electro-hydraulic digital flight control system. It can also carry weather radar and electro-optical equipment to enable night operations.

Basic specifications	
Take-off weight, kg:	
maximum	*3,300*
normal	*3,000*
Max payload, kg:	
inside the fuselage	*1,000*
underslung	*1,300*
Max airspeed, km/h	*280*
Hovering ceiling, m	*3,300*
Service ceiling, m	*5,700*
Max range, km	*635*
Powerplant	*2 x PW-207K turboshafts*
Crew	*1*
Passengers	*10*

Mi-2A

Upgraded Utility Helicopter

The Mi-2A helicopter has transport, trainer, medevac, reconnaissance, airborne command post, VIP, and gunship versions.

The Mi-2 upgrading programme is aimed at extending the helicopter's service life, increasing reliability and flight safety, and improving its flight performance.

The first stage of the upgrading programme envisages enhancement of the helicopter's reliability, improvement of its flight performance, and repairs. The second stage includes service life extension and fitting the helicopter with new equipment, a new power plant (Russian- or foreign-made), new main rotor blades, rotor hubs, and rotor drive system.

Basic specifications	
Take-off weight, kg:	
maximum	*3,700*
normal	*3,550*
Max payload, kg:	
inside the fuselage	*1,000*
underslung	*800*
Passengers	*9*
Air speed, km/h:	
maximum	*235*
cruising	*215*
Hovering ceiling, m	*2,100*
Service ceiling, m	*5,000*
Range, km	*450*
Powerplant	*2 x AI-450, GTD-350W, Arrius turboshafts*
Crew	*1-2*

Mi-34U

Trainer Helicopter

The Mi-34U trainer helicopter is based on the certificated Mi-34S utility helicopter. Designed as a training asset for military and civil aviation flight schools and flying clubs, the Mi-34U can also be used for demonstration flights including helicopter aerobatics.

The baseline Mi-34U can be converted into administrative, passenger, police patrol, ambulance, agricultural, and other versions, developed for the baseline model.

Basic specifications	
Take-off weight, kg:	
maximum	*1,350*
normal	*1,300*
Max payload, kg:	
inside the fuselage	*240*
underslung	*300*
Air speed, km/h:	
maximum	*215*
cruising	*175*
Hovering ceiling, m	*1,000*
Service ceiling, m	*4,500*
Range, km	*400*
Powerplant	*1 x M-14V-26V piston engine*
Crew	*2*

AEROSPACE SYSTEMS

UNMANNED AIR SYSTEMS

REYS-D

Unmanned Air Reconnaissance System

Mission

The Reys-D system is designed to carry out air reconnaissance, additional target and terrain reconnaissance, and battle damage assessment at a depth of 150 km behind the forward edge of the battle area.

The system includes:

- the Reys-D reusable unmann-ed air vehicle
- the SPU self-propelled transporter/launcher providing UAV transportation, aiming and launch
- the TZM transporter/refueller designed to transport and refuel a SPU-mounted UAV
- the POD-D3 mobile data processing and decoding centre
- mobile checking/testing system comprising two test vehicles and a power source for routine UAV maintenance
- technological equipment system.

The Reys-D is capable of carrying out air reconnaissance in any weather, by day and night, in hostile air defence and eventual NBC contamination conditions.

It is capable of detecting enemy objects, receiving and recording reconnaissance data in real-time both on board the reconnaissance UAV and at the ground-based data processing and decoding centre. The system identifies targets, determines their coordinates, prints out photographs and reconnaissance reports.

Basic specifications	
Launch weight (with booster), kg	*1,600*
Range, km	*360*
Air speed, km/h	*850-940*
Altitude range, m	*50-2,000*
Dimensions, m:	
length	*8.06*
wing span	*2.24*
height	*1.54*
Pre-programmed altitude changes	*15*
Reconnaissance area number	*7*
Total area, reconnoitred in one flight, km²	*up to 2,100*

Equipment

The integrated flight navigation system of the Reys-D UAV ensures its flight along a pre-set trajectory with high-precision approach to the designated reconnaissance areas, and landing after completing the mission.

The reconnaissance equipment container is quartered in a detachable nose part of the UAV fuselage. The following two mission payloads are possible:

- the AP-402M aerial camera and the Zima-M IR reconnaissance equipment
- the AP-402M aerial camera and the Aist-M television system.

The Reys-D is a fully autonomous system enabling round-the-clock covert deployment from unsurveyed sites. In the high alert status, the UAV can be launched within 10-12 minutes after receiving the corresponding launch command, as well as immediately after the march (the SPU vehicle can run a distance of up to 500 km). It takes 35-40 minutes to prepare the UAV for launch after the march. The pre-launch preparations can be done by a crew of three.

Thirty seconds after the UAV has flown over the designated area, the POD-3D system operator receives the reconnaissance data, complete with coordinates referenced to the flight route.

Variants

On the basis of the Reys-D UAV the Reys-DM air target capable of imitating various manoeuvring targets flying at speeds of 500 to 900 km/h has been developed.

PCHELA-1

Small-Size Tactical Air Reconnaissance System

Mission

The Pchela-1 system is designed to carry out air reconnaissance, perform additional target and terrain reconnaissance at tactical depth. It can be used to patrol roads, gas and oil pipelines, provide maintenance of power transmission lines, and detect forest fires.

The system incorporates:

- Pchela-1 RPV in transport containers (up to 10 RPVs)
- mobile ground control post (with two automated work-stations)
- transporter-launcher vehicle, with pre-launch test equipment
- transporter-loader vehicle, accommodat ing four RPVs and expendable means
- technical support vehicle.

The Pchela-1 RPV system is mounted on the Ural trucks chassis.

The system offers fully autonomous pre-launch preparation of the RPV, its launch and remote flight control, reception of the reconnaissance data with presentation on the operator's monitor in real time, as well as post-flight maintenance. On the operator's monitor the RPV's flight path and current coordinates also are displayed. The system is capable of providing simultaneous remote control of two RPVs

Basic specifications	
Recce payload:	*TV-camera with zoom-lens, mounted on gyrostabilized platform*
	multi-camera TV system
	IR line scanner (and forward-looking radar)
	IR line-scanner mounted on gyrostabilized platform
Flight altitude, m:	
over sea surface	*100-3,500*
over terrain	*100-1,000*
Air speed, km/h	*120-180*
Flight endurance, hrs	*3.5*
Max launch weight, kg	*138*
RPV launch site altitude (above S/L), m	*up to 2,000*
Wind speed, m/s:	
at launch	*up to 10*
at landing	*up to 8*
Number of simultaneously controlled RPVs	*2*
Ground crew:	
mobile ground control post	*3*
transporter-launcher vehicle	*3*
Dimensions, m:	
length	*2.7*
wing span	*3.4*
height	*1.41*

(with data reception) from the command and launch post.

The system can be deployed by means of standard airdrop facilities in any region of the world.

The Pchela-1 RPV uses two solid-propellant boosters to take off from a short guide rail. Its flight can be controlled by commands of the pre-programmed onboard autopilot or ground operator. The vehicle is recovered by parachute on any level. The four-point non-retractable landing gear can sustain a 10 g-load at landing. The Pchela-1 is made of fibreglass and features low-damage landing capability and high repairability.

It is transported with folded wings in a transport/launch container protecting it during airdrops and providing quick deployment.

Equipment

The onboard equipment of Pchela-1 includes a combined reconnaissance set comprising a TV or IR system mounted on a gyro-stabilised ventral platform. The TV camera field of view can vary within a range of 3-30 degrees. The IR system's ground coverage totals three fourths of the RPV's altitude at three millirads resolution.

AEROSPACE SYSTEMS

TRAINING SYSTEMS

TECHNICAL TRAINING AIDS (AIRCRAFT SIMULATORS AND AUTOMATED TRAINING SYSTEMS)

Modern technical training aids include specialized hardware, general and special software and real controls of aircraft and instruments. They are based on high technologies and mathematical modeling of the aircraft (helicopter) flight dynamics on test benches and geographic information computer technologies that are used in off-cockpit display systems and provide realistic flight environment in the trainer.

STBP-29 Specialised Combat Simulator and IASO-29 Automated Training System

The specialised combat simulator is designed for flying personnel to study and master air materiel, undergo training/retraining and maintain their airmanship. It also assists in the evaluation of the flying personnel readiness for piloting, air navigation and combat employment of the MiG-29 (MiG-29SMT) aircraft individually and in two-plane formation using the avionics suite and in co-operation with ground management equipment in the enemy's fire and jamming countermeasures environment.


MiG-29

The training suite includes:

- fixed-cockpit flight simulator
- external visual system
- computing system.

The training system is controlled from the instructor's seat. For practicing in two-plane formation and simulation of air combat with really controlled enemy aircraft, the system is equipped with the auxiliary pilot's seat.

The training system is effective for mastering the multimode avionics suite, weapon control computing system and flight-navigation complexes.

The interactive automated training system (IATS) is designed for classroom and primary training of flying personnel, engineers and technicians for operation and maintenance of aircraft and ensures high quality of training. It is of modular design and its computing environment features an open architecture.

IATS hardware/software incorporates:

- collective and individual training systems
- flight procedures simulator, including a cockpit simulator that imitates the pilot's seat according to the organization list and functional logic of controls and equipment of the aircraft cockpit as well as control computer system that also imitates operation of the equipment and weapons of aircraft in real time
- reference and information system.

MiG-29 Aircraft
Integrated Simulation Systems for Avionics Suite and Weapons

The avionics suite and weapons integrated simulation systems of the MiG-29, MiG-29SMT, MiG-29K and MiG-29M/M2 aircraft are scaled-down simulators.

These systems simulate maximum realistic physical impacts upon the avionics suite, weapons control system and the weapons themselves and thus allow integration and testing of aircraft systems and comprehensive monitoring of computation processes in airborne computers and data flow in communication lines between the systems.

The simulation systems employ a unique digital simulator of radar signals of the new gener-

ation and a simulator of heat-emitting targets for IRSTs, signal simulators for electronic warfare systems and a display system for combat employment of a fighter against air (ground) targets. The weapons external store simulator being a part of the integrated simulation system provides practicing of all types of weapons employment both in standard situation and in case of failures.

Operation of all scaled-down simulators is controlled by the simulation system computing center that employs high-end universal computers and data highway. Full-size aerodynamic models and weapons plus simulation of realistic tactical situation allow flying personnel to hone their battle techniques. This in turn helps the crew fully master all capabilities of the aircraft.

Technical Training Aids for Military Transport, Combat and Civil Aviation

Technical training aids designed for the Tu-154, Tu-204, Tu-334, Il-76, Il-96, Il-114, An-12, An-24, An-26, An-72, An-74, An-124, Su-22M3, Su-22M4, Su-24, Su-27 and its versions and Su-30 and its versions incorporate specialised and flight procedure simulators and computer classrooms.

Integrated simulators are designed to train flying personnel, using the equipment of the new generation.

A modular approach to training includes systematization of professional skills, using a combination of special training programs for piloting techniques, air navigation, guidance at air (ground) targets, combat employment of airborne weapons and air combat tactics.

Integrated simulators in this class provide a full-scale preparation of crews for flights. The trainers are an integration element that allows flying personnel to gain comprehensive skills in piloting.

Specialised operational flight simulators afford opportunity for flying personnel to practice most important elements of high-complexity flight missions (navigation, combat employment and in-flight refueling). For example, the specialised air refueling simulators have been for the first time developed and manufactured for the Su-30, Su-24, Tu-95 and Tu-160 aircraft for flying personnel to train in air refueling.

Flight procedure simulators help flying personnel master some individual airborne systems of the specified aircraft.

Computer classrooms are designed to form a preset level of theoretical knowledge, practicing a sequence of actions in operation and maintenance of aircraft according to the requirements of the standard documents.

The feasibility of comprehensive upgrading of trainers opens the new prospects of improving the training process. It envisages replacement of the computing system, simulator control equipment, display system, etc. on site. The simulators delivered earlier can be fitted with new digital systems of displayed situation synthesis. Up-to-date techniques of repair and maintenance ensure effective operation of the trainers available.

Mi-8/Mi-17 Helicopters
Technical Training Aids

Integrated simulators of Mi-8/Mi-17 (Mi-17-1V, Mi-17V-5, Mi-171Sh, Mi-26) helicopters can be of motion and fixed types.

Simulators are designed to train flying personnel and engineers, maintain their skills at a required level and retrain the crews of other types of rotary-wing aircraft in a fully realistic cockpit and flight instrument environment with standard consoles and controls.

The simulators motion system provides simulation of acceleration effects. It is electrically operated and has six motion levels.

The fixed simulator includes:

- realistic helicopter cockpit environment
- digital computing system and software
- external visual system of the 'Aurora' type (with a hemi-spherical projection-screen system with cockpit cut-off angles
  - in horizontal plane - 220 degrees
  - in vertical plane - 65 degrees
- displayed database preparation system
- instructor's station and integrated check system
- vibration, shaking and acoustic effects simulation systems.

All tasks to be performed during training can be divided into three groups:

- flight tasks
- helicopter piloting tasks
- combat tasks.

Automated training systems (ATS) are designed for classroom training of flying personnel, engineers and technicians in the interactive mode. These systems form a single functionally interrelated base of theoretical knowledge and monitor programs using computer technologies and afford individual training of each trainee, subject to his specialization and initial level of skills.

The externally-slung cargo operator procedures simulator of the load on external store simulates the operator station (fenced door, rope "spider") also provided with a stereoscopic system to visualize the behaviour of the load and cable through the cockpit door. The appropriate software is delivered to follow the behaviour of the load and the cable and their influence upon the helicopter flight.

Mi-24/Mi-35 Combat Transport Helicopters Technical Training Aids

Integrated simulators of the Mi-24/Mi-35 (Mi-24V, Mi-24P, Mi35P, Mi-35, Mi-35M) helicopters can be of motion and fixed types.

Simulators are designed to train flying personnel in a realistic cockpit and flight instrument environments, providing new opportunities for the crews to master main operation modes and combat missions plus practicing actions in special conditions.

The simulator motion system provides simulation of acceleration effects. It is electrically operated and has six motion levels.

The fixed simulator includes:

- realistic pilot's and navigator's cockpit environments
- digital computing system and software
- external visual system for day and night helicopters
- displayed database preparation system
- instructor's station and integrated check system
- simulation systems of vibration, shaking and acoustic effects.

All training tasks to be performed on the simulator may be divided into three groups, namely: flight tasks, helicopter piloting tasks and combat tasks.

Automated training systems (ATS) are designed for classroom training of flying personnel, engineers and technicians in the interactive mode. Up-to-date automated training systems of the specified types of helicopters plus the flight procedures and integrated simulators open the new prospects in the training process improvement.

Functional databases and monitor programs enable the pilots to acquire firm skills in managing complex combat missions, considering their specialization and initial level of skill.

KRAB-1

Flight Procedures Simulator for Ka-50 Combat Helicopter

The Krab-1 is designed to train pilots and to maintain, improve and restore their skills in handling airborne weapons (Vikhr ATGM, UASM S-8, 2A42 gun) of the Ka-50 helicopter.

The simulator incorporates a cockpit with standard controls, a visual situation display simulator, an instructor's station, a computing system and a cockpit-to-computing system adapter.

The visual situation display simulator provides a realistic environment of landscape, artificial objects, weapons, HUD indicating marks and animation of explosions, smoke and fires.

At his workstation, the instructor can

- form training assignments
- archive the training results, display flight-navigation information and enter failures.

Game Controllers for Virtual Training of Flying Personnel (Display Teams)

Aircraft simulators in this class are designed for virtual training of flying personnel in computer classrooms to help them master individual and group advanced piloting. They are actually computers with joysticks, integrated into a local area network.

Game controllers are effective to practice execution of combat missions by a unit and to simulate a dogfight.

Subject to demand, simulators and their basic software can be used for different types of Russian aircraft and helicopters. Modern game controllers enable flying personnel to execute combat missions at different kinds of landscape, simulating real distortions of environment in various weather conditions.

AEROSPACE SYSTEMS

AEROENGINES

R25-300

Turbojet Engine

The R25-300 two-shaft, two-rotor engine with afterburner has a three-stage low-pressure compressor and a five-stage high-pressure compressor, a cannular combustion chamber, single-staged low- and high-pressure turbines, and a fixed-area nozzle. The two-stage afterburner allows high-altitude air combat.

Basic specifications	
Thrust (H=0, M=0, ISA), kgf:	
emergency thrust	*7,100**
afterburner	*6,850*
Specific fuel consumption, kg/kgf/h	*0.91*
Air consumption, kg/sec	*68.5*
Pressure ratio	*9.1*
Gas temperature before the turbine, ºK	*1,353*
Dimensions, mm:	
length	*4,615*
max diameter	*907*
Engine dry weight, kg	*1,215*

** - 9,900 kgf at M=1.0*

The engine's main advantages are convenient maintenance, a continuous range of afterburning modes control with smooth thrust change, and easy single-handle control. The engine has two afterburning modes: afterburner and emergency thrust. The engine is designed to power the MiG-21 family aircraft.

The R25-300-94 is designed to power the MiG-21-93 aircraft. It has an integrated hydroblade drive generator with multiplier and a reinforced gearbox drive chain.

R-95Sh, R-195

Turbojet Engines

The R-95Sh and R-195 engines feature a two-shaft configuration and a modular design. There is a three-stage low-pressure compressor without a guide vane, and a five-stage high-pressure compressor. The cannular combustion chamber has twin nozzles. The low- and high-pressure turbines are single-staged. There is no afterburner, and the nozzle is of a fixed-area type.

Basic specifications	R-95Sh	R-195
Thrust, kgf:		
max continuous (H=0, M=0)	*4,100*	*4,300*
emergency (H=0, M=0)	*–*	*4,500*
Specific fuel consumption at take-off, kg/kgf/h	*0.860*	*0.890*
Air consumption, kg/sec	*67*	*66*
Pressure ratio	*8.7*	*9.0*
Gas temperature before the turbine, ºK	*1,148*	*1,188*
Dimensions (without accessories), mm:		
length	*2,700*	*2,880*
max diameter	*772*	*805*
Engine dry weight, kg	*830*	*860*

The engines are noted for ease of operation, high reliability and combat survivability. They can withstand 23mm round hits, and retain operability after considerable damage (combat proven cases).

The R-195 engine is a derivative of the R-95Sh engine. It features increased thrust, improved maintainability, reduced IR signature, and enhanced stability during missile launch. The R-195 is fully interchangeable with the R-95Sh engine.

Variants

The R-95Sh engine is fitted on Su-25K, Su-25UBK, and Su-25SMK aircraft.

The R-195 engine is designed for the Su-39 aircraft.

AL-21F-3

Turbojet Engine

The AL-21F-3 engine features a single-shaft configuration. The 14-stage compressor has a sophisticated control system. The cannular combustion chamber has 12 flame tubes. The three-stage turbine is of an impulse-reaction type. The blades of the first and second turbine stages are cooled with the bleed air taken from the compressor. The afterburner has three annular stabilisers and six fuel manifolds with spray and swirl-type nozzles. A perforated screen is installed to ensure internal cooling. The fully variable area propelling nozzle consists of the subsonic convergent and supersonic divergent rims.

Basic specifications	
Thrust (H=0, M=0, ISA), kgf:	
max continuous	*7,800*
min afterburner	*9,700*
full afterburner	*11,250*
Specific fuel consumption, kg/kgf/h:	
economy power (H=0, M=0)	*0.80*
cruising mode	*0.76*
max continuous	*1.86*
Air consumption, kg/sec	*104*
Pressure ratio	*14.55*
Gas temperature before the turbine, °K	*1,385*
Dimensions, mm:	
length /diameter	*5,340/1,030*
Engine dry weight, kg	*1,800*

RD-33

Turbofan Engine Family

The RD-33 engine has a two-shaft turbine configuration with exhaust mixing in the afterburner. The engine features a modular design. The low-pressure compressor has four stages; the high-pressure compressor has nine stages. The engine has a short annular combustion chamber and single-stage low- and high-pressure turbines. The afterburner is common for both ducts. The engine features a variable-area supersonic propelling nozzle.

Due to good gas-dynamic stability, the RD-33 engines do not impose any limitations on piloting and feature high spool-up capacity.

The RD-33 is designed to power the MiG-29 fighter family.

Variants

The RD-33 Series 3 engine with an extended service life is designed to power MiG-29M, MiG-29M2, MiG-29K and MiG-29KUB aircraft.

The RD-33N engine is designed to power the Mirage F1 fighter upgrade. It has a bottom gearbox, and can also be fitted on MiG-21 and Mirage III aircraft upgrades.

The RD-93 engine was developed for the Chinese FC-1 aircraft.

The RD-133 engine is designed for the MiG-29 aircraft. It features a fully variable nozzle with thrust vectoring and a new automatic hydromechnical electronic control system.

Basic specifications	RD-33	RD-133
Thrust (H=0, M=0), kgf:		
max continuous	*5,040*	*5,600*
full afterburner	*8,300*	*9,000*
Specific fuel consumption, max continuous (H=0, M=0), kg/kgf/h	*0.74*	*0.77*
Bypass ratio	*0.46*	*0.437*
Gas temperature before the turbine, °K	*1,680*	*1,720*
Dimensions, mm:		
length	*4,230*	*4,230*
max diameter	*1,040*	*1,040*
Engine dry weight, kg	*1,055*	*1,145*

AL-31F

Turbofan Engine Family

The AL-31F engines have modular design, with a four-stage variable low-pressure compressor and a two-shaft turbine. The nine-stage high-pressure compressor has a variable-area first group of stages. The combustor is of an annular type. The single-stage high and low-pressure turbines have active radial clearance control. The air-to-air heat exchanger of the turbine cooling system is placed in the external duct, and is fitted with a device preventing air flow in dry-thrust engine operation mode. The afterburner is common for both ducts. The supersonic nozzle has a variable-area design. The engine has a top-mounted gearbox, a looped oil system, and an autonomous start-up system. The main control system is electronic, while the auxiliary one is hydraulic. The engine features a surge termination system and high gas-dynamic stability of the compressor.

The AL-31F engines are available both in standard and tropicalised variants. They are operational in a wide altitude/airspeed envelope, and provide stable operation in deep air intake surge modes at Mach numbers of up to 2.0, in controlled, inverted and flat spins, and enable execution of aerobatics in the dynamic operation mode at negative airspeeds of up to 200 km/h.

The engines boast high gas-dynamic stability and durability, enabling their operation in extreme conditions with air intake pressure irregularities and pulsing.

Basic specifications

	AL-31F	AL-31FN	AL-31FP
Thrust, full afterburner, kgf	*12,500*	*12,500*	*12,500*
Specific fuel consumption, kg/kgf/h			
economy power (H=0, M=0)	*0.670*	*0.685*	*0.670*
Dimensions, mm:			
length	*4,950*	*4,897*	*4,990*
max diameter	*1,240*	*1,140*	*1,280*
Engine dry weight, kg	*1,530*	*1,547*	*1,570*

Variants

The AL-31F engine is designed for installation in the Su-27, Su-30, Su-32, and Su-35 aircraft.

The AL-31F Series 3 engine is designed to power the Su-33 aircraft.

The AL-31FN engine is a development of the AL-31F engine featuring both bottom and top gearboxes designed for the Chinese J-10A aircraft.

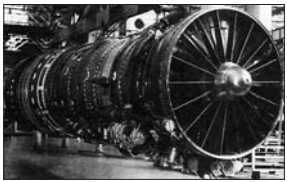
The AL-31FP engine is another development of the AL-31F engine with a swiveling nozzle for the Su-30MK.

NK-25

Turbofan Engine

The NK-25 three-stage bypass turbofan engine features turbine blade radial clearance active control and stator rings perforation for increased compressor stability. The rotor blades and the nozzle vanes are cooled with vortex flows. The engine has an anti-surge protection with automatic recovery of the initial operation mode. The engine control system is electronic.

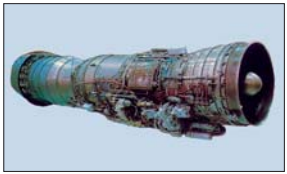
The NK-25 engine is designed for the Tu-22M3E multirole aircraft.



Basic specifications	
Thrust at take-off	
(H=0, M=0, ISA), kgf	*25,000*
Specific fuel consumption	
at take-off, kg/kgf/h	*2.08*
Pressure ratio	*25.9*
Bypass ratio	*1.45*
Gas temperature before the turbine, ºK	*1,600*

D-30F6

Turbofan Engine



The D-30F6 engine features a two-shaft configuration with exhaust mixing from both ducts. The engine consists of seven modules. It has a low-pressure five-stage compressor, a high-pressure ten-stage compressor and a cannular combustion chamber. The low- and high-pressure turbines are two-staged. The nozzle vanes and high-pressure turbine rotor blades are cooled. The afterburner houses the exhaust mixer and has four ring flame stabilisers. The multivane supersonic nozzle is cooled. The engine design enables onboard parameter monitoring. Reliability of the engine is ensured by the protection, backup, and early malfunction detection systems. The electro-hydraulic engine control system is backed up with the hydraulic system activated if the electronic one has failed to ensure flight safety and effective mission accomplishment.

The engine has unique altitude and airspeed performance, providing maximum airspeed of 3,000 km/h at altitude and 1,500 km/h near ground.

The D-30F6 engine is designed to power the MiG-31E fighter/interceptor.

Basic specifications	
Thrust, kgf:	
max continuous (H=0, M=0, ISA)	*9,500*
full afterburner	*15,500*
Specific fuel consumption, kg/kgf/h:	
max continuous (H=0, M=0)	*0.20*
full afterburner	*1.90*
Bypass ratio	*0.57*
Air consumption, kg/sec	*150*
Pressure ratio (total)	*21.15*
Gas temperature before the turbine, ºK	*1,640*
Engine dry weight, kg	*2,416*

D-436TP

Turbofan Engine

The D-436TP turbofan features a three-shaft configuration with minimum number of bearing supports. It has a modular design. The transonic fan is of a single-stage type. The low-pressure compressor has six stages, and the high-pressure compressor has seven stages. The engine has an annular combustion chamber. The low-pressure turbine is single-staged, and the high-pressure turbine is three-staged. The engine is equipped with a thrust reverser, an electronic-hydromechanical control system and universal attachment fittings.

The D-436TP turbofan engine is designed for the Be-200 aircraft.

It boasts high reliability ensured by a long-time operating experience of the D-36 engine. It is easy to maintain, and can be operated in sea environment. The engine demonstrates stable operation in spite of sharp air inflow temperature inversions during forest fire-fighting missions.

The engine complies with standing and future ICAO noise and emission requirements.

Basic specifications	
Thrust, kgf:	
take-off mode (H=0, M=0, ISA+15)	*7,500*
cruising mode (H=11,000 m, M=0.75, ISA)	*1,500*
Specific fuel consumption, kg/kgf/h:	
take-off mode (H=0, M=0)	*0.370*
cruising mode (H=11,000 m, M=0.75)	*0.608*
Bypass ratio	*4.98*
Pressure ratio (total)	*22.17*
Gas temperature before the turbine, ºK	*1,520*
Dimensions fan diameter, mm	*1,373*
Engine dry weight, kg	*1,450*

D-30KP

Turbofan Engine

The D-30KP engine features a two-shaft configuration with exhaust mixing from both ducts. The two-rotor compressor has a three-stage first rotor and an eleven-stage second rotor. The engine has a cannular combustion chamber. The high-pressure turbine has two stages, and the low-pressure turbine has four stages. The nozzle, common for both ducts, has a blade mixer and a mixing chamber.

This is Russia's first production engine to feature cooled rotor blades of the first turbine stage and a clamshell reverser, which does not affect the engine performance at the forward thrust mode.

Basic specifications	D30KP I	D-30KP II
Thrust, kgf:		
take-off mode (H=0, M=0, ISA)	*12,000*	*12,000**
max cruising (H=11,000, M=0.8)	*2,750*	*2,750*
Specific fuel consumption, kg/kgf/h:		
take-off mode (H=0, M=0)	*0.510*	*0.490*
cruising mode (H=11,000, M=0.8)	*0.710*	*0.700*
Bypass ratio	*2.36*	*2.2*
Air consumption, kg/sec	*279*	*269*
Gas temperature before the turbine, ºK	*1,424*	*1,356*
Engine dry weight, kg	*2,668*	*2,650*

** - ISA +30*

Variants

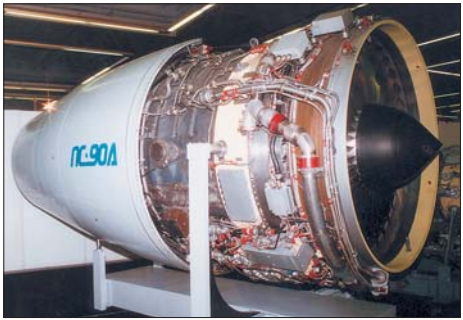
The D-30KP Series 2 engine provides the design take-off thrust at the ambient air temperature of +30ºC.

The engine is installed on the Il-76TD, Il-76MD, Il-76TP, Il-78, and A-50 aircraft.

The D-30KPV version (without reverser) is developed for the A-40 aircraft.

PS-90A

Turbofan Engine



The PS-90 turbofan engine features a two-shaft configuration with exhaust mixing from both ducts. It has a reverser inside the bypass duct. The engine comprises 11 modules. The single-stage fan has titanium blades. The low-pressure compressor has two stages, and the high-pressure compressor has 13 stages. The engine has a cannular combustion chamber. The cooled high-pressure turbine has two stages, and the low-pressure turbine has four stages. The engine has a two-channel digital control system. Advanced control and monitoring system provides timely engine malfunction detection and on-condition maintenance.

The unified PS-90A engine is designed to power the Tu-204, Tu-214, Tu-330, Il-76MF, Il-76T/TD, and Il-96-300 aircraft. In 1992 the engine got the Interstate Aviation Committee and ICAO noise and emission certificates. Introduction of more stringent ICAO requirements will not pose a problem for PS-90A-powered aircraft as only minor upgrading of the standard engine and air intake noise-absorption system will be required.

Variants

The PS-90A-76 derivative has an extended service life and improved acoustic and emission characteristics. It is designed to power the Il-76MF aircraft, and can also be installed on the Il-76T/TD and Il-86 aircraft.

The PS-90A2 derivative boasts enhanced reliability, improved efficiency, and simplified maintenance.

Basic specifications

	PS-90A	PS-90A2
Thrust, kgf:		
take-off mode (H=0, M=0, ISA)	*16,000*	*16,000*
cruising mode (H=11,000 m, V=850 km/h)	*3,500*	*3,700*
Specific fuel consumption, kg/kgf/h cruising mode (H=11,000, V=850 km/h)	*0.595*	*0.595*
Air consumption, kg/sec	*470*	*470*
Dimensions, mm:		
fan diameter	*1,900*	*1,900*
length	*5,333*	*4,964*
Engine dry weight, kg	*2,950*	*2,950*

TV3-117/TV7-117

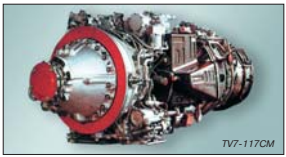
Turboshaft Engine Family

The TV3-117VM/TV3-117VMA turboshaft engine family features a single-shaft configuration. The 12-stage compressor has a variable-area guide vane. The combustion chamber is of a straight-flow annular type. The engine has a two-stage free turbine with the overspeeding protection. The exhaust pipe deflects the gas flow by 60 deg. The engine has an electronic-hydromechanical control system.

The engine is designed to power the Mi-8AMT, Mi-8MT, Mi-8MTV, Mi-14, Mi-17, Mi-171, Mi-172, Mi-24, Mi-28, Mi-35, Ka-27, Ka-28, Ka-29, Ka-31, Ka-32, Ka-50, and Ka-52 helicopters.

The TV3-117 is one of the world's most efficient engines in its class. It is easy to operate, maintain and repair. Introduction of the emergency thrust mode allows the helicopter to land safely with one engine failed. A dust guard can be installed.

Operation of the TV3-117 engine for 25 years in 60 countries has proved its exceptional reliability. The TV3-117VM/VMA is certificated by the Aviation Register of the Interstate Aviation Committee and by corresponding bodies of Canada, China, and India.



Turboshaft engine family incorporates the VK-800, VK-1500VM, VK-2500, VK-3000 (TV7-117) and VK-3500 engines.

High-end technologies, latest electronic digital systems, soft/hardware and monitoring and diagnostic equipment considerably improve capabilities of helicopters equipped with the new turboshaft engines.

These engines differ from the old versions in extended overhaul period of the engine hot components, extra gas-dynamic stability at varying duties, engine parameters accuracy and engine control quality, enhanced monitoring depth providing operation of the engine according to its technical condition and better weight characteristics and overall dimensions.

The VK-800 turboshaft engine of the fifth generation is designed to equip the Mi-54, Ansat and Ka-226 type helicopters. The VK-800V derivative was developed for the power units of helicopters of small and large load-carrying

Basic specifications

Engines	VK 800	VK 1500VM	VK 2500	VK 3000 (TV7-117V)	VK 3500
Power, hp / EM	*1,000*	*1,800 to 1,900*	*2,700*	*3,750*	*4,000*
takeoff	*800*	*1600*	*2,400*	*2,800*	*3,000*
cruise	*450*	*1,100*	*1,750*	*2,000*	*–*
Specific fuel consumption, kg / (hp·h)					
take-off	*0.238*	*0.240*	*0.210*	*0.199*	*0.199*
cruise	*0.291*	*0.265*	*0.230*	*0.220*	*–*
Location	*Mi-54, Ansat, Ka-226*	*Mi-8, Ka-60, Ansat*	*Mi-17, Mi-24, Mi-28N, Ka-32, Ka-50-2*	*Mi-38, Ka-32, Ka-50-2*	*Mi-38*

capacity, both in twin- and single-engine configuration. The engine parameters meet the requirements of the tested model of a centrifugal compressor and the single-stage un-cooled turbines. All this simplifies the engine design and reduces expenses for its manufacture and operation. Moreover, the enhanced characteristics of the main units of the engine provide its high efficiency.

The VK-1500VM engine is a turboshaft derivative with the power shaft in a backward position. It was developed for the Mi helicopters fitted with the TV2-117 engines.

The VK-2500 turboshaft engine is a high-power derivative of the well-know TV3-117VMA engine. By its fuel efficiency and weight characteristics, the engine holds a firm place among the best world's models. Modern control system improves the engine performance and provides its high reliability and long service life.

The new VK-3000 (TV7-117V) is based on the certified TV7-117 turboshaft engine. It is unitized with the base engine by 90 %. The engine has two versions:

- with the power shaft in a forward position – TV7-117V(VM) engine for the Mi-38 heli copter and its derivatives
- with the power shaft in a backward position – TV7-117VK engine for upgrading the Mi-28 and Ka-50/Ka-50-2 helicopters.

The VK-3500 engine is designed for the Mi-38 helicopters.

RD-600V

Turboshaft Engine

The RD-600V turboshaft engine of modular design is installed on the Ka-60/62 multipurpose twin-engine helicopters and its derivatives. The RD-600V is the engine of the new generation of 1,200 to 1,800 hp power class. Its distinguishing features are as follows:

- reverse-flow combustion chamber
- two-stage power turbine
- new memory storage
- automatic electronic digital control system
- segmented two-wall flame tube that increases the engine overhaul period to 10,000 hours
- four-stage miniature axial-centrifugal compressor with a controlled starter, featuring a high degree of compression.

The engine employs a built-in high-effective dust protector that allows the helicopter to operate at unpaved airfields. The engine intermediate gear box can decelerate the output shaft to 6,000 rpm that considerably simplifies the design of the main rotor drive gear box of the helicopter and provides its best weight characteristics and overall dimensions.

The advanced system of faults monitoring and fully automatic digital two-channel test system of emergency warning greatly improves a factor of safety and reliability of helicopters that make use of this engine.

The RD-600V engine is provided with the certificate registered in the Aviation Register of the Interstate Aviation Committee (ARIAC).

Basic specifications	
Power, hp / EM	*1,550*
Power, hp	
takeoff	*1,300*
cruise	*1,000*
Specific fuel consumption, g / (hp·h)	
takeoff	*209*
cruise	*225*
Air flow rate, kg/s	*4*
Pressure ratio	*12.7*
Engine dry weight, kg	*220*
Overhaul period	
time between overhauls, hrs	*220*
service life, hrs	*10,000*

RD-1700

Bypass Turbojet Engine

The RD-1700 bypass turbojet engine is designed for the MiG-UTS trainer aircraft (MiG-AT version).

The RD-1700 is a miniature bypass turbojet engine without afterburner with a fixed-area nozzle. The engine version with afterburner was also developed with the fixed- and variable-area nozzles. The engine uses a two-shaft configuration, has a two-stage fan, a four-stage high-pressure compressor and a two-stage turbine with the cooled blades.

The RD-1700 is a base engine for the family of the bypass turbojet engines with a thrust of 2,000 to 3000 kgf.

Basic specifications	
Maximum thrust, kgf	*1,700*
Specific fuel consumption, kg / (kgf·h)	*0.7*
Air flow rate, kg/s	*30*
Ratio	
pressure	*14.1*
bypass	*0.78*
Dimensions	
length, mm	*1,915*
diameter, mm	*621*
Engine dry weight, kg	*298*

AEROSPACE SYSTEMS

AVIONICS

AVIONICS SUITES

The avionics suite of modern and future aircraft is an integrated complex of weapons and flight control subsystems, general and special hardware/software and airborne equipment, which functions are determined by missions, employment and specific features of aircraft.

The architecture and technical level of the avionics suite components for each specific type of aircraft (helicopter) characterizes its air property and defines further perspective of upgrading and improvement of its functional capabilities.

Main components of the avionics suite are flight-navigation system incorporating automatic weapons and flight systems, digital computer, information modules (electro-optic sensors and airborne radars) and systems of communications, identification and protection, which are integrated by multiplex information communication channels.

The Su-32, MiG-29 aircraft and its derivatives, Su-32, Su-37, Mig-31, MiG-AT aircraft, air-to-air and air-to-surface guided missiles and guided aerial bombs hold a firm place among modern and perspective models of aircraft (helicopter). Automatic weapons and flight control systems are divided into the following types:

- automatic missile and aircraft flight control systems
- fly-by wire systems
- integrated flight control systems, etc.

MiG-29SMT Aircraft Avionics Suite

The MiG-29SMT avionics suite provides:

- automatic desired track flight, automatic and manual change of waypoints in flight, positioning under inertial and air course conditions, corrections from the satellite navigation system
- employment of a wide range of aircraft missiles, such as 'air-to-air' and 'air-to-surface' guided missiles equipped with infrared, active, passive, radio-controlled, TV and laser target seekers, as well as unguided aircraft missiles
- built-in high-accuracy testing and transmission of data on current status of the avionics suite for display and recording.

The avionics suite features a certain margin of computing power to increase its functional capabilities on the customer's request.

The aircraft avionics suite navigation and sighting system includes:

- BTSVM-486-2M aircraft digital computer
- BSPI-6M information conversion and interface unit
- two (four) MFI-10-6M colour 10-inch multifunction liquid-crystal displays
- BFS-3M signal shaping unit
- BKTS1-1 TV signal switching and conversion unit
- Sigma -95NA LINS laser inertial satellite system
- SBKV-2V-1 strapdown attitude-and-heading reference system
- SVS-2TSU-30MKI air signal system
- SUO-30 PK-29 weapons control system
- KOLS-13S IRST station
- SHCH-ZUM helmet-mounted target designation system
- VIM landing and navigation equipment.
- A-323 short-range landing and navigation radio system
- VND-94 ranger finder
- ILS-31 head-up display
- Reprogrammable memory unit
- Aircraft sighting system coverage controls

MiG-29SMT Aircraft
Automated Control System

The SAU-451-05SMT system is designed to provide automated stabilization and control of aircraft with respect to its center of gravity in pitch, roll and heading, altitude parameters and flight speed. The system can also bring aircraft to forward flight from any attitude. Automatic and director control of flight path in the lateral and vertical planes allow aircraft to solve the following functional tasks, namely: engine thrust control, landing approach, maneuvering in dog fighting, formation flight, low-altitude flight (flying around obstacles), terrain avoidance at low altitudes, etc.

MiG-AT Aircraft
Integrated Flight Control Systems

The KSU-821 systems are designed to perform all functions of automatic flight control and fly-by wire systems and can provide:

- required characteristics of stability and handling
- lesser maneuvering wing loads
- suppression of atmospheric turbulence
- automatic spin recovery
- indication of current and pre-stalling angles of attack and overload
- automatic limitation of angles of attack and aural warning about reaching the pre-stalling angle of attack and location at angle of stall
- automatic stabilization of flight angles
- bringing aircraft to forward flight from any attitude
- stabilization of barometric altitude
- pre-selected radio altitude hold and warning
- director and automatic control at landing approach
- automatic engine thrust control
- high-lift device control and aerodynamic balance
- trimmed position of the control stick according to flight regimes
- trimming in pitch, heel and heading and indication of mechanism's neutral positions
- quick reprogramming of aircraft stability and handling characteristics
- automatic preflight and continuous in-flight monitoring with localization of faults and transmission of information of monitoring results.

All circuit configurations of the systems are built around analog-digital or digital computing environment using the latest elements of microelectronics, optoelectronics, micromechanics, large-scale integration circuits and electrical, electrohydraulic or pneumatic boosters.

Hardware/software in conjunction with missile and integrated control systems depends on the type of aircraft and has its own specific composition.

Su-30MK Aircraft
Avionics Suite

The Su-30MK avionics suite is designed to provide automatic desired track flight, automatic and manual change of waypoints in flight, positioning under inertial and air course conditions, corrections from satellite navigation system and employment of the weapons system.

The aircraft avionics suite incorporates:

- PNK-10-PU2 flight-navigation complex including
  - aircraft digital computer
  - TS-060 inertial navigation system
  - short-range navigation radio system
  - air signal system
  - radio altimeter
  - limiting signal system
  - automatic control system
- BTSVM-486-2 aircraft digital computer
- BSPI-6 information conversion and interface unit
- BTSVM-486-2-based display processors
- SU0-30 PK weapons control system
- MFI-10-5 colour 10-inch multifunction liquid-crystal displays (LCD)
- BKTS1-1 TV signal switching and conver sion unit
- BRP-3 reprogrammable memory unit
- KBP-1 integrated power unit
- A-737 satellite navigation system receiver operating with GLONASS and GPS systems at any point of the Earth
- Aircraft sighting system coverage controls.

The navigation and sighting system of the Su-30MK aircraft is designed to ensure control over a wide range of aircraft weapons, among which are 'air-to-air' and 'air-to-surface' guided missiles equipped with infrared, active, passive, radio-controlled, TV and laser target seekers as well as unguided aircraft missiles of different systems.

Centralized entry of flight information into aircraft systems, display of the required graphic, imagery and mixed information on colour multifunction LCDs, simplicity in handling integrated systems allow the aircraft to fully use its technical, functional and combat capabilities.

The Su-30MK aircraft avionics suite was developed in accordance with the adopted standards. This, in turn, provides its compatibility with different types of interface.

The suite affords automatic and built-in high-accuracy testing. Its open architecture allows the customer to change configuration, expanding or minimizing the scope of duties.

Su-30MK

Su-30MK

Aircraft Weapons Control System

The Su-30MK weapons control system is designed to control preparation and employment of aircraft weapons and ensure their interface with the avionics suite.

The system is equipped with intellectual interface and peripheral units that afford interface with avionics suite, weapons, emergency operation unit, local data communication channel, and ground monitoring equipment. The latter incorporates the troubleshooting unit that checks power circuits of aircraft weapons, provides general indication of the circuit operability and blocks incorrect actions of operator.

The system ensures control over available and future weapons, such as air-to-air and air-to-surface missiles, high safety and reliability during weapons employment, intellectual interface of the avionics suite with weapons due to the available incorporated computing environment and built-in test system that checks condition of the system components and interface with weapons.

A modular design of the system allows its sequential upgrading and this greatly expands combat capabilities of the aircraft (helicopter).

Ka-31

Radar Picket Helicopter Avionics Suite

The Ka-31 avionics suite is designed to provide automatic control of the helicopter in all flight regimes and transmission of flight-navigation information to the helicopter's radio facility to effectively search for targets. It also ensures automatic monitoring and indication of the status of helicopter subsystems and basing of the helicopter on ships.

The avionics suite's flight-navigation system of the Ka-31 includes:

- integrated computer system (two Baget-53-16 helicopter digital computers)
- cockpit management system using two PS-3 multifunctional consoles and two MFI-10-5I multifunctional liquid-crystal displays
- A-380MK system of navigation and landing on ship
- SAU-37D automatic digital control system
- navigation aids, including:
  - INS-2000 inertial navigation system
  - SBKV-2V-2 strapdown attitude-and-heading reference system
  - satellite navigation system
  - Doppler ground speed and drift meter
  - air signal system
  - radio altimeter
  - automatic direction finder
  - long-range radio engineering navigation system.
- set of standby instruments: AGR-81 gyro horizon, standby; PNP-72-15 course indicator, INP-R flight director course indicator, standby.

Mi-28NE Combat Helicopter Avionics Suite

The Mi-28NE combat helicopter avionics suite provides:

- around-the-clock combat employment of helicopters in adverse weather conditions
- execution of combat missions at extreme low altitudes
- cooperation with helicopters of the team, airborne and ground command stations and air traffic controllers
- employment of weapons both by the pilot and the operator
- adaptation of new and already employed weapons
- on-condition operation of helicopters at great distances from airfields and bases.

The avionics suite incorporates:

- Baget-53-15-based integrated computer system that allows processing of information by common interface
- navigation aids, including:
  - INS-2000 inertial navigation system
  - SBKV-2V-2 strapdown attitude-and-heading reference system
  - satellite navigation system
  - Doppler ground speed and drift meter
  - air signal system
  - radio altimeter
  - automatic range finder
  - long-range radio engineering navigation system
- four MFI-10-7V multifunctional liquid-crystal displays and two MFPU multifunctional consoles
- gyro-stabilized electro-optic surveillance and sighting system operating in visible and infrared bands
- two-band helicopter radar
- ultra-violet, laser and electronic radiation detection system of the helicopter
- automatic control system
- weapons control system
- helmet-mounted target designation and display system
- switching and matching units
- data transmission and communication system.

By its technical characteristics, the helicopter avionics suite meets the requirements of a modern avionics suite of the fifth generation.

KNEI-24

Electronic Indication and Navigation System

The KNEI-24 for the Mi-35M is designed to enhance accuracy of helicopter navigation and to receive and process information from flight-navigation and special equipment. It provides:

- dead reckoning of current coordinates of the helicopter and their correction, using information from satellite navigation systems
- nonvolatile storage of the database on navigation waypoints and routes and terrain the digital map
- reception, processing and providing the helicopter crew with flight-navigation and surveillance information.

The standard electronic indication and navigation system incorporates:

- two colour 211x158-mm multifunction liquid-crystal displays and button mask to control operation regimes of the IV-86-1 system
- multifunctional computer system
- input/output device
- satellite navigation systems (SN-3700)
- two indicators of gyro horizon (AGR-29RS-15)
- power supply unit
- SVS-V1-1 air signal system.

In conjunction with the gyro-stabilized flight/surveillance (surveillance/sighting) system, these systems allow the helicopter crew to day-and-night map, search, detect and identify targets and obstacles against video pictures on the multifunction displays as well as measure target coordinates (slant range) and employ standard weapons of the helicopter.

Basic specifications	
Doppler radio-navigation and air course method of dead reckoning of helicopter coordinates is provided	
Accuracy of helicopter coordinates determination while operating	
with satellite navigation system, m	*50*
and in differential regime, m	*1 to 5*
Capacity of memory-stored data for programmable waypoints, airfields, radio beacons	*up to 99*
Time of readiness, min	*1*
System weight, kg	*35*

FLIGHT MISSION PLANNING AND POST-FLIGHT CONTROL SYSTEM

The system is designed to provide automatic preparation of flight mission plans for a team of Su-24, Su-27, Su-30MK, Su-35 and MiG-29SMT planes, Mi-35M and Mi-28N helicopters, conversion of operating plans into flight missions for airborne systems and flight crews, preparation of terrain digital maps for airborne situation displays, loading of flight missions and cartographic flight information into portable memory storage of Flash-type to enter data into aircraft equipment, preparation and printing of flight documents.

The system allows coordinated planning for a 36-ship formation based either at one or several airfields.

Flight missions are planned taking into account all factors of tactical, navigational situation and weather conditions, terrain, training level of flight crews and a number of other factors. Time to prepare a plan does not exceed 40 minutes.

The system allows all formats of digital and digital maps of Russia and also the maps meeting the MIL-C-89038 and MIL-PRF-89020A standards of the United States Department of Defense. It supports the use of both vector and raster maps without any restrictions on the theater of operations. Chart scales are from 1: 5 000 to 1: 32 000 000. The system is provided with the Electronic Chart of the World of scale 1: 40 000 000 and supports the use of space photos of any scale.

The system design versions (portable, office, and container) allow the equipment to be adapted to any operating conditions that the Customer may need. For example, the portable version based on the FM 7000 laptop can be used in hostile electromagnetic enviroment and in any weather conditions. The container version based on the Baget-1/Elbrus-90 microcomputers is always available for use under any weather conditions. The office version allows equipment operation under normal climatic conditions. The system can be both of vehicle- and helicopter-mounted versions.

A plan of aviation combat actions has an integrated environment and a change in any parameter of the plan causes its automatic updating, providing its unconditional validity.

Open architecture of software affords adaptation to the technologies of combat actions planning adopted in the Customer's Air Force.

All databases of the system ensure their editing in service thus allowing a user to create his parametric and graphical libraries of tactical and navigational situations.

The system is fitted with an advanced three-dimensional graphic interface of the user, that is provided with the built-in test controls.

Planning functions may also include those obtained after post-flight objective control of the flight crew actions and functioning of the aircraft system under combat conditions.

The system also provides plans for striking, navigation, patrolling, escorting, refueling, electronic countermeasures and dog-fighting.

KARAT

Flight Information Acquisition and Recording System

The Karat flight information acquisition and recording emergency/operation system is designed to acquire, monitor, record and process flight information. It consists of two modules – an airborne one (Karat-B) and an ground one (Karat-N).

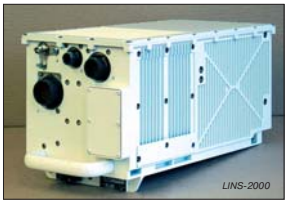
The Karat-B provides acquisition, processing and recording of information coming from sensors and airborne equipment via digital and analog communication lines, storage of the recorded information in case of an air accident, automatic monitoring of airborne equipment functioning on ground and in flight. The Karat-B-25 upgraded system may also operate as a recorder of aircraft information.

The Karat-B software provides quick readout of information during technological work and monitoring of any parameter of the equipment. Another specific feature of the system is its modular design. Such architecture of the system plus a unique program product ensures its adaptation to any type of aircraft. The Karat-B meets the requirements of the TSO C 124 international standard and features modern processor, conversion and interface modules, which, unlike previous analogues, greatly enhanced reliability, accuracy and depth of the equipment monitoring.

Basic specifications	
Recording of parametric information, h	*2*
System provides:	
reception and processing of information coming:	
via the ARINC-429 communication lines	*8 channels*
from autonomous sensors	
as single signals	*128 inputs*
from autonomous sensors	
as analog signals	*40 inputs*
shaping of control commands	*24 outputs*
Memory capacity, Mbytes	*10, max*
Built-in test system	*available*
Weight, kg	*less than 16*

LINS-2000 Laser Inertial Satellite System, INS-2000 Inertial Navigation System


INS-2000


LINS-2000

The LINS-2000 laser inertial satellite and the INS-2000 inertial navigation systems are designed to define and generate flight-navigation parameters of aircraft (helicopter).

The LINS-2000 system employs annular laser gyroscopes, accelerometers, service electronics, computer and incorporated receiver of the GPS/GLONASS satellite navigation systems. The LINS-2000 also contains antenna device.

The INS inertial navigation system uses the dynamically adjusted gyroscopes, service electronics, computer, interface unit and satellite navigation system.

The system also incorporates the antenna device of the satellite navigation system. The INS may also be equipped with a magnetometer. Mean time between failures is 5,000 hours.

Basic specifications

	INS-2000	LINS-2000
Errors (2s):		
coordinates, km/h	*3.78 (INS mode) and 40 m (SNS mode)*	*1.85 (autonomous mode) and 30 m (SNS mode)*
ground speed, m/s	*2.0 (INS mode) and 0.2 (SNS mode)*	*1.0 (INS mode) and 0.2 (SNS mode)*
roll and pitch	*0.18*	*6 angular minutes*
true heading	*18 angular minutes*	*6.0 angular min/h*
Time of readiness		
with gyrocompass, min	*15*	*4*
on preset heading, min	*10*	*0.5*
Mean-time-between failures, hrs		*5,000*
Dimensions, mm	*385 x 264 x 195*	*200 x 209 x 406*
Weight, kg	*21*	*17*
Interface	*–*	*MIL-STD-1553B, multiplex data communication channel*

Flight-Navigation System Control Consoles

Multifunctional liquid-crystal (LC) control consoles provide reception, storage and processing of information coming from external sources, display of digital/letter and graphic information on the cathode-ray and LC displays, information on controls' status displayed on the console face panel and brightness control.

Lighting facilities are adapted to the use of night vision goggles. Consoles are provided with a built-in test system and engraved and multifunctional buttons. Mean time between failures is 5, 000 hours.

Basic specifications

	PS–2ZHK	PS–3	PS–5 ZHK	PS–7V
Display type	*Colour LC*	*Cathode-ray*	*Colour LC*	*Colour LC*
Display format				
	480 x 640 pixels	*10 lines by 21 symbols*	*480 x 640 pixels*	*480 x 640 pixels*
Display space, mm				
	100 x 130	*80 x 15, 80 x 90*	*100 x 130*	*100 x 130*
Brightness cd/m²	*>1000*	*200*	*>1000*	*>1000*
Power supply	*27 V*	*115 V 400 Hz AC*	*27 V*	*27 V*
Power consumed	*25 W*	*100 W*	*40 W*	*40 V*
Interface	*ARINC 429*	*ARINC 429*	*ARINC 429*	*ARINC 429*
Dimensions, length/ width / height, mm				
	170 x 200 x 85	*147 x 192 x 278*	*170 x 200 x 150*	*146 x 200 x 150*
Weight, kg	*2.5*	*2.5*	*4*	*3.5*
Viewing angles, deg				
in azimuth:	*±20*	*±30*	*+20/-10*	*+20/-10*
in elevation:	*±20*	*±30*	*±60*	*±60*
Processor	*I 186*	*I 186*	*I 386*	*I 386*
Temperature, °C	*-40 ÷ +60*	*-60 ÷ +60*	*-40 ÷ +60*	*-40 ÷ +60*

Electromechanical Displays

Basic specifications

	RMI-5	INP-92	IKP-92
Number of input lines	*5*	*6*	*6*
Dimensions, mm	*85x95x200*	*120x120x240*	*120x120x240*
Weight, kg	*2*	*4*	*4*
Voltage, V	*27*	*27*	*27*

Multifunction Liquid-Crystal Displays

Multifunction liquid-crystal displays are designed to equip different types of aircraft and helicopters. A good presentation of information on them greatly helps flight crew take decisions.

The MFI-10-6M (MFI-10-6M1) and MFI-10-7 displays are full-colour display modules with a liquid-crystal AM displays of high brightness and contrast, providing information readout in any outdoor lighting, compatible with night vision goggles, require no forced cooling, reproduce two-dimensional charts due to their built-in facilities and feature a high resolution. Mean time between failures is at least 5,000 hours.

Basic specifications

	MFI 104	MFI 10-5	MFI-10-6	MFI-10-6 MFI-10-6M (MFI-10-6M1)	MFI-10-7
Display space, mm	*211 x 158*	*210 x 158*	*211 x 158*	*211 x 160*	*211 x 160*
Temperature, °C	*±50*	*+55/-40*	*±60*	*±60*	*±60*
Interface	*ARINC-429, RS-232C, MIL-STD-1553B STANAG 3350B PK, 10BaseT*	*ARINC-429, RS-232C, RGB, SSI, KSI, PAL*	*ARINC-429, MIL-STD-1553V STANAG 3350V*	*ARINC-429, MIL-STD-1553V STANAG 3350V*	*ARINC-429, MIL-STD-1553V STANAG 3350V*
Dimensions, mm	*255x205x160*	*255x205x160*	*255x205x135*	*255x205x135*	*255x205x135*
Weight, kg	*9, max*	*9, max*	*5.10*	*≤ 6*	*≤ 6*

MFPI-6

Multifunctional Indication Console

The MFPI-6 multifunctional indication console is designed to equip cockpits of aircraft and combat helicopters.

The full-colour display module with a 4x5 inch LC active-matrix (AM) display allows information readout in any outdoor lighting. The display features high resolution to show any video pictures with the symbolics overlaid. The MFPI-6 is fitted with the control console with 29 multifunctional buttons and replaces electromechanical airborne indicators. It is compatible with night vision goggles. Its control console provides automatic and manual brightness control within a wide range. Mean time between failures is 5,000 hours.

Basic specifications

Full-colour AM LC screen	*VGA (1024 x 768 pixels)*
Display space	*130 x 100 mm*
Control panel	*automatic/manual brightness control (wide range)*
Compatibility with night vision goggles	*on customer's request*
Brightness	*1,000 cd/m², max*
Dimensions, mm	*130 x 190 x 130*
Weight, kg	*≤ 4*
Power consumed	*27 V (2 sides), 30 W (100 W with heating)*

MFPI-6M

BTsVM-486

Airborne Digital Computer Family

The airborne digital computer is built around open modular architecture to ensure optimal selection of specific modifications for the required memory capacities and composition of interface channels of aircraft and helicopter avionics suites.

As part of the aircraft (helicopter) ground flight preparation equipment, the computer is used to plan flight routes and prepare the 2D and 3D maps.

Debugger: Multi-windows symbol debugger of real time with remote debugging via the RS-232C, ARINC-429 channels (GOST 18977-79).

Functional program packages: navigation and control, 2D and 3D-graphic of real time, indication and control, high-precision navigation and flight control at low altitudes, combat missions.

Basic specifications	
Processors	*AMD 486DX4-100, AMD Elan SC520-100,*
Graphical processor	*MIPS R4640-200*
Memory, Mb	
static RAM	*from 4 to 16 Mbytes*
FLASH	*to 512 Mbytes*
Input/output device	
Channel of multiplex data	*MIL STD-1553B with redundancy,*
communication via	*operating as controller,*
	terminal and monitor
Channel of sequential data	*ARINC-429,*
communication via	*to 48 independent inputs*
	and 24 independent outputs
Channel of parallel data communication	*Q-BUS with functions of master and slave*
Output TV signals via	*STANAG 3350B, RS-343 (2D and 3D pictures in real time)*
Programme development tools	
Operating system	*32-digit multitask system of real time RelMK32*
Programming languages	*C++, Assembler*
Software	
Programme library	*- real-time nucleus*
	- input/output
	- mathematic
Casings (construct)	*ARINC 404 within dimensions of $^1/_2$, $^3/_4$ and 1 ATR*
	(GOST 26765 16-87 within dimensions of 2.5 and 3 K)
Mean-time-between failures	*10,000 hours*

BAGET-53

Airborne Digital Computer Family

BAGET 53-18

The Baget-53 family airborne digital computers are designed to equip navigation and navigation-sighting systems of aircraft and helicopter. The computers have open modular architecture, sophisticated software, set of single commands and modules of sequential data communication. They employ a VME system bus and an automatic control system.

The computer software includes the real-time operating system, tests of built-in, scaled-up and autonomous control and input/output libraries.

Basic specifications	
Central processor module:	*Based on MP R3081 50 MHz,*
	1890BM2T 80 MHz
static RAM	*6 Mbytes*
program ROM	*16 Mbytes*
interrupt controller, timer, PDP controller	
sequential port	*RS232C*
FLASH-memory module	*256 Mbytes*
Single command module	*32 inputs, 32 outputs*
MPI module	*as per GOST 2676551-86 (Q – bus)*
Multiplex data communication module	*as per GOST 26765.52-87*
	(4 channels with redundancy, functions:
	controller, terminal, monitor)
Sequential data communication module	*as per GOST 18977-79*
	(16 inputs, 8 outputs with debugging program
	for frequencies of 12.5, 50, 100 kHz),
	built-in controller 386EX, 25 MHz
Construct	*as per GOST 26765.16-87 (4K, 3K)*
	in variants of connectors layout,
	both on front and rear panels (cut-in connector)
Module construct	*'Euromechanics 6U'*
	with board measuring 160 x 233.4 mm

Reprogrammable Memory Unit

The reprogrammable memory unit is designed for operation with the standard cards of the FLASH-memory. It has a socket for connection of the standard of type I and type II with a capacity from 1 to 512 Mbytes and performs writing and reading functions.

The unit can be used for loading flight missions and for airborne recording. Standard hardware and software for the cards of the PCMCIA standard are used as the ground facilities for preparation of flight missions and post-flight data processing.

BRP-3

Basic specifications	
Interface	*2 input and 1 output channel of the ARINC-429 standard (GOST 18977-79)*
Mean time between failures	*10,000 hours*
Power supply	*115 V 400 Hz (11 W) and 27 V (25 W)*
Construct	*404 $^{1}/_{4}$ ATR (GOST 26765 16-87 within dimensions of 1K)*
Weight, kg	*3*

BGS-3

Airborne Graphic Station

The BGS-3 airborne graphic station is designed to provide:

- synthesis of 2D and 3D pictures with the flight-navigation information overlaid
- shaping of the 'flyby' and 'bypass' paths at low altitudes of flight
- shaping of terrain avoidance warning signals at low altitudes, landing and takeoff
- correction of coordinates with reference to the surface relief and 'urban zones' by the correlation-extreme method to reduce psychophysical stress suffered by the flight crew during take-off, landing and low-altitude flights.

Basic specifications	
Central processor based on	*AMD Elan SC520-100*
Graphical processor based on	*MULTIKOR-11*
Plug-in module of FLASH-memory PC CARD ATA, Gbytes	*1*
Power consumed, W	*⩽ 80*
Mean-time-between failures, flying hours	*⩾ 10 000*
Dimensions, mm	*157 x 194 x 320*
Weight of monoblock with memory unit, kg	*8*

Helicopter Night Vision Goggles

Helicopter pilots use night vision goggles (NVG) for visual flight control during take-off, hovering, low-altitude flight, approach and landing performed at night on unequipped and unprepared sites; obstacle detection and reading flight instrumentation in the cockpit.

The binocular goggles incorporate third-generation electro-optical biplanar image intensifiers with a high spectral sensitivity photocathode and an integrated automatic brightness adjustment system activated to prevent crew blinding if lighting conditions change.

The goggles feature a minimum detection range of 500 m for electric power lines, tangent towers, forest borders, stand-alone trees, and trucks against vegetation background.

For NVG use the helicopter's external and internal lighting is adapted by means of special optical filters suppressing illumination in the goggles' operational waveband.

In the GEO-ONV-1 goggles the IR filters are mounted on light conductors, control panels, and flight instruments in the helicopter cockpit. Equipment designed to adapt the helicopter cockpit lighting to the OVN-1 Skosok NVG combines light filters and semiconductor light sources. The filters are made of high-quality coloured glass with solid multi-layered interference coating. The semiconductor light sources are represented by narrow-band light emission structures used in light-emitting diodes. The light-emitting crystals in the light-emitting elements are so oriented as to provide the necessary colour, directional diagram, and light intensity.

Basic specifications

	GEO-ONV-1	OVN-1 Skosok
Magnification, power	*1*	*1*
Binocular covering power, deg	*40*	*40*
Angular resolution, parallel lines/mrad	*0.65*	*0.85*
Exit pupil diameter, mm	*8*	*10*
Exit pupil distance, mm	*22*	*20*
Eyepiece-to-eyepiece adjustment range, mm	*56 to 72*	*56 to 72*
Dioptre lens adjustment range, dioptre	*± 4*	*± 4*
Weight (without storage battery), kg	*0.510*	*0.515*
Power supply, aircraft electric system, V	*27*	*27*
AA batteries, pcs	*2*	*2*

Helmet-Mounted Target Designation and Display System

The helmet-mounted target designation and display system is designed to operate as part of helicopter equipment and provides:

- around-the-clock operation of the helicopter under standard and adverse weather conditions
- day-and-night surveillance of airspace and display of current flight, navigation, sighting and other graphic information
- execution, jointly with the avionics suite, of navigation, surveillance and sighting missions.

Basic specifications	
Measurement range	
angular coordinates	
of helmet position, deg:	
azimuth	*-90 to +90*
elevation	*-60 to +30*
Measurement error	
angular coordinates	
of helmet position,	
angular min	*15, max*
Field of view of helmet-mounted	
micro-display, deg	*30 - 40*
Weight of helmet-mounted	
elements, g	*500, max*

52Sh

Optical Location System

The 52Sh optical location system is designed to detect targets by their heat signatures, automatically track air targets, find range to air and ground targets for gunfire delivery, and designate ground targets with the laser beam for laser guided missile employment.

The system incorporates a field-of-view stabilisation system, a thermal direction finder, and a laser rangefinder/designator.

Basic specifications	
Angle of view range, deg:	
azimuth	*± 60*
elevation	*22.5/+52.5*
Weight, kg	*200*

The 52Sh optical locator is designed for the Su-35 aircraft.

13S

Infrared Search and Track System

The 13S IRST is designed for the MiG-29 aircraft to search, detect and track targets against their thermal radiation at all altitudes, in the lookup and lookdown modes, day and night and in the jamming environment as well as provide air or ground target ranging by means of a laser range-finder.

High maintenance performance is provided by the built-in test system that allows quick evaluation of the main channels operability.

OEPS-27, OEPS-29

Electro-Optical Sighting Systems

The OEPS-27 and OEPS-29 sighting systems are designed to search for, acquire and track air targets in the IR band, locate and find range to both air and ground targets (for gunfire delivery as well).

Basic specifications		
	OEPS-27	OEPS-29
Angle of view range, deg:		
azimuth	*± 60*	*± 30*
elevation	*-60/+15*	*-30/+15*
Weight, kg	*174*	*78*

The OEPS-27 can acquire and track air targets at all altitudes, both in the lookup and lookdown modes, by day and night, under intensive enemy ECM.

The system comprises a thermal direction finder, a laser rangefinder, a helmet-mounted target designation system, and a computer.

The OEPS-27 is designed for the Su-27 family aircraft.

The OEPS-29 is designed for the MiG-29 family aircraft.

SHKVAL

Sighting System

The Shkval sighting system is designed to detect and identify mobile and stationary surface, and air targets by their television images. The system provides target tracking in the manual, programme-corrected, and automatic modes, automatic guidance of anti-tank missiles, delivery of air-to-surface guided munitions, laser- and television-guided bombs, rockets, conventional and retarded bombs.

The system comprises a laser rangefinder/illuminator, a daytime TV-optical system, an automatic television target tracking device, an ATGM laser-beam-riding control channel, a gyro-stabilised actuator, and a communications and interface unit.

The Shkval-V is designed for the Ka-50 helicopter.

The Shkval-M is designed for the Su-39 attack aircraft.

Basic specifications	
Daytime control device field-of-view, deg:	
wide	*3 x 4*
narrow	*0.7 x 0.9*
Night control device field-of-view:	
wide	*18.2 x 13.7*
narrow	*7.3 x 5.5*
Line-of-sight angle range, deg:	
elevation	*-85/+15*
azimuth	*± 35*

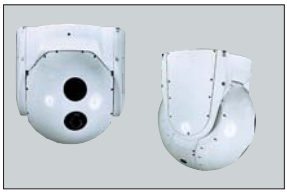
GOES-342
Sighting System

The GOES-342 sighting system is designed to provide round-the-clock visual information for the helicopter crew on the MFD; to acquire and designate surface targets, as well as to perform laser rangefinding and targeting when delivering missiles, rockets, and gunfire by day and night, in any season and in all weather conditions. The system is intended for installation on combat and transport helicopters.

The GOES-342 integral system is built on the baseline gyrostabilised platform. The stabilised optical module unit comprises an IR channel (8-12 μm), daytime/low-level light TV channel, laser rangefinder (1.54 μm), IR locator or laser beam-riding missile guidance channel, stabilisation and control system, and interfacing units.

Basic specifications	
Viewing angles, deg:	
azimuth	*± 230*
elevation	*-115/+25*
TV/IR channel fields of view, deg:	
wide	*18 x 13.5/18 x 12*
narrow	*0.9 x 0.6/4 x 3*
Max rangefinding error, m	*5*
Stabilisation accuracy, μrad	*50*

GOES-520
Sighting System



The GOES-520 round-the-clock gyrostabilised optoelectronic sighting system is designed to acquire and designate ground objects and obstacles using their video images generated by thermal imaging or the TV channel on the multifunction displays by day and night, in all seasons and weather conditions.

The system can be optionally supplied with a combination of channels such as imaging infrared and television, a laser rangefinder, and a missile control channel. The GOES-520 can be installed on helicopters, fixed-wing aircraft, and unmanned air vehicles.

Basic specifications	
Viewing angles, deg:	
azimuth	*± 180*
elevation	*+35/-85*
Dimensions (diameter x height), mm	*350 x 500*
Weight, kg	*45*
Operational temperature range, °C	*± 50*

OKHOTNIK

Image Processing System

The Okhotnik image processing system is designed to operate as part of the electro-optical surveillance and surveillance/sighting complexes.

Composition:

- BUK video-improving subsystem
- automatic target tracking subsystem
- BLIK multi-channel laser-beam control system.

Basic specifications	
Video channels	*TV, infrared*
Number of simultaneously operating information channels	*1 to 2*
System interfaces:	
input/output signal	*full video (1.0 V, 625 lines) as per GOST 7845-92 for black-and-white TV load resistance 75 ohms*
power supply	*from 115/200-V, 400-Hz AC helicopter electrical system; from 27-V DC helicopter electrical system*
Weight and dimensions:	
volume, l	*5 to 7*
weight, kg	*4 to 6*

BUK

Video-Improving Subsystem

The Buk video-improving subsystem greatly enhances quality of TV pictures and infrared images of target environment, including abnormal conditions of surveillance: low and irregular outdoor lighting, adverse weather conditions (haze, fog, dust, rain, snow, etc) and artificial causes (smoke, expositions, flashes).

The system increases distances of acquisition and identification of pin-point targets under abnormal conditions of surveillance by 1.3 to 1.7 times. All data are processed in real time and adequate quality of images is provided.

The Buk system can reduce time needed for acquisition and identification of targets and extend the time limits of their actions. Equipment can be manufactured self-contained: the weight of the subsystem does not exceed 2.2 kg.

Functions:

- smooth electronic zooming from 1 to 4 times
- overlay of graphics
- integration of information coming from the different-spectrum sensors
- electronic stabilization of field of view.

Automatic Target Tracking Subsystem

The system locks on and automatically tracks detected by operator targets and transmits their current coordinates and control signals to the drives of the platform with the image position detectors to ensure high-precision tracking of the target.

Features:

- manual and semiautomatic lock-on of targets
- handling maneuvering targets of various RCS against inhomogeneous backgrounds
- control along two axes in a closed system
- tracking of the target in case of the 5-second (maximum) interruption of the optical contact, automatic detection of tracking loss, automatic target relock-on caused by optical contact interruption
- sub-pixel accuracy of coordinates measurement.

The automatic target tracking system features extra functions to integrate information coming from video channels of different spectrums and to ensure automatic acquisition of targets.

BLIK

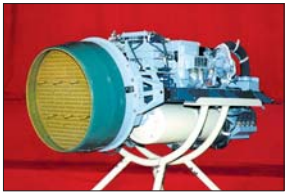
Multi-Channel Laser-Beam Control System

The Blik multi-channel control system provides high-precision guidance of guided weapons by creating in space the information field in the form of the coded light raster, which center coincides with the optical line of sight of the target. The coded raster allows the guided missile to determine its position relative to the center of the information field and to move towards it.

Basic specifications	
Number of control channels	*2, max*
Control range, m	*10,000, max*
Coordinate discrimination error, m	*0.1, max*
Transmitting module weight, kg	*1.2*

OSA

Airborne Radar



The Osa radar is designed to guide active and semi-active radar-homing and heat-seeking missiles. It can provide combined operation of the air-to-air and air-to-surface channels.

In the air-to-air mode the Osa radar detects targets by their speed, measures their range, provides discrete target tracking with alternable target illumination frequency, track-while-scan, vertical, wide-angle, and cruciform fixed-beam search, and HUD target search. The radar system also provides missile launches and semi-automatic flight control during multiple target attacks.

In the air-to-surface mode the Osa has the "sea" and "micro-plan" modes, and is capable of real-beam mapping, covert detection with variable range resolution, two-target track-while-scan, moving target indication and target range finding.

Basic specifications	
Frequency band	*X*
Deviation angle, deg:	
azimuth	*± 60*
elevation	*± 60*
Air target detection range (RCS = 5 m²)	*85*
Number of simultaneously tracked targets	*8*
Number of simultaneously attacked targets	*4*
Weight, kg	*120*
Volume, dm³	*150*
Power consumption AC/DC, kVA	*3.6/0.5*

BARS

Airborne Radar

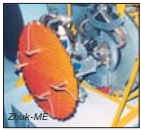
The Bars radar features a phased array with additional mechanical azimuth deflection, and electronic azimuth and elevation scanning.

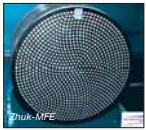
The radar provides detection, tracking and attack of air and ground/surface targets, while continuing airspace surveillance; supports dog-fighting; identifies types and number of air-borne targets; provides mapping with zooming and "freezing" modes, moving ground/surface target indication and coordinates measurement.

The Bars provides guidance of RVV-AE, R-27, R-73E, and Kh-31A missiles.

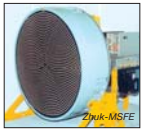
Basic specifications	
Frequency band	*X*
Detection sector, deg:	
azimuth	*± 70*
elevation	*± 45*
Target detection range, km:	
air-to-air mode	*60-140*
air-to-surface mode	*40-150*
Number of simultaneously tracked targets	*not more than 15*
Number of simultaneously attacked targets	*4*

ZHUK Family
Airborne Radars


Zhuk-ME


Zhuk-MFE


Zhuk-MSE


Zhuk-MSFE

The Zhuk is a multifunction coherent radar designed for multi-role aircraft (MiG-29 and Su-27 fighters).

As part of the avionics suite, the Zhuk airborne radar ensures:

In the air-to-air mode:
- lookup/lookdown detection of air targets and measurement of the angular coordinates, range and speed
- tracking of single and clustered targets
- tracking of a clustered air target and attack of several most dangerous single targets
- lock-on and tracking of visual target for dogfight
- detection and engagement of helicopters, including hovering ones
- identification of target types and classes
- identification of clustered target and determination of its composition
- detection of dangerous weather phenomena.

In the air-to-surface mode:
- ground mapping at a resolution of up to 3 x 3 m (with zooming and "freezing" modes)
- simultaneous tracking of several ground (surface) targets
- detection and tracking of moving ground (surface) targets
- measurement of slant visual range to ground (surface) targets
- information support of low-altitude flight.

Basic specifications

	Zhuk-ME	Zhuk-MFE	Zhuk-MSE	Zhuk-MSFE
Air-to-air mode				
Air target detection range				
(RCS = 5 m²), km:				
forward/rear hemisphere	*110 to 120/ 45 to 50*	*100 to 110/ 45 to 50*	*180 to 190/ 65 to 70*	*170 to 180/ 55 to 60*
Scanning sector, deg:				
azimuth	±85	±70	±85	±70
slant	*+56 to -40*	±70	*+56 to -40*	±70
Number of simultaneously tracked/attacked air targets	*to 10/4*	*to 20/4*	*to 10/4*	*to 30/6*
Air-to-surface mode				
Ground (surface) target detection range, km:				
group of tanks /railway bridge	*25/120*	*25/120*	*30/130*	*30/130*
motor boat/destroyer	*150/300*	*150/300*	*150/300*	*150/300*
Number of simultaneously tracked ground (surface) targets	*to 2*	*to 2*	*to 2*	*to 4*
Antenna type	*SA*	*PA*	*SA*	*PA*
Antenna diameter, mm	*624*	*700*	*960*	*980*
Weight, kg	*220*	*285*	*255*	*305*

KOPYO-21I/KOPYO-M

Unified Airborne Radars

The Kopyo is a multimode coherent radar designed for combat aircraft.

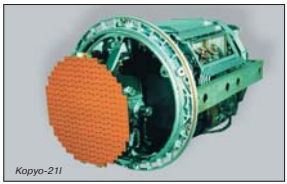
Under normal and adverse weather conditions, the Kopyo airborne radar ensures:

In the air-to-air mode:

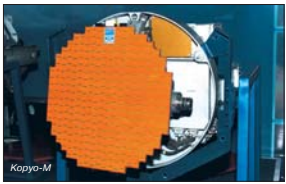
- lookup/lookdown detection, lock-on and tracking of single air target
- simultaneous while-scan tracking of several air targets and discrimination of the most dangerous of them in airspace surveillance
- detection and engagement of helicopters, including hovering ones
- information support in combat
- identification of target types and determination of their number
- detection of dangerous weather phenomena.

In the air-to-surface mode:

- ground mapping with zooming and "freezing" modes
- simultaneous tracking of several ground targets
- detection and tracking of moving ground (surface) targets
- measurement of slant visual range to ground (surface) targets.



Kopyo-21I



Kopyo-M

Basic specifications

	Kopyo-21I	Kopyo-M
Air-to-air mode		
Detection range:		
Air target, RCS = 5 m², km		
lookup:		
forward /rear hemisphere	*57/30*	*80/40*
lookdown:		
forward/rear hemisphere	*57/25*	*80/40*
Scanning sector, deg:		
azimuth	*±40*	*±60*
elevation	*±40*	*+60 to -40*
Number of simultaneously tracked/attacked targets	*8/2*	*10/2*
Air-to-surface mode		
Ground (surface) target detection range, km:		
group of tanks/railway bridge	*20/80*	*25/100*
motor boat/destroyer	*100/200*	*80/150*
Number of simultaneously tracked ground (surface) targets:	*2*	*2*
Antenna type	*SA*	*SA*
Antenna diameter, mm	*500*	*500*
Weight, kg	*100*	*85*

KOPYO-25

Airborne Radar

The Kopyo-25 is a multimode radar designed for the Su-25 family aircraft (installed in suspended under-wing unit).

Under normal and adverse weather conditions, the Kopyo-25 airborne radar ensures:

In the air-to-surface mode:

- ground mapping at a resolution of up to 6 x 6 m (with zooming and "freezing" modes and aircraft targeting)
- simultaneous tracking of several ground targets
- sea-surface surveillance
- detection and tracking of moving ground (surface) targets
- generation of the aircraft control signals when attacking ground (surface) targets
- generation of mission tasks for guided missiles of the air-to-surface class
- measurement of slant visual range to ground (surface) targets
- information support of low-altitude flight.

In the air-to-air mode:

- lookup/lookdown detection of air targets
- continuous tracking of single targets
- lock-on and simultaneous tracking of several air targets within the scanning sector
- detection of helicopters, including hovering ones
- determination of air target coordinates and generation of mission tasks for air-to-air guided missiles, as well as signals and commands for fire control system
- information support for attacking aircraft and using guided heat-seeking missiles
- identification of target types and determination of their number in the tracking mode
- detection of dangerous weather phenomena.

Basic specifications	
Air-to-surface mode	
Detection range, km:	
sea targets (RCS=300 m^2)	*75*
columns of armored vehicles	*25 to 30*
Number of simultaneously tracked ground (surface) targets:	*2*
Air-to-air mode	
Lookdown air target detection range (RCS=5 m^2), km	
forward hemisphere/ rear hemisphere	*70/35*
Number of simultaneously tracked/ attacked targets	*10/2*
Antenna type	*SA*
Antenna diameter, mm	*500*
Weight, kg	*90*

AIRBORNE RADARS FOR COMBAT AND SPECIAL HELICOPTERS

ARBALET

Airborne Radar

the Arbalet is designed for combat helicopters. It is a two-band coherent pulse radar operating in the Ka and L frequency bands.

Under normal and adverse weather conditions and in the presence of natural clutter, unintended interference and jamming, the Arbalet airborne radar ensures:

In the air-to-surface mode:

- detection and identification of ground (surface) targets and measurement of their coordinates
- moving ground (surface) target indication
- employment of guided missiles and guns
- ground mapping

In the air-to-air mode:

- detection and identification of air targets and measurement of their coordinates
- employment of guided missiles and guns
- antiaircraft and antimissile defense.

In the low-altitude flight mode:

- detection of ground obstacles and low-altitude contour matching

In the meteo mode:

- detection of dangerous weather phenomena and determination of their zones and danger level.

Basic specifications	
Air-to-surface mode	
Target detection range, km	
bridge	*25*
tank	*12*
Max mapping range, km	*32*
Azimuth scanning sector, deg	*120*
Air-to-air mode	
Target detection range, km	
attack aircraft	*15*
missile	*5*
Missile detection time, s	*0.5*
Scanning sector (detection sector), deg	
azimuth	*360*
elevation	*±30*
Low-altitude flight mode	
Detection range, km	
power lines	*0.4*
slopes (more than 10 deg)	*1.5*
Weight, kg	*140*

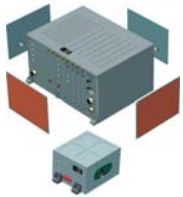
ARBALET-D

Airborne Radar

The Arbalet-D is a decimetric-wave radar designed for helicopters.

Under normal and adverse weather conditions, the Arbalet-D airborne radar ensures:

- detection and measurement of parameters of the targets approaching the helicopter, including guided missiles
- information support for the helicopter crew to repel a guided missile attack



- transmission of information on the enemy's attack to the helicopter crew and ground services and to the on-board recorder
- information support for optical, optoelectronic and other airborne warning systems to increase the approaching target detection probability.

Basic specifications	
Max target detection range, km:	
missile	*3*
attack aircraft	*10*
Scanning sector (detection sector), deg:	
azimuth	*360*
elevation	*-45 to +15*
Closing speed measuring range, m/s	
	25 to 1,000
Time to detect and lock	
on approaching target, s	*1*
Number of simultaneously	
tracked targets	*10*
Weight, kg	*30*

KOPYO-A

Airborne Radar

The Kopyo-A is a coherent multimode radar, which provides sea (earth) surface surveillance during execution by helicopters and aircraft of combat missions and search-and-rescue operations.

Under normal and adverse weather conditions at different states of sea and ground surface, the Kopyo-A airborne radar ensures:

- all-aspect maritime border surveillance and monitoring in a circular zone of 0° to 360° with a scanning radius of up to 250 km
- search and detection of surface objects, including of small-size (boats, motor boats, vehicles, etc.) ones
- detection of coastline and ground mapping at high resolution within the preset angular sector
- identification and tracking of surface targets and precise measurement of their coordinates in the circular scanning zone
- search and detection of air targets
- detection of dangerous weather phenomena and determination of their coordinates
- solution of navigation tasks by coordinates of detected radio-contrast terrain features
- information support for employment of guided missiles.

Basic specifications	
Air-to-surface mode	
Surface target detection range, km:	
destroyer/motor boat	*250/130*
periscope	*30*
Number of simultaneously tracked surface targets	*10, max*
Air-to-air mode	
Target detection range, RCS = 5m², km	*70*
Mapping mode	
Mapping range, km	*250, max*
Range and azimuth resolution, m x m:	
at mapping range of up to 40 km	*20 x 20*
at mapping range of up to 10 km	*5 x 5*
Meteo mode	
Detection range of weather phenomena/ dangerous turbulent areas, km	*0.1 to 260* *0.1 to 200*
Weight, kg	*100*

GUKOL-3

Airborne Radar

The Gukol-3 is a coherent radar designed for meteorological and navigation support of aircraft and helicopters, air patrolling and search-and-rescue operations.

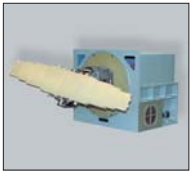
The Gukol-3 airborne radar ensures:

- airspace surveillance, including detection of dangerous weather phenomena, determination of their zones and danger levels (also at low altitudes and in surface clutter)
- detection of weather phenomena turbulent zones, which are dangerous to aircraft/helicopter flights
- generation of horizontal and vertical profiles of weather phenomena
- ground mapping to detect surface objects to ensure navigational safety
- detection of ground and air obstacles ahead of the aircraft/helicopter at maximum ranges - 1 km and 10 km, respectively.

Basic specifications	
Detection range, km:	
weather phenomena	*300*
high turbulent areas	*50*
surface targets	*200*
Scanning sector, deg:	
azimuth	*±60*
elevation	*±30*
Antenna type	*SA*
Antenna diameter, mm	*305*
Weight, kg	*14*

GUKOL-7

Airborne Radar



The Gukol-7 is a millimeter-wave multimode and multifunction radar designed for helicopters.

The Gukol-7 airborne radar ensures:

In the air-to-surface mode:

- ground mapping with zooming and "freezing" modes
- detection of radio-contrast terrain features and measurement of their coordinates when determining the position of the helicopter
- identification of surface targets and radio-contrast terrain features and measurement of their coordinates
- detection of helicopter landing sites and approach/landing of helicopter.

Basic specifications	
Maximum range, km:	
mapping	*18*
target detection range,	
RCS ≥10 m²	*at least 10*
Scanning sector, deg:	
azimuth	*±40*
elevation	*+10 to -30*
Detection range, km:	
obstacle	*5, max*
power line	*0.8, max*
weather phenomena	*30, max*
Weight, kg	*23, max*

In the low-altitude flight mode:

- detection of dangerous ground natural and artificial obstacles (smoke-stacks, power transmission line poles, high-rise buildings and structures), determination of their coordinates and warning of the helicopter crew about possible collision with them.

In the meteo mode:

- detection and identification of weather phenomena and evaluation of their danger level
- detection of approaching aircraft/helicopters and generation of collision warning signals.

GUKOL-10

Airborne Radar

The Gukol-10 weather/navigation radar is a multifunctional two-band (centimeter and millimeter bands) coherent radar designed for all-weather and round-the-clock weather/navigation support of aircraft and helicopter flights, including information support of flights at low altitudes.

Glukol-10 airborne radar ensures:

In the air-to-surface mode:

- ground mapping in the mode of real beam in the millimeter band and usage of synthetic aperture in the centimeter band
- acquisition of radar-contrast surface targets and determination of their coordinates for navigation purposes
- acquisition of unorganized landing grounds, runways and landing on them
- moving surface target indication.

In the low-altitude flight mode:

- detection of natural and man-made ground obstacles (stacks, power transmission lines, high-rise buildings and structures) that might endanger flights
- determination of coordinates and obstacle edges and warning of the crew about possible collision with them.

In the meteo mode:

- detection of weather phenomena, determination of their location, boundaries and danger level
- detection of turbulent zones in weather phenomena, dangerous for aircraft flights
- generation of horizontal and vertical profiles of weather phenomena.

In the air-to-air mode:

- detection of air targets and determination of their coordinates to provide safety of flights and prevention of collision with them.

Basic specifications	
Max range, km:	
mapping	*200*
Max detection range, km:	
ground obstacles	*5*
weather phenomena	*300*
air targets (RCS=10 m²)	*30*
Scanning zone, deg:	
azimuth	*180*
elevation	*90*
Weight, kg	*45*

9B-1103M Family
Active Radar Seekers

9B-1103M

9B-1103M diameter 150 mm

9B-1103M diameter 200 mm

9B-1103M diameter 350 mm

The 9B-1103M family of active radar seekers include:

- 9B-1103M multifunctional pulse Doppler active radar seekers
- upgraded 9B-1103M0150 active radar seekers (diameter 150 mm)
- 9B-1103M0150 active radar seekers (diameter 200 mm)
- 9B-1103M0150 active radar seekers (diameter 350 mm).

Active radar seekers are designed for air-to air/ground-to-air missile and provide:

- search, lock-on and tracking of moving targets using pre-launch target designation from airborne radars or antiaircraft systems
- angular coordinates, target angular speed and missile-to-target closing speed
- reception and decoding of update signals
- generation of missile steering commands transmitted via a digital communications line to the weapon control system.

Operating modes:

- fire-and-forget
- inertial guidance using radio updates
- reprogramming mode when the user can enter a new program into the airborne computer.

Basic specifications

	9B-1103M	9B-1103M-150	9B-1103M-200	9B-1103M-350
Lock-on range of target with 5-sq.m RCS, at least, km	*20*	*13*	*25*	*40*
Reaction time after a preliminary 2-min activation, max, s	*1.5*	*1.0*	*1.0*	*1.0*
Weight (w/o radome), max, kg	*14.5*	*8*	*10*	*13*
Length (w/o radome), mm	*600*	*–*	*400*	*330*
Diameter, mm	*200*	*–*	*200*	*350*

RVV-AE Air-to-Air Missile
Active Radar Seekers

The multifunction Doppler-monopulse active radar seeker of the RVV-AR air-to-air missile provides:

- search, lock-on and tracking of moving targets using target designation from the missile's inertial control system
- angular coordinates, target angular speed and missile-to-target closing speed
- reception and decoding of update signals
- generation of missile steering commands transmitted to the weapon's control system.

Operating modes:
- fire-and-forget
- inertial guidance using radio updates and active terminal guidance.

Basic specifications	
Active radar seeker ensures RVV-AE missile launch from of MiG-29 aircraft in FHS at range, km	*80, max*
Reaction time after a preliminary 2-min activation, s	*1, max*
Length (w/o radome), mm	*604*
Weight (w/o radome), kg	*16, max*
Diameter, mm	*200*

Aircraft communications systems provide reliable digital data transfer via surface-to-surface and air-to-surface communications channels in various frequency bands, and ensure automatic control of aircraft combat operations.

The systems comprise satellite communications systems operating in HF, VHF, UHF, and other frequency bands, data transfer equipment, special-purpose computers, intercom systems, switching, data coding, and ECCM equipment.

Lightning-proof antennas ensure stable operation, and multiplexers provide for simultaneous operation of several transmitters and receivers connected to a single antenna.

K-DIAE/K-DIUE

Standard Communications Sets

The K-DIAE and K-DIUE systems provide aircraft control automation combat interoperation in group missions, and combat efficiency enhancement.

The systems can be fitted on any aircraft.

AT-E

Airborne Data Transfer Terminal

The AT-E terminal ensures full-scale integration of cockpit instrumentation, provides asset compatibility in joint operations, navigation support, self-sustained task-force aircraft operations, and forming of integrated target designation field.

The AT-E terminal is designed for the MiG-21, MiG-29, MiG-31, Su-39, and Yak-130 aircraft, and the Ka-27M, Ka-31, Ka-50-2, Ka-60, Mi-8MTV, Mi-24, Mi-171, and Mi-172 helicopters.

Airborne Communications System for AWACS Aircraft

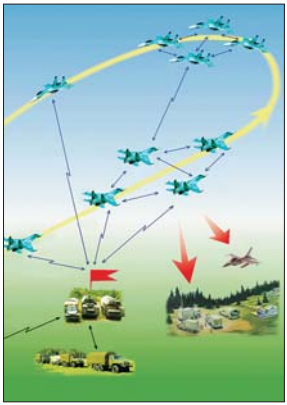
The airborne communications system for AWACS aircraft incorporates communications equipment operating in the VHF, UHF and HF frequency bands, a satellite communications unit, voice communications and switching equipment, data transfer and message recording equipment, a computerised automation system, and data encryption equipment.

The system is mounted on the A-50E aircraft.

Airborne Communications System for Military Transport Aircraft

The system includes HF1, HF2, VHF, UHF, and HF radio stations, radio relay stations, intercom equipment, data encryption equipment, automatic relay device, data transfer equipment, joint control post, and radio multiplexers.

The system is designed to be mounted on the An-32, Il-18, Il-76, and Tu-154 aircraft.



BKS-2ME

Small-Size Communications System for Frontline Aircraft and Helicopters

The system is designed as part of the upgrade package for the radio communications suite of Su-27SK aircraft and the Ka-27, Mi-8, and Mi-24 helicopters. The system comprises the TsIMSS communications unit, Bozon-2M and Burka-M radio stations, and ATM-2 terminal.

Ground Communications System

The ground communications system is designed for ground control stations to provide voice and automatic data exchange communication with the Su-30MK and Su-27SKM aircraft. Fixed and mobile versions of the system are provided.

Functional capabilities:

- MW-DW radio channels to provide line-of-sight voice and data exchange communication with aircraft
- DMW radio channel to provide beyond-line-of-sight voice and data exchange communication with aircraft
- automatic control and monitoring of the system equipment
- protection against falsified data entry and cryptographic protection of data
- anti-noise encryption to provide transmission of data via data exchange communication channels
- decryption of accepted data plus detecting and correcting errors
- acquisition, processing and display on the digital map
- information on air (ground, sea) targets, coming from ground and aircraft radars
- flight navigation data from friendly aircraft
- route data according to flight mission
- two-way data and standard command communication with aircraft via data exchange communication channels, including automatic receipt of emergency messages
- automatic recording of transmitted and accepted information on the system equipment status
- operating conditions – continuous, day-and-night.

K-DLI-03-1

Standard Airborne Data Communications Set

The K-DLI-03-1 standard airborne data communications set is designed to provide voice and digital (data exchange) radio link between the Su-30MK2 and Su-27MK aircraft and with ground control stations via the MW-DW and SW radio channels.

The set provides:

- connection of aircraft to the Air Force automated control system (ACS)
- rise of effectiveness in combat of up to 25%
- cooperation when aircraft operate in independent teams
- assistance to pilots due to data transfer automation
- protection against falsified data entry into voice and digital radio communication channels, immunity to enemy electronic countermeasures in the DMW, MW and DW bands
- universal interface to cooperate with aircraft systems and ACS ground communication centers
- reconfiguration and flexibility of architecture
- automation of equipment monitoring
- installation on any aircraft
- simplicity of maintenance.

KARDAN

Telephone Encryption Equipment

The Kardan telephone encryption equipment is designed for all types of aircrafts, including as part of standard communication systems, and ensures encryption of traffic between flight crews and personnel of ground control stations when calls are transmitted via communication channels digitally in synchronous mode.

This equipment guarantees security of information by means of a unique cryptographic algorithm.

OLEN

Digital Information Encryption Equipment

The Olen digital information encryption equipment can be installed on any aircraft and also can be used as part of standard communication systems. It is designed to provide encryption of digital communication between flight crews and personnel of ground control stations when information is transmitted digitally in simplex mode.

This equipment guarantees security of information by means of a unique cryptographic algorithm and protection against falsified data entry made cryptographically.

L-150 PASTEL

Radar Warning System

The L-150 Pastel radar provides detection and direction-finding onto radars illuminating the carrier aircraft, as well as radar seekers of air-to-air and surface-to-air missiles.

The radar is designed to detect, including doing so in the track-while-scan mode, and find direction to air defence systems and aircraft by emissions of their radars operating in the target acquisition, tracking, and illumination modes. The Pastel is capable of prioritising the radars detected, and providing the crew with information on the most dangerous ones. It can also set off a sound alarm when the aircraft is subjected to hostile illumination. The L-150 can be installed inside the aircraft or in an unshaded container.

Basic specifications	
Frequency band, GHz	*2-18*
Radar signal types	*quasi-continuous, continuous, pulse*
Enemy radar location accuracy, deg	*3-10*
Radar types stored in the database	*128*
Throughput, MHz	*1*
Weight (without display), kg	*45*

SUKHOGRUZ

Electro-Optical Countermeasures System

The Sukhogruz system is designed to protect the aircraft from heat-seeking missiles. It covers a 50-degree cone-shaped sector in the rear hemisphere.

The Sukhogruz effectively jams man-portable heat-seeking surface-to-air missiles, such as the Chaparral, Red Eye, and Strela MANPADS.

Basic specifications	
Modulation frequencies	*8 frequencies in 700-1,700Hz band*
Mode switching time, min	*5*
Emitted power, VA	*6,000*
Weight, kg:	
transmitter	*28*
control unit	*3.5*

ECM EQUIPMENT

Helicopter and Aircraft Electro-Optical System

Intended to protect aircraft and helicopters from air-to-surface missile (ASM), surface-to-air missile (SAM) and air defense gun (ADG) systems by detecting threats and providing appropriate countermeasures

Multi-purpose control indicator panel

Control device

Laser countermeasures equipment

Active jamming radar

Optronic countermeasures equipment

Irradiation warning radar

Flare/chaff dispenser

UF locator

Provides:

- acquisition and identification of air-to-air and surface-to-air missiles fitted with radar seekers and determination of their direction on ASMs, SAMs and ADGs by emissions of their radars and active radar seekers that employ continuous, quasi-continuous and pulse types of radiation
- laser illumination warning
- detection of launching of air-to-air and surface-to-air missiles by emission of their engines
- radio interference against radars and active seekers of air defense weapons
- infrared jamming of against missiles equipped with IR seekers
- control of chaff/heat flare dispensing
- distribution of the system elements between the threatened facilities of air defense.

The optronic system equipment is designed in the form of units installed inside the aircraft/helicopter fuselage. Separate elements of the system can be installed in the external pods if necessary.

The system provides display of most dangerous threats on a multifunction display of the aircraft/helicopter. A self-contained display can also be used as a part of the system.

It provides for on-line reprogramming of the electronic suite database, transmits steering commands for countermeasures equipment and ensures data communication with the systems of aircraft/helicopter via MIL SSTD 1553 B.

The system's serviceability is checked by means of the built-in test system.

Incorporates:

- control device
- radar warning receiver
- laser illumination warning receiver
- missile attack warning radar
- active jamming radar
- optronic countermeasures equipment
- flare/chaff dispenser.

Basic specifications	
Radar warning receiver	
Scan-sector, deg:	
azimuth	*360*
elevation	*60*
Operating frequency range, GHz	*D – J*
Accuracy of direction finding (RMSE), deg:	
azimuth	*3 to 10 (depending on angle of approach)*
elevation	*60 (+20 /-40)*
Illuminating radar acquisition range	*120% from these radars range*
Dynamic range, dB	*40*
Number of radar modes stored in radar memory	*128 and more*
Weight, kg	*30*

Basic specifications	
Laser illumination warning receiver	
Scan-sector, deg:	
azimuth	*360*
elevation	*90*
Accuracy of bearing measurement, deg	*10*
Range of operating wave lengths, μm	*0.4 to 1.1*
Weight, kg	*15*

Basic specifications	
Missile attack warning radar	
Scan-sector:	
optronic unit (OU), deg:	*conical, with top angle of 100*
azimuth	*360 (with 4 optronic units)*
elevation	*90*
Accuracy of bearing measurement, deg	*0.5*
Missile launch acquisition range, km	*more than 6*
Time of response, sec	*0.1*
Weight, kg	*18 (with 4 optronic units)*

Basic specifications	
Active jamming radar	
Jamming sector, deg:	
azimuth	*120*
elevation	*60*
Operating frequency range	*G – J*
Energy potential, W	*2,000, max*
Types of jamming	*RF noise*
	flickering
	quasi-continuous
	range- and speed-distorting
	amplitude- and phase-modulated
Number of simultaneously suppressed radars	*2*
Weight, kg	*51.5*

Basic specifications	
Optronic countermeasures equipment	
Jamming sector, deg:	
azimuth	*360*
elevation	*90 (+30 -60)*
Beam width, deg	*7*
Radiation intensity in IR band, kW/sr	
spectrum band IR 1	*3.0*
spectrum IR 2	*1.2*
Types of jamming	*guided, space pulse-modulated*
Weight, kg	*80*

Basic specifications	
Flare/chaff dispenser	
Type of cartridges dispensed	*antiradar*
	infrared
Caliber of cartridges dispensed, mm	*26; 50*
Number of cartridges	*128, max*
Mode of operation	*automatic*
Weight, kg	*32.7*

AEROSPACE SYSTEMS

ARMAMENT

R-73E

Short-Range Air-to-Air Missile

The R-73E missile is designed to intercept and destroy in close air combat manoeuvrable manned/unmanned air attack and reconnaissance assets by day and night, from all directions, in head-on and tail-on engagements, against the earth background and in aggressive ECM environment.

The missile features an all-aspect IR homing system, a proximity fuse and a rod-type warhead.

The R-73E is one of the world's first all-aspect short-range missiles. Owing to the sensitive IR seeker, the missile is capable of engaging not only receding, but also approaching and colliding-course air targets.

The missile can attack targets in any initial position at designation angles of ± 45 degrees flying at speeds of up to 2,500 km/h at altitudes ranging from 0.02 to 20 km. Minimum range of launch is only 300 m when fired in the rear hemisphere.

The R-73E missile is superior to the world's best counterparts in terms of basic characteristics on which depends its combat effectiveness in dogfight.

The missile is designed to arm the MiG-21-93, MiG-29, Su-39, Su-27 and Su-30 aircraft.

Basic specifications	
Max launch range, km	*30*
Weight, kg:	
launch	*105*
warhead	*8.0*
Target g-number	*12*
Fighter-type target hit probability	*0.6-0.8*
Dimensions, m:	
length	*2.90*
diameter	*0.17*
horizontal stabiliser span	*0.51*

R-33E

Long-Range Air-to-Air Missile

The R-33E missile is designed to engage single and multiple targets within all-round attack zone in all weather conditions, with natural interference, enemy ECM, and evasive manoeuvring against the earth background or in free airspace by day and night.

It features a normal aerodynamic configuration with upper fins folded to fit suspension under the fuselage. In the initial flight stage the missile is guided by the inertial system, and in the terminal stage by the semi-active radar homer. The missile has a solid propellant, single-chamber two-mode engine and a high-explosive fragmentation warhead.

Four missiles are attached to recessed fuselage hardpoints. Launch of the four missiles ensures simultaneous engagement of up to four targets flying at different altitudes with different speeds, as well as of a single target by several missiles. The targets are engaged at altitudes ranging from 0.05 to 28 km.

The R-33E is designed to arm the MiG-31E aircraft.

Basic specifications	
Max launch range, km	*120*
Weight, kg:	
launch	*490*
warhead	*47*
Target g-load	*4*
Fighter-type target hit probability	*0.65*
Dimensions, m:	
length	*4.15*
diameter	*0.38*
horizontal stabiliser span	*1.1*

R-27

Medium-Range Air-to-Air Missile Family

The R-27 air-to-air guided missile is designed to intercept and destroy air targets by day and night, in adverse weather conditions, from all directions, against the earth and sea background, in spite of severe ECM, counterfire and evasive manoeuvring.

The missile's design combines canard and pivoting wing configurations, with tandem destabilisers.

The R-27R1 missile guidance system includes a semi-active radar homing head and inertial navigation guidance with radio correction.

The R-27T1 is fitted with an IR seeker.

The R-27ER1 and R-27-ET1 missiles have an increased power engine.

The R-27 missile locks on a target at any designation angle within ± 50 degrees for the semi-active radar homer and ± 55 degrees for the IR seeker. The carrier g-load can attain 5g at missile launch. The missile can engage targets flying at speeds of up to 3,500 km/h at altitudes ranging from 0.02 to 27 km. Maximum target elevation (depression) in the carrier level flight can reach 10 km. Minimum tail-on range of launch is 500 m.

The R-27 is designed to arm the MiG-29, Su-27 and Su-30 aircraft. The R-27 missiles with homing heads of various types increase integral anti-jamming capability and combat effectiveness of the weapon system.

Basic specifications

	R-27R1	R-27ER1	R-27T1	R-27ET1
Max launch range, km	*60*	*62.5*	*65*	*80*
Weight, kg:				
launch	*253*	*350*	*245*	*343*
warhead	*39*	*39*	*39*	*39*
Target g-load	*8*	*8*	*8*	*8*
Fighter-type target hit probability	*0.6-0.8*	*0.6-0.8*	*0.6-0.8*	*0.6-0.8*
Dimensions, m:				
length	*4.08*	*4.775*	*3.80*	*4.49*
diameter	*0.23*	*0.26*	*0.23*	*0.26*
horizontal stabiliser span	*0.97*	*0.97*	*0.97*	*0.97*

RVV-AE

Medium-Range Air-to-Air Missile

The RVV-AE missile is designed to engage fighters, attack aircraft, bombers, helicopters and military transport aircraft by day and night, in all weather conditions, from all directions, against the earth and sea background with enemy ECM and evasive manoeuvres.

The RVV-AE missile has an active radar homing head and inertial guidance system with radio correction, which allows in-flight target acquisition and re-targeting. The active radar homer improves autonomy of the carrier and ensures effective implementation of the "fire-and-forget" principle.

Basic specifications	
Max launch range, km:	
against fighter-type targets	*50*
against bomber-type targets	*80*
Weight, kg:	
launch	*175*
warhead	*22.5*
Target g-load	*9*
Fighter-type target hit probability	*0.6-0.7*
Dimensions, m:	
length	*3.60*
diameter	*0.20*
horizontal stabiliser span	*0.70*

The RVV-AE missile family features a modular design with a rod-type warhead.

The RVV-AE can engage targets flying at speeds of up to 3,600 km/h at altitudes ranging from 0.02 to 25 km. Minimum range of launch in the rear hemisphere is 300 m. Maximum target elevation (depression) at the missile carrier level flight can attain 10 km. The RVV-AE launch does not impose limitations on the carrier's g-load.

STRELETS

Control Equipment and Launch Module Set for Igla-Type Guided Missiles

The Strelets set is designed to provide automated remote single or salvo launching of the Igla-S, Igla and Igla-1 missiles from different ground-based, air- and sea-borne carriers.

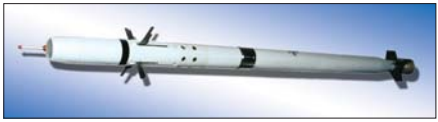
It incorporates:

- universal launch module designed to carry two Igla-type missiles and four power supply sources and to ensure pre-launch operations, including lock-on by the seeker and launch
- communication and control equipment that receives commands, selects module for combat operation and provides comms links with fire control systems platforms
- kit of connectors.

Basic specifications	
Number of launch modules/missiles	*up to 4 / 8*
Reaction time	
(from 'On' to missile launch), s	*6.6*
Weight with fully armed module, kg	*72*
Weight of control equipment, kg	*20, max*

IGLA-S

Guided Missile



Basic specifications	
Target engagement range, m	*up to 6,000*
Altitude of targets engaged, m	*10 to 3,500*
Airspeed of targets engaged, m/s	
head-on	*up to 400*
in pursuit	*up to 320*
Type of optical seeker	*two-spectrum, jamming-proof*
Type of warhead	*HE, impact-delay action, proximity*
Weight of missile/warhead, kg	*11.7 / 2.5*
Into-action time	*not more than 13*
'Fire-and-forget' principle	*provided*
Missile length, mm	*1,625*
Missile calibre, mm	*72*

The Igla-S air-to-air guided missile equipped with a passive two-band IR seeker is designed to destroy day and night aircraft and helicopters as well as low-altitude and stealth targets of the cruise missile types and remotely piloted vehicles head-on and in pursuit at ranges of up to 6.0 km with a heat probability of 0.8 to 0.9.

High effectiveness of the missile is provided due to the proximity fuze and upgraded warhead, which allow destruction of the target not only in case of a direct hit, but also in case of near-miss.

The heat seeker provides reliable selection of a target in the electronic countermeasures environment (heat flares).

Kh-22E

Supersonic Long-Range Air-to-Surface Missile

The Kh-22E supersonic air-to-surface missile is designed to engage radar-contrast mobile and stationary targets at a long range.

The combined guidance system includes an autonomous flight control subsystem and a homing subsystem. The former stabilises yaw and roll angles during the first 25 seconds of the flight, evenly increasing the pitch angle as the homing head keeps tracking the target. In the vertical plane the autonomous flight control system ensures climb to the cruising altitude, subsequent level flight, and dive. At the diving phase the missile assumes radar homing. The missile features an active radar seeker and an HE shaped-charge warhead.

The Kh-22E is part of the weapons suite of the Tu-22M3E bomber.

Basic specifications	
Max range, km	*up to 290*
En-route speed, Mach number	*2.2-3.4*
Launch weight, kg	*5,820*
Warhead weight, kg	*900*
Dimensions, m:	
length	*11.65*
diameter	*1.81*
wing span	*3.00*

Kh-29

Short-Range Air-to-Surface Missile Family

The Kh-29 family is designed to engage sea-surface and ground targets: reinforced concrete shelters, bridges, buildings, warehouses, concrete runways, warships and amphibious landing craft.

The Kh-29T missile features a passive TV homing system. The vertical plane control system operates in two modes, namely autonomous control and homing. The autonomous control mode is activated at the initial stage of the flight, and the homing mode takes over at the terminal stage. The Kh-29TE extended range version is developed.

The Kh-29T arms the Su-27UB, Su-30MK, Su-35, Su-39, MiG-27K, and MiG-29M aircraft.

The Kh-29L missile features semi-active laser guidance providing for the proportional approach method. If the carrier is equipped with the Prozhektor target illumination station, the missile homing is used in both planes. If the carrier is fitted with the Klyon and Kaira illumination stations, then the vertical plane control system realises three-stage guidance to increase the missile approach angle to the target.

The Kh-29L is in the inventory of the Su-25, Su-27UB, Su-30MK, Su-39, MiG-27K, and MiG-29M aircraft.

Basic specifications			
	Kh-29L	**Kh-29T**	**Kh-29TE**
Launch range, km:			
maximum	*8-10*	*10-12*	*30*
minimum			*3*
Launch altitudes, km	*0.2-5*	*0.2-5*	*0.2-10*
Launch speeds, km/h			
Launch weight, kg	*660*	*685*	*690*
Warhead weight, kg	*320*	*320*	*320*
Dimensions, m:			
length	*3.900*	*3.900*	*3.875*
diameter	*0.38*	*0.38*	*0.38*
empennage span	*1.10*	*1.10*	*1.10*

Kh-31

Supersonic Air-to-Surface Missile Family

The Kh-31 missile features a standard configuration with X-shaped control surfaces.

The Kh-31A missile is designed to engage surface ships of up to destroyer class.

The missile is equipped with an active radar seeker and an HE shaped-charge warhead. The seeker has two engagement modes: in the combined mode the seeker locks onto target while the missile is still at the hardpoint, and in the internal guidance mode the seeker locks onto the target after missile launch. The engagement mode is selected by the crew.

The Kh-31A is in the inventory of the Su-30MK, Su-32, Su-35, MiG-29M, MiG-27M, MiG-29SMT, and MiG-29K aircraft.

The Kh-31P missile is designed to engage emitting radars of SAM systems and acquisition radars (depending on the seeker type). The Kh-31P missile arms the Su-30MK, Su-32, Su-35, MiG-29SMT, and MiG-29K aircraft.

The Kh-35E missile is designed to engage missile boats, torpedo boats, gunboats, surface ships of up to 5,000-t displacement, and transport vessels. The missile can be mounted on carriers of all types, including ships, coastal systems, and aircraft.

The Kh-35E features a normal configuration with X-shaped control surfaces. It is powered by a turbojet engine. The detachable solid propellant booster enables its employment from helicopters, vessels, and coast-based carriers. The missile has an HE shaped-charge incendiary warhead. It is containerised for transportation and storage.

The Kh-35E has an active jamming-proof radar seeker. Target designation data can be fed to the missile both from the carrier facilities and external sources. The inertial guidance system controls the missile flight to the target area.

On the basis of the Kh-31 missile the MA-31 air target has been developed.

Basic specifications

	Kh-31A	Kh-31P
Launch range, km:		
max	*25-50*	*up to110*
min	*7.5*	*15*
Launch altitudes, km	*0.1-10*	*0.1-15*
Launch speeds, km/h	*600-1,250*	*600-1,250*
En-route speed, m/s	*600-700*	*600-700*
Launch weight, kg	*610*	*600*
Warhead weight, kg	*94*	*87*
Dimensions, m:		
length	*4.70*	*4.70*
diameter	*0.36*	*0.36*
empennage span	*0.914*	*0.914*

Kh-35E

Anti-Ship Missile

The combat effectiveness of the missile is increased at the expense of extremely low-altitude flight (3-5 m above sea surface), which complicates its interception by ship-based SAM assets.

The Kh-35U missile with the same characteristics as the Kh-35E, arms the MiG-21, MiG-29SMT, Su-30, Su-35 aircraft, and the Ka-27 and Ka-28 helicopters.

Basic specifications

Launch range, km:	
maximum	*130*
minimum	*5*
Launch speeds, km/h	*0.32≤ M≤ 0.9*
En-route speed, Mach number	*0.8*
Launch weight, kg	*520 (610*)*
Warhead weight, kg	*145*
Dimensions, m:	
length	*3.85 (4.40*)*
diameter	*0.42*
empennage span	*1.33*

** - heliborne variant*

Kh-59ME

Medium-Range Air-to-Surface Missile

The Kh-59ME missile is designed to engage pinpoint surface targets with the coordinates preset before launch, in fair weather at daytime.

The missile features a tailless configuration with X-shaped control surfaces. The power plant comprises a turbofan engine and a booster. The missile is stored and transported in a sealed container.

At the initial flight stage the missile is controlled by its inertial guidance system. As the missile approaches the target area, its TV homing head turns on to broadcast the target image to the carrier aircraft at a range of up to 140 km. Two warhead types are available: shaped-charge fragmentation and cluster ones.

The missile arms the Su-30MK aircraft.

Basic specifications	
Max launch range, km	*115*
Flight speed, Mach number	*0.72-88*
Cruising altitude, km	*0.05-1.0*
Launch weight, kg	*930*
Dimensions, m:	
length	*5.7*
diameter	*0.38*
empennage span	*1.30*

KORNET-E

Antitank Missile System

Helicopters can use guided missiles being the versatile versions of the Kornet-E antitank system. Missiles can destroy reactive-armored targets, fortifications and firing positions. There are missile derivatives that have both a tandem shaped-charge warhead and a thermobaric high-explosive and incendiary warhead.

The missile control system is semiautomatic against laser beam and countermeasures-immune.

The 9M133-1 missile with a tandem shaped-charge warhead destroys all modern and future tanks as well as fortifications and field installations.

The 9M133F-1 missile with a thermobaric warhead features a destructive effect comparable to that of a 155 mm high-explosive fragmentation projectile and can destroy strong fortifications, soft-skin materiel and other small targets.

Missiles require no maintenance work in service and in storage for 10 years and need no inspections before suspension aboard helicopter.

Basic specifications	
Range of fire, m	*100 to 5,500*
9M133-1 missile armour penetration, mm	*1,000 to 1,200*
Calibre, mm	*152*
Length, mm	*1,200*
Weight of missile in container, kg	*29*
Temperature range, °C	*±50*

HERMES-A

Guided Weapon System

The Hermes guided weapon system with a semi-active laser seeker is designed to destroy day and night armored materiel, engineer installations and fortifications, and engage low-speed air targets. The basic element of the system is the Hermes supersonic modular guided missile. The bi-caliber guided missile is equipped with a fall-away booster stage and a powerful high-explosive (HE) fragmentation warhead as part of the sustainer stage. The guided missile control system performs combined functions: at the missile initial- and medium-leg to target (positioning of missile to target area) – inertial and at the final-leg to target – laser semi-active seeker starts operating.

It incorporates:

- stabilized, day-and-night optronic system with a two-channel laser target designator
- two-channel target auto-tracker interfaced with the optronic system
- fire control system that includes computer hardware, consoles and controls, displays and documentation and data communication equipment.

Basic specifications	
Max range of fire, km	*15*
Control system:	
initial- and medium-leg to target	*inertial*
final-leg to target	*target-seeking*
Max airspeed, m/s	*1,000*
Average airspeed for 15 km, m/s	*500*
Weight, kg:	
warhead	*at least 28*
GM launch tube	*110, max*
Warhead	*HE-fragmentation*
Missile stage diameter, mm	
booster	*170*
sustainer	*130*
Length of launch tube with missile loaded, mm	*3,500, max*

SHTURM

Antitank Guided Missile

The Shturm anti-tank guided missile is designed to destroy small-size mobile and stationary armoured ground targets and low-speed air targets.

The missile features the canard configuration. It mounts one pair of folding control surfaces and four folding bow-shaped wings. The missile is transported and stored in a sealed launch tube.

A single-channel semi-automatic radio command guidance system ensures alignment-technique guidance. In flight the missile spins around its longitudinal axis. The electronic equipment is jamming-proof and allows for simultaneous attack by a group of 10 helicopters against close-in targets. The narrow antenna pattern and relatively short cycle of radiation hamper enemy electronic countermeasures.

The missile warhead can be of a shaped-charge fragmentation or fuel-air explosive type.

The Shturm ATGM arms the Mi-24V, Mi-25 and Mi-35 helicopters.

Basic specifications	
Max launch range, km	*5*
Flight speed, m/s	*350-420*
Launch weight, kg	*35*
Warhead weight, kg	*5.4*
Armour penetration, mm	*560*
Tank hit probability	*0.65-0.9*
Launch tube dimensions, m:	
length	*1.98*
height	*0.37*
width	*0.33*

ATAKA

Antitank Guided Missile

The Ataka anti-tank guided missile is designed to engage small-size armoured ground targets, low-speed air targets, and weapon emplacements.

It features the canard configuration. The missile has one pair of folding control surfaces and four folding bow-shaped wings. The sealed launch tube is used for transportation and storage of the missile.

The missile is guided by radio commands. During the missile flight, the operator holds the stationary marker on the multi-role display aligned on the target, and adjusts the line-of-sight with the help of controls on the guidance panel until the missile hits the target.

The missile has several warhead versions, including the shaped-charge, HE/fragmentation and fuel-air explosive ones.

The missile arms the Mi-24V, Mi-24P and Mi-28 helicopters.

Basic specifications	
Max launch range, km	*6*
Flight speed, m/s	*400*
Launch weight, kg	*42.5*
Warhead weight, kg	*7.4*
Armour penetration, mm	*800 with ERA protection*
Tank hit probability	*0.65-0.9*

KAB-500

Guided Bomb Family

The KAB-500Kr guided bomb is designed to destroy a wide range of ground and sea-surface targets, including strongly protected and weak-contrast ones, using the fire-and-forget principle.

The KAB-500Kr can be used both singly and in salvo, from level flight, dives and pitch-ups, by day and night (provided that the target is illuminated), against one or several spaced targets in a single attack.

The bomb arms the Su-24M, Su-35, MiG-29M and Su-30MK aircraft.

The KAB-500-OD bomb with a fuel-air explosive warhead is designed to engage personnel and ground targets in terrain accidents.

Basic specifications	
	KAB-500Kr (-OD)
Calibre, kg	*500*
Bomb weight, kg	*520 (370)*
Warhead weight, kg	*380 (250)*
Dropping altitudes, km	*0.5-5*
Dropping speeds, km/h	*550-1,100*
Target hit accuracy (CEP), m	*up to 7*
Dimensions, m:	
length	*3.05*
hull diameter	*0.35*

KAB-1500Kr

Guided Bomb with a TV Seeker

The KAB-1500Kr guided bomb is designed to destroy ground and sea-surface targets of reinforced concrete shelter type, defence industry facilities, warehouses and port terminals.

The KAB-1500Kr guided bomb is used as part of the weapon's systems of front-line aircraft (fighter-bomber, attack aircraft). Bombing is accomplished by flying at altitudes of 1 to 8 km and at speeds of 550 to 1,100 km/h.

Basic specifications	
Weight, kg	*1,525*
Length, mm	*4,630*
Body diameter, mm	*580*
Fin assembly span, mm:	
folded	*850*
unfolded	*1,300*
Warhead weight, kg	*1,170*
Explosives, kg:	
high-explosive	*440*
piercing	*210*
fuel-air explosive	*650*
Target hit accuracy (CEP), m	*4 to 7*
Guidance system	*TV-correlation*
Fuze	*impact, with three types of delay*
Conditions of practical application	*SWC*

KAB-1500

Guided Bomb Family

The KAB-1500L-F guided bomb is designed to destroy ground targets such as reinforced concrete shelters, warehouses, and defence industry facilities, as well as sea-surface targets.

It has a feathered semi-active laser homing head, and an HE warhead.

The KAB-1500Kr bomb is also designed to destroy strong ground and sea-surface targets. It is fitted with a TV homing head, and an HE warhead.

These bombs are used by the Su-24M, Su-30MK, and Su-32 aircraft.

Basic specifications	KAB-1500L-F	KAB-1500Kr
Calibre, kg	*1,500*	*1,500*
Bomb weight, kg	*1,525*	*1,525*
Warhead weight, kg	*1,170*	*1,170*
Dropping altitudes, km	*1-8*	*1-8*
Dropping speeds, km/h	*550-1,100*	*550-1,100*
Target hit accuracy (CEP), m	*up to 10*	*up to 7*
Dimensions, m:		
length	*4.58*	*4.63*
hull diameter	*0.58*	*0.58*

UMGT-1ME

Self-Homing Torpedo

The UMGT-1ME torpedo is designed to destroy submerged and surfaced submarines.

A hydroacoustic active/passive homing system guides the torpedo onto a manoeuvring target irrespective of the target's noise level. The homing system controls the torpedo's course, depth, and roll parameters, provides its manoeuvring in two planes, and guides the torpedo to the proximity fuse activation area or directly onto the target.

The torpedo's modular design facilitates its maintenance. A practice version is available for training purposes.

The UMGT-1ME torpedo is designed for arming ASW aircraft and helicopters with internal suspension (in weapon bays).

Basic specifications	
Torpedo weight, kg	*not more than 725*
Explosive charge weight, kg	*60*
Dimensions, m:	
length	*3.845*
diameter	*0.400*
Parachute container diameter, m	*0.500*
Service life, yrs	*up to 10*

APR-3E

Air-Launched ASW Missile

The APR-3E ASW missile is designed to destroy submarines moving at a speed of 80 km/h at a depth of up to 600 m.

Underwater space is scanned by the hydroacoustic homing system during the missile's gravity-induced descent on a spiral trajectory with the missile engine shut.

The APR-3E missile is powered by a turbo waterjet solid-propellant motor.

The missile can arm the IL-38 aircraft and the Mi-14 and Ka-28 helicopters.

Airborne ASW missiles, in contrast to conventional torpedoes, have maximum operating speed in the target acquisition and detection modes, accelerated approach to the target with destruction before the target can apply countermeasures.

Basic specifications	
Weight, kg	*550*
Warhead weight (TNT equivalent), kg	*100*
Depth range, m	*up to 800*
Speed, km/h	*up to 120*
Hit probability	*0.80-0.85*
Dimensions, m:	
length	*3.60*
calibre	*0.35*

S3V

ASW Guided Bomb

The S3V guided bomb is designed to destroy submarines operating in the following modes: surfaced, at periscope depth, submerged to the maximum depth of 600 m, or lying on the sea bottom.

The S3V bomb equipped with a shaped-charge HE warhead features excellent cost-efficiency. Its hit probability exceeds by 1.2 to 1.5 times that of standard ASW air bombs at moderate depths, and by 4 to 8 times at great depths of up to 600 m. In storage the bomb does not require any special maintenance or testing.

The S3V bomb arms the Mi-14 and Ka-28 helicopters.

Basic specifications	
Bomb weight, kg	*94*
Explosive charge weight, kg	*19*
Submerging speed, m/s	*16.2*
Glide angle, deg	*up to 60*
Trajectory correction system diagram sector, deg	*120*
Dimensions, m:	
length	*1,300*
calibre	*211*

MDM-3

Airborne Bottom Mine

The MDM-3 airborne bottom mine is designed to engage submarines and displacement surface ships of all classes.

The mine features three-channel proximity fuse with acoustic, electromagnetic and hydrodynamic channels. The multichannel design protects the mine from modern mine sweepers, and provides jamming-proof capability within one-year service life.

The mine's design ensures high-accuracy mine dropping and enhanced shock resistance. The mines are carried by the aircraft in the same way as bombs.

Basic specifications	
Mine weight, kg	*525*
Explosive charge weight, kg	*300*
Operational depth, m	*15-35*
Aircraft speed, km/h	*1,000*
Dimensions, m:	
length	*1,580*
diameter	*450*

FAB-500 M62

High-Explosive Bomb

Basic specifications	
Bomb weight, kg	*500*
Drop altitude range, km	*0.57-12*
Drop speed range, km/h	*500-1,900*
Dimensions, m:	
length	*2.47*
diameter	*0.4*

The FAB-500 M62 HE bomb is designed to destroy defence industry facilities, light armoured vehicles, railway junctions, fortifications and personnel.

OFAB

HE Fragmentation Incendiary Bombs

The OFAB HE fragmentation incendiary bombs are designed to destroy light armoured materiel, fuel stocks and other targets by a combined HE, fragmentation, and thermal effect.

Basic specifications	OFAB-500U	OFAB-250-270	OFAB-100-120
Bomb weight, kg	*515*	*268*	*123*
Drop altitudes, km	*0.05-8*	*0.5-12*	*0.5-15*
Drop speed range, km/h	*500-1,350*	*500-1,500*	*500-1,500*
Dimensions, m:			
length	*2.30*	*1.465*	*1.065*
diameter	*0.40*	*0.325*	*0.273*

OFZAB

HE Fragmentation Incendiary Bomb

The OFZAB HE fragmentation incendiary bomb is designed to destroy light armoured materiel, fuel stocks and other targets by a combined HE, fragmentation and thermal effect.

Basic specifications	
Bomb weight, kg	*500*
Drop altitudes, km	*0.9-12*
Drop speed range, km/h	*550-1,850*
Dimensions, m:	
length	*2.385*
diameter	*0.45*

ODAB

Fuel-Air Explosive Bombs

The ODAB fuel-air explosive bombs are designed to destroy industrial facilities, unprotected materiel and personnel. They can also be used to clear mine fields.

Basic specifications		
	ODAB-500PM	ODAB-500PMV
Bomb weight, kg	*520*	*525*
Drop altitudes, km	*0.2-1*	*0.2-12*
Drop speed range, km/h	*500-1,100*	*500-1,500*
Dimensions, m:		
length	*2.28*	*2.38*
diameter	*0.50*	*0.50*

BetAB-500

Concrete-Piercing Bomb

Basic specifications	
Bomb weight, kg	*477*
Drop altitudes, km	*0.03-5*
Drop speed range, km/h	*600-1,200*
Dimensions, m:	
length	*2.20*
diameter	*0.35*

The BetAB -500 concrete-piercing bomb is designed to destroy underground dumps, command posts, communications centres and reinforced concrete shelters.

P-50T

Practice Bomb

The P-50T practice bomb is designed to train pilots (air crews) in round-the-clock bomb delivery.

Basic specifications	
Bomb weight, kg	*50*
Drop altitudes, km	*0.2-25*
Drop speed range, km/h	*500-2,500*
Signal type	*light/smoke*
Light signal visual time, sec	*up to 16*
Smoke signal visual time, sec	*up to 35*
Dimensions, m:	
length	*1.044*
diameter	*0.203*

M6/M6T

Airborne Small-Size Target

The M6/M6T airborne small-size target is designed to simulate an aerial target for heat-seeking and radar-guided weapon systems.

The airborne target can be used to evaluate combat effectiveness of different air defence systems and air-to-air guided missiles, as well as to support training of air defence and air force personnel.

Composition

- target body
- parachute system
- IR-emitting source
- radar reflector

This decoy is airdropped from carrier-aircraft. The air target is simulated during the M6/M6T descent on the parachute thanks to reflections of radars' electromagnetic energy and heat/light generation for heat-seeking missiles.

The M6/M6T small-size target can be detected and tracked in flight visually and with radars and cine-theodolites.

Basic specifications	
Tracking range by cine-theodolite (of the burning plume), km	*up to 35*
Aircraft bombing airspeed, km/h	*750 - 1200*
Airdropping altitude, km	*2.5 - 17*
Plume luminous power at ground, candelas x 106	*more than 2*
Outer diameter, mm	*280*
Length, mm	*1,065*
Flight weight, kg	*98*

S-8

Aircraft Rocket Family

The S-8KOM rocket is designed to destroy armoured targets with a shaped-charge fragmentation warhead, penetrating a 400mm-thick armour plate.

The S-8BM rocket with a penetrating warhead is designed to engage personnel in fortifications. The warhead penetrates a 800mm-thick reinforced concrete plate.

The two rockets have 80mm diameter, 1.54-1.70m length, and weigh 11.1 to 15.2 kg. Their launch ranges lie between 1,200 and 4,500 m, and flight speeds between 450 and 610 km/h. The rockets are operational at ambient temperatures of ± 60ºC.

B8 Rocket Pods

The B8 rocket pod can be useed with all modifications of the S-8 rockets.

The B8M-1 rocket pod is designed for employment by tactical aircraft.

The B8V20-A rocket pod is designed for mounting on helicopters.

The B8V7 rocket pod is designed for mounting on light aircraft.

Basic specifications

	B8M-1	B8V20-A	B8V7
Rockets number	*20*	*20*	*7*
Empty pod weight, kg	*160*	*123*	*40*
Dimensions, m:			
length	*2.76*	*1.70*	*1.70*
diameter	*0.52*	*0.52*	*0.336*

S-13

Aircraft Rocket Family

The S-13T rocket has a tandem warhead with the percussor-penetrator and the HE fragmentation main charge. The warhead's modular design permits installation of various-purpose charges. The tandem warhead can penetrate up to six metres of soil and up to one metre of reinforced concrete.

Basic specifications

	B13L
Rockets number	*5*
Empty pod weight, kg	*160*
Dimensions, m:	
length	*3.55*
diameter	*0.41*

S-13-OF has an HE fragmentation warhead producing up to 450 25-30g diamond-shaped fragments. The nose penetrator prevents the rocket from digging into ground.

B-13L Rocket Pod

The B-13L rocket pod ensures launching of S-13 rockets of all modifications.

S-24B

Aircraft Rocket

The S-24B rocket is designed to destroy a wide range of targets.

The rocket is armed with an HE fragmentation warhead. The proximity fuse detonates 30 m above the target. The rocket produces up to 4,000 fragments with a kill radius of 300-400 m. Against hardened targets, the S-24B rocket is equipped with an impact fuse.

S-25-OFM

Aircraft Rocket

The S-25-OFM rocket is designed to destroy a wide range of targets. The rocket has an HE fragmentation warhead.

Basic specifications		
	S-24B	**S-25-OFM**
Calibre, mm	*240*	*340/266*
Range, km		*up to 4*
Weight, kg:		
rocket	*232*	*367*
warhead		*150*
Rocket length, m	*2.13*	*3.57*

GSh-23L

Aircraft Cannon

The 23mm GSh-23L cannon is installed on the MiG-21-93, Tu-22M3 and Tu-142 aircraft, Mi-24VP and Mi-35M helicopters.

It can also be mounted in the UPK-23-250 gun pod.

GSh-301

Aircraft Cannon

The 30mm GSh-301 cannon is installed on the MiG-29, Su-27, Su-30, Su-32 and Su-35 aircraft.

2A42

Antitank Gun

The 30mm 2A42 gun is installed on the Ka-50, Ka-52 and Mi-28 helicopters.

Basic specifications

	GSh-23L	GSh-301	2A42
Calibre, mm	*23*	*30*	*30*
Muzzle velocity, m/s	*715*	*860*	*980*
Rate of fire, rds/min	*3,000-3,400*	*1,500-1,800*	-
Number of barrels	*2*	*1*	*1*
Weight, kg	*50*	*50*	*39*

The Kord machine gun of airborne version is installed aboard helicopters to engage man-power, unarmored and soft-skin vehicles and low-speed air targets at ranges of up to 2,000 m. It can be installed both on a support in the opening of helicopter sliding door and on a mount attached to the frames of the external store.

Cartridge boxes (two, 300 rounds each) and feed chutes are also secured to the frame of the external store.

KORD

12.7 mm Machine Gun

The machine gun is equipped with an electric trigger, a charger and an ammunition round counter for remote fire control.

The machine gun uses the B-32 12.7-mm cartridges with armor-piercing bullet and BZT-44 with armor-incendiary-tracing bullet.

Cartridges are inserted into a metal link belt that is stored in the cartridge boxes secured on the mount (disintegrating link belt can also be provided).

Basic specifications

Rate of fire, rds/min	*650 to 750*
Muzzle velocity, m/s	*820 to 860*
Accuracy of fire (R80) at 100 m, mm	*250, max*
Armour penetration at 100 m	*20 mm, max*
Service life, shots	*10, 000*
Weight, kg:	
machine gun	*27*
machine gun on mount	*52*

GSh-30

30 mm Airborne Double-Barrel Gun

The GSh-30 airborne double-barrel gun is designed for the Su-25 and Su-39 attack aircraft and helicopters, both in static and mobile versions of gun mounts.

Basic specifications	
Cartridge type	*GSh-6-30*
Range of aimed fire, m	*2,000*
Rate of fire, rounds/ min:	
high	*2,000 to 2,600*
low	*300 to 400*
Muzzle velocity, m/s	*940*
Unit of fire, pcs	*250*

UPK-23-250

Versatile Gun Pod

The UPK-23-250 gun pod houses the 23 mm GSh-23 aircraft cannon, 250-round ammunition load and a feeding system.

UPK-23-250

Basic specifications	
Weight, kg:	
gun pod loaded	*218*
cannon with ammunition	*145*
Range of laying angles, deg:	
elevation	*0*
traverse	*0*

AEROSPACE SYSTEMS

AIRFIELD EQUIPMENT

PAR-10

Non-Directional Radio Beacon

The PAR-10 medium-wave automated ground control approach system is designed to provide long- and short-range approach and landing support to aircraft fitted with automatic direction finders, as well as mark permanent terrain points.

The PAR-10 radio beacon can be mounted on the ZiL-131 or GAZ-3308 wheeled chassis or on the K-type car body of the 782B trailer.

There are 22 stationary versions of the PAR-10S radio beacon available.

PRMG-5

Landing Beacon System

The UHF ground instrument landing system is designed to enable round-the-clock final approach at field and permanent aerodromes, in the manual, semi-automatic, and automatic control modes.

The PRMG-5 features high mobility, small dimensions and weight, and versatile primary power supply. A four-man crew can deploy/dismantle the system in two hours.

RSBN-4N

Radio Navigation Ground Beacon

The RSBN-4N round-the-clock, all-weather short-range radio navigation beacon is designed to provide continuous navigation support for military and civil aircraft, and guide them to any point within the beacon's range.

The RSBN-4N also supports air traffic control.

UPG-300/UPG-300 NGZh-4

Versatile Mobile Hydraulic Systems

The UPG-300/UPG-300 NGZh-4 mobile hydraulic systems are housed in a special car body mounted on the ZiL-131N cross-country chassis. They are designed to check and adjust aircraft hydraulic systems in field conditions, either with or without hydraulic tank pressurisation. The systems comprise three separate main hydraulic systems, which can simultaneously provide pressure to three separate aircraft systems or can be combined to provide hydraulic pressure to one or two aircraft systems.

The hydraulic systems use the AMG-10/7-50s-3/NGZh-4 hydraulic fluids pressurised to 5-21 MPa. The flow rate for each of the three hydraulic systems is 20-70 l/min.

A2111-0000

Oil/Hydraulic Fluid Refiller

The A2111-0000 system is designed to refill hydraulic oil systems and cooling systems of fixed- and rotary-wing aircraft. The refilling car body accomodates three fluid tanks and a pneumatic system to create surplus pressure in the tanks. The refiller can be custom-fitted with various combinations of fluid tanks. The tanks are easily demountable, and can be used independently from the refiller.

The refiller uses the AMG-10 and 7-50s-3 hydraulic fluids, mineral and synthetic oils, and antifreeze coolant pressurized to 0.2-0.55 MPa. Both open and closed refilling is possible.

ZSZh-66M

Oil/Hydraulic Fluid Refiller

The ZSZh-66M (A2104M-0000) oil/ hydraulic fluid refiller is mounted on the GAZ-66 cross-country chassis, and is designed to refill various systems with hydraulic fluids, oils, oil mixtures, and special fluids. The refiller's heated car body houses four storage tanks. Fluids are fed from the tanks through flexible hoses tipped with discharge nozzles. The filled fluid volume is metered.

AEROSPACE SYSTEMS

INTEGRATED GROUND MONITORING EQUIPMENT

TOPAZ-M

Flight Information Processing System

The Topaz-M system processes flight information registered by airborne recorders for online, special and full-scale monitoring of aircraft/helicopter flights in order to:

- record violations of flight performance limitations
- analyze and predict the systems' status (aircraft/helicopter)
- reveal failures and deviations in operation of aircraft/helicopters and locate their causes
- reveal the flight crew's violations of flight regimes and the flight mission
- reveal the flying personnel, engineers and technicians' violations of aircraft/helicopter operating conditions
- find the causes of aircraft/helicopter incidents
- develop algorithms to analyze the status and operation of the aircraft/helicopter systems.

The Topaz-M system processes, analyzes and stores information of airborne recorders of general and special applications, airborne automated monitoring systems, airborne video recorders and airborne cockpit voice recorders.

The Topaz-M system is manufactured in several commercial and laboratory versions for static or mobile applications:

- static laboratory version
- static version with a video information processor
- ship-borne static version (for aircraft/helicopter carriers and shore-based aerodromes)
- ship-borne mobile version
- mobile protected version (manufactured so as to increase its protection for the severe environment applications)
- mobile laboratory version.

The system includes a stationary or portable computer, a re-recorder for rewriting data from the airborne recorder, an information player, a board for integration with the player, and software for the Windows 98SE, Windows XP operating system.

The Topaz-M system can provide objective monitoring of flights of various military and transport aircraft and helicopters.

ADK PRIZMA

Automated Diagnostic System for Roentgen-Fluorescence Analysis of Oil

The ADK Prizma system is designed for rapid analysis of the content of wear particle elements in oils, greases and working fluids after appropriate preparation of samples (deposition on filters). The wear particle elements contain information on the technical status of the friction surfaces in machines and mechanisms. The analysis of this information allows toleranc-ing, troubleshooting, prediction of service life, and control over the status of the friction unit during its entire service life and taking a decision on the type of maintenance service.

The system incorporates:

- Prizma roentgen-fluorescence analyzer
- IBM-compatible personal computer allowed for the network board and fax-modem for on-line transmission of information to diagnostic centers)
- adapted software
- set of test samples
- set of peripheral devices (printer, modem, etc.).

In addition to the ADK Prizma laboratory version, a portable version is also provided, including a notebook computer and a portable printer that, with preservation of all technical and weather characteristics of the system laboratory version, allow recording and printing of all measurements taken directly near vehicle engines and mechanisms and aircraft/helicopters.

The ADK Prizma software includes a common executable module containing all forms and management elements necessary for work graphical . The software is actually an integrated system incorporating the program modules that perform certain functions.

Basic elements of the system software are as follows:

- subsystem to analyze measurement information
- subsystem to enter measurement information processing
- subsystem to define graduation and metrological characteristics of the automated diagnostic system.

The relational databases used in the ADK Prizma employ the tables of the Paradox 7.0 standard for Windows 95, 98.

Basic specifications	
Range of elements determined	*from S to Bi*
Number of simultaneously determined elements	*20, max*
Energy resolution in the line of x-radiations of 5.9 keV	*not more than 220 eV*
Limits of metals in oils, g/t, (%)	*not more than 0.1 (0.00001)*
Limits of chemical elements, g/t	
lower limit	*0.2*
upper limit	*500*
Time to measure one sample per 15 elements, s	*not more than 90*
Time of working mode to settle, min	*not more than 5*
Time to perform analysis and provide results of elements diagnosed, min	*not more than 3*
Hardware basic error (reproduction) of measurements taken on standard samples, %	*not more than 5*
Mode of operation	*automated*
System weight, less computer, kg	*not more 9.1*
System dimensions, mm	*434 x 310 x 170*
Power supply system	*220 V ±10% AC*

DOZOR

On-line Monitoring System

The Dozor on-line monitoring system provides on-line monitoring of the technical status of systems and airborne equipment of aircraft and helicopters and the dump of flight information from airborne recorders of the Tester, BUR-1, BUR-SL and ZBN-T types to the dump solid-state storage with simultaneous on-line monitoring (express analysis) of this information in order to:

- monitor out-of-tolerance condition of flight parameters
- monitor technical status of the power plant, systems and airborne equipment of the aircraft/helicopter
- monitor flight crew's actions in flight
- monitor the aircraft/helicopter power plant and airframe life.

The system can be used autonomously at field (temporary) aerodromes and in the aircraft/helicopter single parking and can also be included into static and mobile flight information processing systems of the Luch, Mayak-85, Topaz and Decoder types as the re-rewriting, primary processing and information reproduction equipment of the airborne recorder.

The system allows entry, conversion and processing of parametric information directly from the test connectors of the systems and airborne equipment.

AEROSPACE SYSTEMS

LIFE SUPPORT EQUIPMENT

VKK-15K

High-Altitude Pressure Suit

The VKK-15K high-altitude pressure suit is a fighter pilot's flight gear designed to provide life support and enhance performance of flight personnel.

It is used in flight missions over land.

Basic specifications	
Max pressure, kgf/cm²:	
bladder	*0.9*
capstan	*0.5*
Max cockpit depressurization altitude, km	*20*
Operational time at an altitude of over 12 km	
(rapid cockpit depressurisation), min	*3*
including time at altitude of 20 km, min	*1*
Weight, kg	*not more than 4.65*
Service life, yrs	*5*

VMSK-4-15

Sea Survival High-Altitude Suit

The VMSK-4-15 suit is designed to provide individual life support to aircraft crews operating over ground and sea at high and low altitudes.

Basic specifications	
Max suit ventilation system resistance, kPa (mm H_2O)	
for air consumption of 250±10 litres/min	*4.5 (500)*
Max differential air pressure inside the water-tight suit, kPa (mm H_2O)	
for air consumption of 350±10 litres/min	*0.49 (50)*
Max margin air leak at a pressure inside the MK-4-15 suit of (2.94±10) kPa	
(300±10 mm H_2O), litres/min	*1.5*
Max weight, kg	*not more than 17*
Service life, yrs	*5*

PPK-3-120

Anti-G Suit

The PPK-3-120 anti-G suit is designed to increase limits of head-to-seat accelerations sustained by fighter pilots. The suit consists of two trouser-legs with a wide belt holding a pocket for a rubber bladder. It is put over the flight suit.

Basic specifications	
Suit endurance pressure, kPa (kgf/sq.cm)	*$112.8_{-9.8}$ ($1.15_{-0.1}$)*
Safe working pressure in suit chamber, kPa (kgf/sq.cm)	*88.2 (0.9)*
Permissible pressure drop in suit system within 1 min	
when checking air tightness at initial pressure of 88.2 kPa (0.9 kgf/sq.cm), max	*8.82 (0.09)*
Weight, kg	*4.5*
Service life, yrs	*8*

VK-3M

Air Ventilation Suit

The VK-3M air ventilation suit is designed to protect pilot from ambient temperature effects. It can be used independently or together with the high-altitude pressure suit.

The suit neither restrains pilot's movements nor discomforts him physically. The air ventilation system provides even air distribution all over the body surface and prevents it from excessive heating or cooling down both at airfield and in 1-1.5h flight with ambient air temperatures of ± 50ºC.

The suit weight is under 1.85 kg.

Basic specifications	
Suit ventilation system resistance:	
for air consumption of 250 litres/min, kPa (mm H_2O), max	*2.45 (250)*
for air consumption of 350 litres/min, kPa (mm H_2O), max	*3.92 (400)*
Overcooling/overheating prevention time at an outside temperature of ±50ºC and a ventilation air consumption of 250-350 litres/min, hrs	*1.5*
Temperature of incoming ventilating air, ºC	*10-80*
Weight, kg	*not more than 1.85*
Service life, yrs	*not more than 10*

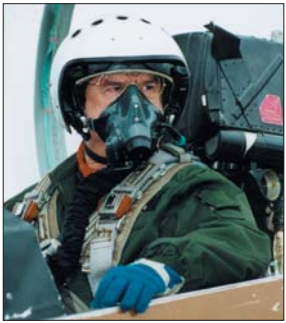
ZSh-7V

Helicopter Crash Helmet

The ZSh-7V crash helmet is designed to protect pilot's head from injuries both in the cockpit during flight or emergency escape from the helicopter.

The crash helmet protects pilot from blinding sunlight and cockpit noises, provides two-way radio communications, and can be fitted with various helmet-mounted observation devices (OVN-1 or GEO-ONV-1 night vision goggles) and oxygen mask.

The helmet can be used in any aircraft with an airspeed under 400 km/h. Maximum altitude for using the helmet with the oxygen mask is 6,000 metres.



AEROSPACE SYSTEMS

SPACE SERVICES

KOSMOS-3M

Launch Vehicle

The Cosmos-3M lightweight launch vehicle (LV) can lift-off from launch pads currently operational at the Plesetsk Cosmodrome. The launch vehicle can be also launched from the Kapustin Yar Launch Site.

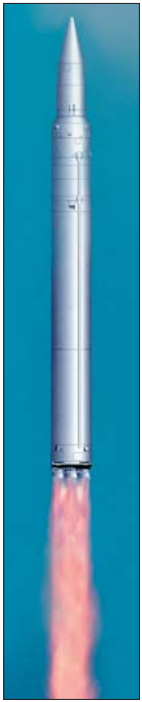
The Cosmos-3M LV has been developed on the basis of the R-14U single-stage medium-range ballistic missile. At the present time Cosmos-3M launch vehicles are primarily used to launch low-orbit military and civil-purpose navigation, communications and COSPAS-SARSAT search-and-rescue satellites.

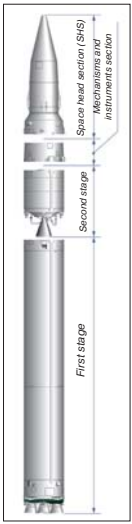
The launch vehicle comprises two rocket stages and the payload fairing. The propellant for either stage's power plant consists of hypergolic propellant components: unsymmetrical dimethylhydrazine (UDMH) as fuel, and nitrogen tetroxide AK-27I as oxidizer. The second stage engine reaches full thrust twice during the flight for high-orbit injection. In-between these two switches the engine operates in the reduced thrust mode.

Basic specifications	
LV Type	*liquid propellant, two-stage*
Control system	*autonomous, inertial*
Launch weight, t	*109*
Height, m	*34.2*
Diameter, m	*2.4*
Payload mass, kg:	
to a circular orbit at an altitude of 1,000 km	*up to 950*
to a sun-synchronous orbit at an altitude of:	
450 km	*945*
700 km	*820*
Launch accuracy (for 700 km altitude):	
altitude, km	*± 15 (3s)*
orbital period, sec.	*± 20 (3s)*
inclination, ang. min.	*+2/-4 (3s)*
Reliability	*0.974*

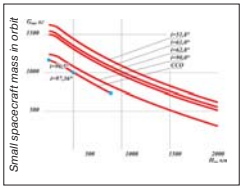
STRELA

Launch Vehicle





Payload location zone



Small spacecraft mass in orbit

The Strela light class launch vehicle is based on the RS-18 intercontinental ballistic missile (NATO designation: SS-19, Stiletto). The Strela LV offers high power performance, accuracy of orbital injection and in-flight reliability. It can lift off from silo launchers currently operational at the Baikonur and Svobodny Cosmodromes.

The principal design concept of the Strela LV has inherited all positive operating characteristics of the original RS-18 ICBM. The Mechanisms and Instruments Section of the RS-18 ICBM fitted up with the launch vehicle flight-control system is used as an upper section of the Strela ascent unit, thus making any modification of the ground control and targeting system unnecessary.

The ascent unit that contains the measuring equipment compartment with a payload adapter and mating stage can be protected by two different fairings: a standard RS-18 fairing (Ascent Unit 1 option) or a larger one optimized during RS-18 trial launches (Ascent Unit 2 option).

All the stages of the Strela launch vehicle operate on high-boiling components of hypergolic propellant – unsymmetrical dimethyl hydrazine as fuel and nitrogen tetroxide as oxidizer.

The Strela LV is stored in transport-launch canister and lifts off from silo launcher.

Basic specifications	
LV type	*liquid-propellant, three-stage*
Control system	*autonomous, inertial*
Launch weight, t	*105*
Height, m	*29.2*
Diameter, m	*2.5*
Payload weight taken to a circular orbit	
at an altitude of, kg:	
500 km	*1,400*
800 km	*1,220*
1500 km	*750*
Injection accuracy for 500 km altitude:	
altitude, km	*±3*
inclination, ang. min.	*±3*
Flight reliability	*0.97*

DNEPR-1

Launch Vehicle

The Dnepr light-class launch vehicle is based on the RS-20 ICBM (NATO designation: SS-18, Satan). The Dnepr LV offers high payload lift capability, accuracy of orbital injection and flight reliability. It is launched from silos currently available at Baikonur Cosmodrome.

The Dnepr LV operates on high-boiling propellant components: unsymmetrical dimethyl hydrazine and nitrogen tetroxide.

The launch vehicle comprises the first, second, third stages and a space head that accommodates the payload. The space head consists of a cylindrical shell, payload adapter, contamination shield and nose fairing. All the LV elements, except for payload adaptation hardware, are inherited from the original SS-18 ICBM.

Dnepr LV is steam ejected from its launch canister to a height of approximately 20 meters above the ground where the first stage engine is ignited. Such type of liftoff offers payload acoustic environment similar to ground-launched LVs.

One of the Dnepr unique capabilities is that it can maintain launch readiness for an unlimited period of time that is restricted solely by the requirements of the integrated payload.

Basic specifications	
LV type	*liquid propellant, three-stage*
Control system	*nertial, computer-based*
Weight at liftoff, t	*211*
Length, m	*34.3*
Diameter, m	*3.0*
Payload lift capability vs. orbit altitude, kg:	
300 km	*3,500*
400 km	*3,000*
600 km	*1,600*
Injection accuracy (for 300 km orbit):	
altitude, km	*± 4.0*
inclination, ang. min	*± 2.4*
Flight reliability	*0.97*

ROCKOT

Launch Vehicle

The Rockot light class launch vehicle is based on the RS-18 ICBM (NATO designation: SS-19, Stiletto). The Rockot LV offers high power performance, accuracy of orbital injection and flight reliability. It can lift-off from launch pads currently operational at the Plesetsk and the Baikonur Cosmodromes.

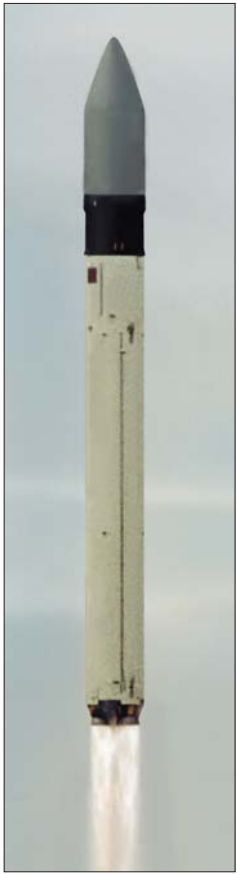
The Rockot LV comprises the first and the second stages, the Breeze-KM upper stage as the third stage, and the payload compartment under the nose fairing that can accommodate a 2.26m-diameter payload. The payload and the nose fairing are installed in the third stage according to the conventional LV pattern.

All the stages of the Rockot LV operate on high-boiling propellant components – dissymmetric dimethyl hydrazine as fuel and nitrogen tetroxide as oxidizer.

The Rockot LV is operated complete with the launch canister with filler ports for refueling.

The first and the second stages are separated under the thrust load developed by the second stage's steering engine that ignites before the liquid-fuel rocket engine of the first stage is cut off. In the meantime, the first stage is slowed down by the powder retro-engines installed in the tail section.

The Breeze-KM upper stage is equipped with the restartable (up to five restart operations) liquid-propellant rocket engine. The engine provides minimum-energy trajectories of spacecraft and facilitates deployment of each satellite into its estimated orbit in case of multiple-injection missions.



Basic specifications	
LV type	*liquid-propellant, three-stage*
Control system	*autonomous, inertial*
Weight at liftoff, t	*107*
Length, m	*29.5*
Diameter, m	*2.5*
Payload lift capability vs. circular orbit altitude, kg:	
200 km	*1,850*
600 km	*1,500*
1500 km	*1,000*
Injection accuracy (for 300 km orbit):	
altitude, km	*±3*
inclination, ang. min.	*±3*
Flight reliability	*0.97*

START/START-1

Launch Vehicles

The Start and Start-1 lightweight launch vehicles are designed to launch small-size spacecraft of various-purpose into low-Earth orbits from the Plesetsk and Svobodny Cosmodromes.

The above space missile systems were created on the basis of technologies developed and tried out in the course of creation and further operation of ground mobile combat systems. The launch vehicles are made up of assemblies, systems and units of the RS-12M (SS-25) ICBM of the Topol Missile System.

The Start LV features an additional engine between the engines used in the 1st and 2nd stages of the Start-1 LV and, correspondingly, differs by longer length, heavier launch weight and higher load-carrying capacity.

The engines are propelled by explosion-proof composite solid propellant providing high specific impulse.

The launch vehicles of the Start family are permanently emplased inside launch canisters (LC) made of composite materials. During pre-launch operations the LV is kept in the horizontal position. The LC is elevated along with the LV into the vertical position immediately before the launch. The missile is projected out of the canister by pressure of combustion materials of a solid propellant gas generator. The engine of the 1st stage is started after the LV leaves the LC.

High accuracy of spacecraft orbital injection is provided by the LV's control system based on an on-board digital computer and high-precision gyro-devices.

Basic specifications

	Start LV	Start-1 LV
LV type	*solid-propellant, five-stage*	*solid-propellant, four-stage*
Control system	*autonomous, inertial*	
Launch weight, t	*60*	*47*
Length, m	*29*	*22.7*
Diameter, m	*1.8*	*1.8*
Payload mass injected into polar circular orbits (i = 90 deg.) at an altitude of, kg:		
200 km	*715*	*490*
400 km	*570*	*370*
600 km	*450*	*275*
800 km	*340*	*185*
1,000 km	*240*	*105*
Injection accuracy:		
altitude, km	*± 5.0*	
inclination, deg.	*± 0.5*	
in orbital period, s	*± 2.5*	

SOYUZ-U

Launch Vehicle

The Soyuz-U launch vehicle is intended to place civilian, research and special-purpose spacecraft as well as Soyuz and Progress spaceships into low Earth orbit.

In terms of the number of launches and reliability, Soyuz-U LV is a world leader among medium-class launch vehicles.

It can lift-off from launch pads currently operational at the Plesetsk and Baikonur Cosmodromes.

The Soyuz-U LV is designed as a system with parallel separation of the lateral rocket engine assemblies upon the first stage burnout, and transverse separation of the second stage engine assembly after burnout.

Each LV assembly has its own propulsion unit using non-toxic propellants (oxygen and kerosene).

Liquid propellant engines of the core section and lateral assemblies are ignited on the ground, which enables engine burn transient control and launch abortion in the event of malfunction. This procedure increases safety of operation.

The third stage (Assembly 'I') propulsion system consists of a four-chamber single-burn engine and four gimbaled steering nozzles (used for three-axis flight control).

Basic specifications	
Type LV	*liquid propellant, three-stage*
Control system	*autonomous, inertial*
Launch liftoff mass, t	*313*
Lenght, m:	
without the spacehead	*33.9*
with the payload fairing	*43.8*
LV Span, m	*10.3*
Payload mass for circular 200 km orbit	
at an altitude of, kg:	
in inclination 51°	*7,200*
in inclination 62.8°	*6,600*
in inclination 82.6°	*6,300*
Injection accuracy:	
altitude, km	*up to 10*
orbital period, sec	*up to 6*
inclination, angular min up to 2	
Flight reliability	*0.98*

MOLNIYA-M

Launch Vehicle

The Molniya-M launch vehicle is intended to place space objects to the Moon, to the planets of the Solar System, as well as to inject Molniya- and Prognoz-type spacecraft into high-elliptical near-Earth orbit.

At present pre-launch preparation and launching of the Molniya-M LV can be realized at the Plesetsk Cosmodrome by using technical and launch complexes currently in operation for Souyz-U LVs.

The Molniya-M is designed as a system with parallel separation of the lateral rocket engine assemblies upon the first stage burnout and transverse separation of the second stage engine assembly after burnout. Each of the LV assemblies has its own propulsion unit using non-toxic propellants (oxygen and kerosene).

Assembly 'I', like that in Souyz-U LV, is used as the third stage.

Assembly 'L' (the upper stage) is fitted up with a cryogenic liquid propellant engine that is ignited in zero gravity after an hour-long earth referenced (intermediate) orbit flight. Compressed gas is used to enable coasting flight control of the upper stage with the nozzle units actuating the required maneuvering. Assembly 'L' includes an autonomous inertial control system.

Basic specifications	
LV type	*liquid propellant, four-stage*
Control system	*autonomous, inertial*
Weight at liftoff (w/o S/C), t	*309*
Length, m	*43.4*
LV span, m	*10.3*
Payload mass for orbit	
with 40,000 km-apogee	
and 63 deg-inclination, kg	*2,000*
Flight reliability	*0.98*

Assembly 'L' (Upper Stage) specifications	
Mass in reference orbit, kg	*6,900*
Fuel in tanks, kg	*3,700*
Assembly mass with propellant outage during jettison, kg	*1,050*
Propellants:	
fuel	*kerosene*
oxidizer	*liquid oxygen*
Thrust in vacuum, kN	*68*
Specific impulse, N·s/kg	*3,400*
Height, m	*3.5*
Diameter, m	*2.35*

PROTON-M

Launch Vehicle

The Proton-M heavy-class launch vehicle is an upgraded version of the Proton-K.

The LV is able to deliver payloads directly into designated geostationary orbit points, thus making possible the insertion of satellites which are not equipped with an apogee propulsion unit.

It can lift-off from launch pads currently operational at the Baikonur Cosmodrome.

The Proton-M is designed as a tandem LV with transverse separation of stages.

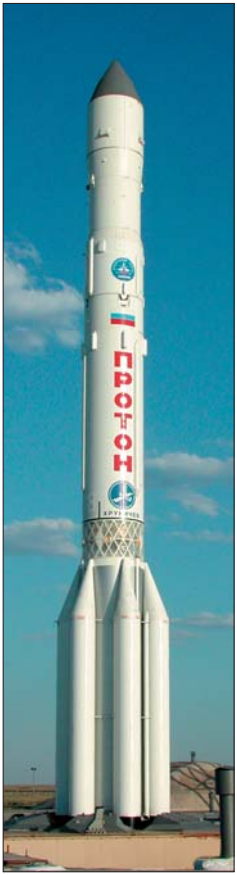
It is composed of three stages and spacehead with Breeze-M upper stage as forth stage.

All stages of the LV and upper stage are fueled by hypergolic propellant components: unsymmetrical dimethyl hydrazine as fuel, and nitrogen tetroxide as oxidizer.

The Proton-M has a larger payload fairing as compared with Proton-K in order to double the space available for payloads.

Upgrading (replacement) of the control system enables to improve power performance as well as operational and environment characteristics of the LV.

The Breeze-M upper stage enables to deliver heavier payloads (up to 3.0-3.2 tonnes) into geostationary orbit.



Basic specifications	
Type LV	*liquid propellant, four-stage*
Control system	*autonomous, inertial*
LV liftoff mass, t	*700*
Length (without the upper stage), m	*42.34*
LV Span, m	*7.4*
Payload capacity, kg:	
low Earth mass payload	
(h=200 km, i=51,6°)	*22,000*
low Earth mass payload	
(h=350 km, i=51,6°)	*19,700*
geostationary orbit mass payload	
(h=36000 km, i=0±0,25°)	*3,000-3,200*
transfer orbit mass payload	
(ha=36000 km, hn=5500 km, i=7-25°)	*4,800-5,500*
Lunar departure trajectory mass	*up to 6,200*
Mars departure trajectory mass	*up to 5,000*
Venus departure trajectory mass	*up to 5,400*
Injection accuracy:	
altitude, km	*up to ±15*
orbital period, sec	*up to ±8*
inclination, angular min	*up to ±1.5*
Payload space available, m^3	*98-150*
Flight reliability	*0.97*

AIR LAUNCH

Space Transportation System

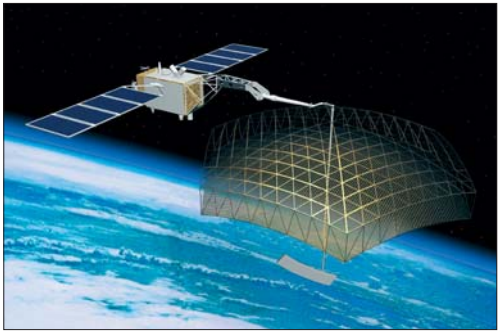
The Air Launch space transportation system is designed to deliver lightweight commercial satellites to a variety of Earth orbits, including sun-synchronous, circular, elliptical, geo-transfer, and geosynchronous orbits, as well as departure trajectories.

The system comprises the Antonov An 124-100 Ruslan heavy lift transport aircraft, Polyot launch vehicle using environmental-friendly liquid oxygen and kerosene as propellant, flight control centre, and ground launch preparation system.

Basic specifications	
Launched satellites weight, t:	
low orbits	*up to 3 - 4*
geo-transfer orbits	*up to 1.4 - 1.6*
geostationary orbits	*up to 0.6 - 0.8*
departure trajectory to the moon	*0.6*
Orbit inclination, deg	*0 - 115*
Payload diameter x length, m	*2.9 x 7*
Launch from customer's territory	*from airfields fitted with ground launch preparation systems*

KONDOR-E

Space Remote Sensing System



The Kondor-E Earth remote sensing system based on small-size spacecraft is designed to gather different types of data and images to meet any customer-defined requirement, including the most specific ones.

The Kondor-E development concept envisaged a high-resolution, all-weather Earth probing system with direct datalink to the customer.

The 800kg Kondor-E spacecraft can be equipped with a synthetic aperture radar, or with optoelectronic equipment.

The Kondor-E version carries a multifunction synthetic aperture radar with a probing signal wavelength of 9.6 cm. The radar provides detailed terrain survey with 1-20m resolution within a 10-200km target area. A 6m-diameter parabolic antenna allows for quick radar beam shift to the right and left of the flight path, thus providing for a 1,000km-wide aggregate survey swath with stereoscopic and interferometric imaging possible within.

The optoelectronic payload includes a telescope for collecting visible imagery at a resolution of 1 m and better, under favourable lighting conditions, and for near-infrared imagery. Images taken with the optical system feature high resolution and excellent interpretability.

The Kondor-E space system's ground component comprises the flight control centre and the central and local data reception and processing centres.

The Kondor-E's technical capabilities can drastically expand the employment area of remote sensing systems. Data obtained by the system can be used in the interest of agriculture, forestry, mapping industry, land use management, geology, mineral exploration, environmental protection, oceanology, ship navigation, ice reconnaissance, other crucial applications, including military.

The Kondor-E space system can be delivered to the customer as a complete turnkey system, or in customised component combinations designed to carry out specific missions. In addition, customers can buy data obtained by Russian Earth remote sensing space systems.

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