5TH EDITION

THE INCOMPLETE ROTORCRAFT CATALOGUE

From countries behind former Iron Curtain

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Preface

Dear reader, you are about to read the incomplete rotorcraft catalogue. It is incomplete due to several reasons.

First of all the scope of this catalogue is limited to the rotorcraft developed, designed or just imagined between 1944 and 2002 in the counties which in the past were behind the Iron Curtain. The reason for that is the person of the main author of this publication – Mr Leonid Kozyarchuk – and his Ukrainian origins together with his life-long rotorcraft-data-gathering endeavor. Due to being located behind the Iron Curtain, up to its fall, he was able to get almost only data on the designs from that part of the world.

The second reason is the fact that you will not find inside anything on big, heavy or popular commercially available rotorcraft, although there are a number of experimental designs covered, which were developed by bigger companies, which also were producing commercially available helicopters. As a rule of thumb, it can be said that this catalogue focuses on small rotorcraft, with people-on-board count between 1 and 3, experimental, research and homebuilt designs: helicopters, autogyros, gyrogliders and hybrids of those. Example of a helicopter matching these criteria you can see on the cover. This is a design by Mr Marinchenko. It features a single-blade reaction-less propeller-driven rotor (prop copter). On top of that the single blade is controlled by a servo flap like in the Kaman helicopters. It is a small helicopter, but just loaded with unique features, which makes it extremely interesting. If you put along its side a big commercial helicopter, the latter would be just boring, thus they were skipped in this catalogue.

Next reason relates to the data availability. Most designs covered by this catalogue were made at the times when the Internet was not even a science-fiction, when information spread in months, weeks, occasionally in days, and not in minutes between any interested person. Many of the homebuilders were known locally, but were completely unrecognized on the national level. Thus it has to be clearly said that there were other interesting rotorcraft out there which are not covered here. Even during works on this edition authors found many new pieces of information, which were previously not available. This happens these days thanks to the Internet and many companies, institutions and private persons who digitize their archives and share them with others – either as a stand-alone archive or just piece by piece by taking voice in a discussion on the Internet forums, illustrating his/hers post with a scanned picture etc. This leads to the final reason.

The final reason is the time limitation. There is a list of rotorcraft which were discovered by the authors recently, which match the catalogue's criteria to be put in, but at this stage they have been omitted on purpose. Those for sure will find its place in the consecutive editions of the catalogue.

Talking about editions, this is the fifth of them, and the first one written in English. The previous ones were published consecutively in Ukrainian, Russian, Polish and once more in Ukrainian between 2012 and 2017. All shared the same title (but different to the present one), which can be translated as: Autogyros and helicopters; 1944-2002; Designs catalogue.

Mentioned in the first paragraph – Mr Leonid Kozyarchuk – was born on 11th of May, 1965, in the USSR (Volyn Oblast, now Ukraine). He is a long-term constructor and enthusiast of rotorcraft and trikes. At the turn of 1990's he studied at the Kharkov Institute of Aviation. He is one of the founders of the Kometa company from the city of Rozhyshche founded in 1993. Between 1996 and 2001 he was a trikes design engineer at the Aeros company in Kiev. Later, between 2001 and 2011 he was a private entrepreneur dealing with manufacturing of parts and components for ultralight aircraft. Over the years Mr Kozyarchuk constructed several ultralight autogyros. For the first one – the LK-1 (built in 1987) – he was awarded one of the national prizes of the USSR. He also published multiple books – mentioned above catalogues and others dedicated to trikes and designs of Mr Igor Bensen. He, however, does not limit his writing scope to aviation.

Mr Marcin Ruszkowski – the co-author of this catalogue – was born in 1984 in Poland. He studied Aerospace Engineering at the Warsaw University of Technology. After graduating he spent several years working hands-on with commercial helicopters as a maintenance engineer in Polish Medical Air Rescue and other companies. In 2013 he joined the design team of the Helipark GmbH company, which was at that time during the endeavor of designing a small two-seat helicopter. Later he decided to dive deeper into the software engineering world and since late 2014 he works at Leon Software – a well known in Europe scheduling and sales software provider for business aviation and small airlines. Aside from his professional career Mr Ruszkowski is passionate about rotorcraft, its design, history and all related subjects, but with stronger accents put on the technical aspects of these fascinating machines. He – like Mr Kozyarchuk – keeps collecting data on every manned rotary-wing machine he encounters. In the era of the Internet this data stack grows very quickly, so in order to properly store those data he develops in his spare time an Internet page which helps him to organize those data: rotorcraft.info.

Before you go further, note that the units within this catalogue are metric. Not the SI units, but rather commonly used ones. This manifests itself in velocities given as km/h, pressures as atmospheres (marked as Atm) or the thrust values as kilogram-force (marked as kG), the latter representing the so-called old technical units which were in use in the eastern Europe countries for quite some time.

This is enough of the introduction. Just turn the page and dive into the fascinating world of small rotorcraft from countries behind the former Iron Curtain.

46. KhAI-27 Kharkovyanin helicopter

It was a two-seat multipurpose liaison, observation helicopter and, when equipped with floating landing gear, it could also be used in a commercial finding of shoals of fish. KhAI-27 was designed and built between 1969 and 1970 by the members of helicopter scientific research group of KhAI (Kharkiv Aviation Institute {ХАИ}). Some of its components were built in the airplane factory in Smolensk city. The chief designer was Mr B. I. Mysov, who was supervised by V. K. Zolotukhin. The design team consisted of students: E. D. Bytensky, V. N. Glushkov, V. S. Ishchuk, I. V. Kolosova, V. S. Mishchenko, V. V. Pleshivtsev, A. P. Opara and others.

The most characteristic structural element of the KhAI-27 helicopter was a floor panel made of aircraft grade aluminum. It was constructed of stringers and end frames which were covered with 1mm thick sheet metal (riveted to panel internal elements). Edges of this panel were reinforced by riveted extra corner stiffeners. All flight controls and electrical harnesses were put inside that element. On top of the panel, two seats, instrument panel and rudder pedals were installed. The main landing gear of skid-type was made of steel tubes of 40×2 of cross-section dimensions. That landing gear was secured to the panel on its bottom side. The main structural element was a sub-frame which carried all main transmission and powerplant components. It was made of 30HGSA tubing and had 4 rubber engine mounts and 10 eye fittings for mounting struts. It also had a plate, located in its front part, to which a main gearbox and rotor pylon was bolted with the use of special bolts. In the upper part of the rotor column, the tail rotor shaft had its output.

The main rotor pylon was equipped with mechanisms for controlling cyclic and collective blades pitch angles. A unique one was that for controlling collective blades pitch angle. It was actuated by a nut turning on a power screw. The nut had an outer shape similar to one known from Bell 47 or Alouette 2 tail rotor pitch change mechanisms on the tail rotor gearbox. It was a kind of helical pulley which was driven by the control cable. The cable ends were connected to the collective lever. The power screw was concentric with the main rotor shaft. Cyclic pitch angle change was controlled by an ordinary swash-plate. It was mounted on an universal joint (being lifted by a power screw) and controlled by a hanging cyclic stick connected directly to a lower (inner) non-rotating swash-plate ring. The rotating ring was mounted to the non-rotating ring on a ball bearing. On the cyclic stick was a lever controlling the engine's clutch.

Main rotor blades were made of fiberglass. They had rectangular planform, without geometrical twist and airfoil used was a NACA 23012. The chord length was equal to 200 mm. Blade fittings were made of welded steel elements and were secured to the fiberglass blade's root by means of hollow rivets.

The tail boom was made of a riveted sheet-metal aircraft grade aluminum. Inside there were five supports for the tail rotor shaft. At the end of the tail boom was installed a tail skid with rubber end. Tail boom was supported by two struts going from the sub-frame.

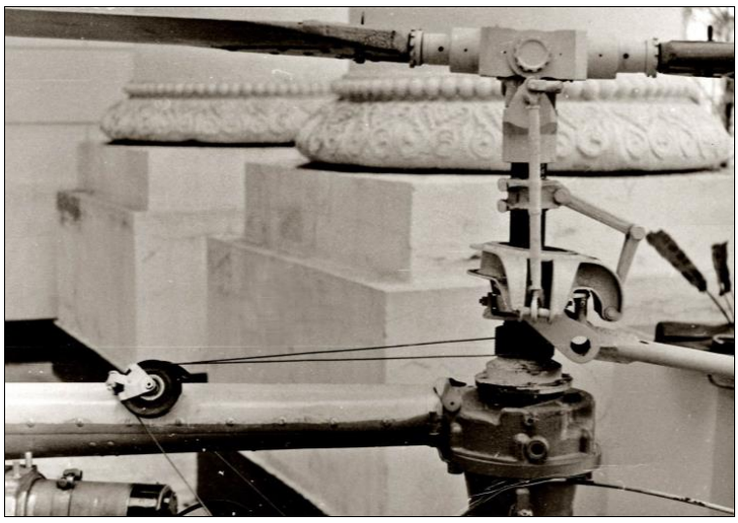
The tail rotor was a two-bladed design with a pitch change mechanism actuated by control cables connected to the rudder pedals. Blades had rectangular planform without geometrical twist. They were made of wood with NACA 0012 airfoil. The powerplant of KhAI-27 consisted of a boosted M-63F motorcycle engine. The oil systems of the engine and main rotor gearbox were connected. Thanks to the modular construction of the helicopter it was easy to be quickly folded and unfolded, which was a required feature regarding its multipurpose use.

Technical and performance data:

Length – 4.0 m,
Height – 1.7 m,
Width – 1.5 m,
Main rotor diameter – 4.6 m,
Tail rotor diameter – 0.8 m,
Engine power – 38 HP,
Empty weight – 145 kg,
Maximum take-off weight – 300 kg,
Maximum speed – 90 km/h,
Cruising speed – 70 km/h,
Descent rate in autorotation – 5.5 m/s,
Service ceiling – 2000 m,
Range – 200 km.

The prototype of KhAI-27 had been tested in the tethered flight. During these tests the lifting system, structure and components have been tested. Although the M-63F engine was boosted by IMZ-Ural motorcycle factory, it was not delivering required power and the KhAI-27 had never been flown freely. The helicopter was exhibited at the ENEA USSR {ВДНХ СССР} exhibition in 1970, where its designers were awarded with diplomas of honor and gold, silver and bronze ENEA medals.

Front view of the KhAI-27 Kharkovyanin helicopter. (Photo from author's archive)

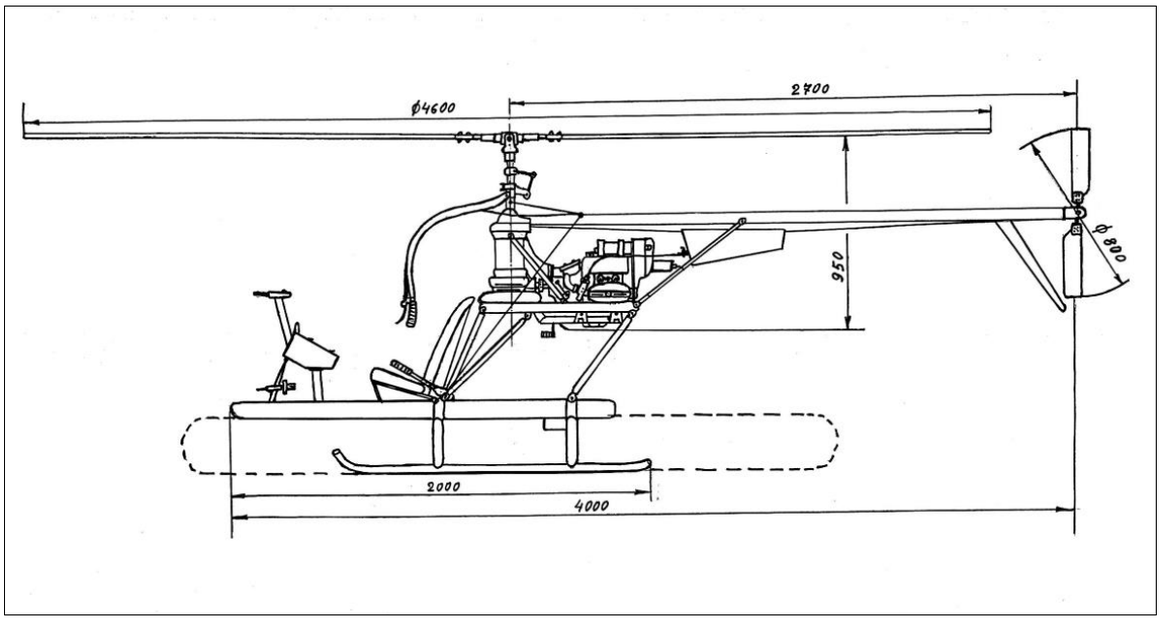


Main rotor pylon of the KhAI-27 Kharkovyanin helicopter. (Photo from the archive of Mr K. S. Gorbenko)

Powerplant and main rotor gearbox of the KhAI-27 Kharkovyanin helicopter.

Tail rotor and its gearbox of the KhAI-27 Kharkovyanin helicopter.

(Photo from the archive of Mr K. S. Gorbenko)



Drawing of the KhAI-27 Kharkovyanin helicopter (left side view). (drawing by the author)

Mr Glushchenko sitting in his autogyro without a powerplant installed.

Front view of the Glushchenko's autogyro.

(Photo from author's archive)

126. Gorniak-3 experimental helicopter

A single-seat experimental helicopter without tail rotor was built between 1981 and 1982 by Ivan Matveyevich Demidov and his son Nikolai Ivanovich Demidov from Novoshakhtinsk city of Rostov Oblast, Russia. During its test, two assistants held its tail boom to prevent rotation of the aircraft. Performance of its powerplant was sufficient to achieve a hover at the altitude of 1.5 m. Gorniak-3 had a welded skid-type landing gear. Its main rotor, together with its shaft and swash-plate were from a decommissioned Ka-15 helicopter. The original blades were trimmed to give a rotor diameter of 9 m. Powerplant of this helicopter consisted of two IZ-P-3 motorcycle engines mated together. Their total displacement was equal to 700 ccm and output power to 32 HP. Both engines were cooled from a single axial fan. They were also equipped with a dual ignition KATEK magneto and a kick starter. The power was transmitted to the main rotor gearbox through a V-belt transmission. Pilot controlled the rotor through an ordinary floor-mounted cyclic stick.

A general view of the Gorniak-3 helicopter.
(Photo from the AEA Internet page)

The powerplant – two IZ-P-3 single-cylinder engines mated together.

The helicopter during its hover tests.

(Photo from the AEA Internet page)

132. S. P. Kalyakin's backpack autogyro

Mr Sergei Petrovich Kalyakin – an engineer from the Ukrainian city of Cherkasy – in 1983 built his single-seat tractor-type backpack autogyro. The main member of its structure was a longitudinal tube made of aircraft grade aluminum. In the front end of it was attached a small Ridel-210 starter motor which was developing 12 HP. The engine was equipped with a pulling propeller. In the rear part there was a vertical stabilizer with a tail support skid. On top of the longitudinal tube was a rigidly installed two-bladed main rotor. Below the rotor was installed a triangular control bar assembly like on a hang glider, made of aircraft grade aluminum. The pilot was suspended in the typical hang glider harness and was able to control the autogyro in roll and pitch by moving himself in respect to the triangular control bar. The main rotor had a diameter of 5.8 m and blades, made of wood, Styrofoam, fiberglass and glued together with epoxy resin, had a chord length of 150 mm.

The autogyro in the gyroglider mode was tested on the slopes near the Dnieper river. During these tests the required towing thrust was measured with the help of a dynamometer – that gave a value of 18 kG. Later, the autogyro was attached to the small buggy car, but strong wind flipped it over and in that event the blades got broken. The autogyro wasn't repaired and it was never tested with its own engine.

133. Juozas Valunas' Va-1 helicopter

A mechanical engineer from the Lithuanian city of Prienai – Mr Juozas Valunas – in 1984 built a single-seat helicopter of his own design. The construction works took him five years. In December, 1983, the first tethered flights were conducted, after which several shortcomings were eliminated.

The helicopter was built in the single main rotor with tail rotor configuration. The main rotor head was equipped with a stabilizing bar and thus resembled the Bell/Young rotor. The fiberglass blades were in fact shortened main rotor blades of a Ka-26 helicopter. The skid-type landing gear was made of steel tubes. The tail boom was made of a thin-walled aircraft grade aluminum tube and was supported by two struts. Va-1's enclosed cabin was made of 3mm thick organic glass.

The engine, which was developing 50 HP, was a two-stroke four-cylinder force-air-cooled boxer with each single cylinder equipped with a dedicated resonant exhaust tube (expansion chamber). The cylinders and pistons were used from the IZ-J-4 motorcycle. Mr Valunas manufactured almost all elements of the helicopter himself, including gearboxes, drive shafts and engine.

Technical and performance data:

Empty weight – 175 kg,
Maximum take-off weight – 280 kg,
Length – 5.95 m,
Main rotor diameter – 5.32 m,
Tail rotor diameter – 1.0 m,
Engine power – 50 HP at 5500 rpm,
Engine weight – 45 kg,
Fuel consumption –15 l/h,
Cruise speed – 80 km/h,
Best rate of climb – 2.7 m/s,
Flight endurance – 1 h.

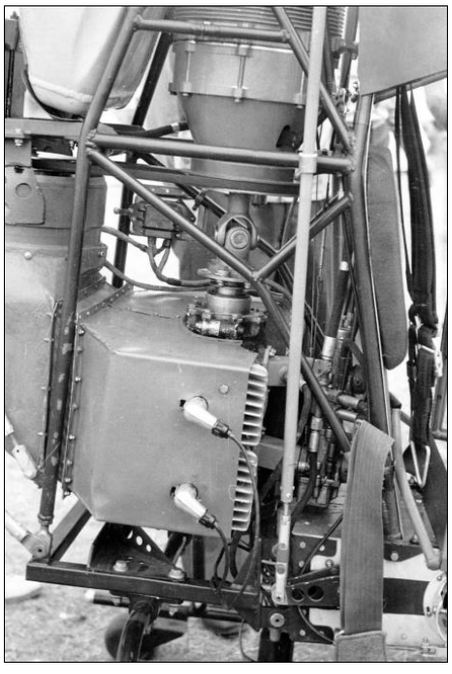
The Va-1 helicopter was presented at SLA-84 (Meeting of amateur aviation 1984 {СЛА-84}) fly-in in Crimea (Ukraine), where it won the first place and was awarded with a prize. The helicopter however did not actually fly there due to very warm air and not enough engine power. Instead the test pilot – Mr A. P. Kholopov – performed only several hops with the battery and cabin transparencies removed. After the SLA-84 Mr Valunas continued to perfect his helicopter. Since 2010, the Va-1 has been displayed at the Lithuanian Aviation Museum in Kaunas.

The Va-1 helicopter during trials in December, 1983 – Mr Valunas at the controls.
(Photo from the archive of Mr A. A. Sautkin)

General view of the Va-1 helicopter.

Gearbox, rotor pylon, rotor head and control system of the Va-1 helicopter.

(Photo by V. Silyukov)



The Va-1's powerplant.
(Photo by V. Silyukov)

The Va-1 helicopter just before the presentation flights at the SLA-84 {СЛА-84} fly-in Crimea.
(Photo from the Internet page: www.manosparnai.lt)

The Va-1 at the SLA-84 {СЛА-84} fly-in in Crimea.
(Photo from the book of Mr K. S. Gorbenko)

The Va-1 helicopter on display at the Lithuanian Aviation Museum.
(Photo from the Internet)

206. Helicopter from the city of Saratov

This helicopter was designed and built in the mid 1990's in the city of Saratov (Russia) by Mr Oleg Petrovich Yakovlev. Its components were manufactured in industrial conditions with application of heat treatments and electroplating. The helicopter had a classical single main rotor with tail rotor layout. Its fuselage was made as a riveted aircraft grade aluminum sheet-metal structure.

Spar of the main rotor blade had a form of a droplet-shaped tube made of 30HGSA steel. The blade's trailing section was made of a styrofoam glued onto the spar. Nose section of the blade had an embedded steel rod along its entire length in order to adjust chord-wise position of CG. On the outside surface the blade had glued on skin made of thin aircraft grade aluminum sheet-metal, which was riveted together on a trailing edge. Main rotor hub, which was made with the use of components from the tail rotor hub of a Mi-1 helicopter, had an axial and horizontal hinges. The main rotor was controlled through the swash-plate by the floor mounted cyclic stick.

Powerplant of the helicopter consisted of two Vikhr-30 motorboat engines placed vertically and one above the other. Their crankshafts were connected by the shaft of the intermediate gearbox, which was placed between the engines. Only the top engine had the ignition system with the distributors for all of the cylinders from both engines. The bottom engine, on the other hand, was driving the electric generator, water pump, cooling systems and an oil pump for the intermediate gearbox. The output shaft of the intermediate gearbox was connected to the input of the main rotor gearbox. The transmission system incorporated three clutches: centrifugal, jaw (manually operated) and an overrunning one. The main rotor gearbox was placed above the engines and had a single reduction stage of 1:6 reduction ratio. Its housing was equipped with an oil pump which was forcing the oil through the bearings and spraying it on the gear wheels. The power to the tail rotor was delivered through the shaft with universal joints.

The empty weight of the helicopter was equal to 210 kg. Its total engine power reached 60 HP. The helicopter was tested in the tethered flight but one of the engines did not deliver its power. The cooling system was inefficient and the engines were quickly getting overheated. When later one of the engines was disassembled it was found that its cylinder sleeve was cracked.

A general view of the helicopter from the city of Saratov.
(Photo from the AEA Internet page)

The cabin, landing gear and the powerplant of the helicopter.
(Photo from the AEA Internet page)

The cyclic stick and instrument panel of the helicopter.
(Photo from the AEA Internet page)

207. Aero-Astra's RAF-2000 autogyro

In 1993 an Aero-Astra {Аэро-Астра} company from the city of Zhukovsky (Moscow Oblast, Russia) had bought a RAF 2000 two-seat autogyro from its original manufacturer, a Canadian company Rotary Air Force, with intention to introduce it to Russian market. Aero-Astra has also become the official representative of a Canadian company in the CIS (Commonwealth of Independent States) countries.

The autogyro was test-flown by the head of the company – Mr Viktor Shumeiko – who already had some experience in flying on two- and single-seat aircraft. The autogyro flew quite well, but it was not made to be utilized on airfields with grass runways. Also the quality of the workmanship was only satisfactory. It took two years for the company's engineers to introduce several improvements to the design and test them in the air.

On the Aero-Astra's RAF-200 the following improvements has been done:

- New energy-absorbing landing gear with a large stroke has been built. Its wheelbase and wheels track was greater than the original one. The now much further forward installed nose wheel also received shock absorption ability. The nose wheel fork was a self adjusting castering design.
- Main landing gear received differential brakes operated from the handle located on the cyclic stick.
- All main components of the control and lifting system were modified (cyclic stick, control rods, hinges and main rotor hub main beam)
- Introduced an adjustable damping suspension of the main rotor pylon on rubber bushings.
- Fuel and cooling system was modified. Also the thrust vector direction was altered by the introduction of new support struts.
- Prerotation mechanism was modified (the clutch vacuum actuator), the control unit for the pneumatic actuator was changed. Modified was also the telescopic shaft with universal joint.
- The cockpit windshield was made of thicker Plexiglas.

In the following years such modified autogyro performed large a number of flights, both with one person on board and with two of them. Mr Alexey Nikolaevich Shcherbakov and Mr Dmitry Aleksandrovich Rakitsky both flew on it.

Technical and performance data:

Length – 4.15 m,
Height – 2.5 m,
Width – 1.8 m,
Main rotor diameter – 9.15 m,
Propeller diameter – 1.73 m,
Empty weight – 254 kg,
Engine power – 130 HP at 6500 rpm,
Powerplant weight – 105 kg,
Maximum take-off weight: (2 POB) – 500 kg,
Take-off speed – 50 km/h,
Take-off distance – 80 m,
Cruise speed – 130 km/h,
Best rate of climb – 6 m/s,
Range – 600 km,
Fuel consumption – 17 l/h,
Maximum flight speed – 185 km/h,
Flight endurance – 4 h.

A general view of the M-91's second variant.
(Photo from the archive of Mr E. G. Surotomin)

256. AV-2 helicopter

This two-seat helicopter of a classic single main rotor with tail rotor layout was built by a well-known helicopter homebuilder from the city of Zhytomir, Mr Vasily Yakovlevich Artemchuk. It was designed, built and flight tested between 2000 and 2002.

AV-2's fuselage was made of aircraft grade aluminum tubes of various diameters. The tail boom was of monocoque type design, made of adequately shaped and riveted aircraft grade aluminum sheet metal. It was supported by a pair of struts. The pilot and passenger were seated on aircraft grade aluminum seats from an AN-2 airplane, which were placed next to each other. The four-point wheeled landing gear was without shock absorbers with nose landing wheels of dimensions of 200×80 mm. The main landing gear wheels of dimensions of 300×125 mm were of aircraft grade. In the front there was a small instrument panel which included basic flight and engine monitoring instruments.

Above the crew compartment was placed the powerplant with main rotor gearbox and rotor pylon. A Japanese four-stroke horizontally opposed automotive Subaru EA-82 engine was used to power the AV-2. Its coolant radiator with integrated fan was placed in front of the engine. Power from the engine was transmitted to the main rotor gearbox by a centrifugal clutch and a Cardan shaft. The gearbox itself was an adequately modified rear differential from a Ford Sierra car. The tail rotor was driven from the main rotor gearbox through a tail rotor drive shaft equipped with five supports on the tail boom. Tail rotor gearbox was an aircraft grade unit salvaged from an unknown aircraft. Tail rotor pitch change was controlled by a rudder pedals through a set of control cables.

On the main rotor shaft of the AV-2 helicopter there were installed a swash-plate and an original main rotor head made of components of Ka-15 and Ka-26 helicopters rotor hubs. The rotating part of a control system incorporated a Bell-type stabilizing bar. Main rotor blades were originally made of wood and polyethylene, but later were changed to shortened fiberglass ones from a Ka-26 helicopter. The tail rotor blades were made of wood, had trapezoidal planform and geometrical twist. The AV-2 was equipped with a dual set of controls in the cockpit.

Technical and performance data:

Height – 2.5 m,
Wheels track – 1.8 m,
Main rotor diameter – 8 m,
Tail rotor diameter – 1.4 m,
Engine power – 95 HP,
Empty weight – 260 kg,
Maximum take-off weight – 440 kg,
Maximum horizontal flight speed – 130 km/h,
Flight endurance – 2 h,
Fuel tank capacity – 30 l,
Best rate of climb – 4 m/s.

The prototype was assembled in 2001 and its tests commenced immediately. After some structural modifications and replacement of the main rotor blades, the helicopter flew confidently in the winter of 2001-2002. Many flights were performed, both with single and two persons on board (with Mr Yakov Antonovitch Artemchuk – a father of Mr Vasily Artemchuk – as a passenger). In total the AV-2 accumulated approximately 1.5 flight hours while being owned by Mr Artemchuk.

A side view of the AV-2 helicopter.

The powerplant and main rotor pylon with gearbox.
(Photo from author's archive)

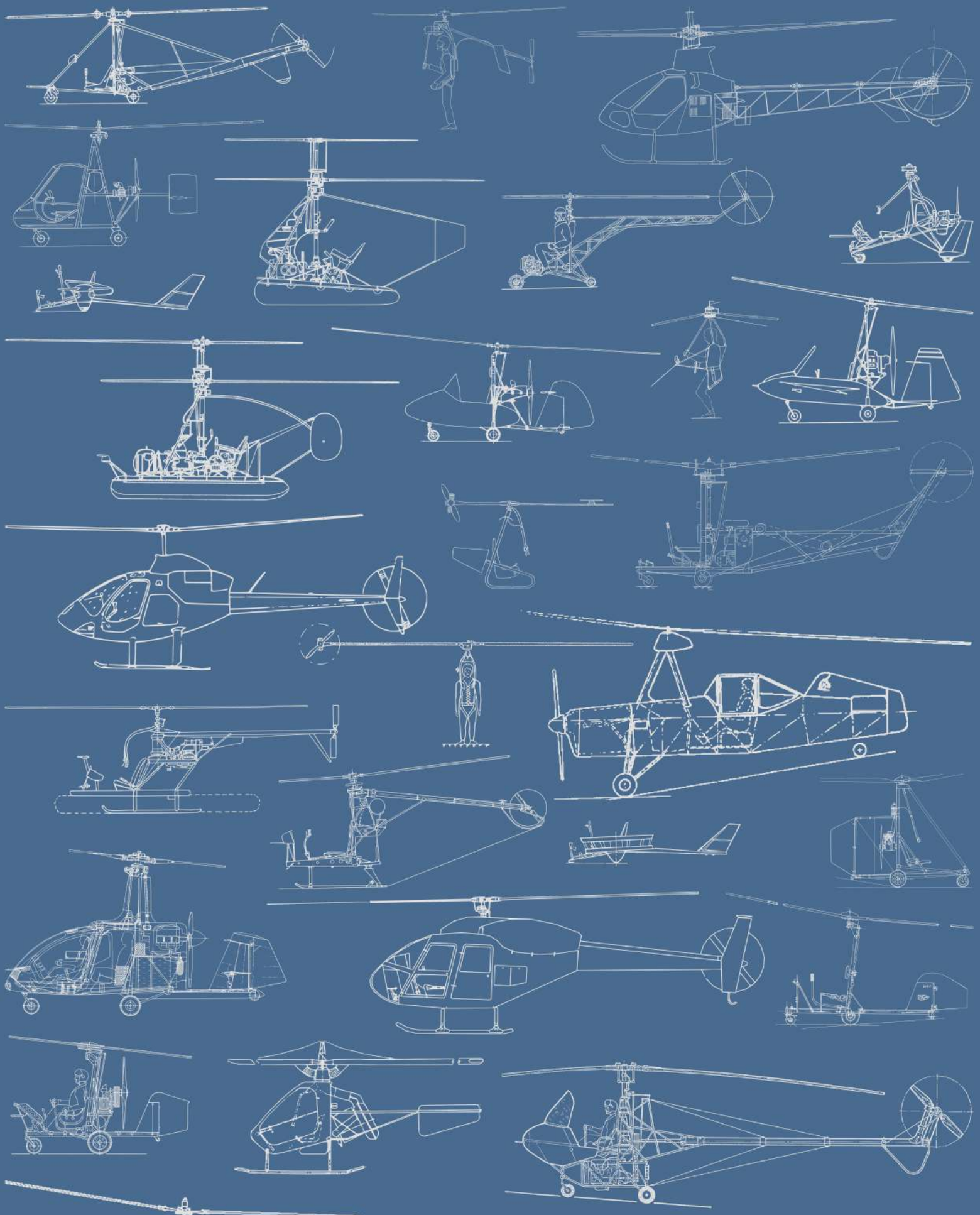
The AV-2 helicopter in flight.
(Photo from author's archive)

257. Virage autogyro from the city of Omsk

This two-seat autogyro with seats in the tandem arrangement was developed and tested in the Virage Aviation Technical Club in Omsk (Russia) between 2001 and 2002 under the leadership of Mr Yuri Viktorovich Kazurov. It was first flown with a single person on board in May of 2002. Several flights were made – along the straight line and the altitude of 40 m, as well as slaloms above the runway. The autogyro was participating in the International Festival of Ultralight Aviation in the city of Kolomna (Russia), where it was awarded the Diploma of the United Federation on Ultralight Aviation of Russian Federation.

The structure of the Virage autogyro was inspired by a technology utilized in a powered hang glider design and consisted of steel and aircraft grade aluminum tubes. Main landing gears were equipped with the oleo struts. The nose landing gear had spring-based shock absorbers and was steerable in the same fashion like one in a powered hang glider. All three wheels had a diameter of 400 mm and were from a moped.

Main rotor (hub and blades) together with its hydraulic prerotation system with electrical engaging mechanism were commercial units manufactured by an American company Rotor Flight Dynamics. The cyclic stick situation in this autogyro was quite unique. The pilot had at his disposal a hanging cyclic stick with a cross member. Its movements and aircraft responses were similar to those of a powered hang glider. The stick was connected to the main rotor through a set of push-pull tubes and levers placed above the occupants' heads. The powerplant consisted of an automotive water-cooled Subaru EJ-20 engine equipped with a reduction gearbox and a four-bladed pusher propeller made by Finish {Финиш} company from the city of Kazan.



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