

Russia and China Show Latest Aircraft



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Late summer airshows in Moscow and Tianjin unveiled several new helicopter variants, prototypes and updates on development projects. In addition to a few long-promised models, there were also a number of surprises.

High-Speed Testbed

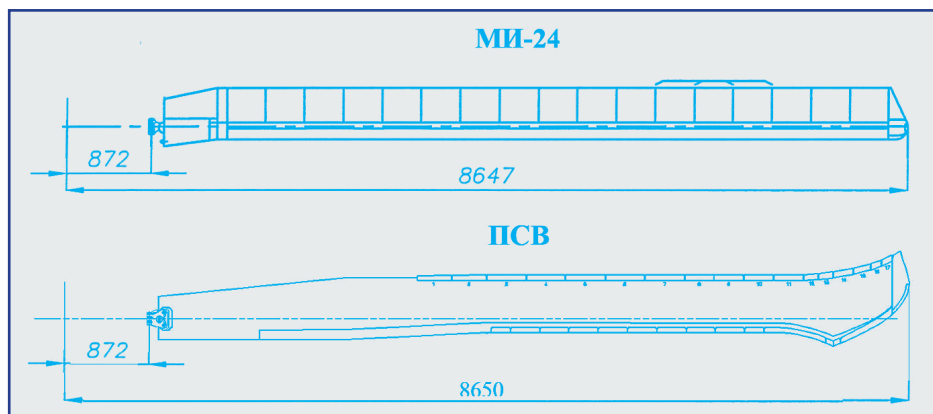
MAKS 2015 — the 12th edition of the “International Aviation and Space Show” held at Ramenskoye Airfield near Moscow — took place August 25–30, 2015. Russian Helicopters showcased a wide range of models, including military and commercial, as well as production and demonstrator helicopters. The Mil Mi-8/17, the Kamov Ka-52 Alligator and Mi-28NE Night Hunter attack helicopters, and the multirole Mi-35M were among the military models supplied to Russian forces and international customers. Commercial models included the new light multirole Kamov Ka-226T; cargo transport, medevac and VIP variants of the Kazan Ansat; the Mi-17V-5 and Mi-171A2 transports; the super-medium Mi-38; and demo of a fire-fighting Ka-32A11BC helicopter.

Russian Helicopters displayed their high-speed PSV testbed at MAKS 2015. (AHS photo by Grigory Omelchenko)

The most striking rotorcraft on display was a testbed for the Russian Helicopters PSV (Perspektivny Skorostnoy Vertolyot) or “Advanced High-Speed Helicopter” program (see “Going Faster – Slowly: Russia’s Advanced High Speed Helicopter Program,” *Vertiflite*, Fall 2010, plus prior articles). Sporting new blades developed with TsAGI (Tsentralniy

Aerogidrodinamicheskii Institut, the Central AeroHydrodynamic Institute), the single-seat conversion to a Mi-24K airframe is intended for aerodynamics tests of the PSV forward fuselage and main rotor. The testbed is reportedly designated Izdeliye (Project) 3701.

The new TsAGI PSV rotor is similar in appearance to the BERP III blades developed by Westland Helicopters in



A planform comparison of the standard Mi-24 blades and the “BERP”-type blades on the PSV. Distances are shown in millimeters (overall rotor diameter is 56 ft 9 in). (TsAGI graphic)

the 1980s under the British Experimental Rotor Programme, which was used for the 1986 world speed record by the Westland Lynx (G-LYNX). The PSV blades, though, rotate clockwise like other Russian- and French-designed rotor systems. Acoustic indicated that a rotor system the TsAGI PSV blades would be 3–4 decibels lower than the conventional Mi-24 blade, with the same radius (8.65 m or 28.7 ft). This was partly as a result of the BERP-like planform, and partly from more advanced airfoils (which TsAGI referred to as their fifth-generation profiles) versus the standard Mi-24 NACA 230 airfoil.

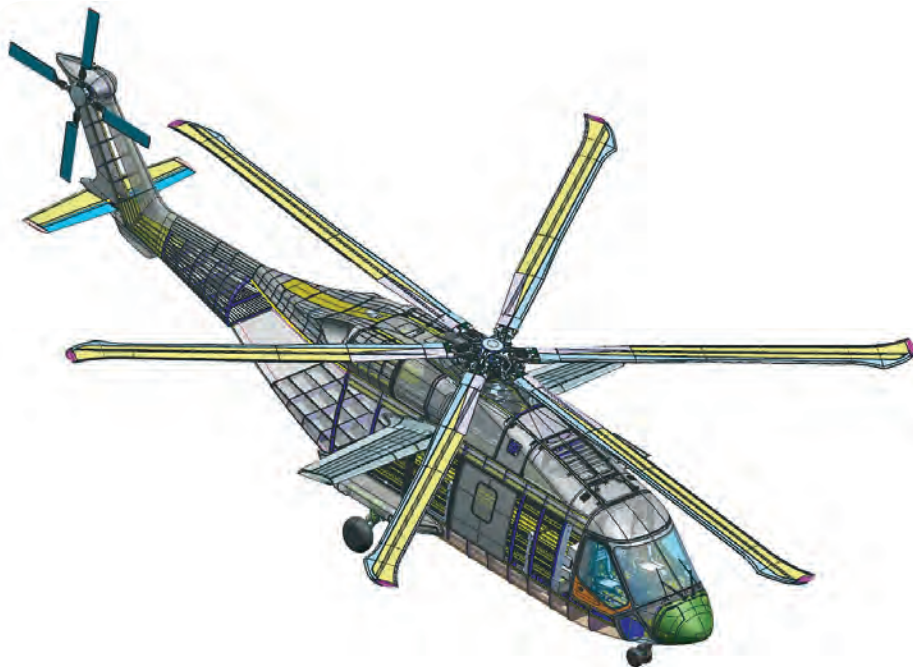
Mil indicated that the Mi-24 PSV Demonstrator is powered by two Klimov VK-2500-01 engines, each with 2,400 shp (1,800 kW) at take-off power and 1,900 shp (1,400 kW) at max continuous power. Maximum-level speed was predicted to be 400 km/h (216 kt); a cruise speed of 340–360 km/h (183–194 kt), and maximum climb rate at sea level of 18.3 m/s (60 ft/s). The aircraft gross weight was stated as 11.5 t (25,350 lb). The PSV testbed is expected to fly by the end of the year.

After flight testing, the PSV blades could be retrofitted to existing Mil production aircraft if successful. Calculations predict that it will give the Mi-28NM — a modernized version of the Night Hunter that will begin evaluations next year — an increase of 10% in maximum speed and raise the Mi-24/M-35 high speed by 13%. In cruise, the speed boosts are 13% and 30%, respectively.

PSV Is Dead — Long Live PSKV!

In April, Russian Helicopters CEO Alexander Mikheev discussed what happened with the PSV program, stating that the company had developed a preliminary design, prepared a prototype of a flying laboratory (Project 3701), developed a preliminary design of the Klimov VK-2500M engine and prepared the technical proposal for the demonstrator. However, feasibility studies indicated that simultaneously increasing speed and reducing the cost of operations for commercial applications would not be achievable.

Consequently, the PSV program was divided into two efforts in 2012. One is the design and development



Mil preliminary design of an operational Advanced High-Speed Helicopter (PSV). The high-speed requirement for commercial applications was quietly shelved in the 2012. (Russian Helicopters graphic)

of an Advanced Medium Commercial Helicopter (*Perspektivny Sredny Kommerchesky Vertolyot* or PSKV), which was previously known as the Russian Advanced Commercial Helicopter (RACHEL), for which Mil had developed its V-37 (Mi-37) conceptual design. Russian Helicopters is continuing to fund the PSKV project this year from its own resources while seeking state support from the Ministry for Industry and Trade for development in 2016 and beyond.

The second thrust is a research program using the foundation of the PSV work to achieve rotorcraft speeds of more than 450 km/h (243 kt). Mikheev noted that the technological advances engendered as part of the PSV program will be used for the commercial PSKV and for high-speed military rotorcraft programs, as well as in the development of other new rotorcraft.

The PSKV will be in the 10–20 t (22,000–44,000 lb) gross take-off weight range, and will comply with international safety and environmental standards. “Putting the PSKV into service will allow [Russian Helicopters] to protect the domestic market, including in the gas and oil offshore transportation segment,” Mikheev stated. In the future, technologies from the research will be integrated into multi-role rotorcraft, search and rescue helicopters, and other

modifications.

Meantime, it was clarified at MAKs that the Ministry of Defence is backing the research of the military high-speed rotorcraft. The Commander-in-Chief of the Russian Aerospace Forces, Colonel General Viktor Bondarev, stated that the program is proceeding “full speed ahead.” Two high-speed programs are being funded: the UVK attack helicopter (*Udarny Vertolyotny Kompleks* – Strike Helicopter System) and medium-sized PSSTDV transport (*Perspektivny Sredny Skorostnoy Transportno-Desantny Vertolyot* – Advanced High-Speed Medium Utility Helicopter), the latter reportedly based on the PSKV civil design.

The operational UVK is targeted to reach 450–500 km/h (240–270 kt), according to Bondarev. Mil and Kamov are developing competing approaches and the first UVK demonstrator is expected to fly in 2018, with production to begin in 2022.

Naval Alligators

On display for the first time was the naval variant of the Ka-52 (S/N01-01), now officially designated the Ka-52K Katran (“spiny dogfish shark”). In addition to the folding blades and other shipboard accommodations, the aircraft also for the first time displayed a totally



An upgraded version of the carrier-based Kamov Ka-52K helicopter, seen here MAKS 2015 airshow, showing the new EOS-52 EOTS system. (AHS photos by Grigory Omelchenko)

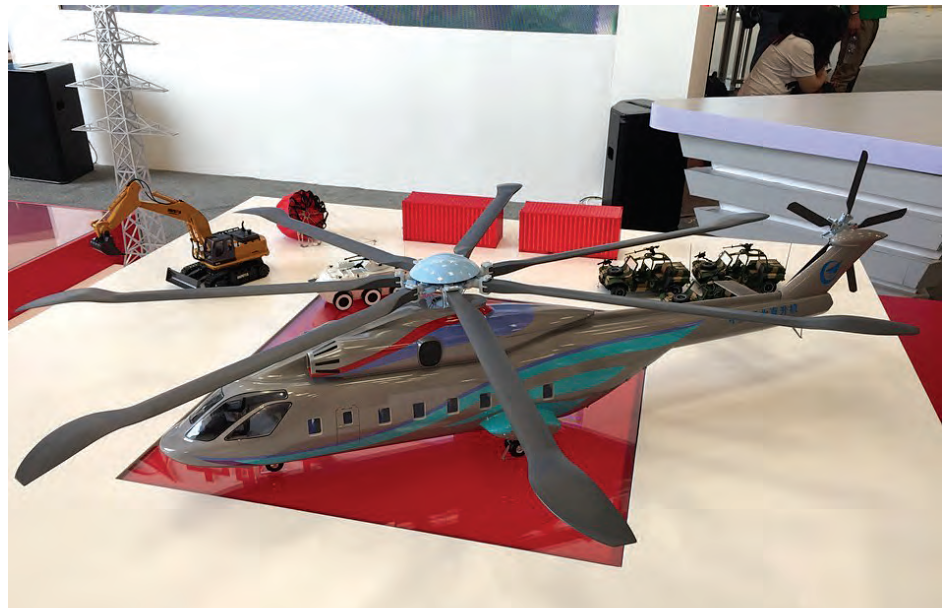
new OES-52 Electro-Optical Targeting System (EOTS) turret under the nose, developed by Joint Stock Company NPK SPP (Research and Production Corporation "Precision Systems and Instruments").

Interestingly, it appears that Egypt will be the first export customer for Ka-52K Katrans. After European Union sanctions against Russia left France unable to deliver the two Mistral-class ships it had built for Moscow, Egypt will now purchase both carriers as well as the helicopters that were planned to operate from them. The Egyptian Navy will operate up to 16 of the Ka-52K naval attack helicopters from each ship, as well as Ka-27 combat search and rescue helicopters and Ka-29 assault transports. These Ka-52K Katrans are in addition to the 50 examples of the Ka-52 Alligator land-based attack helicopters the country had already ordered.

Big News on Heavy Lift

After years of discussions, a joint framework of cooperation was signed in May between the governments of China and Russia. Subsequently, Russian Helicopters and AVIC have worked to develop the preliminary specifications and gain a consensus on the basic design of what is now known as the Advanced Heavy Lift (AHL) helicopter. A final contract is expected to be signed before the end of 2015.

The clean-sheet design is for a helicopter with a maximum take-off weight of 38.2 t (84,400 lb), which is roughly the size of the CH-53K King Stallion, or about one-third smaller



A model of the joint Russian Helicopters-Avicopter Advanced Heavy Lift (AHL) helicopter was shown for the first time at the China Helicopter Exposition. (Mil.Huanqiu.com website)

than the Russian Helicopters Mi-26T that China operates, which is capable of carrying 56 t (123,500 lb). The AHL features seven rotor BERP-type blades (one less blade than the Mi-26), and a five-bladed tail rotor. The rotor diameter is estimated to be up to 30 m (100 ft).

The internal load is specified as 10 t (22,000 lb) and a maximum external load of up to 15 t (33,000 lb), and the aircraft has to be able to perform around-the-clock operation at high/hot and in any weather conditions. Performance numbers for the AHL are as follows: maximum cruise speed 300 km/h (162 kt), service ceiling 5.7 km (19,000 ft) and range 630 km (340 km). It was originally planned that the engine would be the Ukraine D136, but due to the conflict in that country, it will now leverage the technology of the Russian Perm PD-14 engine.

China estimates that it will need more than 200 of the AHL helicopters by 2040.

AC352 Unveiled

On September 9, the Aviation Corporation of China (AVIC) unveiled the prototype Avicopter AC352 — its version of the Airbus H175 — at the Third China Helicopter Exposition in Tianjin. Oil and gas operator CITIC Offshore Helicopter — which "owns Asia's largest helicopter fleet" — announced that it had officially signed on as the AC352 launch customer.

AVIC plans to start flying the AC352 by the end of the year. The Chinese aircraft was produced by AVIC's Harbin Aircraft Industry Group (HAIG), which also manufactures the airframes for both versions; similarly Airbus manufactures



The AC352 is the Avicopter version of the Airbus H175. The primary difference is the use of Chinese avionics and the joint AVIC-Turbomeca engine. (Turbomeca photo)



Avicopter displayed the full-scale mock-up of the AC3X2 which they have now designated the "AC322". (People.cn website)

the dynamic systems for both models.

The primary difference between the Avicopter AC352 and the Airbus H175, besides country of origin, is the engine. Turbomeca and AVIC Engine co-developed and co-produce the engine, called the Ardiden 3C by Turbomeca and WZ16 by AVIC Engine, while the H175 is powered by the Pratt & Whitney Canada PT6-C67E.

Last year, Airbus Helicopters and Avicopter signed a 20-year joint production agreement for as many as 1,000 EC175/AC352 helicopters to be produced. HAIG announced that it expects to sell about 400 of them.

New Models and Updates

Avicopter brought back the full-scale AC3X2 mock-up of its next civil helicopter, now officially designated the AC322. The 3 t (6,600 lb) twin is targeted towards the burgeoning Chinese emergency medical services (EMS) market. The AC322 is designed to seat two crew plus eight passengers, or two side-by-side stretchers plus attendants.

Also at the Expo, HAIG displayed several models of the AC312, which has been produced at Harbin since 1981, based on the original 4 t (9,000

lb) AS365N Dauphin. An upgraded version, the AC312A, with longer range, a better engine for high/hot conditions and new avionics was developed several years ago. The next upgrade under development is the AC312E, with certification planned for 2017.

A more radical extrapolation is the AC312C, with a completely redesigned, larger fuselage, clamshell doors, and skids; certification is planned for 2018. Rockwell Collins has been selected by Avicopter to provide its Proline 21 avionics system to both the -C and -E versions.

A new version of the Avicopter Z-19 scout/attack helicopter was also on display. The Z-19 (see "Fog Begins to Clear in China," Vertiflite, Nov/Dec 2013) is a derivative of the Z-9 — the military version of the AC312. Though it has the heart of the Dauphin, the 5 t (11,000 lb) Z-19 is essentially a new aircraft. The new Z-19E Export version shown is claimed to have improved avionics, self-protection systems and reduction in observables. This was the first time that a Z-19 had been on display at such close range.

Meanwhile, Avicopter made the first flight of its Z-11WB light attack aircraft on September 28, a few weeks after the Tianjin airshow. The aircraft is a weaponized version of the AC311 that first flew in China in November 2010. The AC311 is a derivative of the Airbus AS350 / H125 Écureuil; in military (non-weaponized) service it is designated Z-11. An internet image shows a nose-mounted sensor turret and weapons pylons.

In addition to the numerous types of new products mentioned, Avicopter also had a 100 kg (220 lb) six-rotor flying car model called the "Fighting Gazelle" that was exhibited for the first time. Numerous flight demos were also conducted with AVIC's civil helicopter fleet — three AC311s, two AC312s and an AC313 — as well as several military flights. The Fenglei (Wind and Thunder) aerobatics team of the People's Liberation Army (PLA) also conducted flight demonstrations with Z-10 and Z-19 attack helicopters. More than 50 helicopters from a dozen countries were on display five day biennial event.

A second exhibition hall was set up for unmanned aerial vehicles (UAVs), including winning entries of the "AVIC Cup — International UAV Innovation Competition." There were several

unusual configurations, including a canard-rotor-wing, cycloidal rotor, quad-tiltrotor, tailsitter and the K800 Jueying

(Absolute Shadow) compound, which was also on display in 2013.



The Z-19E is an "export" version of the Avicopter light attack helicopter. This was the first time that a Z-19 was on display at such close quarters. (Mil.Huanqiu.com website)



Shortly after the China Helicopter Expo, Z-11WB — an armed derivative of the AS350 / H125 Écureuil — made its first flight. (Chinese internet photo)



The AVIC China Helicopter Research and Development Institute (CHRD) K800 Jueying has been flown as a model aircraft. (Mil.Huanqiu.com website)

Check out "Fog Begins to Clear in China" in the Nov/Dec 2013 issue of *Vertiflite* or the AHS website at www.vtol.org/avicopter for more information on Chinese helicopters.

AHS International Upcoming Events

Aeromechanics Design for Vertical Lift

January 20-22, 2016
San Francisco, California, USA
Sponsored by the AHS International San Francisco Bay Area Chapter

Development, Affordability and Qualification of Complex Systems

February 9-11, 2016
Huntsville, Alabama, USA
Sponsored by the AHS Redstone Chapter

AHS International's 72nd Annual Forum & Technology Display

May 17-19, 2016
(Events begin on May 16)
Palm Beach County Convention Center
West Palm Beach, Florida, USA
"Leveraging Emerging Technologies for Future Capabilities"

42nd European Rotorcraft Forum

September 5-8, 2016
Lille, France
Presented by 3AF

AIAA-AHS-SAE-RAeS International Powered Lift Conference

September 27-29, 2016
Hartford, Connecticut USA
Hosted by SAE International

Rotorcraft Virtual Engineering Conference

November 8-9, 2016
University of Liverpool
United Kingdom
Hosted by the Royal Aeronautical Society and co-sponsored by AHS International, the University of Liverpool, DGLR, ADAA and 3AF

For more information on any of these meetings, visit

www.vtol.org