MILE STONES

Soviet heavy lift helicopters

Dr Carlo Kopp

Russian industry remains a world class manufacturer of heavy lift helicopters, continuing to produce designs that are the most used operationally. Less appreciated in the West is the heritage of these designs dating back to the 1950s when Soviet industry poured intellectual and material resources into heavy lift design, development and manufacture.

Soviet interest in rotary wing aircraft was a natural byproduct of the enormous doctrinal weight of manoeuvre warfare philosophy in the Red Army, and a propensity to emulate German designs, but do better if achievable. That led to the ubiquitous Avtomat Kalashnikova, starting from Hugo Schmeisser's MP43/StG.44 series, and is a pattern repeated through the 1950s.

Initially, Germany led in high payload rotary wing design, with the Focke-Achgelis FA-223 Drache side-by-side twin-rotor design. Built in small numbers and trialled operationally in 1945 the FA-223 could lift a tonne of payload on a sling, powered by a 1,000 SHP class radial piston engine. The first operational use of helicopters was in Burma, with the well publicised combat rescue operations commencing in April 1944, using early Sikorsky R-4 Hoverfly aircraft, later supplemented by R-6 aircraft.

The Red Army regarded tactical aviation as subordinate to the land army, so it took an immediate interest in the helicopter, which was appealing as the replacement for numerous light observation and liaison aircraft – the ubiquitous Polikarpov Po-2 biplane having been built in large numbers for this purpose. Four industry design bureaus – Mil, Kamov, Yakovlev and Bratukhin - became heavily involved in the development of helicopters, these groups ultimately responsible for all Soviet designs.

Not surprisingly, light utility helicopters were the first to enter mass production, with Mil's Mi-1 Hare first flown in 1948. It was modelled on the Bristol Sycamore.

The C-130 is the benchmark for tactical airlifters in the West. It was also the benchmark for Soviet heavy lift helicopter designers.

The Mi-6 was the first mass production heavy lift helicopter. With around 2/3 of the payload capability of the C-130, it was a major asset for the Red Army.

While the Mil bureau invested its efforts in conventional tail rotor designs, following the US and British lead, the Kamov bureau developed a series of coaxial rotor designs, a technology which remains almost unique to Soviet/Russian production designs. The Yakovlev bureau started by emulating Sikorsky tail rotor designs but invested most of its effort into tandem rotor design, following the lead of Piasecki, later to become Boeing Vertol. Least well known are the numerous Bratukhin bureau designs modelled on the Focke-Achgelis layout, which became in part the basis of the contemporary Boeing-Bell V-22 Osprey.

The Bratukhin designs were the largest of the first generation Soviet helicopters, starting with the 1946 Bratukhin G-3 LOH, with two 450 SHP radials, followed by the problematic G-4 which did not even enter limited production. The larger B-5 and B-10 also proved to be failures, as was the larger and more refined B-11. This was the end of the line for Bratukhin's side-by-side rotor designs.

The Kamov bureau specialised in naval applications, and its coaxial rotor technology became the basis of the widely used family of shipboard utility, ASW, and ISR/targeting helicopters.

The Yakovlev bureau was more successful, with its tandem rotor Yak-24 Horse, first flown in 1953. The Yak-24 was a genuine heavy assault and transport

helicopter design, similar in concept to the Piasecki H-21 Shawnee and Bristol Belvedere. Unlike its Western counterparts built to carry 18 – 20 troops, the YaK-24 was sized to carry 30 to 40 troops, or four tonnes of payload, and was powered by a pair of 1,720 SHP engines.

The Yak-24 was not built in large numbers, with Russian sources claiming about 100 aircraft built. It was however used to trial a number of applications, including the first Soviet use of a helicopter as an aerial crane, as a deployment platform for a panoramic camera system and later a side-looking radar, and as an aerial POL pipeline laying system. The latter experiment was to provide a means of resupplying rapidly advancing armoured divisions with fuel, where local terrain was too soft to permit pipelaying trucks to be used.

The Mi-26 Halo is a genuine C-130 sized heavy lift helicopter. It remains in production.

By far the most successful of the early Soviet entrants in rotary wing design was the Mil bureau. Mil's initial success was soon followed by the Mil-4 Hound assault/utility helicopter, which first flew in 1952. It was a direct analogue of the US Sikorsky S-55/H-19 Chickasaw / Westland Whirlwind series. Powered by a 1,700 SHP Shvetsov Ash-82B radial, the Hound could carry a squad of 12 troops, or a payload of 1.2 to 1.6 metric tonnes, with aft fuselage clamshell doors for loading stretchers, pallets, cases or even vehicles. Many assault variants were fitted with a ventral canoe shaped nacelle for a prone gunner, armed with a forward firing .50 cal machine gun. Built until 1966, more than 3,000 were manufactured, with China building an additional 545 reversed engineered Harbin Z-5s. Attempts to fit a gas turbine engine were abandoned.

The success of the Mi-4 Hound compelled the Mil bureau to more ambitious goals, and following operational analysis of Red Army battlefield assault and resupply needs, the bureau embarked on the development of the VM-6 design in 1952, later to become the Mi-6 Hook. The intent was to produce a 6 tonne payload class helicopter capable of moving troops, supplies, ammunition and artillery pieces on a very fluid battlefield.

The new design was to be equipped with two large 5,500 SHP Kuznetsov TV-2VM gas turbines, mounted above the fuselage adjacent to the main rotor gearbox. The large fuselage was sized around the 20 tonne class Antonov An-8 Camp and An-12 Cub tactical airlifters, the intent being to accommodate similar payloads. Initial objectives were to carry more than 60 airborne troops and kit, a BTR-152 personnel carrier, artillery tractors and artillery pieces.

The payload bay of the Mi-6 was massive by period standards, with a volume of 80 cubic metres, floor strength of 2 tonnes/square metre, and aft 2.65 x 2.7 metre clamshell doors. Internal clearances permitted payloads between 2.0 and 2.5 metres height, with an internal payload mass of up to 12 tonnes, and slung external payload mass of up to 8 tonnes.

Useful comparisons are the US C-130 Hercules, with a 127.4 cubic metre volume, and payload of up to ~20 tonnes, and the CH-47 with a 41.7 cubic metre volume and internal payloads of 6 to 9 tonnes. In practical terms the Mi-6 delivered around twice the payload mass and volume of the Chinook, and around two thirds that of the Hercules.

The new Mil design lived up to performance expectations, with a prototype breaking records in 1957 by lifting a 12 tonne payload to 7,800 ft AMSL during a test flight. This was superceded in September 1962 by a sortie in which a 20.1 tonne payload was lifted to 9,000 ft AMSL. Superlative lifting performance was matched by high cruise speeds with an auxiliary variable incidence wing, the Mi-6 was less susceptible to retreating blade stall at high speeds. In 1963, an Mi-6 variant achieved an average speed of 340.15 km / h (183.5 KTAS) over a leg of 100 km distance.

The Mi-6 Hook was a major advance in transport and heavy assault helicopter design, and well aligned with Soviet land force manoeuvre doctrine of the period. The aircraft could lift up to 90 passengers, or 61 to 70 airborne troops with equipment. The aircraft could be used to rapidly deliver reinforcements, or where NATO air defences were broken, rapidly insert and then resupply large numbers of troops.

The Mi-6 entered production in 1960, and ceased production in 1981, after more than 900 were built. The type was exported globally to more than 20 Soviet allies and clients. Numerous variants were built, including airborne command posts, electronic warfare and ISR platforms, and dedicated medevac aircraft.

In terms of internal and external payload lifting performance, the Mi-6 was not surpassed until the deployment of the volumetrically smaller USMC Sikorsky S-80E/CH-53E Super Stallion in 1981.

The success of the Mi-6 Hook rapidly led to the derivative Mi-10 Harke series, a Soviet analogue to the Sikorsky S-64/CH-54 Tarhe / Skycrane / Aircrane. Like the CH-54, the Mi-10 was built to carry both slung and containerised payloads. The Mi-10 series was rated for 12 tonne payloads, or 15 tonnes in overload configuration. Sources differ on the number built, with figures ranging from 55 to 181 aircraft. The basic design was delivered as the 'short legged' Mi-10K crane, and 'long legged' Mi-10/10R capable of carrying containers, vehicles or a captive cargo platform.

The Soviets can also lay claim to the largest rotary wing aircraft ever built, the gargantuan Mi-12/V-12 Homer, developed during the late 1960s.

The requirement for this behemoth was set during the early 1960s when the RVSN (Strategic Missiles Forces or 'Soviet SAC') identified the need to rapidly reload ballistic missile silos, and rapidly redeploy mobile ICBMs, including components of the large UR-500 ICBM. Concurrently, the Red Army sought a rotary wing airlift system to supplement the large 80 tonne payload An-22 Cock turboprop airlifter, then in development. The concept was to use the An-22 to deliver large payloads across a theatre of operations, and then employ a 20 to 40 tonne payload class helicopter to move these payloads to forward operating bases.

Mil's solution to the requirement was pragmatic, and involved designing a new side-by-side rotor design, in which the complete main gearbox, engine and rotor assemblies of the Mi-6 were mated with a unique wing and fuselage.

The first Mil V-12 prototype flew in 1968, and the aircraft attracted a lot of attention, as the Soviet propaganda machine extolled its virtues. The program was cancelled in 1974, as its primary purpose of moving ICBMs collapsed with the UR-500 program, components of which evolved into the Proton booster. Only two V-12 Homers were built, and both remain in museums.

The last of the Mil bureau behemoths is the Mi-26 Halo, which was developed to meet needs identified during the definition of the earlier V-12. The Red Army wanted to move 15 to 20 tonne payloads in-theatre, to distances between 500 and 700 km. This requirement is similar in some respects to the 1950s tactical airlift requirements which led to the C-130, and the resulting Mi-26 Halo is arguably a C-130 sized heavy lift helicopter. The prototype first flew in 1977.

Conceptually, the Mi-26 resembles the Mi-6, but it is much larger, and with 20,000 SHP installed has twice the power. Dimensionally, the eight blade main rotor is actually smaller in diameter than the Mi-6 rotor, but the Mi-26 is longer, taller and bulkier, reflecting its 20 tonne payload class design.

The Mi-26 Halo remains on offer as a production item, and has been exported to numerous former Soviet clients. It qualifies as the largest helicopter design to be produced in large numbers, and used operationally, with claims that more than 270 have been built to date.

As the history of Soviet heavy lift helicopters shows, different operational and strategic doctrine yields different solutions. The US did not adopt a helicopter with the lifting capacity of the 1960 Mi-6 Hook until the 1980s, when the US Marine Corps sought the CH-53E to support amphibious forces with heavy resupply capability. To date no Western nation has sought a helicopter in the class of the Mi-26.

Mil Mi-12/V-12 prototype now on display in Moscow.