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Igor Sikorsky: One Man, Three Careers

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Table of Contents

Introduction

The eventful life of one of the world's foremost aviation pioneers, also one of the best known and best loved figures in aviation, was marked by three successive and distinguished careers.

Igor Sikorsky was best known for:
– the construction of the first multiengine aircraft;
– pioneer work in transoceanic flight; and
– the development of the helicopter.

The Construction of the First Multiengine Aircraft

Igor Ivanovich Sikorsky was born in Kiev (Russia; now in the Ukraine) on 25 May 1889. As a school boy, he showed great interest in contemporary science, especially aviation; he was fascinated by the speculations of Jules Verne and Leonardo da Vinci. Sikorsky actually built and flew several model airplanes made of bamboo strips with tissue paper covering; he "borrowed" whalebone stays from his sisters' corsets in order to make engines for his model helicopters.

It was during a vacation in Germany with his father that he first heard of the trendsetting work of the Wright brothers in the United States; he also came in contact with Count Zeppelin's work on rigid airships. Sikorsky decided then and there that his career should be in aviation.

After he returned to Russia, he graduated from the Naval Academy in Tsarist Russia's capital city, St Petersburg, a city known for a long time as Leningrad. He studied engineering in Paris and later, in 1907, entered the Mechanical Engineering College of the Polytechnical Institute in Kiev. Early in 1909, Sikorsky went back to Paris, the mecca for all aviation enthusiasts, to learn as much as possible about the new science. While in Paris, he met many of the great names, men like Louis Blériot, Henri Farman, and especially Ferdinand Ferber; he also learned to fly. He returned to Russia with a 25-hp Anzani engine and started designing helicopters, despite all the advice to the contrary given to him by French experts.

The Sikorsky S-6A

His first helicopter, built in 1909, did not leave the ground, despite months of tinkering. The second one, built in 1910, did become airborne but only without the weight of its nineteen-year-old pilot. Unfortunately, because of an insufficient knowledge of the principles behind rotary-wing flight, destructive vibrations, and the insufficient power of the engine, both were failures.

Sikorsky started working on fixed-wing aircraft instead and he did not have to wait long for success. An early design known as the S-6A was shown at the 1912 Moscow air show, where it received the highest award; it also won the first prize in the St Petersburg military competition held in the fall of that same year.

The Bolshoi Baltiskiy

With these successes, Sikorsky became the engineering manager of the aeronautical subsidiary of RBVZ (RussoBaltic Railroad Car Works). The numerous lives lost due to engine failures gave Sikorsky the idea of making an aircraft with more than one engine. In September 1912, with RBVZ's blessing, he proceeded to build a very large machine, the "Bolshoi Baltiskiy," or Great Baltic, with two 100-hp Argus tractor engines. Deemed to be underpowered, it was re-equipped with two more engines, mounted as pushers. Thus modified, Sikorsky's machine became the world's first multiengine aircraft. This revolutionary machine had an enclosed cabin with upholstered chairs, a large balcony up front where those aboard could take a stroll in the fresh air and, for the first time, there was a washroom in a heavier than-air machine. Many aviation experts were convinced it wouldn't work. They assumed that the airplane's sheer size and weight would make takeoff impossible, and prevent it from turning, the enclosed cabin would prevent the pilot from feeling how the aircraft was doing, and that the loss of one engine would make it uncontrollable. However, the first flight, on 13 May 1913, was very successful.

Pilot's Cabin in the Bolshoi Baltiskiy

Sikorsky and Tsar Nicholas II aboard the Russkiy vityaz.

Sikorsky and a colleague aboard one of his giant airplanes.

Model of the Russkiy vityaz

The second aircraft, called "Russkiy vityaz," or Russian Knight, was designed soon after by Sikorsky, Lavrov and Mackenzie-Kennedy; it also flew in 1913, with four 100-hp tractor engines. Unfortunately, it crashed after being hit in mid-air by an engine that had torn off an escorting aircraft. The experience Sikorsky gained with the two aircraft was used to design the "Il'ya Muromets," a still larger four-engine biplane named after a tenth-century legendary hero. It had a heated cabin, a compartment in the rear fuselage for eating and sleeping, a promenade deck on top of the upper fuselage, and a firing platform in the middle of the fuselage. This aircraft, which first flew in February 1914, may have been designed for the civilian market but was only used by the military. Flight testing of the huge machine, with its span of 31 metres, however, proved that the four 100-hp Argus engines were not powerful enough. It was re-equipped with two 140-hp engines nearer the fuselage and two 130-hp engines further away. With these improvements, the giant aircraft set a number of world records, including most passengers carried (sixteen people and one dog) and longest time spent in the air (five hours). A flight from St Petersburg to Kiev in late June took twelve days, with many stops along the way. The return flight took only ten and a half hours with only one stop between the two cities. This impressed those at the general headquarters of the Imperial Army and ten aircraft were ordered for the Imperial Russian Air Service. These became the first four-engine bombers to go into battle, when the First World War began in the summer of 1914.

An Il'ya Muromets

The pilots and crews were recruited from among the test pilots and engineers of RBVZ, the manufacturer. The performance of the first pair of airplanes was very disappointing. This led to criticism and requests to suspend production. Nevertheless, production continued and the EVK (squadron of flying ships) was created under the command of the former chairman of RBVZ. The first of many raids by the EVK was launched from its Jablonna base in Poland, in February 1915. The EVK was more than an ordinary bomber squadron; in fact, it was a completely self-contained unit that did its own testing, training and maintenance.

More government orders soon followed; five basic models of Il'ya Muromets have been identified: IMB, IMV, IMG1 to G3, IMD, IMYe-1 and Ye-2. There were many differences between these models such as type of engine, wingspan, length, armament and bomb load. Inadequate supplies of engines were a constant problem, which explains why many aircraft were completed with outer engines that were different from the inner ones. The main production models, with close to seventy built, were the IMV, and IMG1 to G3 subtypes introduced in 1915 and 1916. Their success was such that, in December 1916, Tsar Nicholas II approved French and British requests to build the Il'ya Muromets under licence but the options were never taken up. By the summer of 1917, RBVZ was producing three or four of these giant bombers each month. They normally carried a crew of four but could carry as many as seven, manning up to seven machine guns that were mounted all around, including in the tail.

The German pilots who flew against them had great respect for these flying porcupines. Despite their conventional, yet solid, structure of wood with fabric covering, they could carry between 450 and 700 kg of bombs for up to five or six hours. When production stopped, in 1918, eighty or so Il'ya Muromets had been built by RBVZ; only half of those were ever used at the front. The rest were used to provide the considerable amount of training necessary to handle them; despite this, two aircraft were lost in crashes after reaching the front. Thanks to the aircraft's toughness, sheer size and heavy firepower, only one Il'ya Muromets was lost to enemy air attacks, in September 1916, after shooting down three of its attackers. Thirty or so were destroyed on their airfields in February 1918 to prevent their capture by the Germans.

Between February 1915 and November 1917, the EVK had flown about four hundred combat missions against German targets. Both wheel and ski under-carriage systems were used. Sikorsky designed other, smaller aircraft during the First World War, like the S-16 two-seat reconnaissance aircraft and the S-20 single-seat fighter. Il'ya Muromets were flown by both sides during the Russian civil war and the Bolsheviks used some to initiate passenger services on two routes.

Pioneer Work on Transoceanic Flight

The 1917 Russian Revolution ended Sikorsky's first aviation career. He left Russia, and a considerable personal fortune, to go to France in 1917, where he was commissioned to design a large bomber for service in Allied air forces. However, the aircraft was still on the drawing board when the Armistice was signed in November 1918.

The lack of work in the French aircraft industry forced Sikorsky to emigrate to the United States in March 1919. To survive, he taught and lectured; the industry was in a slump. However, Sikorsky's reputation and strength of character were such that he actually convinced some of his students and friends to pool their resources to create Sikorsky Aero Engineering Corp. of Westbury, Long Island, in March 1923. The firm began its activities, on a chicken farm, by making a single S-29A (in which the *A* stood for America), a large two-engine fourteen-passenger biplane transport aircraft with a metal structure. The tough and reliable S-29A was actually used by movie mogul Howard Hughes in his movie "Hell's Angels." Sikorsky built a few more one-off aircraft, including the S-35, a twin-engine fourteen-passenger transport aircraft.

In 1926, a famous French First World War ace, René Fonck, requested it for his attempt to fly across the Atlantic, from New York to Paris. The undercarriage of the S-35, equipped with extra tanks and a third engine, collapsed on takeoff; Fonck survived but two others died in the huge fire. The improved S-37 was not ready when Lindbergh flew across the Atlantic in 1927.

The company's fortunes changed when it leased an S-36 eight-seat sesquiplane amphibian flying boat to Pan American Airways for survey flights in the West Indies and South America. The airline liked it but wanted more power; Sikorsky obliged with the nine-seater S-38. The successful trial flights of this aircraft in June 1928 led to a number of orders. This production success, the first for Sikorsky in the United States, brought about the re-organization of the company into the Sikorsky Aviation Corp. with new facilities in Stratford, Connecticut. Yet another change came about when financially troubled Sikorsky Aviation became a subsidiary of a giant conglomerate, the United Aircraft and Transport Co., in 1929. One hundred and fourteen Sikorsky S-38s were eventually built: some for airlines like Pan American Airways, some for companies like Standard Oil, Hughes Products and the Chicago Tribune, and some for the U.S. Army and Navy.

Christening of an S-38 operated by Canadian Colonial Airways

Captain E. P. Wells and CF-ASO

Toronto's first scheduled airline service began in June 1929 with downtown-to-downtown flights to Buffalo performed by S-38s registered in the United States but used by Canadian Colonial Airways. Canadian National Exhibition visitors loved it but when the fair ended, the service folded and, with the onset of the Depression, never resumed. Only one S-38 was registered in Canada, CF-ASO; it was used by Canadian Airways of Montreal, between 1932 and 1934. A colourful scale model of CF-ASO is on display at the National Aviation Museum. The Canadian Pratt & Whitney Aircraft Co. of Longueuil, Quebec, known today as Pratt & Whitney Canada, was the agent in the sale of this aircraft. Both companies were, and still are, subsidiaries of United Aircraft/United Technologies.

Canadian Airways' CF-ASO

Further modifications of the basic S-38 formula soon followed, like the single-engine S-39, the four-engine S-40 (for Pan American Airways) and the twin-engine S-41.

A Sikorsky S-42

The climax of Sikorsky's second career was the design of a famous four-engine flying boat, the S-42. This aircraft, the largest by Sikorsky thus far, was designed to meet a tough August 1931 requirement of Pan American Airways, one of the most thriving airlines then. It had to have a range of 2500 miles (4025 km) or more, at a cruising speed of 145 mph (233 km/h), with a payload consisting of twelve passengers and approximately 300 lb (135 kg) of mail. Sikorsky's S-42, incorporated several new ideas. The typical Sikorsky cutoff hull was extended to a full length, providing support for the tail assembly, and the four 700-hp Pratt & Whitney R-1860 Hornet engines were equipped with Hamilton Standard variable-pitch propellers to enhance performance. The aluminum alloy skin of the hull was flush-riveted to reduce drag, and the pylon-mounted wing was equipped with an advanced airfoil for a high level speed, and with flaps to keep the landing speed low. It carried a greater payload farther and faster with a lower fuel consumption.

An S-42 in its element

The first S-42 took to the air in March 1934 and very soon it established no less than ten altitude-with-load world records. Eight of those were set on a single day, proving the superiority of American commercial aircraft over their European competitors. Pan American Airways' fleet of three S-42s, four S-42As and three S-42Bs was used to open up transoceanic air routes across the Pacific and the Atlantic, from its first delivery in August 1934 onward.

Compared with the S-42, the improved S-42A had four 750-hp engines; an improved airfoil; an increased span; a stronger and lighter aluminum alloy skin; a larger gross weight and useful load; and convertible sleeping accommodations for fourteen passengers. The S-42B offered all that, with certain aerodynamic improvements, an increase in gross weight, the ability to carry more fuel and travel a greater distance, and the addition of constant-speed propellers to enhance performance. Over short distances, all versions could carry thirty-two passengers or, with some modifications, up to forty.

Pan American Airways' president, Juan Trippe, thus had an aircraft capable of flying across the Atlantic but a previous agreement with Great Britain, which lacked such a long-range aircraft, made such flights impossible. The original aircraft, christened *Brazilian Clipper*, therefore flew the first non-stop survey flight over the Pacific in April 1935, from San Francisco to Honolulu. In 1937, an S-42B known as the *Samoan Clipper* surveyed the route from San Francisco all the way to New Zealand, via Honolulu; regular flights from Hawaii to New Zealand began in December. On the second commercial flight, the aircraft blew up in mid-air; the service was discontinued until 1940.

The S-42B was also used for the inaugural and, after that, the scheduled mail and passenger service between New York and the Bermudas, in cooperation with Great Britain's Imperial Airways. The last S-42B delivered, the *Pan American Clipper III*, even made three survey flights across the Atlantic, from the United States to Great Britain, by way of New Brunswick, Newfoundland and the Irish Free State, starting in July 1937. Sikorsky's second aviation career did not end with the S-42; he also designed a very successful twin-engine amphibian, known as the S-43.

Development of the Helicopter

The VS-300

Despite his pre-First World War failures with helicopters, Sikorsky had continued to jot down ideas for a single main rotor design throughout the 1920s and early 1930s. The basic patents were filed in 1931 and awarded in 1935. Sometimes, Sikorsky and a few key aides even managed to sneak an unauthorized rotary-wing experiment into United Aircraft's wind tunnel. The decision to build a prototype was not made until 1938, the year during which United Aircraft merged its Sikorsky division with its Chance Vought division to create Vought Sikorsky Aircraft. Because of the Depression and the lack of profit, the faltering Sikorsky division was going to be shut down, unless Sikorsky himself could come up with an interesting, and cheap, research project. Sikorsky immediately asked United Aircraft for permission to build a helicopter and got it. In the spring of 1939, Sikorsky and a small team of engineers designed the VS-300. The *VS* stood for Vought-Sikorsky; the 300 indicated that it was Sikorsky's third helicopter design. The entire project was funded and developed with limited company funds, with no government help at all.

A Pitcairn PAA-1

A Cierva C.30A Rota

A Focke-Achgelis Fa 61

A lot of progress had been made since Sikorsky's failed experiments of 1909/10: Cierva's autogiros had been produced in Spain and Great Britain. Pitcairn and Kaman were working in the United States. The team of Breguet and Dorand was designing in France. Flettner and the team of Focke and Achgelis were working in Germany. By this time, a good understanding of basic principles, such as the transmission and reduction gear boxes, the collective pitch required to go up and down, and the cyclic pitch required to go in every direction, existed. Sikorsky's genius was his ability to take the best from available ideas, even though it took him quite a while. He was also able to see that the development of these dynamic components was the only really important thing.

The original version of VS-300 had a 75-hp Franklin four-cylinder engine; its basic structure was of heavy-gauge welded steel tubes. It had no covering and no instruments in the cockpit. The first vertical takeoff of the first practical helicopter in the Western hemisphere took place on 14 September 1939. Sikorsky as the pilot wore his traditional and soon to be legendary homburg. Only a few company engineers and mechanics were there to see the wheels of the vibration-racked machine go as far from the ground as the short tie-down cables would permit. The 28-foot (8.5-m) three-bladed main rotor and the anti-torque rotor at the rear, as first designed, did not prove sufficient to exercise full control. A long process of tinkering and modifications began and the mechanics soon came to refer to the untrustworthy craft as "Igor's nightmare." After a crash caused by strong wind, in December 1939, two smaller and nearly horizontal rotors were added on outriggers on each side of the tail section to provide both lateral and longitudinal control. Thus modified, the VS-300 was tested in March 1940, with the tethering reduced to a pair of ropes held by the ground crew.

Sikorsky flies the VS-300.

The VS-300 on floats

The first free, that is, untethered, flight took place on 13 May 1940, with Sikorsky at the controls, as was often the case. His reasons for wanting to pilot the test flights were simple: he had to take the blame for flight trouble in order to be able to accept the credit for making it work. More changes followed, including the installation of a 90-hp Franklin engine; the removal of one, and later both, rear horizontal rotors; the lengthening of the rear fuselage; and the installation of a still more powerful 100-hp Franklin engine.

Setting a record

While the helicopter now known as the VS-300A could climb vertically, fly sideways and backwards, it could not safely fly forward until 1941. For publicity, mechanics would change wheels while the VS-300A hovered in midair.

The December 1941 version of the VS-300A

On 6 May 1941, in front of the press and witnesses, the VS-300A actually broke the world endurance record previously held by Germany's Focke-Achgelis Fa 61; it hovered motionless for one hour 32 minutes and 26.1 seconds. In Sikorsky's humorous welcome to the press, he had assured them that it would be the most unspectacular event they ever covered. The final, December 1941, version of the VS-300A had, like the first one, a single three-bladed main rotor and a single anti-torque rotor at the rear; its forward fuselage was covered to improve the pilot's comfort. The main difference now was that Sikorsky had complete control; the VS 300A was still awkward and harder to handle than contemporary German models, but it could take off and land vertically, and hover and fly in any direction.

It is probably true to say that more development work was done with the ever changing VS 300A than with any other flying machine ever built; it was modified no less than eighteen times. Having played its part in the development of a practical helicopter, the VS-300A was delivered to the Edison Museum, now the Henry Ford Museum, of Dearborn, Michigan, in October 1943; Henry Ford himself accepted the aircraft. In fact, the Breguet-Dorand Gyroplane Laboratoire and the Focke-Achgelis Fa 61 were the first helicopters that could take off and land vertically, and hover and fly in any direction, but it was the VS-300 that paved the way for production models capable of carrying useful loads. Unlike the situation in Germany, Sikorsky and United Aircraft had a secure industrial base for a massive development and production effort. As the general manager of Sikorsky Aircraft said in the mid-1960s: "Before Igor Sikorsky flew the VS-300 there was no helicopter industry; after he flew it, there was."

The R-4

The Sikorsky XR-4

A Sikorsky YR-4

The next phase began in July 1940 when the officer in charge of the U.S. Army's helicopter development program visited Sikorsky; he was so impressed by what he saw the that he recommended, and got financial backing for, a new military design. In January 1941, Sikorsky and Gluhareff designed the production model of VS-300, designated VS-316A. It was a bigger machine with an enclosed cabin with side-by-side seating and dual controls for the two-man crew, a 165- to 175-hp Warner R-500 Super Scarab engine, a larger 36-foot (11-m) rotor, and a heavy-gauge welded steel-tube fabric-covered fuselage. The VS-316A set the design for all future Sikorsky helicopters.

The VS-316A, better known by its military designation, the XR-4, first flew on 14 January 1942. It was so successful that the U.S. Army Air Forces (USAAF) started testing it in May. The XR-4 was delivered by air with Sikorsky on board as a passenger. During the trip, he and the pilot hovered to read highway signs, and asked flabbergasted motorists for directions. Three service-test YR-4As were ordered by the USAAF in late 1942, with a 180-hp Warner R-550 engine and a larger, 38-foot (11.6-m) rotor.

A batch of twenty-seven pre-series YR-4Bs, similar to the YR-4A, but with enlarged cabins, was ordered in 1943 for further evaluation and used by the USAAF, U.S. Navy and the Royal Air Force. They were thoroughly if not brutally tested by all three, not to mention the U.S. Coast Guard and British Fleet Air Arm, over the worst sorts of terrain and in the worst types of weather, from Alaska all the way to Burma. While in Burma, in April 1944, a YR-4B performed the world's first recorded casualty evacuation flight by helicopter: a stranded pilot and three wounded soldiers were lifted from behind Japanese lines, one at a time. The results of this extensive testing were such that Sikorsky received an order for one hundred helicopters, similar to the YR-4B except with a greater range and a 200-hp engine. Fifty or so R-4Bs and HNS-1s were built for the U.S. Army and Navy, and fifty or so Hoverfly Mk.Is were built for the RAF and, especially, the Fleet Air Arm.

The importance of the helicopter was so great that Vought-Sikorsky Aircraft was dissolved on 1 January 1943 and Sikorsky became once again an independent division within United Aircraft. The R-4B series went into service in 1945. Many were fitted with two floats for landing aboard ships or on water. The R-4B did not remain in service very long once the Second World War ended; it was supplanted in both the United States and Great Britain by the S-51 family. The Sikorsky R-4 was nonetheless the first U.S. helicopter to be put in production and also the first helicopter ever to be exported. The R-4 series was not, however, the first helicopter in the world to be manufactured in any number; that honour belonged to Germany's small Flettner Fl 282 Kolibri (Hummingbird).

A U.S. Coast Guard HNS-1 flying from Goose Bay, Labrador, in May 1945, performed the first helicopter rescue in Canada. It saved eleven Canadian airmen from two separate crashes in rugged territory by flying them to safety one at a time. The first Canadian helicopter pilots were trained on Royal Navy Hoverflies; one of the pilots took part in a rescue operation in Virginia, in May 1945, during his stay in the United States as a naval liaison officer. One British machine was transferred at some point to Canada.

The National Aviation Museum's R-4B

The National Aviation Museum's R-4B was never used in Canada as such; its engineless airframe was acquired in November 1983 from the Planes of Fame Museum of Chino, California, in exchange for a Japanese Second World War dive bomber.

While the military R-4 was being produced, Sikorsky was working on the all-metal VS-327, designed to meet a USAAF requirement for an observation helicopter. It was bigger, better and more streamlined than the R-4. The first of five prototypes, known as XR-5s, flew on 18 August 1943; twenty-six pre-series YR-5As soon followed.

An early R-5

An HO3S of the U.S. Navy

A Westland Widgeon

The R-5/S-51

Thirty-five or so R-5As were delivered to the USAAF, out of one hundred ordered; many were later modified to R-5D standards, with improvements like an external winch for rescue operations, a 600-hp engine, a third passenger seat and extra fuel tanks. A USAAF R-5 performed the first rescue from a sinking vessel and the first use of a rescue winch, on 29 November 1945, off the coast of Connecticut.

The R-5D, redesignated the H-5D in 1948, marked the way toward the first helicopter designed for civilian activities, the four-seat Sikorsky S-51. The S-51, which first flew on 16 February 1946, was the first Sikorsky helicopter to be licensed by the U.S. Civil Aviation Administration for commercial operations. The world's first commercial sale was confirmed, with deliveries in August 1946, to Helicopter Air Transport of Philadelphia. Among main civilian users were: Los Angeles Airways, which, in October 1947, began the world's first official helicopter mail transport service; and British European Airways, which launched the world's first regular helicopter passenger service in June 1950.

Approximately 216 true S-51s were eventually built between 1946 and 1951 by Sikorsky; sixty-five or so R-5/H-5s were used by the U.S. Air Force and ninety or so HO3Ss were used by the U.S. Navy and Marine Corps, for rescue work and observation. One hundred and thirty-three more, known as Dragonflies, were built under licence by Westland in Great Britain. This was a first for the British industry and the beginning of a long relationship with Sikorsky. Eighty or so were used by the Royal Navy and eight by the RAF. After the successful trials of a Dragonfly with a redesigned cabin, in the summer of 1955, Westland built fifteen Widgeons for three air forces and civilian customers.

An H-5 of the RCAF

In Canada, the RCAF acquired seven Sikorsky-built H-5s, the service's very first helicopters, in April 1947; the last ones were retired in 1965. Pratt & Whitney Aircraft was Sikorsky's agent for the sale of these aircraft; it remained sales and overhaul/repairs agent for Sikorsky products in Canada until 1972.

The RCAF's S-51s were used to train pilots how to fly and how to maintain this new type of flying machine in all sorts of weather and all sorts of terrain. The first one to be delivered is now in the National Aviation Museum; it spent its career in many different places between New Brunswick and Alberta, before the Museum acquired it in January 1965. The Canadian Department of Transport's first helicopter was also an S-51, delivered in June 1950. It pioneered the use of ship-borne helicopters in ice reconnaissance ahead of icebreakers. Helicopters remain in use in the Canadian Coast Guard today.

The Museum's H-5

The Department of Transport's first helicopter

An RCAF H-5 hovers over a crash site in British Columbia.

The S-55

Development of the helicopter entered yet another phase on 7 November 1949, with the first flight of the Sikorsky S-55. That particular machine was one of five YH-19s ordered by the U.S. Air Force. Its most significant feature was the location of the 600-hp engine, a Pratt & Whitney or a Wright, in the nose, canted at approximately 45 degrees so that it did not take up space in the cabin, which was located beneath the main rotor. An added advantage of the arrangement was the ground-level access to the engine compartment through clamshell doors. It was more awkward for the crew, however, because they were located above and forward of the cabin. For the first time, a helicopter was capable of lifting a fairly heavy load: six to eight casualty litters and one medical attendant or ten soldiers, in addition to its two-man crew.

A Sikorsky YH-19

The S-55 was suitable for passenger, cargo or airmail transport as well as for military transport of soldiers or equipment, medical evacuation and rescue work. It became the first helicopter to be used in an antisubmarine role, carrying a sonar or torpedoes. It came out at exactly the right time to be used in large numbers during the Korean war. This is where it demonstrated for the first time what the helicopter was truly capable of, rescuing people or carrying them to and from most otherwise inaccessible places.

An H-19 in American colours

The main user of the second Sikorsky helicopter to be built on a large scale was, understandably, the U.S. Department of Defense; every service used it. Approximately 325 H-19 transports were used by the U.S. Air Force, 340 or so H-19 transports were used by the U.S. Army, and 335 or so utility and transport HO4Ss and HRs were used by the U.S. Navy, the Marine Corps and the Coast Guard. Two U.S. Air Force H-19s became the first helicopters ever to cross the Atlantic, from the United States to Great Britain, with three stops along the way. The flight began 15 July 1952 and only ended on July 31 because of bad weather delays. Quite a few U.S.-bought military models were eventually transferred to foreign countries, especially Great Britain. It proved very popular with many commercial operators; SABENA in Belgium used it for the first international helicopter service in the world, from September 1953 onward. The Sikorsky S-55 was in fact the world's first fully certified transport helicopter.

A civilian S-55 fitted with floats

Sikorsky built more than one thousand over a period of more than ten years, a spectacular number, with approximately 550 more built by Westland in Great Britain (where it was called the Whirlwind), Mitsubishi in Japan, and SNCASE in France. Some of Westland's Whirlwinds were turbine powered. The S-55s were eventually supplied to commercial and military operators in approximately thirty-five countries. The R-1340 Wasp engines used in many of the S-55s built by Sikorsky for American and foreign customers were in fact built in Canada by Pratt & Whitney. Just after its establishment in 1952, Okanagan Helicopters, a well-known British Columbia helicopter operator, bought the second civilian S-55, CF-GHV, to leave the production line. It had acquired twenty-one by 1957.

In Canada, the Royal Canadian Navy (RCN) acquired thirteen Sikorsky-built HO4S-2s for utility and rescue work in 1952. The RCN's very first helicopter carrier landing was done by an HO4S aboard HMCS *Magnificent*, on 6 May 1952. In November 1952, they started serving as airplane guards from HMCS *Magnificent*. One of them was used in the first helicopter rescue in the Royal Canadian Navy, in September 1953. Six of them were modified and upgraded by Pratt & Whitney Aircraft in 1955 to a sonar-equipped HO4S-3 configuration for antisubmarine duty. These machines were flown from HMCS *Shearwater* naval air station in Nova Scotia, and HMCS *Bonaventure*, Canada's sole aircraft carrier at the time.

A Westland Whirlwind

Two additional views of the Museum's HO4S-3

Maintenance and repair in the field

The National Aviation Museum's HO4S-3

With the arrival of the far better Sea King, the HO4S-3s were transferred to a utility and rescue unit, where one was used to save no less than thirty-two people, in eight rescue missions, during its career. The most famous mission performed by this HO4S took place in November 1955 when the Liberian freighter *Kismet II* ran aground off Cape Breton Island, Nova Scotia, during a storm; in four flights, twenty-one people, one cat and one dog were saved from the wrecked ship. Like the other HO4Ss, it was retired in May 1970 and transferred to the National Aviation Museum. The RCAF acquired fifteen H-19s, which was the U.S. Air Force designation, in 1954; the last one of these utility helicopters was retired in April 1966.

To give an idea of the price increase, one S-51 cost $85 000 in 1947 and by 1954, one S-55 cost $150 000. These, and other types, proved their worth from May 1955 to August 1957, during the construction of the Mid-Canada defensive radar line, when the absence of roads forced the builders to rely on helicopters to airlift everything.

One of the S-55s involved in the contribution of the Mid-Canada Line

The S-61/Sea King

Work on an even more successful design, a large and powerful twin engine amphibious antisubmarine helicopter for the U.S. Navy, began in the late 1950s. Unlike previous rotary wing sub-chasers, the new Sikorsky S-61 design combined the "hunter," equipped with dipping sonar, and the "killer," equipped with homing torpedoes, into a single machine rather than a team of two. To save space, the tail pylon and the five blades of main rotor could be power-folded; the S-61 could also operate on one engine if necessary.

The combination of advances introduced in the S-61, Sikorsky's first turbine-powered helicopter, fully justified the use of often-overused terms like "new generation" or "breakthrough." The prototype of the S-61B, known to the U.S. Navy as the HSS-2 or "Hiss2" Sea King, flew for the first time on 11 March 1959. Deliveries of the HSS-2 production model to the Navy began in September 1961; in June 1962, the type was redesignated SH-3. The SH-3A broke a number of world speed records over fixed distances shortly after its introduction. The proof of its versatility, its reliability and its performance lies in the fact that the S-61/Sea King remained in production until the 1980s.

A whole family of related machines was produced for both military and civilian operators, with various fuselages and in amphibious and non-amphibious versions with folding and non-folding rotor blades. The non-amphibious twenty-eight-seat S-61L for civilian operators, which entered service with Los Angeles Airways in January 1962, was in fact the world's first real helicopter airliner; the fully amphibious S-61N followed soon after.

A simple listing of the S-61's military roles is also impressive. They were used for antisubmarine warfare; minesweeping; troop, VIP and assault transport; search and rescue/combat rescue; and logistical support.

The U.S. Department of Defense was the main customer, as before, but the U.S. Air Force, the U.S. Navy and the Coast Guard all used it. Two HH-3E "Jolly Green Giants" of the U.S. Air Force's Aerospace Rescue and Recovery Service performed the first non-stop helicopter crossing of the North Atlantic. They left New York on 31 May 1967 for the Paris Air show and arrived the following day after nine in-flight refuellings. The S-61 family was built by Sikorsky, and Agusta in Italy, Mitsubishi in Japan, and Westland in Great Britain, which also developed the Commando troop transport version.

To this day, the Sea King remains one of the most widely used amphibious helicopters in the world; it was in use in the armed forces of at least seventeen countries. At one point, Okanagan Helicopters Ltd of British Columbia, one of the world's major helicopter operators, owned seven S-61Ls and S-61Ns as part of its fleet.

A Sikorsky Sea King lowers its sonar.

In Canada, the Royal Canadian Navy acquired forty-one CHSS-2s in 1963/64; they replaced the HO4S-3s at Shearwater, and on HMCS *Bonaventure* until its retirement in 1970. Here is yet another idea of the cost increase: while one S-55 cost $150 000 in 1954, each of the forty one Sea Kings cost approximately $1 100 000 in 1963/64, half of which was electronics. All but four were assembled by United Aircraft of Canada, now Pratt & Whitney Canada, in Montreal, from U.S.-manufactured components. The four Sikorsky-assembled Sea Kings were somewhat different but were later brought to CHSS-2 standard with Canadian electronics, crew stations and "Beartrap" capability. The Sea King was finally chosen over the original favourite contender, the Kaman HU2K Seasprite, because the Canadian government and Kaman could not agree on the price and on production sharing, and United Aircraft of Canada presented a very good, updated proposal. The basic sheet metal hull, the "tub," was assembled by Sikorsky and delivered to Longueuil. The rest of the helicopter arrived in kits that had to be assembled, or was in fact manufactured at Longueuil. The Canadian content increased with each new aircraft built.

From the second half of the 1960s onward, many Sea Kings operated from destroyer escorts of the Royal Canadian Navy and Canadian Armed Forces. Trials that had begun around 1956, in which HO4S helicopters were flown from simple platforms and restrained with simple web straps, had created an interest in the idea. A special landing system, the Helicopter Haul-Down Rapid Securing Device, HHRSD for short, was designed to enable them to land safely aboard small ships in all sorts of weather, that is, with ships tossing and turning. The system is most often called the "Beartrap." It was developed and built by Fairey Aviation of Dartmouth, Nova Scotia, and is is now built under licence and used by many navies around the world. The beartrap requires four main manoeuvres: (1) the pilot flies to a point above the deck of the ship and lowers a messenger cable attached to a probe under the fuselage; (2) sailors attach the messenger cable to a cable connected to a winch mounted below the beartrap on the deck; (3) a landing officer applies tension to the cable and slowly flies the helicopter downward; and (4) when the helicopter's probe is in position, two movable beams spring together and hold it, and the helicopter, securely.

The CHSS-2 was redesignated CH-124 around 1969, when the Canadian Armed Forces unified; many of them were still in service in the Maritime Air Group in 1999. Despite the near legendary toughness of the design and the numerous equipment upgradings during the past quarter-century, the Canadian Sea Kings are due for retirement.

Two additional views of the Sikorsky Sea King

Conclusion

It took years to make the fragile and temperamental helicopter reliable; indeed, early machines were sometimes described as a thousand parts flying in close formation. If the pilot so much as took his hand off the control stick of an S-51 or an S-55, for example, the helicopter would immediately fly out of control. Improvements were made, however, and the number of useful, and destructive, purposes to which the helicopter can be put now is limited only by our imagination.

Igor Sikorsky retired from Sikorsky Aircraft's top position in 1957, at the age of 68, after three very distinct careers and a half-century of pioneering work in aviation. Even after his official retirement, he continued to work for the Sikorsky Aircraft division of United Aircraft as a consulting engineer. He died of a heart attack on 26 October 1972; he was 83 years old. Over the years, he had received numerous honorary degrees and many awards, both national and international.

Specifications

S-38

Two 420-hp Pratt & Whitney R-1340 Wasp piston engines

Span	71 ft 8 in	21.8 m
Length	40 ft 3 in	12.3 m
Max. takeoff weight	10,480 lb	4 755 kg
Max. speed	125 mph	201 km/h
Accommodations	8 passengers	

R-4B

One 200-hp Warner R-550 Super Scarab piston engine

Main rotor diameter	38 ft	11.6 m
Length of fuselage	35 ft 5 in	10.8 m
Length, overall	48 ft 2 in	14.7 m
Height	12 ft 5 in	3.8 m
Max. takeoff weight	2,535 lb	1 150 kg
Max. speed	75 mph	121 km/h
Service ceiling	8,000 ft	2 440 m
Range	130 mi	210 km
Crew	2	

S-51/H-5

One 450-hp Pratt & Whitney R-985 Wasp Jr piston engine

Main rotor diameter	49 ft	14.9 m
Length of fuselage	40 ft 10 in	12.5 m
Length, overall	57 ft 1/2 in	17.4 m
Height	12 ft 6 in	3.8 m
Max. takeoff weight	5,500 lb	2 495 kg
Max. speed	103 mph	166 km/h
Service ceiling	13,500 ft	4 115 m
Crew	1	
Accommodations	3 people or 2 stretcher pods outside	
Payload	950 lb	430 kg

S-55/HO4S-3

One 600-hp Wright R-1300 Cyclone piston engine

Main rotor diameter	53 ft	16.2 m
Length of fuselage	42 ft 2 in	12.9 m
Height	13 ft 4 in	4.1 m
Max. takeoff weight	7,540 lb	3 420 kg
Max. speed	112 mph	180 km/h
Crew	2	
Accommodations	10 people	

S-61/CHSS-2, CH-124 Sea King

Two 1,250-hp General Electric T-58 turbo-shafts

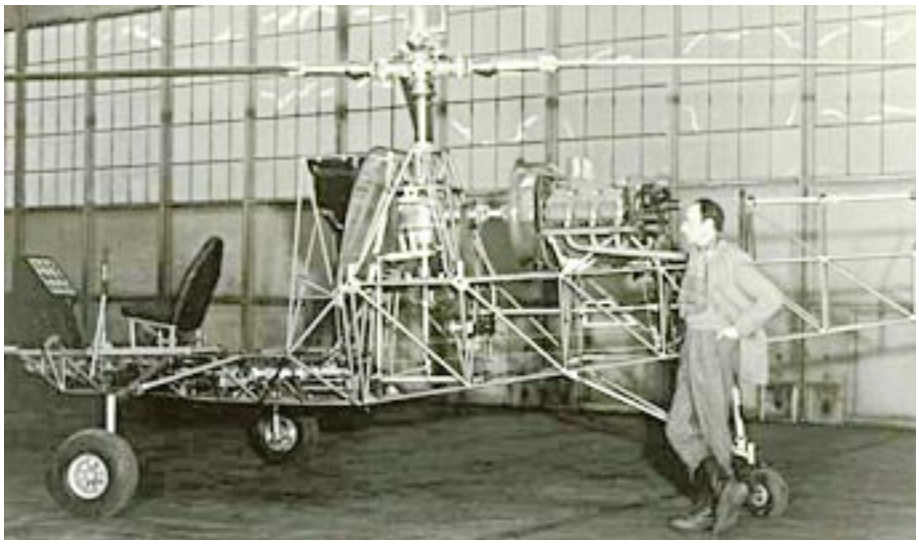
Main rotor diameter	62 ft	18.9 m
Length of fuselage	54 ft 9 in	16.7 m
Length, overall	72 ft 8 in	22.2 m
Height	16 ft 10 in	5.1 m
Max. takeoff weight	20,500 lb	9 300 kg
Max. speed	166 mph	267 km/h
Service ceiling	14,700 ft	4 480 m
Max. range	625 mi	1 005 km
Armament	up to 4 homing torpedoes	
Crew	4	

Canada's First Certified Helicopter

The first helicopter certified in the British Commonwealth was the SG-VI. It was designed by two Americans, Bernard Sznycer and his assistant Selma Gotlieb, and built in Montreal. Financial backing and, eventually, manufacturing facilities were provided by Intercity Airlines Co., a Montreal firm created for this specific design. The prototype, known as the SG-VIC, made a number of tethered flights before its first free flight on 7 July 1947.

The modified and redesigned SG-VID Grey Gull flew in February 1948. Both versions proved remarkably easy to handle and vibration-free, but financial restrictions slowed development of this promising design. It received the Canadian Department of Transport certification in 1951, after gruelling tests in dreadful winter weather. However, the program was terminated soon after, when Intercity Airlines' financial backing dissolved. Sznycer returned to the United States.

The Grey Gull in flight



The SG-VI in a hangar