



I. I. Sikorsky

Igor Ivan Sikorsky

1889-1972

By Carlos C. Wood

Igor Ivan Sikorsky died on October 26, 1972, in Easton, Connecticut. When he was born in Kiev, Russia, on May 25, 1889, Dr. I. A. Sikorsky (Professor of Philosophy in the St. Vladimir University of Kiev) and his wife welcomed a new addition to a family already comprised of three daughters and a son.

Professor Sikorsky and his wife were cultured in the true sense of the word, being interested in the great works of the past across a broad spectrum, working hard (and effectively) to advance the scientific and human work of the time, and imbuing young people with knowledge and drive for efforts in the future. This formed the base of Igor Sikorsky's upbringing.

One of the earliest recollections of Igor Sikorsky dealt with his mother. She received an education in a medical college, but motherhood prevented her continuation of scientific work. Before Igor was born, she was much absorbed with the life and work of Leonardo da Vinci, who among all his other activities was among the first to study flying and to produce preliminary designs and sketches of wings. Young Igor was told by his mother of Leonard da Vinci's attempts to design a flying machine. Even at an early age Igor was so interested in flying that he never forgot this information and continued to ask his family, and others he considered competent, questions about flight. It is obvious that this was a great determinant to Igor's later career.

Professor Sikorsky worked long hours as an active physician,

lecturing at the University and continuing his scientific research and writing at home. For relief from these efforts, it became his habit to journey abroad each year for several weeks, during which he studied scientific subjects, visited galleries and libraries, and purchased more books. During his lifetime he accumulated a personal library of some 12,000 volumes.

In 1900 he was accompanied on one of these trips by his youngest son, Igor. They spent the summer in the German Tyrol. As a result of conversations with his father at that time, at the age of eleven Igor Sikorsky was introduced to the natural sciences, particularly mechanics and astronomy, which remained of great interest to him for the remainder of his life.

Thus started, for the next few years Igor investigated many things in the natural science area. He made electric batteries. He built a small electric motor. Becoming interested in chemistry, he even made a bomb (successfully exploded in a hole in the family garden). He tried repeatedly to make flying models, and finally in 1901 he succeeded in making a model of a rubber-powered helicopter that could actually rise in the air!

In 1903, fourteen-year-old Igor Sikorsky entered the Naval Academy in Petrograd. He spent three years there, completing the general course. He finally decided that his real work would be in the field of creative engineering, and he couldn't get the flying machine out of his mind. Such a machine appeared to be impossible at the time, but he decided to enter actively into the study of engineering. Accordingly, although in good standing, he resigned from the Naval Academy in 1906 at the age of seventeen.

The abortive 1906 Revolution in Russia seriously disrupted academic work in that country, so Igor spent several months in Paris studying engineering. By 1907 the Russian situation had improved, so he returned to Russia and entered the Polytechnic Institute of Kiev in the fall, at the age of eighteen.

During his first academic year at the Institute, Igor Sikorsky was reasonably successful as a student, but was not particularly interested in theoretical studies or higher mathematics, as they seemed somewhat afield from actual work. Living at home, he still worked in his small workshop and laboratory, where he built and experimented with mechanical devices.

In the summer of 1908, Igor again went to Germany with his father. While there he read almost daily of the flights of Count Zeppelin in one of his early dirigibles. Also, and of far greater importance, for the first time he read of the successful flights of the Wright brothers. Whereas before this time all preponderant information was that powered flight of heavier-than-air machines appeared to be impossible, the success of the Wright brothers changed the whole picture. Thus, well-knowing that many people had spent much time, capability, and money unsuccessfully trying to design flying machines in the past, Igor Sikorsky, at the age of nineteen, decided to hitch his life to the aviation star.

Thus, during his summer vacation in 1908, in the room of a small hotel in Germany, Igor Ivanovitch Sikorsky began his first steady work in aeronautics. This work would occupy him until his death, sixty-four years later.

After some months of study and building of experimental apparatus at home in Kiev, Igor went to Paris with the good wishes of his father and the financial support of his sister Olga to extend his formal and informal aeronautics education and to buy a twenty-five horse power Anzani engine plus some parts for the aircraft he was planning to build.

Against the advice of what aeronautical experts there were at the time, Igor Sikorsky had decided to build a helicopter as his first flying machine. Construction started in May 1909, and the machine was completed and tests began in July. Mechanical dynamics problems were solved satisfactorily, and some solutions were found to dynamic control problems. However, unfortunately the machine would not lift its own weight, and some basic control problems remained. When this became apparent, Igor gave up the thought of flying this particular machine and instead obtained all possible technical and operating information from the machine before disassembly in October.

Design work had been proceeding on a second helicopter in the interim, but construction was delayed until after another trip to Paris to obtain more aeronautical information, engines, and to have some parts made. At this time Igor saw the Wright airplane in flight for the first time. Construction of the airplane was also considered at this time.

In February 1910 construction of a second helicopter was started and also of an airplane, the S-1. The early spring of 1910 saw completion of the second helicopter. It worked better than the first one, but appeared marginal in performance. Accordingly, effort was concentrated on completion of the S-1 airplane, which was fielded for tests in April 1910.

Igor found that the S-1 (after he taught himself to fly it) could barely fly in ground effect-the fifteen horse power Anzani was too small. Accordingly, a twenty-five horse power engine was installed, other logical changes were made, and in June 1910 the S-2 was completed. It first left the ground on June 3 and cracked up in an accident on June 30. It was determined that the installed power was minimal to permit level flight out of ground effect. But, Igor Sikorsky had flown in an airplane of his own design!

More changes, more power-the S-3. Then the S-4 and the S-5 both completed in April 1911. The higher-powered and larger S-5 appeared more promising, and at the end of April its tests started. On May 17 full flight was accomplished, and by mid-summer 1911 one-hour flights at 1,000 feet altitude were accomplished. Success!

In the fall of 1911 Igor Sikorsky was issued FAI pilot license No. 64 by the Imperial Aero Club of Russia.

Construction of the 100 horse power S-6 started in August 1911, and it was flown in November. Necessary improvements were made to result in the S-6-A, which was flown at the end of the year and proved capable of beating the existing world's speed record with a pilot and two passengers aboard at 113 kilometers per hour. The S-6-A received the highest award in the Moscow aircraft exhibition in February 1912.

In the spring of 1912 Igor Sikorsky entered into an agreement with the Russian Baltic Railroad Car Factory in Petrograd as Designer and Chief Engineer of the aircraft factory of the company, on very favorable terms.

During 1912 the S-6-B two-place biplane, S-7 two-place monoplane, and the smaller S-8 training plane were built. In September the S-6-B won a Russian army competition against many other competitors, with a cash prize and orders for some aircraft.

For some time Igor Sikorsky had been thinking about and doing preliminary design work on a large four-engined airplane. This was at a time when the experts were sure that a large aircraft would not be feasible and that control of four engines was not possible. On September 17, 1912, the Chairman of the organization that Igor had joined asked him to proceed on this large four-engine airplane.

On May 13, 1913, the "Grand" flew for the first time, complete with its closed cabin and its outdoor nose balcony. Thus was born the large multi-engined type of aircraft. Other Sikorsky-designed aircraft, the S-10 and S-11, won the Russian military competition in 1913.

An improved four-engined airplane, the "Ilya Mourometz," was started in August 1913. It had a wing span of 102 feet, a wing area about 1,700 square feet, and a gross weight over 10,000 pounds. Quite an airplane for the time, it was flown in January 1914. On June 18, 1914, a world's record was set for flight duration of six hours and thirty-three minutes with pilot and six passengers. This was just prior to the outbreak of World War I.

During World War I about seventy-five of these four-engined airplanes were delivered as bombers. A total of about 400 raids were made, with only one plane lost due to enemy action.

All work was stopped by the Revolution in the spring of 1917. Finally making up his mind, Igor Sikorsky left Russia in March 1918, taking with him a few hundred English pounds, and leaving behind the substantial investments resulting from his several years of intensive and successful work.

He went to Paris via London. In Paris he was asked to design a heavy bomber for the French. Plans were completed in August 1918. During the fall, preparations for starting construction were made. When the Armistice was signed in November 1918, work was stopped.

Because of curtailments in aviation, Igor decided to emigrate to the United States and start over. He landed in New York City on March 30, 1919.

The next few years held many disappointments for Igor Sikorsky. The aviation business in the United States was demobiliz

ing from the expansion of World War I, and essentially no new work was available. During the summer of 1919 Igor did organize a company and started preliminary engineering work, but the company was disbanded before start of any construction. In the fall of 1919 he visited Washington and McCook Field in Dayton, where he spent six weeks working on the preliminary design of a large three-engined bomber for the Army Air Service. Igor returned to New York early in 1920 and unsuccessfully made several more attempts to reenter aviation in the next several months. Late in the fall of 1920, in order to obtain some income, he started teaching mathematics to Russian immigrants. Soon after, he began to give lectures on aviation and on astronomy. With these activities he was able to support himself.

These efforts took time mostly in the evening and on weekends. So, in the remaining available time, Igor turned again to designs for commercial airplanes. But up to 1922 it was not possible either to obtain a position with existing aviation concerns or to finance a company by normal methods. But all of these efforts were bringing Igor Sikorsky into contact with many people who offered either to subscribe small amounts or to assist as workers in an aviation endeavor. Accordingly, on March 5, 1923, a new company was incorporated as "Sikorsky Aero Engineering Corporation." The aims were to collect as many subscriptions as possible and to start as soon as possible on the construction of an all-metal, twin-engined, passenger transport plane—the S-29-A (A for America).

Work was started at a time when only \$1,000 in cash had been received. After months of literally living from hand to mouth, with little or no pay for the workers, the S-29-A was first flown on May 4, 1924. Too many people crowded aboard on this first flight, and a forced landing on a nearby golf course badly damaged the airplane. This seemed the end.

But more money was raised, more effort expended, and on September 25, 1924, the repaired, re-engined S-29-A was successfully flown. It could fly on one engine, could carry fourteen passengers, and could cruise at 100 miles per hour. It proved the practicability of twin-engined commercial transports. Many people were given their first rides in this airplane. In 1926 it was sold to Roscoe Turner, who used it successfully for several more years.

In the meantime other efforts were being made, including the design of the S-34 twin-engined amphibian. It did not turn out to be practical, but furnished valuable experience and information, which was used later.

In the spring of 1926 work was started on the three-engined S-35 for a New York to Paris flight by the French Captain Rene Fonck. With insufficient time for testing, and under pressure of publicity, this airplane crashed on the attempted trans-Atlantic takeoff on September 21, 1926. This again put the Sikorsky company in bad shape financially, but help from New England friends permitted it to continue.

By the end of 1926 work was proceeding on the twin-engined S-37 for Captain Fonck to try again. By the spring of 1927 the S-37 was successfully flown and shown to be entirely suitable for the transatlantic flight.

On May 21, 1927, Charles Lindbergh made his remarkable solo flight across the Atlantic. This was to have a great, favorable, and long-term influence on aviation in the United States, but it also removed the most important reason for Captain Fonck's flight and the S-37 project died. The S-37 eventually was sold, flown to Argentina, and extensively used to carry passengers across the Andes.

In the meantime the experience gained from the S-34 amphibian was being applied to another twin-engined amphibian, the S-36, which was very satisfactory, and a few aircraft were sold in 1927. From this experience it was decided to make one more try.

During early 1928 construction of the twin-engined S-38 amphibian was under way. Because of the enthusiasm resulting from the Lindbergh flight, ten of these ten-seater aircraft were being built. The S-38 was successfully flown in May 1928 and proved to be an excellent airplane. Demonstration to the U.S. Navy showed its performance to be better than any other airplane of its size and power, and the Navy bought some. Pan American Airways also bought some and used them to open up the commercial air routes to South America. Other orders followed. The first ten aircraft were quickly sold, a second series of ten were also sold in a short time, and soon the company had more business than it could handle.

This great increase in business required enlargement of the factory, so the Sikorsky Manufacturing Corporation was reorganized as the Sikorsky Aviation Corporation, with increased capital. Land was purchased in Stratford, Connecticut, and a large modern plant with all necessary facilities was built there during 1929. Also, in 1929 the Sikorsky Aircraft Corporation became first a subsidiary and later a Division of United Aircraft Corporation. This latter relationship still exists.

During 1929 and 1930, more than 100 S-38's were built and sold. The S-38 airplanes were used in the pioneering and operations of about ten airlines, as well as by many private operators.

About this time Pan American asked for the construction of a much larger transport airplane. Sikorsky was chosen to produce it. At this time a personal relationship began between Igor Sikorsky and Col. Charles Lindbergh (who was an advisor to Pan American) that continued throughout the remainder of Igor's life. This new four-engined airplane was known as the S-40 *Flying Clipper*. It could carry its normal load of about 4,800 pounds for 700 miles at a cruising speed of 115 miles per hour. It could carry a payload of 300 pounds for 1,500 miles. The S-40 was completed in the spring of 1931 and went into Pan American service in late fall 1931.

Pan American really wanted to fly transoceanic, and with the success of the S-40 attention was turned to development of a transport airplane for such service. Building on the excellent characteristics of the S-40, and using all of the latest aeronautical information, the latest power plants and propellers, and the Pan American operating experience, plans were made for a true transoceanic flying *Clipper*-the S-42.

The S-42 was designed in 1932, and construction began in 1933. By the end of the year the airplane was completed, but winter and ice in the river held up first flight of the S-42 flying boat until March 1934. The capability of the S-42 was shown on April 26, 1934, when it carried a load of 16,608 pounds to 16,000 feet altitude. On May 17 it carried 11,023 pounds to 20,407 feet altitude. On August 1, 1934, the S-42 set eight more world records for loads up to 4,409 pounds for distances up to 1,249 miles at speeds over 157 miles per hour.

Shortly later the first S-42 was delivered to Pan American and in the fall of 1934 introduced new air travel that reduced the schedule time between the United States and Argentina from eight days to five days.

The second S-42 was equipped with long-range tanks and delivered to Pan American shortly afterwards. After much testing at Miami it was flown to San Francisco, from where it made the first flight to Honolulu on April 17, 1935. Later, another Pan American S-42 inaugurated the longest over-ocean airline in the world between San Francisco and New Zealand.

Finally, in July 1937 the first regular airline crossing of the North Atlantic between the United States and England started. Service also started to Portugal by the Bermuda-Azores route. Ten S-42's were built, all for Pan American.

Two additional types of fixed wing airplanes were built. The twin-engined S-43 amphibian carried fifteen passengers, a crew of three, and cruised at 160 miles per hour. It first flew on June 1, 1935, and in April 1936 set four world altitude records, one of 24,950 feet with zero payload. Fifty-three were built, with the U.S. Navy and Pan American being the prime users.

The large four-engined S-44 flying boat won a U.S. Navy competition and was first flown as the XPBS-1 on August 13, 1937. Sikorsky lost the production contract on price, but the design was used in the S-44-A commercial flying boat. This airplane cruised at about 210 miles per hour and could carry a load of thirty-two passengers from New York to Rome (4,600 miles) nonstop. Three aircraft were built and operated during World War II.

Writing in 1938, Igor Sikorsky remarks: "The successful flights of the S-42 across both major oceans may be considered as concluding the pioneering period of aviation. They are also to a large extent the conclusion of the story of the *Winged-S*."

Thus, with all of his insight, Igor Sikorsky could be wrong. He was just on the verge of a complete new period of aviation pioneering. His third aviation career was about ready to start.

The Sikorsky Division had made no money on the S-42 and had lost money on the S-44. It was necessary to close down the Sikorsky Division airplane production operations in 1938. But the decision

was made to keep Igor Sikorsky and his creative technical group together-if they had any ideas of an aircraft development program that would warrant such action. Igor Sikorsky did have an idea, and he sold it to United Aircraft management.

In all of the busy years since 1909, Igor had continued to think about and make notes on the helicopter. Since 1928 he had been working informally with a couple of his close associates on ideas. He told the United Aircraft management that now was the time to add a new dimension, the vertical, to flying. The United Aircraft management agreed, and asked Igor, with a few close associates, to try and do it.

The first effort was the VS-300 helicopter, designed in spring 1939, built during that summer, and first flown (to an altitude of a few inches) by Igor Sikorsky himself on September 14, 1939.

It is interesting to note that the VS-300 closely resembled a helicopter design on which Igor had applied for a patent June 27, 1931, the patent being granted on March 19, 1935. It had a single main rotor (three blades) and a tail rotor (two blades). Although many variations (added rotors, etc.) of this basic main and tail rotor configuration were tried on the VS-300 (and by others before and since), the single main and tail rotor configuration was finally adopted and is still the basic arrangement of all subsequent Sikorsky helicopters (and many other manufacturers around the world). It is the configuration of at least ninety percent of all helicopters built to date.

Development flights continued until December 9, 1939, when a gust of wind upset the VS-300 because of lack of aircraft control power, and the VS-300 was badly damaged. The aircraft was rebuilt in a second configuration, adding two horizontal tail rotors supported on booms. The revised VS-300 began tethered flight on March 6, 1940, flew free on May 13, and was demonstrated to the public on May 20. Igor amazed onlookers by flying backwards, sideways, and even turned on a spot. Igor was presented with Connecticut Helicopter License No. 1.

Most spectators did not notice that the machine had not flown forward. Asked about this later, Igor replied, "That is one of the minor engineering problems that we have not yet solved!" Actually,

the added horizontal tail rotors had to operate in the turbulent wake from the main rotor in forward flight, making forward flight a problem. After adequate main rotor control power was provided, the two horizontal tail rotors were removed, and the aircraft performed very well in forward flight.

However, while still in this second configuration, the VS-300 established an American helicopter endurance record of 1 hour, 5 minutes, 14.5 seconds on April 15, 1941, and a world's record of 1 hour, 32 minutes, 26.1 seconds on May 6.

During May 1941 the VS-300 was again modified, removing the two horizontal tail rotors, increasing cyclic control power on the main rotor, and installing a single horizontal tail rotor high on the machine. This third configuration flew on June 12, 1941, was much better than the second configuration, and reached a forward flight speed of seventy miles per hour. Igor and his people then knew that they had the makings of a successful helicopter.

Versions of these aircraft can build bridges, install power lines in inaccessible places, lift and carry outsized articles without regard for dimensions, operate in construction and logging with no requirement for access roads, and can furnish transport literally from point (with or without landing at either point), in weather where fixed-wing airplanes cannot operate and even surface movement is difficult. These machines can find and operate with (or against) submarines, equipped with automatic hover, automatic navigation; can lay marine or land mines, or sweep them, in day, at night, or in almost any weather.

The helicopter has saved many lives, and Igor Sikorsky was always very proud of this. Many have been saved by rapid transport of injured people to medical facilities, in peace and in war. At least 10,000 lives have been saved by rescue operations from floods, off of ships in distress, from hurricanes, from behind enemy lines, in good weather and bad, during day or at night.

Igor Sikorsky long felt that the helicopter can help solve many of the increasingly complex world problems. From our experience to date, it appears that, as usual, he was right.

This then is the legacy that Igor Ivan Sikorsky leaves the world, as the result of his lifelong dedication and creative efforts in

aviation. He was awarded membership in many organizations, many patents, and many honors. His was a life for which the people of the world should be very grateful.

In closing, a brief look at the man himself: He was soft-spoken-in my knowledge he never gave orders, but he made suggestions that were always worth listening to. He was courtly in an unassuming way-he always bowed on introduction. He retained a charming accent when speaking in English-and probably because he learned much of his English through reading the Bible, he always slightly accented the "ed" at the end of words. He was most considerate of others-he would wait often a considerable length of time until others, no matter how humble, finished speaking before even wishing them "Merry Christmas." Although shy, he was forceful in technical discussion.

Igor Sikorsky was a devoted family man, with five children: Tania, Sergei, Nikolai, Igor, Jr., and George.

Igor Sikorsky has been called a mystic, but I feel that he was a philosopher searching for the higher truths that should guide man if he is to continue to survive within the growing mismatch between technology and social consciousness. Aside from the *Story of the Winged-S*, he wrote three other books-some small but powerful: *The Message of the Lord's Prayer*, published in 1942 and reprinted in 1963; *The Invisible Encounter*, published in 1947; and *In Search of Higher Realities*, published around 1969.

In these books his insight into man's social capabilities was just as powerful as was his insight into man's technical capabilities. He felt that man is capable of overcoming the dichotomy between society and technology if he will seriously look to the Creator for guidance.

In 1969 a noted man long acquainted with him contributed a forward to a book on Igor Sikorsky in which he said, in part:

All of us who have known Mr. Sikorsky well enough to call him "Igor"-and a mere acquaintance would not encourage this familiarity because of his quiet unassuming dignity-admire him very much and greatly value his friendship. He is a truly unusual person. He is a genius. He has great natural ability. He has, throughout his life, increased his inherently high capabilities by study, observation, and analytical consideration. He is able, and willing, to

concentrate and think through. He is not only intelligent, but wise-a person who instinctively-without the necessity for conscious thought-does the kindly, the right thing. A true gentleman, of the old school.

His three greatest aeronautical achievements were the multi-motored airplane, the flying boat, and the practical helicopter. He spent a full lifetime in developing and producing each in its turn. Almost every possible problem and frustration was faced and overcome. A less courageous and determined man would not have succeeded, as he did, in any of the three areas.

He dared to dream dreams-to dream the near impossible-and he made those dreams come true.

Lt. Gen. James H. Doolittle, USAF (Ret.)

For those of us who knew Igor Sikorsky, we can only comment, "Well and truly said."

Igor Ivan Sikorsky was a whole man, one who it was a privilege to work with and to know. He will long be admired, respected, and loved.