



# Sikorsky Archives News

January 2025

Published by the Igor I. Sikorsky Historical Archives

Sacred Heart University, West Campus Room 161D, 3135 Easton Turnpike, Fairfield, CT 06825

## Sikorsky Builds Big — the S-56



*The Sikorsky S-56 (here the US Marine Corps HR2S-1) was the biggest, most powerful helicopter in the West for a decade.  
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Soon after the Second World War, US Marine Corps Lt. Col. Edward Dyer visited Bridgeport, Connecticut and told Igor Sikorsky of the need for a shipboard helicopter to carry 5,000 lb loads on amphibious assaults. Sikorsky reportedly declared, "We can build an airplane [helicopter] that will carry much more than that. We know how to do it. Take my word for it." The assault helicopter the Marines wanted to project combat power from the sea became the S-56 -- the HR2S or CH-37 in US military service. The big Marine Deuce and Army Mojave began production in the then-new Sikorsky Aircraft Stratford factory and provided the engineering and operational foundation for even more capable helicopters to come.

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The twin-engine Deuce ultimately served with only two Marine squadrons and deployed aboard ship only once in squadron strength. The fast, noisy giant nevertheless went to war in Vietnam and remained the biggest, most powerful helicopter in the free world for a decade. Sergei Sikorsky reflected, "It proved the idea that a large, single-rotor helicopter could lift as much as a large, twin-rotor machine. The single-rotor configuration could -- and would -- be more compact than a twin-rotor helicopter." He added, "For the Marine Corps, Sikorsky proved that an automatically-folding main rotor was possible, even for helicopter rotors as large as the S-56."

The impetus for the S-56 started when General Roy Geiger, commander of Fleet Marine Forces Pacific, witnessed the atomic bomb test at Bikini Atoll in September 1946 and recognized the threat such weapons posed to massed assault fleets. A Marine board considered huge flying boats to extend the standoff range of landing forces but ultimately issued a 1947 report, *Military Requirements of Helicopters for Ship-To-Shore Movement of Troops and Cargo*. The report envisioned "vertical envelopment" landing Marines behind defended beaches with two types of helicopters: an assault transport to carry 15 to 20 Marines and an even bigger heavy lifter to deliver combat cargo. The Marines approached Igor Sikorsky and Frank Piasecki to grow their signature single- and tandem-rotor helicopters.

The 5,500 lb Sikorsky S-51 (HO3S-1) observation helicopter shuttled a few Marines at a time from the carrier USS Palao to Camp Lejeune, North Carolina in 1948. The 7,200 lb S-55 (HRS) interim transport helicopter went to Korea in 1951 and carried up to eight Marines in land-based operations. The Navy issued a specification for a 20-seat Marine assault helicopter in September 1950. On December 31, 1950, Sikorsky responded with two proposals, one for a more conventional S-56A (XHR2S-A) with five-bladed main rotor and anti-torque tail rotor and the other

for a compound S-56B (XHR2S-B) with thruster or tractor propellers and lifting wings that folded for deck storage. Both were offered with either familiar Pratt & Whitney R-2800 radial piston engines or experimental Allison XT-38-A-2 turboshafts.

Sikorsky drawings depicted commercial airliners based on the turbine-engine compound helicopter. Igor Sikorsky wrote in *The Story of the Winged S*, "There is no doubt that helicopters carrying up to fifty passengers, and when necessary, even more, powered by several engines or turbines, will make their appearance in the immediate future and will prove very useful for a number of military missions, as well as for air transport services."

Sikorsky's XHR2S-B mockup modeled a 31,000 lb helicopter big enough to carry 26 Marines -- two combat assault squads -- or 24 casualty litters. The 68 ft diameter, five-bladed main rotor and the tail rotor pylon folded to save deck and hangar space aboard ships. Nose doors let jeeps drive in and out. A monorail crane carried a ton of cargo from clamshell nose to cabin side door, and a cargo hook could carry 10,000 lb sling loads. The pilot and copilot of the new helicopter sat on a flight deck accessed from the cabin by a folding ladder. In May 1951, Sikorsky Aircraft won a contract to build the lower-risk S-56A as the XHR2S-1 with reciprocating engines. Work began in Bridgeport on four test aircraft.



The S-56B mockup showed a compound helicopter with folding wings and pusher props.



Four S-56 test aircraft were built in Bridgeport

The S-56 first flew at Bridgeport on December 18, 1953 with Sikorsky pilots Jimmy Viner and Jim Chuddars. Sikorsky News in January 1954 reported a crowd of more than 500 on hand for the first official flight, including officers from all the armed services. The paper noted, "Sikorsky officials are currently preparing for construction of additional plant facilities in order to 'mass' produce the giant copter." The Army began testing an XHR2S as its YH-37 medium cargo helicopter at Fort Rucker in 1954.

The new Sikorsky headquarters in Stratford gave the company space to do more manufacturing in-house. Five-pointed magnesium hub plates forged in Massachusetts for the S-56 main rotor, for example, were precision-machined, inspected, polished, and corrosion-coated in Stratford. In April 1955, Sikorsky News reported, "Approximately 200 employees of the Sikorsky Aircraft division of United Aircraft Corporation are scheduled to begin machine work of production parts for the S-56 in the new Stratford plant this month." With Sikorsky Bridgeport busy building S-58s, the Stratford factory filled with S-56s and the last S-55s. Nelson H. Downs, assistant to Sikorsky general manager Bernard Whelan announced full-scale S-56 production was expected by January 1956.



The XHR2S-1 flew for the first time at Bridgeport in 1953.

## Shake, Rattle, and Fly

The 250-acre Sikorsky site in Stratford was dedicated formally on March 26, 1955. Future Sikorsky president Bill Paul joined the company that year as a machine operator but became an engineering aide after a year of night school. He recalled, "My job was to measure the vibration of



Igor Sikorsky posed with pilots Jimmy Viner and Jim Chuddars in early 1954.



*Sikorsky envisioned compound helicopter airliners based on the S-56.*

every helicopter that was up for production.” The YH-37 test program at Fort Rucker had recorded vibrations three to five times Army specifications, depending on airspeed. “There’s no helicopter that I know of, maybe there was one before my time, that had a vibration problem like this,” Paul recalled. “It was so bad, the instrument panel was bouncing off its shocks, and debris was coming up from behind it.”

Flight testing also revealed a disturbing tail shake at 80 to 100 kt. “It was like someone was pushing on the tail of the helicopter,” said Paul. “It was going back and forth.” The young engineering aide rode in several S-56 test aircraft. “I realized in one of the helicopters there was no tail-shake, whereas in every one of the others, there was.” Paul noted the S-56 tail rotor tips were in line with the main rotor wake and looked for some difference in the more stable test helicopter. “It turned out there was an instrument can on top of the rotor system that may have been blocking that disturbance.” Paul suggested testers take the device off the straight-flyer and put it on an aircraft with tail-shake. “Lo and behold, it went away. I developed what they called ‘the beanie.’ I ended up patenting that, and every helicopter got one. I got \$300 bucks for it.”

The common-sense analysis launched Bill Paul’s career. “When I took the information back to Ken

Mard, the engineer I had been assigned to, he took it to Michael Gluhareff who at that time was the director of engineering. He asked me questions, and I couldn’t tell him ‘Why,’ just the observations of what I saw.” Gluhareff called chief of research Phil Michel and said, ‘This young man with one year of engineering study at night has solved your problem.’ They all laughed at that.”

More complicated were persistent S-56 vibration problems. “Everybody came over to Stratford to solve the problem, recalled Bill Paul. “Phil Christopher, head of the dynamics group and head of flight test, took skin off the aircraft to raise the frequency of the aircraft. They took a lot of skin off around the transmission; nothing happened. Another thing he wanted to do was to loosen the bolts connecting the main rotor to the aircraft. And I had to fly around with all these crazy things.”

S-56 engineers tried a series of vibration absorbers. “The vibration from the rotor was right in synch with the natural frequency of the aircraft,” said Paul. “We decided to change the natural frequency of the aircraft.” The first attempt put 2,000 lb of weight under the S-56 pilot’s seat and in the clamshell doors up front. The mass was reduced to 300, 80, and finally 40 lb in the helicopter’s nose. Sikorsky engineers took the weights down to Fort Rucker to show the Army their interim solution. “It wasn’t the final answer, but we showed them we were on the way to the answer.”

Bill Paul and others turned their attention to the S-56 main rotor. “I said to Ken, if we could find a way of stopping the vibration at the rotor head with something, the vibration wouldn’t be in the aircraft.” Mard looked at industrial vibration reducers and researched bifilars commonly used on crankshafts. The S-56 bifilar put four moving weights in the center of the rotor head tuned to counter the vibration. It was the first application of a bifilar on a helicopter. “From that point on, we used it on other helicopters as well,” explained Bill Paul.

When the first production HR2S-1 rolled off the Stratford line in October 1955, the S-56 had a 72 ft diameter main rotor, stiffer vertical fin with dorsal fillet, an all-moving horizontal tail, and 2,100 hp engines restricted to 1,725 hp normal takeoff power and 1,380 hp in cruise. Pilots had two sets of throttles -- twist grips to make coarse power adjustments and an overhead throttle quadrant to balance the torque of the engines. "

Much of Sikorsky's S-56 workforce was in place by May 11, 1956 when Marine Major Roy Lee Anderson and company assistant chief of flight test Robert Decker flew the aircraft from Stratford to Marine test squadron HMX-1 at Naval Air Test Center Patuxent River, Maryland. The 236-mile flight lasted 2 hours, 36 minutes and averaged 101 mph ground speed. On 10 November 1956, Anderson and Sikorsky pilot Robert Duke took an HR2S-1 to 7,000 ft with a 13,250 lb payload and



*The HR2S-1 embarked aboard USS Tarawa for deck trials.*

12,000 ft with an 11,050 lb payload, breaking a record set by the Soviet tandem-rotor Yak-24.

Nine days later, an HR2S-1 piloted by Anderson set a new world's helicopter speed record at 162.7 mph (142 kt) despite turbulent cross winds and the loss of the pilots' window escape panel. The decorated Anderson later retired from the Marine Corps and joined Sikorsky, becoming flight operations coordinator in 1963 when Bob Decker rose to chief test pilot.

Despite the power and potential of the big Deuce, Marine testers found the advanced S-56 automatic stabilization equipment (ASE) with its attitude- and heading-hold functions unreliable. Still-high vibration took a toll on cockpit instruments. Hydraulic rotor folding was prone to failures. Reciprocating engines consumed oil and needed frequent overhaul. Turboshafts promised more power in lighter engines with less vibration. In 1955, the Navy ordered more piston-engine Sikorsky S-58s (HUS-1s or H-34s) to lift Marine assaults until the arrival of turbines.

Marine plans called for nine HR2S squadrons with 20 helicopters each, but budget cuts trimmed the program to just three medium-lift helicopter squadrons, one quickly disestablished. The Navy Bureau of Aeronautics in 1957 launched



*Roy Anderson and Bob Decker set a world speed record in the HR2S-1 1956. (Fédération Aéronautique Internationale)*



*Stratford delivered the 100th S-56 in 1958, here with factory manager Alex Sperber, engineering manager Michael Gluhareff, general manager Lee Johnson, and Air Force Lt. Col. Charles Wilkins.*

an HR2S-1 Fleet Introduction Program at Quantico that flew 200 hours to familiarize Marines with the big new helicopter. Full-scale training began with Marine Medium Helicopter Squadron 461 at New River, North Carolina in January 1957. HMR(M)-462 was commissioned at Santa Ana, California that November. The Navy tested two HR2S-1W with big nose radars in 1957, but the airborne early warning helicopter never reached production. Sikorsky celebrated delivery of the 100th S-56, a Marine HR2S-1, on August 28, 1958 and transferred the last of 55 production Deuces to the Marines in 1959.

Marine HR2S-1s became CH-37Cs in 1962, and Marine Medium Helicopter Squadrons were redesignated Heavy Helicopter Squadrons. CH-37Cs went to sea with CH-34s in the Caribbean Ready Force. Starting in September 1965, Marine Deuces carried troops, food, and ammunition in Vietnam under the callsign Junkman. Sikorsky News reported that by May 1967, the helicopters had hauled 31,000 passengers and 12.5 million pounds of cargo. The Deuce retired in Vietnam in 1967 as the twin-turbine S-65 (CH-53A) joined the Marines.



*The Navy tested the HRS2S-1W with a large radome for airborne early warning.*

## Airmobile Army

The US Army took delivery of its first CH-37A in December 1956 at Fort Rucker and showed the Mojave could airlift big loads including a Little John rocket launcher with launch crew and tow jeep internally. The big helicopter also sling-lifted the CH-34 and other downed aircraft. In February, 1958, the 4th Transportation Company (Medium Helicopter) at Fort Benning, Georgia became the first field unit equipped with the CH-37A. Sikorsky News reported in July 1958 on Project AMMO where three Mojaves sling-lifted a nuclear-capable Honest John rocket and launch equipment at Fort Bliss, Texas and White Sands, New Mexico.



*The Army CH-37A carried heavy external loads such as the M50 tracked vehicle.*

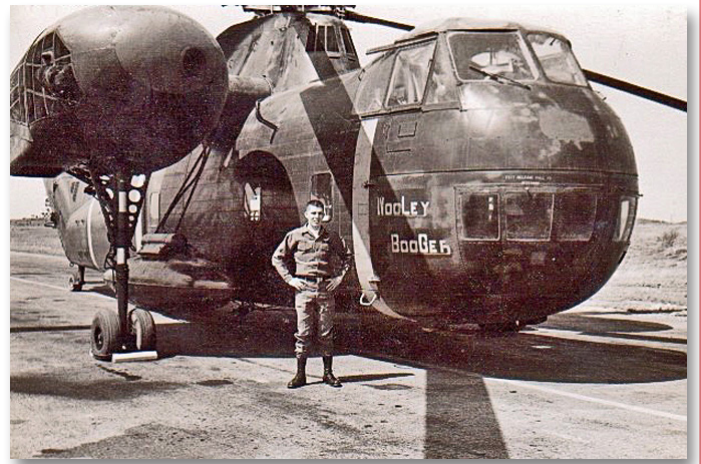


*The Army Mojave deployed to Germany and Korea could also deliver troops to air assault.*

Army aviator Jerry Ogles transitioned to the CH-37B at Fort Rucker. "I was a young officer with only the UH-1H and the H-23 as my past experience. Climbing into the cockpit of that huge machine seemed too good to be true. . . I even had to climb the ladder to mount the cockpit." Ogles went on to log 973 hours in the big Mojave and flew the CH-37B from June 1968 to November 1969 with the 19th Aviation Company at Camp Humphreys, Korea. Mojaves in Korea hauled classified warheads to forward artillery batteries along the Demilitarized Zone, transported UN negotiators to and from Panmunjom, and returned sailors from the captured spy ship Pueblo when released by North Korea.

Ogles ferried the last Mojave from Korea to Japan for retirement in the United States. He recalled, "I really liked the ASE system that allowed me to fly from Pusan to Fukuoka without touching the controls – making only minor corrections for heading in the 'yaw' channel. [The CH-37B] had great fuel range with auxiliary tanks. It was stable and fast for that period of time. Yes, it was noisy, but I was enamored enough with the aircraft to consider that a bonus – young and crazy, I suppose." Ogles concluded, "After 40 years of military flight training, the CH-37B is still my favorite of all aircraft."

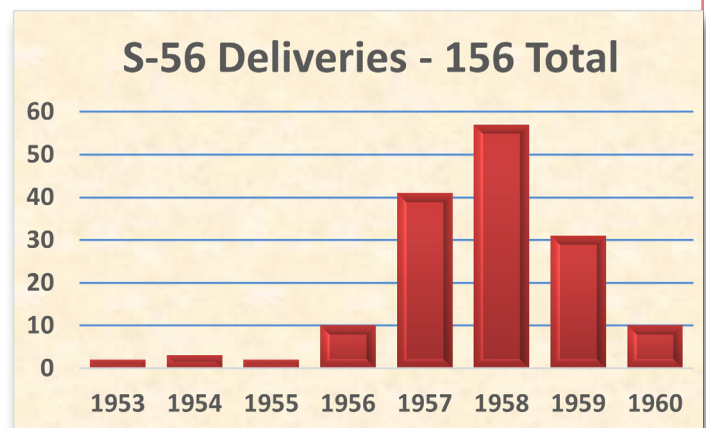
Army CH-37Bs sling-lifted downed aircraft in Vietnam from 1963 to 1966. The Mojave retired from Army National Guard service in 1969, its place in Army aviation taken by the Sikorsky S-64 and the tandem-rotor Chinook. Military



*Jerry Ogles flew this retiring CH-37B, The Wooley Booger, from Korea to Japan in 1969. (Bishop Jerry Ogles)*

CH-37s were acquired by Keystone Helicopters and modified for commercial crane work – one positioned 9,200 lb transmission towers in the hills of West Virginia.

In a 1963 program update, Igor Sikorsky wrote of the S-56, "During the last two or more years of its production the military services rejected all our proposals for improvements. Subsequently the orders were discontinued, the services counting on the expected considerable superiority of the competing aircraft. Actually, I firmly believe that a turbinized version of the S-56 with a rear entrance door, a redesigned landing gear and only a few other minor modifications would, even today, be an incomparably better aircraft than the Chinook. It certainly would have warranted production of another two or three hundred aircraft."



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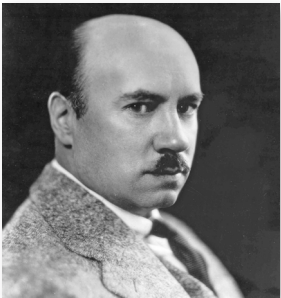
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*The Archives received this 3D-printed, life-sized statue of Igor Sikorsky, courtesy of the Sikorsky Digital Transformation department. The statue stands proudly at the entrance to our Sacred Heart Office.*

Prepared by Frank Colucci and John Bulakowski with graphic art and layout by Jodi Buckley.



“A minor mistake in a small airplane can be temporarily taken care of by the ability of the test pilot. However, the bigger the ship the less is the possibility of such correction, and the plane must be free from any pronounced defects, even in adjustment, from the very beginning.”

Igor Sikorsky, *The Story of the Winged S*

