



# Sikorsky Archives News

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## Sikorsky Builds Marine Corps Heavy Lift



*Sikorsky Aircraft made the U.S. Marine Corps vision of Vertical Envelopment real with progressively more capable helicopters.*

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Five years after the U.S. Marine Corps first practiced helicopter assault from the sea with S-51s (HO3S-1s), Sikorsky Aircraft flew a heavy lifter that started helicopter production at Stratford and the evolution of Marine expeditionary lift. The S-56 or XHR2S-1 flew for the first time at Bridgeport, Connecticut on December 18, 1953 with company pilots Jimmy Viner and Jim Chudars. It was the first twin-engine helicopter built for the U.S. military and the first with retractable landing gear, power-folding rotors for shipboard operations, and autostabilization equipment. The S-56 promised to concentrate, move, and sustain combat power from the sea. Though the big, fast Deuce never met Marine expectations, it led to heavy lift Sea Stallions, Super Stations, and today's King Stallion.



*The S-56 or XHR2S helicopter flew for the first time at Sikorsky's Bridgeport, Connecticut facility in December 1953. (Sikorsky Archives)*

In September 1946, the commander of Fleet Marine Forces Pacific, General Roy Geiger, witnessed the first atomic bomb detonation at Bikini Atoll and reported the threat such weapons posed to large assault fleets. A special board of Marine officers considered alternatives. In February 1947, a report on Military Requirements of Helicopters for Ship-To-Shore Movement of Troops and Cargo described an assault helicopter to carry 15 to 20 Marines and a bigger aircraft to haul combat equipment. Col. Edward Dyer



*Igor Sikorsky was on hand for the first XHR2S flight by Jimmy Viner and Jim Chudars. (Sikorsky Archives)*

visited Bridgeport and outlined the need for a helicopter to carry 5,000 lb. Enthusiastic Igor Sikorsky told him, "We can build an airplane [helicopter] that will carry much more than that. We know how to do it. Take my word for it."

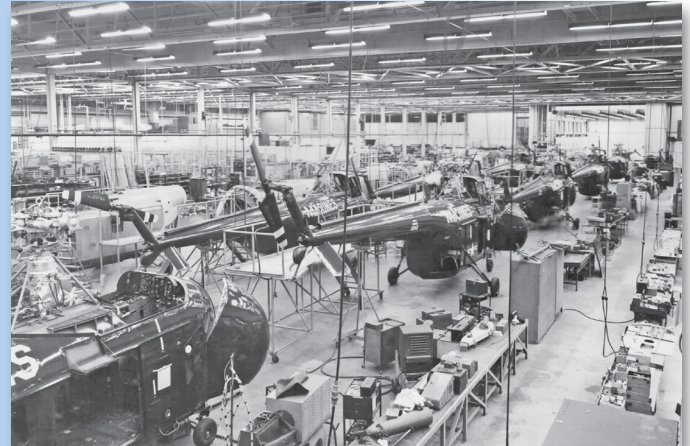
The Sikorsky S-51 (HO3S-1) first delivered to the Marines in February 1948 carried a useful load around 1,450 lb. Marine Helicopter Squadron HMX-1 that year used five of the light observation helicopters to shuttle 66 Marines and a few hundred pounds of equipment from the aircraft carrier U.S.S. Palau to Camp Lejeune, North Carolina. In 1950, HO3S-1s flew combat medical evacuation and resupply missions with Marine Observation Squadron VMO-6 in Korea.



*The S-51 (HO3S-1) was used extensively in the Korean conflict*

The Sikorsky S-52 (HO5S-1) replaced S-51s in the light helicopter squadrons in 1952.

With their objective heavy lifter still years in the future, the Marines ordered the Sikorsky S-55 (HRS-1) in 1950 and commissioned their first Medium Helicopter Squadron in 1951. HMR-161 took HRS-1s to Korea and began operations in support of the 1st Marine Regiment in August 1951. In successive operations, HRS-1s and -2s moved troops and rocket launchers, and by the armistice, HMR-161 had flown more 18,000 sorties demonstrating Marine air mobility in combat.



*Bridgeport made S-55s for all the US armed services. Here, the line is full of HRS-2s for Marine medium lift squadrons. (Sikorsky Archives)*



*The medium S-55 or HRS-1 gave the Marines air mobility in Korea with HMR-161 (Sikorsky Archives)*



*The Sikorsky S-52 or HO5S-1 flew Medevac and resupply missions with Marine Corps squadron VMO-6 in Korea (Sikorsky Archives)*



*Marine Helicopter Squadron HMX-1 was the test unit for helicopter development. Here, an S-55 or Marine HRS flies with floats for water landings. (Sikorsky Archives)*





The 1,000th S-55, a Marine HRS is inspected by Igor Sikorsky and company general manager Bernard Whelan. (Sikorsky Archives)

In May 1951, Sikorsky won a contract for the S-56 (HR2S-1), a powerful, long ranged, instrument flight capable helicopter to insert Marines behind the enemy and exploit terrain and surprise with “vertical envelopment.” The challenges of a marinized heavy lift helicopter able to fly at night and in adverse weather led the Marines to order the 14,000 lb Sikorsky S-58 (HUS-1/CH-34) in 1954. The Marine HUS-1 entered service in February 1957. Operation Shufly first sent Marine Medium Lift Squadron HMM-362 to South Vietnam with CH-34s in 1962. The Marines ultimately bought more than 600 S-58s, and the hard working HUS was not retired altogether until 1972.



The S-58 or HUS-1 was the Marine medium lift helicopter early in the Vietnam war. (Sikorsky Archives)

## Deuces Wild

As an assault helicopter, the 31,000 lb XHR2S was big enough for 26 Marines -- two combat assault squads -- or 24 casualty litters. Nose doors let jeeps drive in and out. A monorail crane carried a ton of cargo from clamshell nose to aft side door, and a belly hook could carry 10,000 lb sling loads. Sikorsky initially proposed a traditional S-56A with piston engines and a compound S-56B with turboshaft propulsion, thruster or tractor propellers, and lifting wings. With jet engines in short supply, the Marines bought the conventional helicopter with five-bladed main rotor and 1,900 hp Pratt & Whitney R-2800 radial piston engines like those in Corsair fighters of World War II.

Sikorsky's new 250-acre home in Stratford, Connecticut was dedicated on March



Marines board an S-58/UH-34D aboard the aircraft carrier USS Bennington in 1963. (US Navy)



Sikorsky mocked up the S-56B with pusher turboprops and folding wings. (Sikorsky Archives)



26, 1955. S-56 production brought previously outsourced manufacturing under the new roof. Five-pointed magnesium rotor head stars forged in Massachusetts, for example, became the first hub plates precision machined, inspected, polished, and corrosion coated in house.



*The HR2S-1 lifts a Sikorsky HUS (S-58) in a downed aircraft recovery exercise. (Sikorsky Archives)*

Much of the S-56 workforce was in place by May 11, 1956 when Marine Major Roy Anderson and Sikorsky assistant chief of flight test Robert Decker flew from Stratford to Naval Air Test Center Patuxent River, Maryland to deliver the first HR2S-1. The 236 mile flight lasted 2 hours, 36 minutes and averaged 101 mph ground speed. On 10 November 10, 1956, Anderson and Sikorsky pilot Robert Duke flew an HR2S-1 to 7,000 ft with a 13,250 lb payload and 12,000 ft with an 11,050 lb payload, breaking a record set by the Soviet tandem rotor Yak-24. Nine days later, an empty HR2S-1 set a new world's helicopter speed record at 162.7 mph (142 kt).

By the time the first HR2S-1 was delivered for testing by HMX-1 at Quantico, Virginia, the big helicopter was in production configuration with 2,100 hp engines, a 72 ft diameter main rotor, and other refinements. However, S-56 automatic stabilization equipment with attitude and heading hold was unreliable. Intense vibration took a toll on cockpit instruments. Reciprocating engines guzzled oil and needed frequent overhaul. Hydraulic rotor folding was troublesome.



*The HR2S flew its shipboard trials aboard the USS Tarawa in 1956 and deployed aboard ships to support the Caribbean Ready Force starting in 1962. (Sikorsky Archives)*

HMR(M)-462 was commissioned at Mojave California as the second and last Deuce squadron. The S-56 joined the Army as the CH-37A in 1956. Sikorsky delivered the 100th S-56, a Marine HR2S-1, in 1958 and the last of 55 production Deuces to the Marines in 1959. The Marine HR2S-1 became the CH-37C, and Deuce squadrons became Marine Heavy Helicopter Squadrons in 1962.

CH-37Cs went to sea with the Caribbean Ready Force and to war in Vietnam. Their primary mission in the combat theatre was hauling troops, food, and ammunition internally. By May 1967 when "Junkman" operations ended in Vietnam, Deuces had moved 32,000 passengers and 12.5 million pounds of cargo.



## Sea Stallions



*The first operational CH-53As were delivered to HMH-463 on September 12, 1966 for the Fleet Introduction Team (Sikorsky Archives)*

When the Navy withdrew from tri-service XC 142 tilt-wing turboprop development, the Marines sought a CH-37C replacement with power to move heavy cargo and recover downed aircraft. Turboshafts with high power-to-weight ratios promised to revolutionize helicopter performance. The Navy sponsored development of the General Electric T64 turboshaft/turboprop first run in 1959. Sikorsky won the



*Marine CH-53As went to Vietnam in 1967. Here, one delivers barbed wire to protect the Marine outpost at Con Thien. (Sikorsky Archives)*

Heavy Helicopter Experimental competition in August 1962 with the S-65 (CH-53A).



*A CH-53A sling-lifts a 105 mm artillery piece to An Hoa, Vietnam during Operation Sussex Bay, summer 1968. (US Marine Corps/Sikorsky Archives)*



*The CH-53D with -413 engines upped the Sea Stallion gross weight to 42,000 lb. (Sikorsky Archives)*





*CH-53D production at Stratford delivered 124 improved Sea Stallions to the Marines, plus export aircraft for Israel and Austria. Similar CH-53Gs were co-produced in Germany. (Sikorsky Archives)*

The new 35,000 lb helicopter had two T64-GE-3 engines to drive a six-bladed main rotor, 72 ft in diameter. Though largely aluminum structure like the S-56, the S-65 made extensive use of titanium in place of heavier steel for dynamic and structural components. Sikorsky News noted CH-53A hub plates were the largest titanium forgings used to date in helicopters and reported the introduction of numerically controlled milling machines and chemical milling at Stratford. The CH-53A also made early use of composite materials with fiberglass cockpit canopies in place of metal.

The first five production helicopters with 2,850 shp T64-GE-6 engines were delivered



*The CH-53D carried Marines and cargo in Afghanistan until it was retired in 2003. (US Navy)*

ered to HMH-463 at Santa Ana, California in September 1964 for a Fleet Introduction Team. The squadron took CH-53As to Vietnam in January 1967, and by the end of the year, the 36 helicopters in theater had retrieved 370 downed aircraft. The Marines ultimately received 138 CH-53As.

The baseline S-65 was powerful, fast, and agile. On October 23, 1968, a CH-53A flown by Marine Lt. Col. Robert Guay and Sikorsky pilot Byron Graham flew loops and rolls over Long Island Sound. The first CH-53D with 3,925 shp T64-GE-413 engines, uprated transmission, seats for 55 troops, and other improvements was delivered to the Marines in March 1969. In May 1970, Sikorsky began work on S-65 Improved Rotor Blades (IRBs) with titanium spars bonded to aramid honeycomb and wrapped in fiberglass. The wide-chord IRB with new airfoil and twist hiked the CH-53D gross weight to 42,000 pounds. In 1972, Sikorsky introduced an elastomeric rotor head that eliminated oil lubrication and cut parts count by 30%. Elastomeric hubs were retrofitted to in-service CH-53Ds, T64 engines were uprated to 4,100 shp -416 and finally 4,500 shp -419 standards.



*The CH-53E used the power of three T64 engines and seven main rotor blades to haul heavy cargo for the Marines. (Sikorsky Archives)*





*The CH-53E Super Stallion entered service in 1981 and remains in eight active and one reserve HMH squadrons. (Sikorsky Archives)*

The CH-53A and -53D served widely with Marine squadrons on land and assault ships. The Marines ultimately received 124 CH-53Ds. Delta model Sea Stallions hauled evacuees from Saigon to ships in 1975, carried air assaults in Desert Storm, and moved Marines in Afghanistan until the last retired with HMH-363 in 2012. The air-refuelable S-65 also spun off US Air Force rescue and Special Operations helicopters and Navy minesweepers. S-65C export versions still serve Germany, Israel, and Iran.

## Super Stallions

In late 1970, the Marine Corps broke with joint-service Heavy Lift Helicopter plans and received Congressional approval for a three-engined, seven-bladed stretch of the twin-engined, six-bladed CH-53A/D. The CH-53E (S-65/S-80) Super Stallion with three T64-GE-416 engines was to carry 16-ton external loads to support amphibious assaults and recover downed aircraft, including the CH-53D. It would more than double the external load of the CH-53D in a deck footprint

just 10% larger than its predecessor. The Navy simultaneously wanted a heavy-lifter for Vertical On-Board Delivery to aircraft carriers. In January 1973, Sikorsky News quoted Naval Air Systems Command project manager Colonel F. M. Kleppsattel, "The CH-53E will solve most of the heavy lift requirements of the Marine Corps and Navy during the foreseeable future."

The CH-53E production contract came on February 27, 1978, and the first production helicopter joined HMH-464 at New River, North Carolina in 1981. Composite medium lift squadrons are reinforced with heavy lift detachments when deployed. HMM-162 was the first to take CH-53Es overseas when it went to Beirut in 1983. The Super Stallion became essential to full-spectrum Marine operations. In September 1989, HMH-461 deployed CH-53Es to Puerto Rico for Hurricane Hugo relief. In 1990 and 1991, Operations Desert Shield and Desert Storm saw CH-53Es of HMH-464, -465, and -466 move Marines and cargo to liberate Kuwait.

CH-53Es extended the reach of MEU (SOCs) [Marine Expeditionary Units (Special Operations Capable)]. Marine Major, today Sikorsky President, Dan Schultz led two CH-53Es on a 900 nm round-trip from USS Trenton to the besieged US embassy in Mogadishu, Somalia during Operation



*The CH-53K Heavy Lift Replacement helicopter was designed to carry about three times the load of the CH-53E yet fit the same deck footprint. (US Navy)*



Eastern Exit in 1990. The helicopters inserted Navy SEALs and Force Recon Marines to secure the compound and extracted 61 multi-nationals to Navy ships with three air refuelings – two at night. Five years later, CH-53E crews rescued a downed Air Force pilot from Bosnia and returned him to the USS Kearsarge.

In Operations Enduring Freedom and Iraqi Freedom, and subsequent actions, Super Stallions provided the power to move and resupply forces at high density altitudes. Sikorsky delivered the last of 180 CH-53Es in 2003. The Marine fleet has since received night visionics and navigation, communications, and survivability upgrades. The Marines now expect to “sundown” the CH-53E in 2032 when they achieve full operational capability with the new CH-53K.

## King Stallions

The Sikorsky S-95 or Marine CH-53K Heavy Lift Replacement helicopter started as a low-risk derivative of the CH-53E. It emerged as an all-new technology helicopter to fit the Super Stallion deck footprint yet carry nearly three times the payload to high and hot landing zones. The 88,000 lb King Stallion was also designed to enhance survivability and cut operating costs compared to its predecessor, and to provide digital connectivity in a networked battlespace.

Marine requirements called for a Heavy Lift Replacement helicopter able to haul 27,000 lbs over 110 nm high and hot. The King Stallion has three fuel-efficient 7,500 shp General Electric T408-GE-400 turboshafts to



*The CH-53K line in Stratford is filling with low rate initial production. (Sikorsky Archives)*





*The CH-53K undergoing air to air refueling tests behind a Lockheed Martin KC-13. (Sikorsky Archives)*

drive a split-torque gearbox that packs 30% more power in a CH-53E-sized transmission. To fit assault ships, the CH-53K main rotor matches the 79 ft diameter rotor of the '53E, but wider-chord, drooped-tip, fourth-generation all-composite rotor blades generate 30% more lift and ride a titanium hub designed for on-condition maintenance.

King Stallion main rotor blades are the largest all-composite helicopter blades ever made by Sikorsky with fiberglass skins covering honeycomb cores and graphite spars 30 ft long. By wetted area, the CH-53K is more than 75% fiber reinforced composites. Fly-by-wire flight controls optimize CH-53K handling with heavy loads and in degraded visual environments. An integrated "glass" cockpit manages crew workload.

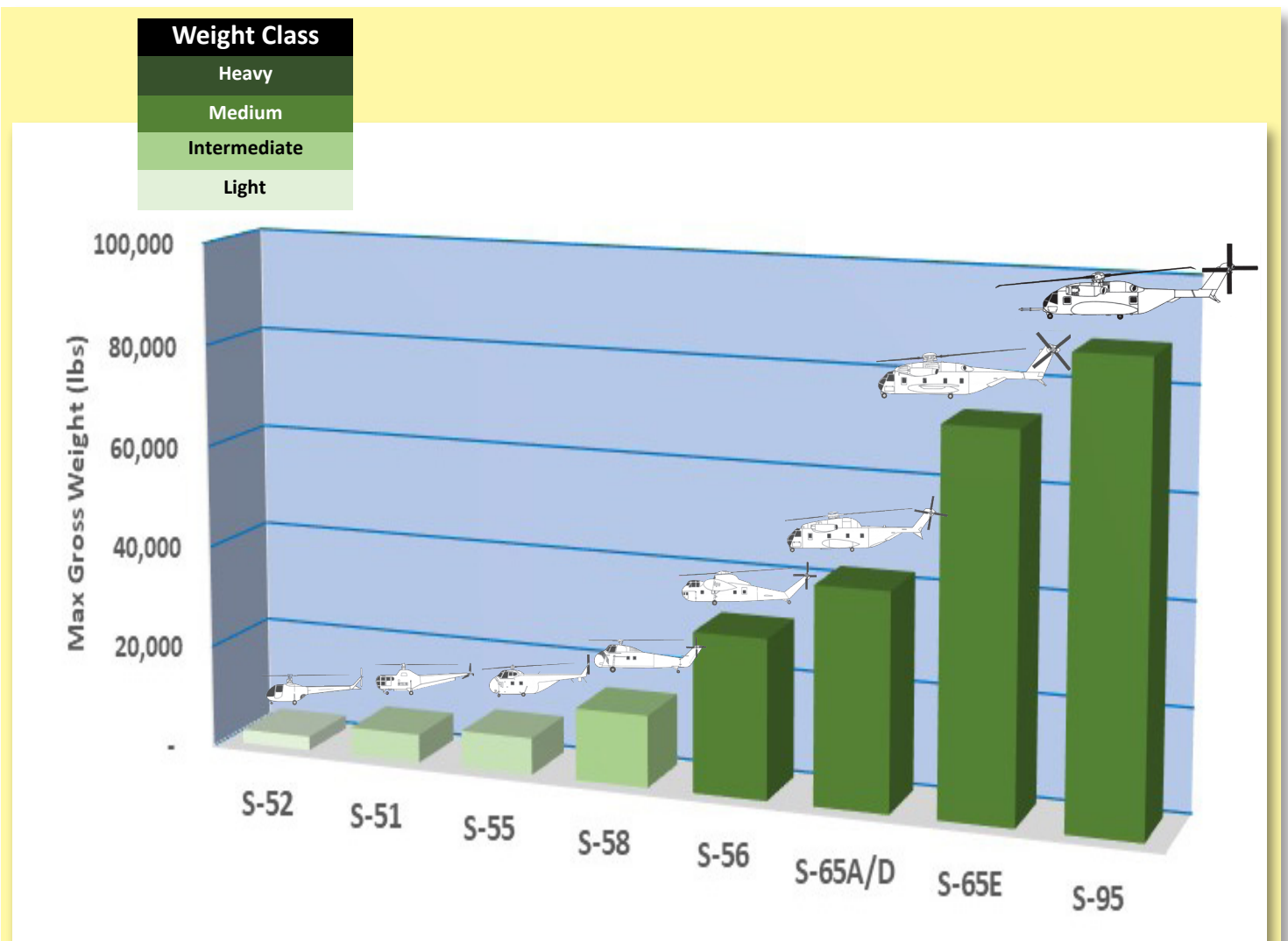
Sikorsky received the CH-53K System Development and Demonstration contract in April 2006 and opened its Heavy Lift Development Center in Stratford in February 2007. King Stallion parts were designed, fabricated, and integrated in a virtual environment that accelerated assembly of the real helicopter.

Stratford facilities static tested the CH-53K airframe, whirl-tested King Stallion rotor blades, and integrated the glass cockpit of the new heavy lifter. A new 60,000 sq ft hangar at the Sikorsky Development Flight Center (DFC) in West Palm Beach, Florida opened in 2012 to assemble and house King Stallion test aircraft. Four CH-53K Engineering Development Models (EDMs) and a fully functional Ground Test Article were assembled in Florida.



EDM-1 hovered for the first time at West Palm Beach on October 27, 2015. CH-53K Low Rate Initial Production aircraft are on the production line today in Stratford. The Marine Corps plans 200 King Stallions to equip eight active duty squadrons, two reserve units, and one training squadron, and Sikorsky's latest heavy lifter is competing for international orders.

The Marine Corps is refocusing from fighting extremism in the Middle East to peer-level conflicts with emphasis on the Indo-Pacific region. Warfighting scenarios are turning from inland to littoral battlespaces. The joint service Future Vertical Lift initiative may give future Marines a fast, long ranged Attack Utility Replacement Aircraft (AURA) based on Sikorsky X2 technology. Whatever and wherever the conflict, the expeditionary Marines will still depend on vertical lift. Sikorsky helicopters were the first to give them forceful, flexible lift from the sea, and they will remain central to the Marine Corps' evolving mission.



The maximum gross weight of Sikorsky helicopters for the Marine Corps has increased by over 85,000 pounds since the first delivery of the S-52. (Sikorsky Archives)



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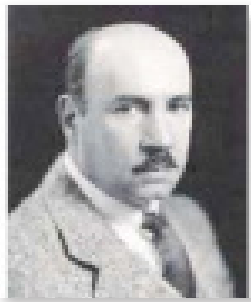
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*John Travolta, Master of Ceremonies, with Sergei Sikorsky on January 16, 2020. Sergei was awarded the Elling Halvorson Vertical Flight Hall of Fame Award. (Sikorsky Archives)*

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



*“I forsee the creation of vast new detachments of air cavalry capable of landing large groups of men behind the fighting lines.”*

Igor Sikorsky – 1940

