



# Sikorsky Archives News

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## Sikorsky Helicopters Catch and Release



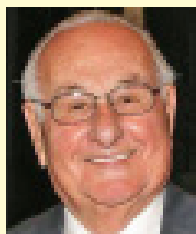
*Sikorsky S-61R, S-65, and S-70 helicopters have flown mid-air retrieval missions to capture Unmanned Air Vehicles. (Sikorsky Archives)*



Long before spaceplanes and reconnaissance drones could land themselves reliably, Sikorsky helicopters recovered satellite capsules from the sea and snagged unmanned aircraft in flight. Sixty years ago, an S-55 hoisted from the Pacific the first object ever returned from space. Mid-air retrieval and more ambitious sea recovery missions used S-56s, S-58s, S-61s, and S-65s. Sikorsky S-70s (Navy MH-60S Knighthawks) still fish target drones and training torpedoes from the sea. However, mid-air retrieval by helicopter still plays in commercial space launch plans, and heavy-lift S-64s or S-65s may again catch parachute loads in flight.

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Dear Members, Donors and Volunteers,

As we enter a new year, I sincerely thank all for your hard work and support in 2020 and wish everyone a Very Happy and Healthy 2021.

My message last year looked forward to a number of events for 2020, including our transition to the University of New Haven (UNH) and the continued use of Sikorsky volunteer employees in the digitization, categorization and display of our data. Unfortunately, the situation changed drastically with the emergence of the pandemic. The impact postponed our planned move to UNH and severely limited the efforts of the volunteers. We implemented remote working and restricted the onsite operations.

It has been a challenge, but I'm glad to report that we were able to continue to be responsive to many domestic, international and Sikorsky queries about Igor Sikorsky and his legacy.

We will continue to be diligent and compliant to the COVID-19 situation and look positively to 2021 allowing us to fully resume our mission.

On the lighter side, I reached my 9th decade on November 11th and was honored with a surprise virtual birthday party that was attended by over 40 of my past and present associates and friends. I was honored to see so many faces from my years of association with Sikorsky.

Again, stay well and thank you for your support.

Happy New Year!

*Dan Libertino*  
Dan Libertino

Months before Igor Sikorsky first flew his VS-300 helicopter in 1939, All American Aviation began experimental airmail services using fixed-wing aircraft trailing hooks to snatch postal pouches from the ground. C-47 Dakota transports likewise retrieved grounded gliders during World War II. When the Cold War demanded imagery from behind the Iron Curtain, the Corona Program developed Discoverer satellites to photograph Soviet sites from orbit and parachute film capsules into the Pacific. Ground-to-air retrieval became mid-air retrieval as Air Force C-119 transports were deployed made by the renamed All American Engineering Company. The aircraft trailed hooks on poles to snag the cap-

sule parachute, payed out cable to dissipate energy, and winched parachute and film capsule through the aft door of the Flying Boxcar.



*A Navy HO4S (S-55) from the USNS Haiti Victory hoisted the first object ever returned from space in 1960.  
(Sikorsky Archives)*



However, when Discoverer 13 ejected a 120 lb test capsule from orbit on August 11, 1960, the payload fell into the Pacific Missile Test Range about 190 miles north-northwest of Honolulu, Hawaii and out of sight of the recovery planes. A Sikorsky S-55 (Navy HO4S) from the wartime Liberty Ship Haiti Victory dropped divers who attached the floating capsule to the helicopter hoist. The helicopter took the capsule aboard. President Eisenhower later received an American flag that was carried by the spacecraft.

## No Hard Landings

A Sikorsky S-58 (Marine Corps HUS-1D) recovered sub-orbital astronaut Alan Shepard and his Freedom 7 spacecraft after an Atlantic splashdown in 1961. In 1962, White Sands Missile Range, New Mexico, experimented with using a twin-engine S-56 (Army CH-37B Mojave) to retrieve parachuted payloads in mid-air and protect instruments and structures from impact. The winch from the Air Force C-119 was modified and installed in the Army Mojave. Two 24 ft poles extended below the helicopter to hook the payload drogue chute. Catching the drogue released



*A Marine HUS-1D (S-58) recovered Mercury astronaut Alan Shepard and his Mercury capsule in 1961. (Sikorsky Archives)*

the main canopy, payed out cable through the helicopter floor, and braked the cable until payload and helicopter speeds matched and the winch could reel the payload under the helicopter for return.

In October 1963, the newsletter of the American Helicopter Society (AHS), reported a CH-37 had snatched a 2,500-pound parachute target to conclude the MARS (Mid-Air Retrieval System) program. Piston-engined helicopters were nevertheless power-limited for recovery missions. The S-58 that rescued astronaut Gus Grissom from his sinking Liberty Bell 7 had to jettison the spacecraft when the capsule grew heavy with water. An S-56 hit the ground in 1962 trying to recover a prototype reconnaissance drone at 8,000 ft in the Magdalena Mountains of New Mexico.



*The Army CH-37B (S-56) ultimately snagged 2,500 lb loads in mid-air retrieval tests at White Sands Missile Range in 1962 and 1963. (Sikorsky Archives)*

The Navy made its first astronaut pickup with the turbine-engined S-61 (SH-3A) when Mercury astronaut Scott Carpenter splashed down on May 24, 1962. The Sea King remained the astronaut recovery helicopter in all subsequent Mercury, Gemini, and Apollo missions but never had to lift a spacecraft. The Air Force put the S-61 (CH-3B) into service in March 1962, and in December 1963 the AHS Newsletter noted, "Sikorsky helicop-

ters are setting the stage, quietly but purposefully, for increased rotary winged participation in the United States space effort."



*The Air Force used its CH-3Bs (S-61) for drone recovery in 1962 and changed the Air Rescue Service to Aerospace Rescue Service in 1963 to acknowledge the space recovery mission. (Sikorsky Archives)*

The publication pictured a short-bodied Sea King hovering over a Firebee target drone and reported, "Three Air Force CH-3Bs, used in October to recover drones from the Gulf of Mexico in the biennial William Tell weapons meet at Tyndall Air Force Base, Panama City, Florida, are being outfitted at the Sikorsky plant for other space recovery duties." Air Rescue Service vice-commander Col. Theodore Tatum suggested the stretched S-61R (CH-3C) then in development might be an ideal space recovery helicopter. He noted, "Our problem is not only the pilot but also the capsule. We envision use of the new bird (CH-3C) first at Cape Canaveral in case of any difficulty there. . . CH-3Cs, with their range and speed, would be deployed around the world if enough of them are available."

The same AHS Newsletter issue reported a proposal made at a space rendezvous, rescue and recovery symposium at Edwards Air Force

Base, California. It suggested, ". . . a Sikorsky S-64 Skycrane could be used to make mid-air catches of Redstone space boosters, thus effecting 'substantial savings' in recovery and re-use of the rocket boosters." The story added, "Both National Aeronautics and Space Administration and Air Force officials have shown active interest in the helicopter's ability to catch aerial targets, particularly after the White Sands MARS program."

Sikorsky News in January 1964 reported first delivery of the CH-3C, and in early 1965 the Air Force tested MARS on the new helicopter. The Air Force never used mid-air retrieval for rocket boosters but it sent MARS helicopters to war in Southeast Asia in April 1966 to recover Remotely Piloted Vehicles (RPVs).

The 350th Reconnaissance Squadron deployed detachments including Lightning Bug jet reconnaissance drones with Hercules turboprop launch aircraft, initially at Bien Hoa and MARS helicopters at Danang, South Vietnam. The Remotely Piloted Vehicles (RPVs) penetrated North Vietnamese airspace, photographed five to 15 targets, and returned to safer skies to deploy two-tier parachutes. Hard



*Air Force CH-3Cs (S-61Rs) with MARS rigs went to Southeast Asia in 1966 and remained essential to reconnaissance drone operations over North Vietnam. (Sikorsky Archives)*



parachute landings damaged expensive cameras and reusable drones, so MARS CH-3Cs were sent to trap RPVs before they hit ground or water.



*The Navy has long used helicopters like this SH-3G (S-61) to recover target drones, but Medium Range UAV plans included MARS to avoid saltwater infiltration and lengthy cleanup between missions. (Department of Defense)*



*Three Air Force CH-53Bs (S-65s) were modified with MARS to support Air Launched Cruise Missile testing and drone experiments on the Utah Test Range. (National Archives)*

(future Sikorsky test pilot) Rus Stiles joined the 21st Special Operations Squadron and watched Buffalo Hunter H-3s arrive at Nakhon Phanom, Thailand. "That's the first time I ever heard about MARS," he recalled. "They had their own compound, very, very secretive – everything at that base was very secretive." Significantly, the secure area included a sawdust circle. "They'd bring the drone back externally, and they were so heavy they couldn't hover. They had to come in slow around translational lift speed and time it perfectly to drop the drone in the sawdust." MARS crews logged 2,655 successful recoveries out of 2,745 attempts, a 97% success rate. One crew reportedly made four captures in a day.

The Air Force 6514th Test Squadron subsequently used the bigger, more powerful HH-53 (S-65) to recover test drones and cruise missiles at the Utah Test and Training Range. Three HH-53Bs modified for MARS retrievals had their ramp door removed, a winch over

Two helicopters flew each mission in case the primary recovery aircraft missed or tore the RPV parachute. The capture helicopter would orbit at around 10,000 ft to allow several passes at the falling RPV. The CH-3C had a MARS winch mounted over a hole in the cabin floor and a hooked cable running along the helicopter hull to poles extending from the cabin ramp. At around 50 kt, the helicopter pilot aimed just above the drone engagement parachute. The hook striking the engagement chute pulled free of the trailing poles, released the main chute, and payed out cable from the hydraulic winch. The winch reeled in the 2,000 lb bug to ride home under the helicopter.

As a new Air Force HH-53B (S-65) pilot,

the cabin floor hole, and cameras looking fore and aft. A single “flying” hook and two side hook poles extended 12 ft below and 13 ft across the rear of the helicopter. The Air Force MARS incorporated a guillotine to sever the load line should the main parachute fail to separate.

The Navy first tried MARS unsuccessfully on an SH-3 Sea King in 1969, but 20 years later the Naval Rotary Wing Aircraft Test Directorate at Patuxent River, Maryland, outfitted an SH-60B Seahawk to recover the developmental BQM-145 mid-range UAV. Test pilot Lt Cdr Rick Becker (later chief test pilot at the Sikorsky development flight center) first practiced MARS technique at Hill Air Force Base. A cylindrical test vehicle with tandem parafoils was first caught by an Air Force NCH-53A at Edwards Air Force Base in California.

The Navy MARS Seahawk used a single hydraulically actuated pole on the right side of the aircraft and a winch paying the load cable down through the cabin floor. Becker noted, “There was no guillotine, at least on our rig. We had sharp knives.” The first Seahawk MARS capture was made at China Lake, California on August 27, 1990.

The BQM-145 UAV never entered production, but the MARS concept is at least proposed by commercial space launch companies looking to retrieve launch hardware and re-entering payloads. The United Launch Alliance’s proposed Vulcan rocket is expected to re-use first stage engines recovered in midair by helicopter. A NASA study in 2016 including the current S-64 type certificate holder, Erickson Inc., postulated an S-64F could retrieve 25,000 lb.

## Crested Rooster

From 1958 to 1986, the Star Catchers of U.S. Air Force 6594th Test Group flew MARS Flying Boxcars and Hercules out of Hickam Air Force Base, Hawaii to retrieve satellite capsules. Three Air Force CH-3Bs and three borrowed Navy Sea Kings meanwhile provided backup from two ships with hangars and helidecks in the Pacific Missile Test Range. The historic Haiti Victory was renamed Longview in November 1960 and by 1974, the surface recovery branch of the Corona program kept two Air Force helicopters at sea full-time.



*An Air Force CH-3B (S-61) comes aboard the Longview, backup for fixed-wing Starcatchers. (Bill Wood courtesy Navsource)*

H-53 pilot Rus Stiles joined the helicopter unit in Hawaii after two tours in southeast Asia. He explained, “They had these satellites up all the time but they were on-demand . . . They kind of knew where the orbit was, but not exactly where they’d eject the film.” The Crested Rooster modification undertaken by Warner Robbins Air Logistics Center was meant to eliminate the ships and make the recovery unit more responsive. It enabled the air-refuelable HH-53C to retrieve Corona capsules from the sea and carry them home internally to maximize range.



The modified helicopter would launch and refuel outbound to recover film capsules from the sea if the Hercules aircraft missed the parachute. "It had a cradle in the back the shape of a space capsule cut in half," explained Rus Stiles. The tracked cradle stowed in the cabin under the main gearbox and moved to clamshell doors cut in the helicopter ramp. Parajumpers (PJs) would deploy from the helicopter at 10 ft and 10 kt to connect the 600 lb capsule in the water, and the winch cable would lift the capsule into the helicopter in a 70 ft hover. The cradle would rotate 90 degrees to receive the unique payload and secure it in the cabin.



*Air Refuelable HH-53Cs (S-65s) were the backups for fixed-wing MARS aircraft. (Sikorsky Archives)*

For their long, overwater missions, Crested Rooster HH-53Cs were the first Air Force aircraft with inertial navigation systems Stiles recalled. "We had a 300-gallon internal auxiliary fuel tank in addition to the 650-gallon aux tank. We needed enough range to go the full operational radius – I think 750 miles from Honolulu." An extra oil tank was installed to replenish the main gearbox lubrication.

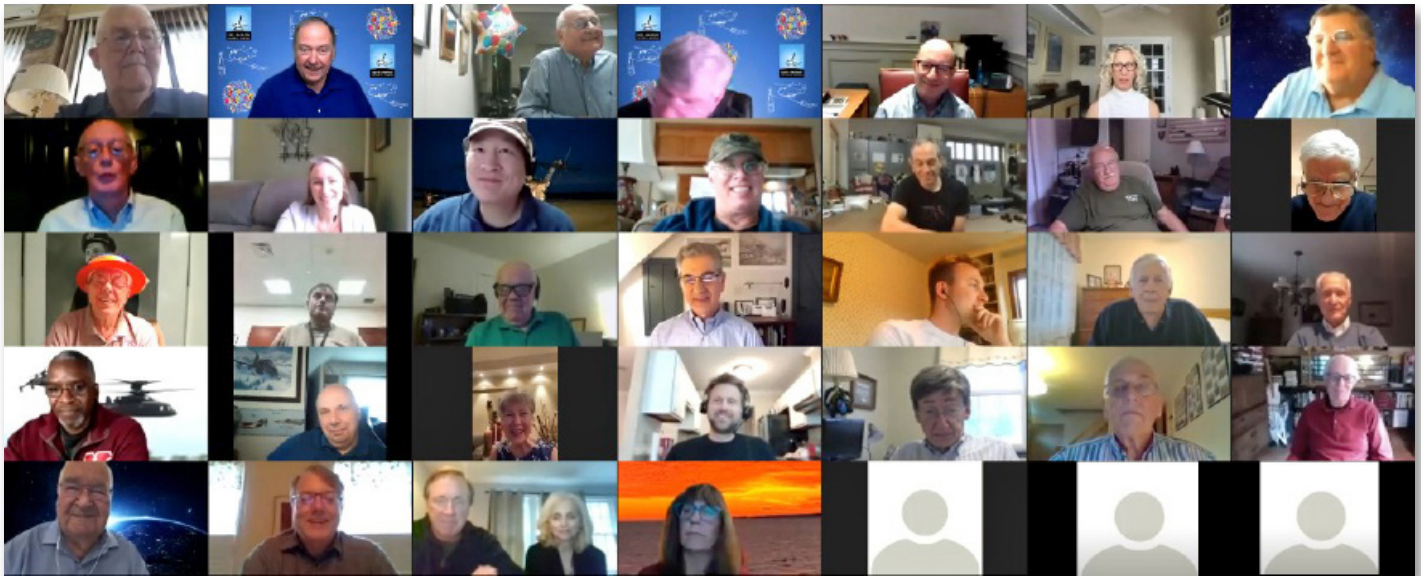
Recovery crews included two pilots, two PJs, and a flight engineer. The helicopter had a galley to cook hot meals, a toilet, and a pallet with three airline-style seats. "Our missions

were sometimes 12 to 14 hours. To give pilots and crew members a little rest, you could go back to the comfort pallet. I don't remember any of the pilots ever getting out of their seats." Competitively-qualified Star Catcher Hercules crews trained constantly, and Crested Rooster helicopters were part of every operation. The film capsule had a TACAN beacon to help the Hercules crews find their targets, but the helicopter crews sought a different prize without nav aids. "The big capsule had a heat shield," explained Stiles. "The heat shield would get ejected before they caught it. If you could find the heat shield and bring it back, they could study the re-entry burning. I got a couple of heat shields, which is pretty amazing if you think about it."

Still amazing is the flexibility Sikorsky helicopters bring to airborne operations. Project Convergence in October 2020 saw the US Army experiment with Air Launched Effects. Unmanned aircraft launched from UH-60 and MH-60 (S-70) Black Hawks were trapped 38 times by an unmanned helicopter in a complex demonstration of manned-unmanned teaming.



*An Army MH-60M (S-70) launched Air Launched Effects (unmanned air vehicles) recovered by the unmanned Flying Launch And Recovery System during Project Convergence trials at Yuma. (US Army)*



Happy 90th to Dan Liberto, November 11, 2020

Screen shot from a surprise virtual birthday party. Over 40 people were in attendance and wishing Dan (L-R top row, third photo) a happy birthday.

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



“...the helicopter is capable of offering services in a number of cases and conditions where nothing else could be of use.”

Igor Sikorsky — *The Story of the Winged-S*

  
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