THE SIKORSKY S-58 SERIES HELICOPTER

by

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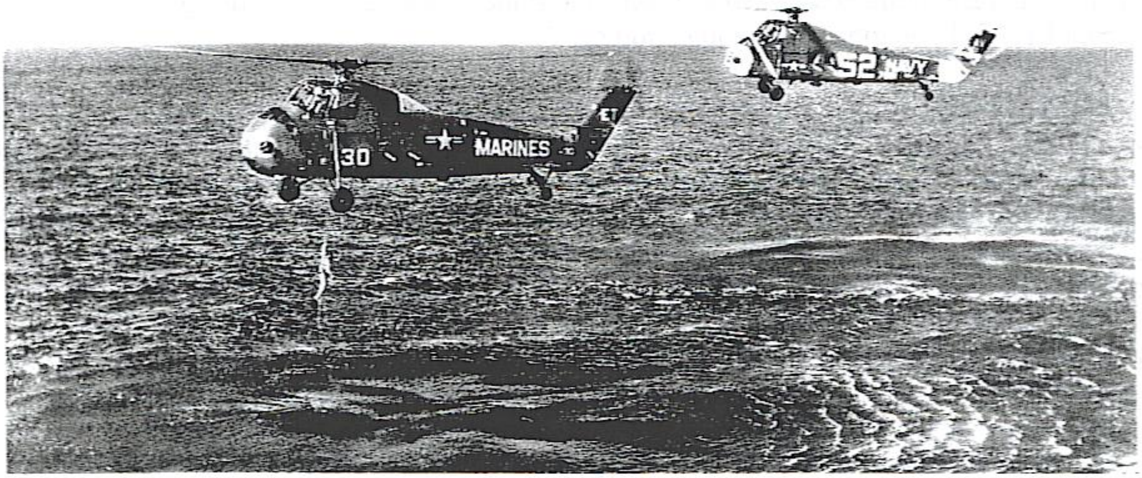

The Sikorsky S-58 series helicopter was built in a number of different configurations between 1953 and 1968. S-58 indicates that this was the 58^{th} Sikorsky design, but all designs did not go into production. The aircraft built for the U.S. Navy were designated HSS-1 or HSS-1N; those built for the U.S. Marine Corps were HUS-1, HUS-1A or UH-34D. HUS-1G was assigned to U.S. Coast Guard aircraft. Five built for presidential use were designated HUS-1Z. Four prototype aircraft were designated XHSS-1. Two HSS-1 helicopters were designated –1F and were used as ground and flight test articles during the development of the General Electric T-58 turbine engines which were used in the H-3 series helicopters. Aircraft built for the U.S. Army, France and Germany were designated UH-34A.

Some S-58's were delivered to foreign operators in the ASW configurations as HSS-1, HSS-IN or SH-34J aircraft. Civilian versions were designated S-58A, -B or –C. An after market configuration was developed when a Canadian Pratt & Whitney PT-6 Twin pack turbine engine became available in the late 1960s. There were several options available to operators interested in this aircraft. Sikorsky purchased surplus H-34s and modified them "in-house" and sold them as FAA approved S-58Ts. For those who preferred to do the work themselves Sikorsky provided a modification kit with instructions. The buyer could purchase a surplus H-34 on the market in this transaction. A number of military and civilian users converted their S-58s to this turbine-powered configuration.

It is also noted that as Sikorsky Aircraft had done with earlier models, license agreements for the manufacture of the S-58 were entered into with foreign companies; Westland Aircraft, Ltd, of England and SUD Aviation in France. Westland manufactured the S-58 as the Wessex for the Royal Navy. This version was built with a single 1450 shaft horsepower Napier Gazelle shaft turbine engine in lieu of a piston powered engine. It was identified as a HAS Mk 1. A Mark 2 version was developed for the R.A.F. powered by two coupled 1350 shp Bristol Siddely Gnome shaft turbine engines. A Mark 3 was also built with a 1600 shp Gazelle engine replacing the 1450 shp Gazelle. Westland also built an HU Mark 5 helicopter for use by Commando forces operating from Royal Navy aircraft carriers. Westland built HAS Mk 3, MK 52 and MK 53 helicopters for the Royal Australian Navy, Iraqi Air Force and the Ghana Air Force. Bristow

Helicopters, Ltd, a civilian operator providing helicopter support services to off- shore oil wells in the North Sea purchased Westland MK 60 helicopters, a civilian version of the Mk 2. Westland built 348 aircraft. They could market world wide, except for the U.S. and Canada.

Sud Aviation assembled 92 S-58s purchased from Sikorsky Aircraft for the French Armed Forces. Sud went on to build an additional 185 helicopters for the French Air Force, the French Navy and Belgium. They also produced a turbine-powered version, using two Turbomeca Baston IV engines producing 1900 shp.

Let it be noted that the foregoing was the result of the U.S. Navy's requirement for an anti-submarine warfare (ASW) helicopter to replace the in-service HO4S-1 and -3 models. Fleet operations aboard ASW configured aircraft carriers showed that for the helicopters to be able to keep up with newer, faster submarines, the helicopters would have to be faster, have an increased range and payload and be able to carry weapons as well as detection equipment. A study was undertaken to determine the feasibility of installing a larger engine in the HO4S series aircraft. It was determined that the aircraft that would result would not be satisfactory. Instead the Navy and Sikorsky agreed upon a proposal to design a new aircraft. The U.S. Navy designation for this helicopter was XHSS-1, the Sikorsky model number was S-58. Four were ordered under this contract.

Some of the specifics of this aircraft were; Gross weight 13,0001bs; Useful load 5,370 Ibs.; Maximum speed 107 knots; Search mission endurance 4 hours; Engine Wright R-1820-84 producing 1,525 hp; Length 42 ft; Length (stowed for shipboard operation) 37 ft (tail folded); Height 16 ft; Cabin width 5ft Sin; Cabin length 13ft 3in; Main rotor diameter 56 ft; Tail rotor diameter 9ft 4in. A four bladed main and tail rotor was used.

While the HSS-1 was being designed to be an improvement over its predecessor, the HO4S-1, its proven good features were incorporated into the HSS-1. These included the front mounted engine, enclosed by clam shell doors, where it was readily accessible for inspection and maintenance, and easily removable with a minimum of equipment. The individually interchangeable all-metal main rotor blade design was retained, though the length and width of the blade was increased. The Blade Inspection Method (BIM) feature that permitted rapid inspection of the main rotor blade's integrity was retained. This feature applied an inert gas at low pressure into the hollow spar. Loss of pressure was detected by a change in the color of a pressure indicator installed at the inboard end of the blade and visible to the pilot and plane captain during post and preflight checks. Loss of pressure called for removal of the blade.

The offset flapping hinge main rotor hub design was retained, as this feature permits greater center of gravity travel and more immediate control response. The single main rotor configuration was retained as it provides the greatest overall aerodynamic efficiency and simplicity. The general fuselage design of the S-55/HO4S-1 with cabin, fuel cells, cargo sling and internal loads concentrated under the main rotor was retained, as this minimized center of gravity shifts as fuel was expended; or passengers or cargo added or reduced. A low drag fuselage profile was developed through wind tunnel research to give more stable moment characteristics to the aircraft, and to permit higher speeds and more efficient cruising. This accounts for the changes in the profile between the HO4S and the HSS.

Extended periods of hovering during sonar search and the spray of salt water along the bottom of the fuselage as the sonar transducer was reeled in as the aircraft transitioned into forward flight resulted in accelerated corrosion of the magnesium panels on the underside of the fuselage. Accordingly, aluminum alloy panels were specified for this area on the HSS.

Design changes introduced to the main rotor head and main rotor blades, which resulted in the use of a four-bladed, 56 ft. diameter main rotor, made a significant improvement in the retreating blade stall characteristics of the HSS helicopter. The conditions at which blade stall would occur were moved to a range beyond normal flight regimes, thus retreating blade stall was rarely encountered.

Studies showed that the HSS-1 operating envelope with its larger main rotor diameter would generate high feedback forces into the flight control system. This condition was present in the S-55/HO4S-1 aircraft, too. In this model, a set of three hydraulic servos was incorporated in the flight control linkage between the cockpit controls and the rotor head. Like power steering in an automobile, the pilot needed to apply only a light force to fly the aircraft. If a loss of hydraulic power was experienced the pilot could reduce the feedback forces by reducing air speed. At reduced air speed full control could be maintained without the assistance of the hydraulic servos. In the HSS-1 manual movement of the flight controls would not be possible without hydraulic servo power in all flight regimes, so two separate hydraulic power servo systems were incorporated into the flight control system, each with its own hydraulic oil supply, hydraulic pumps and hydraulic lines and each capable of controlling the aircraft if one system failed. The added set of servos also became a part of newly designed Automatic Stabilization System. More on this system follows.

HO4S-1 and earlier models used a centrifugal clutch that gradually brought the main and tail rotors up to speed as engine speed was increased. Changes that created the HO4S-3 included installation of a 700 hp engine (up from 550hp) and a hydro mechanical clutch. This clutch was also installed on the S-58/HSS series aircraft. Instead of clutch shoes the hydro mechanical clutch engaged by filling its fluid coupling with oil from an adjacent oil tank and pump. Once the rotors were up to speed a momentary reduction power allowed a mechanical unit within the clutch to rotate and cause a solid drive between the engine and the rotor system drive train. A free wheel unit, which would allow the main rotors to autorotate in the event of engine failure, was also part of the clutch. This clutch made it possible to drive an engine mounted generator fast enough to provide electrical power to the aircraft sufficient for performing all systems pre-flight checks without engaging the main rotors and creating a strong downdraft to the discomfort of ground personnel.

At its conception the HSS-1 was projected to be capable of around-the-clock flight operations. However, when the program started all of the systems required for night and/or instrument flying had not yet been fully developed, so the aircraft was initially outfitted for day and limited instrument flight. A projected configuration capable of 24 hour operation was identified and designated HSS-1N. Thus initial design included electrical and hydraulic power sufficient to handle projected HSS-1N requirements.

In the planning stage the S-58 was projected as a tri-service aircraft. With this in mind a design/marketing team was established to study the needs and desires of potential operators; military and civilian. Based on these studies several flight profiles and cabin configurations were developed. Thus, as design went forward provisions for hard points for military or civilian seating arrangements were incorporated or provided for in a practical manner. Strong points and access hatches for the installation of an external cargo sling were provided; attachment points for litters were provided; adequate structure for the installation of an external fuel tank was provided; provisions for installation and operation of a rescue hoist were also included. Mission profiles for anti-submarine (ASW) search, ASW attack, and troop or cargo transport were developed.

In order to increase the effectiveness of the HSS-1 and the HSS-1N helicopter over its predecessor, a system had to be provided to reduce pilot and crew fatigue. This was accomplished by developing and installing Automatic Stabilization Equipment (ASE) into the U.S. Navy's versions of the S-58; the HSS-1 and HSS-1N. The need for stabilization in the helicopter had been recognized in the late 1940s. After successful operation of hydraulic servo units had been demonstrated in an S-51, a breadboard assembly of a pitch channel, including a gyro and a servo motor was installed. This device maintained pitch stability in flight. The flight control system in the HSS-1 was designed to accept the installation of a complete ASE system. The ASE was capable of detecting the helicopter's movements about its pitch, roll and yaw axes not induced by the pilot, but by turbulent air, etc.

Autopilots capable of keeping fixed wing aircraft on a steady course were already available, but they were designed for a different purpose. They were used to keep an aircraft on a straight and level course once it had reached a desired altitude and heading. If an in-course change had to be made the pilot would have to turn off the autopilot, make the course change and then re-engage the autopilot. If he had arrived at his destination, he would disengage the autopilot and fly the aircraft in for a landing. If a malfunction occurred while the aircraft was on autopilot produced a violent maneuver, the pilot had to quickly disengage the autopilot and fly it manually until the problem was corrected.

This type of occurrence could not be allowed to happen in a helicopter with the ASE engaged. Most of the helicopter's flight environment would be close to the water; in a sonar search hover, or flying to a new dip location, or landing, or taking off. In short, it would be in harm's way before the pilot could take the extra actions to right the craft. The ASE was designed so that random failures in the system couldn't cause a large control movement. A minor control correction, hardly noticeable to the passengers, would keep the aircraft under control. Total displacement of the flight control by an ASE malfunction could not effect more than 20% of the total control movement available in the flight control system, and the remaining 80% was always available to the pilot and was enough to safely fly the aircraft.

There were also switches built into the flight controls with which the pilot could quickly isolate a defective component from the flight control system by shutting down its hydraulic or electric power.

The "off-the-shelf items selected to be the heart of the ASE contained gyros that when engaged sensed all aircraft movement around its pitch, roll and yaw axes. A barometric altimeter could also be linked to the system to maintain altitude, but this device was not sensitive enough to be useful. Electronic signals could be developed in these and related components that could detect the direction and rate of change of the helicopter due to turbulence, or other outside factors. These signals were processed in such a manner that they automatically operated small reversible electric motors mounted on the hydraulic servo units so that just enough counter movement was created to balance the aforementioned turbulence. This is a very brief statement about what was a very complex system that worked very well, but had to be thoroughly understood by the pilots and maintenance personnel.

The hydraulic servos we speak of are akin to power steering in an automobile or truck. As these vehicles got larger and heavier power assist was required to help the driver turn the steering wheel. A power steering installation in a vehicle includes a supply of fluid, a pump to pressurize the fluid and a power piston attached to the steering linkage to move the linkage in the desired direction. Also required was a device working with the power piston that could direct the oil flow in the proper direction, and shut-off the oil flow when the turn was completed. This device is called a pilot valve. By its action it senses the direction the driver has selected and it also senses when the driver has stopped turning the steering wheel and when the car is on its desired heading. At this moment the pilot valve has been positioned to shut off the flow of oil and the car stabilizes on its new heading. In an auto we are concerned with what would be the yaw axis.

The same principle is applied in most large helicopters as the force required to move the flight controls once the main rotor blades are at operating speed is greater than can be exerted by the pilot. There are 7 hydraulic servos of the S-58 series helicopters. The HSS-1N has 8, as one is add to the engine throttle linkage. Three primary servos are installed around the main gearbox below the swashplate and through a suitable linkage to the secondary servos. The three secondary servos are installed between the primary servos and the cockpit controls. Either set of servos provides adequate assist, but it is normal to have both systems functioning at all times for reasons to be explained.

In early 1955 the ASW squadrons that were flying HO4S-1 and -3 helicopters started to receive HSS-1 's, with deliveries to selected squadrons on both coasts. At the same time plans were being set in motion to assign the HSS-1 equipped squadron to an Air Group slated to deploy aboard aircraft carriers being modified to operate as Anti-Submarine Carriers (CVS). Thus, the deployment date of the helicopter squadron was set and it became the task of all concerned; the squadrons, the flight and maintenance training units, the supply and logistic support activities and the prime contractors and their suppliers to meet the challenge. And all were determined to do so.

To "jump start" the process, HS-4, the first West Coast squadron to receive the aircraft, initiated familiarization sessions using personnel arriving from NAS Patuxent River with experience in the HSS-1 test programs. Factory service reps with training at the factory were requested to conduct training for the pilots to familiarize them with the systems; and normal and emergency procedures. Sikorsky pilots came to Ream Field to train enough squadron instructors to start a flight program. It should be noted that at about this same time Navy fighter squadrons based at NAS Miramar were emerging from an indoctrination program to ready fighter squadrons to operate a new sophisticated fighter. ComFair San Diego determined that because the contractor team that had worked with these squadrons did too much of the work to keep the aircraft flying, the squadron personnel had not received enough experience to keep up the same level of availability when they became operational. As I, the writer, had been the contact to CFSD, I was called in and told in no uncertain terms not to let this happen on the HSS-1 program.

The writer recalls this period. The manufacturer of the "off-the-shelf Control, Gyro and Amplifier Box, one of the primary components in the ASE system, had assigned a service representative to this program. He was an energetic and dedicated person and had worked on this component as part of the autopilot system in the USAF F-86. He volunteered to teach the first familiarization classes to the pilots during the morning all-pilots meetings. The assigned Sikorsky tech reps also attended these classes. It turned out that he was presenting information that applied only to the F-86 and not the HSS-1 and because he was talking about "hard overs", which the ASE was designed to not allow to occur, he was unnecessarily worrying the pilots with misinformation. Fortunately we had a good relationship and he agreed to let me replace him for a few classes while he listened. Although I had attended factory school on this aircraft and had, while I was a crew chief at the plant, installed the first hydraulic servos in one of the early models and knew how they worked, I found it was difficult to explain how the system worked on a blackboard or using static schematics. Out of necessity I got the idea of building a "mobile" panel, which I did at home over a weekend. Using this panel it was possible to show how the various components functioned and how the movement of the controls caused the pilot valve to direct the hydraulic oil to move in the desired direction and shut off at the proper moment. When I reported this to the plant I learned that the school instructors there had experienced the same difficulty and that tool engineering was developing a set of "mobile" trainers for the school and the Navy's maintenance training detachments.

The overall squadron training program did pay-off and the pilots soon became comfortable with the HSS-1 and its systems. This is not to say that it was easy. It took a lot of practice and work with the sonarmen to coordinate the maneuver of getting into a hover and deploying the sonar transducer. This was done through visual observations of the pilot, co-pilot and sonar operators. There was also another component of the system that came into play, the sonar coupler. Once the hover was established and the sonar transducer was lowered into the water the sonar coupler was activated. Through sensors in the transducer and the cable and reel components, instruments in the cockpit and on the sonar operator's console could display whether the sonar cable was vertical to the sonar transducer, as well as the depth of the transducer and the height of the aircraft above the water. It was important to keep the sonar cable vertical to the transducer, to keep it from being dragged through the water and damaged. Wind and water conditions were a factor, but pilots told me that during day operations they were comfortable with this maneuver and seldom had to depend on the coupler to hold position.

After a number of operational deployments with the HSS-1 demonstrated that submarines could be located and tracked during daylight hours, the U.S. Navy directed Sikorsky to proceed with the HSS-1N night/all weather configuration. This involved adding an APN 97 doppler radar navigation set, which had been developed by Ryan Aeronautical Co.; an APN 117 radar altimeter was already part of the instrument package, but it hadn't been used in the sonar approach system in the HSS-1. It was activated for the -IN configuration. An electro-mechanical hydraulic servo unit similar to those used in the flight controls was added to the engine throttle control linkage. This feature was designed to maintain engine speeds selected by the pilot. Additionally, the sonar coupler was replaced by a hover coupler. (The APN 97 doppler radar navigation set was used in the moon lander, to guide it to a "soft" landing on the moon).

The addition of these components created an Automatic Flight Control System. To set up an automatic approach, for example, level flight could be established at a suitable altitude of 100 ft, into the wind, at a speed of 60 knots, and the desired hover altitude selected on the radar altimeter, and this information was feed to the AFCS via the hover coupler. The aircraft would fly into a hover at the selected altitude "hands off'. When the aircraft had stabilized in the hover and the sonar transducer was lowered into the water the hover coupler would be switched to "cable" mode. This would combine information generated by the depth of the transducer, the length of extended cable, and a combination of radar altimeter and barometric altimeter information, which would be processed by the AFCS to maintain the hover altitude. Engine power selected by the pilot was maintained by the throttle governor as the aircraft held its selected altitude while responding to varying wind and sea conditions.

The addition of the HSS-1N "package' added more complexities to an already complex aircraft. More training was required for the pilots, sonarmen and maintenance personnel. A full complement of test equipment was required for each squadron and support activity. Procedures had to be modified for the test equipment, as initial instructions that worked ashore didn't work aboard a pitching and rolling ship, especially when checking gyros. The supply and logistics support activities had difficulties providing parts and equipment in a timely manner, until they sorted out the many differences between the -1 and the -IN version and identified what wasn't interchangeable between them.

As the pace of operations increased, maintenance became a problem. Maintenance man-hours per flight hour became excessive. Maintenance of non-ASE equipped aircraft such as the HUS-1 was deemed normal by the Marines. The same could not be said of the HSS-1 and -IN models equipped with the ASE, the automatic flight control system, and related sonar equipment. The ASE and AFCS systems were difficult to troubleshoot. What appeared on the discrepancy report as a simple problem often was related to an electrical, hydraulic or avionics malfunction elsewhere in the aircraft and delay resulted until maintenance control finally got the cognizant shop and skill on the job. It soon became apparent to some that maintenance could be improved by forming an integrated maintenance team, or shop, but this was contrary to the table of organization of the squadron and would result in failed AdMat inspections if implemented. As the tempo of operations increased more people became convinced that establishing some form of integrated maintenance would speed the process and improve availability, and a way was found to implement it.

Also in the matter of availability and high maintenance man-hours, it must be noted that these complex avionics systems were put together using state of the art avionics of the time. The vacuum tube and black and white TV were the technology of the era. I still recall how often I went searching for a vacuum tube tester or a TV shop to repair a blacked out picture tube. The vacuum tubes liked the helicopter less than the living room floor, so it created quite a workload for the avionics troubleshooters. In fact, a shock mounted base was provided for some of the "black boxes" containing vacuum tubes, but only limited improvement was realized.

The automatic stabilization equipment performs its function as a stability device as follows. On those aircraft not equipped with ASE, as the pilot flies the aircraft he is manipulating the flight controls as necessary to take off and fly a selected course. If the aircraft encounters turbulence, or other forces that affect the stability of the helicopter, the pilot instinctively manipulates the controls to steady the aircraft. On ASE equipped aircraft a number of components are added to the aircraft to stabilize it. The directional control sticks and the rudder pedals are fitted with small devices called stick cancellers. When the control stick is moved and the aircraft starts to react, the gyros sense this movement and start to develop a signal to return the aircraft to its course. The stick canceller's function is to block the gyros output and keep the helicopter on the pilot's selected course.

If turbulence has displaced the helicopter, the gyros will put out a signal that will not be blocked by the stick canceller. This gyro signal tells the ASE the direction and velocity of the displacement and the ASE creates a signal that will automatically return the helicopter to the pilot selected course with no effort by the pilot. This occurs because trie system is designed to respond to a pilot-induced control movement or a gyro-induced control movement, or a combination of both. The pilot's control movement displaces the servo pilot valve through a series of control rods, while the gyro signal displaces the pilot valve via a small electric motor, in parallel with the pilots input. Once you understand what's going on, its simple, but these signals go through a network of mechanical, hydraulic, electrical and electronic devices that have to be adjusted to give the desired responses. The pilots and maintenance personnel must understand how they function and how to recognize and correct malfunctions. This starts with training of the pilots, mechanics and technicians in the proper use of flight and maintenance handbooks, and proper execution of pre-flight checks which were designed to assure that all systems are functional.

There are also variables introduced that are a function of the responsiveness of the aircraft. This was arrived at by flying many flights with adjustable devices temporarily installed to change the dynamics of the system and get the opinion of company and Navy pilots to the "feel" of the aircraft. Add to this the fact that some of the devices, like the doppler radar navigation set performed differently under differing water conditions. A glassy sea would weaken the return signals and result in a sluggish automatic approach. Choppy water would result in a more optimum approach and a high sea state could make the approach a real adventure.

In view of this it was not unexpected that with the arrival of the HSS-1N with its complex automatic flight control system, it brought out a number of supporters and doubters as to whether this aircraft would succeed or fail to fulfill the 24 hour ASW mission.

HS-4 was the first West Coast squadron to deploy with the HSS-lNs, and word came back that they weren't flying the -IN at night as they were having problems adjusting the avionics systems. As the HSS-1N was taking shape it was anticipated that the airframes service representative already in the field would not have the "know how " to assist with the additional ASE components. Accordingly, Sikorsky trained a number of avionics specialists on the HSS-1N system. Some of them were former Navy sonarmen, and they worked out very well in this task. As HS-4 had departed without an avionics rep, one was sent to join the squadron in WestPac. Upon arrival he found that none of the aircraft were adjusted for night flying. Two aircraft and a crew were assigned to make the aircraft ready for night operations. Once they were properly adjusted day flights were performed to check their performance and they were accepted for night missions. In addition, the avionics rep organized training for the maintenance crew and the squadron was able to commence ASW operations with the air group. This is not to say that the program was an immediate success. There were hardware problems, and changes that had to be made to test procedures and test equipment. And there was the matter of navigating and communicating, but the dedicated effort of the entire team of military and civilian personnel showed that helicopter ASW operations had merit. No doubt the state of the Soviet submarine threat also influenced the decision. There was no question that lessons learned at this time lead to the development of the improved helicopters that followed, the H-3 and the H-60 series, which with improving technologies have produced the fine weapons system used today.

The U.S. Marine Corps at the time was operating the Marine version of the S-55, the HRS-1 or -3. This helicopter was the same as the Navy HO4S series, but without the sonar equipment. The Marines needed a larger helicopter and had, in fact, along with the U.S. Army, contracted with Sikorsky for the production of a large, twin-engine, piston powered helicopter in the 31,000 Ibs. class. This was the S-56; the H-37 was its Army designation and HR2S-1 was the Marine/Navy designation. As development of this model was on a slow track and the S-58 program was moving rapidly, the Marine version of the S-58, the HUS-1, was ordered and deliveries to the Marines commenced in March of 1957. This helicopter was later designated the UH-34D.

The HUS-1 had a maximum airspeed about 20 knots faster than the HRS and it doubled its payload. This increased performance enabled the Marine ground forces to expand on techniques they had developed since receiving the HRSs in Korea. There they had developed a tactic called "Vertical Envelopment", which involved carrying ground personnel onto inaccessible high ground and supporting them as they drove the enemy from the area. The troops and equipment were then removed by the helicopters. With the use of the HUS-1 the Marines also developed amphibious assault tactics which also used the greater capabilities of this aircraft.

May I note that I worked as a tech rep with the Marines in Korea, on the HO3S-1, and in Southern California on the MRS, an aircraft they liked because it was a big improvement over the HO3S-1, but the most frequent statement heard from the pilots when they returned from their first flight in an HUS was; "This is the Cadillac of helicopters". They appreciated the duel servo control system, which made manipulation of the flight controls almost effortless. The aircraft had lower vibration levels as a result of improved rotor blade manufacturing techniques and improved dynamic balance procedures that were made possible using the whirl stands to produce interchangeable blades. Maintenance personnel appreciated the ease of maintenance due to the configuration of the aircraft. As they continued to work with the HUS-1 they referred to it as a "tough workhorse".

Once the 3rd Marine Aircraft Wing at Santa Ana was up to strength, squadrons were deployed to Okinawa and when activity in South Vietnam escalated the Marines operated there until the termination of activities. At the same time UH-34D models were provided to the South Vietnamese Air Force. Production records provided by the Igor I. Sikorsky Historical Archive list 1800 S-58s manufactured between the end of 1953 and 1968. More than half of them went to the U.S. Navy and Marines, including 5 HUS-lZs, to the presidential support squadron HMX-1 based at MCAS Quantico, VA. Six (6) HUS-IGs were delivered to the U.S. Coast Guard.

The U.S. Army received over 400 CH-34A helicopters, the Army designation for their S-58s. Most of the Army CH-34As were based in Germany, supporting the Army's Air Mobile Division. The Army modified several of their H-34s to a VH-34A. These were based at Ft. Belvoir and co-ordinated with the Marines in the joint task of providing helicopter transportation for President Eisenhower.

Versions of the S-58 were obtained by other foreign governments through direct purchase or military assistance. Germany acquired 138 CH-34As for its Air Force and 6 SH-34Js (same as HSS-1N) for its Navy. Ten (10) SH-34Js were purchased by Japan for the Japanese Maritime Defense Force. A total of 34 in various configurations were obtained by Italy, Chile, Holland, the USSR and Israel, either through direct purchase or the U.S. Military assistance program. Seventy-nine (79) CH-34A and UH34D aircraft were produced for the Military Assistance Program. These, plus a number that became excess to U.S. requirements were allocated to Thailand, South Vietnam and Indonesia. Air America also operated some in its mixed inventory.

The S-58 in its many forms saw a diversity of action, in combat in North Africa with the French, in Israel, in Vietnam with U.S. Marines and the South Vietnam Air Force. In Thailand it was used to protect Thai borders from the action in South Vietnam. They were also used by Thai civilian entities, such as agriculture and customs. The aircraft were used in numerous humanitarian operations, such as floods in California, Connecticut and South Vietnam. There were countless individual rescues of ill and injured seamen who needed medical attention not available on their ships.

To simplify logistics on the ASW carriers the embarked helicopter squadrons removed the sonar equipment on (usually two) aircraft and configured them for plane guard and utility missions, thus enabling them to provide the task force with the variety of assistance it had become accustomed to.

Additionally, the Bureau of Naval Weapons authorized the release of H-34 Airframe Change No. 246. This provided for the conversion of HSS-1 and -INs to utility configurations as UH-34G/J models. These aircraft were released to active and reserve squadrons, and individual air stations, for training, local rescue and SAR, and the many other missions the helicopter community had developed through the years. Marine helicopters worked with NASA's space program during the Mercury missions that lead to the moon landings. The helicopters recovered the astronauts and their capsules after their earth orbiting missions. One HSS-1F ground article and one flight article was used to develop the G.E. T-58 engine for use in the H-3 helicopters. Ship based UH-34 were used to rescue down fighter pilots off of Vietnam during that action.

As U.S. Army and Navy/Marine aircraft became surplus to these services, they were issued to a number of state Air National Guard units. The Los Angeles Sheriffs Aero squadron obtained several surplus H-34s to augment its smaller helicopters and provide search and rescue capabilities in some of the mountainous sections of the county.

Civilian operators domestically, and around the world, purchased approximately 30 S-58s. Sabena Airlines operated a shuttle service between Brussels and Paris. New York Airways operated a shuttle service between the New York area airports and downtown Manhattan. A number of S-58s were purchased by oil companies, or operators that leased their services to oil companies to assist in exploration for oil deposits, to support their construction crews in building oil well platforms and then supplying the platforms and rotating the crews. Platforms were located in the Gulf of Mexico, in Alaska, in the North Sea, in Indonesia, off of Brazil in the Atlantic Ocean and in eastern Peru and western Brazil. When the S-58T became available, some were used in these operations. S-58s were also used for logging and fighting forest fires.

In the summary, it can be said the S-58 series helicopters contributed significantly in the use of rotary wing aircraft in military and civilian operations. Its success encouraged the development of the next generation of helicopters.

For the reader who is interested, a book titled "Sikorsky H-34 - An Illustrated History" was written by Lennart Lundh. It carries Library of Congress Catalog Number: 97-80805 and presents in photographs and words a very detailed account of the operational history of the H-34. Also, an article titled "A Marine UH-34D Flies The "Airshow Circuit" printed in the July 2001 edition of "Air and Space Smithsonian", written by Stephan Wilkinson with photos by Lance Cheung recounts vividly the history of the UH-34D in Vietnam combat as related by a Vietnam veteran. Both are truly recommended reading.

This writer acknowledges the assistance of the Igor I. Sikorsky Historical Archives, Inc. in preparing this article. He also thanks colleagues and military and civilian personnel he worked with during a 34-year career, 25 years of which consisted of fieldwork in the western United States and the Pacific Ocean Area. What was presented here can be expanded many fold if those of you who participated in the development, operation, maintenance and support of the overall program contribute your knowledge and experience to the Naval Helicopter Historical Society. You are respectfully urged to do so.

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