Navy HO2S and Coast Guard ASW Dipping Evaluations at NAS Key West

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The HO2S-1 was intended as the follow-on design to the HNS-1, but it was never produced in relevant quantities during the war years due to significant delays in design and production. The design was based on a 1942 U.S. Army Air Force (USAAF) requirement for a larger more capable observation helicopter over the R-4 (Navy HNS-1). The HNS-1 was underpowered and the boxy fuselage made the main rotor inefficient by obstructing airflow from the main rotor, which reduced lift. To be effective in a scouting/observation role, the next model needed a cabin with much better visibility than what the HNS-1 offered. The Royal Air Force also wanted a model that could possibly carry bombs capable of engaging German submarines. With these design factors in mind, Sikorsky designed the R-5/HO2S to improve upon the useful load, endurance, speed, and service ceiling over the R-4/HNS-1.

To this end, the R-5 was given a Pratt and Whitney R-985 450-hp Wasp Junior radial engine (same powerplant as the Vought OS2U Kingfisher) to power an improved three-bladed, 48 foot rotor disc mounted to a much more streamlined and aerodynamic helicopter center section; which was constructed of a steel frame covered with “plastic impregnated plywood panels”. The main rotor blades themselves consisted of laminated wood spars supporting plywood ribs and leading edge and canvas covered pockets. The whole assembly was then covered in fabric to produce a NACA 0012 airfoil.[1] Unfortunately, blades of this design had some severe limitations (i.e. difficult to manufacture, hard to balance, and very susceptible to rain damage) and the wooden spars were eventually replaced by steel tubes. At that time, however, Sikorsky had no choice but to retain the fabric covering as it was the only material that would allow the blades to flap and flex. The slim, aluminum framed, two-seat tandem cockpit placed the observer station in the front seat encapsulated by what can only be described as a Plexiglass "fishbowl", with the pilot seated directly behind him.[2] The landing gear consisted of two main mounts on the aft section of the cabin undercarriage supplemented by a stilted rear wheel at the base of the tail boom. In some models, there was a small fourth wheel mounted centerline on the cabin beneath the observer seat.

According to Sikorsky, the first experimental version of the R-5 (XR-5) made its initial flight on 18 August 1943. In March 1944, the Army Air Forces ordered 26 test and evaluation prototype (YR-5A) variants. This order was followed by a production contract for 100 R-5s. Due largely to limitations in capacity and materials, only 34 were actually delivered before the end of World War II resulted in the cancellation of the contract. Of these 34, two were transferred to the Navy. The Navy designated the aircraft the HO2S-1 in accordance with their aircraft naming convention of the day (Helicopter, Observation Model Number Two, Sikorsky, first in series) and assigned them BuNos 75689/90. Both were then immediately transferred to the Coast Guard,

[1] https://www.sikorskyarchives.com/S-48(R-5).php

[2] https://www.si.edu/object/sikorsky-xr-5%3Anasm_A19600308000

to continue the mission of developing the helicopter as a shipboard ASW weapons platform on behalf of the Navy. Neither of the two helicopters enjoyed a long service life.

BuNo 75689 was accepted the day after Christmas, 1945 and delivered to CGAS Brooklyn on January 4, 1946, two days before the Coast Guard was transferred back to the Department of Treasury from its wartime service under the Department of the Navy. Seemingly the only flight of note took place on 22 March 1946 when ENS Richard S. Wohlgemuth, USNR[3] crashed it on takeoff on a CAVU afternoon at Mustin Field in Philadelphia, PA. He had 4.5 hours in-model (675 total) at the time of the mishap. The pilot attempted a takeoff against a 6kt tailwind with a passenger aboard and the aircraft settled with power within about 75 yards of transitioning to forward flight. The tail rotor was damaged in the ensuing tail strike, but there were no reports of the aircraft being destroyed beyond repair. Still, spare parts were extremely scarce to say nothing of the postwar operating budget. On June 24, 1946, the aircraft was transferred to CGAS Elizabeth City for disposal and was stricken from the inventory on July 31.

BuNo 75690 also had a very short service life, but the role it played in Navy helicopter ASW development is significant. It was turned over to the Coast Guard at CGAS Brooklyn on 17 January 1946. The more powerful 450 hp aircraft was quickly seen as a better test and evaluation platform for the Naval Research Lab experimental Hayes XCF dipping sonar over the Coast Guard XHOS helicopter. On March 12, 1946, following the six week install of the sonar equipment, Coast Guard LT Stewart Graham flew BuNo 75690 to NAS Key West, Florida with mechanic, Merwin Westerberg as passenger. The four day flight from New York to Key West was recognized as the first long distance flight of the R-5/HO2S helicopter. Upon arrival, they reported to the newly named Anti-submarine Development Squadron One (ASDevRon One), known today as VX-1. A second pilot, ENS William Coffee, USCG arrived shortly afterward and testing began a few days later. From March 22 through May 22, 1946, BuNo 75690 conducted dipping sonar tests on several US submarines and a more technologically advanced captured German submarine operating between Key West and Cuba.

LT Graham would later recall the significant limitations of the HO2S in a dipping configuration:

The HO2S has a tandem-seat cockpit piloted from the rear seat; the sonar operator occupied the front seat. My sonar operator, [Dr. J J Coop, Ph.D], was over six feet tall and blocked out much of the pilot's forward visibility… The HO2S was inherently unstable and hard to fly because of extreme flight control forces. I alleviated some undesirable features by using a bungee cord, one end secured to the floorboard and the other, at the pilot's discretion, to a position on the control stick. It still took sheer strength and determination to maintain a good hovering position with the sonar transducer lowered to a depth of 60 feet.

[3] Of note, his service is listed as USNR on the mishap report, but is not found on the official Navy list of qualified helicopter pilots. A pilot by the same name, however, is listed as Coast Guard Aviator #264, as flying various types of Coast Guard patrol airplanes to include the P4Y and R5D, and was promoted to CDR, USCG in 1967.

Each morning, prior to dawn, the pilot and mechanic would meet up at the seaplane base hangar on NAS Key West and fly BuNo 75690 out to LST 606, which was assigned to support the project as a floating helicopter base. There, they would swap out the mechanic for the sonar operator that was aboard. On the morning of 22 MAY 1946, ENS Coffee crashed while attempting to land on the LST for the routine crew swap. He attempted to come into a 30 foot hover about 20 ft shy of the LST deck edge for unspecified reasons and immediately settled with power. Despite a heroic effort to regain forward airspeed while simultaneously avoiding potential injury to flight deck personnel, the helicopter crashed into the sea and immediately rolled over.

Neither ENS Coffee[4] nor AMM2 Westerberg were seriously injured and both were able to abandon the submerged, overturned aircraft within seconds. The helicopter had an inflated seven man life raft affixed to the underside as a makeshift flotation device which actually kept it afloat for about 20 minutes until the raft burst from the pressure of the sinking helicopter. Every effort was made to salvage the aircraft, but after the raft burst, the lines attached to the aircraft to facilitate the salvage effort parted and the helicopter sank in 30 feet of water. Divers managed to recover it four hours later, but by then, the salt water had already begun to take a toll. The loss of BuNo 75690 effectively ended the dipping sonar testing, but not before proving the concept of the ASW helicopter and laying the groundwork for rotary-wing ASW as we know it today. As LT Graham would later write, “When the Key West test results were analyzed, even the most skeptical decision makers were convinced that the helicopter-mounted sonar was the answer for the antisubmarine warfare program.” It would be five years before the follow-on production version of the Hayes XCF dipping sonar, the AN/AQS-4, was ready for evaluation by VX-1. Much of the challenge awaiting VX-1 would be finding a helicopter suitable to operate it.

[4] ENS Coffee, an enlisted Coast Guard pilot during the war, had 1776 total hours at the time of the mishap and 100 hours in model (likely referring to total rotary wing as total time last 90 days was fewer than 10 hours).