Oregon Historic Site Record

LOCATION AND PROPERTY NAME

address:	1945 Water	**historic name:**	USS Blueback (SS 581)
	Portland, Multnomah County	**current/other names:**	
assoc addresses:		**block/lot/tax lot:**	
location descr:	Located in Willamette River	**twnshp/rng/sect/qtr sect:**	1S 1E 3

PROPERTY CHARACTERISTICS

resource type:	Structure	**height (stories):**		**total elig resources:**	1	**total inelig resources:**	0
elig evaluation:	eligible/significant			**NR Status:**	Individually Listed		
prim constr date:	1959	**second date:**		**date indiv listed:**	09/18/2008		

primary orig use:	DEFENSE: General	**orig use comments:**	
second orig use:			
primary style:	Utilitarian	**prim style comments:**	Submarine
secondary style:		**sec style comments:**	
primary siding:	Steel	**siding comments:**	
secondary siding:			
plan type:		**architect:**	
		builder:	

comments/notes:

Final draft completed by Dan Anderson SHPO intern - Need to do final review and packaging before submitting to NR (ij 5/23/2008) Nomination incorrectly identifies address as 1495 Water Ave.

GROUPINGS / ASSOCIATIONS

Not associated with any surveys or groupings.

SHPO INFORMATION FOR THIS PROPERTY

NR date listed:	09/18/2008	**106 Project(s):**	None
ILS survey date:		**Special Assess Project(s):**	None
RLS survey date:		**Federal Tax Project(s):**	None

ARCHITECTURAL / PROPERTY DESCRIPTION

(Includes expanded description of the building/property, setting, significant landscape features, outbuildings and alterations)

DESCRIPTION SUMMARY Constructed in 1959, the USS Blueback is a Barbel Class fast-attack submarine designed to dive to a depth of over 700 feet. At the time of construction, the Blueback and her two sister ships were the most technologically advanced submarines in the world. The design incorporated a revolutionary tear-drop hull shape that enabled superior under-water handling with the latest control, communication, and offensive systems. At 219 feet long and with a beam (width) of 29 feet, the Blueback displaced 2,146 tons when surfaced and 2,637 tons submerged. When the Blueback was launched in 1959 she was the last diesel-electric sub to be commissioned by the US Navy. Of the three Barbel Class submarines, the Blueback is the only extant ship. The Blueback was decommissioned in 1990 and acquired in 1994 by the Oregon Museum of Science and Industry (OMSI) in Portland. Museum staff has carefully restored the ship to its in-service appearance, altering only what was necessary to make the ship accessible to the public. SETTING The USS Blueback is moored on the east bank of the Willamette River. The bow faces upstream to the south toward the Ross Island Bridge (OR 26). Downtown Portland is easily visible on the West side of the river to the northwest. The Marquam Bridge (I-5) crosses the river a few hundred feet to the north of the Blueback's home port. The east side of the river retains an industrial feel and association despite the recent conversion of nearby warehouses and factories to mixed-use developments. As a ship, the Blueback retains its historic setting because it is located in an appropriate maritime environment. Although inland, Portland is a Pacific Ocean port and the city regularly receives ocean-going commercial-ship traffic traveling along the Columbia and Willamette Rivers. Designed to travel great distances and assigned to various ports throughout its service career, the Blueback is not historically associated with any particular moorage. USS BLUEBACK AS BUILT The Blueback was ordered in 1956 by the US Navy, and her keel was laid in 1957 by Ingalls Shipbuilding Corporation of Pascagoula, Mississippi. She was finally commissioned 15 October 1959. The Blueback is 219ft. 6in. long and has a beam (width) of 29ft. She was designed to accommodate 77 crewmembers plus 8 officers as her active duty crew. The Blueback was instantly recognizable as a member of the Barbel Class when she was launched. In 1959 the number of active duty subs built around the now familiar tear-drop shape came to a grand total of three, Blueback and her two sister ships. The design, which now is automatically associated with the word "submarine," was, at the time, an innovation yet to be tested in active duty. Where previous subs were similar in shape to surface ships, with flat decks, pointed prows, and raised conning towers, the Barbel subs were cylindrical in shape, with a rounded nose and a tapered tail. The only other submarine built with this "tear drop" form was the test-bed submarine Albacore (AGSS-569), which pioneered the design. This submarine was strictly for scientific research on hydrodynamics, speed, and optimal design, and was not intended for combat duty. Blueback and the other "B Gals" were also the first active duty submarines to be built out of high tensile HY-80 steel alloy, allowing a dive depth of over 700ft and a crush depth of over 1000ft. The ship was built with a double hull; the inner, or "pressure hull" was what gave the sub its strength, the outer hull was designed for maximum hydrodynamic qualities and minimize sound. The sub was equipped with one screw, or propeller, which allowed the Blueback a maximum speed of 21 knots when submerged and 17 knots while surfaced. While relatively devoid of features, the hull is punctuated with various fittings such as cleats, ladders, and access hatches. Panel lines between the steel plates can be seen along the entire submarine. With the exception of the tail and bow areas, the top surface of the ship is flattened for sailors to walk on. This area conceals a long sonar antenna, and is surrounded by railing made of metal posts and steel cable. A distinctive horizontal gap of about twelve inches runs several feet below the deck area. At the bow (nose), submerged below the water, are six hatches covering the torpedo tubes, three on each side. A centered hatch at the top of the sub on the bow can be opened to allow torpedoes to be brought into the sub. There are three other hatches on the deck. One is at the bow, another is approximately centered in the deck above the officer's wardroom, and the last is located closer to the stern. The Blueback's exterior is painted black, and the ship's number and other markings are stenciled in white. The Blueback's most notable exterior feature is the tapered vertical structure, or sail, located on the front third of the ship's deck. The sub's dive planes (small winglets that direct the sub up or down in a dive) are mounted on either side of the sail. Like most submarines, the sail is equipped with several different antennas of various shapes and sizes projecting from the top of the structure, including periscopes, and a snorkel tube. From front to back, the projections are: periscope number 1, periscope number 2, the UHF/IFF antenna, the high signal frequency AN/BRA II antenna, a dome shaped BRD-6B radio direction finder and electronic counter measure antenna, a football shaped very low signal frequency AT/317E antenna, a whip antenna, and the snorkel induction head valve and snorkel exhaust valve. The various antennas and devices are painted black, natural metal, or gray with black camouflage stippling. While in active service, the antenna and snorkel tube were retracted when underwater to protect them. These devices are currently fully extended for display. An interior port-side hatch from the main hull into the sail allows access for maintenance; however, this area is not a habitable compartment. Other notable exterior features are the stern planes at the extreme rear of the ship. Four stern planes extend from the main hull, two vertical and two horizontal. The two horizontal planes have smaller rectangular sonar domes mounted vertically at the end of each. The propeller mount is located behind the planes at the extreme rear of the ship where the hull narrows to a cone. With the exception of the top vertical plane, the stern planes are submerged, even when the sub is surfaced. The location of the submerged planes is marked with orange floats. The Blueback's interior is a Spartan, utilitarian affair, with linoleum floors, Formica paneled walls, stainless steel fixtures, and steel bulkheads and fittings painted neutral gray throughout. It is immediately apparent to the visitor that every spare inch of space needs to be utilized on a submarine. Storage compartments, knobs, levers, wires,

and pipes are crammed into every available space, which is a characteristic found throughout the ship with few exceptions. Along its length the ship is divided into three main compartments. The torpedo compartment at the bow and this area is the largest space in the ship. The Midship compartment in the center, and is at the widest point in the ship. This area contains the living quarters and control center. The machinery compartment is located at the rear of the boat and includes the engines and related controls. The midship compartment is divided into three floors, the upper two of which house the living spaces and the control center, the bottom deck primarily houses the massive batteries, but also dry goods. The torpedo and machinery compartments have two decks each, with the main space on the top deck and the lower deck serving as space for additional equipment or storage. Each main compartment is divided further into more spaces that are connected with a central hallway, just wide enough for two people to pass. Each space has a curved side wall, as the submarine is circular in cross section. To prevent flooding in the event of an emergency, watertight doors separate several spaces throughout the ship. The sub is entered through an added stairway just aft of the officer's wardroom, or mess. The wardroom contains a u-shaped seating area that is quite similar to a corner booth at a restaurant with Formica and stainless steel surfaces for the table and a vinyl bench seat. The area includes the pantry, a small half kitchen about the size of a broom closet, and the executive officer's quarters. Just fore of the officer's wardroom, on the starboard (right) side, is the yeoman's room, or ship's office, where records and the ship's typewriter are found. Across from this space, on the port (left) side is the ship's radio room, equipped with several different types of communications devices. This room is roughly as big as an average-sized bathroom. Moving forward down a narrow hallway toward the bow is the attack center. This hallway-shaped space is crammed with equipment used to track the speed and heading of torpedo targets and compare this information to the sub's speed and heading. Using this information a solution can be calculated for the crewmen to know where to "aim" their torpedo to hit the selected target. In this area, painted bulkheads and pipes are the only finishes, other than the linoleum floor. Ahead of the attack center is the ship's command center. The small room is dominated by two periscopes in the center. Since there are no windows on a sub, periscopes are how the sub observes activities on the surface and how surface torpedo targets and hits are confirmed. Also located in the command center are the dive controls, which are located in a long bank of switches controlling hydraulic actuators and gages, designed to monitor and control ballast, dive angle, dive depth, and the roll of the submarine as it turns. At the bow end of the room on the port side are the navigation controls, which look like an airplane cockpit. There are two seats here, each equipped with its own control yoke (similar to an airplane) and a console littered with gauges, switches, levers, and lights. It is also in the command center where the ship's chart table is located on the port side of the room. The whole control room is about the size of an average bedroom found at home. Back in the hallway between the attack center and command center, a very narrow and steep set of steel stairs leads down to the second deck. Forward of this stairway is a locker used to store the ship's small arms and ammunition for immediate use should the need arise. The torpedo room is the foremost room in the sub and is also the largest. The room is mostly filled by the two banks of torpedo storage racks. The sub has six torpedo tubes, and carries a total of 22 weapons on board. It is capable of firing several types of torpedoes, but the most common was the Mark 37 wire-guided torpedo. In addition, the sub carried several shorter Mark 57 mines. The weapons are brought into the ship via a loading hatch from the top of the ship's bow. A hydraulic lift rises from the torpedo room floor to align the weapon in one of the racks. When the tubes need to be loaded for firing, a hydraulic rammer pushes the torpedo into position, and then pushes the weapon into the tube. Also in this room is an escape hatch, right above the heavy watertight hatch. Should the sub be in trouble, sailors could egress the sinking sub through this hatch. Behind the torpedo room are the crew's head and the crew's showers. On the port side aft of the stairwell is the ship's sonar control center. The sonar room is the sub's eyes and ears underwater, the sensitive equipment identified and located ships, submarines, and other obstacles. Any information gathered here was passed up to the control room and the attack center. The sub has sonar sensors and masker emitters in several locations. Some are located in the bow though they are covered by special bulkheads and cannot be seen from outside the sub, and several large sensors are located in vertical additions to the horizontal planes at the stern. Masker emitters are located all over the hull, though they also cannot be seen from the exterior. Their job is to constantly project small amounts of white noise to distort or hide the sub's presence from enemy sonar. Just aft of the sonar room and crew's washroom are the bunk rooms. The ship had only enough bunks for the men to sleep in three rotating shifts. The bunks are stacked three high on both sides of the central aisle, each bunk is just big enough for a sailor to fit into. Sailors were very limited in the amount of personal storage space, each being given a small drawer four inches tall under the bunk for his personal possessions. Scattered throughout the crew's living area are some larger lockers, which would also be used to stow personal belongings. The crew quarters are vinyl floored, with light wood-pattern Formica paneling with polished steel trim throughout. Aft of the crew's quarters was the ship's galley, where the kitchen, frozen stores, chilled stores, and dry stores were located and prepared. Dining facilities for 20 crewmen are located in the galley, so as with sleeping, the crew had to take their meals in shifts. The galley is one of the biggest rooms on the ship. It is finished with vinyl floors like the rest of the sub and painted bulkheads for walls. Fixtures throughout the room, such as the refrigerator and pantry doors, sinks, and other appliances are made of stainless steel. The four tables in this space have Formica tops with polished steel trim. Bench seats are located on either side. Aft of the galley and separated by a small watertight door is another deck hatch, and beyond this are the ship's engines. Two of the Fairbanks-Morse diesels are on the second deck; the third is offset in the center below them. The engines do not drive the propeller directly; rather, they generated electricity to run an electric drive motor, which spins the propeller. Since diesel engines require air to run, when the sub is underwater a device called a snorkel is raised from the sail to the surface, allowing air to be brought inside the sub and exhaust expelled. The electric motor allows the sub's diesel engines to be shut off, so the sub can run on battery power. Electric power is the most silent way to move a sub, even more so than the more modern nuclear powered subs since it requires no pistons or moving parts, keeps vibration to a minimum, and does not require air to run. For those reasons, electric power was used whenever the sub was below snorkel depth or did not want to be detected. The engine room is crowded with painted pipes and bulkheads and has a steel floor. The sub's engines, batteries, electric-drive motor, and drive related machinery are all controlled from the maneuvering room, which is the room furthest aft on the second deck, right behind the diesel engines themselves. In this room, all the ship's power systems, engines, and generators can be monitored via a system of gauges, or shut down in the case of an emergency. This room has wood-colored Formica-paneling with many types of gauges and levers set into the walls. Consoles are located on the fore and aft walls, with seats for crewmen who are monitoring the gauges. Just aft of this room is a small, narrow, steel walkway that leads to the stern of the sub where crewmen could perform maintenance on the shaft. The massive batteries are located on and fill nearly the whole of the third deck. The sub has two batteries; each one has 252 cells rated at 500 volts. The batteries give the sub a submerged endurance of over 100 hours at three knots, or 30 minutes at full speed. After the sub has reached its battery limit, the batteries need to be recharged, which is accomplished by running the diesel engines while snorkeling underwater or at the surface for several hours. The battery rooms are lined with rubber to keep corrosive battery acid from damaging bulkheads. In addition, the rooms are watertight in order to keep seawater from getting into the batteries in case of an emergency. USS BLUEBACK CURRENT CONDITION During its service history the USS Blueback was modified by the US Navy to incorporate the latest technologies; however, these modifications do not negatively impact the vehicle's character-defining features or significance. The only notable modification is the relocation of the dive planes from the vessel's bow to the conning tower in 1964. The Blueback is currently maintained as a museum ship by OMSI. Generally, any changes made to the Blueback were done to facilitate the safety of visitors to the ship. To that end, an entry hatch has been added to the port, or left side of the hull, roughly center – it opens directly aft of the officer's wardroom. This entry hatch has a double hatch, with a covered porch and a railing on the stairs. To keep the sub from drifting and to compensate for the changing levels of water in the Willamette River, two large mooring brackets were welded to the port side of the hull, which are connected to the pilings on the dock, allowing the sub to rise and fall as the water level changes. In addition, the Blueback's massive five-blade brass propeller was removed, and is now set up as a memorial right outside the museum's main building on the walkway that leads down to the dock. The propeller is not included as part of this nomination. To prevent water and debris from seeping into the sub, openings such as ballast tanks and the six torpedo tubes, which will not be used by a museum ship, have been welded closed. Other minor modifications involve the removal of classified or sensitive equipment by the Navy, such as one of the periscopes. Replacement parts, however, have been used wherever possible, as is the case with the two periscopes. Several Plexiglas panels have been installed in various places in the ship. In the engine room, for example, Plexiglas panels have been added to one engine to show its inner workings to visitors. Usually, these panels take the place of an existing solid metal access panel, and are there to show what is behind without having to open the panel. Aside from these minor modifications, the Blueback's appearance is identical to what it was during its service and retains a very high degree of physical integrity throughout. In keeping with its current use as a museum ship, guided tours are offered several times a day. OMSI's goal is to keep the submarine as authentic as possible to give visitors the best presentation of life on a submarine. As such, the sub is meticulously maintained so that everyone, young and old, can see a Cold War submarine "in action."

HISTORY

(Chronological, descriptive history of the property from its construction through at least the historic period - preferably to the present)

SUMMARY Commissioned in 1959, the USS Blueback (SS-581) is nationally significant under Criterion "C" in the area of Engineering as the last surviving example of a Barbel Class submarine. The period of significance is the year that the Blueback was completed and launched. Only consisting of three ships, the Barbell class combined proven WWII-era diesel-electric motor technology with a revolutionary tear-drop hull shape, high-strength steel, and other improvements that were incorporated into later submarine designs. The technological advance was driven by the transition in submarine warfare from the older Fleet Boat system to the modern nuclear-powered vessels of the Cold War. However, the Blueback and her sister ships were a transitional design. After independently studying nuclear power in the Nautilus test ship and the tear-drop hull shape with the Albacore test submarine and the active-duty Barbell Class, these technologies were combined to create the modern nuclear submarines used by the U.S. Navy from the Cold War to the present. As the last diesel-electric submarine to join the US Navy and the last to be decommissioned, the Blueback represents an important transition in maritime technology and navel warfare. HISTORIC CONTEXT: THE COLD WAR SUBS The ability of the submarine to approach and destroy enemy vessels in complete secrecy has captivated naval commanders for centuries. Legend has it that Alexander the Great descended beneath the waves near the city of Tyre in a primitive diving bell in 332 B.C. A design in a sketch book by Leonardo da Vinci represents a submersible covered in goatskins. A design by an Englishman in the late 1500s included the concept of a double hull and trim and ballast systems, but was never built. It was the United States that made the first military submarine. In 1776, a Yale University student named David Bushnell designed and built an egg-shaped submarine called the Turtle. The small vessel came equipped with a hand powered screw, a drill bit, and a waterproof time-bomb that could be attached using the drill bit. On 6 September 1776, Sergeant Ezra Lee of the Continental Army used the Turtle to make an abortive attack on the HMS Eagle. Though no damage was done, and no one was hurt, it

was a promising start for military submarines. The first successful use of submarine in combat occurred eighty years later when the Confederate submarine H. L. Hunley attacked and sunk the USS Housatonic during the Civil War. Military submarines became important weapons in WWI with the German development of the dreaded Unterseeboot fleet, commonly called U-boats. Drastic improvements in submarine construction were made just prior to WWI, such as improved diesel engines, better periscopes and torpedoes, and wireless systems. These new technologies allowed the subs to operate far from home base and to be more lethal and secretive than ever. The U-boats wreaked havoc upon the merchant fleets of the North Atlantic, almost completely cutting England off from its allies. In one well-known incident, the elderly U-9 sank three British cruisers and inflicted over 1,400 casualties. Clearly, submarines were the key to owning the seas. Upon entering the war, the United States began turning out subs as fast as possible, and continued to do so on through WWII. The purpose of a submarine during WWI and WWII was simply to sink other ships. These “Fleet Boats” worked in concert with the surface fleet to track down and eliminate threats, often well into enemy controlled seas. Fleet boats, aesthetically, are little different from their surface counterparts – they had a flat deck, a pointed prow or nose, a conning tower, and surface armament in the form of several anti-aircraft machine guns and a larger deck gun for use against lightly-armored surface vessels. The batteries of these older subs did not store enough electricity to allow the ship to stay under for very long. Because of this, the ships were designed for maximum surface handling characteristics, where they spent the majority of their time. These early submarines only submerged to escape detection. The U.S. Balao class, for instance, had a battery endurance of 48 hours at a meager two knots an hour. Battery power was drained more quickly if the sub tried to travel faster. On the surface the fleet boats kept up with surface ships, maintaining a speed of about 21 knots. When submerged, most fleet boats could only dive to a maximum of around 400 feet. This is shallow compared to modern subs, which can dive nearly twice that depth. The American submarines in WWII included three separate types or classes, Gato, Balao, and the later Tench, which were all virtually identical. 311 feet long with a beam of 27 feet, these fleet ships were made to knife through the water on the surface. Gato and Balao were heavily armed with ten torpedo tubes, six forward, four aft. They carried a large store of torpedoes, but were also armed with more conventional weapons as well. Balao, the most numerous class of American fleet subs, was armed with a forward facing five-inch deck gun, and four machine guns, which was a typical arrangement at the time. Each sub carried a limited store of torpedoes, no matter how long their patrol might be. Often commanders would opt to save a torpedo and sink a stricken enemy vessel with surface weapons, unless the target was heavily armored. When WWII ended, the United States found itself in an ideological, and sometimes armed, conflict with the USSR. While open warfare was limited, the conflict largely polarized the world into pro-US or pro-Soviet governments. In contested nations, proxy wars between the two combatants and their allies raged, sometimes for years or decades. Although open conflict between the US and the USSR was largely avoided, both nations sought to intimidate the other by the size and potency of their forces and by developing new weapons. During this period, military technology saw a rapid burst of growth as the US and the USSR tried to achieve an advantage, and naval forces were no exception. Up to WWII, the pinnacle of surface fleet development was the battleship - a literal floating fortress. During WWII, it was shown that carrier-borne aircraft could sink any surface ship. The aircraft carrier’s ability to locate and destroy enemy vessels from hundreds of miles away led to major changes in navel warfare after WWII, including the use of submarines. Because of airplanes, subs could no longer remain on the surface for long, if at all. Radar and enemy spy planes made the ships far too vulnerable on the surface. In addition, because of the advances in submarine detection technology and surface ship weapons, Cold War subs could not fire torpedoes without being quickly detected by the enemy and destroyed. However, because submarines were hard to detect under the surface, these ships could still be called upon for missions that required secrecy, such as intelligence gathering missions or covert operations. POST WWII SUBMARINE DEVELOPMENT An effective way at improving technology quickly is to reverse engineer a superior machine. In WWII, the US captured several German U-Boats, which were widely held to be the best submarines in the world at the time. By reverse engineering these captured subs, American scientists hoped to determine how to best improve American ships. What they found led to the creation of four goals for American submarine development: increased battery capacity, more streamlined hulls, snorkel systems, and improved fire control systems. With these goals in mind, the American Navy began the GUPPY (Greater Underwater Propulsion Power) program, which simply took WWII subs and retrofitted them to be more effective. Surface weapons were removed because they were no longer needed and only increased drag on the submarine when submerged. The conning tower became much less boxy and more streamlined. Snorkels, or long tubes that can be extended to let air into the sub, allowed the subs to run under diesel power even while under the surface. From these GUPPY boats came the Tang Class of submarines. Purpose built with the GUPPY improvements, these subs were the pinnacle of submarine technology when they were revealed in 1947. Though they were the most advanced subs in the world, they still had flat decks and tall conning towers. They were also slow, managing top speeds of only 15 knots at the surface and 18 knots submerged. Though the Tang Class represented the best technology of the time, the Navy still sought to improve these designs. One field of research was nuclear technology, which would allow a submarine to stay submerged for long periods of time. The Navy was also interested in improving handling and performance. Instead of pursuing both nuclear power and improved performance in a single design, the Navy developed each concept separately using non-combat concept submarines constructed solely to test new designs and technologies. The improvements developed from these ships were incorporated into combat vessels. Launched 5 December 1953, the Albacore (AGSS-569) was designed to test hydrodynamics, noise reduction, and generally to make improvements wherever possible. Albacore was the first sub in the world to be built with the now familiar “tear drop” -shaped hull. Previous sub types had flat decks and pointed prows to maximize speed and maneuverability on the surface. In contrast, the Albacore was a cylinder with a rounded nose and a tapering tail that allowed it to move more easily while submerged. The new hull shape increased the speed of the ship under the surface dramatically. It was so quick and so maneuverable that when submerged that sailors dubbed its movements “hydrobatics.” The Albacore was also the first to pioneer the aircraft controls that all subsequent subs would use. In place of the hand-cranks and -wheels used by previous classes of ship, a simple yoke and pedals would do. The Albacore was at the fore of a new trend in submarine development that emphasized hydrodynamics and underwater efficiency over surface performance. The Barbel class was developed directly from the tests conducted on the Albacore. The contract to build the first ship of the class, the USS Barbel (SS-580) was awarded to Portsmouth Naval Shipyard in Kittery, Maine on 24 August 1955 and her keel was laid down on 18 May 1956. At the same time tests were conducted on the Albacore, the Navy introduced the USS Nautilus (SSN-571) as a test bed for nuclear power plants. Funded by Congress in 1951, the experimental Nautilus was finally launched 21 January 1954. Where Albacore researched hull design, Nautilus was intended to test power plants and engine endurance. Nautilus looked quite similar to a Tang Class submarine, yet internally was very different. Diesel engines existed solely as backups should the new nuclear generator stop working. The Navy quickly realized that nuclear power submarines were limited in range only by the amount of food that could be stored for the sailors. Nuclear generators require no oxygen, so the sub never has to surface or snorkel. They require no refueling, so the sub is not limited in the distance it can travel from port. Since Nautilus had no need for oxygen, she became the first sub to travel all the way under the polar ice cap, from the Bering Strait to the Greenland Sea. From the new propulsion technology developed with Nautilus came the next class of subs. The Skate Class was the first full class of submarines to be nuclear powered. They were developed directly from the Nautilus, but, like Nautilus, they were not built with the hull design pioneered by Albacore. They were still constructed much like the GUPPY and Tang subs: flat decked with a tall sail. The first class of submarines to put the two differing directions of development together was the Skipjack class. Skipjack had the nuclear reactors from Nautilus, and the hull form and maneuverability advancements from the USS Albacore and the Barbel Class. Production of the Skipjack boats was rushed. Funding was approved in fiscal year 1956 and the first ship of the Skipjack class, the Skipjack, received its commission three years later on 15 Apr 1959. Beginning with the Skipjack, all subsequent submarines utilized the tear-drop shape and nuclear power among other innovations. Both the Albacore and Nautilus continued in service as test vessels for new technologies. The Albacore was decommissioned in 1972 and in 1985 was taken out of the water and set on a concrete pedestal in Albacore Park in Portsmouth Virginia. Decommissioned 1980, the Nautilus was listed as a National Historic Landmark in 1982. In 1985 it became part of the permanent collection at the US Navy Submarine Force Museum in Groton Connecticut. THE BLUEBACK AND THE BARBEL CLASS The first class of subs to employ the improvements pioneered by the Albacore was the Barbel class. The first ship of the class, The Barbel (SS 580) was launched in July 1958 and commissioned six months later on 17 January 1959. Though nuclear power plants were used in mid-1950s in the Nautilus and later in the Skate Class, the Blueback and the other Barbels would be diesel-electric. Diesel-electric subs under battery power were, and are to this day, quieter than nuclear ships. Though nuclear subs never have to surface, their reactors cannot be shut down, and the pumps that circulate coolant must be running constantly. Electricity, on the other hand, requires no pumps, no engines, no reactors, and very few moving parts, so the amount of noise they make is minimal and renders them nearly invisible to sonar when under battery power. At the time the three Barbel Class submarines were ordered in 1955, diesel-electric motor technology was proven. However, the Navy’s changing priorities favored the fuel conservation and range advantages of nuclear submarines over the stealth of diesel subs. Although only three of the Barbel Class subs were constructed, the class represents the pinnacle of diesel-electric technology. These were the first active duty submarine to include many of the advances in submarine design pioneered by the Albacore. The Barbels were, at the time of their launch, arguably the world’s best submarines. Though not nuclear powered, the Barbels excelled at secrecy. At 21 knots submerged, they were faster than any other US submarine except the Albacore. Their hulls were far more hydrodynamic than any other sub in the world at the time – lending much greater maneuverability and noise reduction when submerged. Their internal electronics were better than any other active duty US submarine – airplane controls in the command center like in Albacore, push button ballast and dive controls, and advanced BQS 4 active/passive Sonar equipment in the nose. They were the first active duty subs to be constructed of HY-80 steel, which was stronger than previous types and allowed for much deeper dive depths. All subsequent submarine types in the US would be built of HY-80 steel. The Barbels were also among the most silent submarines in the world at the time. Masker emitters placed in the hull covered the sub with a small amount of white noise to distort the sub’s shape to sonar, and the single propeller had been manufactured with extreme precision, to ensure it cut through the water as quietly as possible. Compared to any other active duty submarine in the world at the time of their launch, the Blueback and the other Barbels had a truly distinctive appearance. The cylindrical hull with rounded nose and tapered tail differed so drastically from any other class of submarine in service at the time, and marked the Blueback as a product of the hydrodynamic research conducted by Albacore. Like the Albacore and other Barbels, Blueback originally had her diving planes mounted to the sides of her nose, which was the typical arrangement for all previous submarine types. The dive planes are winglets that are designed to help point the nose of the sub down in a dive, and up in a surfacing maneuver. While the boat is on the surface, the planes rotate and fold up hydraulically, so they are held vertically to keep out of the way. However, it was quickly realized that this arrangement was only effective at low speeds, and that on a high-speed ship such as the Blueback the dive planes were less effective in steering the ship and increased drag. The dive planes were relocated in 1964 to their current position on the sail, where they are permanently held horizontally. The change was subsequently mirrored in the design of other submarine types. The Barbel’s had other improvements as well. Submarines before the Albacore and the Barbels had a “conning tower” rather than a sail. The tower on the hull had a pressurized room in it that housed the periscopes and other equipment. In these subs, sailors would have to climb up into the tower to use the

periscopes, and would have to relay what they saw down to the command center. In the Barbels, the conning tower was eliminated. The tower like projection on top of the hull simply stored the antennas, periscopes, and snorkel tubes, with no room for sailors. All functions of the conning tower were relocated to the command center, eliminating the need for a separate room and the chance of miscommunication. All subsequent sub designs would follow the Barbels in doing away with the conning tower. Other changes were made in the ship's systems. Like the other Barbel-class submarines, the ships command center was one of the most advanced found in any submarine at that time. The most advanced control, communication, and weapons systems of the time could be found on board. The third and last of its class, the USS Blueback was launched from Ingalls Shipbuilding Corporation in Pascagoula, Mississippi on 16 May 1959. Ingalls had never built a submarine before – in fact, no shipyard in the entire southern United States had built a submarine since the early attempts during the Civil War. She was compact, as submarines go, at 219 feet, 6 inches long and 29 feet across. At the launch, Rear Admiral L. R. Daspit, Director of Undersea Warfare Division of the Navy remarked on the "ideal tear-drop" hull design, noting that "Blueback will have great speed and maneuverability." He continued, this "ship has the latest and best electronic equipment yet designed, Blueback will be well equipped to act as a killer submarine on an antisubmarine patrol, to act as a mine-layer, to perform reconnaissance missions, or to do other military missions which require surprise, stealth, or undetected operations for their success." It was also noted at the time that the Blueback would be the last diesel submarine. After being commissioned on 15 October 1959, the ship went through a short "fitting out" period of arming and crewing before heading out in 1960 to her new home in San Diego, California. There, she performed acceptance trials and training runs, before relocating to Pearl Harbor, Hawaii. In 1965, she was deployed to assist American operations in Vietnam. Blueback spent the next decade patrolling the Pacific and running "special assignments" in the Far East. For her service, Blueback was awarded two battle stars for participating in high profile engagements during Vietnam. Unfortunately, much of Blueback's operational history is as yet still classified; however, her superior engineering allowed the crew to complete a wide variety of reconnaissance and covert operations, just as she was deigned to. Compared to her nuclear contemporaries, Blueback and here sister ships were silent, efficient, and above all reliable. Blueback's engines were far simpler than a nuclear submarine's, and were far less prone to having engineering problems. The Blueback crew, to highlight that difference, created the Diesel Boats Forever (DBF) pin, which quickly became very popular. Submariners on diesel boats would wear a DBF pin as a mark of pride – the pin was equipped with slots for stars that could be added for each time the diesel boat was called on to "rescue" a nuclear sub that had broken down, a smug way of humbling their compatriots aboard nuclear boats. Although only containing three ships, the Submarines of the Barbel Class enjoyed long service histories. Barbel (SS-580), built by Portsmouth Naval Shipyard in Kittery, Maine and commissioned in 1958, was decommissioned in 1989, partially scrapped in the 1990s and finally sunk as a target ship in 2001. Her hulk lies off the California coast under 3,600 feet of water. Bonefish (SS-582), built by New York Shipbuilding Corporation of Camden, New Jersey, was commissioned in July 1959. Her career was cut short in 1988 by a fire in the battery compartments that gutted the submarine, and killed three sailors. The damage was so extensive that the sub had to be deactivated and decommissioned. Later in 1988, the sub was scrapped in its entirety. Blueback was the last diesel-electric submarine to join the US Navy, and was also the last to leave. She was decommissioned 1 October 1990, and laid up in the Pacific Reserve Fleet in Bremerton, Washington. Her name was struck from the Naval Register 30 October 1990 after more than 30 years of service. In February 1994, the Oregon Museum of Science and Industry (OMSI) purchased the dilapidated Blueback and towed it to its current berth on the Willamette River in Portland. When OMSI acquired the sub, it could safely be called a "floating pile of junk." Rust and grime covered the majority of the hull, and the interior spaces were little better; after 30 years of nearly constant use, followed by a several year long period of disuse, the interior needed a good scrubbing. Bulkheads were removed, cleaned, and painted. The outer hull needed repairs, a good stiff cleaning to remove the rust, and a fresh coat of black paint. Currently, OMSI maintains the Blueback as a museum ship, in such a condition that future submariners and "old salts" alike can experience a little piece of life on a military sub. CRITERIA CONSIDERATION B and G The pivotal importance of the Cold War and the involvement of the U.S. Armed forces in this global conflict is already well-recognized by historians. Although not yet 50 years old, the Blueback tells an important piece of this story: How the US Navy developed and fielded new weapons in response to the changing realities of naval warefare. The Blueback is the sole physical example of how this transition affected the design of submarines after the loss of the two other sister ships decades ago. Although comparable in design, the USS Albacore, the test-ship that pioneered the concepts used on the Blueback, never was intended for active combat and has lost its integrity of setting. Because of the importance of the history and engineering that this resource represents and its uniqueness, the Blueback meets the requirements under Criteria Consideration G. In the case of a vehicle, such as a ship, Criterion B does not apply because it is inherent in the design and intent of a vehicle that it move from place to place. The Blueback maintains its historic setting because it is located in an appropriate marine setting on the Willamette River. CONCLUSION During the Cold War the changing nature of navel warfare forced the development of faster, quieter, and more technologically advanced submarines. The USS Blueback represents the development of key technologies during this period. For its time, the Blueback's hull was the most advanced design of any submarine in the world when she was launched. This tear-drop design quickly became the standard hull form for all subsequent submarines, both domestic and foreign. The hull design also pioneered the use of the "sail" over a traditional conning tower. Other important technologies were developed on Blueback and her sister ships as well, such as push button ballast and dive controls, flight-yolk steering, and modern communication and weapons systems. At the same time, the Blueback and her sister ships are unique in that they were built as diesel-electric submarines during a time when the US Navy decided that it would be an "all nuclear" navy. The decision meant that the Barbels served as some of the last diesel-electric subs in a navy of nuclear boats. Blueback herself was in service after some of her newer successors had already been decommissioned. As the only remaining ship of her class and as a physical link to the development of navel technology in the Cold War the USS Blueback is eligible for the National Register Criterion C in the area of Engineering.

RESEARCH INFORMATION

Title Records	Census Records	Property Tax Records	Local Histories
Sanborn Maps	Biographical Sources	SHPO Files	Interviews
Obituaries	✔ Newspapers	State Archives	✔ Historic Photographs
City Directories	Building Permits	State Library	

Local Library:	Oregon Museum of Science and Industry	**University Library:**	
Historical Society:		**Other Respository:**	

Bibliography:

BIBLIOGRAPHY Bibliographical Note: This nomination to the National Register of Historic Places makes extensive use of the archival materials located at the Oregon Museum of Science and Industry (OMSI), located in Portland OR. These documents include technical manuals, correspondence, photographs, and drawings. Materials from this source are noted as the "USS Blueback Collection." Albacore Park Association. "Albacore Park." http://www.ussalbacore.org/html/albacore_park.html. Accessed 15 July 2008. Allison, William T., Jeffrey Grey, and Janet G. Valentine. American Military History: A Survey From Colonial Times to the Present. New Jersey: Pearson Prentice Hall, 2007. Clancy, Tom. Submarine: A Guided Tour Inside a Nuclear Warship. New York: Berkley Books, 1993. Department of the Navy, Naval Historical Center. "Dictionary of American Naval Fighting Ships, Blueback II." http://www.history.navy.mil/danfs/b7/blueback-ii.htm. Accessed 30 January 2008. Friedman, Norman. U.S. Submarines Since 1945I. Annapolis, Maryland: Naval Institute Press, 1994. Meagher, Patrick. "The DBF Pin." Submarine Sailor. http://www.submarinesailor.com/history/dbfpin/dbfpin.asp. Accessed 31 January 2008. Pimlott, John L, editor, The World at Arms: The Reader's Digest Illustrated History of WWII. New York: The Reader's Digest Association, Ltd., 1989. US Navy Submarine Force Museum. "History of USS Nautilus (SSN 571)." http://www.ussnautilus.org/history.html. Accessed 15 July 2008. Weir, Gary E. Forged In War: The Naval-Industrial Complex and American Submarine Construction, 1940- 1961. Washington: Naval Historical Center, Department of the Navy, 1993.