

Maritime Museum of San Diego

Vol. 50: 3 & 4 Summer/Fall 2014

MAINS'L HAUL

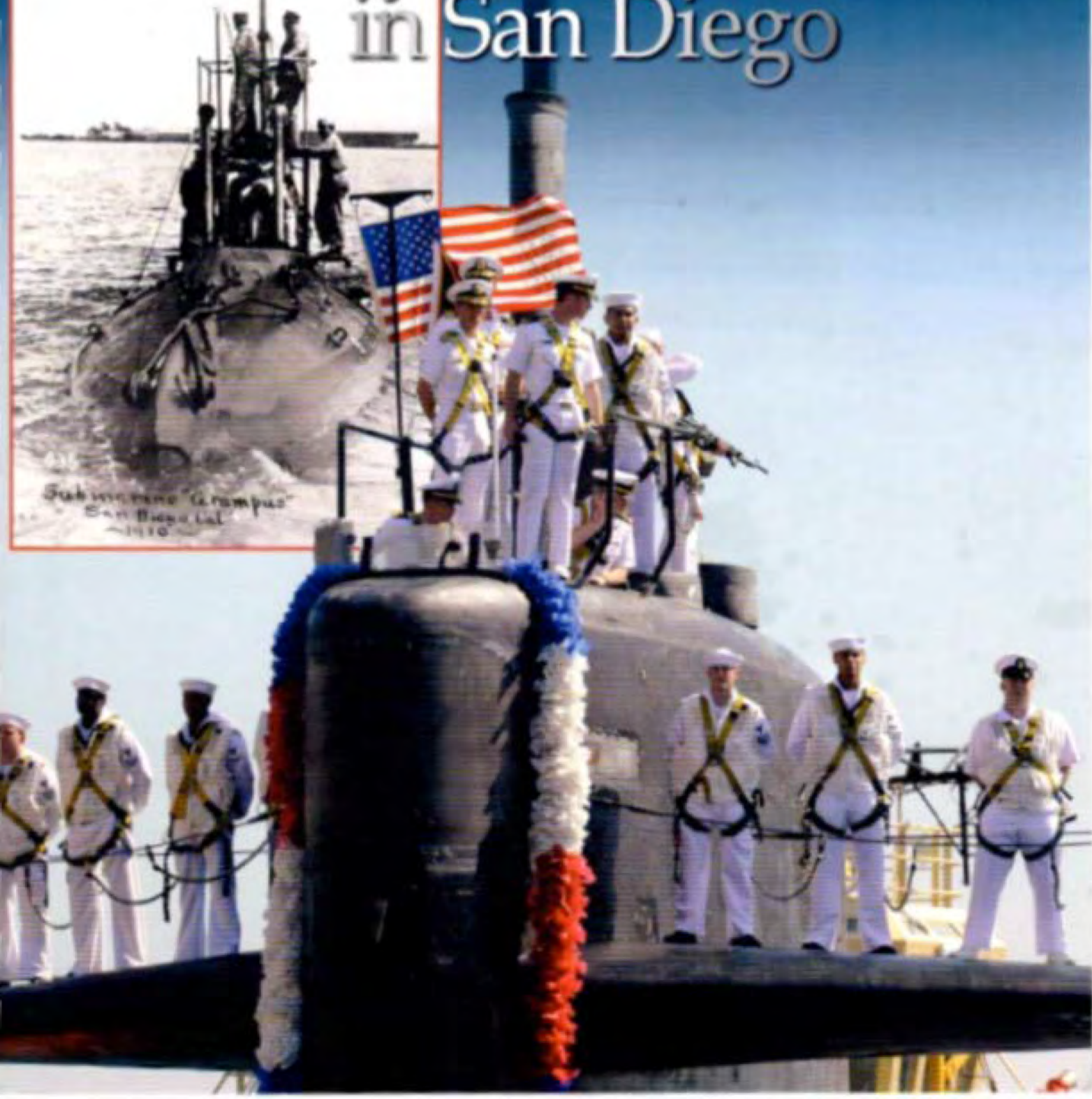
\$14.95

A Journal of Pacific Maritime History

A Century of Submarines in San Diego



Submarine "Grampus"
San Diego Cal.
~1910



Submarine "Firsts" in San Diego

28 June 1910 First submarines arrive in San Diego, *Grampus* (SS-4) and *Pike* (SS-6).

1911 First operational submarine training site in San Diego (Camp Richardson) is established in Coronado, just north of the ferry landing.



17 December 1917 First (and only) U.S. submarine lost during WWI, USS *F-1*, off the coast of San Diego, due to a collision in the fog with sister submarine *F-3*.



1927 First long-range "fleet submarines" (V-class) arrive in San Diego, marking a strategic shift from submarines for coastal defense to submarines that could operate in collaboration with the surface fleet.

15 June 1939 The Navy's first Sound School for destroyers and submarines founded in San Diego.

1941 The *Porpoise* and *Salmon*-class boats that had been stationed in San Diego during the late 1930s, and moved west in response to the increasing threat in the Western Pacific, were among the first submarines to engage in combat following the attack on Pearl Harbor and Manila.

January 1942 San Diego's *S-18* (SS-123) was one of the first two submarines sent to Dutch Harbor, Alaska, during World War II.



1945 U.S. Navy Radio and Sound Laboratory (NRSL) on Point Loma developed the Navy's first sonar set to show multiple targets in radar-like fashion on a display screen, which enabled U.S. submarines to penetrate the heavily mined Japanese Inland Sea in 1945, and later played a major role in supporting under-ice operations.

12 February 1947 San Diego submarine *Cusk* (SS-348) launched the first guided missile (Loon, a German V-1 rocket variant) to be fired from a submarine.

1949 The Navy's first submarine flotilla commander since World War I is established in San Diego, in recognition that San Diego would become a major hub for submarine operations in future years.



1949 Submarine tender *Sperry* (AS-12), while returning to San Diego, operated in support of the first publicized test firings of missiles from submarines.

29 May 1957 First visit by a nuclear submarine to San Diego, by the world's first nuclear submarine *Nautilus* (SSN-571).

3 June 1957 First Pacific Fleet exercise involving a nuclear submarine, off the coast of San Diego.



December 1960 The first general-purpose computer is installed onboard a U.S. submarine, *Baya* (AGSS-318), and it is the first of its kind to be used for real-time sonar data processing.

28 June 1961 First *Skipjack*-class SSN stationed in San Diego, *Sculpin* (SSN-590).

29 May 1962

First *Thresher*-class SSN stationed in San Diego, *Permit* (SSN-593), reporting to Submarine Squadron THREE.



1962 *Snook* (SSN-592) is the first nuclear submarine to deploy as part of an Aircraft Carrier Hunter Killer Group, attached to Carrier Division SEVENTEEN, for the entire seven-month deployment.



1 March 1969 San Diego's first *Sturgeon*-class SSN, *Gurnard* (SSN-662), arrives at Ballast Point.

27 September 1971 *Dixon* (AS-37), the first of the *L.Y. Spear*-class of submarine tenders built to service nuclear submarines, is homeported in San Diego.

1974 Harpoon ship-to-ship missile first test-fired from the submarine *Pintado* (SSN-672).

February 1978 *Barb* (SSN-596) conducts first submerged launch of Tomahawk land-attack cruise missile at the San Clemente Island test range.

21 March 1982 Arrival of first *Los Angeles*-class submarine, *La Jolla* (SSN-701), to be homeported in San Diego (photo below).

1984 *McKee* (AS-41) became the first submarine tender certified to service Tomahawk cruise missiles.

1987 First *Los Angeles*-class submarine with the Vertical Launch System, *Louisville* (SSN-724), arrives at its new homeport in San Diego.

19 January 1991 *Louisville* (SSN-724) completes a high-speed transit from San Diego to the Red Sea to launch Tomahawk cruise missiles into Iraq, at the beginning of Operation Desert Storm, marking the first weapon launched in an act of war by a U.S. submarine since World War II.



La Jolla (SSN-701)





Maritime Museum of San Diego Board of Trustees 2014

David MacVean, Chairman
Kenneth Andersen, Vice Chair
Robert Dilworth, Vice Chair
Alex Gruft, Secretary

Dennis Burks
Robert Clelland
Iris Engstrand
Virgil Erwin
Fredrick Frye
Sarita Fuentes
Gary Gould
Wayne Hanson
Rudolf Hradecky
Patricia Hsieh
Michael B. Jones
Jeffrey Kirsch
James Lonergan
Charles MacVean
Paul Nierman
David O'Brien
Himanshu Parikh
John Rebelo
John Reid, Jr.
Stanley Rodriguez
Jon Schmid
Douglas Sharp
Ken Stipanov

Ex Officio

Raymond Ashley, President/CEO
William Dysart, Past Chairman
RADM Patrick Lorge
Commander, Navy Region Southwest
Sharon Cloward, Port Tenants
Association Representative
Steve Andres, Docent Chairman
Lynne Eddy, Ships Maintenance
Crew Representative

PRESIDENT'S ADVISORY COUNCIL

Dr. William Brown
Barbara Sharp

MAINS'L HAUL EDITORIAL BOARD

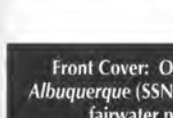
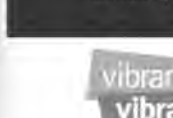
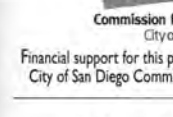
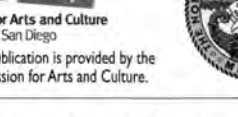
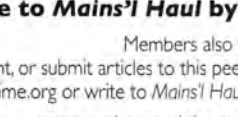
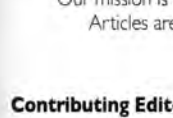
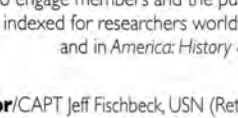
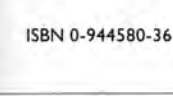
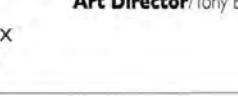
Raymond Ashley, Ph.D.
President & CEO
Jim Cassidy, Ph.D.
U.S. Navy Civilian (Retired)
Filipe Castro, Ph.D.
Texas A&M University
Iris W. Engstrand, Ph.D.
University of San Diego
W. Michael Mathes, Ph.D.
El Colegio de Jalisco
Carla Rahn Phillips, Ph.D.
University of Minnesota
Timothy Runyan, Ph.D.
East Carolina University
Abraham J. Shragge, Ph.D.
University of California, San Diego
Raymond Starr, Ph.D.
San Diego State University, Emeritus
William Still, Ph.D.
East Carolina University, Emeritus
Richard Unger, Ph.D.
University of British Columbia

MAINS'L HAUL is published
by the Maritime Museum of San Diego,
wind and weather permitting,
aboard the ferryboat *Berkeley*.
MAINSAIL HAUL—An order in tacking ship
bidding, "Swing the main yards."

Maritime Museum of San Diego MAINS'L HAUL A Journal of Pacific Maritime History

Vol. 50: 3 & 4 Summer/Fall 2014

A Century of Submarines in San Diego

	2	A Message from the Chief of Naval Operations	2
	4	Admiral Jonathan W. Greenert, USN	
	16	From the Helm	3
	26	Ray Ashley, Ph.D.	
	42	Ballast Point: A Premier Base for Submarines	4
	44	Captains Bruce Linder and Sam Ward, USN (Ret.)	
	48	Submarines in San Diego: The Early Years	16
	54	Captain Bruce Linder, USN (Ret.) and Captain Thomas E. Ishee, USN	
	66	San Diego Submarines: The War Years (1941-1945)	26
	74	CDR R.D. Baker, USN (Ret.) and Captain Scott A. van Hoften, USN (Ret.)	
	102	Timeline: A Century of Submarines in San Diego	42
	78	Various Contributors	
	96	Full Circle: An Interview with George V. Kinnison	44
	96	Sarah Bishop Dolbec	
	102	Captain Charles B. Bishop, USN (Ret.) Sailor J. Scientist	48
	96	Sarah Bishop Dolbec	
	102	Submarine Rescue and Deep Submergence Comes to San Diego	52
	96	Captain Charles R. MacVean, USN (Ret.), Ph.D.	
	102	Small San Diego Lab Makes a Big Difference	54
	96	Tom LaPuzzo	
	102	San Diego-based Research Submarines	66
	96	Tom LaPuzzo	
	102	Vice Admiral Bernard Kauderer, USN (Ret.) Cold War Perspective	74
	96	Sarah Bishop Dolbec	
	102	Submarines in San Diego during the Cold War	78
	96	Captains Bill Hughes and Jeff Fischbeck, USN (Ret.)	
	102	Post-Cold War Submarine Operations in San Diego	96
	96	Commander Brien W. Dickson, USN	
	102	San Diego Submarines and the Hollywood Connection	102
	96	Captain Jeff Fischbeck, USN (Ret.)	
	102		

Front Cover: On 21 August 2013, CDR Chris Cavanaugh, Commanding Officer of the *Los Angeles*-class attack submarine *Albuquerque* (SSN 706), pilots his ship pier-side to Navy Base Point Loma, San Diego, as his Sailors look on from the bridge and fairwater planes. The *Albuquerque* had just completed a seven-month deployment to the western Pacific region.

U.S. Navy photo by Mass Communication Specialist 2nd Class Kyle Carlstrom (Released).

vibrant culture
vibrant city

Commission for Arts and Culture
City of San Diego

Financial support for this publication is provided by the
City of San Diego Commission for Arts and Culture.



Unified Port
of San Diego



Subscribe to Mains'l Haul by joining the Maritime Museum of San Diego.

Members also receive a newsletter and other benefits.

To subscribe, comment, or submit articles to this peer-reviewed journal, visit the *Mains'l Haul* pages at www.sdmaritime.org, email: editor@sdmaritime.org or write to *Mains'l Haul*, Maritime Museum of San Diego, 1492 N. Harbor Dr., San Diego, CA 92101.

Our mission is to engage members and the public in the study of maritime history, while promoting scholarly research.

Articles are indexed for researchers worldwide at www.sdmaritime.org under Publications, *Mains'l Haul*,

and in *America: History & Life* and *Historical Abstracts*. ISSN# 1540-3386

Editor/Neva Sullaway

Contributing Editor/CAPT Jeff Fischbeck, USN (Ret.) Photo & Biographical Research/Proofreading/Sarah Bishop Dolbec

Art Director/Tony Enyedy Printer/Crest Offset Printing Company

ISBN 0-944580-36-X



CHIEF OF NAVAL OPERATIONS

A MESSAGE FROM THE CHIEF OF NAVAL OPERATIONS

I would like to commend the Maritime Museum of San Diego for illuminating over a hundred years of submarine history in San Diego in the current edition of the *Mains'l Haul*. As a former Submarine Squadron Commander in San Diego, I deeply appreciate the history that has shaped our modern naval forces.

While reflecting on the Century of Submarines in San Diego, I am impressed by two points that have remained constant despite our changing environment: the consistent focus on preeminent capabilities and the unwavering community support. From the beginning, U.S. Submariners have reported to San Diego to ready themselves through training and maintenance; to operate forward; and when called, to deliver credible combat power to fight and win our nation's wars. That was true in World War II (WWII), in the Cold War, and it is true today.

In the early years, our Submariners developed the equipment and established the tactics that would elevate the submarine to a highly effective combat weapon during WWII. Following WWII, the submarine group in San Diego became the foundation for continued growth of submarine operations through the Cold War and beyond. San Diego witnessed the evolution of submarines first hand – from the introduction and integration of the nuclear-powered submarine to the development and testing of new weapons and tactics that our Submariners skillfully employ.

Our unmatched prowess in the undersea domain is among our most important military advantage. We achieved this because of the relentless efforts of those early submarine pioneers who came to San Diego and those who followed; they set a vision of excellence that blazed a trail for our undersea community. San Diego played a pivotal role in the advancement of submarine operations and in ensuring our advantage in the undersea domain will extend well into the future.

Throughout this past century that marks such historic achievements in the submarine community, we have been privileged to have the unwavering support of the San Diego community. The strong interest and commitment to our entire Navy by "America's Finest City" has been vital to our success – in the past and in the future. On behalf of the men and women of the world's greatest Navy, thank you!

Sincerely,


JONATHAN W. GREENERT
Admiral, U.S. Navy

*Subtle and insubstantial, the expert leaves
no trace; divinely mysterious, he is inaudible.
Thus he is master of his enemy's fate.*

—Sun Tzu, *The Art of War*, 4th Century, B.C

From its most important direction of approach, Point Loma is San Diego's conspicuous geographic feature. It was Point Loma that Cabrillo first saw looming above the horizon as his ships made their way north. When they anchored adjacent to the cobble beach of its small projecting promontory, it would be sixty-five years before English settlers set foot in Jamestown, and seventy-eight years before Pilgrims laid eyes on Cape Cod. Because several thousand people were living around the shores of San Diego Bay in 1542, and their descendants and their memories have been with us through all the ages, the continuity of Point Loma's story of the sea remains intact, elevating its significance to one of those few sacred places in the national landscape where we can truly say "America began here."

In keeping with that status, millions of people see it every year. Travelers seated next to the window of nearly all the aircraft that take off from Lindbergh Field can gaze down on it during their ascent. Cruise ship passengers, excursion passengers, recreational boaters, and fisherman gaze at it from sea level as they enter or depart the Bay. Because of Cabrillo National Monument, hundreds of thousands of residents and visitors enjoy the spectacular view of the entire Bay and its surroundings, stretching out before them. But whether it's from the summit of Point Loma's spine or the view from sea level as one passes Ballast Point, the eyes are always drawn to the cluster of buildings, piers, facilities, support ships, and the long, low, dark vessels that lay moored alongside. It would be safe to observe that nearly all of the millions of people who view that particular element of the scene every year, do so with an almost total lack of understanding about what they are actually looking at.

All warfare is based on deception.
—Sun Tzu

From the beginning, seapower has often found expression in the overt and conspicuous display of overwhelming technical superiority. Stately ships-of-the-line, imposing

dreadnaughts, and majestic aircraft carriers have, each in their age, served as billboards advertising the scale of national power, intent, and capability of controlling the seas. In this role, the ability of capital ships to make an impression or dominate an outcome came with an unambiguous announcement of their presence – an aspect of seapower sometimes referenced as "Mahanian," after its

most articulate and distinguished historian of the concept. There has always been, however, a corollary aspect in which seapower is amplified not so much by where the asset is located, as the fact that it could be *anywhere* and an enemy would never know until it was too late. In the seapower of deception, there has never been an exemplar to compare with the submarine and, in our particular case, the skill of the deception is even more pronounced when developed and projected not only from plain sight, but literally in front of an immense audience.

In our account of Point Loma and its submarines, the technical secrets of that deception will obviously remain a mystery. But what we hope our readers will understand a little better from these articles, is that there is a hidden geography of American history and a hidden geography of the sea from which we can say that our national prominence and even our survival has thus far flowed decisively and, of *those* sacred places, Point Loma rises with distinction, hidden as always in conspicuous view.

FROM THE HELM

by Ray Ashley, Ph.D.

President and CEO,
Maritime Museum of San Diego

Asheville (SSN-758) departs Naval Base Point Loma for Pearl Harbor, Hawaii, December 2013.

U.S. Navy Photo

A Century of Submarines in San Diego

Ballast Point: A Premier Base for Submarines

By Captain Bruce Linder, USN (Ret.) and Captain Sam Ward, USN (Ret.)

Bruce Linder,

Captain, USN (Ret.) is an accomplished maritime historian with four books and over 120 magazine and journal articles to his credit. His most recent book is *San Salvador: Cabrillo's Galleon of Discovery*. Linder is an Annapolis graduate and has commanded a guided missile frigate and two major naval bases. He has an advanced degree in Oceanography from the University of Michigan and studied for a year at the Brookings Institution in Washington, D.C., in National Security Affairs. He has held the Robert and Laura Kyle Chair in Maritime History and has been awarded both the San Diego Book Award in Nonfiction and the Arleigh Burke Literary Award in Naval History. Linder is currently the Executive Director of the Coronado Historical Association.

Sam Ward,

Captain, USN (Ret.) was a career submarine officer through the 1980s, commanding *Archerfish* (SSN-678) and Submarine Development Squadron TWELVE. He also worked in the defense and information technology industries, managing large systems engineering programs and organizations. He is currently President of the local chapter of the Naval Submarine League.

In March 1803, the American trading brig *Lelia Byrd*, fleeing from Spanish authorities, sprinted down the San Diego Bay channel toward open sea. It was a race not for reasons of honor, patriotism, or battle tactics but purely for escape, as Captain William Shaler had been caught red-handed illegally trading otter pelts with residents of the sleepy village of San Diego. If caught, he and his crew would surely be headed to the local calaboose, but standing in his path to freedom stood a small Spanish fort at the entrance to the harbor...and it was clearing its guns for action.

Completed in 1796 or 1797, this small earthen and adobe fortification crowned the tip of a small promontory referred to as *La Punta de los Guijarros*, or Cobblestones Point, today called Ballast Point. The *castillo* could hold ten guns and was manned by a part-time garrison. Six years after it was finished, the fort received its baptism by fire in the so-called "Battle of San Diego Bay." The "battle" was not much for history as Spanish gunners only lobbed a few lackluster shots toward *Lelia Byrd* as she passed, prompting the American captain to return fire with his small 3-pounder cannon that, at least, caused the Spanish to duck.¹

From this beginning, Ballast Point has always stood at the intersection of military and seagoing influences. All shipping coming to San Diego must pass its flanks and, over the years, it has been a favored point of fortification for cannon and gun to command every inch of San Diego Bay's approaches.

From the time of the first Spanish explorers to San Diego Bay (Juan Rodríguez Cabrillo in 1542, and Sebastian Vizcaino in 1602), through all the years of the nineteenth century,

The painting by Jerry MacMullen shows the American brig *Lelia Byrd* fleeing the Spanish guns aimed at the Yankee smuggler, from *La Punta de los Guijarros* (now Ballast Point).

Courtesy of MMSSD



5
cardano lo grabò

and pebbles from the nearby promontory served as an “exchange” of sorts, with sailors taking stones aboard or leaving excess ashore as needed to adjust ballast. “Cobblestone Point” quickly became, officially, “Ballast Point” on all the world’s nautical charts.

The American era in San Diego began on 29 July 1846, during the opening days of the Mexican War. On that date, sloop-of-war *Cyane*, of 22 guns, arrived under the command of Commander Samuel Francis DuPont and anchored between Ballast Point and La Playa. DuPont captured the nearby Mexican brig *Juanita* with its cargo of arms and sent an armed party of sailors and Marines to formally raise the American flag over San Diego’s central plaza – “Old Town” today. For the remaining years of the war, the Ballast Point anchorage was largely used as a logistics and repair center for ships of the American Pacific squadron that were engaged in various naval campaigns stretching from Los Angeles to Mazatlan.³

Immediately following the Mexican War, the United States established a military reservation covering all of Point Loma, by Executive Order of 26 February 1852, but the first significant use of Ballast Point, from 1857 to 1873, fell to small whaling companies who hunted whales from small offshore boats and then processed whales ashore for oil and whalebone products.

The Army finally evicted San Diego’s whalers around 1873 to begin work on a massive polygonal earthen and masonry artillery works on Ballast Point, part of the “Endicott Plan” for nationwide harbor fortifications. Although these harbor fortifications were never completed, the Army reserved a single acre for a Post Cemetery high atop the Point Loma Reserve at this same time (it ultimately would secure a much longer history as Rosecrans National Cemetery).⁴

With the onset of the Spanish American War in 1898, Ballast Point suddenly became a very busy place. The government had established the Ballast Point lighthouse in August 1890 with a station light, channel beacons and fog-bell, but plans for harbor fortifications did not gain momentum until war loomed in 1897.⁵ In short order the Army began construction on what would be called Fort Rosecrans, with a garrison of two companies of the Coast Artillery and buildings that included officer’s quarters, barracks, a guardhouse, hospital, stables, storehouses, and magazines. Three different batteries rose at Ballast Point, all aimed seaward down the San Diego channel entrance – Battery Calef-Wilkeson with large 10” disappearing mounts and Batteries McGrath and Fetterman with smaller 5” and 3” mounts.

In concert with these activities an auxiliary naval force of revenue cutters, armed yachts, and other hastily converted vessels, manned by the San Diego Naval Militia, patrolled the harbor entrance, while revenue cutter *Corwin* helped protect new minefields to be sewn in the channel.⁶

With the onset of the Spanish American War in 1898, Ballast Point suddenly became a very busy place.

Ballast Pt. Lighthouse, circa 1890s.

© San Diego History Center, file #3359





Minefields were the responsibility of the Army as part of their overall harbor defense scheme. The mines chosen for San Diego were crude, electrically controlled devices triggered from an observation post ashore to detonate beneath threatening vessels.⁷ Five triple-groups of mines were sewn beginning in May 1898, from a storage magazine at Ballast Point by an Army detachment that included eighty "patriotic citizen" volunteers. Due to their dangerous nature and by the rapid progress of the war, San Diego's mines were removed after only three months, but the Army maintained a Ballast Point mining capability up until 1942.⁸

The Spanish-American war had taught the San Diego Chamber of Commerce a thing or two about the value of federal spending on local improvements. San Diego's focus now turned to convincing the Navy, as well as the Army, to fund dredging and other developments for the bay. After vigorous lobbying, the Navy took control of a section

Fort Rosecrans, circa 1911.

© San Diego History Center, file #9118564-1805

of the Point Loma Reservation at La Playa, near Ballast Point in 1900, for what would be the Navy's first formal base in San Diego, a Navy coal depot. This base began in 1904 and established a certain air of governmental momentum that would bring a string of other bases to San Diego including wireless radio stations, repair bases, hospitals and training sites.⁹ The La Playa site, now a major fueling center, is still in Navy hands today.



Fort Rosecrans, circa 1911.

© San Diego History Center, file # 6441

From 1935 through 1939, San Diego became the center of efforts to develop the Navy's first standard underwater sound tactics for both destroyers and submarines.

World War I had little activity for Army and Navy men across Point Loma. Fort Rosecrans fortifications were strengthened with the addition of two new batteries, each carrying four 12" mortars, but the Rosecrans garrison was under-billeted and the Navy's Pacific Squadron stood as a backwater force far from the primary action in the Atlantic. After the war, Fort Rosecrans was placed in caretaker status with little

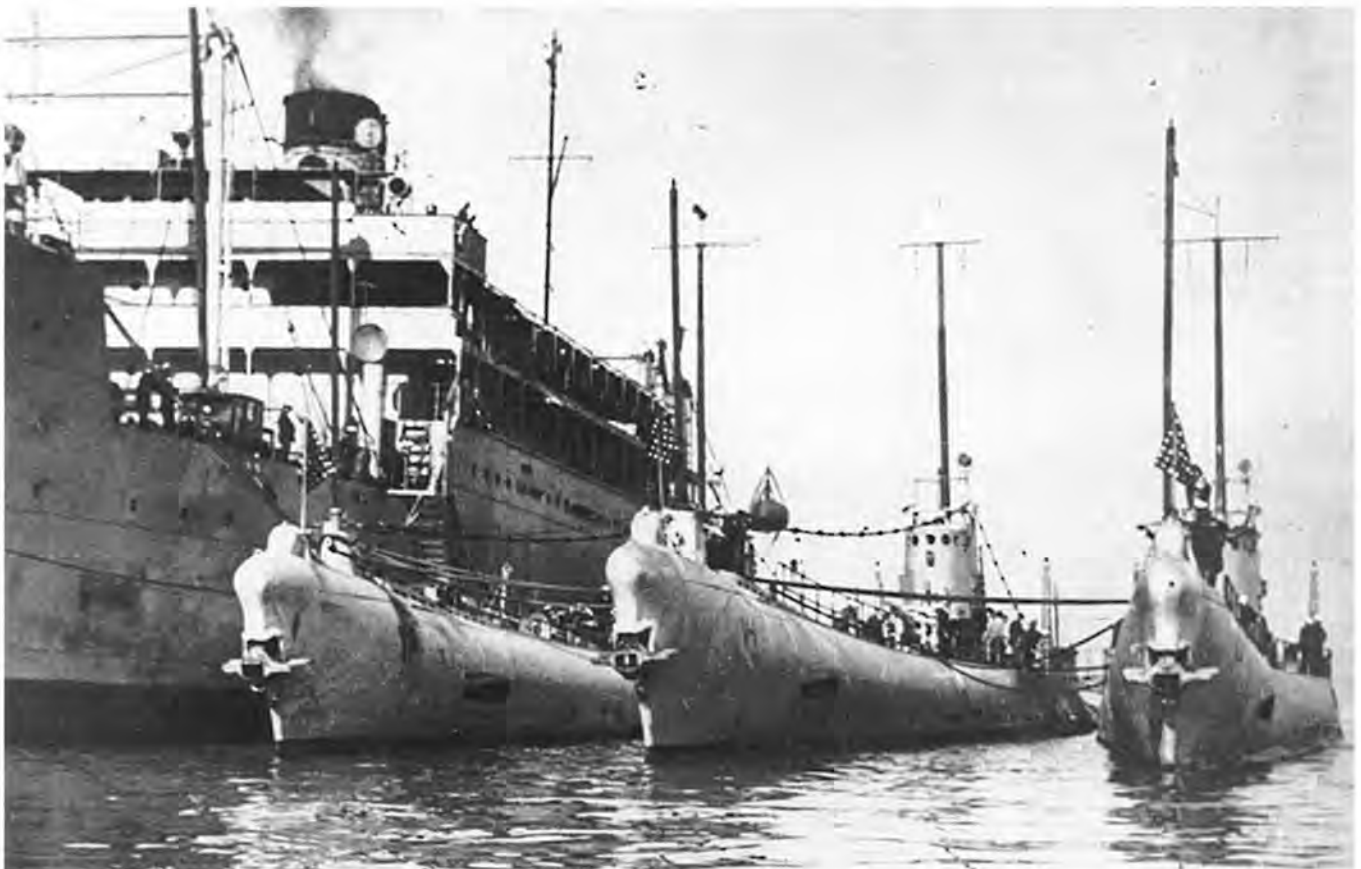
activity, but its size actually increased by about twenty acres with the addition of dredge material drawn from the bay.

When the Navy closed its primary Pacific Submarine Base in San Pedro during 1923-1925, it transferred repair and upkeep responsibility for fleet submarines to San Diego.¹⁰ San Pedro had originally been recommended to the Navy by the Helm Commission report on military basing, but funding as well as local support was in short supply and a shift to San Diego would provide repair services at the San Diego Destroyer Base, while keeping the submarines near the core of the Pacific Fleet. Eighty men were transferred to San Diego with the move.

By 1930, one-third of the Navy's worldwide submarine tonnage was based in San Diego, accommodated at the Destroyer Base or alongside submarine tenders such as *Argonne* (AS-10) flagship of Submarine Division TWENTY and *Holland* (AS-3), that moored from buoys in the bay, primarily off Broadway Pier and, what is today, Harbor Island. Between 1929 and 1931, Division TWENTY was commanded by one of the Navy's rising stars, Captain Chester Nimitz.¹¹

***Argonne* with Submarines V-2, V-1 and V-3 alongside at San Diego, 10 December 1928.**

U.S. Navy Photo





Navy Day, 1945

© San Diego History Center,
file #OP 16827-13

With so many submarines in San Diego during the 1930s, it was not coincidental that San Diego began to take center stage in a stunning new technology – the use of underwater sound to detect submarines. The British Navy used the acronym ASDIC for first generation submarine detection equipment, but it soon became known by the more familiar SONAR – Sound Navigation and Ranging. From 1935 through 1939, San Diego became the center of efforts to develop the Navy's first standard underwater sound tactics for both destroyers and submarines. These efforts also included the first-ever formal training in the use of underwater sound equipment and work with the Scripps Institution of Oceanography in studies of underwater thermal gradients.¹² The Navy's first Sound School was founded at the Destroyer Base on 15 June 1939.¹³ By December 1941, the Sound School was operating with seven destroyers and six submarines and was turning out about seventy-five enlisted sound operators and fifteen sound officers every five weeks. The school's name was changed to the West Coast Sound Training School in 1942 (when a similar facility was commissioned in Key West), and was relocated to new facilities built on reclaimed land from the bay near Shelter Island. The school's destroyers and submarines moored at finger piers at the site. That school is still operating today as part of Naval Base Point Loma and

the Naval Mine and Anti-submarine Warfare Command at the corner of Nimitz Boulevard and Harbor Drive and is the primary anti-submarine warfare training center in the world.¹⁴

Ballast Point again took on a leading defense role in the early days of World War II. Gun emplacements were manned on the seaward side of Point Loma and construction began on even heavier gun mounts, but most still considered the primary defense of the harbor hinging on Batteries White, Whistler, McGrath, and, later, Humphreys, around Ballast Point.

A Harbor Defense Control Post was established in the Old Spanish Lighthouse on Point Loma with an Army officer, Navy officer and enlisted assistants managing the defenses of the harbor twenty-four hours a day.¹⁵ Navy signalmen stationed atop the lighthouse tower challenged all vessels approaching the harbor by blinker light. Assuming a correct response, submarine nets at Ballast Point were drawn away from the channel. Eventually, signaling operations were relocated to a forty-foot tower south of the Old Lighthouse that contained a yardarm, blinkers and canvas flag bag with a sonar station at its base that could monitor sound buoys off the entrance.¹⁶ Much of the harbor defense activity around Ballast Point and the Point Loma Military Reservation was deemphasized by 1944, and most of the assigned Army troops were transferred elsewhere.

Immediately after World War II, the Navy established Submarine Group San Diego to help manage the rebasing of submarines from forward locations to permanent homeports along the West Coast. Celebrated combat submariners Captain Augustus St. Angelo and Captain Donc Donaho commanded that Group.

In 1949, the Navy named a flotilla commander for submarines in San Diego, the first submarine flotilla organized since World War I, and recognition that San Diego was to become a major hub for submarine operations in the years to come. The overall strategic concept for Submarine Flotilla ONE was one of mobility. Within the flotilla, Submarine Squadrons THREE and FIVE were based aboard submarine tenders *Nereus* (AS-17) and *Sperry* (AS-12), each with fifteen submarines divided into three divisions. Submarines would be rapidly deployable with their tenders to any forward location in the Pacific, while San Diego naval facilities would supply submarines with important logistical, repair and billeting resources.



The San Diego Union

Page b2

WEDNESDAY MORNING, JULY 15, 1959

SUBMARINE PIER VITAL

Keep Pace With Atomic Navy

SUPPORT FOR the Navy's proposed nuclear submarine shore facility at Ballast Point must have high priority in San Diego's civic thinking and planning. San Diego must keep pace with the atomic age Navy.

San Diego is the natural place to base the atomic-submarines assigned to Pacific operations. Here are found the carriers and the destroyers that are the constant companions of the submarine on the anti-submarine warfare hunter-killer teams.

By the nature of its harbor San Diego can also be a submarine building base. It can be to the West Coast what New London is to the East Coast. We must not forget that the major builder of atomic submarines, the Electric Boat Co., is a unit of the General Dynamics Corp., parent of San Diego's Convair, Astronautics, and General Atomic.

With some forward-looking civic planning, San Diego could have been a major submarine base 40 years ago.

There were at first some scattered minor objections on the Navy's proposal to develop a nuclear submarine facility on the harbor side of Point Loma. There was a question of whether the nuclear submarines would interfere with harbor traffic; and whether the shore installation would conflict with residential areas.

The proposed three finger piers adjacent to the Navy fuel facility on Point Loma provide easy and swift access to the sea. No longer will our submarines have to moor to a tender in the congested harbor. And the installation in no way would be prejudicial to residential interests. It is well inside naval territory.

A shore facility is important for morale reasons, too. San Diego makes adequate provision for the housing and diversion of other naval complements. Why cannot this be extended to the men who spend so much of their time below decks and under the sea?

It's later than we think. Seattle and other West Coast cities are anxious to replace San Diego as the hub of Pacific naval activity. They are more than willing to provide a home port for the submariners.

There is no time to lose in swinging San Diego's support behind the Ballast Point project. In seven to 10 years the nuclear submarines will have replaced the conventional undersea craft. San Diego must be ready. It must look ahead.

The interests of national security transcend and outweigh any objections to the construction of a modern submarine base in San Diego Harbor.

A Star To Steer By





The world's first atomic-powered submarine, *Nautilus* (SSN-571), was also the first nuclear submarine to visit San Diego, during a brief port visit in May 1957, when she moored at Broadway Pier. © San Diego History Center, file # UT84_31176.1

San Diego stood as the only West Coast operational submarine homeport with diesel submarines, tenders and submarine rescue vessels assigned. San Diego submarines represented all specialties including regular fleet boats and those converted for GUPPY (Greater Underwater Propulsive Power), snorkel, radar picket, or transport duties. Training was conducted ashore at the Fleet Sonar School and at sea in several excellent nearby ranges. An indication of the importance of the submarine presence and mission was that several notable World War II submarine heroes, including Rear Admirals Dick O'Kane and Gene Fluckey, commanded San Diego submarine tenders.

By the late 1950s, many – including San Diego Congressman Bob Wilson – began to recognize that the coming of the nuclear submarine would reshape the Navy's submarine service much as new supercarriers were redefining carrier aviation. In August 1958, Wilson cornered the Secretary of the Navy (on a plane returning to Washington) to press for the need for a new San Diego nuclear submarine base. Although submarines had been stationed at 32nd Street for years and recommendations had been floated for a new South Bay submarine base, most opinions favored a base site near the harbor's mouth. Such a base would offer convenient access to the sea and would, in part, remove any potential nuclear threat to downtown.¹⁷

Through Wilson's efforts, a broad consensus between the Navy and the city slowly began to build

to keep the city "current" with the modern Navy and remove submarines from potentially dangerous mid-channel moorings.¹⁸ San Diegans strongly favored Wilson's initiative: "There is no time to lose in swinging San Diego's support behind the Ballast Point project," read one editorial from the *San Diego Union*. "In seven to ten years, the nuclear submarine will have replaced the conventional undersea craft. San Diego must keep pace with the atomic age Navy."¹⁹ There was even the suggestion that San Diego might become a submarine construction base for General Dynamics and General Atomic.²⁰

The Point Loma Military Reservation had been declared surplus on 31 December 1949, and then transferred to the Navy Department on 3 December 1957. With momentum building for a submarine base at Ballast Point, but to avoid delays associated with officially designating a new "base," the Navy subtly titled all Fort Rosecrans property as simply an extension of the preexisting U. S. Navy Electronics Laboratory (NEL), on 1 March 1959.²¹

The world's first atomic-powered submarine, *Nautilus* (SSN-571), was also the first nuclear submarine to visit San Diego during a brief port visit in May 1957, when she moored at Broadway Pier. *Sargo* (SSN-583) followed with a visit in 1958. That same year, Congress approved \$1.7 million for construction of the first nuclear submarine piers at Ballast Point.

When the Navy obtained control of the Ballast Point waterfront in 1959, both submarine tenders moved from the center of San Diego Bay to new anchorages, just offshore the planned submarine base, with their submarines tied up alongside. Small boats still transported the submariners from a boat landing on the short ride to the tenders. Since the existing piers were old and not suitable for ship moorings, a new pier was authorized and construction began in 1960. The submariners were quick to set up recreational activities ashore, such as a swimming pool and basketball courts. Energetic volunteers also converted the abandoned Sealift Command building near the waterfront as an Officer's Club, fitting it out with "gently used" furniture and carpets from local motels. By mid-1961, the new Ballast Point pier was ready for use.²² For the first time submariners could drive to

Modern submarine tenders *Dixon* (foreground) and *Mckee* provide support in 1987.

Courtesy of CDR Ray Ferbrache, USN (Ret.)

work, rather than ride small boats back and forth to their ships.

Sculpin (SSN- 590) became the first "Atom Sub" (as described in press headlines) to be homeported at Ballast Point, when she arrived in June 1961, with

Scamp (SSN-588) immediately joining her. Congressman Wilson, in characteristic fashion, stumped for even more: *We hope eventually to have more piers so the entire Pacific Submarine Fleet can be stationed here.*²³

A year later, the base was supporting four nuclear submarines, twenty-two diesel submarines, and stalwart tenders *Nereus* and *Sperry*. By 23 October 1963, the NEL subterfuge was wearing thin with the increasing and obvious nuclear submarine

activity at Ballast Point, but the Navy, still sensitive to any opposition to the establishment of a "base," redesignated Ballast Point simply as a Naval Submarine Support Facility.²⁴

By 1968, twenty-five boats called San Diego home and all major local submarine commands:



Ballast Point Submarine Support Facility, 1966

© San Diego History Center, file #UT85_F1380-8





La Jolla (SSN-701) was the first of a new class of faster, more capable SSNs homeported in San Diego.

Courtesy of MMSD

Submarine Flotilla ONE and Squadrons THREE and FIVE were embarked aboard Ballast Point tenders. Construction also began on the first permanent submarine training building at Ballast Point, a “Get Wet” damage control trainer. Submarine Development Group ONE, an outgrowth of the San Diego-based Deep Submergence Group was established in 1967, making Ballast Point the worldwide center for deep diving exploration, science, and operations.

The arrival of submarine tender *Dixon* (AS-37), in 1971, marked the next phase in submarine expansion in San Diego. *Dixon* had been specifically built to service nuclear submarines and was fitted with special shops and other facilities not available in older tenders. As *Dixon* became a permanent presence in Ballast Point, several facilities were similarly added ashore to improve nuclear submarine maintenance. Modest training capabilities were also installed in existing structures on the base, so submarine crews could maintain proficiency during extended maintenance periods. Submarine Flotilla ONE and Submarine Squadron FIVE were disestablished in 1973 to form Submarine Group FIVE, under the command of Carl Trost, the future Chief of Naval Operations. Submarine Squadron THREE remained in San Diego until 1995.²⁵

The 1980s introduced digital technology into the submarine fleet, both in the shipboard systems used to detect, track and engage enemy ships, and in the weapons themselves. *La Jolla* (SSN-701), the first Navy ship to bear that name, entered San Diego in 1982 as the first of a new class of faster, more capable SSNs to be homeported at the base.

The 1980s introduced digital technology into the submarine fleet, both in the shipboard systems used to detect, track and engage enemy ships, and in the weapons themselves.

La Jolla was, fittingly, sponsored by Congressman Wilson's wife, Shirley Wilson (of La Jolla).²⁶ These ships featured digital sonar systems, such as the BQQ-5, that enabled considerable expansion in detection and tracking ranges, and digital combat systems, providing the means to engage targets with multiple weapons and weapon types.

Submarine weaponry was substantially upgraded during this period with the addition of the Mark 48 digital torpedo, the Fleet's first new heavyweight torpedo since the World War II Mark 14 torpedo. It had significant acoustic detection capability, and was wire-guided, as well. Harpoon missiles were also added to the submarine fleet, providing an over-the-horizon, anti-ship capability. Later, the Tomahawk land attack missile was introduced, further expanding the submarine's offensive capabilities.

This rapid expansion of technology challenged Ballast Point to keep these systems operating and crews trained in their use. Many new facilities were built to provide this support. In 1978, a state-of-the-art, multi-story Submarine Training Center was constructed, with modern diving trainers and torpedo attack trainers that replicated the systems on the newer submarines. In 1992, this center was named to honor World War II great, Rear Admiral Dick O'Kane.

Despite the end of the Cold War in the 1990s, submarine operational tempo stayed high as several San Diego-based submarines were decommissioned, while fewer new construction boats replaced them.

With all these new capabilities at Ballast Point, the Naval Submarine Support Facility designation was finally changed to "Naval Submarine Base, San Diego" on 1 October 1981. By the mid-1980s, the base was supporting over twenty submarines (with only two still diesel-powered, *Blueback* (SS-581) and research submarine *Dolphin* (AGSS-555)), two submarine tenders, deep submergence rescue vessels *Avalon* and *Mystic*, and floating drydocks *San Onofre* and *Arco*.²⁷

A new nuclear support tender *McKee* (AS-41) took up duties at Ballast Point in 1982, replacing tender *Sperry*, which had serviced submarines in San Diego for just short of thirty-five years. In 1984, *McKee* was the first submarine tender to become certified for servicing Tomahawk missiles, providing San Diego ships with local missile logistics support. Submarine Squadron ELEVEN was established in 1986 to provide better support and supervision of the large group of assigned SSNs that were deploying to the Western Pacific at a high operating tempo.

Coronado (AGF-11) operated as the command ship and flagship for THIRD Fleet and was frequently moored at Ballast Point, beginning in 1991. She was the first combatant ship in the Navy with assigned women in her crew and, between 2000 and 2003, acted as a Sea Based Battle Lab coordinating a series of Fleet Battle Experiments sponsored by the Navy's SPAWAR Systems Center in San Diego.

Despite the end of the Cold War in the 1990s, submarine operational tempo stayed high as several San Diego-based submarines were decommissioned, while fewer new construction boats replaced them. Submarine squadrons and Ballast Point tenders, likewise, adjusted. Submarine Squadron ELEVEN assumed all group and squadron command responsibilities in 1995. Submarine Group FIVE and *Dixon* were decommissioned that same year with tender *McKee* following four years later. With no remaining tenders at Ballast Point, various shipyard teams periodically visited the base for ship support, and some shore-base shop facilities were expanded to meet the needs of the smaller, but still very complex Squadron.

In a major reorganization of San Diego bases, Naval Base Point Loma was established on 1 October 1998. This new and broader base command encompassed the Submarine Base at Ballast Point, the Fleet Antisubmarine Warfare Training Center, and five additional Point Loma commands.

As the first century of submarines in San Diego came to a close, it is Ballast Point that is seen by all San Diegans as the premier center of submarine operations, technology, and training along the entire West Coast. It has proven to be an inspiring story of one of the most impressive of all submarine bases in the world. Those on the base can enjoy a taste of Ballast Point history by viewing twelve historic buildings along the terraced hillside overlooking the harbor that harkens back to the Army's Fort Rosecrans. At the same time, visitors at Cabrillo National Monument marvel at the black shapes of sleek, modern submarines below them.

NOTES

- 1 Fort Guajarras briefly exchanged fire with another small American trading ship in 1828. This ended the Fort's history of active military action and it fell into disuse by 1839, and was sold to a local rancher for about forty dollars in 1840.
- 2 Richard Henry Dana Jr., *Two Years Before the Mast* (Library of America: New York, 2005), 100.
- 3 Bruce Linder, *San Diego's Navy* (Annapolis: US Naval Institute Press, 2001), 5.
- 4 George Ruhlen, "Fort Rosecrans," *Journal of San Diego History* (October 1959).
- 5 Robert Adamson, "Point Loma's Century of Light," *Journal of San Diego History* (October 1955). The 115th company of Coast Artillery was the first to establish an encampment on Ballast Point in 1898, followed shortly by the 28th Coast Artillery, of about 225 men.
- 6 Robert Erwin Johnson, *Thence Round Cape Horn* (Annapolis: Naval Institute Press, 1964), 152; Rear Admiral Joseph Miller Letter to SECNAV, 15 April 1898, Area 9 File 1814-1910, War Records Branch, National Archives.
- 7 Linder, *San Diego's Navy*, 18.
- 8 "Harbor Notes," *San Diego Union*, 29 April 1898, 6; Barry Allen Joyce, *A Harbor Worth Defending: A Military History of Point Loma* (San Diego: Cabrillo Historical Association, 1995), 17; U. S. Corps of Engineers (Los Angeles Office) letter, 9 February 1905, General Correspondence, Naval Coaling Station, NARA, Laguna; Diane Cooper, "Remember the Maine and Mine the Harbors," *Mains' T'haul* (Spring 1998), 44, 30.
- 9 SECNAV, Annual Report of the Secretary of the Navy, 1901, (Washington, DC, Department of the Navy), 366.
- 10 Annual Report, 1923, Commandant Files, Eleventh Naval District, NARA Laguna; James D. Newland, "Admiral Cements Station's Foundation," *Traditions* (November 1995), 11. The Navy had originally placed its submarine base in San Pedro during World War I as a temporary measure, but reflecting its preference for operating submarines in the waters off Los Angeles rather than San Diego. The Navy Department had intended to use property provided by the city of Los Angeles. Postwar budget constraints prevented this planned action and the Commander-in-Chief of the Pacific Fleet recommended removing the submarines to San Diego, occupying a corner of the Destroyer Base where they could receive maintenance more efficiently. Eighty men were transferred to San Diego with the move.
- 11 Jeffrey W. Farquhar, "The History of Naval Station San Diego," thesis, University of San Diego, San Diego, 1996, 59; E. B. Potter, *Nimitz* (Annapolis: Naval Institute Press, 1976), 150.
- 12 *Fleet Anti-Submarine Warfare School Command History*, (Department of the Navy, 3 June 1965), 3. The earliest prototype echo-ranging or underwater sound gear in the U. S. Navy, designated QA, was tested at sea in 1927. An improved QC set went into much wider production with nine U. S. destroyers fitted with the echo-ranging gear in 1934.
- 13 *History of the Fleet Operational Training Command, Pacific*, (Department of the Navy, 1946), I:417, 423.
- 14 Linder, *San Diego's Navy*, 129-130. The West Coast Sound School was re-designated as U. S. Fleet Sonar School, San Diego in 1945.
- 15 James W. Hinds, *San Diego's Military Sites*, (San Diego: San Diego Historical Society, 1986), 110.
- 16 Howard B. Overton, *Oral Histories of Cabrillo National Monument*, San Diego, n.p.; Joyce, *A Harbor Worth Defending*, 53. Although one set of submarine nets was normally used at the harbor entrance, when tensions were highest, two anti-submarine nets were deployable – one would open while the other remained closed.
- 17 Alec C. Schiller, "Congressman Bob Wilson's Contributions to the Navy and San Diego," thesis, San Diego State University, San Diego, 1990, n.p., 100.
- 18 Abraham J. Shragge, "Boosters and Bluejackets: The Civic Culture of Militarism in San Diego, California 1900-1945", Diss., University of California San Diego, 1998, 568; Bob Wilson, *Confessions of a Kinetic Congressman*, (San Diego, San Diego State University Foundation, 1996), 57.
- 19 "Keep Pace With Atomic Navy," *San Diego Union*, 15 July 1959, B-2.
- 20 Linder, *San Diego's Navy*, 160.
- 21 Hinds, *San Diego's Military Sites*, 327.
- 22 Interview CDR Ed Farley with Sam Ward, 14 January 2014; Interview CAPT Jim Tregurtha with Sam Ward 14 January 2014.
- 23 Schiller, "Congressman Bob Wilson's Contribution to the Navy and San Diego", 108; "A-Sub Pier is Dedicated," *San Diego Union*, 30 September 1962, A-23.
- 24 Lester Bell, "New Sub Base Gets Key Role," *San Diego Union*, 18 November 1963, A4; Hinds, *San Diego's Military Sites*, 327.
- 25 The Navy's 39th Chief of Naval Operations, Admiral Jonathan Greenert, also served as senior submariner in San Diego, serving as Commander, Submarine Squadron ELEVEN.
- 26 Hyman G. Rickover ltr of 28 July 1981 to Shirley Wilson (San Diego, Maritime Museum file IMG 6148).
- 27 Paolo E. Coletta, ed., *United States Navy and Marine Corps Bases, Domestic*, (Westport: Greenwood Press, 1985), 571. Diesel submarine *Blueback* was finally decommissioned on 1 October 1990.

The Early Years

In 1910, operational submarines for the world's navies were new and, to the untrained eye, looked rather strange and vaguely dangerous.

It was a time of tremendous advances in technology, just seven years after the Wright Brothers' first powered flight and four years after the Royal Navy's HMS *Dreadnought* revolutionized naval power. San Diegans had witnessed their own grand spectacle of naval technology just two years previous with the visit of the sixteen battleships of the American battleline – the Great White Fleet.

And here, right in San Diego Bay, were *Grampus* (A-3) and *Pike* (A-5), members of the first full class of submarines (seven boats in all), built for the Navy and the only ones assigned to the West Coast. Constructed at the Union Iron Works in San Francisco, *Grampus* and *Pike* were very small, about the size of a modern school bus, at sixty-four feet long and displacing 123 tons submerged. They were powered by a 180 horsepower, four-cylinder gasoline engine on the surface, a 70 horsepower electric motor and 60-cell battery while submerged, and carried a single 18-inch torpedo tube forward with three torpedoes as armament.



Constructed at the Union Iron Works in San Francisco, *Grampus* and *Pike* were very small, about the size of a modern school bus, at 64 feet long and displacing 123 tons submerged.

© Navy History & Heritage Command, Washington, D.C. file #b53765



Submarine "Grampus"
San Diego, Cal.
~1910~
© Navy History & Heritage Command, Washington, D.C. file #b77180



Submerged operations were very limited, with a test depth of only 150 feet, a maximum speed of seven knots and an endurance of four hours. A flying bridge was added after building to afford conning officers some protection while in open sea. Each submarine had a crew of two officers and ten enlisted.²

Grampus, *Pike* and their two support vessels, *Fortune* and *Justin*, made the 560-mile trip down the coast from their base at Mare Island to San Diego Bay (the longest trip ever by a submarine), arriving 28 June 1910. The submarines were nested alongside of *Fortune*, which was moored to the Torpedo Flotilla piers in Coronado, near the Ferry Landing. *Fortune* served as a tender to the two submarines, resupplying fuel and water and helping with maintenance. An equipment warehouse was built nearby and a submarine repair building planned. This arrangement of assigning a submarine tender to take care of submarines in distant ports – as prototyped in Coronado – would become a mainstay of submarine operations for the next eighty years.³

The two submarines formed the FIRST Division of the Pacific Torpedo Flotilla, with the SECOND and THIRD divisions composed of torpedo boats and destroyers, all stationed together in Coronado. The flotilla operated as a unit in developing and exercising tactics and also operating with other larger ships of the Pacific Squadron. Basing in San Diego provided many advantages for the small submarines, including closeness to fleet units, excellent weather, and operating conditions in both bay and open ocean environments.

The San Diego press colorfully labeled the submarines as “demon divers” and “war demons.” For San Diegans, these small ships that could cruise under water represented nothing less than a marvel. Onlookers avid curiosity and their eagerness to observe the craft often impeded the Navy’s training operations in the bay.

On 9 December 1910, the *San Diego Evening Tribune* reported, “the deadly little *Grampus* made a sensational dive yesterday, running under water from the submarine station at Coronado down the channel and out past Point Loma to the Pacific, a total distance of about eight miles.” Her captain navigated with the help of a new invention called the periscope (*Grampus* and *Pike* had fixed non-retracting periscopes).⁴

This milestone was a significant one for a submarine crew as there were many hazards associated with operating these boats, including suffocation. Early submarine propulsion on the surface came by gasoline engines, the fumes from which could cause a form of intoxication known as the “gasoline jags.”

Also, *Grampus* and *Pike* were damp and cramped inside and the boat’s primitive electrical systems were prone to grounds, sometimes resulting in electrical fires.

“Technical problems were formidable,” one historian has commented, “with unsafe structures, unreliable engines, inefficient storage batteries, poor communications, inadequate optics, primitive metallurgy, and poor construction techniques.”⁵ Given the hazards inside the submarine, it was common for the crew to ride on the hull, even though the vessel afforded very little freeboard and there was little protection from the elements.

During their stay at Coronado, both *Grampus* and *Pike* were drawn out of the water at the Spreckels Marine Railway, on North Island, for maintenance. The crew rightly earned an extra five dollars a day for hazardous pay plus a one dollar bonus for each dive.

Grampus and *Pike* operated in San Diego for two years

and firmly established a keen awareness of submarines throughout the local communities. For the last year of their stay, the boats were transferred to a pier at the Naval Coaling Station, near Ballast Point on Point Loma, in part, to test its desirability as a larger operating base. The reports were bad. “There is much dissatisfaction over the station on Point Loma,” read one account. Commuting to and from the station was much longer than what the crew was used to at Coronado and “[t]he Point Loma sitel is located inconveniently...big vessels are coming and going constantly and the submarines not only menace navigation but in the event of a collision it is possible that the submarine would be crippled.”⁶

Before their departure northward on 31 May 1912 to Mare Island, the crews of *Grampus* and *Pike* stood on their slippery decks and witnessed a momentous historic event – the very first flights of Glenn Curtiss’ hydroaeroplane in San Diego Bay and the birth of United States naval aviation. It was a riveting and intriguing intersection of history where one, at a single moment in time, could observe the beginnings of the two most important naval warfare breakthroughs of the twentieth century. Even more significant, this single moment of history might have occurred anywhere, but it happened in San Diego – a harbinger of the great impact the Navy would have on San Diego over the next one hundred years.⁷

Within seven quick months of *Grampus* and *Pike*’s departure from San Diego, four boats of an entirely new class of American submarine arrived in San Diego Bay for winter maneuvers with the Torpedo Flotilla. These were boats of the new F-class and could be compared to A-class submarines much as Apollo could be compared to Mercury in the American space program of the 1960s.⁸

The San Diego press colorfully labeled the submarines as demon divers and war demons.

These submarines had been built at Union Iron Works in San Francisco, and Moran Brothers Shipbuilding of Seattle, and were three times the size of their A-class brethren with a length of 143 feet and a submerged displacement of 400 tons. Their new style hull and greater space for propulsion allowed for a top speed of fourteen knots and an endurance of an astounding 2500 nautical miles.⁹ Although similar to C- and D-class submarines that operated in the Atlantic, the F-class only numbered four units and operated solely in the Pacific.¹⁰

The F-class also represented a giant leap in submarine tactics. Early submarine designs were experimental and conceptual. Limitations in speed, endurance, propulsion, and visual optics limited *Grampus* and *Pike* to such missions as stealthy port entry, or harbor defense. Now, after a degree of operational use, more advanced designs, such as the F-class, held the promise that submarines could act in coordinated operations with units of the Torpedo Flotilla or larger units of the fleet. Coordinated operations became a goal for larger submarines and it quickly became clear that the best place in the Pacific to develop those tactics was in the waters off Southern California.

As the F-class introduced vast improvements in stability, diesel engineering, habitability, bow-plane control, and compartmentalization for survivability, these craft challenged their crews with new concepts and new operational processes. Very quickly the Navy recognized that specific training was required for the crews to fully

master their vessels and that more fleet sailors would have to be trained in submarines to man larger and, now, more numerous boats.

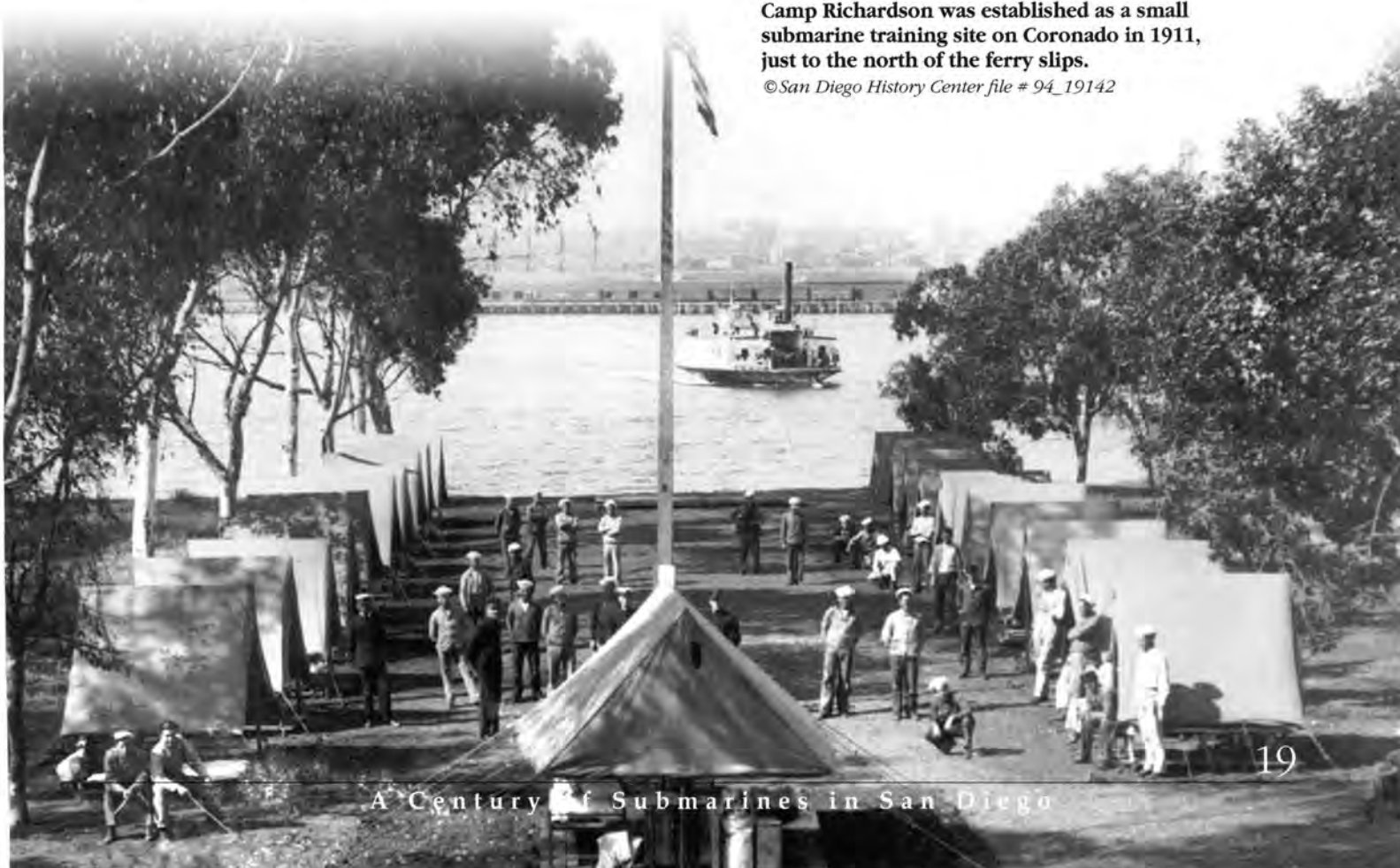
To meet these needs, Commander Louis C. Richardson of the Pacific Torpedo Flotilla established a small submarine training site on Coronado in 1911, just to the north of the ferry slips, which took the name Camp Richardson. Touted as "the only school of its kind in the world" and built around a cluster of campaign tents, the school offered courses up to six months in length.¹¹

Immediately following the F-class in the Pacific, and also built at Union Iron Works and Moran Brothers, were three submarines of the H-class (*H-1*, *H-2*, and *H-3*) and four submarines of the K-class (*K-3*, *K-4*, *K-7*, and *K-8*). The H-class shared many of the same characteristics as the F-class, but provided a "chariot" bridge and improvements in ventilation and periscopes. The K-class was slightly larger than H-class boats with increased underwater speed. Despite obvious improvements, the K-class limits in test depth (200 feet) and underwater endurance (twenty-six nautical miles at eight knots) were indications that underwater attack capabilities were still limited.

While in Southern California, these pre-war submarines split their time between Coronado and the new breakwater-protected harbor at San Pedro, and in doing so emphasized a smoldering problem for the Navy.

Camp Richardson was established as a small submarine training site on Coronado in 1911, just to the north of the ferry slips.

© San Diego History Center file # 94_19142





***F-1* became the only American submarine loss of World War I.**

Navy History and Heritage Command, Washington, D.C., file # NH99234

Everybody agreed that a permanent base should be developed for the fleet's submarines in Southern California; no one could agree where that should be. Coronado held the Pacific's only submarine training site, two submarine mooring piers, a marine railway for docking submarines for repairs, and the destroyers and torpedo boats of the Pacific Torpedo Flotilla. San Pedro, though, provided a larger Los Angeles political base, relatively louder supporters, and offers of new subsidized port facilities. This competition for submarines would remain unresolved for more than a decade. San Diego had difficulty recovering from fumbling the Navy's initial test of basing submarines in Point Loma, and the submarines of the H-class and their tender always considered San Pedro their home.

The Navy also experimented with the dispatch of submarines to Hawaiian waters for extended periods supported by the tender *Alert*. All four F-class boats deployed to Honolulu Harbor for eighteen months, during 1914-1915, and were followed by K-class boats for two years, from 1915-1917, with the submarines towed to and from the Hawaiian Islands.

With the commencement of World War I, Pacific submarines went into action. *Grampus* and *Pike*, which in 1915 had deployed onboard the collier *Hector* to become the FIRST Submarine Division of the Asiatic Fleet in Manila Bay, were assigned coastal defense patrols to protect the Philippines from German raiders, a threat that never materialized. All Pacific H-class and K-class boats were transferred to the Atlantic Fleet and conducted coastal defense patrols in the Caribbean, Chesapeake Bay, Key West, and Long Island Sound. Submarines *F-1*, *F-2*, and *F-3*, as well as several new R-class submarines, remained with the Pacific Fleet.



Pictured is H-6 in San Pedro on a calm day. The H-class shared many of the same characteristics as the F-class, but provided a “chariot” bridge and improvements in ventilation and periscopes.

U.S. Navy Photo

Despite being far from hostilities, *F-1* became the only American submarine loss of World War I. On 17 December 1917, three F-class boats were operating in company on the surface at nine knots when they entered a wall of heavy fog, while enroute from San Pedro to San Diego. In maneuvering to steer free of the mist, *F-3* rammed *F-1* just abaft her bridge, tearing a three-foot hole in her pressure hull and rupturing her main ballast tanks. Cold ocean water poured into the tight confines of the submarine and, as the crew of *F-3* watched in horror, *F-1* disappeared below the waves in less than ten seconds. The sinking occurred about nine nautical miles west of Ocean Beach, probably only thirty minutes from the time when the subs would have turned up the well-remembered San Diego channel. Nineteen sailors lost their lives that day while the commanding officer, Lieutenant Commander Alfred Montgomery, and four men on the bridge escaped.¹²

Due to wartime censorship, the Navy only reported the barest of details on the loss, except that the collision had occurred “in American waters.” It was not until fifty years later that the whole story was told through the efforts of the *San Diego Union* pursuing unclassified records from the accident’s Board of Inquiry.¹³

F-1 was not the only Pacific loss among these early pre-war classes of submarines that had seen so much time in San Diego. *F-4* was lost in a diving accident on 25 March 1915, off Honolulu Harbor, with the loss of all hands; and four men were lost during the grounding of *H-1* on Baja California’s Santa Margarita Island, on 11 March 1920, while that submarine was returning to California from war duties with the Atlantic Fleet.

Facing the immediate demands of a European war, Navy planners introduced the R-class and S-class submarine (both first laid down in 1917). About fifty percent larger than H-boats, the R-boats afforded room for many improvements in design, including larger torpedo tubes, deck guns, radios, two gyrocompasses, chariot bridges, a fathometer, and an electro-acoustic transducer (the Fressenden oscillator) that was used for submerged communications.¹⁴ Six boats of this class were built at the Union Iron Works in San Francisco and commissioned in 1918. In the 1920s and early 1930s all paid calls to San Diego and San Pedro, primarily for training, but were frequently assigned to either the Panama Canal Zone or to Pearl Harbor for lengthy assignments.¹⁵

S-class submarines were larger still, thirty-three feet longer than R-boats. The S-class represented the most numerous class of American submarines built in that time, with fifty-one submarines commissioned between 1920 and 1925. The class also featured tremendous extension in endurance – rated at 5400 nautical miles at eleven knots, and even more if ballast tanks were used for fuel. This allowed American submarines, for the first time, to transit trans-oceanic distances.¹⁶ S-30 through S-41 were built at Union Iron Works, but large numbers of the class were sent to the Pacific from Atlantic building yards during the 1920s.

The years following World War I were years of significant adjustment for American submarine planners. German submarine technology had proven superior to what the U.S. Navy had fielded, but greater still was the difference in the German use of that technology in the choice of strategic direction for their submarine fleet.

While American submarine pre-war focus had been primarily on coastal defense, German use during the war had been offensive. Although German submarines had introduced the policy of “unrestricted submarine warfare” against unarmed merchant shipping – a practice broadly considered abhorrent and dishonorable by American commanders – the German innovation in centralized coordinated command and forward operational deployment of submarines gained credence in the U.S.

World War I had taught U.S. submariners that forward submarine operations near an enemy’s coast appeared to be more valuable than operations in support of the battle fleet. In addition, submarine mobility was executed by surfaced runs, so surfaced ship-handling was important. Submarines might be attacked at any time by anti-submarine forces, so a submarine had to always be ready to submerge quickly. The standard was to dive in less than a minute and submarines learned to “ride the vents,” keeping the seawater intake valves open and air vent valves shut, which allowed for quick flooding of ballast tanks when the vent valves were opened.¹⁷

At the same time Congress authorized the Navy’s S-boats, money was set-aside for nine additional “fleet boats.” Broadly speaking, the S-boats (and the follow-on “R-class” that saw some duty in Southern California in the 1920s) represented coastal defense submarines, while fleet boat designs were intended to operate with the Battle Fleet and featured high speed and endurance. These fleet boats became the “V-class” and were the only U. S. submarines produced for a decade after the S-boats.¹⁸

The V-class of submarines was not really a class at all but represented five distinct designs of varying size, capability and mission. One was a mine-laying submarine, others had powerful engines for speed and advance scouting, two were large enough to deliver special operations teams or troops, and several offered a return to smaller size.

In the 1920s, the United States boasted the largest submarine fleet in the world – 94,000 tons of submarines compared with Japan’s 76,000 tons, or Britain’s 65,000 tons. Although larger in number, the American fleet was dominated by low endurance S-boats that were similar to designs that Britain and Japan had already scrapped as obsolete.¹⁹

In 1922, the American fleet organization was changed to combine the Pacific and Atlantic Fleets into a single United States Fleet with the main body of that fleet, consisting of battleships and cruisers, organized as the “Battle Fleet” and assigned to the Pacific. Older battleships

and other units were assigned to the “Scouting Fleet” in the Atlantic. Submarines were assigned by divisions to both the Battle Fleet and Scouting Fleet where appropriate.

War funds had helped build up submarine support facilities in San Pedro, beginning in 1917, and the Navy formally designated the site as a submarine base. After the war, when the Navy redistributed its forces between the Pacific and Atlantic, San Pedro’s status as the only West Coast submarine base was reinforced. However, by 1928, it had become clear that the port and shoreside facilities in San Pedro were insufficient to support Pacific submarines, their tenders, and the battleships and other large Battle Fleet units that were also stationed there. The Navy ordered all submarines to San Diego to be supported by tenders moored in San Diego Bay and ship repair facilities at the 32nd Street Destroyer Base. At the flick of a policy pen, San Diego instantly became the largest submarine base in the Pacific.

San Diego’s sudden prominence in submarine operations was not only measured in numbers of submarines but in submarine quality, training and doctrine. The new cutting edge V-class submarines were all assigned to San Diego and to Submarine Squadron TWENTY, making San Diego the centerpiece for efforts to test how submarines would fit in the war plans for coming hostilities.

In April 1927, the new submarine tender *Holland* (AS-3), then based in San Francisco, became the flagship of Captain J. T. Tompkins, Commander, Submarine Divisions, Battle Fleet. In September of that year, she permanently shifted to San Diego, still as flagship.

World War I had taught U.S. submariners that forward submarine operations, near an enemy’s coast, appeared to be more valuable than operations in support of the battle fleet.



Holland (AS-3) shown operating with S-boats in the Panama Canal Zone, 7 May 1927.

© Naval Heritage and History Command, file #NH9923

In San Diego Bay, she shared tending duties with *Argonne* (AS-10), with periodic tours to service submarines assigned to the defense of the Panama Canal Zone.

In June 1929, then-Captain Chester Nimitz relieved as Commander, Submarine Divisions, Battle Fleet, with additional duty as Commander, Submarine Division TWENTY. As Nimitz commanded all the Navy's newest V-class submarines, he focused broadly on submarine tactical development.

San Diego became a hot bed of experimental tactical thought. On several occasions, Nimitz advanced the new thought that fleet submarines should not be considered as mere scouts for the battleline, but should operate far forward of the battleline to attack enemy ships well before they could threaten American battleships.²⁰

In 1928, the Navy ordered all submarines to San Diego to be supported by tenders moored in San Diego Bay and ship repair facilities at the 32nd Street Destroyer Base. Pictured is the Destroyer Base in 1925.

Courtesy of MMSD, file # P-6899

Although this specific tactic did not prove fruitful in the later Pacific war, such thinking broke the mold of tightly tying the submarine to the battleline. By the time more successful doctrines of unrestricted warfare against commerce, massing submarines together into attack zones, and forward area offensive reconnaissance came to the fore, improved submarine designs and tactical training (begun during experimentation in Southern California) allowed the Pacific submarine force to thrive.

In December 1930, the U.S. Fleet was reorganized again with primary components – the Battle Force, Scouting Force, Base Force, and Submarine Force – and with Nimitz' command, redesignated as Submarine Division TWELVE. Commander, Submarine Force, U.S. Fleet, a rear admiral, now had overall command of all submarines and the submarine bases at New London, Coco Solo, Panama, and Pearl Harbor.





The submarine tender *Holland* is moored with two V-class and four S-class submarines (port side), with four additional submarines on the starboard side, in San Diego Bay, c. 1930s.

Courtesy of MMSD, file # P-8349

In 1935, *Holland* was flagship to the newly designated Submarine Squadron SIX, in San Diego, with divisions TWELVE, FOURTEEN, and FIFTEEN. Later, Squadron SIX added a specific "Experimental Division" to its organization that consisted of two to four boats assigned to "special duty with underwater sound training school," where both surface and submarine crews were trained in the latest sonar advances. These submarines participated in both static and at-sea training overseen by the Navy's Sound School. Experimental Division submarines were moored first at San Diego's Destroyer Base and later at piers near the Naval Training Center on Point Loma.

By the late 1930s, with the Battle Force more frequently engaged in fleet exercises in mid-Pacific, greater numbers of submarines, submarine tenders, and senior submarine commanders were likewise pushed forward for permanent basing in Pearl Harbor, or with the Asiatic Fleet in the Far East. San Diego became a favored location for shakedown, advanced training for newly commissioned boats and tactics development. For instance, *Seawolf*, *Saury* and several other newly-built submarines were assigned to Squadron SIX at times,

from 1938 to 1940, but ultimately sailed for Cavite, in Manila Bay, and were present there when hostilities began. San Diego tender *Holland* sailed for Pearl Harbor in mid-1941, and arrived in Cavite in November 1941, as flagship for Submarine Squadron TWO.

As World War II approached, San Diego's immense impact on American submarine strength and viability was everywhere in evidence. Nearly every submarine at

forward Pacific bases in Hawaii and the Philippines had seen service in San Diego earlier in their careers. Thousands of American submariners had been trained at facilities around San Diego Bay, or in the waters of the Southern California operating areas. San Diego had stood as a worldwide leader in underwater acoustics through the efforts of the Navy's Sound

San Diego became a favored location for shakedown, advanced training for newly commissioned boats and tactics development.

School and Scripps Institution of Oceanography, and all Navy operational training in sonar and underwater sensors was San Diego-based.

But, perhaps as important, San Diego had sat exactly in the middle of twenty years of efforts and experiments to determine the best designs and employments for Pacific submarines. Once the lessons from V-class submarine operations near San Diego were fully understood in the mid- to late-1930s, improvements in overall American submarine design were rapid. In the late-1930s and early-1940s, momentum quickly built as a result of improved fleet submarine design, largely dominated by the necessities of Pacific campaigns. The result was a string of

impressive advances in submarine capabilities, beginning with ten boats of the *Porpoise* and *Perch* classes that entered service beginning in 1935, followed by sixteen boats of the *Salmon*, *Sargo*, and *Seadragon* classes two years later, and culminating in the successful fleet boat designs beginning with the *Tambor* and *Gar* classes that would dominate American submarine triumphs during the war.

By the time of the attack on Pearl Harbor, San Diego already represented a war-fighting rear echelon for submariners. The only submarines in port on 7 December 1941 were four old "S-class" boats (*S-35*, *S-34*, *S-18*, *S-23*), while all newer boats were already pressing forward across the Pacific. Two of the very newest submarines built to the latest fleet-boat design – *Gar* (SS-206) and *Grayling* (SS-209) – were enroute to San Diego on that Sunday morning, after transiting the Panama Canal. But, as further proof of the times, they were only to stop briefly in San Diego Bay for supplies and fuel before proceeding ahead to the Pacific front lines.

NOTES

- 1 "Submarines Grampus and Pike Dive Today in Waters of San Diego Bay," *San Diego Evening Tribune*, 21 July 1910, 1.
- 2 Drew Middleton, *Submarine: The Ultimate Naval Weapon - Its Past, Present & Future* (Chicago: Playboy Press, 1976), 28. Norman Friedman, *U.S. Submarines through 1945* (Annapolis: Naval Institute Press, 1995), 306.
- 3 "Submarines Grampus and Pike in Port after Longest Trip Ever Made by Ships of This Class," *San Diego Evening Tribune*, 28 June 1910, 1.
- 4 "Grampus Makes 8 Miles under Water," *San Diego Evening Tribune*, 9 December 1910, 8.
- 5 David Randall Hinkle, ed. *United States Submarines* (New York: Barnes & Noble, 2002), 41.
- 6 "Forced to Wait for Boat to Pt. Loma," *San Diego Evening Tribune*, 25 January 1912, 5.
- 7 "Cruiser Maryland Arrives," *San Diego Union*, 31 May 1912, 9. In 1915, *Grampus* and *Pike* were transported to the Philippines, where they joined a force of early submarines of the Asiatic Fleet. As the U.S. entered WWI, these nine submarines provided coastal defense for Manila Bay. Although no threat materialized, they proved that submarines could be used in forward-deployed areas and presaged the submarine defense of the Philippines that would take place in the opening days of World War II.
- 8 "Underwater Craft to Begin Practice," *San Diego Union*, 16 January 1913, 9. "F Group Rivals in Frolics under Sea," *San Diego Union*, 8 April 1913.
- 9 Friedman, *U.S. Submarines through 1945*, 58. "Navy Diving Boats May Be Sent Here for Tests," *San Diego Union*, 9 December 1911, 8.
- 10 *F-1* was originally named *Carp* but renamed in November 1911, *F-2* originally named *Barracuda*, *F-3* *Pickrel*, and *F-4* *Skate*.
- 11 "Submarine School Is Established," *San Diego Union*, 27 May 1911, 8. This may have been the first submarine school for the U.S. Navy, as a similar school in San Pedro was not established until 1914 and Groton's more famous Submarine School did not open until 1916.
- 12 Don B. Marshall, *California Shipwrecks* (Seattle: Superior Publishing, 1978), 15. Bruce Linder, *San Diego's Navy* (Annapolis: Naval Institute Press, 2001), 63. LT Montgomery's career in the submarine service was tarnished by the collision and loss of *F-1* and he transferred to the aviation community in 1922. There he excelled, rising to command Carrier Division TWELVE and Carrier Division THREE in World War II, for which he was awarded three Distinguished Service Medals and the Navy Cross.
- 13 "News of the War," *San Diego Union*, 19 December 1917, 1. John Bunker, "Navy Lifts 50-Year Silence on Point Loma Sub Sinking," *ibid.*, 30 August 1970, G1. Recently the exact location of the *F-1* wreckage was discovered through the help of the Navy's Deep Submergence Unit, as 8.7 nautical miles due west of the Ocean Beach Pier.
- 14 Friedman, *U.S. Submarines through 1945*, 119.
- 15 *Ibid.*
- 16 *Ibid.*
- 17 *Ibid.*, 149-151.
- 18 Edward C. Whitman, "The Navy's Variegated V-Class: Out of One, Many?" *Undersea Warfare*, Fall 2003.
- 19 Friedman, *U.S. Submarines through 1945*, 164.
- 20 Jerry Holland, "Nimitz, the Submariner," *Undersea Warfare*, Spring 2003.

**Fleet Sonar School buildings,
1947, at what is today the Naval
Mine and Anti-Submarine Warfare
Command base on Point Loma.**
*Official U.S. Navy Photo,
Courtesy of SSC Pacific*



San Diego Submarines:

By CDR R.D. Baker, USN (Ret.) and Captain Scott A. van Hoften USN (Ret.)

R. D. Baker,

Commander, USN (Ret.), a docent at the Maritime Museum of San Diego, is a retired submariner with thirty years (1961-1991) service as both an enlisted man and as an officer, all of them in submarines or submarine-related assignments. He served as an electronics technician in the diesel submarines *Carp* and *Barbel* and in the ballistic missile submarine *John Adams*. As a Chief Warrant Officer, he served as Weapons Officer in the diesel submarine *Greenfish*. He completed two tours in the submarine tenders *Holland*, as a repair division officer, and *Simon Lake* as Executive Officer. He completed two tours on the staff of Submarine Development Group ONE, as Projects Officer and Logistics Officer, with additional duty as Officer-in-Charge of the bathyscaphe *Trieste*. CDR Baker commanded the submarine drydock *San Onofre* and closed out his career as the Chief Staff Officer of Submarine Squadron ELEVEN.

Scott A. van Hoften,

Captain, USN (Ret.), is a 1963 graduate of Stanford University. Upon graduation, he went directly into the nuclear submarine service and served on both diesel and nuclear attack submarines. He commanded *Guitarro* (SSN-665) in San Diego, from 1978 to 1981, during which *Guitarro* launched twenty Tomahawk cruise missiles as part of the test and evaluation program. Captain van Hoften served for four and a half years as Defense and Naval Attaché at the Embassy in Tokyo, Japan.



THE WAR YEARS 1940-1945

December 7, 1941, found San Diego strangely bereft of submarines. As a result of the Japanese threat to the Philippine Islands, the submarine tender *Holland* (AS-3) was transferred to the U.S. Asiatic Fleet in late fall, 1941, along with the embarked Submarine Squadron SIX staff and virtually all assigned submarines, to aid in the defense of the Philippine Islands. The two submarines remaining in San Diego were of the S-Class, a 20-year-old class, assigned to provide services to the West Coast Sound Training School in training anti-submarine warfare operators. By the spring of 1942, both of these submarines, along with four other S-class submarines had also been transferred to Dutch Harbor, in the Aleutian Islands, to assist in the defense of Alaskan territory. Most of these S-boats had returned to San Diego by 1943, again to provide training services to the West Coast Sound Training Squadron and most were

The War Years (1941-1945)

The entrance to San Diego Bay was netted during the War Years. The concentration of submarine activity moved to the Pacific theater, which included defense of the Alaskan territories.

Official U.S. Navy Photo, Courtesy of SSC Pacific



decommissioned by the end of 1945. For the remainder of the war years, the only other submarines in San Diego were newly commissioned submarines that had been built on the West Coast, primarily at Mare Island Navy Shipyard in Northern California. These submarines conducted post-construction shakedown trials and training in the San Diego area before moving west to join the war in the Pacific. War's end found ships and men returning to San Diego in large numbers and the San Diego submarine community grew as the submarine tenders *Nereus* (AS-17) and *Sperry* (AS-12) took up moorings in San Diego's harbor with the submarines of Squadrons THREE and SEVEN alongside.

THE PACIFIC SUBMARINE CAMPAIGN

The Submarine Force's contribution to the overall Allied success in World War II has been well documented. As San Diego had been a major homeport for submarines in the late-1930s and into the very early-1940s, it might seem that San Diego would have played a major role in the success of submarine warfare in the Pacific during the conduct of the war. However, as the threat of conflict in Asia and, specifically, in the Philippine Islands grew during the mid- to late-1930s, the capable submarines were replaced with older, less capable units. San Diego's submarine roles during the bulk of the war were training and refit, but San Diego was not as involved with the day-to-day activities of prosecuting the submarine warfare effort in the Pacific, as were Pearl Harbor, Brisbane, Australia, and other forward submarine operating bases.

While the recognized date for the beginning of World War II in the United States is 7 December 1941, following the surprise attack on Pearl Harbor by naval air forces of the Empire of Japan, it is important to recognize that Europe had been at war since 3 September 1939, following Germany's attack on Poland on 1 September. In Asia, throughout the 1930s, the Empire of Japan had been expanding its influence and power in China and elsewhere in Asia seeking raw materials, oil and dominance. Under the rubric of the Greater East Asia Co-Prosperity Sphere, Japan was expanding into China, Thailand, Burma, Malaysia, New Guinea, Indonesia, the Philippine Islands and Indo China. Despite the predominance of an isolationist sentiment throughout the U.S. during the 1930s, the President, and many in the military, considered an armed conflict with Japan to be inevitable, as it would only be a matter of time before the ambitions of the Japanese would significantly infringe upon U.S. interests.

Considering this geopolitical background, it is useful to note the effect the increasing concern over a conflict in the Pacific had on the submarine force in San Diego.

San Diego became a favored location for shakedown, advanced training for newly commissioned boats and tactics development.

In late 1939, there were twenty submarines operating from San Diego. These submarines were assigned to Submarine Squadron SIX and included the *Perch* class-submarines: *Perch*, *Pickrel*, *Pompano*, *Plunger*, *Permit*, *Pollack*, *Pike*, *Porpoise* and *Tarpon*; and the *Salmon/Sargo*-class submarines: *Snapper*, *Salmon*, *Seal*, *Skipjack*, *Stingray*, *Sargo*, *Saury*, *Sculpin*, *Spearfish*, *Swordfish* and *Seawolf*. When in port these submarines moored alongside the submarine tender *Holland*, which was anchored in the harbor at the foot of Grape Street. Two older S-boats (*S-27* and *S-28*) were also in San Diego providing training support to the West Coast Sound Training School.¹

With the exception of the older S-boats, these boats were built as part of President Roosevelt's National Industrial Recovery Act of 1933 which, among other things, authorized building twenty-six new submarines over the next few years. The *Porpoise*-class was all 300 feet long, displacing 1,300 tons with a design depth of 250 feet and

carrying 90,000 gallons of fuel. The *Salmon*-class was 308 feet long, displaced 1,450 tons and also had a design depth of 250 feet, but carried 110,000 gallons of fuel. A significant difference was that the *Porpoise*-class had four torpedo tubes forward and only two aft, while the

Salmon-class had four torpedo tubes forward and aft.² Later additions to the fleet benefited greatly from early experiences of submarine war patrols. Significantly, the follow-on Fleet Boats had six torpedo tubes forward and four aft.

Initially, submarines were fitted out with one 3" deck gun. It

is also important to note that submarines of this era were not fitted with the "snorkel" equipment developed by the Germans that allowed the diesel-powered submarines to recharge their batteries while remaining submerged, with only the snorkel above water to provide air to the diesel engines. Without a snorkel, a diesel submarine had to surface at least once a day to recharge its batteries. During these periods on the surface, it was far more vulnerable to detection and attack. The limitations on the time a submarine could remain submerged became a major factor in planning and executing attacks.

Admiral Charles A. Lockwood, Jr. (who subsequently served as the Commander, Submarine Forces, U.S. Pacific Fleet), advocated mounting a 5" deck gun, but lost the issue to others (primarily Admiral Thomas Hart, Chairman of the Navy's General Board responsible for naval construction), who believed submarines would

Without a snorkel, a diesel submarine had to surface at least once a day to recharge their batteries.





rarely, if ever, use a deck gun but would attack submerged and, probably, below periscope depth.³ Subsequent experience during the early portions of the war demonstrated that many attacks were better prosecuted on the surface and a 5" gun was far more effective. Finally, after the war started, boats began being fitted with the larger 5" gun.⁴

In late-1939, in response to the increasing threat in the western Pacific, six San Diego-based boats were forward deployed to Cavite, in the Philippines, to prepare for what was generally believed to be an eminent attack by the Japanese. *Pickarel*, *Perch*, *Porpoise*, *Pike*, *Tarpon* and *Permit* departed San Diego and joined Submarine Squadron FIVE in Cavite. *Pollack*, *Pompano* and *Plunger* remained in San Diego with *Plunger* being forward deployed on 30 November 1941.⁵

In October 1941, San Diego's submarine tender *Holland*, Submarine Squadron SIX staff, and *Salmon*, *Sturgeon* and *Skipjack* departed San Diego enroute to the Philippines via Pearl Harbor where they were joined by *Swordfish*.⁶

The Porpoise-class Submarine Permit (SS-178) was among the subs deployed to Cavite, in the Philippines.

©Naval History and Heritage Command, file #99671

Panoramic photograph of Holland (AS-3) moored at Buoy 19 in San Diego Bay, c. 1939, with eleven submarines alongside.

Submarines are (from left to right):

***Salmon* (SS-182), *Seal* (SS-183), *Stingray* (SS-186), *Perch* (SS-176), *Pollack* (SS-180), *Cachalot* (SS-170), *Cuttlefish* (SS-171), *Skipjack* (SS-184), *Sturgeon* (SS-187), *Snapper* (SS-185) and *Sargo* (SS-188). SS-182 through SS-187 were members of Submarine Division FIFTEEN, commanded by R. W. Christie. *Richmond* (CL-9), flagship of the Commander, Submarine Force, U.S. Pacific Fleet, is in the right distance.**

©U.S. Naval History and Heritage Center, file # NH 68481



Separately, *Seal* and *Snapper* departed San Diego in the fall of 1941 for Cavite. *Stingray* had departed San Diego in April 1940 for operations out of Pearl Harbor and then entered overhaul in Mare Island Naval Shipyard. She departed overhaul for Pearl Harbor and Cavite, arriving late October 1941.⁷

As part of the policy of moving the more capable submarines west, several of the older S-class boats, already in the Western Pacific, were reassigned to San Diego. *S-27* and *S-28* arrived in June of 1939.

S-34 and *S-35* arrived from Pearl Harbor in April of 1941. *S-18* and *S-23* arrived in September 1941. They were joined, briefly, in June of 1942 by *S-33*.⁸

Seven December 1941 saw San Diego with *S-18*, *S-23*, *S-34* and *S-35* in port, and with *S-27* and *S-28* undergoing overhaul in the Mare Island Naval Shipyard. *Grayling* and *Gar* were enroute to San Diego having transited the Panama Canal from the Atlantic Fleet but only paused briefly for repairs before continuing on to the Western Pacific.⁹

With the increasing threat perceived in the Aleutian Island area from Japanese operations, many of San Diego's S-boats were transferred to the new base in Dutch Harbor. *S-18* and *S-23* departed in January 1942; *S-34* and *S-35* in March 1942, and finally, *S-27* and *S-28* left in May of 1942. This effectively cleared San Diego briefly of operational submarines. However, over the next four years, while the war raged in the western Pacific, San Diego provided upkeep and training for submarines between war patrols or in conjunction with overhaul.

The *Porpoise*- and *Salmon*-class boats that had been stationed in San Diego, during the late-1930s, were among the first submarines to engage in combat following the attacks on Pearl Harbor and Manila.

Perch had departed San Diego for Manila in October 1939. Once there she became the division flagship.¹⁰ She spent the year preceding Pearl Harbor operating in and around the Philippines and the coast of China. A week before Japan attacked Pearl Harbor, *Perch* rendezvoused with two transports off Shanghai, China, and escorted the 4th Marines from China to the Philippines. At the

outbreak of hostilities, *Perch* was in the Cavite Navy Yard. She took part in the rush to clear the Navy Yard, on 10 December 1941, and watched, at close range, the destruction of Cavite by Japanese bombers. That night *Perch* slipped through the Corregidor minefields and scouted between Luzon and Formosa in search of targets. As hunting was poor, she shifted to an area off Hong Kong, and, on Christmas

Perch (SS-176), formerly *P-5*, departed San Diego for Manila, in October 1939. Once there she became the division flagship, but would ultimately be a casualty of war.

©Naval History and Heritage Command, file #NH42491

The loss of oil, and air from damaged ballast tanks, convinced the enemy that *Perch* was breaking up and they went on the look for other kills, allowing *Perch* to surface.





***Perch* took part in the rush to clear the Navy Yard, on 10 December 1941, and watched, at close range, the destruction of Cavite by Japanese bombers.** U.S. Navy Photo

night, fired four torpedoes at a large merchantman, all torpedoes missing their target. A few days later an eight thousand-ton Japanese merchant ship was hit by one of *Perch*'s torpedoes. Enemy escorts prevented *Perch* from observing the kill, but expert evasion got her clear of the attackers' well-placed depth charges.

On the evening of 1 March 1942, *Perch* surfaced thirty miles northwest of Surabaya, Java (Indonesia), and started an attack on the enemy convoy that was landing troops to the west of Surabaya. Two enemy destroyers attacked and drove her down with a string of depth charges that caused her to bottom at 135 feet. Several more depth charge attacks caused extensive damage, putting the starboard motors out of commission and causing extensive flooding throughout the boat. After repairs, *Perch* surfaced at two o'clock in the morning only to again be driven down by the enemy destroyers. The loss of oil, and air from damaged ballast tanks, convinced the enemy that *Perch* was breaking up and they went on the look for other kills, allowing *Perch* to surface. With the submarine's decks awash and only

one engine in commission, the crew made all possible repairs. During the early morning of 3 March, a test dive was made with almost fatal results. Expert handling enabled her to surface from that dive only to be attacked by two enemy cruisers and three destroyers. When the enemy shells commenced to straddle the boat, the commanding officer ordered all hands on deck, and with all possible hull openings open, *Perch* made her last dive. She was struck from the Navy List 24 June 1942.

The entire crew was captured by a Japanese destroyer. Of the fifty-four men and five officers, only six (who died of malnutrition in Japanese prisoner-of-war camps), were unable to return home to enjoy the victory for which they had fought so gallantly.¹¹

Another San Diego boat, *Seawolf*, had been deployed to Cavite in the fall of 1940, and was there when Pearl Harbor was attacked. She departed on her first war patrol on 8 December and remained at sea until the day after Christmas. While hunting for Japanese shipping, she tried to sink a supply ship but was unsuccessful. For her efforts, she underwent her first depth charge attack.

She subsequently participated in a total of fifteen war patrols, sinking approximately 71,609 tons of enemy shipping.¹² On her final war patrol, *Seawolf* departed Brisbane, Australia, on 21 September 1944. On 3 October, *Seawolf* and *Narwhal* exchanged radar recognition signals. Shortly afterward, a U.S. SEVENTH Fleet task group in the area was attacked by a Japanese submarine. One of the U.S. planes searching for the Japanese submarine dropped two bombs on a submerging submarine, despite the fact that the submarine was in a safety zone for American submarines. A second attack on this site resulted in underwater explosions. No further contact was made with *Seawolf* and she was believed sunk by U.S. forces with the loss of all hands.¹³ These were the risks and the reality of submarine warfare.

From today's perspective, submarine warfare at that time was primitive. Navigation was difficult, especially compared to today's Global Positioning Systems that can determine present location within a few yards. Communications were extremely limited with HF (high frequency) transmissions generally required for long-range contact. Today, we consider any electronic emission to be tantamount to being detected due to the nature of satellite geo-location systems. In many cases the submarines had limited radar installations, if any. The most frustrating aspect of the early part of the war for the Submarine Service was the faulty torpedoes that tended to run much deeper than set, and pass well under the intended target. Admiral Lockwood, after relieving as Commander Submarines, Southwest Pacific, set about to investigate and rectify the problem despite the obstinate actions of the Bureau of Ordnance. Following correction of the problem, and the availability of more torpedoes, the war patrols became more successful.

Another major issue facing the Submarine Force performance in the early portion of the war was the nature of the training, especially in fleet exercises. Submarines were viewed as not a part of the main battle fleet due to their many limitations and were assigned mostly scouting duties. In exercises, Commanding Officers were severely criticized and marked down for being detected during exercises, as detection was viewed as being attacked and destroyed. That philosophy, on the part of Battle Fleet and

Submarine Force senior commanders, drove submarine tactics to encourage submerged sonar approaches. During the early part of the war, these cautious tactics proved ineffective for successful attacks on surface units. Many submarine CO's, who had "excelled" in the pre-war environment of exercises, ended up being relieved of command for being too cautious and timid.¹⁴ Not surprisingly, by the end of the war, submarine CO's were most often thought of as reckless and daring – both characteristics necessary to succeed in unrestricted submarine warfare.

When the submarine building program began to provide updated fleet-type submarines, the older boats, such as the S-class that had been in San Diego immediately before the war, began returning to San Diego. Additionally, as war patrol damage and the results of constant operation began to take their toll, many submarines were

returning to San Diego and Mare Island for overhaul, refit and upgrading. As new electronic weapons systems and mechanical upgrades became available, they were being retrofitted on the returning submarines to improve their performance on patrol.

THE ALASKAN SUBMARINE CAMPAIGN

The Pacific war plan, Rainbow Five, included a provision that two submarines would be dispatched to Dutch Harbor, Alaska, upon outbreak of hostilities with Japan.¹⁵ Their mission would be to provide CinPacFleet with information on Japanese fleet movements in Alaskan waters and to defend the seaplane base at Dutch Harbor from attack, in the eastern Aleutians. *S-18* and *S-23* departed San Diego in January 1942, and made brief patrols in February under extraordinary weather and sea conditions.¹⁶ An entry in *S-23*'s deck log for 13 February notes:

*Shipped heavy sea over bridge. All hands on bridge bruised and battered. Officer of the Deck suffered broken nose. Solid stream of water down hatch [bridge hatch] for 65 seconds. Put high pressure pump on control room bilges; dry after two hours...Barometer 29.60, thirty knot wind from northwest.*¹⁷

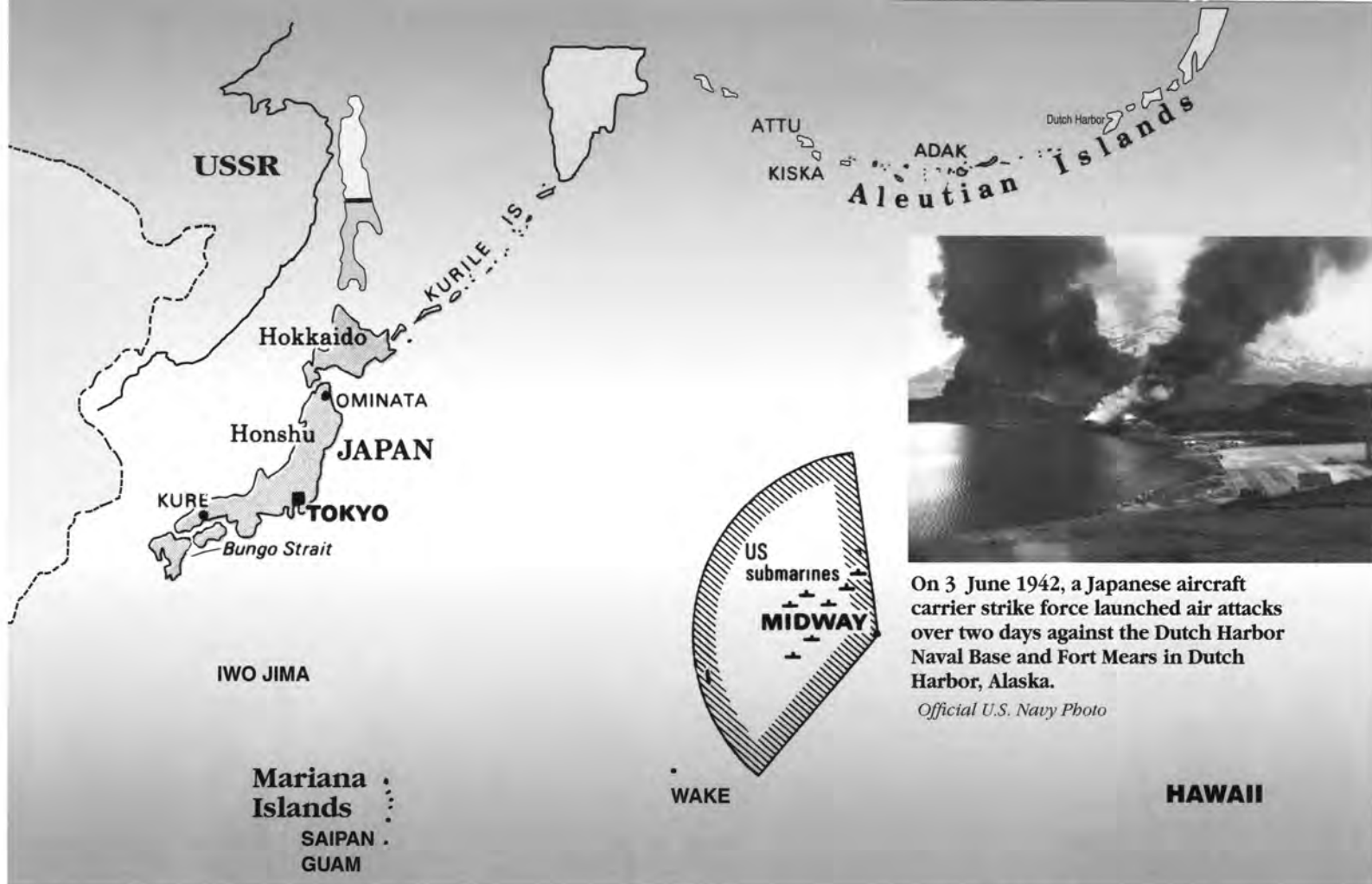
Not surprisingly, by the end of the war, submarine CO's were most often thought of as reckless and daring – both characteristics necessary to succeed in unrestricted submarine warfare.



After these patrols, both *S-18* and *S-23* returned to San Diego for refit and modifications made necessary by the extreme weather and sea conditions. These repairs included superstructure modifications and additional internal heating. Both boats returned to Dutch Harbor in the spring of 1942 and were joined by eight additional S-boats, including *S-27* and *S-28* from San Diego. These ten submarines comprised Submarine Division FIFTY-THREE. By April, both *S-34* and *S-35* had made patrols into Japanese territory, penetrating as far as Paramushiro, at the northern end of the Kurile Islands, Japan's northernmost naval base. Both submarines made attacks on merchant shipping but without any success.

***S-32* returns to Dutch Harbor Submarine Base after patrol.**

*San Francisco Call-Bulletin, Aleutian Islands Photographs, 1942-1948
Courtesy of the University of Alaska Fairbanks, Archives, file #UAF-1970-11-27*



Prior to the Battle of the Coral Sea in May 1942, code breakers had determined that Japan's next major offensive in the Pacific would be the invasion of Midway Island. This attack would be accompanied by a diversionary attack toward the Aleutian Islands.

Prior to the Battle of the Coral Sea in May 1942, code breakers had determined that Japan's next major offensive in the Pacific would be the invasion of Midway Island. This attack would be accompanied by a diversionary attack toward the Aleutian Islands. In response to this threat, a North Pacific Force was assembled under the command of Rear Admiral Theobald, who also assumed command of the existing "Alaska Navy" including the Dutch Harbor submarines. Believing that the Japanese would attack military facilities on the Alaskan mainland and the eastern Aleutians, RADM Theobald deployed his surface forces near the eastern end of the islands. Four of the six submarines were assigned to patrol the approaches to this area, while the remaining two submarines patrolled in the area of Attu on the western extremity of the Aleutians. It turned out that the Japanese apparently had no real interest in the eastern Aleutians and, as a result, neither the surface force nor the submarines made contact with the enemy.¹⁸ Dutch Harbor was bombed by Japanese carrier aircraft on 3 and 4 June, but that was the extent of action in the eastern Aleutians. The Japanese did, however, seize the islands of Attu and Kiska in the Western Aleutians without

opposition on 6 and 7 June. Only S-34 and S-35 were in position to oppose these landings, but neither submarine sighted any elements of the invasion forces, partially because of dense fog.¹⁹

The occupation of Attu and Kiska created supply line issues for the Japanese, as supply convoys had to be protected by warships that were needed elsewhere. In response to this convoy activity, seven fleet boats were deployed, primarily from Pearl Harbor, with limited success. *Growler*, under the command of LCDR Gilmore, sank one destroyer off Kiska, on 5 July.²⁰ *Grunion* sank two patrol boats²¹ and *Triton*²² sank a destroyer. *Grunion* was later lost off Kiska.

One of the San Diego boats, S-18, arrived in Dutch Harbor in January 1942, and conducted defensive patrols out of the new and still incomplete submarine base until March, when she returned to San Diego for refit. Enroute back to Dutch Harbor on 29 May, she was ordered to patrol the southern approaches to Unimak Pass, at the eastern end of the Aleutian Islands.²³ S-18 arrived on station 2 June, the day before the Japanese bombed Dutch Harbor. Hampered by fog, rain and poor radio reception, and lacking radar, fathometer and

deciphering equipment, *S-18* remained on station through 10 June before returning to Dutch Harbor. Three days later she was underway again, this time to patrol west and north of Attu, then north of Kiska. The weather, as on earlier patrols, was consistently bad. Material defects and design limitations in speed and maneuverability continued to plague her. Her fourth patrol was aborted after a crack developed in the starboard main engine housing, while her fifth patrol was interrupted by the loss of the starboard stern plane that made depth control erratic. In all, *S-18* conducted six patrols without engaging enemy shipping. During her second patrol she sighted a Japanese submarine, but was unable to close the target. *S-18* was ordered back to San Diego in February 1943, where she provided services to the West Coast Sound Training Squadron, until the end of the war. She was decommissioned in October 1945.

Another San Diego S-boat, *S-27*, was undergoing overhaul at Mare Island Naval Shipyard, when Pearl Harbor was attacked. Returning to San Diego in January 1942, she provided services to the West Coast Sound Training Squadron until May when she was ordered to Dutch Harbor. Arriving on 12 June, a week after the Japanese attack, she took on provisions and then departed on patrol in areas west of Dutch Harbor.²⁴ The night of 18 June, she surfaced near East Cape to charge batteries. Because of the limited hours of darkness, battery charges were conducted using both engines and no propulsion. An undetected current carried the boat five miles from its estimated position. At midnight, she got underway slowly, using one engine while continuing the battery charge on the other engine. Within an hour she had run aground on rocks off Amchitka Island. Waves bumped her against the rocks causing her to roll ten to fifteen degrees. Efforts to extricate the boat, including backing both motors and discharging fuel and variable ballast, were unsuccessful and in the process the starboard screw was disabled after striking a rock. Six distress messages were sent, but only one was received at Dutch Harbor. By 3:30 that morning, it was clear the boat was well and truly grounded and that the sea conditions would cause additional damage. The decision to abandon the boat was made and most of the crew evacuated using a rubber boat and lines rigged between the boat and the shore. At 1:15 P.M. a message advised:

HEAVY POUNDING CONTINUES • HELPLESS • ALL ASHORE EXCEPT SIX • ALL COMPARTMENTS DRY EXCEPT TORPEDO ROOM • WILL STAY UNTIL UNTENABLE • ALL CRYPTO AIDS DESTROYED BUT THIS • WHEN ABANDONED WILL WALK TO CONSTANTINE [an abandoned Russian fishing settlement] *IF FREE ON* [sic] *ENEMY*.²⁵

The crew continued to remove supplies and destroy equipment for two days before the presence of chlorine gas prohibited further visits. A crew member wrote:

*We were in a sort of an unsheltered cove with all of our provisions, clothing and little ammo piled on the beach. I suppose this was the lesser of two evils. All of us were wet and the temperature was about 60 degrees, uncomfortable at the very best. Fires were started and wet clothing removed. A couple ounces of grog in some coffee picked us up a little.*²⁶

The much older S-boats, considering their success and the performance of their crews, were more impressive than their record suggests.



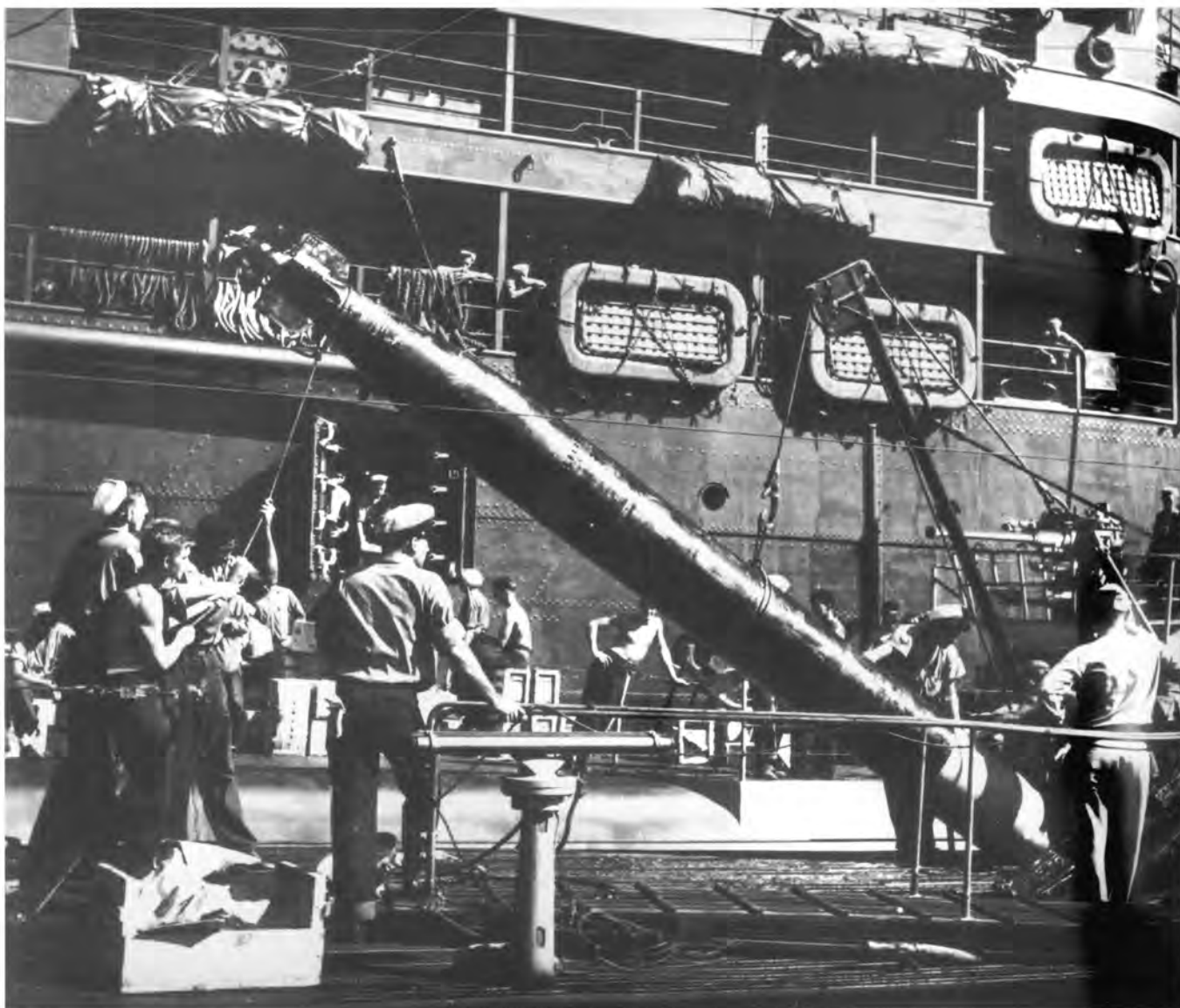
The crew later moved into abandoned buildings in Constantine and awaited rescue. Eight days later, an overflying PBY spotted the crew's distress signals and three PBYs arrived the following day to evacuate S-27's crew.

In preparation for the retaking of Attu and Kiska, seven more S-boats were ordered to Dutch Harbor in the spring of 1943, along with the submarine tender *Beaver*.²⁷ Until August, patrol efforts by the Dutch Harbor boats were concentrated on supply lines between Japan and the western Aleutians.²⁸ After the retaking of Attu and Kiska, the patrol focused on hunting expeditions in the northern Kurile Islands, at the entrance to the Sea of Okhotsk,

An Mk-14 torpedo is loaded on board a ship in 1945. This torpedo became the mainstay weapon of the U.S. submarine fleet, but was beset by problems during the early years of WWII.

but very little was accomplished. The twenty-four patrols, mounted from May 1943 to the end of the year, resulted in only four enemy sinkings, totaling some 13,000 tons. San Diego submarines accounted for two of these successful actions. On 1 July 1943, while patrolling the approaches to the Sea of Okhotsk, S-35 sank the 5,400 ton fishing tender *Banshu Maru No. 7*.²⁹ On 16 September 1943, S-28 attacked and sank the 1,368 ton converted gunboat *Katsura Maru No. 2*, after firing a spread of four torpedoes, two of which exploded.³⁰

Considering the significant contribution made, especially in the early years of the war, by the much older S-boats, their success and the performance of their crews were even more impressive in light of their limitations. What is most notable to those familiar with subsequent submarine classes is what features and amenities the S-boats did NOT have.





Beaver is pictured in Olongapo, Philippines, March 1929. Beaver tended boats in the Aleutians and was the only working tender in San Diego during the war.
 © Naval History and Heritage Command, file #59967

The boats were commissioned between 1920 and 1925, so they were at least sixteen years old by the outbreak of the war. They were not equipped with radar, fathometer or deciphering equipment. They were generally outfitted with four torpedo tubes forward and, in some ships, one aft. They were not able to utilize the new Mk-14 torpedo that had been designed to use the new, very secret, Mark VI magnetic exploder (which may have served as a blessing initially, as there were extensive problems associated with that exploder during the first years of the war). Additionally, they were not furnished with air-conditioning equipment for the crew, which, in view of their employment early on in the Aleutians, became a great burden for the crew. Until modified, the only source of heat for the crew aboard the S-boats was the crew galley stove. Yet, as noted, they conducted operations in and around Alaska and the northern regions of the Japanese Islands – not

always successfully. Their limitations became a real issue and most were modified during refits or overhauls.

With the end of a Japanese threat to the Aleutians in late 1943, ComSubPac ordered the remaining S-boats

With the end of a Japanese threat to the Aleutians in late 1943, ComSubPac ordered the remaining S-boats withdrawn from Alaska and assigned to training duties in San Diego and Pearl Harbor.

withdrawn from Alaska and assigned to training duties in San Diego and Pearl Harbor. Overall the Aleutian submarine campaign was a bad investment in men and material. Only nine confirmed sinkings were scored over eighty patrols conducted in the Alaskan theater, and four of these were by Pearl Harbor-

based fleet boats. Two S-boats and one fleet boat were lost, with all hands. Admiral Harlfinger described S-boat duty in Alaska thusly:

The conditions those boats endured up there are simply indescribable. It was God awful. Cold. Dreary. Foggy. Ice glaze. The periscopes froze. The decks and lifelines were caked with ice. Blizzards. You could never get a navigational fix.³¹

San Diego Submarines: The War Years (1941-1945)

SUBMARINE ACTIVITY IN SAN DIEGO DURING WAR YEARS

By May 1943, most of San Diego's S-boats had returned home for repairs and subsequent duty with the West Coast Sound Training Squadron (WCSTS). They were later joined by other S-boats from the Western Pacific, Pearl Harbor and the Aleutians. The Squadron's war diary for 1 August 1943 listed radio call signs for four S-boats. One year later, on 27 August 1944, the war diary listed radio call signs for nine S-boats. The West Coast Sound Training School was originally established in June 1939, as the Sound School at the Destroyer Base (now the 32nd street Naval Station), but it had its beginnings in 1938, when Destroyer Division NINETEEN began training sound operators in the waters between San Diego and San Clemente Island. By December 1941, the training squadron boasted seven destroyers and six submarines. Sound School was designated the West Coast Sound Training School in 1942, and later organized as the Fleet Sonar School on 14 April 1942. The school and its facilities were relocated from the Naval Station to its present location on Point Loma in March 1943, where finger piers provided mooring space for the WCSTS submarines, ships and small craft. The S-boats were also occasionally used to provide at-sea training for students in the many service schools located in San Diego, such as the Quartermaster Class A school at the Naval Training Center.^{32 33}

Maintenance support for San Diego's S-boats were first provided by repair facilities at the Naval Station, until the submarine tender *Beaver* (AS-5) arrived from the Aleutians on February 1944, and remained in San Diego tending the boats of the WCSTS, until her departure for conversion in June 1945.³⁴

The West Coast Sound Training School was a component of the Fleet Operational Training Command, Pacific. This command included a variety of training commands including Anti-Aircraft Training Centers in Pacific Beach (Port Hueneme), California, and Pacific Beach, Washington, a pre-commissioning

training center at Treasure Island, San Francisco, and the San Diego Shakedown Group.³⁵ The shakedown group conducted training and evaluation of the crews of newly commissioned ships and the crews of ships completing overhauls. The purpose of this training and evaluation was to ensure that ships and crews were ready for combat operations at sea.

In addition to the S-boats permanently stationed with the WCSTS, San Diego was visited by other submarines enroute to the western Pacific, as well as other submarines enroute from the western Pacific to

shipyards on both coasts. Submarines transiting from the Atlantic to the war zones typically went directly to Pearl Harbor via the Panama Canal. Submarines built or overhauled on the West Coast often called at San Diego for shakedown training before proceeding on to the war zone. Of the nineteen submarines built at Mare Island Naval Shipyard

between 1939 and 1945, seven were known to have visited San Diego for shakedown training while several others also may have called here. *Tang* called at San Diego for eighteen days of extensive training exercises, after her commissioning in 1943, before proceeding to the western Pacific where she established her near legendary records.^{36 37}

END OF THE WAR: In Summary

Japan's acceptance of conditions for cessation of hostilities on 15 August 1945 (14 August in San Diego) caused varied reactions locally and along the West Coast. By 16 August, the *San Diego Union's* front page carried stories of layoffs resulting from cancellation of defense contracts, crowds celebrating the end of gas rationing, and reports that San Francisco's three-day victory celebrations had resulted in 600 injured and seven deaths.³⁸

Over the 1,347 days of war, some 288 submarines served at some time in the Pacific theater. Two hundred and sixty-three of those submarines conducted 1,474 war patrols. In carrying out these war patrols the submarines sank 1,392 Japanese ships. Eighty-six of these submarines also rescued 504 downed airmen.



San Diego's fleet boats that went west in 1940 and 1941 conducted ninety-eight war patrols, while the S-boats conducted an additional twenty-seven war patrols before returning home.³⁹ Fifty-two submarines were lost, including forty-one on war patrol (including two from San Diego). Three thousand four hundred eighty-four (3,484) submariners were lost with these submarines.⁴⁰ In addition to anti-shipping missions and lifeguard missions, U.S. submarines were sent on special missions to rescue civilians and troops, transport ammunition and food, conduct sabotage and perform other tasks in enemy-held territory. Pacific Fleet submarines took the battle to the Japanese supply lines while the Pacific Fleet regained their footing after the attack on Pearl Harbor.

San Diego Submarines: The War Years (1941-1945)



Inactivated World War II submarines moored at Mare Island Naval Shipyard, 3 January 1946. The mixture of boats from the *Salmon/Sargo*, *Gato*, and *Balao*-classes illustrate the clear differences in the conning tower fairwaters and the periscope shears that can be used to identify boats. The high bridges, with the uncovered support frames (the “covered wagon” look), of the *Gatos* and *Salmon/Sargo*’s contrast with the low and sleek look of the *Balao*’s. The fatter, more robust periscope shears of the *Balao*’s are markedly different from the thinner shears, with more supporting structure of the *Gatos* and *Salmon/Sargo*’s.

Courtesy of CDR Ray Ferbrache, USN (Ret.)

The end of the war brought about significant changes in the Submarine Force. On 1 May 1945, there were 201 submarines assigned to Commander, Submarine Force, U.S. Pacific Fleet, distributed over sixteen submarine squadrons, scattered from Fremantle, Australia, to Subic Bay, Guam, Pearl Harbor and San Diego.⁴¹ Between that date and the end of the war, an additional eight boats were lost in combat. Of these 193 submarines, 111 were decommissioned, including all San Diego’s S-boats, while most of the remaining submarines were dispersed to San Diego, Panama, Key West and New London. Many of the boats slated for decommissioning operated briefly while awaiting their turn in the inactivation queue.⁴²

Before returning to the United States, twelve submarines sailed to Tokyo Bay and were present at the Japanese surrender ceremonies on 2 September 1945. Eventually, twenty-three submarines made their way to San Diego for duty.⁴³

NOTES

- 1 Dictionary of American Fighting Ships (DANFS), <http://www.history.navy.mil/danfs/index.html>
- 2 Clay Blair, *Silent Victory* (Philadelphia and New York: J.B. Lippincott Co., 1975), 43.
- 3 *ibid.*, 47
- 4 *ibid.*, 322-323
- 5 *ibid.*, 55
- 6 DANFS, <http://www.history.navy.mil/danfs/s3/salmon-ii.htm>
- 7 DANFS, <http://www.history.navy.mil/danfs/s18/stingray-ii.htm>
- 8 DANFS, <http://www.history.navy.mil/danfs/index.html>
- 9 *ibid.*
- 10 *ibid.*
- 11 DANFS, <http://www.history.navy.mil/danfs/p5/perch-i.htm>
- 12 Theodore Roscoe, *United States Submarine Operations in World War II* (Annapolis, Maryland: U.S. Naval Institute Press, 1949), 553.
- 13 DANFS, <http://www.history.navy.mil/danfs/s9/seawolf-i.htm>
- 14 Clay Blair, *Silent Victory* (Philadelphia and New York: J.B. Lippincott Co.), 46.
- 15 US Pacific Fleet Operating Plan – Rainbow Five www.ibiblio.org/hyperwar/USN/rep/Rainbow5-USN.html (accessed 19 December 2013)
- 16 Edward C. Whitman, "The Forgotten Theater: U.S. Submarine Operations in the Aleutians in World War II," *Under Sea Warfare*, Spring 2003.
- 17 *ibid.*
- 18 *ibid.*
- 19 *ibid.*
- 20 DANFS, <http://www.history.navy.mil/danfs/g9/growler-iii.htm>
- 21 DANFS, <http://www.history.navy.mil/danfs/g9/grunion.htm>
- 22 DANFS, <http://www.history.navy.mil/danfs/t8/triton-iii.htm>
- 23 DANFS, <http://www.history.navy.mil/danfs/s1/s-18.htm>
- 24 DANFS, <http://www.history.navy.mil/danfs/s1/s-27.htm>
- 25 S-27 (SS-132) June 19, 1942 - No Men Lost - The Loss of S-27, George Herold, S-27 http://www.navsource.org/archives/08/SS-132_S-27.pdf
- 26 *ibid.*
- 27 DANFS, <http://www.history.navy.mil/danfs/b4/beaver-i.htm>
- 28 *ibid.*
- 29 DANFS <http://www.history.navy.mil/danfs/s1/s-35.htm>
- 30 DANFS <http://www.history.navy.mil/danfs/s1/s-28.htm>
- 31 *ibid.*
- 32 Bruce Linder, *San Diego's Navy: An Illustrated History* (Annapolis, Maryland: U.S. Naval Institute Press, 2001), 129.
- 33 Edward Davis, *The United States Navy and U.S. Marine Corps at San Diego* (San Diego, California: Pioneer Printers, 1955), 61-62.
- 34 DANFS, <http://www.history.navy.mil/danfs/b4/beaver-i.htm>
- 35 US Pacific Fleet Organization, 1 May 1945, www.ibiblio.org/USN/OOB/PacFleet/Org-450501 (P. 239)
- 36 William Tuohy, *The Bravest Man: Richard O'Kane and the Amazing Submarine Adventures of the USS Tang* (Stroud, UK: Sutton Publishing Ltd, 2001), 163.
- 37 DANFS, <http://www.history.navy.mil/danfs/t2/tang-i.htm>
- 38 *San Diego Union*, 16 August 1945, (Page 1)
- 39 DANFS (Ship histories for all San Diego-based submarines listed in Pacific Fleet Order of Battle, dated January 1939, <http://www.history.navy.mil/danfs/index.html>
- 40 William P. Grun, "U.S. Pacific Submarines in World War II" (P. 4), <http://www.hnsa.org/doc/subsinpacific.htm>
- 41 *Ibid.*
- 42 DANFS, (Ship histories for all 211 submarines listed in Pacific Fleet Order of Battle dated 1 May 1945 <http://www.history.navy.mil/danfs/index.html>
- 43 *Ibid.*

A CENTURY OF SUBM

U.S. Submarine Missions:

Coastal and Harbor Defense

Long-Range Scouting

Naval Gun Shore Bombardment

Anti-Shipping

Coastal and Harbor Attack

Intelligence, Surveillance,

Anti-Surface Ship Warfare

Mine Laying

Insertion/Extraction

Search and Rescue (SAR)

Radar Picket



Submarines in San Diego:

A-Class (2)

F-Class (4)

H (9) & K-Class (2)

B (2), C (1), D (1) & N-Class (3)

R-Class (4)

S-Class (12)

V-Class (8)

Porpoise-Class (4)

Shark (2) & Perch (6)

Salmon (6), Sargo (5)
& Seadragon-Class (2)

Gato (2) &

Tench-



Submarine "Crampus"
San Diego, Cal.
~1910~



Propulsion for SD Subs:

Diesel (F, H-Class & Beyond)

Gasoline (A, B, C, D and G-Class)

Era:

Pre-WW II

WW II

1910

1911

1912

1913

1914

1915

1916

1917

1918

1919

1920

1921

1922

1923

1924

1925

1926

1927

1928

1929

1930

1931

1932

1933

1934

1935

1936

1937

1938

1939

1940

1941

1942

1943

1944

1945

1946

1947

1948

1949

1950

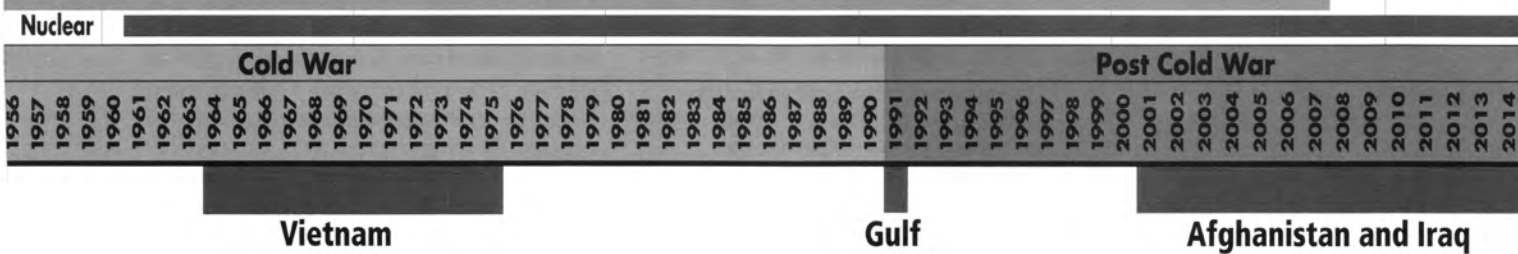
1951

1952

World War I

World War II

Kore





Twenty-year old QM George Kinnison was honorably discharged from the U.S. Navy in Spring of 1946 after three years of service.

Courtesy of the Kinnison Family

Sarah Bishop Dolbec

has worked in museums and in public history since 1997, researching and writing on history and the arts, from the American Wild West to the Ottoman Empire, to Feudal Japan. Before moving to San Diego, she coordinated exhibits and managed programs at Mystic Seaport Museum, Mystic, CT, including "Restoring an Icon: The *Charles W. Morgan*" an exhibition on the history and re-launch of the world's last wooden whaling ship. She has also served as Interpretation Coordinator at the Nantucket Historical Association, Nantucket, MA, and Curatorial Fellow at the Bruce Museum of Arts and Science, Greenwich, CT. She holds a Master's Degree in Museum Science and Bachelor's degrees in History and French. Sarah continues her work as an Exhibition and Curatorial Consultant. She is the wife of a Submarine Officer, and has contributed photographic and biographical research, the transcription of interviews, and editorial support for this publication.

Full Circle: George V. Kinnison

World War II Veteran

By Sarah Bishop Dolbec

Growing up on a farm in Wyoming during the Great Depression and the Dust Bowl, George Kinnison had no idea he would have enough adventures to fill three lifetimes, or that one day he would create an emblem to inspire future generations. From plying the ocean's depths to soaring among the clouds, Kinnison's life is inextricably tied to San Diego.¹

At age sixteen, Kinnison enlisted in the United States Navy's V-5 training program for aviator cadets in 1942. A year later he was called up for active service, but soon after reporting he was informed that there were no billets for pilot training. He could choose another division of Navy service or return home. Bounced between Monterey, California, where preflight cadets were processed, and Bremerton, Washington, where a recruiter convinced him that he should become a submarine Quartermaster (QM), Kinnison found himself in sunny San Diego. He attended boot camp at the Naval Training Center and Quartermaster School and Submarine School at Naval Base Point Loma, training on *S-32* (SS-137), a diesel boat formerly on duty in Alaska and then moored at the 32nd Street Destroyer Base.²

It was the best place in the world; I'd never seen sunshine and sand and beaches before. Sub school was a real delight here....

Ready for Action

At eighteen, Kinnison graduated QM Third Class and was assigned to the *Saufish* (SS-276). He joined the boat in Pearl Harbor before her third war patrol in June 1943. Over the next two years, he would see combat in eight patrols, learning at an early age that being depth-charged was just part of the job.



Kinnison on the bridge for QM watch, East China Sea, 1944.

Courtesy of the Kinnison Family

You didn't realize what's really happening. There were depth charges going off overhead, you don't know enough to be scared. All the crew was mostly under twenty-five. You learned to hear the click, click, click, bang, though. The worst enemy we had was Chidori, a Japanese destroyer;³ which was shallow draft, fast, and maneuverable. When he latched onto us with his sonar, it was hard to get rid of him. The only choice of getting rid of him was to find a pressure gradient...a change in temperature of the water...



Pictured is the second *Sawfish* battle flag made by QM George Kinnison in 1945. The stars represent ships sunk and the upright bars along the bottom tally the boat's war patrols. *Courtesy of the Kinnison Family*

that will deflect the sonar pinging coming in. So [in] a pressure gradient...we change course and speed, and...go deeper. When you'd get pinned down and couldn't get away, like in the China Sea where it's shallow water, you'd play games with the guy; all kinds of maneuvers to try to get rid of him. That's why very few skippers wanted to get into the China Sea. Boats actually got more damage than you knew you got. For instance, it didn't take much to spring [the] periscope shears...if you take twenty to thirty depth charges in the water at forty-five second intervals, bang, bang, pop, pop....

Designated "safety zones" close to mainland areas afforded submarine crews a moment of relief.

Two things that submarines did when they passed each other in the safety zone: we always exchanged records and movies. Threw a line over and string it back and forth.... One time in a wolfpack, we exchanged secret orders in a mayonnaise jar with the line gun, shooting it over and them shooting it back.

However, the zones were not without their perils. [It was] not unusual [while] going to and from a station...mines that had [been] anchored to the sea floor would come loose and could be floating anywhere.... It was always a big danger. Usually, when

The strange thing about this is that my career started in San Diego in sub school and ended up on the Sawfish in San Diego. It made a full circle and the interface is that battle flag.

aviators spotted the mines they shot them from above, but sometimes submariners had to eliminate the threat.

As lead Quartermaster, Kinnison's battle station was the conning tower, and he was assistant to the Navigator:

...All submarines sailed under secret orders; the crew didn't know where we were going. As quartermaster, I knew where we might go, but I got one false chart, too. But until the skipper told us where we were going, we didn't know....

He was also responsible for using the 35mm camera installed on the boat's second periscope, to document engagements with the enemy. As the only crew member authorized to use the camera, he captured other aspects of WWII submarine life, from R & R (rest and relaxation) activities to mail call – *the most important thing that happens to sailors in war time. During the war, when you came into port, there were two things you had: mail call, number one, and ice cream and gee-dunk [snack food], number two.*



Above: Kinnison on gang watch aboard the *Sawfish* during her "Victory Tour" with the *Steelhead* at Long Beach, CA, on 27 October 1945. Courtesy of the Kinnison Family

Through it all, Kinnison never forgot his lofty ambitions. Once on Guam, his unique skill-set proved serendipitous. *I got permission to go up to the airport at the military base. I just wanted to get a ride on an airplane. This TBF [torpedo bomber aircraft] was just starting to take off— they have a pilot flying and they have a regular [gunner] in the back seat.* [The third crewmember position was a radioman/bombardier.⁴] *This lieutenant is going around talking to himself; he was really ticked off 'cause he was going to miss a mission. His radioman apparently got sick over night and couldn't make it. I was wandering around, and he said, 'You're a quartermaster?' 'Yeah,' George answered. The lieutenant said, 'I know you know how to operate a radio; have you ever operated a .50 caliber?' 'Yeah.' So I legally flew a war patrol in a TBF.*

Drawn into History

After the *Sawfish's* tenth war patrol ended in April 1945, she returned to Mare Island for her second overhaul.⁵ Kinnison took the opportunity to make a lasting contribution to his command. The boat's battle flag at the time was a simple hand saw surrounded by stars representing ships sunk.

In the submarine tender's sail loft, Kinnison sewed a figure of a sawfish with boxing gloves rising from the sea, breaking an enemy vessel in half. He kept the red stars

for ships sunk and added bars along the bottom to note the number of patrols made.

Soon after, someone told Kinnison that Walt Disney was doing battle flags for free, so he went to Disney Studios and spoke with an artist. The artist changed the enemy ship into a sailor and gave Kinnison the drawing. This design would become the basis for the boat's new insignia. The *Sawfish* left the shipyard in August to rejoin the fleet in the Pacific. The war ended before she arrived in Pearl Harbor, and she was ordered back to San Diego to the West Coast Sound Training School on Point Loma. She was joined briefly by the *Apogon* (SS-308) and the *Steelhead* (SS-280) on a short Southern California "Peace Tour" that lasted until Christmas of 1945.⁶ The boats docked at Long Beach and San Diego, receiving visitors and giving tours. *The new battle flag was a victory flag,* mused Kinnison.

For her wartime service, the *Sawfish* was awarded eight battle stars over ten patrols, three of which earned the Navy Cross. She had sailed in wolfpacks with the *Rock* (SS-274) and *Tilefish* (SS-307), *Drum* (SS-228) and *Icefish* (SS-367).⁷ Like many other submarines, she enjoyed her share of dramatic episodes, including rescuing downed pilots floating in the ocean, struggling with defective torpedoes, and avenging a sister ship. Kinnison earned the Navy Commendation Medal with "V" device for Valor and the Navy Unit Commendation Medal with one star, among other citations.



Kinnison as a test pilot for North American Aviation in 1957.

Courtesy of the Kinnison Family

A New Mission

Kinnison was honorably discharged just before his twenty-first birthday and set about making his dream of flying a reality. He went to the University of Wyoming in the summer of 1946, majoring in Engineering and enrolling in ROTC (Reserve Officer Training Corps). Two years later, he received his wings and commission in the newly formed United States Air Force as a member of its first officers' class. He remained in the Air Force until 1955, serving in the Korean War and later stationed at O'Hare Air Force Base. Kinnison spent the next twenty-eight years as a test pilot for North American Aviation. He broke the sound barrier, briefed military leaders on aircraft weaponry, and became friends with "the original seven" astronauts. He often met pilots rescued by submariners in the war – once by another boat in his wolfpack..

While Kinnison's path led him beneath the waves and across the skies, he always came back to California. Now living in Fallbrook, he reflects, *The strange thing about this is that my career started in San Diego in sub school and ended up on the Sawfish in San Diego. It made a full circle and the interface is that battle flag.* After displaying it proudly in his home for forty years, Kinnison donated the *Sawfish* battle flag to the San Diego chapter of WWII Submarine Veterans in 1995. It now hangs in the Submarine Squadron ELEVEN headquarters at Naval Base Point Loma, reminding today's submariners of a legacy of strength, resolve, and determination.

NOTES

Editor's note: Some pronouns used by the speaker in the original interview have been changed to enhance contextual understanding.

- 1 This biography is a compilation of three interviews conducted by the author with George Kinnison and son, Gary, in San Diego, CA, on 8 November 2013, 16 January and 13 February 2014.
- 2 *Dictionary of American Naval Fighting Ships*, Naval History and Heritage Command, 2014, <http://www.history.navy.mil/DANFS/index.html>, S-32 (SS-137).
- 3 The *Chidori* was a torpedo boat equipped with nearly as much firepower as a destroyer. *Conway's All the World's Fighting Ships, 1922-1946* (New York: Mayflower Books, 1980).
- 4 Drendel, Lou. "Grumman TBF/TBM Avenger". *U.S. Navy Carrier Bombers of World War II* (Carrollton, Texas: Squadron/Signal Publications, Inc., 1987).
- 5 *Dictionary of American Naval Fighting Ships*, Naval History and Heritage Command, 2014, <http://www.history.navy.mil/DANFS/index.html>, *Sawfish* (SS-276).
- 6 Ibid., *Apogon* (SS-308), *Steelhead* (SS-280).
- 7 Ibid., *Sawfish* (SS-276).
- 8 Ibid.



CAPT Thomas E. Ishee, (right), Submarine Squadron ELEVEN Commodore from June 2012 to February 2014, stands next to former QM George Kinnison and Kinnison's flag, December 2013.

Photo by Gary Kinnison

Captain Charles B. Bishop, USN (Ret.)

Sailor & Scientist

By Sarah Bishop Dolbec

Charles Birney Bishop has dedicated his life to understanding the marine world for the benefit of the environment and for those who operate within it. His personal efforts, over more than forty years, contributed to San Diego's success as a leader in undersea sound research and technology.¹

A native of New Haven, Connecticut, Bishop grew up steeped in American maritime history, drawn to the sea and the Navy. He graduated from the Naval Academy in 1941 and was assigned to the destroyer *Cummings* (DD-365), escorting troop ships in the Pacific arena. His first taste of submarine combat was outside the small town of Efate, in the New Hebrides Islands. On a bright, sunny day in the middle of the war zone, there was no pilot boat to bring the *Cummings* and the ship

she was protecting into the harbor. Suddenly, an enemy periscope rose out of the water, and Bishop rushed to the pilot house to drop the depth charges. Despite a sonar check, there was no trace of the submarine.²

After two years of escort duty, Bishop was eager to experience shiphandling and knew submarines would provide that opportunity since, in his words, *their stock in trade is the ability of all officers to handle the ship*.³ After submarine school in New London and a short stint on the *Roncadore* (SS-301), Bishop was assigned to the newly constructed *Piranha* (SS-389) and made Chief Engineer. Over the course of five war patrols, he advanced to Executive Officer and then Commanding Officer at the time of her decommissioning. For his WWII service, Bishop earned the Bronze Star and Navy Commendation Medals.⁴



Midshipman Charles Bishop's Naval Academy class graduated just after the bombing of Pearl Harbor.

Courtesy of the Bishop Family

The crew of the *Piranha* with their Disney-designed battle flag.

Courtesy of the Bishop Family



The converted sailing yacht, the *E. W. Scripps*, owned by Scripps Institution of Oceanography, performed electromagnetic propagation tests in 1953, with the submerged WWII diesel submarine-turned-research vessel, the *Baya*, for the Marine Physical Laboratory and the Naval Electronics Laboratory.

Courtesy of Scripps Institution of Oceanography Archives, UC San Diego Library



Bishop's experiences during the war, both above and below the surface made it clear to him there was room for improvement.

... Things need to be better than what you're working with, which means you've got to do research, you've got to do development.... I got really interested in sonar and improving the capabilities of sonar. Having had destroyer experience with submarines, you get a different perspective.... Technology was changing for the anti-submarine warfare [ASW] people pretty fast.

Anti-submarines had to get on top of things to maintain our capabilities.

With only a handful of institutions around the country doing oceanography at the time, San Diego was a prime location for this type of research. In 1946, the Navy established the Marine Physical Laboratory (MPL) to work with its Naval Electronics Laboratory (NEL) on Point Loma, based on successful war-time advances made in partnership with the University of California Division of War Research. MPL continued to involve academics and engineers in experimental physics and sea-going action to help solve Navy problems. Administered by the University of California and later by nearby Scripps Institution of Oceanography, a forerunner in marine studies since 1903, it would become one of the first university research support labs to advise and support the Navy on undersea warfare issues. MPL contributed to the advancement of the Navy's capabilities in both pro- and anti-submarine warfare by enhancing knowledge about the marine environment through development of engineering devices and techniques.⁵

After the war, Bishop was able to join this center of underwater sound research and development. Following an assignment in San Diego on the *Segundo* (SS-398), Bishop spent three years in graduate school, earning a Master's in Applied Physics from University of California, Los Angeles. During that time, he worked closely with NEL and their underwater sound lab on projects such as the special sonar that enables submarines to operate under the Arctic ice.⁶

[It was] a very interesting part of the Navy in those days. We made some significant advances...being able to develop

acoustics in the lower frequencies. Lower frequencies give you more range capability.

Bishop knew the solutions to better submarine capabilities lay obfuscated within the medium itself:

... You get very closely connected with what the ocean

is like, how [it] changes.

Particularly for acoustics, the ability to hear things, depending on what depth you're at and where the sounds channels are.... The ideal submarine would be one which is not detectable from other things that live in the ocean. You want to be able to operate a submarine very quietly, so you're not radiating a lot of recognizable noise, and operate so that you take advantage of the physics of the ocean itself – its sound layers

– the different capabilities to be detected or not be detected.

Bishop's shore billets and sea-tours balanced study and practice. *It was good in those days because you went to school, but then you also went to sea to work on things related to what your education was all about. Sometimes submarines, sometimes in surface ships.* His East Coast assignments taught him the difficulty of operating submarines and doing research, development, testing, and evaluation in colder, stormier climes, where inclement weather could delay, if not derail, the process. *It's a different world when you have to break the ice to get out of the river.*

In 1953, Bishop commanded the San Diego-based *Baya* (AGSS-318), a WWII diesel boat that had been transferred to NEL as a research vessel and often worked in concert with MPL. In addition to conducting underwater gravity measurements off the coast, the *Baya* went to sea in tandem with a 1930s sailboat, the *E.W. Scripps*.⁷ As technology advanced, Bishop saw the vulnerability of surface forces and the potential of the new nuclear subs. Fast, yet noisy, it was vital they improve their systems and be able to work independently from battle groups, if and when necessary. *The thing is you have got to project into the future. You can't just say, I can handle what is here today.*⁸

The ocean's an interesting place to work. There's always more information available than you're even capable of using. ...Lots of sound in the sea, but the trick is to pick out what you want and what you need...and how you're going to get it out.



Soon, Bishop was in a position to help bring about that future. From the late 1950s through the late 1960s, he served in upper levels of naval administration in Washington, D.C. While working in the undersea and anti-submarine departments of the Office of Naval Research, the Chief of Naval Operations, and the Naval Material Command, he had the ability to move resources and put the right people and right projects together at the right time.

In 1957, Bishop was part of a group of naval and university staff that evaluated and procured the new Swiss-designed, Italian-built bathyscaphe *Trieste* for the U.S. Navy. During the review process, he was the first American naval officer to participate in an "orientation dive" on the vessel, which could carry two persons to the deepest reaches of the ocean. *Trieste* would enable the Navy to sponsor and facilitate its own deep-sea studies on everything from bioluminescence and the effects of tremendous pressure, to the deep scattering layer and acoustic convergence zones, achieving an unprecedented intimacy with the marine environment. The *Trieste* was brought to San Diego where Navy and university laboratories could have easy access, setting the stage for the birth of a new era in Navy technology.⁹ In 1963, Bishop arranged for *Trieste's* use in

The *Trieste* arrived in San Diego for operation by the Navy Electronics Laboratory in 1958, initiating the Navy's Deep Submergence Rescue Program and submarine rescue capabilities, now located at North Island Naval Air Station.

Official U.S. Navy photograph, Courtesy of SSC Pacific

the successful search for the *Thresher* (SSN-593), a sub lost with all hands off the coast of New England. This event marked the beginning of the Navy's Deep Submergence Rescue Program and the creation of submarine rescue capabilities, now located at North Island Naval Air Station.¹⁰

While in Washington, Bishop continued to support San Diego laboratories' efforts on projects such as Long Range Propagation Group, SUBROC (a submarine-launched rocket program), and acoustic directional measurements. He worked to consolidate the diverse research programs and groups around the country to focus their efforts in San Diego, where great weather, deep-water access, and support ships and facilities converged in a place people were eager to live and work.¹¹

Between these shore assignments, Bishop's active duty included combat in Korea and Vietnam, commanding destroyers, submarines, and amphibious ships, as well as serving as Commander of Amphibious Squadron SEVEN and Amphibious Ready Group Alfa. He received the Legion of Merit with Combat "V", among other decorations.¹²

Bishop returned to San Diego in 1969 to helm the newly established Naval Undersea Warfare Center, soon shortened to Naval Undersea Center (NUC). He described their role for the Navy as a continuous flow of new knowledge and new capability for the fleet to use in all the things it is called upon to do in the undersea environment.¹³ NUC programs addressed critical Navy needs in

In the 2011 documentary, *Deepest Dive: The Story of the Trieste*, Bishop commented: *The ocean is seventy percent of the earth's surface and so much of that has never been explored. Every time someone goes out they're finding something new that can be helpful to humanity.*

advanced undersea weapons systems, undersea surveillance, sonar technology, and manned and unmanned undersea vehicles for work, research, and rescue.¹⁴

The two Point Loma labs with which Bishop worked – NELC and NUC – would eventually merge to form the Naval Ocean Systems Center, today's Space and Naval Warfare Systems Center (SSC) Pacific. This synergy of resources would go on to create some of the most cutting edge Naval technologies, such as Fleet Satellite communications, command and control technology, imaging radar, fixed undersea surveillance systems (SOSUS), towed array sonars (SURTASS), ASW torpedoes, and operational marine mammal systems.¹⁵ Bishop retired from the military in 1972 and transitioned to the public side of oceanography. He joined his long-time collaborators at MPL as Assistant Director, where he enjoyed an atmosphere of unfettered investigation and could share the laboratory's wealth of knowledge and experience with wider audiences, while still supporting the Navy's capabilities.

Among the many projects Bishop championed, he secured the Navy's design and logistical support for the trials and implementation of the revolutionary Floating Instrument Platform (FLIP) at MPL, now owned by the Navy. FLIP created a stable platform at sea to measure the effects of the environment on long-range sound propagation, without interference or fluctuations caused by surface waves, moving vessels, or sloping hulls. Originally developed in support of the Navy's SUBROC program, it has been used principally for acoustics research since then, including geophysics, meteorology, physical oceanography, non-acoustic ASW, and in laser experiments.¹⁶

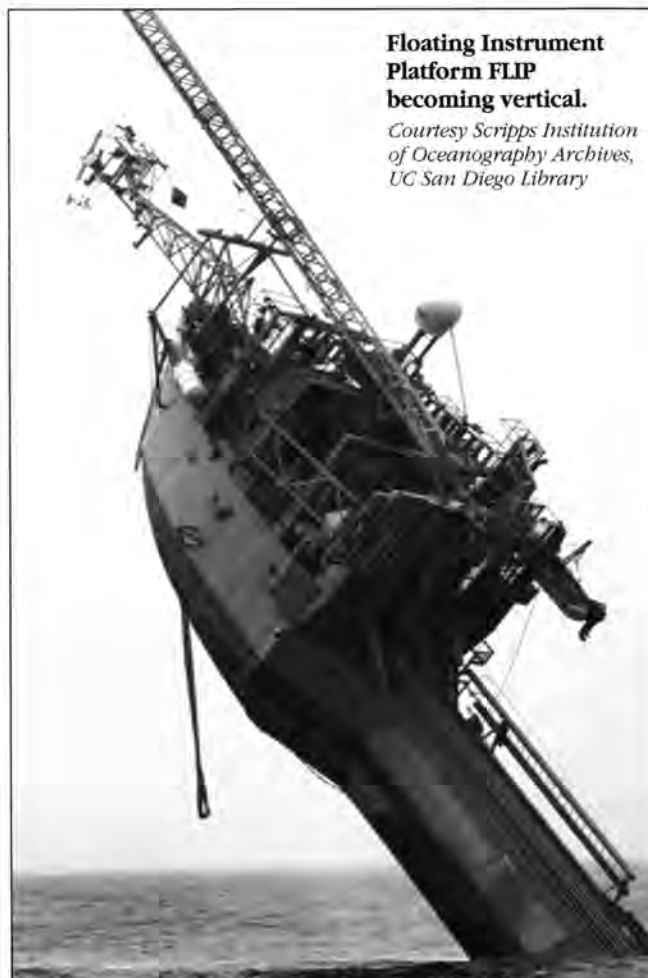


Bishop has been a member of the Marine Technology Society since 1965, an organization that brings together international and regional experts, and students to benefit from San Diego's varied scientific community and resources. In 1984, Bishop helped establish the San Diego Oceans Foundation, a non-profit educational institution dedicated to promoting ocean stewardship by involving volunteers, students, and organizations in active participation and awareness projects, providing the public with a deeper appreciation of the environment and creating "citizen scientists."

In recognition of Bishop's life-long efforts, he was honored in 2002 with the Roger Revelle Award, which celebrates individuals from science, academia, industry, military, recreation, and philanthropy, who have helped resolve ocean issues and encourage stewardship of ocean resources.

NOTES

- 1 All quotes in this biography, unless otherwise noted, are from an interview by the author with Capt. Charles Bishop, USN (Ret.), 13 February 2014, San Diego, CA.
- 2 Charles Bishop Interview, The National WWII Museum, <http://www.w2online.org/view/charles-bishop/segment-1>, 19 April 2012.



Floating Instrument Platform FLIP becoming vertical.

Courtesy Scripps Institution of Oceanography Archives, UC San Diego Library

- 3 Tom LaPuzza and Mark Taylor, "Profile of a Career Navy Officer," *Seascope*, Special Issue, 1 July 1972.
- 4 "Capt. Bishop Welcomed to Post," *Star-News*, Pasadena, CA, 26 March 1969, 6. John R. McCabe, "Command Changes at NUWC," *Seascope*, Vol. 2, No. 6, 14 Feb 1969.
- 5 Mark Jacobsen, Interview with Capt. Charles Bishop, Naval Ocean Systems Center, Oral History Collection, October 1987, 16. Charles Bishop, "The Value of MPL to the Navy," *Seeking Signals in the Sea: Recollections of the Marine Physical Laboratory*, Elizabeth Shor, ed. (San Diego: Marine Physical Laboratory, SIO, UCSD, 1997), 51. See <http://www.mpl.ucsd.edu/about/history.1.html>
- 6 Bill Decker, "Captain Charles B. Bishop, USN (Ret.) Receives the Roger Revelle Award," *Navy Submarine League Update*, 06 July 2002.
- 7 Bishop, op. cit., 51.
- 8 Jacobsen, op. cit., 6.
- 9 Gary E. Weir, *An Ocean in Common: American Naval Officers, Scientists and the Ocean Environment* (Texas: Texas A&M University Press, 2001), 318-321.
- 10 Decker, op. cit.
- 11 Bishop, op. cit., 53. Jacobsen, op. cit., 1.
- 12 "Captain Bishop to Retire: CDR Gunn New Commander" *Seascope*, Vol. 5, No. 12, 9 June 1972.
- 13 LaPuzza and Taylor, op. cit.
- 14 Tom LaPuzza correspondence, 4 April 2014.
- 15 LaPuzza, op. cit. Bruce R. Linder, *San Diego's Navy: An Illustrated History* (Annapolis, Maryland: Naval Institute Press, 2001), 168.
- 16 Fred Fisher, "A Saga from Graduate Student to FLIP," Shor, op. cit., 93. See <http://www.mpl.ucsd.edu/resources/flip.intro.html>.

Submarine Rescue and Deep Submergence Comes to San Diego

By Captain Charles R. MacVean, USN (Ret.), Ph.D.

Born and raised in Ridgewood, New Jersey, MacVean received his commission through the NROTC program at Dartmouth College, graduating in 1959. Following assignment to the *Forrest Sherman* (DD-931), he was sent to Cornell University where he earned a Ph.D. in Nuclear Science and Engineering. MacVean's sixteen years of sea duty included qualification in submarines, and duty as the Navigator on *Tinosa* (SSN-606). Following *Tinosa*, he was the Navigator on the *George Washington* (SSBN-598). After a shore tour in the Office of the Secretary of Defense, he was the commissioning Executive Officer on *Parche* (SSN-683). MacVean commanded *Seawolf* (SSN-575) during the height of the Cold War, and then commanded Submarine Development Group ONE in San Diego. Captain MacVean was awarded two Distinguished Service Medals and a Legion of Merit among other awards.

The loss of the *Thresher* in 1963 forcefully pointed out the Navy's need for submarine rescue systems of significant capability, as well as the ability to search for, locate and recover objects from the deep ocean. By 1967, the Submarine Development Group ONE, at Ballast Point, was established as the operational focal point for all deep submergence matters. The loss of *Scorpion* in the spring of 1968 further accelerated the organizational and equipment aspects of Development Group ONE. In the early 1970s Deep Submergence Rescue Vehicles (DSRVs) were completing development and the Rescue Unit Home Port (RUHP) was established at North Island Naval Air Station, close to the runways needed to support a flyaway capability. The RUHP was subsequently named Submarine Rescue Unit (SRU), the Deep Submergence Unit (DSU), and most recently the Undersea Rescue Center (URC). With an increasing need to push newer technologies into deeper water, the Development Group expanded rapidly. By 1980, there were seventeen ships and units associated with Development Group ONE. This included nuclear submarines, a diesel electric submarine,



Above: After leaving the Undersea Rescue Center, *Mystic* (DSRV-1) joins the San Diego commute on the Coronado Bridge.

Below: Sailors check out the installation of the DSRV on their submarine at Ballast Point.

submarine rescue ships, deep submergence support ships, deep submergence rescue vehicles, deep submergence vehicles, towed deep search systems, remotely controlled vehicles, advanced diving systems and an infrastructure of schools to support these assets.¹

The submarine rescue activities were centered at North Island Naval Air Station with the Submarine Rescue Unit's primary resources, the *Mystic* (DSRV-1) and *Avalon* (DSRV-2). These DSRV's were designed and built for rapid deployment in the event of a submarine accident. The vehicles were capable of being transported by truck, ship, certain attack submarines and by aircraft, in spite of their weight of thirty-seven tons. These manned submersibles were capable of diving to 5000 feet to rescue personnel from a disabled submarine, anywhere in the world.

San Diego has made the difference. Nowhere else can you find a locale combining a Navy organization with sea-going assets dedicated to deep ocean research and exploration, a Navy Electronics Laboratory pushing forward in electronics, torpedoes, and underwater vehicles, a Scripps Institution of Oceanography working in a broad spectrum of ocean physics challenges, a Marine Physical Laboratory carrying out directly applicable experiments, the intellectual capital housed in the universities represented by the University of California San Diego, University of San Diego and San Diego State University, and, finally, the gathering of nearby pioneering companies vested in marine technology.





Designed to be flown by the U.S. Air Force, the DSRV, weighing almost 40 tons, was a very tight fit, even for a C-5A.

Mystic was launched in 1970 and *Avalon* was launched in 1971. As their capabilities grew,

missions were accomplished either by "Flyaway" on board U.S. Air Force C-5A and C-141 aircraft, or by being carried "piggy back" on Mother Submarines that were appropriately configured nuclear attack submarines. Mission transport and logistic support could also be provided by the catamaran-hulled submarine rescue ships, *Pigeon* (ASR-21) and *Ortolan* (ASR-22), with *Pigeon* being homeported in San Diego. *Florikan* (ASR-9) carried classical submarine rescue capabilities. Although, thankfully, no actual submarine rescue operations were conducted during their thirty-year lifetimes, numerous frontiers were expanded because of their furtherance of techniques that would have remained untouched without them. Reliability, sonar and video search equipment, launch and retrieval techniques, battery technology, submerged navigation and life support, all moved forward under the extensive and active programs associated with the U.S. Navy's dedications to improving submarine rescue throughout the world. Importantly, the DSRVs raised the international awareness of the need for multinational cooperation in the realm of submarine rescue. This need led to the 2003 establishment of the International Submarine Escape and Rescue Liaison Office, in Norfolk, Virginia, which is staffed by submarine rescue experts from around the world. The DSRVs are now retired: *Avalon* was decommissioned in 2000 and *Mystic's* deactivation began in 2008. The replacement system, known as the Submarine Rescue Diving and Recompression System (SRDRS), is coming on line and when certification is completed, it will also be deployed from North Island. This new system has the added advantage of being able to rescue submarines from a downed submarine that has become pressurized. It incorporates a decompression chamber to prevent rescues from being incapacitated by the Bends following their rescue. This system is supported from a surface ship, such as a fleet tug, and it can rescue personnel down to 2000 feet.²

Other Development Group ONE assets have also played important parts in the exploration of innerspace. The well-known DSV *Trieste* descended to 36,000 feet in 1960, and found *Thresher* at 8,400 feet in 1963. Subsequent to joining the Development Group, she routinely operated to 20,000 feet, primarily operating off the *Point Loma* (AGDS-2). DSV *Seacliff* and DSV *Turtle* certified to 20,000 feet and 10,000 feet respectively, rounded out the triad of DSVs that provided much needed search, location, up-close inspection and recovery capability for a variety of scientific and military tasks. Augmenting these vehicles were towed systems, such as SILOS. These systems contained ahead-looking and side-scan sonars, as well as still and video cameras and, by not

being manned, they had the advantage of being able to operate around the clock without the need to get men back on deck. Following this were the first remotely controlled vehicles, such as SCORPIO. They were tethered to provide power and command and control signals, but they also brought mechanical manipulators into the equations, permitting real work and recovery at depth. More recently, the Atmosphere Dive Suit (ADS 2000) has been added to the mix. This aluminum alloy "suit" allows a diver to be lowered to 2000 feet, while the atmosphere in the suit remains at the equivalent of sea level. The system took eleven years to develop, but in 2006, a Navy Chief Petty Officer made a dive to 2000 feet just off La Jolla, California. This system is an important adjunct to the Navy's submarine rescue preparations.²

Rounding out the resources at Development Group ONE were several submarines. Certainly the mission of that Group was to advance the technologies applicable to our deploying submarines. The *Dolphin* (AGSS-555), now at the Maritime Museum of San Diego, is a prime example of a deep diving submarine, totally dedicated to experimentation with and development of submarine equipment and techniques for the U.S. and allied Navies. Ocean Engineering was also the underlying work of several nuclear submarines assigned to the Development Group: *Halibut* (SSN-587), *Seawolf* (SSN-575), *Parche* (SSN-683), *Pogy* (SSN-647) and *Richard B. Russell* (SSN-687), all contributed greatly to the exploration of ocean frontiers with operational significance.¹

The challenges of the 1970s remain today. The ultimate goal is to make things work at deeper and deeper depths, so that submarines and people can function in the deep ocean with more information and knowledge. High pressure seawater is not kind to electronics, cables, connectors, hydraulics, pressure vessels, sonars or cameras. Getting power to the depths, and quality information back to the surface, is the very essence of what it is all about; regardless of the platform, be it a submarine or instrumentation sled.



Above: DSRV operations off of surface ships are supported by specially qualified divers.

Below: *Hawkbill* (SSN-666), based in San Diego, goes to sea for initial trials with the DSRV *Mystic*.

NOTES

- 1 Author's Notes
- 2 Command Histories



Small San Diego Lab Makes a Big Difference:

Submarine Research Facility/Arctic Submarine Laboratory Contribution to the Navy's Operational Capability in the Arctic

By Tom LaPuzza

Tom LaPuzza, a 1968 graduate of the University of San Diego, worked in the Public Affairs Office, of what is today the Space and Naval Warfare Systems Center (SSC) Pacific, from 1969 until 2010. During eighteen years of that time, he was Public Affairs Officer for SSC and its predecessor organizations, serving additionally as the principal spokesman for the Navy Marine Mammal Program. After his retirement in 2006, he continued to work at the Center; he is an SSC emeritus. His current project is developing a predominantly photographic history of SSC Pacific for its 75th Anniversary in 2015.

The U.S. Navy has operated submarines in and under the Arctic Ocean in all seasons and under all weather conditions for more than five decades. It is reasonable to say a large measure of that capability resulted from the efforts of one organization – the Submarine Research Facility/Arctic Submarine Laboratory,¹ and one man – Dr. Waldo K. Lyon.² Lyon was the first physicist at the U.S. Navy Radio and Sound Laboratory (NRSL) on Point Loma, arriving less than a year after its establishment in 1940. His early assignment was to develop underwater acoustics technology in support of surface ship and submarine operations. One of the significant early achievements at the Point Loma lab was development of QLA sonar, a continuous tone, frequency modulated scanning sonar that enabled U.S. submarines to penetrate the heavily mined Japanese Inland Sea in 1945. QLA was the Navy's first sonar set to show multiple targets in radar-like fashion on a display screen, and it would play a major role in supporting under-ice operations.³

Lyon's other priority during World War II was setting up a properly equipped lab to test submarine sonar projectors and similar devices. Recalling early lab history, he wrote:

Planning for the Submarine Research Facility...was initiated in September 1943, when the need was recognized for a physical laboratory within an establishment [NRSL] predominantly concerned with electronics engineering. Spectroscopy was needed for the study of materials, radiography for the study of internal mechanical structures, pressure tanks and hydraulic circuits for observing materials and devices under deep submergence.⁴

In the mid-1940s, Lyon advocated the use of Battery Whistler, one of a number of coastal defense batteries lining the Point Loma peninsula, for such a lab. A decommissioned Army mortar emplacement overlooking San Diego harbor from atop the peninsula, its existing physical condition (thick concrete walls, mortar pits) was perfect for the research facility he envisioned. As a result of significant contributions during World War II, NRSL (re-named the U.S. Navy Electronics Laboratory, NEL), grew in size after the war, and Lyon's planning on paper gave way to pouring more concrete and re-configuration of the mortar battery to support underwater testing.

A bridge crane with 15,000-pound capacity was installed in 1948, as was a super-pressure chamber manufactured from a twelve-inch gun barrel from the retired battleship *Alabama* (BB-60), modified to produce pressure conditions equivalent to the ocean bottom. (Ultimately, the lab would boast five pressure vessels: two horizontal ones fashioned

Early in the lab establishment process, an event occurred that would profoundly influence its ultimate use.



All Photos Courtesy of SSC Pacific, Official U.S. Navy Photos

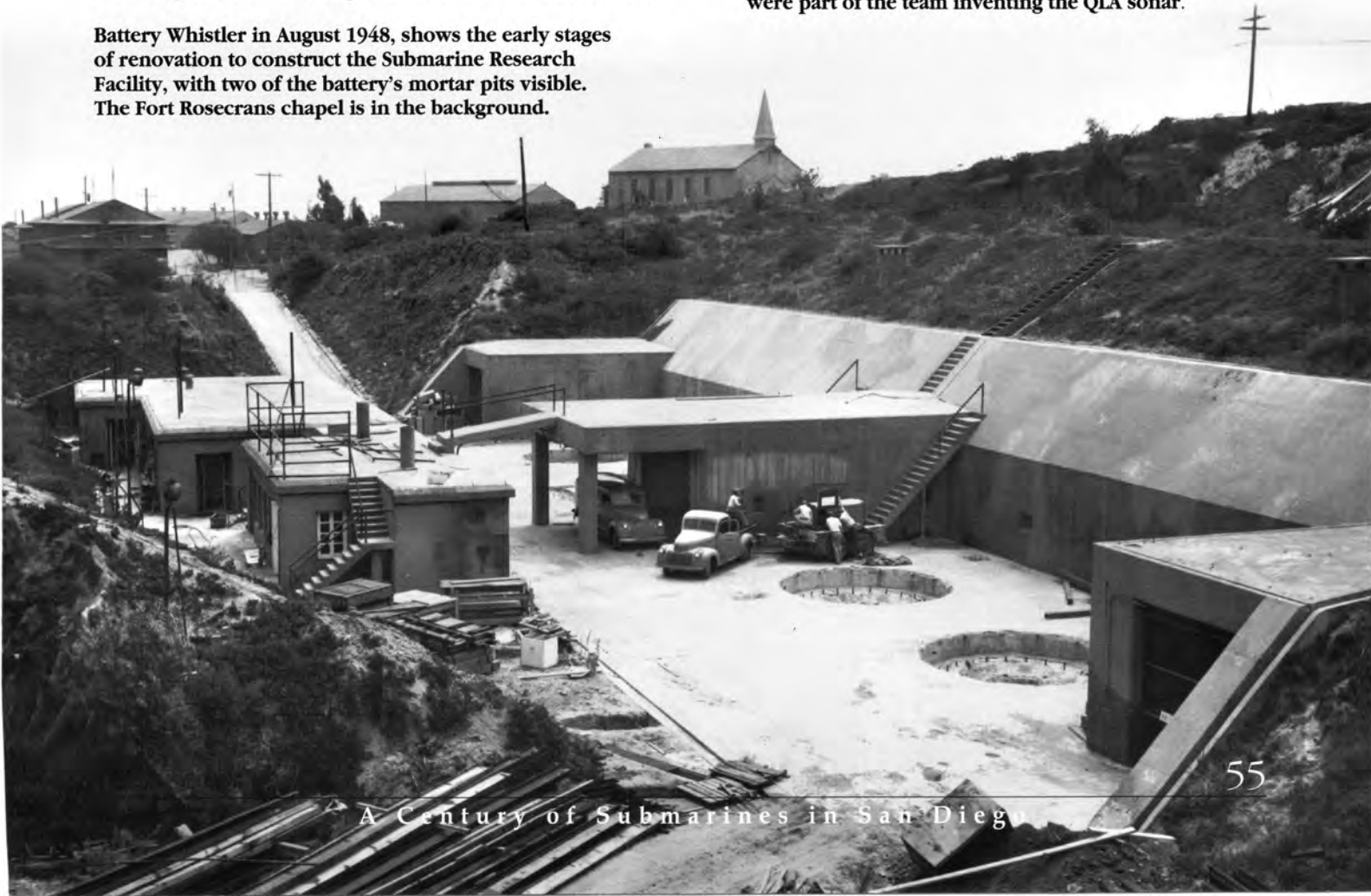
from twelve-inch and sixteen-inch gun barrels, and three vertical, the largest with sixty-inch inside diameter and ten-foot depth, with a working pressure of 10,000 psi.) The following year saw delivery and installation of a twenty-two-million-electron-volt betatron, a massive high-penetration x-ray device to inspect sonar projectors and other equipment. Work concentrated on refrigeration and high-pressure machinery in underground spaces in 1949-1950.

Early in the lab establishment process, an event occurred that would profoundly influence its ultimate use. In the fall of 1946, NEL was invited to participate in Admiral Richard Byrd's expedition to Antarctica. Lyon suggested requesting a submarine to study the physics of sea ice. With the request approved, he went aboard the assigned diesel-electric submarine *Sennett* (SS-408) on 31 December. The sub entered the ice field following three surface ships and a Coast Guard icebreaker.

Battery Whistler in August 1948, shows the early stages of renovation to construct the Submarine Research Facility, with two of the battery's mortar pits visible. The Fort Rosecrans chapel is in the background.



A 27 March 1946 photo shows Art Roshon (right) and Kenneth Wyckoff in their development lab where they were part of the team inventing the QLA sonar.



A Man For All Seasons: Waldo Lyon

By Tom LaPuzza

He was short, slender, and soft-spoken, a brilliant individual with a Ph.D. in physics from UCLA, whose quiet voice, calm demeanor and often purposely expressionless face hid an intensity and drive that would enable a reluctant U.S. Navy to operate its submarines in the most extreme environment on earth.

Waldo Lyon spent many months of his life in that environment, and the rest of his time transforming a World War I mortar battery into a laboratory to simulate that environment, study its effects on naval operations, and support those operations when they occurred.

A Presidential citation summarized the significance of his efforts: *He has been singularly responsible for the pioneering development of the knowledge, techniques and instruments that made it possible for a submarine to navigate under the ice in the Arctic. In the face of formidable obstacles he persevered in believing that trans-Arctic submarine navigation could become a reality and directed his efforts toward this objective.*

His first experience with the environment was in 1946, when he suggested some basic research during the Admiral Byrd expedition to Antarctica. He spent several weeks aboard the diesel submarine *Sennet* (SS-408), realizing first-hand the substantial lack of knowledge relating to at-sea operations in the high south (and north) latitudes.

He devoted the next half-century of his life to addressing, and trying to remedy, that lack, acknowledging in an award acceptance speech decades later that he had not succeeded to his satisfaction. Nevertheless, his tireless efforts and continual pushing for funding to combine laboratory research with actual experience in the ice fields provided the U.S. Navy definite superiority in Arctic submarine operation.

He enjoyed limited success with a handful of diesel submarine cruises in the late-1940s and early-1950s, then spent half a dozen years waiting for his next ride to the Arctic. The advent of nuclear-powered submarines was the key to his dreams, serving as senior scientist on the 1957 *Nautilus* (SSN-571) thousand-mile "venture" under the ice, the 1958 *Nautilus* trans-Arctic cruise via the North Pole ("Operation Sunshine"), the 1959 *Skate* (SSN-578) surfacing at the pole, and the month-long dead-of-winter cruise of *Sargo* (SSN-583) in 1960. The latter fulfilled his determined belief and goal that a submarine could operate in the Arctic in all seasons.

In spite of these successes, Navy hierarchy generally rated Arctic submarine warfare a low priority. Lyon continued hammering away at the necessity of building submarines specifically designed for the frozen environment. Despite repeated disappointments, he was not above humor, the wry kind, as befitted the individual. When an experienced exposé writer from a major newspaper asked him to describe U.S.-Soviet under-ice warfare, he remained silent a

Dr. Waldo K. Lyon (right), chief architect of the U.S. Navy's ability to operate its submarines in the Arctic, with Rear Admiral Hyman G. Rickover, the "father of the nuclear Navy," on the deck of the first U.S. nuclear submarine, *Nautilus*.



It maneuvered around larger chunks of ice broken up by the icebreaker and smashed into the smaller ones. Eventually the ice became too heavy, and the icebreaker towed *Sennett* out of the field.

Lyon spent three weeks conducting radar and sonar experiments on the edge of the ice pack. He was able to identify various-sized pieces of ice on both the QLA scanning sonar, and another NEL development, an echo-ranging sonar. Thus began a major re-focusing of Waldo Lyon and his research laboratory in response to what he considered a critical need of the U.S. Navy – the capability to operate its submarines in the Arctic Ocean.

Lyon found a willing supporter in Commander Submarine Force Pacific Rear Admiral Allan McCann, who agreed to provide five subs for an Arctic research cruise, and went along himself. NEL installed a QLA sonar on *Boarfish* (SS-327), plus a topside recording fathometer for upward ranging while under the ice. The submarine made its first dive under the ice of the Chukchi Sea on 1 August 1947, with Arthur Roshon, a Lyon associate and one of the QLA inventors, watching the screen in the conning tower and interpreting data for the sub's captain. Lyon was in the forward torpedo room, monitoring the indicator for the upward-looking echo sounder. *Boarfish* dove under the ice twice more, once twelve miles in.

The force included the submarine tender *Nereus* (AS-17), which conducted oceanographic surveys at every opportunity across the Bering Sea and near the ice in the Chukchi Sea. Additional data-gathering was done along the Alaskan coast.



Lab Objectives Set

Following the cruise, Admiral McCann requested information on planned Arctic work, to which Lyon responded in March 1948 with a set of objectives for his laboratory and complementary field work: 1) development of a narrow-beam QLA sonar for use in identifying ice lakes; 2) study of sound propagation in water of upward refraction and extremely positive thermal layers; 3) oceanographic studies of Arctic areas for sonar and submarine charts, including bottom topography, thermal-salinity structure, horizontal currents, and the properties of sea ice.⁵

Admiral McCann assigned the diesel sub *Carp* (SS-338) for experimental work under Lyon's direction. The sub, with Lyon aboard, spent more than a week, in September 1948, operating in and under pack ice, studying the question of buoyancy control since stationary dives and ascents were prerequisite for successful operations in ice areas.

Waldo Lyon then requested a fleet-class sub be modified for under-ice experimentation, citing the value of the limited cruises of *Sennett*, *Boarfish* and *Carp*. He had initiated the effort

Diesel submarine, *Carp* (SS-338), was provided for experimental work in 1948. Waldo Lyon used it to study buoyancy control, a prerequisite to the stationary dives and surfacing required in iced-over waters. While the single fathometer, forward of the conning tower, easily identified overhead ice, the large chunks of ice on deck after surfacing demonstrated the need for a second upward-looking fathometer aft.

continued Waldo Lyon

long moment, seemingly considering how much sensitive information to reveal. He then plunged into a lengthy, technically complex discussion of precise maneuvering between ice keels, with the seafloor not far below and the ice canopy looming overhead, tension in the operations center, arming weapons.... Then, he said, realizing the improbability of weapons effectiveness, the two subs surfaced and the crews fought with broomsticks on the ice. And he let fly a sly grin.

He described in his extensive scientific journals the first failed attempt to establish an essential data-gathering field station at Cape Prince of Wales, Alaska, at the narrowest point of the Bering Strait, relating matter-of-factly his thirteen hours in an open landing craft, almost half of those standing in two feet of water when the pump failed; motoring thirty miles to the north in search of shelter that proved unattainable; six hours back in a twenty-five-knot gale; grounding far offshore where the craft was destroyed by wind and waves, and rescue by a shore party. With little regard for the physical rigors experienced, the following day he was working the planned project of laying a four-mile-long telephone cable in the strait.¹

With more than twenty long cruises to and under the polar ice, Dr. Lyon had little time for family, repeatedly missing wedding anniversaries and birthdays, and normal pursuits. Nevertheless, he found time for his non-work passion – badminton, winning four national seniors' doubles championships and serving as president of the American Badminton Association.

As years passed, the number of Arctic-capable submarines and submariners increased. After a 1981 cruise on the nuclear sub *Silversides* (SSN-751), Lyon turned over active participation to younger members of his Arctic Submarine Laboratory, limiting himself to supporting the effort with testing and research. He foresaw the necessity and value of relinquishing leadership of that lab to senior military officers, which occurred in 1984. His personal work unfinished, he remained as Chief Engineer and Senior Scientist, as well as the Navy's senior consultant on the Arctic.

Recognition was not lacking for his efforts: Besides sharing with submarine crews ten Navy Unit Commendations and two Presidential Unit Citations, he received one Department of Defense and two Navy Distinguished Civilian Service Awards, their highest, and the President's Medal for Distinguished Federal Service. For the latter, he was in the Arctic testing undersea weapons; his wife accepted the award for him from John F. Kennedy, who expressed astonished pleasure at under-ice navigation capability.

And that was exactly what Waldo Lyon had done for the Navy – he provided the means to navigate safely under the frozen canopy and surface through three or four feet of ice, in every season. The awards were gratifying, but his real interest was in ensuring the Navy he served was fully prepared to operate effectively in the Arctic. For half a century he did so by conducting research in his lab, inventing new technology, and most of all by serving alongside submarine crews hour-by-hour, day-after-day. He imparted knowledge to and instilled confidence in those brave men who dove HY-80 hardened-steel eggshells under the implacable and impermeable ice, celebrating with them when things went well, calmly working with them on solutions when they didn't.

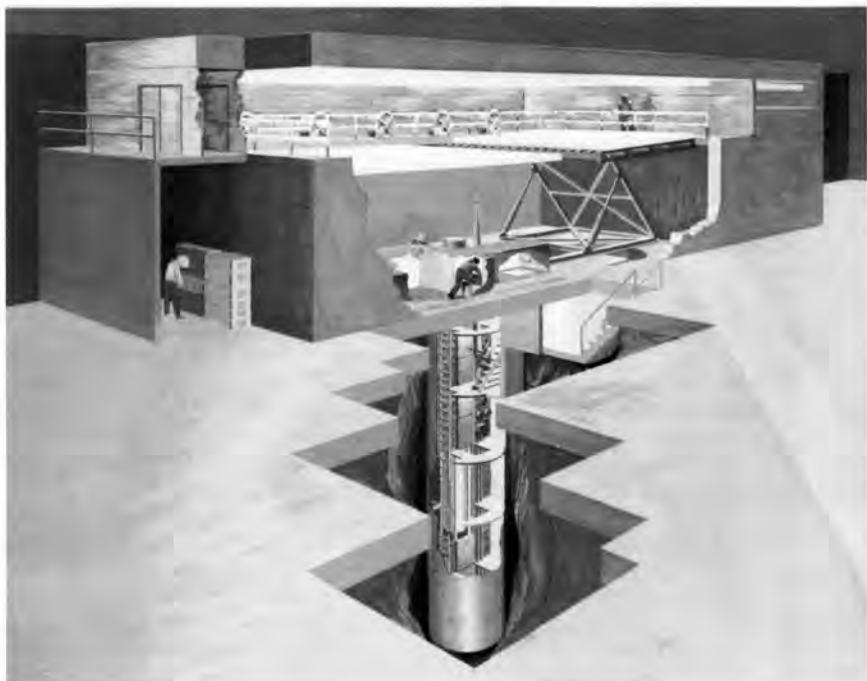
The Executive Officer of one of those submarines, Dr. Lyon's roommate during a cruise, summarized the feelings of his community: *I believe everyone felt Waldo was truly one of us. He spoke our language. He understood our concerns.... He was always calm, cheerful, assured, and outgoing. It is hard to explain how unusual this relationship was for a civilian on board. I think it is not an exaggeration to say that none of us saw Waldo as a civilian. He was Waldo Lyon, and that meant a lot.*²

A year after Waldo Lyon died, on 3 May 1999, the crew of the nuclear submarine *Hawkbill* (SSN-666), as its final act of an Arctic deployment, placed his ashes on the ice at the North Pole.

NOTES

- 1 See Leary, William M., *Under Ice* (College Station, Texas: Texas A&M Press, 1999), 30-33, for a detailed account of this summary.
- 2 Yates, William K., Executive Officer, *Sargo*, in 24 March 1997 letter to William Leary.





Artist's concept showing the experimental pool iced over, with the nine-foot-diameter, forty-eight-foot-deep observation chamber underneath.

Below: In a 1967 test, a highly instrumented model of an icebreaker approaches an area of heavy ice in the Submarine Research Facility's sea-ice cryostat. Facility scientists could control precisely the variation in sea ice properties such as brine content and the "crushable" skeletal layer at the water-ice boundary for realistic testing.



that would occupy his attention for the rest of his life – gaining physical and oceanographic knowledge of an unexplored ocean. He believed his lab personnel were equal to the task, as long as the Navy provided a fleet submarine with his specified modifications to ensure its effective and safe use in the Arctic.

Lyon was so confident that he stated, *The reality of a polar submarine that can navigate the entire Arctic Ocean is not only admissible, but may be an immediate practicality.*⁶

Higher Navy authority disagreed, *Development of the trans-Arctic*

*submarine remains in the realm of fantasy.*⁷

When that authority also turned down his short list of simple modifications with detailed drawings, to transform a current boat into an Arctic-capable one, and denied requests for a sub to conduct Arctic field studies, Lyon turned his attention to his research facility to solve critical icing problems of submarine periscope windows and snorkel

head valves. Those problems had been reported by submariners during cold weather operations in the North Pacific and, within a month, by Atlantic Fleet submarines. A recommended solution had failed.

The project officer assigned to work the problem visited Lyon's San Diego lab, where construction had begun in 1952, with no designated funds, and with labor provided by the staff only when they had extra time. Lyon had proposed a project to construct an Arctic pool at Battery Whistler, not only to study sea ice, but also to provide a test bed for equipment on his envisioned under-ice submarine. His proposal was turned down, so he had to put his plans on hold. The project officer reviewed the plans during his visit to the lab, and he went away convinced it was the ideal place to determine a solution to snorkel icing. Funds were approved quickly to complete construction and outfitting of the Arctic pool.

In a report at the time, Lyon described the research facility as *essentially a refrigerated laboratory pool thirty feet wide, seventy-five feet long, by sixteen feet deep. A watertight space that can be accessed from outside the pool wall is built into the floor of the pool for observation.*⁸ With the space immediately above heavily insulated, ammonia and methylene chloride were used to refrigerate the chamber to air temperatures as low as minus seventy degrees F., thus producing the ice sheet on the water surface. Critical Arctic Ocean conditions for seawater temperature, salinity, dissolved air content, suspended particulate matter, and circulation patterns could be replicated.

The pool, which held about a million gallons of seawater, was large enough to ensure simulation of the process of sea-ice formation under natural conditions without errors resulting from the effects of the pool wall. This ensured agreement of measurements of ice grown in the lab with field observations – for example, measurements on compressive strength critical to icebreaker design.

The under-floor observation chamber, nine feet in diameter and forty-eight feet deep, supported device testing and taking measurements of ice properties, such as acoustic reflection coefficients from underneath. An eight-ton research vehicle was used for impact tests against the ice sheet from underneath to gather data required for materials and procedures for surfacing through the ice.

Four decades later, Lyon described the challenge he faced and the capability of the Arctic lab to meet it in a *Proceedings* article:

*Unlike fresh-water ice, the underside of sea ice is a crushable composite of crystals and brine cells – a low-strength variable layer. To be meaningful to submarine engineering, measurements and physical studies must be made from underneath the ice.*⁹ He described the sea-ice canopy as: *highly variable. Viewed from below, it is upside-down, rolling hills of ice: 'badlands' of ice buttes and blocks, scattered or piled one on another; canyons between massive ridges; flat ice planes, and open cracks and lakes, in other words, an ice-jungle.*¹⁰

Although Lyon and his associates had gained substantial knowledge of the “jungle” through various ship and submarine cruises in the 1940s and 1950s, they required the laboratory environment to determine, and counter, the limitations of their knowledge. The research facility provided the means for precise measurements and analyses, but *initial experiments showed that growing the various forms of sea ice true to nature is a very complex*

task, he wrote in *Proceedings*. What the facility staff learned from those experiences led to major changes in pool design and construction to achieve controlled growth of true sea ice, allowing study of its physical properties. Of particular interest was the elasticity of the ice, since that would substantially affect a submarine's capability to surface through it.

In addition to the experimental pool, a sea ice cryostat was built in the research facility, providing a towing basin in which the use of ship models could provide essential lessons in how to design icebreakers. It allowed precisely controlled variation of sea ice

properties – brine content, rate of cooling and warming, and the “crushable” skeletal layer at the ice-sea water boundary.

With the discovery of oil in Prudhoe Bay, Alaska, the U.S. Coast Guard tasked the research facility with studying the sea-keeping capabilities of the massive SS *Manhattan* oil tanker. At 940 feet, it was

the biggest U.S. commercial vessel and the largest icebreaker ever built.¹¹

Despite his belief about the potential for an Arctic submarine, Waldo Lyon had reservations about icebreakers and a healthy regard for Mother Nature, based on personal experience during a cruise on the U.S. Coast Guard's *Northwind*, when the ship became trapped in the ice:

*In her impatience to break free, explosives were tried unsuccessfully on a large floe lying across the bow—an impressive demonstration of the disparity in magnitude between man-made and natural forces in an ice floe.*¹²

Operation Sunshine

Between 1951 and 1956, working actively on development of the Submarine Research Facility, Lyon continued on-site study in the Arctic, participating in seven icebreaker operations and establishing a staffed, year-round data-gathering field station at Cape Prince of Wales, Alaska. The low-key approach, however, was about to end.

In mid-1957, the Chief of Naval Operations (CNO) approved limited operation of the first nuclear submarine, *Nautilus* (SSN-571), in the ice fields. Early the next year, Lyon and the sub's skipper, Commander William Anderson, were called to the White House to discuss the feasibility of a plan termed Operation Sunshine.

Only about a dozen people – President Eisenhower, the CNO, a few others – knew about it... The biggest problem was that we needed a QLA sonar, which the diesel boats all had but not Nautilus. We couldn't ask for one without giving away the mission, Lyon said.¹³

Only about a dozen people – President Eisenhower, the CNO, a few others – knew about it...

The "mission" was to send *Nautilus* over the North American continent, from the Pacific to the Atlantic, through the North Pole, under the ice. Heavy ice conditions prevented the first attempt in June, but two months later the sub, with Waldo Lyon aboard to support under-ice navigation, steamed across the Arctic Ocean and through the North Pole on 3 August 1958. Presidential awards and a ticker-tape parade down Broadway highlighted the significance of the achievement. Lyon returned to San Diego with massive amounts of technical data to sift through.

The following year he was aboard *Skate* (SSN-578) when it surfaced at the pole. For that effort Lyon and Art Roshon had developed a new under-ice sonar that would be critical in what Lyon always called *the cruise of all time – shallow water, heavy ice, learning to surface through the ice; everything was easier after that.*¹⁴ "That" was the February-March 1960 voyage of *Sargo* (SSN-583), a dead-of-winter cruise in the worst possible weather and ice conditions, resulting in a demonstration of Lyon's dream and essential goal – the ability to operate a submarine in the Arctic in any season, in any weather.

Years later, the sub's Commanding Officer would comment on Lyon's substantial intensity in developing Arctic operational capability, and the dedicated pursuit by civilian Navy scientists:

*On the Sargo...he became very interested in seeing what we could do about surfacing in the winter, in shallow water, rather than just going in to the deep water... Especially as we were starting out with this, trying to pinpoint what the sonar was showing us, we were leaning very heavily on Waldo or Art Roshon to make sure that we felt comfortable, and later on, when we had troubles...we leaned very, very heavily on Art Roshon."*¹⁵

During the cruise, the submarine's officers worked "hand-in-glove with the scientists," usually the CO with Lyon, and the Executive Officer or Engineering Officer with Roshon. Following the cruise, Roshon received the Navy Distinguished Civilian Service Award, its highest, for

his "ingenious modification" of the iceberg detector after it failed, and the American Society of Naval Engineers gave Lyon its prestigious Gold Medal Award.

In describing the effort, Admiral Nicholson cited it as: *one of the great benefits... our submarines having the ability...to go from the Atlantic to the Pacific and save all that time and [distance]... It's not only cheaper and safer, but it's completely undetectable.*

While under-ice navigation and related challenges were being handled successfully, concern continued

about weapons performance. By 1962, U.S. submarines could go essentially anywhere they needed to go in the Arctic, but the ability to fight when they got there was questionable. As an example, in Submarine Ice Exercise 2-62, *Skate* and *Seadragon* (SSN-584) spent several weeks above the Arctic Circle, firing a number of the most capable sub-launched torpedoes the Navy had – Mark 37 Mod 0, with no success.

Commander Joseph Skoog of *Skate* wrote in his patrol report:

*Well, it's not impossible to hit a deep target under ice – only damned unlikely.... We have no torpedo capable of hitting a submarine which is shallow under ice..."*¹⁶ It would be several decades before that problem was addressed successfully.



The highpoint of the "cruise of all time," as Waldo Lyon termed it, was the surfacing of *Sargo* (SSN-583) at the North Pole on 9 February 1959, near the beginning of a month spent in the Arctic under the worst possible conditions.

Facility becomes Arctic Submarine Lab

Major re-organization of the Navy's research, development and engineering structure in the late-1960s resulted in establishment of a new organization on the San Diego Bay waterfront, to which Waldo Lyon and his lab were transferred. In 1969, the lab's title was formally changed to Arctic Submarine Laboratory (ASL).

After years without meaningful polar cruises, *Queenfish* (SSN-651) became the first of the new *Sturgeon*-class submarines to operate under the ice in 1967, and two years later, again with ASL's Waldo Lyon and Dick Boyle aboard, *Whale* (SSN-638)

became the first *Sturgeon*-class boat to surface at the North Pole, sixty years to the day after Admiral Peary arrived there over the ice.

Commenting on those and subsequent cruises, Lyon reported:

When the Sturgeon (SSN-637)-class came out – with their hardened sails, rotating sail planes, ice-avoidance sonar, upward-looking sonar to characterize the ocean overhead, and inertial navigation system – we ran them to death.¹⁷

Tactical Trumps Scientific

While ASL support of the Submarine Force in the Arctic had combined the scientific (physics of sea ice) with the tactical (submarine operations in and under the ice), things changed following the late sixties cruises.

Up to the mid-1970s, we were still doing some science, but after that the major thrust was surveillance – tracking Soviet subs, said Dr. Lyon in a 1996 interview, upon the occasion of his retirement.¹⁸ He lamented the emphasis on tactical operations, which precluded spending much time on the essential element of research into the Arctic environment.

Changing times dictated other changes, according to sonar expert Rod McLennan, who joined the ASL staff in the early eighties:

“...the old BQS-8/BQS-14 line of sonars, which were continuous transmission frequency modulation, were useful in navigating under the ice, but they were very prone to intercept. And we made a transition from the 1958 period, of running science under the ice, to getting into more and more tactical warfare issues under the ice in 1980, and we could not allow that sonar to be aboard our boats when it was a beacon for torpedoes. So we had a rather rudimentary system ready to go on-line, and ...we made that absolutely critical link that Waldo Lyon always wanted to have, to have the engineering and the physics capability aboard the ship to answer the questions that maybe the military side only dreamed about.”¹⁹

The “rather rudimentary” system, developed by McLennan and fellow lab engineers Bob Anderson and Bob Vachon, was refined and ultimately patented as the “Color Sonar for Underwater Object Collision Avoidance” in 1991. Long before that, all Arctic-bound submarines carried it beginning in 1983, and the Navy gave final acceptance and incorporated it into the combat suite of all *Sturgeon*-class submarines in 1988.

It provided substantially greater distance warnings of potential collisions with ice keels and replaced an operator display, requiring constant observation and attention, with one continuously refreshed and visible. The sonar also introduced color displays aboard submarines – a novel and not always welcome concept, until the substantial value of it was understood. The sonar won the first Office of Naval Research Vice Admiral Bowen Award for Patented Inventions in 1997.²⁰

Veteran of three Arctic submarine cruises, McLennan cited what he called the “crucial job” of the Arctic Lab – continuity. Submarine officers and enlisted personnel served generally for one under-ice cruise, then went

on to something else, he said. The civilian ASL pilots provided the continuity and experience to support highly qualified military personnel whose qualifications seldom included Arctic cruises.

So we supplied pilots on every one of those... under-ice cruises.

By 1962, U.S. submarines could go essentially anywhere they needed to go in the Arctic, but the ability to fight when they got there was questionable.

Soviet Subs Detected

In major stories in January 1984, the *New York Times* and *Newsweek* reported on the reality of what Waldo Lyon had been warning about for almost four decades – Soviet submarines positioned under the Arctic ice. And not just any subs, but *Typhoon*-class ballistic missile boats, at 575 feet long and 48,000-ton displacement the largest ever made, carrying twenty missiles. Reacting to that, the U.S. Navy increased its own presence in the area.

Reflecting similar emphasis, for the first time in its thirty-seven-year history, ASL would have a senior Navy officer as Director. After serving as Commander, Ocean Systems Atlantic, Captain Jack Sabol was assigned to the Point Loma Navy center, now the Naval Ocean Systems Center (NOSC). After nine months of orientation, he assumed the NOSC Arctic Submarine Lab Director's role in January 1984. Waldo Lyon became Chief Engineer and Senior Scientist, continuing as the Navy's senior consultant on Arctic submarine engineering, oceanography and Arctic naval warfare.²¹

Facility changes also occurred, as the Chief of Naval Material approved renovation of the sea ice cryostat and experimental pool to make them operational for testing. In ensuing years, the facility was used to study and correct icing problems on the later improved *Los Angeles* (SSN-688)-class boats, for development of sonar technology for remote acoustic measurement of ice thickness, and for ice break-through tests of models of *Seawolf* (SSN-21)-class submarine sails.



M. Dorman
Director ARCSUBLAB
Officer Tactical Command

M. Dorman
USS Archerfish
SSN 678

R. Dorman
USS Ray
SSN 653

Alfred H.
USS Hawkbill
SSN 666

Ice Exercise 1-86 was the largest exercise ever conducted at the North Pole, with ASL military director Captain Merrill Dorman coordinating the rendezvous of three nuclear subs, plus ice camp testing to demonstrate the under-ice capability of an ASW torpedo.

The results of the new emphasis on Arctic operations became apparent when Captain Merrill Dorman, Sabol's relief as ASL Director, staged a major event – Ice Exercise (ICEX) 1-86, serving as Officer in Tactical Command for a historic three-submarine rendezvous at the North Pole on 6 May 1986. Coincident with that, a team of NOSC engineers spent five weeks at the ice camp demonstrating the viability of an anti-submarine warfare (ASW) torpedo under the ice.²² VIPs attending ICEX 1-86 included Secretary of the Navy John Lehman, who rode one of the submarines serving as a target for the ASW weapon testing.

Soviet Union and Funding Disappear

And then the Soviet Union “disappeared.” The nemesis that spawned nearly half a century of U.S. platform and weapon developments conceded, many believed, those developments could not be equaled and certainly not countered, and quietly threw in the towel. It was cause for substantial relief and well-earned self-congratulation in the halls of the Pentagon and at military bases and laboratories across the nation. It was also cause for substantial monetary cutbacks.

The funding for the Arctic Sub Lab started shutting down almost immediately, said Rod McLennan, who had become ASL's civilian Technical Director by then.

Another critical event occurred at the time, as the Navy conducted sweeping re-organization of its research and development

infrastructure, tied substantially to BRAC '91.²³ Among the ordered actions was transfer of the Arctic Submarine Lab, from the San Diego Navy R&D Center to which it had been attached for almost half a century, to the Naval Undersea Warfare Center (NUWC) Keyport (Washington) Division.

The formal transfer was the first action resulting from BRAC '91, occurring 27 January 1992.²⁴

A team of NOSC engineers spent five weeks at the ice camp demonstrating the viability of an anti-submarine warfare (ASW) torpedo under the ice.

The transfer was unfortunate for the lab, since key warfare center officials considered ASL of little importance. They were *able to shut down the funding to the lab and then [the physical lab in Battery Whistler] eventually was completely cleared out... and the Arctic Submarine Lab was reduced to just the piloting aspect...*²⁵

ASL continued to operate on the physical footprint of the Point Loma Navy R&D center, which provided personnel, security and other services, but NUWC ordered closure of the cryogenic facilities in 1993. The lab's field station at Cape Prince of Wales, after continuously collecting Arctic data for forty-five years, was closed in 1996. The following year Battery Whistler was vacated, the same year ASL became a detachment of Submarine Development Squadron FIVE.

A final interesting occurrence punctuated the return of the battery area to "pristine condition." The contractor crew clearing the site discovered a long metal cylinder amidst the detritus of more than five decades of operation and five years empty and abandoned. A lengthy effort revealed what ASL personnel had known for many years – the cylinder was the navigation periscope of U-505, a World War II German submarine that on 4 June 1944 suffered the ignominy of being the first enemy warship captured by the U.S. since the War of 1812. The periscope was "appropriated" by Waldo Lyon somehow, and after installation in the floor of the experimental pool, it was used for underwater observation of pool tests. The U-505 itself had been on display for years at the Chicago Museum of Science and Industry. The periscope was eventually shipped to Chicago to become part of the submarine exhibit.²⁶

Captain Jeff Fischbeck, former Commanding Officer of the *La Jolla* (SSN-701), and a participant in one of the few Arctic missions without ASL ice pilots, became lab director in 1998. *It was a time, he said, when higher-authority ordered reorganizations and consolidations worried ASL employees, and drew attention away from the lab.* Battery Whistler had just been gutted, and the future was not bright. At the end of Fischbeck's four years there (the longest



A salvage crew discovered a German U-boat periscope that served as an underwater/under-ice viewing device at the Arctic Submarine Laboratory.

tenure of any military director), things had turned around, much of that was based on the Science Ice Exercise in 1999. *Hawkbill* (SSN-666) was the submarine involved; it hosted an impressive set of VIP visitors including the Deputy Secretary of Defense, the Secretary of the Navy and Chief of Naval Operations, the head of the National Science Foundation, and a U.S. Senator. The Commander Submarine Force Pacific, Admiral Al Konetzni, came along and, cruising under the ice, discussed the fact the submarine they were riding represented the last class of Arctic-capable boats the Navy had, and that class was going away soon.

He said that opportunity of being under the ice with these people actually enabled us to save a few submarines...because of the money that they were willing to spend after seeing what the capabilities were, the now-retired Captain Fischbeck related.²⁷

As the submarine readied to get underway to return to San Diego, its last official act was to place the ashes of Waldo Lyon, who had died the previous year, on the ice at the North Pole.

In his interview, Captain Fischbeck emphasized the substantially significant role Dr. Lyon and Arctic Submarine Laboratory personnel had played in developing U.S. Navy capability to operate in the Arctic and pass on that capability to "very, very talented and capable people" in the Submarine Force.

In 2008, the Arctic Submarine Lab became a detachment of Commander Submarine Force Pacific. Jeff Gossett, a veteran of a number of ice-piloting cruises and ice camps, is the ASL Technical Director in 2014. He advised current policy is: *to collect science data during the transit portions of some [initially] or all [nowadays] submarines operating in the Arctic Ocean. The ice camp program picked back up in 2003 with subsequent camps in 2007, 2009, 2011, and scheduled for 2014.*²⁸

Today the ice pool and sea ice cryostat are gone, as are the betatron and the high-pressure test chambers fashioned creatively out of naval guns. Only the thick concrete base and some of the original walls of the former

mortar emplacement give testimony that scientists and engineers were once here, using their knowledge to support the submarine operating forces. The offices have moved up the hill several hundred yards, where that effort to support and keep safe those brave sailors who dive under impenetrable ice in fragile steel hulls continues.



Dr. Waldo Lyon leans against the control panel in the Arctic Submarine Laboratory shortly before his 1996 retirement, following fifty-five years of service to the Navy, particularly the Submarine Navy.

Many individuals – most notably the officers and enlisted personnel whose uniforms proudly display the dolphins signifying submarine-qualified – have contributed in some small or substantial fashion to the U.S. Navy's ability to operate in and under the Arctic ice. But without the determined leadership and technical capabilities of Waldo Lyon and his small cadre of Navy civilian employees at the Arctic Submarine Laboratory, the Arctic might still be viewed as a cold, dark, and uninhabitable portion of the earth, where all but the foolish fear to venture.

NOTES

- 1 The Submarine Research Facility, renamed the Arctic Submarine Laboratory in 1969, was a component of the Navy research, development and engineering center established on Point Loma in 1940. That center was variously named U.S. Navy Radio and Sound Laboratory/University of California Division of War Research, U.S. Navy Electronics Laboratory, Naval Electronics Laboratory Center, Naval Undersea Center, Naval Ocean Systems Center, and Naval Command, Control and Ocean Surveillance Center Research, Development, Test and Evaluation Division. All those names (NRSL/UCDWR, NEL, NELC, NUC, NOSC, NRaD) essentially represent the same organization, in the same physical locations, through the half-century the Arctic Submarine Laboratory was associated with it. To avoid confusion, the Navy organizational names have been omitted from this article except where absolutely necessary.
- 2 Tom LaPuzza, "Waldo Lyon: A Man for All Seasons," *Mains'l Haul*, this issue.
- 3 Naval Ocean Systems Center. *Fifty Years of Research and Development on Point Loma, 1940-1990*. NOSC Technical Document 1940, September 1990, 12-13.
- 4 W.K. Lyon, NEL Submarine Research Facility. U.S. Navy Electronics Laboratory Report 336, 16 October 1952, 2.
- 5 W.K. Lyon, The Polar Submarine and Navigation of the Arctic Ocean. U.S. Navy Electronics Laboratory Research Report 88, 18 November 1948; re-issued 21 May 1959, 24.
- 6 *Ibid.*, 66.
- 7 Arctic and Cold Weather Coordinating Committee, Office of the Chief of Naval Operations. *The Navy Arctic Operations Handbook*, 1949.

- 8 Op. cit. NEL Submarine Research Facility, 17.
- 9 W.K. Lyon, "Submarine Combat in the Ice." U.S. Naval Institute *Proceedings*, 118 (2) (1992), 37.
- 10 Ibid., 38.
- 11 http://en.wikipedia.org/wiki/SS_Manhattan_ (1962), accessed 9 January 2014.
- 12 W.K. Lyon, "Experiments in the use of explosives in sea ice." *Polar Record*, Vol. 10, No. 66, September 1960, 237.
- 13 Tom LaPuzza, "Arctic Lab pioneer Dr. Waldo Lyon retires after 55 years." Naval Command, Control and Ocean Surveillance Center Research, Development, Test and Evaluation Division Outlook, 1 November 1996, 3.
- 14 Ibid., 3.
- 15 John Nicholson, Vice Admiral, USN (Retired), in telephone interview 18 December 2013 with Tom LaPuzza.
- 16 Joseph Skoog, Jr., Commander, USN, Commanding Officer of *Skate*, in patrol report for SUBICEX 2-62, cited in: Leary, William M. *Under Ice* (College Station, Texas: Texas A&M University Press, 1999), 220.
- 17 Op. cit. "Arctic Lab pioneer Dr. Waldo Lyon retires after 55 years," 3.
- 18 Ibid., 3.
- 19 Rod McLennan, in telephone interview 17 December 2013 with Tom LaPuzza.
- 20 Space and Naval Warfare Systems Center San Diego. "First annual Vice Adm. Bowen Award presented." Outlook, 27 June 1997, 1.
- 21 Naval Ocean Systems Center. "Increased Arctic emphasis results in NOSC changes." Outlook, 27 January 1984, 1.
- 22 In an 8 November 2013 e-mail to the author, team leader Augie Troncale reported, "ICEX 1-86 proved the effectiveness of the Mark 46 in the under ice environment. Prior to the exercise most experts believed an active acoustic torpedo would not perform well in the under ice environment."
- 23 The Base Closure and Realignment Commission (BRAC) was the focus of the Department of Defense initiative to reduce unneeded bases in a judicious manner freed from political pressures. See: <http://www.brac.gov/> for details.
- 24 Naval Command, Control and Ocean Surveillance Center RDT&E Division. "Arctic Submarine Laboratory transfers to NUWC." Outlook, 14 February 1992, 1.
- 25 Op. cit. Rod McLennan telephone interview.
- 26 Jack A. Green, Navy News Service release 030207-14 of 7 Feb. 2003, accessed 19 December 2013 at http://www.navy.mil/submit/display.asp?story_id=5714
- 27 Captain Jeff Fischbeck, USN (Retired), in phone interview 21 December 2013 with Tom LaPuzza.
- 28 Jeff Gossett, in e-mail to Tom LaPuzza, dated 20 November 2013.

Connecticut (SSN-22)
surfaced at the North
Pole in March 2011.



San Diego-based Research Submarines

By Tom LaPuzza

Tom LaPuzza, a 1968 graduate of the University of San Diego, worked in the Public Affairs Office, of what is today, the Space and Naval Warfare Systems Center (SSC) Pacific from 1969 until 2010. During eighteen years of that time, he was Public Affairs Officer for SSC and its predecessor organizations, serving additionally as the principal spokesman for the Navy Marine Mammal Program. After his retirement in 2006, he continued to work at the Center; today he is an SSC emeritus. His current project is developing a predominantly photographic history of SSC Pacific for its 75th Anniversary in 2015.

*He decided to destroy his invention, plans and machines, for fear...that men, because of their evil nature, should use it to assassinate at the bottoms of the seas by destroying vessels and drowning the men on them.*¹

Such was the intention five centuries ago of Leonardo da Vinci, in contemplating his vision of a submarine and fearing what he foresaw as its likely use by unscrupulous men in Venice. History has proven da Vinci at least partially correct in that submarines have been used on occasion to sink non-combatants without provocation. What he did not consider, apparently, was the deterrence factor of submarines in the hands of nations seeking peace and security rather than domination. Thus, the United States has employed the submarine's stealth and weapons, but often merely the threat of the latter, to guarantee its security and the safety of its citizens.

A small number of those submarines, when their days as armed operational platforms ended, have been used for research purposes, and at least one submarine was designed and built specifically for purposes other than warfare. This is the story of two of those submarines.

With the end of World War II large numbers of combatant platforms became surplus, including many submarines. Most were cut up for scrap, but a few continued to support the Navy. One was *Baya* (SS-318), which completed five Pacific war patrols in the brief period between her commissioning in

May 1944 and decommissioning in May 1946.

However, her service was not over. The boat was re-commissioned as an electronics experimental submarine and re-designated AGSS (Auxiliary, General, Submarine).

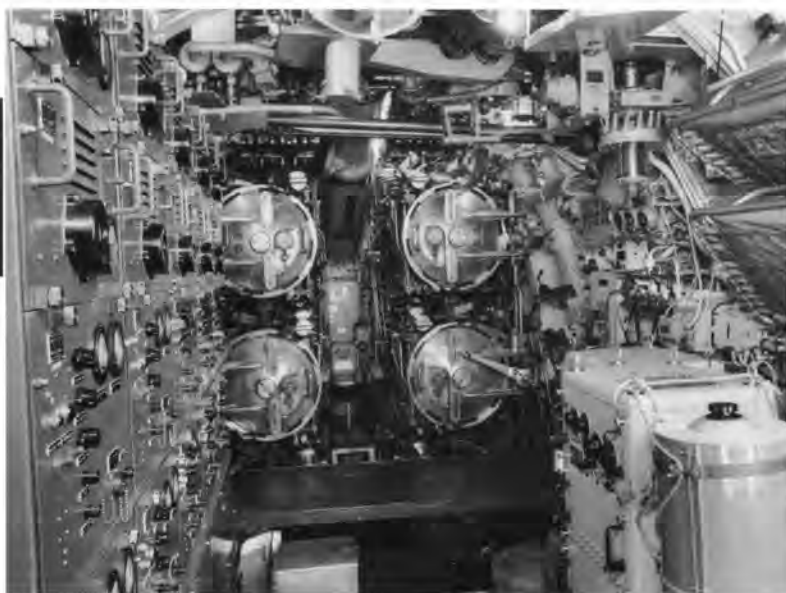
Assigned to the U.S. Navy Electronics Laboratory (NEL)² in 1947, the sub steamed to San Diego to join the small fleet of miscellaneous craft supporting NEL's continuation of its pioneering wartime

He decided to destroy his invention, plans and machines, for fear...that men, because of their evil nature, should use it to assassinate at the bottoms of the seas by destroying vessels and drowning the men on them.

—Leonardo da Vinci

Baya (AGSS-318) at sea in August 1948.





Photos Courtesy of SSC Pacific, Official U.S. Navy Photos

Left: Below-deck processing equipment for Long Range Active Detection (LORAD) sonar on *Baya*.

Below: Long Range Active Detection (LORAD) sonar array on deck of *Baya* berthed at waterfront area of U.S. Navy Electronics Laboratory in June 1955.



sonar development. *Baya* was usually paired with one of two World War II patrol boats – *Rexburg* or *Marysville*³ – to conduct sonar experiments in the local San Diego area.

At the time, NEL's Dr. Waldo Lyon was in the early stages of research to provide the U.S. Navy with arctic submarine capability.^{4,5} Repeatedly refused a fleet sub (and often any sub) for this effort, the NEL Commanding Officer assigned him *Baya* for an Arctic cruise.

Baya and EPCE(R)-857 departed San Diego in July 1949 for Operation Aleutians. Objectives were to study low-frequency acoustic propagation and sound-transmission loss in shallow water, at long ranges in the Bering and Chukchi seas, just south of the pack ice.

In the cruise report scientist Kenneth Mackenzie noted temperatures were recorded from the surface to the bottom every half-hour by the sub and every hour by the patrol craft.⁶ Following the propagation tests, sonar studies of the temperature-layered waters were conducted, revealing the presence of positive thermal layers near the ice, important factors in submarine operations in those areas.

LORAD sonar

One of NEL's major programs during the 1950s involved development of the Long Range Active Detection sonar, LORAD. The task was stated as: *Develop an active sonar (LORAD) for the detection of submarines in deep water at range of 100 miles or more, and in shallow water at ranges in excess of ten miles.*⁷

For the project, fifty barium titanate hydrophones salvaged from AN/SSQ-2 sonobuoys were installed two-and-a-half feet apart in a channel along the starboard side of *Baya*. The channel was covered with sheet metal to protect the hydrophones and reduce drag on the sub.

Testing was conducted in May and June 1955, 150 miles west of San Diego, in water depths to 12,000 feet. *Baya* then steamed to Hawaii and conducted long-range tests with sonar in much deeper waters.

In both exercises *Baya* conducted successful long-range tests with LORAD, which *detected a submarine in deep water at the ranges of the first and second convergence zones, about thirty-three and sixty-seven miles. The equipment utilizes the phenomenon of the convergence of signals in the deep ocean at annular zones spaced about thirty miles apart outward from the source. The experimental LORAD equipment provides a new and powerful research tool for study of the behavior of sound in the ocean.*⁸

As LORAD development progressed, it became clear the dimensions of *Baya* would not support the large equipment. The sub put into San Francisco Naval Shipyard in late 1958, where its knife-edge was replaced with a bulbous bow to accommodate the sonar array.



***Baya* spent the fall of 1958 in drydock at San Francisco Naval Shipyard, where her original bow (left), too cramped for the planned sonar suit, was replaced with a bulbous bow to accommodate the latest version of the Long Range Active Detection (LORAD) sonar, giving the sub an entirely new look.**

We actually modified the bow of the Baya with a large compartment in which we placed a planar array that was maybe fifteen by twenty-five feet, said Morris Akers, a physicist who worked extensively on sonar design and on transducer fundamentals like molding and firing ceramic components.⁹

One of the unforeseen effects of placing transducers in an array and driving them together became disastrously apparent during the first sea trial.

When we fired it up, the array just exploded, Akers related. Unequal loading of the transducers, with some

receiving power as others were radiating, led to the explosion. After substantial analysis, an NEL engineer invented Velocity Control, which allowed individual control of each transducer and solved the problem. *A tremendous amount of the knowledge that was gained from LORAD, for design and manufacturing of both transducers and electronic amplifiers with both passive and acoustic arrays, has been integrated into fleet and commercial sonar systems,* Akers wrote.

The computer age was far in the future, but *Baya* participated in a unique effort of the Point Loma Navy lab in late-1960 and early-1961. A single AN/USQ-20



general-purpose, stored program computer was employed on a time-share basis on the sub (serving as an integral component of LORAD signal processing equipment) and ashore, where it was used to debug a wide variety of data-processing programs for analysis of LORAD-generated sea test data. Computer cabinets and peripherals were installed at both locations, and the transfer required merely moving thirteen plug-in chassis.

The laboratory's newspaper reported:

*Used in connection with the AN/BQS-5 sonar equipment, this will be the first general-purpose computer installed on board a U.S. submarine and the first of its kind to be used for real-time sonar data processing.*¹⁰

Testing of LORAD aboard *Baya* continued for several years, including another cruise to *determine characteristics of propagation, scattering and diffraction of underwater sound...and their relation to environmental conditions.*¹¹

Experiments were conducted in thirty fathoms of water over a smooth sea floor in the Bering Sea, west of the Aleutians. With both subs at 100-foot keel depth, *Baya* ensounded the target – *Rock* (AGSS-274) – using continuous wave tone pulses and frequency modulated pulses as she closed. Submarine target echoes were successfully received. Following a final research cruise to Alaska in 1971, *Baya* was decommissioned 30 October 1972, after more than a quarter-century of service.

Research submarine

The sonar work pursued by *Baya* and the two patrol craft was greatly enhanced with the arrival of another unique submarine in November 1970.

First proposed and funded in the mid-1950s, the keel for the research sub *Dolphin* (AGSS-555) was laid in 1961. The 1963 loss of *Thresher* (SSN-593) halted all sub construction for analysis, to preclude a repeat of that disaster.¹²

After those delays, the research sub, constructed at Portsmouth Naval Shipyard,

was launched in June 1968, in a ceremony at which the keynote speaker stated:

*We look to Dolphin to patrol the unknown and answer questions about it...Dolphin will lead the way for the Navy's deep fleet of the 21st Century.*¹³

Navy sources reported the sub was *capable of operating to a depth in excess of any known submarine now operational. It will carry out sonar research under the direction of the NUWC's Dolphin Research Sonar Project Office.*¹⁴

Dolphin was the last diesel submarine the U.S. Navy built. She was originally 152 feet long, with a cylindrical pressure hull eighteen feet in exterior diameter, closed at the bow and stern with hemispherical caps fashioned of HY80 steel. She displaced 750 tons surfaced, 925 tons submerged. Highly automated, the boat had three computer-operated systems, including a hovering system, and a twelve-ton scientific payload to exploit deep-diving

***Dolphin* (AGSS-555) arrives at her homeport of San Diego for the first time on 7 November 1970.**

We look to Dolphin to patrol the unknown and answer questions about it... Dolphin will lead the way for the Navy's deep fleet of the 21st Century.



Other projects

Dolphin was involved in a variety of projects during her long career. Among them were:

Mobile Submarine

Simulator. During World War II the Point Loma lab had developed sound beacons intended as decoys, to be launched by a submarine under attack to lead the attacker away. In 1976, *Dolphin* successfully demonstrated the first submarine launch of a MOSS system, which subsequently became integral to defensive systems on all fleet ballistic missile and Trident submarines.

Upper Ocean

Turbulence Tripod. During the 1980s, the Naval Postgraduate School conducted extensive studies (temperature, sound transmission, biological organisms) of the upper fifty meters of the ocean, where a significant amount of submarine activity occurs. In support of those efforts, a tripod was mounted on *Dolphin's* deck to measure micro-turbulence in the water, and a "bug catcher" attached to the sail allowed biological sample collection.

Weapons testing.

Various iterations of the Point Loma lab developed anti-submarine warfare (ASW) torpedoes, from World War II until a major Navy re-organization in 1992.²¹ Even after that time, the Department of Defense testing authority, Operational Test and Evaluation Force (OPTEVFOR), requested use of the lab's extensive testing facilities and expertise to evaluate weapons, and *Dolphin* served as a set "not-to-hit" target for Mark 50 torpedo testing in 1995, and for Mark 54 testing in 1997 and 2001-2002. Her unique capabilities allowed her to simulate small, slow, quiet diesel-electric submarines that represent one of the Navy's most critical and elusive adversaries, and thus provide ASW forces the opportunity to develop more effective means of countering these subs.

submarine technology and to pursue acoustic and oceanographic research at great depths. *Dolphin* was designed to carry more sonar per ton than any other sub in the world. Equipped originally with a single experimental torpedo tube that allowed the crew to execute the deepest torpedo launch on record,¹⁵ the tube was removed in 1970 during shipyard conversion for Phase II operations. The yard activity included installation of a new bow sonar dome that increased her length to 165 feet. The sub's crew spaces for three officers and twenty-one enlisted personnel were augmented by permanent berthing for four civilian scientists.

Robert Waldie, an experienced sonar expert at the Point Loma lab, was *Dolphin* Project Technical Director. He had written one of the key reports and co-authored the second^{16, 17} that proposed the sub's sonar suit and its acoustic and oceanographic research program for the coming years. At the time of the sub's launch, he discussed its one-of-a-kind research sonar, which employed ceramic cylinders as cavity resonators.

*The ceramic cylinders are attractive as sources because they offer the possibility of high efficiency, broadband, high-power transducers capable of being used in deep submergence applications.*¹⁸

After the year-long shipyard period, the submarine steamed through the Panama Canal and, on 7 November 1970, arrived in her homeport of San Diego. Assigned operationally to Commander, Submarine Development Group ONE (like *Baya*), *Dolphin's* "home" during its entire commissioned period was the pier of what was then the Naval Undersea Research and Development Center. Shortly after the *Dolphin's* arrival, the center began installing additional sonar equipment in that extended thirteen-foot bow in anticipation of *Dolphin's* first research cruise.

During that cruise in the spring/early summer of 1971, the two Center submarines and the oceanographic research ship USNS *S.P. Lee* (T-AGS-31) spent four months conducting acoustic research in the Gulf of Alaska. The objective was to prove the concept of the oceanic reliable acoustic path in real world situations, a feat that would not have been possible without *Dolphin's* unique deep-diving capabilities.

This test gathered the definitive data for the Navy's understanding of the reliable acoustic path and how to use the path tactically with our sub force, said John Benya, an engineer whose thirty-five-year career with the Point Loma Lab was spent exclusively working on *Dolphin*.¹⁹

Benya explained the importance of *Dolphin* in terms of equipment certification, giving as different examples: the BQS-15 ECN-17 sonar, reverse osmosis desalinization plant, and new batteries – her last project.

*The Navy has a rule that all new equipment must be certified on a submarine before it can be installed on an operational boat. The cost of certification on a nuclear submarine is horrendous, but the cost for the same process on *Dolphin* is about ten percent of that. That's really where *Dolphin* paid off for certain systems, with the substantial cost savings to certify and allow new equipment use on operational submarines.*²⁰

The reverse osmosis (RO) effort evolved from a substantial shortage of fresh water on *Dolphin* during cruises lasting more than ten days. Water for drinking and cooking was sufficient, but showers were generally out of the question.

***Dolphin* became the first Navy vessel to take an RO unit to sea, and with successful technical and operational evaluation in 1983; units later began going aboard the Navy's nuclear submarines.**

Dolphin on the high seas in 1994, during one of her many research cruises.



Benya contacted a marine supplier and assisted procurement and installation of an RO system on the boat. *Dolphin* became the first Navy vessel to take an RO unit to sea, and with successful technical and operational evaluation in 1983, units later began going aboard the Navy's nuclear submarines.

At the same time the reliable acoustic path effort was underway, *Dolphin* served as the test platform for the experimental under-ice sonar BQS-15 XN1. A later version provided obstacle avoidance capability, and with improvements over the years this became the BQS-15 ECN-17, a phased array sonar that eliminated the mechanical components of the XN-1. The 1995 evaluation of the prototype system aboard *Dolphin*, which became the first submarine to test successfully a BQS sonar, led to that sonar's certification for nuclear fleet submarines. Upgrades to this sonar are now used on all Navy subs.

Dolphin's numerous sonar evaluations included the High Frequency Obstacle Avoidance Sonar in 1988, the High Resolution Electronic Imaging Undersea System in 1995, and a state-of-the-art three-dimensional obstacle avoidance sonar in 2002.

Communications improvements

The most critical asset of the submarine is stealth, and the two greatest threats to that (excluding surfacing) are active sonar and radio communications. Despite that, the latter is often essential. In addition to its sonar work, the Point Loma Navy laboratory was responsible for developing communications technology, including submarine communications. It provided increasingly effective underwater communications using low frequency/very low frequency/extremely low frequency (LF/VLF/ELF) radio, but VLF requires trailing an antenna close to the surface, an obvious detection hazard. And, although ELF allows the sub to operate hundreds of feet deep, the messages must be very short and take a long time to receive.

In the mid-1970s, the lab began experimenting with optical communications. The first such effort, Submarine to Air Optical Communication System (SAOCS), was intended to test the concept. Rather than using lasers, SAOCS employed high-powered lights, with *Dolphin* transmitting signals to a helicopter while submerged.

***Dolphin*, at Point Loma Navy Lab dock, with equipment for the Tactical Airborne Laser Communications system installed on deck.**



A Center history published a decade later explained the technology: *Communications to submarines at depth is possible due to a window in the transmission characteristics of seawater. This window occurs in a narrow band in the blue-to-green visible light region of the electromagnetic spectrum. Proper choices of laser transmitters and matching optical receivers allow communications to operational depths.*²²

In the 1981 Strategic Laser Communications Project, *Dolphin* demonstrated significant technology advances when she was able to receive laser light signals and messages in both day and night conditions, even under overcast skies. Her 1984 involvement in assessment of the Submarine Laser Communication (Airborne) off San Clemente "far exceeded expectations."

While satellite communication with subs was the ultimate goal, *Dolphin* next participated in a lower-cost program, using a high-altitude aircraft to communicate via blue-green lasers. Laser communications can penetrate hundreds of feet of water, transmit long messages, and are difficult to intercept or jam. The test series for the Tactical Airborne Laser Communications (TALC) system in 1991 involved bi-directional communications between the participating aircraft at high altitude and *Dolphin* deep underwater. The evolution marked the

first successful submarine-to-aircraft laser transmission.

On the night of 21 May 2002, *Dolphin* was about 100 miles off San Diego, preparing for Mark 54 torpedo testing. A new steel door had been installed on the sail

to protect the hatch should the sail be hit by a torpedo. With heavy seas, the steel door opened and the ship began flooding through the open pressure hull hatch. Torrents of water came aboard (an estimated seventy-five to eighty tons), shorting out all the electrical systems and sparking fires.

The crew's heroic actions saved the ship, but they were forced to abandon ship in the early morning hours of 22 May. Investigation estimated the ship was only seventy-five seconds away from sinking at that time.

Over the next three years, the damage was repaired and *Dolphin* was once again operational. The boat's refurbishment allowed one last important test, of a new gel-cell lead-acid battery. Designed with extremely low internal impedance and requiring no cooling water, the battery offered substantial promise for submarine power requirements. On one of her last sea trips, *Dolphin* executed nine normal dives as quickly as possible, then did a maximum current emergency battery discharge. This last successful test of *Dolphin* effectively certified the new battery for use on all the Navy's nuclear submarines.

Laser communications can penetrate hundreds of feet of water, transmit long messages, and are difficult to intercept or jam.

Dolphin (AGSS-555) was decommissioned 1 January 2007, after nearly four decades of service to the Nation, and especially to her sister deep-diving boats. She had dived deeper than any of them, in fact substantially below her official unclassified depth of 2,000 feet, and cleared the way for many advances that made them safer and more operationally effective. *Dolphin* continues to serve, moored now at the Maritime Museum of San Diego where visitors can gain a greater understanding of the U.S. Navy's Submarine Force by touring one of its most important and unique boats.

NOTES

- 1 "Leonardo da Vinci: Artist, Inventor, and Universal Genius of the Renaissance." At: <http://www.leonardo-history.com/inventor.htm> accessed December 22, 2013.
- 2 NEL, established originally as the U.S. Navy Radio and Sound Laboratory on Point Loma in 1940, it expanded after the war and became a premier Navy research, development and engineering center. Its title later was changed to Naval Electronics Laboratory Center. Through a series of re-organizations and mergers that defy simple or brief description; the other names associated with the Point Loma Navy laboratory complex (at one time there were two labs side-by-side), during the six decades commissioned submarines were assigned there to support research were: Naval Undersea Warfare Center; Naval Undersea Center; Naval Ocean Systems Center; Naval Command, Control and Ocean Surveillance Center Research, Development, Test and Evaluation Division; and Space and Naval Warfare Systems Center San Diego. All those names (NEL, NELC, NUWC, NUC, NOSC, NRad, SSC San Diego) essentially represent the same organization in its various incarnations, in the same physical locations, during those decades. To avoid confusion, the Navy organizational names have been omitted from this article, except where absolutely necessary.
- 3 *Rexburg/Marysville* were originally planned as Patrol Craft Escort (PCE)-855/857, respectively, without names. An (R) for Rescue was added before commissioning in 1944/1945 as PCE(R). After the war, they were re-designated Experimental Patrol Craft Escort (Rescue)—EPCE(R), and named *Marysville* in February 1950, *Rexburg* in February 1956. They were assigned to NEL to support underwater acoustics research. A 19-ton, 900-foot-long Thermistor Chain with a "thermistor bead" (temperature-sensing device) every 27 feet for recording depth-vs.-temperature "lines" across large areas of the ocean was installed on *Marysville* in July 1961 to allow study of ocean temperature structure, a critical factor in underwater acoustics and sonar operation. *Rexburg* was decommissioned in March 1970, *Marysville* in July 1970.
- 4 Tom LaPuzza, "A Man for All Seasons: Waldo Lyon." *Mains'l Haul*, this issue.
- 5 Tom LaPuzza, "Small San Diego Lab Makes a Big Difference: Submarine Research Facility/Arctic Submarine Laboratory Contribution to the Navy's Operational Capability in the Arctic." *Mains'l Haul*, this issue.
- 6 K.V. Mackenzie, Long-Range Sound Transmission in the Shallow Bering and Chukchi Seas. NEL Report 640, 10 November 1955, 4.
- 7 R.G. Stephenson, Coordinator. LORAD Summary Report. NEL Report 698, 22 June 1956, 1. This "report" was an entire thick volume with more than 40 authors of individual areas of technical work, and summarized a number of years in which "many NEL employees participated in the effort," with direction and participation by the office of the Chief of Naval Operations, the Navy Bureau of Ships, Commander In Chief U.S. Pacific Fleet, Commander Submarine Force Pacific, and Commander, First Fleet.
- 8 Ibid., i.
- 9 Morris Akers, in an e-mail to the author on 20 January 2014.
- 10 U.S. Navy Electronics Laboratory. "First Time: New Computer Facility Ready for Use in '61." Calendar, 2 December 1960, 6.
- 11 J.A. Whitney, LORAD Tests in the Shallow Bering Sea. NEL Report 1160, 27 February 1963.
- 12 *Thresher*, after completing initial sea trials, underwent overhaul and was pursuing post-overhaul trials 220 miles east of Cape Cod when she experienced what was later determined to be a piping failure that led to loss of power and inability to blow her ballast tanks quickly enough to forestall sinking. She was lost 10 April 1963 with her entire crew and a small number of civilian technicians in 8,400 feet of water. With her loss, *Permit* (SSN-594) became the lead ship of the class.
- 13 Frosch, Dr. Robert A., Assistant Secretary of the Navy for Research and Development. Quoted in: Naval Undersea Warfare Center. "*Dolphin* (AGSS-555): To carry out sonar research." Seascope, 14 June 1968, 1.
- 14 See End Note 2. In the seven years between *Dolphin*'s keel-laying and commissioning, the portion of NEL that worked submarine sonar issues became part of the newly established Naval Undersea Warfare Center (NUWC), which took over the same lab and office spaces. The submarine sonar personnel were transferred to NUWC in 1967. During that same time period, the original plan to conduct sea trials to demonstrate deep-diving and quieting technologies and then scrap the boat was amended, based on several proposals of the Point Loma lab to utilize her in research roles (See End Notes 16 and 17). The successful participation of the boat, in the first major acoustic research cruise to the Gulf of Alaska in 1971, assured continued operation of *Dolphin* in oceanographic and acoustic research cruises.
- 15 Decommissioning brochure, *Dolphin* (AGSS-555), 22 September 2006.
- 16 Waldie, R.L. A Proposed Sonar Suit and Research Program for the Deep-Diving Submarine *Dolphin* (AGSS-555). Navy Electronics Laboratory Letter Report 081. January 1963.
- 17 U.S. Navy Electronics Laboratory. Proposed Acoustic and Oceanographic Program for the Deep-Diving Submarine *Dolphin* (AGSS-555). NEL Technical Memorandum 583. 14 January 1963.
- 18 Naval Undersea Warfare Center. Outlook. 14 June 1968, 3.
- 19 John Benya, e-mail to author, 6 February 2014.
- 20 John Benya, phone conversation with the author, 8 February 2014.
- 21 During the Base Closure and Realignment Commission (BRAC) process in 1991, all the Point Loma lab's weapons development programs, with one exception, were transferred to the Naval Undersea Warfare Center (a new name matching the Point Loma lab's name back in the late 1960s, but a completely different lab located in Newport, R.I. and Keyport, Washington).
- 22 Naval Ocean Systems Center. *Fifty Years of Research and Development on Point Loma, 1940-1990*. NOSC Technical Document 1940, September 1990, 117.



The now-retired *Dolphin* (AGSS-555) continues to serve today, as visitors to the Maritime Museum of San Diego are provided an opportunity to go aboard the world's deepest diving submarine for a first-hand undersea vessel experience.

Courtesy Maritime Museum of San Diego

Vice Admiral Bernard Kauderer, USN (Ret.) Cold War Perspective

By Sarah Bishop Dolbec

During Bernard "Bud" Kauderer's thirty-three years of U.S. Navy service on the front lines of the Cold War, he learned submarines inside and out, from one coast to the other, witnessing and making history in his own right. As the first and only officer to serve both as Commander, Submarine Force, U.S. Pacific Fleet (COMSUBPAC) and Commander, Submarine Force, U.S. Atlantic Fleet (COMSUBLANT, now known as COMSUBFOR), he has a broad view of what makes the submarine force tick. Of all his ports of call, San Diego was destined to be his homeport.¹

Kauderer grew up in the Navy city of Philadelphia, Pennsylvania, with dreams of attending the Naval Academy in Annapolis, Maryland. While working for Big Brothers of America, he was recommended for an appointment to the Academy. Kauderer graduated in 1953, a few months after meeting his future wife, Myra Frances (Mickey) Weissman of Brooklyn, New York.

Kauderer started out above the waves on East Coast surface ships, thinking he had found his calling. On *The Sullivans* (DD-537), a WWII destroyer in Newport, Rhode Island: *I learned a lot about shiphandling, seamanship, leadership, and had decided my path through the Navy was going to be early command of a surface ship. To set the groundwork for that, I thought, wouldn't it be neat to serve on a small ship?* Fate intervened when one of his Academy classmates, serving on a diesel-electric submarine, came to the Charleston Naval Shipyard. Invited aboard, he recalls: *I had never before been on a submarine, so I went up, had lunch, met everybody, had a detailed tour of the ship, and was so impressed, I went home that night and said to [my wife] Mickey, I think I'll apply to submarine school.*

Era of Experimentation

In 1957, Kauderer joined the San Diego-based *Raton* (SSR-270), a radar picket submarine, as Operations Assistant. *At the end of WWII, we had all these wonderful diesel*

submarines and the Navy was trying to find new roles for them. One idea was to take a submarine, cut it in half, put in a thirty-foot section, which included a Combat Information Center, just like on a destroyer, and install on the submarine an air search radar to be able to find airplanes, a height-finding radar to determine how high they were, and a great big new surface search radar...it was kind of an ungainly looking submarine. The whole idea was that we would proceed ahead of an aircraft carrier battle group and clear the way, making sure nobody was approaching the battle group. The idea failed because the diesel submarine could not keep up with the aircraft carrier battle group.

The *Raton* was chosen as a test subject again, when she happened to be in the western Pacific and was sent into a typhoon to study the effect of heavy seas on submarines with added compartments:

The cooks were not very happy, because the food wouldn't stay on the electric range. Most everybody stayed in their bunks.... We had to

make a quick stop someplace and [install] gauges to measure strain in the hull. Then we were sent back out to test the hull.... No one ever knew whether the hull would break apart in those heavy seas. In any case, we did it.

Kauderer's first stay in San Diego was no less interesting – living on Coronado and working on one of more than two dozen submarines berthed alongside two large tenders moored in middle of the harbor. The Coronado Bridge didn't exist [and] was being contested by the residents of Coronado.



VADM Kauderer commanded the submarine forces of the U.S. Pacific Fleet, then the Atlantic Fleet, the only officer to have this dual-honor.

Courtesy of the Kauderer family.

There's nothing like submarine command – you're an independent operator, you have great responsibility, you have great people working for you, and your judgement is challenged 24 hours a day – even in port.

'It will make Coronado a stop on the way to Mexico, and we don't want it.' You lived your life by the ferry schedule and by the schedule of the motor launches from the tenders that took you either from the Coronado side or the San Diego side out to the nest of submarines.

Being located in the harbor was sometimes a challenge. [At that time] North Island Naval Air Station...was a base for anti-submarine warfare seaplanes. Submarines getting underway from the tenders would battle the seaplanes to get into the channel. And it was comical on Monday, because those darn pilots would intentionally get in your way in the channel and taxi out ahead of you very slowly, and you were frustrated.²

Kauderer decided to enter the Navy's burgeoning nuclear power program. After enduring a *somewhat painful* Admiral Rickover interview, he returned to San Diego, thinking he didn't get selected. When he received an acceptance phone call, he and his growing family picked up and moved again. *They went wherever I went*, Kauderer acknowledged.

His first assignment nuclear power training in 1959 was Assistant Engineer on the *Robert E. Lee* (SSBN-601), one of the first Polaris missile submarines in Newport News, Virginia. This new *George Washington*-class of nuclear-powered ballistic missile submarines [SSBN] was made from nuclear-powered fast attack submarines [SSN] under construction that were cut in half and an extra 130-foot section missile compartment installed, using the concept tested earlier by the *Raton*.

That was the first time the Navy had experimented with two crews for SSBNs. With some other aspects being unique, [the] first of a kind in that first group of five [SSBNs], we had some experimental things. [This] was a whole new concept of being submerged for long, uninterrupted periods of time, as opposed to the culture of a submarine operating for a few days, coming up, even surfacing.... Here was a whole new world.

For instance, the *Robert E. Lee* had a huge gyrostabilizer. The idea was that that when we came close to the surface to launch missiles, the ship would rock and roll with whatever the problem was on the surface at that time. So to stabilize the submarine during the launch process and make sure it was absolutely motionless and pointing straight up, you turned on this multi-ton, rotating gyroscope. [However,] the gyroscope didn't really stop the submarine rolling in the heavy seas, and it turns out it wasn't critical to the launch of the missiles anyway. They would have launched without being stabilized. It was a gigantic piece of machinery. Took up a lot of space – a lot of power.

There was also a biological experiment based on the idea of being submerged on a deterrent patrol: How can these young people exist without fresh fruits and vegetables?

A hydroponic garden was installed in the lower level of the missile compartment with tables of vermiculite soil and lights above. It was the job of the missile technicians to care for the plants. Halfway through the first patrol, one little leaf of lettuce appeared and was served to the captain with great fanfare.

There were new things for the mechanics, too, like the concept of making the boat's own oxygen. By using heat from the reactor to increase water to a very high temperature, salt was filtered out and then pumped over the side. Then, the very pure water was separated into hydrogen and oxygen by electrolysis.... The hydrogen went overboard and the oxygen was stored in high pressure flasks in the ballast tanks.

The ship's atmosphere was maintained ideally at 21% oxygen, 78% nitrogen, and 1 or 2% of other gasses. So we had a machine to remove the carbon dioxide from breathing and from cooking. In those days everybody smoked, which created carbon monoxide, and you had to get rid of that. You had to oxidize the monoxide to make dioxide, which could then be filtered out. There were lots of filters and over the course of two patrols, the air would become so pure that when we'd get home, you'd kiss your wife, kiss your kids, and then get laid out with the flu.

From the Front Lines to the Home Front

As the Cold War intensified, Kauderer's assignments brought him closer to danger. In 1962, he was the Chief Engineer on the *Skipjack* (SSN-585) – the first submarine to combine a nuclear power plant and the teardrop-shaped hull of the *Barbel*-class. It was one of the first of the new S5W nuclear [reactor] plants [designed] by Rickover's engineers, and was also the first nuclear sub to have been tested to withstand a mine explosion. Their first operation was in October during the Cuban Missile Crisis, patrolling the waters off Cuba, monitoring the comings and goings of Soviet missile supply ships without being detected. We were aware...of what was going on between the President and the Soviet Union. We maintained a watch...and reported what we saw.

Kauderer's next few years were spent in the Western Pacific. He was the first Executive Officer of the Gold Crew on *Ulysses S. Grant* (SSBN-631), one of the first ballistic missile nuclear submarines to operate out of Guam. From 1966 to 1970, Kauderer was Commanding Officer (CO) of *Barb* (SSN-596) out of Pearl Harbor. I had interesting operations as a commanding officer, mostly classified, but as you can imagine an attack submarine operating in the Pacific, [we] encountered some very interesting events.



Kauderer was pleased to return to San Diego as the second CO of the submarine tender *Dixon* (AS-37), a beautiful, brand-new big ship and the first designed to service nuclear subs. A small floating city, she had a crew of fifty-five officers and 1200 enlisted:

A submarine would come alongside with a long list of [repairs] for thirty-day upkeep, [and] at the end of that upkeep you could see that everything had been repaired or replaced. ...Very satisfying, especially for the crew who were amazing technicians – they could fix anything.

Unique Perspective

When Kauderer was selected as a Rear Admiral in 1977, his point of view continued to expand. He spent two years, again in San Diego, as Commander, Submarine Group FIVE, overseeing three squadrons, including the Navy's growing Deep Submergence Rescue Unit, with deep sea divers and technicians to operate rescue submarines that could go down to a sunken submarine. After serving as Deputy Director of the Navy's Research and Development, Test and Evaluation office in Washington, he came back West when he was selected as COMSUBPAC. He was in charge of two squadrons in Pearl Harbor, three in San Diego, probably a total of fifty or more SSNs, as I recall, plus all the tenders and bases, etc.

In 1983, Kauderer was appointed COMSUBLANT, after

The *Dixon* (AS-37) and *McKee* (AS-41) at Naval Submarine Base Point Loma, near Ballast Point, in 1987.

Courtesy of CDR Ray Ferbrache, USN (Ret.)

having served as COMSUBPAC—an unprecedented step. Now a Vice Admiral, he was concurrently Commander, NATO Submarine Forces, Western Atlantic. The submarine force

was pretty well supported by Congress, principally because Admiral Rickover had established support from Congress...the importance of the Submarine Force. It was great to see that interaction and...that submarine research and development was funded, and the number of ships we

had was funded. In his NATO role, Kauderer found working with other nations was a similarly fascinating process of collaboration. Among the British, French, German and other political allies, it was all cooperative, very much devoted to a common potential enemy – the Soviets.

A few years earlier, Kauderer had tried to share his West Coast lessons learned with his East Coast colleagues. At that time, the Submarine Force was divided 60% Atlantic, 40% Pacific, and that division of forces was based on the ever-present Soviet threat. But I could see in the Pacific that the threat was growing. It was my opinion that rather than split [them] 60/40, as a minimum, the Submarine Force should be split 50/50. Nobody liked that....

I tried to educate people in the vast expanse of the Pacific and couple it with the Indian Ocean. That's three-fourths of

I tried to educate people in the vast expanse of the Pacific and couple it with the Indian Ocean. That's three-fourths of the earth's ocean, as opposed to the Atlantic, [which] in comparison is really much smaller.

the earth's ocean, as opposed to the Atlantic, [which] in comparison is really much smaller. They didn't realize what distances we had to travel, going from the West Coast or even Pearl Harbor, to the western Pacific, what a long trip that was.... People who are traditional Atlantic-area sailors have no concept of the Pacific. They don't understand that when you sail on a deployment from San Diego to the western Pacific, and stop to make a port call at Pearl Harbor en route, you've [already] gone as far as it would be to go from Norfolk to Gibraltar. They're not even halfway there. It is larger, takes longer, lots more going on, and a lot more work. You have to be more prepared for emergency repairs because you could be farther removed from a repair-capable facility. Now that we have [submarines homeported] in Guam...that helps. One of the things I became ever more convinced of was the importance of the submarine tenders [with] the repair, maintenance, and re-supply capability they had, which we gave away when we did away with the tenders, and how important it was in the remote areas of the Pacific.

Continuing Legacy

Kauderer retired from active service in 1986, having earned numerous medals for his active duty and public service efforts, including the Distinguished Service, Meritorious Service, and Navy Commendation Medals. Throughout his career, he was inspired to stay in longer, in part because of the people he worked with: *The most important thing is the people with whom you're associated in the submarine community. They are so talented and so capable, it was pleasure to work with them.... I think the most enjoyable part [of submarine life] was the association with really wonderful people – intelligent, hardworking, friendly. Nothing fazed them; they were willing to take on anything....*



In 1992, Mrs. Mickey Kauderer was selected by the Secretary of the Navy and the President to be the sponsor of the Annapolis (SSN-760). Kauderer said of his wife proudly: What an honor it was to be selected... when normally they are wives of Presidents, Vice Presidents, Senators, and Secretaries of Defense.

Courtesy of the Kauderer Family

There [is] probably no other community in the Navy that has the aggressive spirit, the intelligence, the camaraderie.... Those were the things that attracted me, and that's what attracts people to join the Submarine Force as volunteers and to stay in the Submarine Force.

Kauderer went on to consult on submarine technology for government, industry, and academia for another nearly twenty years. He initiated a classified program on the future of submarine technology with Johns Hopkins Applied Physics Laboratory and conducted an annual 3-day Submarine Technology Symposium that continues today. He also served for five years as a member of NASA's Aerospace Safety Advisory Panel. *What's a submariner doing advising NASA? The international space station was just then going into space, and it turns out that the life support systems on the space station, oxygen generation, plumbing, and air ventilation looked amazingly like submarine systems.*

In 1995, the Kauderers moved back to their frequent homeport, San Diego, where they always said they would one day settle. *It's just a wonderful place to live. We have three generations of Navy [in our family], all of whom seem to be enjoying what they're doing.* Finally, in 2005, after consulting at the nearby Space and Naval Warfare Systems Command (SPAWAR), and frequent advisory trips back to Washington, D.C., Kauderer officially took a break from the Navy, though he remains involved with public service.

NOTES

- 1 This biography is a compilation of interviews by the author with VADM (Ret.) Kauderer on 23 and 30 January 2014, Carlsbad, CA, unless otherwise noted.
- 2 Interview with VADM (Ret.) Kauderer, CAPT (Ret.) Joe Meyer, CAPT (Ret.) Dick Bivin, and CAPT (Ret.) Bob Murrill on 2 December 2013, Carlsbad, CA.

Submarines in San Diego during the Cold War

By Captain Bill Hughes, USN (Ret.) and Captain Jeff Fischbeck, USN (Ret.)

Bill Hughes, Captain, USN (Ret.), a 1963 graduate of the United States Naval Academy, is the Vice President and past President of the Pacific Southwest Chapter of the Naval Submarine League. During his naval career he served on five submarines, including *John C Calhoun* (SSBN-630), *Alexander Hamilton* (SSBN-617) and *Silversides* (SSN-679). He commanded *Flasher* (SSN-613), homeported in San Diego, from 1979 to 1982, and was commissioning Commanding Officer of *Olympia* (SSN-717), from 1982 to 1984. His other San Diego tours included Deputy Submarine Squadron THREE Commander in 1984 and Commander Submarine Squadron THREE, from 1987 to 1989. His shore tours included the Bureau of Naval Personnel, Commander in Chief Pacific Fleet Staff and the Joint Staff. Subsequent to retiring from the Navy, he worked as a senior executive in the independent electricity generating industry from 1993 to 2005.

Jeff Fischbeck, Captain, USN, (Ret.), a 1971 graduate of Colgate University, served his thirty-year naval career onboard five nuclear submarines, including *Greenling* (SSN-614), *Henry Clay* (SSBN-625), *Lapon* (SSN-661), and *Pogy* (SSN-647). He commanded *La Jolla* (SSN-701), homeported in San Diego from 1988 to 1991. His other San Diego tours included Deputy Submarine Squadron THREE Commander (1991-1992), and Director, Arctic Submarine Laboratory (1998-2002). Shore tours included command of the NROTC at Carnegie Mellon University and University of Pittsburgh, and submarine billets in Naples, Italy, and Brussels, Belgium. After retiring from the Navy, he worked as a senior consultant for the Department of Homeland Security and served as President of the Pacific Southwest Chapter of the Naval Submarine League.

EVOLUTION: Early Post-World War II Submarine Designs and Re-designs

At the end of World War II, the United States Navy had over 6700 commissioned ships, including 232 submarines. As these ships returned home, the Navy began rapidly drawing down from wartime levels, so that by June 1946, there were less than 1300 commissioned ships, including eighty-four submarines. Most of the Pacific-based submarines, especially the older pre-war models, sailed directly to Mare Island Naval Shipyard, where some were mothballed and placed in the reserve fleet on the Napa River, some were cut up for scrap, and some were prepared for transfer to other countries. The remaining subs returned to their homeports in Pearl Harbor and San Diego for rest and relaxation, before resuming training exercises and deployments to the western Pacific.¹

Meanwhile, in Washington, as the drawdown was underway, the nation's leaders were questioning whether warships, in particular submarines, would be useful in the future. Some thought that the atomic bomb made all warships obsolete. Others, particularly the Air Force, believed that long-range bombers, possibly carrying atomic bombs, would be a sufficient deterrent to future aggression and a large Navy was unnecessary. In addition, the Russians, who were becoming the next major antagonist, were far less dependent than Japan on a large merchant marine to deliver commodities and therefore did not require a large surface warship fleet. The U.S. submarines that had devastated Japan's Navy and merchant fleet were designed and operated with the primary mission of sinking surface ships, not submarines. With no enemy warships to sink, and little or no Anti-Submarine Warfare (ASW) capability, many in Washington were asking why submarines were needed, and senior submariners were wondering how to answer those questions.²

These questions were partially answered in the Bikini Atomic bomb tests conducted in July 1946. Two 20 kiloton bombs were detonated, one an air blast from an altitude of 1000 feet and one 500 feet under water, with surface ships and submarines arrayed at varying ranges and depths from ground zero. Although some ships, especially those close to ground zero, suffered major damage, particularly from the underwater blast, most survived. These encouraging results allowed planning for new post-war naval classes to continue.³

While the Russians had few surface ships, the country did end the war with over 200 submarines of its own as well as submarines, shipyards, engineers and scientists captured from the Germans. The United States' intelligence community predicted that, with these German resources, Russia could build a massive undersea armada of advanced technology submarines.⁴ The threat soon became real. In March 1946,



Winston Churchill called attention to the “iron curtain” across eastern Europe and, in September 1947, Stalin’s chief ideologue, at the first meeting of the Communist Cominform, declared that *since 1945 the world had been become irrevocably divided into an imperialist camp, led by the United States and a progressive socialist camp, led by the Soviet Union.* The Cold War had begun in earnest. In 1948, Stalin called for a major ship and submarine building program to commence. The need for U.S. submarines and surface ships to become adept at ASW soon became apparent.⁵

In early 1946, Admiral Chester Nimitz, shortly after relieving Admiral Ernest King as the first post-war Chief of Naval Operations, established a new position of Coordinator of Submarine Warfare (OP-31) on his staff. [The Office of the Chief of Naval Operations

The second atomic bomb was tested in Operation Crossroads at the Bikini Atoll.

U.S. Navy Photo, from This Month in Photo of the Day: Images from the National Geographic Archive

Some thought that the atomic bomb made all warships obsolete.



In 1948, Ex-German submarine U-3008 was a Type XXI used as a test vessel by the U.S. Navy.

U.S. Navy Photo

(OPNAV) is divided into numbered staff functions, called OP's.] He appointed Rear Charles Admiral Styer to be the first OP-31. Soon after, Admiral Styer convened a conference of the most experienced submarine admirals and captains to determine how to keep the submarine relevant in the future. The conference recommended taking the earliest possible advantage of developments in atomic energy for application to submarine

main propulsion, to allow a submarine to remain submerged one hundred percent of the time. This was expected to take ten years. In the meantime, the conference planned a series of submarine programs that reflected an intensive and innovative effort to determine future submarine roles and missions. These decisions, approved by the General Board and the Secretary of the Navy, were the genesis of what

would eventually become the fast, quiet, deep diving, nuclear-powered submarines of today's United States Submarine Force.⁶

The first major step was to take advantage of lessons learned from the two 1,620-ton German Type XXI high speed submarines transferred from the Germans after the surrender. The Type XXI was highly advanced in comparison to the U.S. submarines, with a streamlined underwater hull, high capacity batteries, submerged speeds of 17 knots for over an hour, and an operating depth of 850 feet, more than twice that of comparable American submarines. It also had a snorkel system that allowed it to operate its diesel engines and recharge its batteries at periscope depth (about sixty feet) without surfacing, thereby significantly reducing the chances of being detected and attacked. To take advantage of the lessons learned from the Type XXI, the Greater Underwater Propulsive Power (GUPPY) program was designed to improve the underwater performance of U.S. fleet-type submarines. Over the next several years approximately fifty fleet boats received the GUPPY conversion, which involved removing the deck guns, streamlining bows and conning towers, installing improved batteries and an advanced snorkel system.⁷ The experience of *Remora* (SS-487) was typical.

Skipper, I've been up to my a- in water before... I don't think we want to do that again!

The photo shows the sail of *Remora* (SS-487) taken before GUPPY II conversion.

U.S. Navy Photo Archive # 19-N-92667, from navsource.org

Commissioned in January 1946, *Remora* conducted shakedown and training exercises out of New London, Connecticut, until February 1947, when she entered Mare Island Naval Shipyard for a GUPPY II conversion, which was completed in November 1947. She then moved to San Diego, her new homeport.⁸ According to longtime San Diego residents and *Remora* shipmates, retired Navy Captains Dick Bivin and Joe Myer, *Remora* was the first GUPPY conversion boat in San Diego and the Commanding Officer (CO), who shall remain nameless, was anxious to show what the boat was capable of during an Operational Readiness Inspection. The inspecting officer was Commander Dick O'Kane, a World War II submarine hero, Japanese prisoner of war and Medal of Honor winner. The CO said to O'Kane, *We're going to be on the surface, we're going to back down, submerge, raise the snorkel mast and snorkel.* Nobody had ever done this maneuver, and O'Kane said, *Are you going to do this in war time?* And the CO said, *Well, I don't know,* and O'Kane said, *Let's cancel it.* Then the Skipper said, *We'll do an airless surface* (surfacing without blowing air from the ballast tanks – a risky maneuver, because at high speeds the GUPPY submarines tended to re-submerge on their own). After the surfacing, but prior to blowing ballast tanks, the CO invited O'Kane up on deck with the boat still half-submerged. The CO said, *Here's a stopwatch. We'll go full on four (diesel engines) and find out how long it takes us to do it.* O'Kane said, *Skipper, I've been up to my a-- in water before... I don't think we want to do that again!* The CO was pretty deflated!⁹

Bow-on view of *Remora* (SS-487), alongside a destroyer (note the taller-faired sail).

Photo Courtesy of John Hummel, from navsource.org





Raton (SSR-270) entering port.

*Courtesy of Stephen Gower,
Photo #80-G-681530, from navsource.org*

Between 1946 and the late-1950s other, less comprehensive programs were initiated to convert, modify or build submarines designed for specific missions. The more successful of these programs included radar pickets to provide early warning to aircraft carrier task groups (SSRs), hunter killers (SSKs), transports to carry troops and equipment (SSTs), guided missile shooters to attack the enemy from a distance (SSGs) and submarines designed to perform research and auxiliary functions (AGSS). Although some of these programs were merely an excuse to build more submarines, most, even though relatively short-lived, provided the proving grounds for many elements of technology and design that would end up in the nuclear-powered submarines of the future. Many San Diego-based submarines were involved in these programs.

Raton (SSR-270) was one of six *Gato* class submarines that were cut in half forward of the conning tower, where a 24-foot section was inserted to provide space for radar electronics and a combat information center. Surface and air search radars were installed on the deck. As described by longtime San Diego resident, Vice Admiral Bernard (Bud) Kauderer, whose first submarine tour was on *Raton* in the mid-1950s, the boat was too slow to stay ahead of the aircraft carrier



Baya (AGSS-318) and research vessel PCE-855 are conducting testing for Navy Electronics Laboratory (NEL). These photographs were included in a 1956 photo scrapbook describing the work performed at the NEL.

Official U.S. Navy Photo



tasks forces it was designed to alert. This limitation, along with advances in airborne and surface ship radar, led to the program being discontinued in the late 1950s. An interesting sidelight to *Raton*'s career was also provided by Admiral Kauderer. He relates that the

Raton was intentionally sent into the eye of a typhoon in the western Pacific. At that time the designers of the first Polaris missile submarine, pushed for time, were planning to cut the original hull of the *Scorpion* (SSN-589) in half, insert a

missile compartment forward of the engineering spaces, and complete that hull as the *George Washington* (SSBN-598). They were interested in how *Raton*, with her extra 24-foot section, would handle in heavy seas. "We bounced around for a couple of days. It was very interesting," noted Admiral Kauderer.¹⁰

After five war patrols, *Baya* (SS-318) was decommissioned at Mare Island in May 1946. Two years later, after all torpedo loading and stowage equipment was removed to make room for Naval Electronics Laboratory (NEL) personnel and equipment, she was recommissioned as AGSS-318. Returning to San Diego, she served until the early 1970s as NEL's and later Naval Undersea Warfare Center's "guinea pig," conducting tests involving sonar, ASW and oceanographic research. These tests, conducted in operating areas off of San Diego and Pearl Harbor, as well as the Gulf of Alaska and the western Pacific, provided significant input to the design of future sonar systems and submarine quieting technology.¹¹

This angle of *Albacore* (AGSS-569) shows the "X" configuration tail planes fitted in 1960-1961.

This photograph was received by All Hands magazine on 26 March 1965. Official U.S. Navy Photo, USNHC # HN 97664, now in the collections of the National Archives, from nausource.org

They were interested in how *Raton*, with her extra 24-foot section, would handle in heavy seas.

Perch (SS-313), after seven war patrols, was placed in reserve at Mare Island in early 1947. After significant modifications, including removal of all torpedo tubes and two of her four diesel engines, she was

recommissioned in May 1948 as SSP-313, a transport submarine capable of carrying over 100 troops and their equipment, including an armored amphibious vehicle. After two years of various cargo and troop carrying exercises, she deployed to the western Pacific in 1950. During this deployment, *Perch* transported a force of British commandos in a raid on the northeast coast of Korea to successfully destroy a train tunnel on the major north-south supply line. As a result of this action, *Perch*'s Commanding Officer, Lieutenant Commander O. H. Payne, was awarded the Bronze Star. Although other U.S. and allied submarines took part in the war by conducting surveillance, and guarding nearby waters for potential seaborne interference from Russia or China, Payne was the only submarine CO to receive a combat award during the Korean Conflict. *Perch* subsequently operated out of San Diego and later Subic Bay, Philippine Islands until 1967, when she was decommissioned and served as a Naval Reserve Training Submarine in San Diego until 1971.¹²

In addition to the fleet submarine conversions to research roles, the Navy constructed two specialized diesel and battery powered research submarines. The first was *Albacore* (AGSS-569), commissioned in December 1953. *Albacore's* streamlined, cigar-shaped hull allowed her to exceed thirty knots submerged on the battery. Unarmed, she was primarily used to test various plane, rudder and propeller configurations for their effect on speed and submerged handling. The second research submarine was *Dolphin* (AGSS-555), a small (15-foot constant diameter hull), deep-diving submarine that carried out numerous deep-ocean missions in support of various Navy programs, while homeported in San Diego. *Dolphin*, the U.S. Navy's last diesel-electric powered submarine, was decommissioned in January 2007 and donated to the Maritime Museum of San Diego, where she is on exhibit.¹³

The first new attack boats built after World War II were the six *Tang*-class and the later, but similar *Darter* (SS-576). These boats drew heavily on the German Type XXI technology and design, but had some innovative features, such as "pancake" type diesel engines. The engines were so troublesome that they earned the class the sobriquet, *Harder, Darter, Trigger, Trout: always in, never out!* These engines were eventually replaced with conventional submarine diesel

engines and all of this class conducted western Pacific deployments from San Diego, serving reliably until the mid-1970s when most were sold to other countries or scrapped.¹⁴

After the *Tang*-class boats were constructed, the Navy adopted the *Albacore*-type hull. This streamlined shape was incorporated into the next (and last) diesel-powered attack submarines built in the U.S., the three *Barbel*-class boats, all completed in 1959. These boats could exceed thirty knots submerged and are considered among the most successful diesel submarines ever constructed. Two of the class, *Bonefish* (SS-582) and *Blueback* (SS-581), were homeported in San Diego for various periods during the 1960s, 1970s and 1980s. *Blueback*, decommissioned in October 1990, was the U.S. Navy's last operational diesel attack submarine. She is now at the Oregon Museum of Science and History in Portland, Oregon, one of the many National Submarine Memorials around the country.¹⁵

On 12 February 1947, *Cusk* launched the first guided missile to be fired from a submarine.

Early Guided Missile Submarines

San Diego-based submarines were very involved in the early development of the U.S. submarine-launched guided missile program. Shortly after the end of World War II, the Navy conducted extensive testing on captured German V1 missiles and developed an Americanized version, named the "Loon". Two San Diego-based fleet submarines, *Cusk* (SS-348) and *Carbonero* (SS-337), were modified with a ramp for launching the Loon. On 12 February 1947, *Cusk* launched the first guided missile to be fired from a submarine. (The Executive Officer on *Cusk* was Eugene Wilkinson, the future first Commanding Officer

Cusk (SSG-348) firing a Loon missile, 15 May 1951.
U.S. Navy photo



of the world's first nuclear-powered ship, the *Nautilus* (SSN-571)). Subsequent launchings from *Cusk* and *Carbonero* provided technical data used in developing the Regulus I guided missile, and the submarine systems used to store and launch the missiles.¹⁶

The 33-foot long Regulus I missile was essentially an unmanned jet aircraft. The missile had a range of 500 miles and could fly at 600 miles per hour and deliver a nuclear warhead against a fixed target. In the mid-50s the fleet boats *Tunny* and San Diego-based *Barbero* were converted to Regulus launchers (designated SSG-282 and SSG-317, respectively) with a capacity of two missiles stored in a waterproof hanger topside. To fire the missile the submarines would surface, prepare the launching ramp, pull a missile from the hanger, load it on the ramp, spread its wings and fire.¹⁷ *Barbero* lived several lives during her twenty years of service, being decommissioned in 1945 after two successful war patrols, recommissioned as a troop carrier in 1948, decommissioned in 1950, and finally recommissioned as a Regulus missile launcher in January 1956. She completed her special missile-related shakedown training in March 1956 by successfully test firing two Regulus missiles off of San Clemente Island. Subsequently, she served as an integral part of the



The Regulus missile is loaded aboard the *Barbero* (SSG-317), circa 1960. The crane has the missile positioned just in front of the container where it can be inspected before further loading.

Photo Courtesy of Ron Phillipi

nation's defense against nuclear war by carrying out early versions of the deterrent patrols until 1964. In her final role, *Barbero* was sunk as a target in October 1964.¹⁸

The potential effectiveness of the Regulus submarine strike system led to new construction of *Growler* (SSG-577) and *Grayback* (SSG-574) and later, the nuclear powered *Halibut* (SSGN-576), as purpose-built Regulus Missile launchers, with a capacity of four missiles each. With five Regulus submarines, the Navy operated one or two of these submarines on continuous patrol in the western Pacific, targeting the Soviet Union, from the late 1950s, until they were replaced by the Polaris missile submarines in 1964.¹⁹

The Pacific's nuclear-powered ballistic missile submarines, including *Halibut*, the Polaris/Poseidon missile SSBNs and the modern day Trident submarines, were based in Guam, Hawaii, or later, at the Trident Submarine Base in Bangor, Washington. Although none were homeported in San Diego, they frequently visited to conduct exercises with the attack submarines, to fire exercise torpedoes on the range off of San Clemente Island, and to allow the crews to enjoy the sights, sounds and hospitality of San Diego.



A sailor is at the Diving Control Station onboard *Daniel Boone* (SSBN-629), 4 September 1964.

San Diego History Center, from the San Diego Union Tribune Collection, file #UT85_E959-4

Revolution: The Early Development of Nuclear-Powered Submarines

The First “True Submersibles”

As early as 1939, Dr. Ross Gunn, the Superintendent of the Division of Mechanics and Electricity of the Naval Research Laboratory (NRL) began to pursue his conviction that harnessing the power of the atom would enormously increase the range and effectiveness of a submarine. By 1944, under Gunn's direction, NRL had built an isotope separation plant, at the Philadelphia Navy Yard, to produce Uranium 235 (U235), to be used in a submarine reactor core. Forbidden by the Manhattan Project from actually producing U235, Gunn continued to pursue his dream after the war. By November 1945, he had convinced the Chief of the Bureau of Ships (BUSHIPS) that his ideas had merit. On 26 March 1946, he presented his report to a large group of senior officers and scientists with interests in nuclear power and submarines. The report, detailing the process of using the reactor to produce heat to turn water into steam to power turbines, included the possibility of eventually driving a submarine at forty knots and staying submerged for weeks at a time, instead of hours. The report was received with great enthusiasm by the Navy. However, progress by NRL, along this line of development, ended when the civilian AEC was created in January 1947, to replace the Manhattan Project, and took over all responsibility for nuclear matters, including the development of nuclear reactors. The Navy did not give up hope, because earlier in June 1946, the Navy managed to craft an agreement with the Manhattan Project (before the AEC took over) for five officers to take nuclear training at Oak Ridge. The plan was to build a nuclear reactor with the involvement of both private industry and government, thus making each group familiar with nuclear technology and to put the five officers in a position to lead future nuclear reactor development for the Navy.²⁰

One of the five officers selected to go to Oak Ridge by Admiral Earle Mills, the Chief of the Bureau of Ships (BUSHIPS), was Commander Hyman G. Rickover. Rickover, a 1922 graduate of the United States Naval Academy, had an undistinguished career before the War. His only submarine experience was as a junior officer on the submarine *S-9* and Executive Officer (XO) of *S-48*, a submarine with many personnel and material problems. Rickover's

dogged efforts to correct these problems led to his reputation in the tight submarine community as a despot who harassed his shipmates unmercifully. His only command was an old minesweeper/tug boat in the Asiatic Fleet, the *Finch* (AM-9), in the summer of 1937. Sensing that his orders to the lowly *Finch* meant that he would never be selected to command a submarine, and having earned a master's degree in electrical engineering early in his career, he applied and was accepted into the Engineering Duty Officer (EDO) community. He left the *Finch* in October

1937, after only four months in command, to start a new career.²¹

Commander Rickover's first two EDO assignments were as a planning officer at the Cavite naval shipyard, in the Philippines, and then as assistant engineer in the battleship *New Mexico* (BB-40). In early 1940, he was ordered to Washington

as assistant head and then, during the War, head of the Electrical Section of BUSHIPS. In this job, he earned high praise for his section's outstanding record in its production of power and lighting equipment for the fleet. His ability to surround himself with the best people, his obsession with detail, his close partnering with industry in the design and production of components and his tireless work ethic impressed Admiral Mills, and led to his assignment to Oak Ridge, in spite of his compulsion to irritate everyone he dealt with. These traits, along with the ability to manipulate people and work behind the scenes to get his wishes, would become hallmarks of his budding career as the “Father of the Nuclear Navy.”²²

By late 1947 Rickover, now a Captain, was back in BUSHIPS working for Admiral Mills. He convinced Admiral Mills and senior submariners in OP-31, and eventually John Sullivan, the Secretary of the Navy (SECNAV), of the importance of rapidly developing nuclear propulsion for submarines. Sullivan, in turn, convinced James Forrestal, the Secretary of Defense, who named BUSHIPS as the Navy agency responsible for developing an atomic submarine. By late 1949, Rickover had managed to position himself as head of the BUSHIPS nuclear power branch, and the head of the AEC's reactor development section. He used the two positions to play the AEC and the Navy against each other, until he had accomplished his goal of complete control over the Navy's and AEC's joint efforts to develop the first submarine nuclear

By the summer of 1953, Rickover had the Navy nuclear power program running at full steam with himself at the helm.

power plant. Eventually, he also gained control over the design, building and testing of all nuclear-powered ships as well as the selection and training of the officers and enlisted men responsible for operating those ships.

When he couldn't get what he wanted from the Navy, Rickover went to Congress, the most influential members of which were in his fold. The most illustrative example of his congressional influence came after he was passed over for selection to Admiral for the second time in 1952. Normally, this meant forced retirement within a year, but pressure from the Senate Armed Services Committee caused the Navy to set a precedent by making Rickover eligible for a third selection board and he was selected for Rear Admiral in 1953. He only remained on active duty past mandatory retirement age of sixty two because of successive two-year presidential extensions he orchestrated through his admirers in Congress.

In the words of Admiral Galantin, the Chief of Navy Material (successor to BUSHIPS), from 1966 to 1970: *Rickover had progressively performed a feat that could stand in comparison with the achievements of the federal government's greatest empire builder, J. Edgar Hoover. Rickover had ingeniously circumvented the normal bureaucratic way by carefully attending, from the very first, to acquiring autonomy before acquiring resources.*²³

By the summer of 1953, Rickover had the Navy nuclear power program running at full steam with himself at the helm, sometimes with the grudging assistance from his colleagues in BUSHIPS, many of whom he had run rough shod over in the past. He had directed the design, building and operation of two full-size prototypes of the first two submarine reactors. He had contracted with Electric

Boat Company in New London, Connecticut, for the construction of the first two nuclear submarines. He had hand-picked the civilians and Navy engineers to work for his Naval Reactors Bureau, as well as

the officers and enlisted who would operate the submarines.

Among those first selected to spend two years studying atomic physics and nuclear reactors at Oak Ridge National Laboratory, and Argonne National Laboratory, was the man who Rickover eventually would select to command the first nuclear-powered submarine, *Nautilus* (SSN-571), Commander Eugene Wilkinson. Wilkinson was a native of Southern California. He grew up in Long Beach, California, and graduated from San Diego State University, where he subsequently taught chemistry and mathematics for two years. At the beginning of World War II, Wilkinson was given a commission and sent to Submarine School. He

participated in eight submarine war patrols during World War II and earned a Silver Star for valor, while serving on *Darter* (SS-227). He had commanded three diesel submarines before being selected by Rickover. In a 2001 biography of Admiral Rickover, Francis Duncan wrote that Rickover chose Wilkinson because *he was intelligent, and free from the deadly embrace of tradition* – a reference to his not being a graduate of the United States Naval Academy. On 17 January 1955, as Wilkinson steered *Nautilus* out of the shipyard, with Rickover on the bridge, he sent the famous message *Underway on nuclear power*. [Vice Admiral Wilkinson, a long-time San Diego resident, with a distinguished Navy and civilian career, passed away in July 2013, a true pioneer of the nuclear submarine Navy.²⁴]



Admiral Rickover, 1955

Courtesy of the U.S. Navy, Official U.S. Navy Photo

SUBMERGED FOR 3,049 MILES

Nautilus Arrives, Breaks Undersea Distance Mark

By LESTER BELL.
The San Diego Union's
Military Writer

The Nautilus, driven smoothly by atomic power, swept proudly past Point Loma yesterday morning with a new mark in the submarine record book which she has rewritten time and time again.

On her maiden voyage to the West Coast, the Nautilus surfaced 10 miles off San Diego at 8 a.m. yesterday after running submerged 3,049 miles from the Panama Canal.

Capt. Eugene P. Wilkinson of San Diego, the husky and amiable skipper of the revolutionary submarine, told reporters the Nautilus added 1,000 miles to the old record in her seven-day undersea run.

Since 11 a.m. on Jan. 17, 1955, when Wilkinson sent the epic message, "Under way on nuclear power," the Nautilus has demolished distance, endurance and sustained high-speed records for submarines.

The Nautilus is on a two-month loan from the Atlantic Fleet to acquaint Pacific personnel with the capabilities of a submarine that can stay submerged indefinitely.

The Nautilus can divorce itself from surface atmosphere because her nuclear reactor requires no oxygen

A Woman's View

The Nautilus presents a new concept in living aboard a submarine. How does this housekeeping situation look to a woman? The San Diego Union sent Sue Seay of the Women's Page staff to find out. Read her account of her visit on Page A-8.

and her crew can survive comfortably on revitalized air.

She reported for duty with the Pacific Fleet on May 22, the day she dived off Panama for the 18-knot undersea voyage to San Diego.

"To get here on time," Wilkinson said at yesterday's press conference in the crews mess, "we had to submerge."

He pointed out that the Nautilus makes her best speed submerged. Still se-

(Continued on Page A-3, Col. 4)

The first nuclear submarine to visit San Diego brought much excitement to the waterfront.

The San Diego Union, 30 May 1957, accessed from the San Diego State University Archives, 10 December 2013

Nautilus Arrives Here, Sets New Undersea Record Of 3,049 Miles

(Continued from Page 1)
cret, it is officially stated as "more than 20 knots." However, interpretations of Navy press releases indicate a top speed of about 30 knots.

Wilkinson said he is convinced the Nautilus could sail submerged around the world if Navy operating schedules could spare her for the necessary 63 days. He said the speed would be about 15 knots.

As for the crew's endurance on such an extended undersea cruise, Wilkinson said, "It is simply a question of motivation."

He said if the Nautilus submariners knew they were making the first round-the-world undersea voyage they would have the staying power to resist boredom.

Her first assignment to the Pacific will find the Nautilus getting under way next week for "Operation Home Run," a fleet exercise scheduled for June 3-12 off California.

"We haven't got our operational orders yet," Wilkinson said with a grin. "But we don't figure to strike out."

The big, dark-gray submarine bore down the channel with white water boiling

against her whale-head bow. Her conning tower bulked large against the leaden sky, dwarfing the 40-odd men who made her ready for mooring. As they broke out heaving lines and mooring lines, or stood at quarters to return honors, a fresh morning wind chilled the air. But a warm welcome awaited them at Navy Pier.

The first San Diego officer to greet the Nautilus was Capt. John E. Lee, commander of Submarine Flotilla One. He boarded her beyond the channel buoys. The Nautilus was no stranger to Lee. He had accepted her for the Navy.

The Nautilus stacked speed coming up channel, accompanied by five Navy tugboats saluting her with spouting fire nozzles. Planes passed overhead in salute and a helicopter hovered about her like a hummingbird on its photographic mission.

Among the tugboats was one bearing reporters and photographers dispatched in the welcoming flotilla.

The Nautilus went alongside Navy Pier as smartly as an admiral's barge and with as little trouble. Her lines were



CAPT. EUGENE WILKINSON
Home Port For Skipper

soon made fast and welcoming dignitaries were piped aboard. Vice Adm. Robert L. Denison, commander, First Fleet, was the first aboard, followed by Rear Adm. Charles C. Hartman, commander of the 11th Naval District.

Mrs. Janice Wilkinson, the commanding officer's wife, was the first woman aboard. She had flown here from New London, Conn., to greet her husband. However, a San Diego address, 1830 Sunset Blvd., is their permanent home.

If the Nautilus is impressive from the topside, she is even more spacious below. More than 300 feet long and 28 feet on the beam, the Nautilus displaces 3,000 tons, considerably more than a conventional submarine.

Because she does not require fuel tanks, more space is available for operations and living areas. Men sleep in Pullman-type berthing compartments and no longer nest their bunks among the torpedoes. They can stow a seabag of clothing in comparatively commodious lockers as against the bare necessities found in cramped diesel subs.

The ladder leading down into the control room appeared as wide as a grand staircase. While a man can stand in the middle of the torpedo room and not touch a torpedo on either side with outstretched arms.

The first true submersible, Nautilus (4100 tons, 320 foot length), set many records for submerged endurance in the early days of operation. One of those records was the 3,049 miles she traveled submerged while enroute to San Diego via the Panama Canal. The first nuclear submarine to visit San Diego brought much excitement to the waterfront. Arriving on 29 May 1957, the Nautilus proceeded up the channel "accompanied by five Navy tugboats saluting her with fire nozzles. Planes passed overhead and a helicopter hovered over her like a hummingbird." She went alongside Navy Pier "as smartly as an admiral's barge and with as little trouble," with a large crowd of dignitaries, families and reporters to welcome her. After a five day visit, Nautilus got underway to participate in the first Pacific Fleet exercise involving a nuclear submarine, returning for a short

visit in early July on her way back to the Atlantic, Nautilus returned to San Diego with less fanfare, for the third and last time in May 1958. She was enroute to her historic passage across the North Pole. Delayed by bad ice conditions, she finally reached the Pole on 3 August 1958 and continued on until she surfaced northeast of Greenland, 96 hours and 1830 miles later.²⁵

Other than her nuclear power plant, Nautilus, like the five submarines that followed her (Seawolf SSN-575), (4100 tons, 337 foot length), and the four boats of the Skate-class, scaled down for the sake of economy to Tang-class size (2800 tons, 268 foot length), closely followed the design of the German Type XXI submarine, particularly in hull configuration and twin screw configuration. This limited their maximum submerged speed and also contributed to significant levels of radiated noise

that could be picked up by an enemy submarine or surface ship. *Seawolf* was unique in that the fluid transferring heat from the reactor to the steam generators was initially liquid sodium instead of water. The Navy soon learned that the sodium caused rapid corrosion of the stainless steel piping, causing leaks and frequent shipyard repairs. In 1958, the sodium-cooled reactor was replaced with a conventional pressurized water reactor.²⁶

The first nuclear-powered submarines to be homeported in San Diego were: *Sculpin* (SSN-590), *Scamp* (SSN-588) and *Snook* (SSN-592), beginning with *Sculpin*'s arrival in early June 1961. These boats were all of the *Skipjack* (SSN-585)-class (3513 tons, 252 foot length), with hulls designed after the cigar shape of the research submarine *Albacore*. Evolutionary quieting measures and a single low-speed propeller, combined with a more powerful reactor. (The 15,000 shaft horsepower "S5W" reactor design, with minimal changes, except for step improvements in core life, would eventually be used in ninety-nine U.S. submarines). The result was a faster, more maneuverable and somewhat quieter submarine that could cruise over twice the distance *Nautilus* could travel, before undertaking expensive and lengthy shipyard refueling. Along with the three less capable *Skate*-class submarines homeported in Pearl Harbor, the only nuclear attack submarines on the West Coast, until the arrival of *Permit* (SSN-594), were the work horses of the Pacific Submarine Force. *Snook*, for example, conducted ten western Pacific deployments between 1962 and 1978. In 1962, she was the first nuclear submarine to deploy as part of an Aircraft Carrier Hunter Killer Group, attached to Carrier Division SEVENTEEN for the entire seven month deployment. *Sculpin*, *Snook* and *Scamp* all participated in the Vietnam War, conducting surveillance operations in the South China Sea. These three submarines remained homeported in San Diego until the mid-1970s, when they left for the East Coast.^{27, 28}



The first nuclear-powered submarines to be homeported in San Diego were *Sculpin* (SSN-590), *Scamp* (SSN-588) and *Snook* (SSN-592), beginning with *Sculpin*'s arrival in early June 1961.

Nuclear Submarines: The Second Generation



The first of the *Thresher* design to arrive in San Diego, in May 1962, was *Permit*, for which the thirteen-ship class was renamed after the loss of *Thresher*.

©San Diego History Center, from the San Diego Union Tribune Collection, file #UT85_B7440.7

Although the *Skipjack*-class submarines were a significant improvement of their predecessors, they only had the maximum depth capability of the recently constructed fleet boats - about 700 feet. They also were relatively noisy and had limited long-range sonar capability and minimal electronic surveillance capability. In 1956 the CNO, Admiral Arleigh Burke, requested the Committee of Undersea Warfare of the National Academy of Sciences, to study the effect of advanced technology on submarine warfare. The results of the study led (in January 1958), to the Navy ordering the first of a new generation of quieter, deep diving and otherwise more advanced submarines, the *Thresher* (SSN-593) class, the first modern U.S. submarine - the lineal predecessor of all attack-type submarines and a true warship. Using HY-80 steel (capable of withstanding 80,000 tons per square inch of water pressure) for the first time in a submarine hull, her depth capability increased significantly. (The exact test depth is still classified.) A large new bow-mounted spherical sonar provided improved active and passive sonar range and accuracy, and combined with a new integrated digital fire control system, significantly improved the ability to track and accurately attack potential targets. Rubber sound mounts isolated rotating machinery (e.g., pumps, turbines and reduction gear) from the hull. This, and a new screw design, significantly reduced radiated noise that could be picked up by enemy sonar. Because the *Thresher* and following ships of the class were heavier (4300 tons), and longer (279 feet) than the *Skipjack*-class, the ship was somewhat slower.²⁹

Thresher was commissioned on 3 August 1961, and, after extensive trials to test the new systems and evaluate the effectiveness of the sound quieting, she returned to Portsmouth Naval Shipyard for a nine month post-shakedown availability. During the first sea-trials after the overhaul, on 9 April 1963, while at test depth, she was lost with all hands due to a flooding casualty, believed to be caused by the failure of a seawater piping joint, combined with failure of the high pressure ballast blow system (because of icing in the piping),

among other potentially extenuating problems. The inability to determine the actual cause led to an exhaustive review of submarine design, construction and operation. The resulting comprehensive "Sub Safe" program included more rigorous inspection of material and workmanship, redesign and replacement of some components and piping systems, and improved training and operation procedures. All operating nuclear-powered submarines and those under construction completed the Sub Safe program in the next few years at great additional expense.

The Sub Safe program continues to be one of the most important aspects of submarine design, construction and operation to this day. The *Thresher* tragedy also led to the development of the Deep Submergence Rescue System in the mid-1960s. This system was based at the North Island Naval Air Station, where the current Submarine Rescue Command is located.³⁰

Eight submarines of the original *Thresher* design (with Sub Safe improvements) called San Diego their homeport at various times from the early 1960s, through the early 1990s. All eight of these submarines: *Permit* (SSN-594), *Plunger* (SSN-595), *Barb* (SSN-596), *Pollack* (SSN-603), *Haddo* (SSN-604), *Guardfish* (SSN-612), *Flasher* (SSN-613) and *Haddock* (SSN-621), were assigned to Submarine Squadron THREE. *Flasher* was known as a "long hull 594," because it had been lengthened by thirteen feet to improve habitability and add room to the torpedo room for the longer Mark 48 torpedoes. As the first true deep diving, quiet and fast attack submarine class, they each had long and distinguished careers, while developing new submarine tactics, participating in new weapons development and carrying the Cold War to the doorstep of Russia, during numerous lengthy (normally six to seven months, but longer during crises) western Pacific deployments. The first to arrive in San Diego, in May 1962, was *Permit*, for which the thirteen-ship class was renamed after the loss of *Thresher*. After final acceptance trials in January 1963, she participated in a thorough evaluation of the SUBROC missile, which was capable of dropping a nuclear depth charge. On 28 March, *Permit* became the first submarine to successfully test fire a SUBROC. That was the auspicious beginning of a career that resulted in her crew being awarded three Meritorious Unit Commendations and three Navy Unit Commendations for operations in the western Pacific. This number of

rarely given awards, including the Presidential Unit Commendation, is typical of those earned during the height of the Cold War by submarines operating out of San Diego.³¹

One unclassified example of these operations is detailed by the former Commanding Officer of *Guardfish*, Captain David Minton. In May 1972, the Vietnam War was heating up and the Paris peace talks had broken off. U.S. Naval forces had commenced mining Haiphong, and other major

Vietnamese ports, to deny the North Vietnam Army resupplies from sea. On 9 May, *Guardfish*, on patrol in the Sea of Japan near Vladivostok, the major Russian naval base, received a message of a possible Russian response to the mining. The next day *Guardfish* detected a Russian *Echo II* submarine departing

port. The *Echo II*, capable of firing 200-mile range surface-to-surface missiles, submerged and headed south at high speed. *Guardfish* followed the *Echo II*, relaying radio reports to SUBPAC via P3 Orion ASW aircraft, until she reached the South China Sea on 18 May, where the *Echo II* loitered for the next eight days, about 700 miles from U.S. aircraft carriers. Meanwhile, President Nixon went to Moscow for his historic summit meeting with Soviet General Secretary, Leonid Brezhnev. During the meeting on 24 May, National Security Advisor Henry Kissinger informed Brezhnev that the U.S. was aware of the presence of Russian submarines near Vietnam and considered that presence highly provocative and dangerous. Two days later *Echo II* turned north and established a patrol south of Okinawa. *Echo* spotted *Guardfish's* periscope, while both submarines were at periscope depth, and commenced radical maneuvers causing *Guardfish* to lose contact. *Guardfish* headed for Guam and arrived on 10 June, after 123 days submerged with only an eight-day refit for a break. For the operation, Minton was awarded the Distinguished Service Medal and the ship was awarded the Navy Unit Commendation. This operation and many others like it, combined with relatively cramped living and working spaces, and the many months away from home, earned the *Permit* (SSN-594) class crews the title of "594 Tough." All of the eight *Permit*-class remained under the command of Submarine Squadron THREE, until they were decommissioned in the late-1980s and early-1990s.³²

The Sub Safe program continues to be one of the most important aspects of submarine design, construction and operation to this day.



***Gurnard* (SSN-662) is waterborne following her launching at Mare Island Naval Shipyard on 20 May 1967.**

Photo courtesy of the Vallejo Naval and Historical Museum and battleshipiowa.org. (via Bill Gonyo).

By 1961, re-engineering had been ordered for the *Permit*-class, to improve the engine room arrangement for improved access, enlarge the sail to improve depth-keeping at periscope depth, and to make room for an electronic counter measures (ECM) mast, a second radio mast and a second periscope, and improve overall ship silencing. Eventually, the amount of desired changes became so extensive that the modified design was redesignated as a new class, *Sturgeon* (SSN-637). The overall changes from the *Permit*-class resulted in improved mission capability, maintainability and habitability. The *Sturgeon*-class submarines were also designed to operate under the ice pack of the Arctic Ocean with a hardened sail, and with sail planes that could rotate ninety degrees to allow them to pass vertically through the ice. There were thirty-seven *Sturgeon*-class submarines commissioned between 1967 and 1975. The first twenty-eight had a submerged displacement of 4600 tons and were 292 feet long. The increases in weight and length again came with a commensurate loss of speed. The last nine 637s were lengthened eight feet to provide for the addition of a combined radio/ESM room, a lengthened torpedo room and added living space.^{33 34}

Eight *Sturgeon*-class submarines eventually called San Diego home. The first to arrive was *Gurnard* (SSN-662) in 1972, followed by *Hawkbill* (SSN-666), *Pintado* (SSN-672), *Guitarro* (SSN-665), *Drum* (SSN-677), *William H. Bates* (SSN-680), *Pogy* (SSN-647) and *Puffer* (SSN-652). In 1986, these

submarines, initially attached to Submarine Group FIVE, were reassigned to the newly established Submarine Squadron ELEVEN, except for *Guitarro* and *Gurnard*, which were assigned to Submarine Squadron THREE. These submarines continued the tasks assigned to the earlier SSNs, while developing new tactics to take advantage of their improved capabilities, and supporting new weapons development, like the Mark 48 torpedo, which was extensively tested at the underwater weapons range near San Clemente

It was argued that a class of high-speed submarines was needed to keep up with the speeds of our carriers, their escorts, and support ships.

Island, and the Harpoon ship-to-ship missile, first test fired from a submarine by *Pintado* in 1974. Because of their under ice capability, these submarines also conducted voyages to the Arctic with the support of the Navy's Arctic Submarine Laboratory in San Diego. The 637s, with their improved quieting, longer-range sonar and ESM capability, were ideally suited for missions involving surveillance and tracking of other submarines. Their capabilities were exercised often in training and during numerous deployments to the western Pacific, through the 1980s and 1990s.

Nuclear Submarines: The Next Generation

During the Cold War, it became clear there was a need to protect deployed aircraft carriers and the escort ships of their battle groups from the undersea threats of Soviet and other adversaries' submarines. The most effective anti-submarine platforms were our own submarines. So, in order to authorize and fund further numbers and improvements in U.S. submarines, it was argued that a class of high-speed submarines was needed to keep up with the speeds of our carriers, their escorts, and support ships. The *Los Angeles* (SSN-688) class of fast attack nuclear submarines was the result. Its original design was focused on improved speed capabilities, as well as improved quietness. Those design considerations included the use of a much more powerful propulsion plant, while keeping the ship's relative weight low for its size. For instance, the hull steel was thinner. The multiple interior watertight bulkheads of past submarine designs caused too much weight and

were therefore reduced to a single bulkhead in the 688-class design. The sail or "fairwater" that housed the masts, antennas and periscopes was made thinner and lighter than the previous ice-penetrating sails of the *Sturgeon* (SSN-637)-class. The overall design for speed was a success, while it also improved acoustic stealth, and allowed room for future capability improvements through later modifications of the 688-class. Much like Tom Cruise's character quipped (in the blockbuster aviation movie *Top Gun*, 1985), *I feel the need for speed* – the need for speed in the 688-class turned out to be a real advantage for San Diego submarines over the years.

San Diego's first *Los Angeles*-class submarine, *La Jolla* (SSN-701), arrived in its namesake city with great fanfare on 21 March 1982.

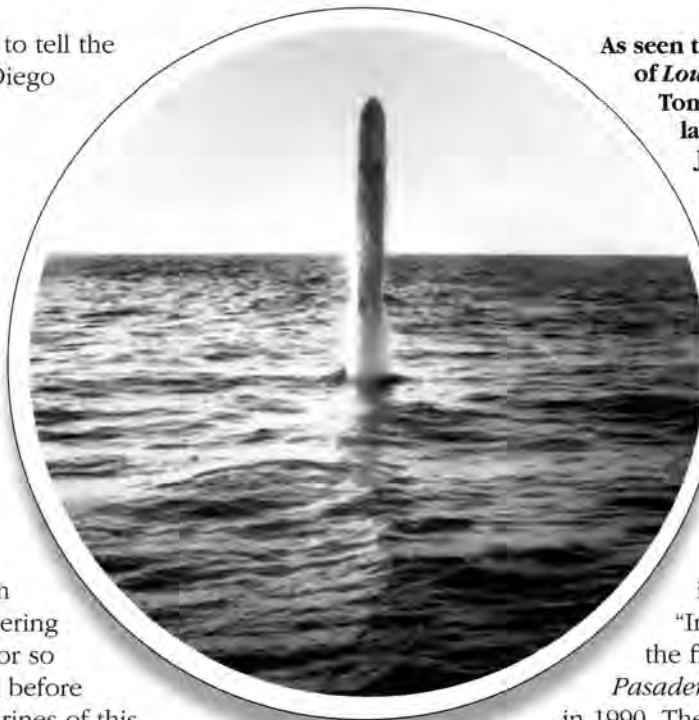
From the Shirley Wilson Collection, Maritime Museum of San Diego



Perhaps the best way to tell the story of 688s in San Diego is to begin with the hometown namesake submarine, *La Jolla* (SSN-701). Even though the lead ship of its class, the *Los Angeles* (SSN-688), was designed and built in the 1970s, it wasn't until 21 March 1982 that San Diego would see its first 688 homeported at the submarine base in Point Loma. This was in part due to production delays with the early boats of this submarine class, from thorough inspections uncovering hull welds on a half dozen or so 688s that needed reworking before commissioning. The submarines of this class were the first to be named after a U.S. city rather than a fish or deceased notable people. As Admiral Rickover, the "father of nuclear submarines," was once quoted, *Fish don't vote*.³⁵ It was only fitting that the U.S. Congressman from San Diego, Bob Wilson, was given the privilege to name the first submarine stationed in his city after *La Jolla*, one of its villages. In fact, it is the only U.S. submarine ever to be named after a village.³⁶

On its arrival, *La Jolla* was celebrated and enjoyed many initial successes as the first 688 homeported in San Diego. She became the first 688 to launch a Tomahawk cruise missile at the test ranges on San Clemente Island and in the Nevada desert. She was the first 688 to deploy from San Diego to the Western Pacific for six months in 1984. She was an advanced 2nd Flight 688, and the first in the wave of similar sister submarines – *Houston* (SSN-713) and *Portsmouth* (SSN-707) in 1984, and *Salt Lake City* (SSN-716) in 1985, all homeported in San Diego. This influx of 688s led to the creation (in July 1986), of what was to later become San Diego's all-688 squadron, Submarine Squadron ELEVEN.

San Diego then started receiving the next flight of 688's, originally known as the 3rd Flight. They were designed with even more horsepower (and thus speed). They were also the first to have a Vertical Launch System (VLS) of twelve tubes for conventional Tomahawk land-attack missiles, for which they were initially dubbed "baby boomers" (in a manner reminiscent of the nation's strategic ballistic missile submarines, or SSBNs, which were informally called "boomers"). The first 688s with



As seen through the periscope of *Louisville* (SSN-724), a Tomahawk cruise missile is launched against Iraq on 19 January 1991. This was the first warshot launched against an enemy by a U.S. submarine since World War II.

Courtesy of R. D. Baker

the VLS to homeport in San Diego were *Louisville* (SSN-724) in 1987, and *Chicago* (SSN-721) in 1988.

The final variant of 688's to be homeported in San Diego was the "Improved 688" or "688i," the first of which was *Pasadena* (SSN-752), arriving in 1990. The 688i-class was the first

U.S. submarine design in forty years to incorporate bow-planes (for better depth control at low speeds), as well as hardened sails and other features for improved under-ice capabilities.

In the decade after the Cold War, Submarine Squadron ELEVEN became the sole submarine squadron in San Diego, comprised of only 688-class submarines, like *La Jolla* and her successors. These 688-class submarines that have called San Diego home, in order of arrival, include: *Asheville* (SSN-758), *Jefferson City* (SSN-759), *Bremerton* (SSN-698), *Helena* (SSN-725), *Topeka* (SSN-754), *Hampton* (SSN-767), *San Francisco* (SSN-711), and *Albuquerque* (SSN-706).

The arrival of 688s to San Diego was coordinated to coincide with the initial 688 submarines, such as *La Jolla* leaving for mid-life refueling, or in some cases, early decommissioning due to defense spending cuts of the 1990s, following the Cold War and the first Gulf War. *La Jolla* remained a San Diego boat until its refuelling overhaul in Portsmouth, New Hampshire, in 1998, following which she was homeported in Pearl Harbor, Hawaii. This San Diego namesake nuclear submarine remains on active duty in its thirty-third year of service, until its scheduled conversion to a Moored Training Ship in Charleston, South Carolina, after its final year of distinguished service at sea.

San Diego has the distinction of being the Pacific's submarine homeport most distant to the overseas operating areas to which U.S. attack submarines normally deploy. Despite this geographic reality, there will always be a need to maintain a good number of submarines homeported in San Diego, as was well argued by U.S. Congressman Bob Wilson in the 1960s,



Congressman Wilson, (left) aboard *La Jolla* in 1989, was given the privilege to name the first submarine stationed in his city after *La Jolla*, one of its villages. In fact, it is the only U.S. submarine ever to be named after a village. *La Jolla* (SSN-701) enjoys a record of many “firsts” in San Diego submarine history.

*From the Shirley Wilson Collection,
Maritime Museum of San Diego*

and later during the post Cold War downsizing – to support and train the components of the largest naval fleet presence in the U.S. in San Diego. Despite these long distances to deployment areas, San Diego was still the Pacific's point of origin for staging the first submarine missile launch of the 1991 Operation Desert Storm, the first Gulf War, thanks to that “need for speed” that was incorporated into the 688 design years earlier. The result was the ability of *Louisville* (SSN-724) to conduct an unprecedented 14,000 nautical mile high-speed submerged transit from San Diego to the Indian Ocean, North Arabian Sea and Red Sea, so that she was in a position to strike Iraq with conventional Tomahawk land-attack missiles, on the orders of the National Command Authority, 19 January 1991. This was the first use of a weapon launched by a U.S. submarine in an act of war since the days of World War II. It marked the distinct transition from the days of predominately Cold War missions, to the Strike missions of the future.

NOTES

- 1 The *Dictionary of American Fighting Ships* (DANFS), (The Naval History and Heritage Command, Washington D.C., no date). This website contains condensed histories of operations for most U.S. warships through c. 1974, as well as total numbers of active ships of each type for every year between 1886 and 2011.
- 2 Norman Polmar, *The American Submarine, 2nd Edition*, (Annapolis: Nautical and Aviation Publishing Company of America, 1988) 75. Norman Polmar is a prolific author and an internationally known analyst, consultant, and award-winning author specializing in naval, aviation and intelligence areas.
- 3 Ibid., 77.
- 4 Ibid., 79.
- 5 Thomas Parrish, *The Submarine, a History*, (New York City: Penguin Group Inc., 2005) 428.
- 6 Admiral I. J. Galantin, USN *Submarine Admiral. From Battlewagons to Ballistic Missiles, USA*. (The Board of Trustees of the University of Illinois, 1995), 136. Admiral Galantin's book is written with exceptional inside knowledge of the evolution of the modern submarine force. He was awarded a Navy Cross and three Silver Stars for successful war patrols as Commanding Officer of *Halibut*. He served on several operational staffs, including Submarine Squadron FIVE in San Diego and COMSUBLANT. Between 1949 and 1965, he had several tours in the Submarine Warfare and Special Project Divisions of the CNO's staff and he served as the first Chief of the Navy Material Command from 1966 to 1970.
- 7 Polmar, 83.
- 8 DANFS, *Remora* (SS-487) Ship's History.
- 9 Cold War Panel Interview with retired Vice Admiral Bernard Kauderer and retired Navy Captains Dick Bivin, Joe Meyer and Bob Merrill, 12/2/13. Admiral Kauderer also served as Commanding Officer of *Dixon* and Commander Submarine Group FIVE in San Diego as well as being the only officer to command both Submarine Forces Pacific and Atlantic. Captains Bivin, Meyer and Murrill served in several submarines and submarine commands in San Diego.
- 10 Ibid.
- 11 DANFS, *Baya* (AGSS-318) Ship's History.
- 12 DANFS, *Perch* (SSP-313) Ship's History.
- 13 Polmar, 95.
- 14 Ibid., 97.
- 15 DANFS, *Blueback* (SS-581) and *Bonefish* (SS-582) Ship's History
- 16 Polmar, 103.
- 17 Ibid., 105.
- 18 DANFS, *Barbero* (SSG-317) Ship's History
- 19 Polmar, 105.
- 20 Parrish, 435-437.
- 21 Ibid., 439.
- 22 Ibid., 441.
- 23 Ibid., 447.
- 24 *New York Times* Obituary of Vice Admiral Eugene P. Wilkerson, 16 July 2013.
- 25 *San Diego Union*, page A-1, 30 May 1957.
- 26 Polmar, 117.
- 27 Ibid., 115.
- 28 DANFS, *Sculpin* (SSN-590), *Scamp* (SSN-588) and *Snook* (SSN-592) Ship's Histories
- 29 Norman Friedman, *U.S. Submarines since 1945, An Illustrated Design History*, (Annapolis: U.S. Naval Institute Press, 1994), 142-144. Friedman provides an exceptional history of the development and technical details of each class of U.S. submarine, from 1945 to the early 1990s.
- 30 Polmar, 143.
- 31 DANFS
- 32 David Randall Hinkle, editor, *United States Submarines*, (Hong Kong: Hugh Lauter Levin Associates, Inc., 2002), 249-251. This collaborative effort between Sonalyst Inc. and the Naval Submarine League commemorated the 100th anniversary of the United States Submarine Service in 2000.
- 33 Friedman, 147.
- 34 Hinkle, 237.
- 35 Norman Polmar, *The Naval Institute Guide to the Ships and Aircraft of the U.S. Fleet*, (Naval Institute Press, 2005), 70.
- 36 Shirley Wilson Collection, Maritime Museum of San Diego, 130.1, 9/28/1976 letter.

Post-Cold War Submarine Operations in San Diego

Complexity of San Diego Submarine Operations Grows as National Defense Requirements Evolve

By Commander Brien W. Dickson, USN

Commander Brien Dickson currently serves as the Deputy Commodore for Training on the staff of Commander Submarine Squadron ELEVEN in San Diego. Originally from Casper, Wyoming, he graduated with distinction from the United States Naval Academy in 1993, with a Bachelor of Science degree in Aerospace Engineering.

As a career submarine officer, he served on *Kamehameha* (SSN-642), *Ohio* (SSBN-726), and *La Jolla* (SSN-701), and commanded *Jefferson City* (SSN-759). Under his command, *Jefferson City* deployed to the Arabian Gulf in 2011-2012, earning a Meritorious Unit Citation and the Battle Efficiency "E" for 2012.

He has been awarded two Defense Meritorious Service Medals and five Navy & Marine Corps Commendation Medals. The Naval Submarine League recognized him in 2013 with the RADM Jack N. Darby award for his inspirational leadership and excellence in command.

At the end of the Cold War, with no nation capable of challenging the U. S. Navy on the high seas, the Submarine Force faced a similar challenge as it did following World War II – the seeming loss of its primary mission. However, in September 1992, the Navy published “. . . From the Sea: Preparing the Naval Service for the 21st Century.” In that white paper, the Navy laid out a clear element to the Navy’s mission to “Provide the initial, enabling capability for joint operations.” This new focus led to an increased emphasis on Strike, Naval Special Warfare Support, and littoral (coastal) operations. The emphasis on littoral regions meant that U.S. submarines would shift the focus of their operations to shallow waters and be called upon to counter potential adversaries’ diesel threats.

The submarine, which had proven essential for sea control against the Japanese during World War II, and as a counter to the Soviet maritime threat during the Cold War, now had a proven tactical weapon in the Tomahawk cruise missile.¹ The



Louisville (SSN-724)

Courtesy of the Maritime Museum of San Diego

Louisville had just conducted the first submarine launched Tomahawk missile strike against an Iraqi target. In doing so, Louisville had fired the first shot in anger from a U.S. submarine since the close of World War II.

Louisville's 1991 Tomahawk launch marked a transition of mission emphasis to the type of engagements that United States would see for the next two decades. A submarine had directly attacked targets on land for the first time since World War II when Gene Fluckey, in command of the submarine *Barb* (SS-220), conducted rocket attacks on the Japanese ports

The Louisville Slugger

By Captain Frank W. Stewart, USN (Ret.)

Retired Navy Captain Frank W. Stewart is a native of upstate New York and graduated from Cornell University in 1971, with a commission in the Navy through the ROTC program. His naval career spanned over twenty-seven years and was spent primarily in the submarine service. He served as Commanding Officer of *Barb* (SSN-596), *Louisville* (SSN-724) and closed out his career as Commanding Officer of *Henry M. Jackson* (SSBN-730)(Gold).

He earned multiple awards of the Legions of Merit and a Bronze Star, and contributed to multiple unit awards including four Presidential Unit Citations (Navy) and eight Battle Efficiency "E's".

of Shiritori and Kashiho on 23 July 1945.² Although the Tomahawk was originally developed with anti-ship and nuclear warhead variants, the conventional land attack variants of the weapon have proven the most useful. Originally, the Tomahawk Land Attack Missile (TLAM) was guided by an inertial navigation system capable of updating its position through Terrain Contour Matching (TERCOM), automated radar navigation, and the use of visual overhead images with Digital Scene Matching Area Correlation (DISMAC). Although extremely accurate, mission planning was a lengthy process involving production of the radar "maps" and digital scenes required to guide the TLAMs to their targets. The latest versions of the TLAM are now guided on their 1,000 mile journeys to their targets using global positioning satellite (GPS) data. This has enabled submarines to rapidly engage mobile targets such as missile launchers.

San Diego played an important role in the development of the Tomahawk. The missiles were originally built by General Dynamics. Many of the Tomahawk test launches were performed from the Southern California Offshore Range (SCORE), near San Clemente Island, off the San Diego coast.

At the time of the invasion of Kuwait, *Louisville* (SSN-724) was operating out of San Diego, California, one of only three Pacific Fleet SSNs with the vertical launch Tomahawk weapons delivery system that provides twelve external missile tubes to increase SSN weapons delivery capability. *Louisville* departed San Diego in December 1990 for participation in Operation Desert Shield.

The ship sailed with a crew of about 130 men and a weapons load ready to support any warfare commander's tasking. After submerging west of San Diego, a high-speed transit to the northern Red Sea commenced. Our route took us across the Pacific Ocean, through the South Pacific islands and across the Indian Ocean to the southern entrance of the Red Sea. Throughout the transit the crew trained for strike warfare operations. Although diplomatic efforts were ongoing, message traffic gave little hope for a peaceful settlement to the crisis in Kuwait.

After becoming the first U.S. SSN to operate in the Red Sea, we learned that diplomatic efforts had failed and war with Iraq was a reality. Desert Shield had become Desert Storm. Our long hours of planning, training, and maintenance were going to be put to the ultimate test.

Louisville was operating in the northern Red Sea at periscope depth when the launch order tasking message was received by the radio room watch early on 19 January 1991. I then informed the crew of what was expected of us and the final preparations that were required. Following completion of the Tomahawk missile pre-launch checks, with morale and excitement the highest I had ever seen, battlestations were manned.

The periscope video system was placed in operation to enable recording and real-time observation of the launch. When all prerequisites were met, I gave the order to launch the Tomahawk missile toward its Iraqi target. As the missile left the ship a small shudder was felt, followed by sighting of the Tomahawk as it broke the surface. There were cheers all around. *Louisville* had just conducted the first submarine launched Tomahawk missile strike against an Iraqi target. In doing so, *Louisville* had fired the first shot in anger from a U.S. submarine since the close of World War II.

The successful execution of this historic strike was the culmination of a tremendous amount of effort by everyone involved. *Louisville* had transited farther and faster than any previous ship of any type in any navy. Once on station the mission was flawlessly conducted, demonstrating a capability that is a key element of our nation's conventional deterrence.

Louisville's historic deployment concluded when the ship returned home to San Diego on 29 April 1991 to a spectacular homecoming, including the presentation of special edition "Louisville Slugger" bats to each member of the crew, commemorating our Tomahawk strike.



Courtesy of R. D. Baker



The U.S. Navy has had a long history with San Clemente Island, where there have been numerous exercises including amphibious landings, gunnery exercises, and naval special warfare training.

Besides providing an excellent test range for missiles, the SCORE played an instrumental part in training submarine crews. The U.S. Navy has had a long history with San Clemente Island, where there have been numerous exercises including amphibious landings, gunnery exercises, and naval special warfare training. In 1985, SCORE added the Southern California Anti-Submarine Warfare Range (SOAR), an instrumented three-dimensional (air, surface and subsurface) tracking range for training and evaluating the performance of undersea warfare (USW) crews, platforms and equipment.

At SCORE, it was fittingly the San Diego nuclear-powered fast attack submarine *Barb* (SSN-596) that conducted the first submerged Tomahawk shot on 2 February 1978.³ Advanced versions of *Los Angeles*-class (or 688-class) submarines built in the 1980s added twelve vertical launch system (VLS) tubes to carry Tomahawk cruise missiles, increasing the weapons load by approximately fifty percent. *Louisville* was one of the first of these upgraded 688s and executed the first VLS Tomahawk test launch in March 1988.⁴ It was also at SCORE that the British submarine HMS *Splendid* (S-106) shot the first British TLAM, hitting a target on San Clemente Island on 19 November 1998.

The Chilean submarine CS *Carrera* (SS-22) departs Naval Base Point Loma on 2 November 2011.

Courtesy of Commander, Submarine Squadron ELEVEN



Principal range users are West Coast air, surface and submarine commands. Located west of San Clemente Island, sixty-eight miles off the Southern California coast, SOAR now provides 670 square miles of area instrumented for USW and Anti-Submarine Warfare (ASW) training. SOAR has been well utilized; submarines alone have participated in over 2,133 training events on the range since 1988. During those events, seventy-five different submarines have logged over 28,775 hours.⁵ That extensive breadth of training provides our submarines an edge over other navies, which do not have the resources to match that level of training.

Much of the USW exercises conducted on the SOAR were focused on developing the Navy's ability to locate, track, and engage with quiet diesel submarines. While the U.S. Navy has employed only nuclear-powered submarines since 1990, due to their superior range, speed, and weapons capability; many of our adversaries have continued to employ diesel submarines. Modern diesel submarines have limited speed, are range restricted by their fuel supply, have limited weapons, and are extremely quiet. Within the littoral seas, they pose a significant risk to surface warships and general shipping.

Since the U.S. does not operate diesel submarines, the waters off San Diego have hosted some innovative training partnerships to ensure the readiness of our forces to counter diesel submarines. In 2001, the U.S. Navy initiated the international engagement program, the Diesel-Electric Submarine Initiative (DESI). As of 2008, the program had sponsored over seventeen diesel submarine deployments and provided for over 1,700 deployed submarine days in support of fleet pre-deployment exercises and bilateral tactical development events. These events provide benefits to both the U.S. Navy and the participating South American navies. For the U.S., the participation of South

American diesel-electric submarines in fleet training and certification events provides the U.S. the opportunity to practice and improve ASW training against current threats.⁶ Active DESI participants, who have deployed submarines to San Diego, include the navies of Peru and Chile. The Chilean submarines CS *Simpson* (S-21) and CS *Carrera* (SS-22) deployed to San Diego in 2007 and 2011 respectively, in support of U.S. Third Fleet exercises.

Besides the DESI program the U.S. Navy also hosted the Swedish attack submarine HMS *Gotland* in San Diego for a two year bilateral

training effort with the U.S. Navy's ASW. *Gotland* arrived on 27 June 2005, and provided a unique opportunity for the U.S. Navy to work with an air-independent propulsion (AIP) system submarine. *Gotland's* Chief Engineer, Lt. Cmdr. Rickard Boberg, explained: *The Stirling AIP system allows us to stay submerged at sea for weeks without having to come up to recharge our batteries or snorkel for air. With our low signatures and smaller sonar cross section, it will be a little more challenging for the [other] ships and submarines.*⁷

Although modern diesels are challenging targets, developments in sonar systems and improved understanding

of complex sound propagation in the ocean environment have helped the submarine crews to prepare for the threat. The Southern California operating areas provide a rich environment for building sonar team skills due to the variety of hydrographic features in the area. The shoals, reefs, sea mounts, offshore islands, and deep underwater canyons allow crews to experience sound propagation in a complex littoral environment first-hand, ensuring they are ready for forward deployed operations. The same area provides navigation challenges. Robust boating activity near Catalina Island, heavy merchant traffic near Los Angeles, and frequent military exercises out of San Diego provide a challenging training environment. Hawaii and Seattle-based submarines frequently come to San Diego for those reasons.



***Gotland* provided a unique opportunity for the U. S. Navy to work with an air-independent propulsion (AIP) system submarine.**

U.S. Navy Photo



Robust boating activity in San Diego waters provides a challenging training environment.
Courtesy of the Maritime Museum of San Diego

Kamehameha (SSBN-642) was one such Hawaii-based submarine that came to San Diego in 1997 and 1998. *Kamehameha* was originally a strategic ballistic missile submarine. The Navy refueled her at the end of the Cold War (a very costly process for a nuclear-powered ship), but no longer required her strategic missile capabilities. So instead of scrapping, the “*Kam*” underwent an extensive conversion process to carry two dry-deck shelters (DDS) in order to provide a covert platform for deploying naval special warfare personnel. The DDS units provided a three chamber system to enable divers and Navy SEALs to leave the submarine while submerged. The DDS’s rear chamber was the length of mid-sized car and provided storage for either a mini-submarine or rubber raiding craft.



The DDS units provided a three chamber system to enable divers and Navy SEALs to leave the submarine while submerged.

In 1998, *Kamehameha* worked with local San Diego SEAL teams and carried out training missions in San Diego harbor, executing simulated attacks against moored

ships with limpet mines and training exercises with marine mammals. Captain Howard Reese commanded *Kamehameha* during those operations and commented, *Everything we were doing, we were writing the book.* *Kamehameha*’s development work in the 1990s contributed to the capabilities later built into the four converted *Ohio*-class guided missile submarines (SSGNs).⁸

All of this training is solid preparation for submarines that deploy the world over. San Diego submarines have conducted over eighty-five deployments over the last twenty-three years. Since over half of the Submarine Squadron ELEVEN submarines are Improved 688s with advanced strike capabilities, they have preferentially been selected for deployments to the Persian Gulf, over halfway around the globe. Other San Diego-based submarines have conducted short deployments off of Central and South America to assist in counter

“Divers on Deck”

*U.S. Navy photo
DN-ST-95-00318,
by LCDR Mike Wood,
from the Defense Visual
Information Center*

drug operations. Most San Diego submarines in the last two decades have deployed to the western Pacific, where they conduct national tasking and international exercises with our partner nations throughout the Pacific Rim.

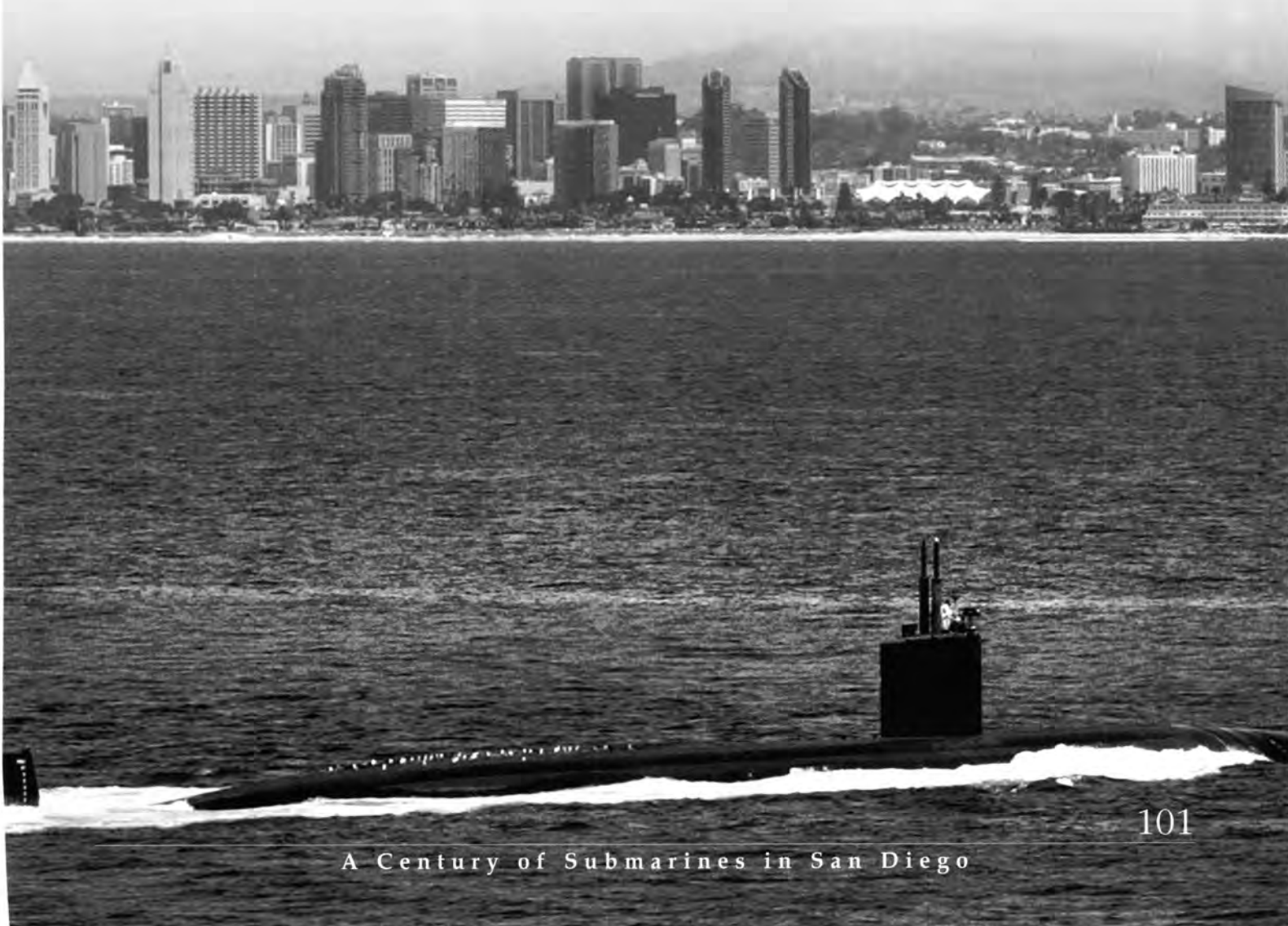
In the post-Cold War era, San Diego submarines moved from a focus on robust deep water ASW capabilities to that of providing a variety of other capabilities in support of our nation's objectives, by dominating the undersea environment and providing a significant portion of our nation's conventional strike capability. As current events develop, a resurgent Russia and China accelerated military buildup may prove to be catalysts for even more changes in San Diego submarines and perhaps a return to deep ocean ASW missions.

Jefferson City (SSN-759) moves quietly off the coast of San Diego, with Coronado and the city skyline in the background.

Courtesy of the Author

NOTES

- 1 Strategic Ballistic Missile Submarines (SSBNs) carry ballistic missiles to hold at risk targets on land. However, the submarine's capability is meant to deter major war rather than be used in smaller conflicts.
- 2 Eugene B. Fluckey, *Thunder Below* (University of Illinois, 1992) 388-390.
- 3 Editors of Publications International, Ltd., "Conquering Air and Space Timeline," science.howstuffworks.com
- 4 CDR T.F. Olson, *Los Angeles (SSN 688) Class Vertical Launch System, Steel Boats, Iron Men: History of the U.S. Submarine Force*, edited by Mike H. Rindskopf (Paducah, Kentucky: Turner Publishing, 1944), 51.
- 5 The author is especially appreciative of the assistance of Heidi Nevitt, SCORE Director of Operations, who provided much of the historical information on SCORE.
- 6 Jason Reagle, "DESI: Seven Years of U.S. Diesel-Electric Submarine Partnerships," *Undersea Warfare*, Issue 38, 2008.
- 7 Paul Cage, "Swedish Submarine HMS *Gotland* Arrives in San Diego," www.navy.mil, Story Number: NNS050630-03, Release Date: 6/30/2005 12:57 P.M.
- 8 Based on personal account with Captain Howard Reese, USN (Ret.), former Commanding Officer of the *Kamehameha*.



San Diego Submarines and

By Captain Jeff Fischbeck, USN (Ret.)

Retired Captain Jeff Fischbeck served his thirty-year Navy career aboard five nuclear submarines and several submarine billets ashore, including command of *La Jolla* (SSN-701) in San Diego (1988-1991), and Director of the Arctic Submarine Laboratory (1998-2002).

Submarine Movies Filmed in San Diego

A Submarine Pirate (1915)
Submarine (1928)
Submarine D-1 (1937)
The Devils Playground (1937)
20,000 Leagues Under the Sea (1954)
Hellcats of the Navy (1957)
Torpedo Run (1958)
Run Silent, Run Deep (1958)
The Battle of the Coral Sea (1959)
Up Periscope (1959)
Operation Petticoat (1959)
On the Beach (1959)
Ice Station Zebra (1968)
Gray Lady Down (1977)
The Hunt for Red October (1990)
Phantom (2013)



For those not having a direct personal connection to submarines, the public perception of them is often shaped by the news media and Hollywood's portrayals, right or wrong. San Diego's role in movies about submarines has been a factor since the earliest days of motion pictures and since the arrival of the first submarines in San Diego in 1910. It started with the silent picture fantasy *A Submarine Pirate* (1915) and continued through blockbuster hits of their times such as



An actor rows toward a U.S. Navy submarine used in the 1915 silent film *A Submarine Pirate*, in San Diego.

Keystone Film Company

Run Silent, Run Deep (1958) and *The Hunt for Red October* (1990).

The latest Hollywood submarine production *Phantom* (2013) was filmed with high technology miniature digital cameras aboard the Soviet-era Foxtrot-class diesel submarine at the Maritime Museum of San Diego. A more complete list of San Diego-related submarine movies is provided in the left sidebar of Submarine Movies Filmed in San Diego.¹



the Hollywood Connection

World War II Era

An important role that Hollywood played, in addition to creating public awareness and perception of the War, is less well-known – the involvement of Walt Disney and some of the people working for him. These contributions included not only instructional films during World War II,² but also insignia designs for various Armed Forces units, and even advancements in technological capability.

Disney's stylized versions of combat mascots found their way onto submarine battle flags – unique flags that were carried aboard to unofficially document a boat's exploits. Typically, the submarine's name, mascot, motto, and hull number, as well as a tally of ships sunk, were documented with hand-stitched additions to the flag and updated as changes occurred. The mascot was usually a stylized version of an aquatic animal, since the boats were all named after fish and other marine creatures.

Walt Disney must have recognized the value of these battle flags in keeping spirits and morale high. This was especially useful for the Submarine Force, the one arm of the military whose casualties in battle were the highest percentage of any U.S. fighting forces in World War II. Disney took the general themes of the original flags and created professional looking cartoon-like caricatures for many of the WWII vintage boats.

One such boat was the *Sawfish* (SS-276), stationed in San Diego as a training ship at the West Coast Sound Training School from late 1945 until early 1946. The boat's original flag, hand-sewn by then-Quartermaster George Kinnison in 1945³, currently hangs in the offices of Commander Submarine Squadron ELEVEN, the Senior Submarine Commander in San Diego. The Disney studio artist slightly altered Kinnison's imagery in what would become the official insignia of the boat.

The tradition of Disney-created nautical caricatures for submarines continued beyond the war era and lasted throughout the years that submarines were named for fish, even into the era of nuclear-powered submarines, such as the very first nuclear submarine, *Nautilus* (SSN-571), and the modern day submarine *Pasadena* (SSN-752), based on Disney's turtle mascot for the WWII light cruiser, *Pasadena* (CL-65).⁴

Another Disney contribution to the submarine force through San Diego connections was a technical one – the development and refinement of sonar devices. A former Disney sound expert, Art Roshon, worked as a civilian with the Navy in San Diego, during and after World War II, to develop improved sonars. This Disney expert was also instrumental in developing under-ice sonars with Dr. Waldo Lyon at the Arctic Submarine Laboratory in San Diego, so that *Nautilus* and other nuclear submarines could safely transit and operate under arctic ice.

In early 1942, many from the Disney Studios "joined the FM Sonar Group in the Underwater Sound Laboratory of the University of California Division of War Research (UCDWR) at San Diego. [...] Some] had been responsible for the sound system used in Disney's *Fantasia*. Art Roshon, an early member of the team who had stayed with the program until his retirement ... had been involved in a number of interesting programs after the war, including an Upward-Looking Sonar, a derivative of the FM Sonar that was installed on the *Nautilus*. He was on board when it made its trip under the ice at the North Pole, using the sonar to probe the ice above."⁵



***Sawfish* (SS-276) Battle Flag**
Courtesy of the Kinnison Family



***Sawfish*, with its Disney-designed insignia displayed on the conning tower, has Commanding Officer, LCDR W. L. Michael on the bridge with watchstanders, and LCDR W. E. Sims on the after deck, circa 1945.**

Courtesy of the Kinnison Family



***Nautilus* (SSN-571) logo.**

Courtesy of the U.S. Navy



***Pasadena* (CL-65) and (SSN-752) logos.**

Courtesy of the U.S. Navy





Beyond World War II

The U.S. Navy saw the advantages of supporting movie productions with more realistic and often more positive images of U.S. fighting forces through the participation and involvement of actual ships and naval personnel. For instance, in the earlier days the previously mentioned silent movie, *A Submarine Pirate* (1915), used scenes with actual U.S. Navy submarines off San Diego Harbor. However, the absurdly fictional storyline with the antics of a Charlie Chaplin-esque submarine commander could hardly be considered useful for recruiting, or for promoting the actual professionalism of the nation's Submarine Force. (Perhaps not

so coincidentally, the star was Syd Chaplin, Charlie's half-brother.) Post-war productions saw a more active role by the military in helping set the stage more realistically, not that it always happened that way.

San Diego was a conveniently close locale for Hollywood to shoot submarine films, and provided relatively easy access to real Submarine Force heroes and boats. One famous movie, *Run Silent, Run Deep* (1958), brought the stars Clark Gable and Burt Lancaster to San Diego for the filming. They were able to learn from and rub elbows with real war heroes such as the local Submarine Flotilla ONE Commander, Captain John E. "Jack" Lee, who had deployed on eight war patrols and had been awarded three Navy Crosses for the successes of his submarines *Grayling* (SS-209) and *Croaker* (SS-246), in enemy engagements during WWII. Captain Lee's son, John, recounted seeing famous movie stars enjoying a stay at his family's home in San Diego numerous times.⁶



SUBMARINERS—Burt Lancaster receives honorary submariner's insignia, dolphins, from Capt. John E. Lee, USN, commander of Submarine Flotilla One. Clark Gable, who also received the insignia, looks on during dockside ceremonies at the San Diego submarine base. Gable and Lancaster costar in "*Run Silent, Run Deep*," which has been filming in the San Diego area.

Retired Navy Captain Joe Meyer was stationed aboard a diesel submarine in San Diego's Submarine Squadron THREE at the time of the filming. He recounts that the Commanding Officer of *Redfish* (SS-395), the diesel submarine that was used in



1957 – Actor Clark Gable and Captain John E. "Jack" Lee, Commander Submarine Flotilla ONE, are aboard a San Diego ship during the filming of *Run Silent, Run Deep*. Courtesy of the John Lee family

filming *Run Silent, Run Deep*, told him the following about the Commanding Officer in the movie, Clark Gable, and the Executive Officer, Burt Lancaster. *Clark Gable was a perfectionist and worked hard. He would spend hours in the conning tower with the Quartermaster working on the periscope so he'd get it right. While Clark Gable worked hard, Burt Lancaster was up topside doing acrobatic tricks for the crew and would get on the railing to do hand-stands.*⁷

Redfish was a movie star in her own right. In addition to playing the part of the fictitious U.S. submarine *Nerka* in *Run Silent, Run Deep* (1958), it was fitted with a "dummy" rear fin, and played the part of Jules Verne's *Nautilus* in the Walt Disney film *20,000 Leagues Under the Sea* (1954).⁸

Cold War Movies

Many scenes in the film adaptation of Alistair MacLean's Cold War novel *Ice Station Zebra* (1968) were filmed in the relative warmth and comfort of Southern California. The Navy provided the San Diego-based diesel submarine *Ronquil* (SS-396), a veteran of five war patrols during World War II, to simulate the movie's fictitious nuclear-powered submarine *Tigerfish* (SSN-509), while underway on the surface.

Scenes from *Ice Station Zebra* using the San Diego submarine *Ronquil* were included a decade later in another fictional submarine movie, *Gray Lady Down* (1978). In 1976, the nuclear submarine *Gurnard* (SSN-662) provided



The fictitious nuclear submarine *Tigerfish* (SSN-509) in *Ice Station Zebra* (1968), simulated by the actual diesel submarine *Ronquil*, with the hills of Point Loma in the background.

Courtesy of George Bisbarat, Naval Historian and Artist



"Action!" on the submarine piers at Ballast Point during the filming of *Ice Station Zebra* (1968).

Courtesy of George Bisbarat, Naval Historian and Artist

Movie star Rock Hudson onset at the Navy Submarine Support Facility at Ballast Point during the filming of *Ice Station Zebra* (1968).

Courtesy of George Bisbarat, Naval Historian and Artist



actor Charlton Heston with the opportunity to see a real submarine operate when he rode aboard her to prepare for making that movie.⁹

One of the most popular submarine movies of its time was based on Tom Clancy's first novel, "The Hunt for Red October" (1990). Portions of the movie were filmed in San Diego, using local submarines, drydocks, and active duty naval personnel as actors. Scenes below decks were filmed on the diesel submarine *Blueback* (SS-580). The San Diego-based *Los Angeles*-class submarine *Houston* (SSN-715) played her sister ship, the novel's *Dallas* (SSN-700), and was used to film the at-sea scenes, including an intentional emergency main ballast tank blow for the scene where she seemed to leap out of the ocean. The *Salt Lake City* (SSN-716) took the actor Alec Baldwin and some of the Hollywood cast members to sea overnight. This included the star Scott Glenn, who portrayed the *Dallas* Commanding Officer. The intent was to learn the professional

lingo, mannerisms and routines of the submarine's crew. In fact, Scott Glenn attributed the way he portrayed the fictional *Dallas* Commanding Officer to imitating every gesture of the actual *Salt Lake City* Commanding Officer, then CDR Tom Fargo, a decorated submariner who later rose to become CINCPAC (now called USPACOM), the four-star Admiral responsible for all U.S. Army, Navy, Marine Corps, Coast Guard and Air Force in the Pacific. Fargo points out the rationale for all the official support. *The Navy and Department of Defense had made a decision that it was*

a positive story...and had previously seen similar success in supporting the filming of Top Gun a few years earlier.¹⁰ The movie was a box office hit, and the not-so "silent service" enjoyed a wave of popularity being favourably cast in the limelight, as San Diego artist and humourist Jeff Bacon portrayed in one of his "Broadside" cartoons from a 1990 issue of the *Navy Times* newspaper.

Most recently, the film *Phantom* (2013) was filmed aboard the Maritime

Museum of San Diego's Soviet era *Foxtrot*-class diesel submarine, B-39. The film is a fictionalized account of a Soviet submarine that sank in the Pacific, and starred some well-known Hollywood actors. Its biggest success was not at the box office, but rather, in breaking new technological ground in movie-making with miniaturized digital cameras needed for the tight confines of the small submarine in order to bring the submarine "back to life" on the screen.

While the nation's four *Ohio*-Class SSGN submarines are homeported far from San Diego, one did provide a dramatic role in depicting Special Forces swimmer retrieval with Coronado-based U.S. Navy SEALs in the movie, *Act of Valor* (2012). Continued cooperation with Hollywood on projects such as this movie, to more realistically show the dedication and hard work of men and women in our maritime services, can serve the Submarine Force well in the future, as it has done, at times, in the past 100 years.



Above: One of the most popular submarine movies of its time was based on Tom Clancy's first novel, *The Hunt for Red October* (1990).

Right: Actor Alec Baldwin, on Submarine Base Point Loma, confers with Navy officials before embarking on *Salt Lake City* (SSN-716) in 1989.

Bruce McBroom, Still Photographer, Paramount Pictures Corporation
Courtesy of Bill Hughes



Below: *Permit* (SSN-594) was used in the filming of *The Hunt for Red October*, shown here in the Navy floating drydock Arco (ARDM-5) in 1989.

Bruce McBroom, Still Photographer, Paramount Pictures Corporation
Courtesy of Bill Hughes



NOTES

- 1 Gregory L. Williams, "Filming San Diego: Hollywood's Backlot, 1898-2002," *The Journal of San Diego History*, Spring 2002, Vol. 48: No. 2, and other sources.
- 2 Roberta Tuttle, "Disney Characters Part of Service Lore," *The New London Day*, 28 July 1985.
- 3 George Kinnison interview, 13 February 2014.
- 4 <http://usspasadena.org/ssn.htm> and email, Kevin M. Kern, Disney Archives Collection Specialist, The Walt Disney Studios, Burbank, CA, 6 January 2014.
- 5 Sidney Bertram, autobiography, http://www.bertramweb.com/aaasid_bio/sid_10_waryears.html.
- 6 John Lee interview, 24 November 2013.
- 7 Cold War Panel Interview with retired Vice Admiral Bernard Kauderer and retired Navy Captains Dick Bivin, Joe Meyer and Bob Murrill, 2 December 2013.
- 8 Dave Smith, "In a League of Its Own," Walt Disney Corporation, [http://en.wikipedia.org/wiki/USS_Redfish_\(SS-395\)#cite_note-5](http://en.wikipedia.org/wiki/USS_Redfish_(SS-395)#cite_note-5).
- 9 *Gurnard* (SSN 662) website (2008), <http://websitesbycook.com/gurnard/history.html>.
- 10 Admiral Tom Fargo, USN (Ret), via email 21 January 2014.

Broadside

By Jeff Bacon

EXCUSE ME. ARE YOU ONE OF THOSE GUYS LIKE IN "HUNT FOR RED OCTOBER"?

WHY..... YES! AS A MATTER OF FACT I AM.



Things we thought we would never see: 1) Destruction of the Berlin Wall; 2) A peaceful transition of power in Nicaragua; 3) pilots posing as submariners to meet babes.

Reprinted with the express permission of Jeff Bacon

U.S. Navy SEALs and a surfaced *Ohio*-Class SSGN in the movie *Act of Valor* (2012).

Courtesy of Relativity Media



Acknowledgements

Firstly, the Editor would like to acknowledge the challenge of compressing such a voluminous history into 108 pages. I am grateful to the authors who met the impossible challenge, condensing their topics into a seamless history.

CAPT Thomas E. Ishee, Commodore, Submarine Squadron ELEVEN in San Diego, from June 2012 to February 2014, provided the impetus and inspiration for the creation of this issue.

Special thanks to Sarah Bishop Dolbec, who contributed hours of photo and biographical research and conducted, transcribed, and presented the interviews herein, and to CAPT Jeff Fischbeck, who acted as Contributing Editor. Thanks to those who agreed to be interviewed: VADM Bernard Kauderer, CAPT Dick Bivin, CAPT Joe Meyer, CAPT Bob Murrill, CAPT Charlie Bishop, George Kinnison (and son Gary), and John Lee (son of RADM John E. "Jack" Lee). They shared not only their histories, but their personal photos and memorabilia with the authors.

I'd like to thank Maritime Museum Assistant Librarian, Gordon Sheldon, and Docents (retired Submariners) Tom Shipman and Steve Andres for their original contributions.

Rick Crawford, Special Collections Supervisor, San Diego Public Library, offered research guidance, which was most helpful, as did Alex Bevil, Historian, California State Parks, who shared his original research.

Thanks also to Carol Myers and Lauren Rasmussen, San Diego History Center Archives, for their patient and expert research guidance, and to Heather Smedberg, UCSD Library Archives, Special Collections.

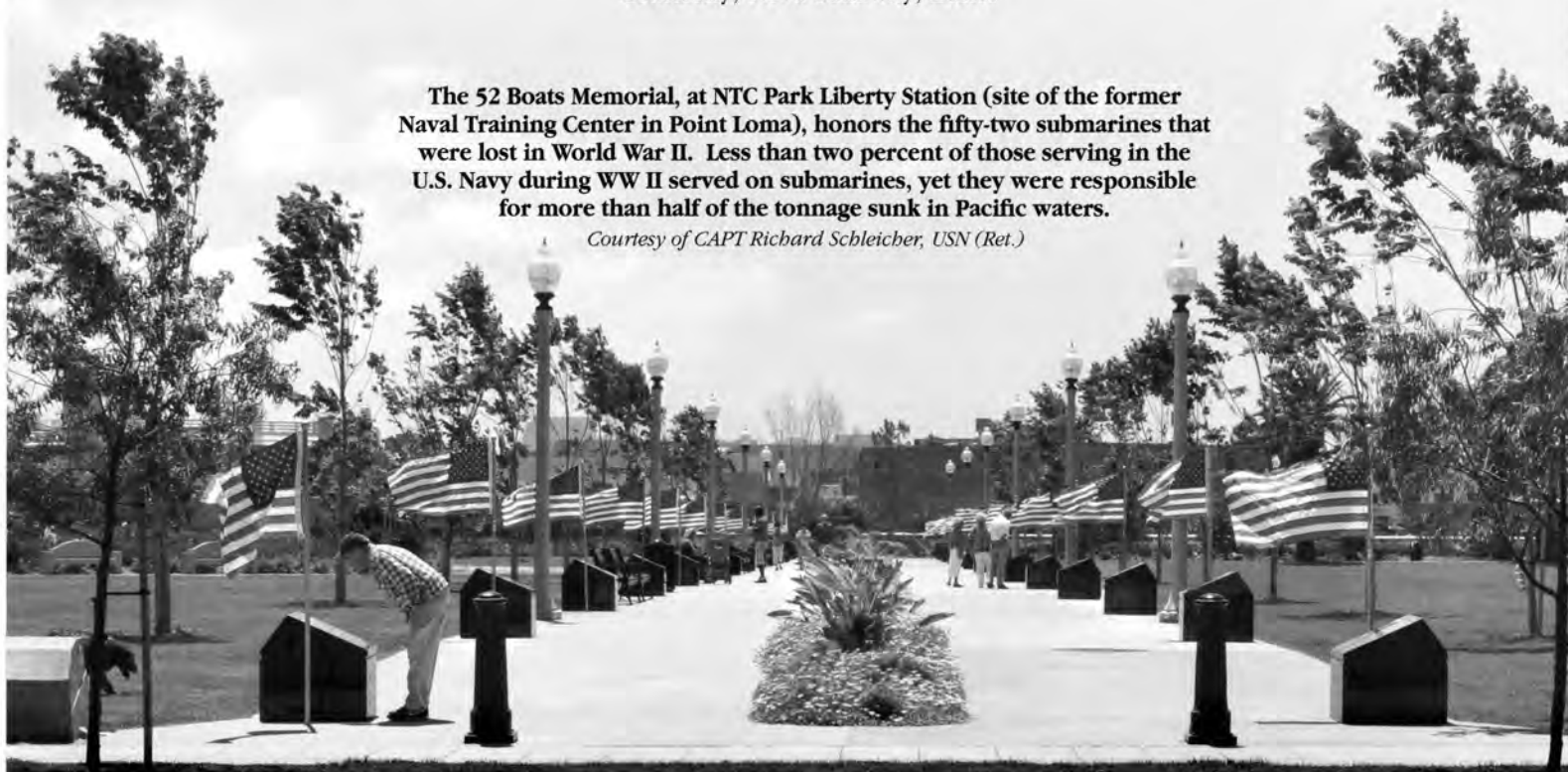
We are grateful for the support from the following: ADM Jonathan W. Greenert and staff, CAPT Scott Adams and staff, EMCM(SS) Paul Benton, George Bisharat, STSCS(SS) Bob Bissonnette, LCDR Dave Brevig, MC2(SW/AW) Kyle Carlstrom, EMC(SS) John Clear, CDR Phil Eaken, CDR Ed Farley, CDR Ray Ferbrache, ETCS(SS) Jared Jones, CAPT Don Mathiowetz, MM2(SS) William Patterson, FTC(SS) Joe Phoenix, LT Scott Sagisi, CAPT Richard Schleicher, CAPT Jim Tregurtha, and MC1(AW) Anthony Walker.

The Editor would like to thank all those who serve in the United States Navy and their families, for their unending dedication in the heroic defense of our country.

Gratefully, Neva Sullaway, Editor

The 52 Boats Memorial, at NTC Park Liberty Station (site of the former Naval Training Center in Point Loma), honors the fifty-two submarines that were lost in World War II. Less than two percent of those serving in the U.S. Navy during WW II served on submarines, yet they were responsible for more than half of the tonnage sunk in Pacific waters.

Courtesy of CAPT Richard Schleicher, USN (Ret.)



— The Maritime Museum of San Diego Salutes —

A Century of Submarines in San Diego



From **PRESIDIO**

TO **PACIFIC POWERHOUSE**

HOW THE MILITARY SHAPED SAN DIEGO

Presented by

SAN DIEGO HISTORY CENTER



On Exhibit Now

The Maritime Museum of San Diego is proud to be a part of the countywide collaboration with nine other museums telling the story of the military's impact on San Diego, which has influenced every aspect of our political, economic, and social development.

Submarine Exhibit at the Maritime Museum of San Diego:
General Admission (Military Discount) available online or at the Maritime Museum of San Diego.

www.sdmaritime.org

Back Cover: *Jefferson City* (SSN-759) moves quietly off the coast of San Diego, with Coronado and the city skyline in the background.

USS Fish, July 1910



A Century of Submarines in San Diego

