

U.S. COAST GUARD BUOY TENDERS, 180' CLASS
U.S. Coast Guard Buoy Tenders
U.S. Coast Guard Headquarters, 2100 2nd Street Southwest
Washington
District of Columbia County
District of Columbia

HAER No. DC-57

HAER
DC-57

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C St. NW
Washington, DC 20240

HISTORIC AMERICAN ENGINEERING RECORD

U.S. COAST GUARD BUOY TENDERS, 180' CLASS

HAER No. DC-57

RIG/TYPE
OF CRAFT:

Cutter

TRADE:

Buoy tending (government)

PRINCIPAL
DIMENSIONS:

Length: 180'

Beam: 37'

Depth: 14'

Displacement: 935 tons

(The listed dimensions are "as built," but it should be noted that draft and displacement were subject to change over time.)

LOCATION:

Various (See individual histories)

DATES OF
CONSTRUCTION:

September 16, 1941 - September 22, 1944

DESIGNER:

The preliminary design work was done by the U.S. Light-House Service (USLHS). The U.S. Coast Guard (USCG) modified the USLHS designs to suit the expanded missions of the new vessels. Minor design changes were undertaken by A.M. Deering of Chicago, Illinois and Marine Iron and Shipbuilding of Duluth, Minnesota during the production run.

BUILDER:

All but one of the vessels were built by Marine Iron and Shipbuilding Company of Duluth, Minnesota and Zenith Dredge Company, also of Duluth. The lone exception, IRONWOOD, was built in the U.S. Coast Guard Shipyard at Curtis Bay, Maryland.

PRESENT OWNER: Various (See individual histories)

PRESENT USE: Various (See individual histories)

SIGNIFICANCE:

These vessels were built to serve as 180' U.S. Coast Guard cutters. A total of thirty-nine of these cutters, built in three subclasses, were purchased by the government from 1942-1944. The USCG designed the 180s to service Aids-to-Navigation (AtoN), perform Search and Rescue missions (SAR), carry out

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Law Enforcement duties (LE), and conduct ice-breaking operations. Members of the class have served in the USCG from 1942 to the present. They have significantly contributed to safe navigation on inland and international waters in times of peace and war.

HISTORIAN: Marc R. Porter

PROJECT

INFORMATION: This project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. The HAER program is administered by the Historic American Buildings Survey/Historic American Engineering Record Division (HABS/HAER) of the National Park Service, U.S. Department of the Interior, E. Blaine Cliver, Chief.

The project was prepared under the direction of HAER Maritime Program Manager Todd Croteau. The historical report was produced by Marc Porter, and edited by Richard O'Connor and Justine Christianson, HAER Historians. Vessel drawings were produced by Todd Croteau, Dana Lockett, and Peter Brooks, HAER Architects. Jet Lowe, HAER photographer, produced large-format photographic documentation.

FOR DOCUMENTATION ON INDIVIDUAL CUTTERS IN THE 180' IRIS CLASS, SEE:

HAER No. DC-60	U.S. Coast Guard Buoy Tenders, 180' Iris Class
HAER No. AK-45	U.S. Coast Guard Cutter FIREBUSH
HAER No. AK-46	U.S. Coast Guard Cutter SEDGE
HAER No. AK-47	U.S. Coast Guard Cutter SWEETBRIER
HAER No. AK-48	U.S. Coast Guard Cutter WOODRUSH
HAER No. AL-199	U.S. Coast Guard Cutter SALVIA
HAER No. CA-309	U.S. Coast Guard Cutter BLACKHAW
HAER No. FL-17	U.S. Coast Guard Cutter REDBUD
HAER No. GU-2	U.S. Coast Guard Cutter SASSAFRASS
HAER No. GU-3	U.S. Coast Guard Cutter BASSWOOD
HAER No. HI-61	U.S. Coast Guard Cutter MALLOW
HAER No. MA-152	U.S. Coast Guard Cutter BITTERSWEET
HAER No. ME-68	U.S. Coast Guard Cutter SPAR
HAER No. MI-323	U.S. Coast Guard Cutter BRAMBLE
HAER No. MI-328	U.S. Coast Guard Cutter ACACIA

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HAER No. MN-98 U.S. Coast Guard Cutter SUNDEW
HAER No. NJ-139 U.S. Coast Guard Cutter HORNBEAM
HAER No. OR-118 U.S. Coast Guard Cutter IRIS
HAER No. PR-43 U.S. Coast Guard Cutter SAGEBRUSH
HAER No. TX-107 U.S. Coast Guard Cutter BLACKTHORN
HAER No. WA-169 U.S. Coast Guard Cutter MARIPOSA

FOR DOCUMENTATION ON INDIVIDUAL CUTTERS IN THE 180' MESQUITE CLASS,
SEE:

HAER No. DC-59 U.S. Coast Guard Buoy Tenders, 180' Mesquite Class
HAER No. AK-44 U.S. Coast Guard Cutter IRONWOOD
HAER No. AL-198 U.S. Coast Guard Cutter SWEETGUM
HAER No. CA-293 U.S. Coast Guard Cutter BUTTONWOOD
HAER No. CA-294 U.S. Coast Guard Cutter PLANETREE
HAER No. MI-327 U.S. Coast Guard Cutter MESQUITE
HAER No. TX-106 U.S. Coast Guard Cutter PAWPAW

FOR DOCUMENTATION ON INDIVIDUAL CUTTERS IN THE 180' CACTUS CLASS, SEE:

HAER No. DC-58 U.S. Coast Guard Cutter, 180' Cactus Class
HAER No. AK-43 U.S. Coast Guard Cutter BALSAM
HAER No. CA-305 U.S. Coast Guard Cutter CLOVER
HAER No. CA-306 U.S. Coast Guard Cutter CONIFER
HAER No. CT-188 U.S. Coast Guard Cutter EVERGREEN
HAER No. FL-15 U.S. Coast Guard Cutter GENTIAN
HAER No. FL-16 U.S. Coast Guard Cutter LAUREL
HAER No. MI-326 U.S. Coast Guard Cutter WOODBINE
HAER No. NY-328 U.S. Coast Guard Cutter SORREL
HAER No. OR-114 U.S. Coast Guard Cutter COWSLIP
HAER No. OR-115 U.S. Coast Guard Cutter CACTUS
HAER No. OR-116 U.S. Coast Guard Cutter CITRUS
HAER No. OR-117 U.S. Coast Guard Cutter TUPELO
HAER No. SC-36 U.S. Coast Guard Cutter MADRONA

Aids-to-Navigation and Buoy Tenders

Nothing indicates the liberality, prosperity or intelligence of a nation more clearly than the facilities which it affords for the safe approach of the mariner to its shores.

--Anonymous, Eighteenth Century (from Military Essay by R.J. Papp Jr.)

Maritime activity has been a cornerstone of this nation's development from the earliest European colonial forays to the present. This activity has included exploratory voyages, passenger carriage, freight transport, fishing, and naval endeavors. Maritime platforms have ranged in size and complexity from log rafts to modern supertankers; their voyages have taken them on transoceanic routes and deep into the continental interior. For centuries, boats and ships provided the only effective and economical way to move people and goods over anything but the shortest distances. Even today, long after the construction of extensive rail networks, the advent of air travel, and the completion of interstate highways, ships continue to carry the bulk of commercial cargoes. Vessels of various shapes and sizes literally built this country and remain essential components of the economy and elements of the national defense.

The ability of ships to play such an integral role in the development of the United States was dependent on several factors. First, the ships themselves had to be built or acquired. Second, they required competent crews. Finally, the ability to safely navigate from port to port was essential. Well built and manned ships were useless as economic or naval competitors if their masters could not find the intended destination, or worse, guided the vessels into harm's way. The first two prerequisites are beyond the scope of this work. Suffice to say that the North American colonies were heirs to the seafaring tradition of Western Europe and, as such, were possessed with ample reserves of experienced mariners and shipwrights. Moreover, timber and other shipbuilding materials were available in abundance throughout Europe's North American colonies. Safe navigation, the third prerequisite, was the primary duty of the buoy tenders. Several interrelated skills and technologies are necessary to ensure safe passage. Traditional blue water (oceanic) navigation is dependent on a complex but uniform body of knowledge. The master or mates on an oceangoing vessel must be adept at finding their position and charting their course using concepts and calculations that require devoted study. Once mastered, however, those skills are useful for sailing on the North Atlantic or on the South Pacific. The oceangoing navigator may need to become familiar with some local phenomenon such as ocean currents and prevailing winds, but more importantly, he must also be an expert at actually handling a vessel in all types of weather conditions, not just deciding which direction to point the bow. By and large though, the craft itself can sail in any ocean.

Conversely, the coastal or inshore navigator relies not on universal principles, such as the position of celestial bodies and hypothetical lines of latitude and longitude, but on detailed and specific local knowledge. The danger to ships on the high seas has traditionally been adverse weather and, to a

lesser degree, collisions with other ships or floating objects. Closer to shore and on inland waters, the variety and number of threats grows exponentially. Traffic density increases with proximity to ports, making collision more likely. Weather remains a threat but the presence of shoal water limits a mariner's avenues of escape, so running from inclement weather becomes less feasible. Floating objects, whether man-made or natural, abound on coastal and inland waters, and currents and tides can also be problematic. Finally, and perhaps most significantly, land itself becomes the chief danger. Sandbars, submerged reefs, and rocky shores menace passing ships, and collision with land becomes the chief threat to those traveling on the water.

The myriad threats endangering mariners are distributed unequally and often remain hidden from view. Thus, detailed local knowledge is the key to safe coastal or inshore navigation. The uses of geometry and trigonometry to divine lines of position from the altitude of celestial bodies, mainstays of traditional blue water navigation, become far less important than knowing about the sandbar around the next bend in the river or hazardous currents at a harbor entrance. Traditionally, the pilot system satisfied this need for local knowledge. In an area covered by a pilot system, small vessels carrying men familiar with the local waters met ships approaching the coast. These local experts, known as "pilots," boarded inbound vessels to provide navigational advice and prevent captains from losing their ships within sight of the destination. Similarly, pilots worked on many coastal and riverine shipping routes. The pilot system is effective in many regards since it provides each vessel with an expert on the waters being transited. It is still used today in most harbors and along many rivers. By law, all foreign flagged vessels over a certain tonnage must engage a pilot when entering U.S. waters. U.S. flagged vessels and naval units may waive the pilot but most take one aboard for the added measure of safety they provide.

An alternative system makes the hidden dangers, heretofore known only to the pilots, apparent to the average mariner. This system uses Aids-to-Navigation (AtoN), which are essentially visual indicators, and sound signals that serve to orient mariners and warn them of dangers. Aids-to-Navigation can be floating objects such as buoys. They can be structures embedded in the bottom and topped with a marker, or they can be objects built entirely on land. Whatever form they take, AtoN have a common purpose: their position combined with their shape and markings tells the watchful navigator where he can proceed safely and what areas to avoid. To increase their utility further, many AtoN are equipped with lights that make them visible at night. Most lights exhibit a certain color or flash so that the individual AtoN is not only visible but also recognizable as the AtoN marking a specific shoal or channel. The addition of sound signals such as bells, whistles, and gongs, each as distinct as the different lights, serve to make the AtoN's position and identity known in periods of low visibility like fog and rain.

AtoN are a code that, when deciphered, lead the mariner past hazards and into safe harbors. They are comparable to road signs, but rather than being written on the side of a sign, they consist of a more practical code system that allows a competent navigator to "read" most AtoN from some distance.

AtoN are most useful when used with nautical charts or sailing directions. These documents, along with a familiarity with the particular system in place, serve as the code book for deciphering a seemingly bewildering array of buoys, markers, lights, and sounds. Mastery of the code book and a watchful eye when underway provide mariners operating in well marked areas with the detailed information previously known only to pilots.

An AtoN system is most effective when in place alongside a pilot system rather than as a freestanding alternative or competitor. AtoNs are invaluable to a navigator in unfamiliar waters, and they are also very useful to pilots since they serve as reminders. This combination of pilots and AtoNs is the system that has long existed in Europe and North America.

A well-developed AtoN system is valuable for many reasons. Economic value blends with social benefit when well-marked waterways prevent vessel casualties. Not only are owners saved from paying to replace ships and insurance companies saved from covering losses, but also the lives of mariners are spared. The presence of recreational boaters magnifies the need for AtoN, since recreational boating increases the total number of vessels in a given area. Perhaps more significantly, it often involves captains and navigators who do not work on the water for a living and are therefore generally less experienced and more prone to navigational errors.

The use of Aids to Navigation can be traced as far back as 279 BC with the construction of the Pharos Lighthouse, known as a “wonder of the ancient world.” After its construction, mariners soon began using the smoke and light produced by its beacon to chart their course.¹ Records detailing ancient and early medieval European history do not mention floating AtoN. Their first recorded appearance is in a Spanish collection of sailing directions titled “La Compasso de Navigare.” This work mentions a floating buoy in the Guadalquivir River that marked the approach to Seville. Who placed the buoy and when they did so is a mystery, but it must predate the 1295 publication date of “La Compasso de Navigare.”² Less than three decades later, floating AtoN appeared in Dutch waters along the approaches to the Zuider Zee, and by 1358 buoys marked stretches of the Maas River. Presumably the use of floating buoys spread from Spain to its Lowland colonies and then throughout European waters during the early modern period. King Henry VII granted the Guild of Shipmen and Mariners the right to maintain AtoN in English waters. This royal charter eventually led to the formation of Trinity House, a quasi-governmental organization granted the right to establish various AtoN in 1594 by

¹ Amy Marshall, “Frequently Close to the Point of Peril: A History of Buoys and Tenders in U.S. Coastal Waters, 1789-1939” (Masters Thesis, East Carolina University, 1998), 1; Robert Hendrickson, *The Ocean Almanac* (New York: Doubleday, 1984), 332-333.

² Marshall, “Frequently Close to the Point of Peril,” 5.

Queen Elizabeth.³

As European influence and power spread to the New World so did the use of AtoN. Colonists built a lighthouse on Little Brewster Island in the approaches to Boston Harbor as early as 1716. Floating buoys were in use on the Delaware River by 1767 and in Boston by 1780. Other floating AtoN undoubtedly existed in the English colonies but they were not noted in colonial records. Even fewer extant records are available for Spain's North American colonies but AtoN may have been in use even earlier than in the English colonies. Local governments in the English colonies funded lighthouses, and pilots or other mariners privately constructed and maintained the smaller AtoN.⁴

Shortly after England's colonies broke away to form the United States of America, the fledgling government turned its attention to matters of navigational safety. This was no doubt due to the realization that the United States depended upon waterborne commerce, both foreign and domestic, for its economic survival. On August 7, 1789, Congress federalized existing lighthouses and allocated money for the construction and maintenance of lighthouses and other AtoN. The federal entity placed in charge of AtoN, the Light-House Establishment, took its name from Congress' "Act for the Establishment and Support of Lighthouses, Beacons, Buoys, and Public Piers." The Light-House Establishment was set up as part of the Treasury Department.⁵

Though the Treasury Department was placed in charge of matters relating to the markers, there was little in the way of administrative oversight. Most lighthouses were left in the care of the individual hired as the light keeper, who operated with almost complete autonomy, provided the light remained operational. Private contractors generally maintained smaller AtoN, but they also operated without real government oversight. The government assigned contractors an area with a certain number of buoys or other AtoN specified. The precise placement of the markers was left to the contractor, as were many decisions regarding the size and type of marker employed. Finally, maintenance decisions were left to the contractor's discretion.

Maintenance issues are important in any discussion of Aids-to-Navigation. Choosing the site for an

³ Amy K. Marshall, *History of Buoys and Tenders* (Washington: U.S. Coast Guard Historians Office, 1995), 2.

⁴ Marshall, "Frequently Close to the Point of Peril," 8; Marshall, *History of Buoys and Tenders*, 2.

⁵ Marshall, "Frequently Close to the Point of Peril," 14; Marshall, *History of Buoys and Tenders*, 3.

AtoN, building the marker, and placing it on station is a small portion of the work involved. Lights burn out, and buoys drift off station. Any sound making apparatus, even one as simple as a bell, eventually requires repair or replacement. The marine environment is harsh. Salt water, ice, and marine organisms take their toll on any man-made structure. Paint wears away over time. Corroded fittings require replacement. Layers of marine growth accrete rapidly and require removal on a regular basis. Environmental changes make it necessary to revisit existing AtoN frequently. As sand bars shift or obstructions move, a formerly clear channel may become dangerous and, conversely, new areas may open to navigation.

The cutters were also equally important in tending shore-based AtoN. Often, lighthouses and other shore-based AtoN are found on islands or in areas that can be difficult to reach by land, particularly in the days before extensive road networks. These sites, like their floating counterparts required tenders to remain in proper operating condition. Up until the automation of lighthouses in the twentieth century, AtoN tenders spent much of their time servicing and supplying shore-based markers or installations.

Early buoy tenders and AtoN in U.S. waters clearly reflected the administrative system in place to oversee them, illustrating the lack of administrative controls and an absence of standardization. As with most choices relating to AtoN, picking the vessels to perform tender work was left to the contractor. Government officials gave the contractors a set amount of money for a specified area. Out of that money the contractor paid the expenses required to fulfill the contract and kept the remainder as profit. This meant tenders were chosen with the contractor's bottom line in mind, whether or not the tender was the ideal vessel for the task. No rational businessperson paid extra to build or buy a vessel for service as a tender when an alternative cheaper, or already owned, vessel would serve adequately, if not ideally. Not surprisingly, problems abounded in this system. Mariners complained that markers were placed with the contractor's convenience in mind rather than the safety of shipping. Observers noted that many contracted tenders were suitable only for handling smaller buoys so the contractors marked sea-lanes with undersized AtoN.

It is unclear when the use of government vessels as AtoN tenders was first advocated or by whom. The benefits offered by government tenders seem obvious. A government tender could operate without regard to a profit margin. This meant a tender could conceivably carry larger crews than its private counterparts. It also meant the markers and their locations could be chosen with their value as AtoN in mind over all other considerations. Perhaps most significantly, officials could order federally operated vessels to certain areas or direct them to conduct certain operations, whereas a private contractor and his vessel were beyond direct government control. The relative advantages of government buoy tenders were probably apparent to American leaders from the very outset. The federal government was, however, initially a far smaller entity than its later incarnations and much less involved in regulatory or commercial affairs. In the early days of this nation's history, an active role in buoy tending was beyond the federal government's mandate and wherewithal.

By 1839, dissatisfaction with the contractor system had grown to the point where the federal government was willing to undertake a direct role in maintaining AtoN. The topsail schooner RICHARD RUSH, measuring just over 73' in length and built in 1831, was transferred from use as a revenue cutter to the control of the Light-House Establishment.⁶ While it would be harsh to call the RICHARD RUSH a failure, it is fair to say the schooner was not an ideal platform for buoy tending. Naval architects designed revenue cutters to chase down smugglers and other lawbreakers. The same hull shape that gave the revenue cutter speed under sail made it unstable when attempting to haul buoys and their anchors out of the water.⁷ Despite RICHARD RUSH's dubious value as an operational prototype it was a very significant vessel. The former revenue cutter was the first government vessel assigned the AtoN mission and was the progenitor of hundreds of vessels that have served in that role under the aegis of several government organizations over the last 160 years. RICHARD RUSH was unsuitable as a buoy tender but other, more suitable, vessels followed.

RICHARD RUSH's immediate followers were other sailing vessels that had generally been built to suit other purposes but were placed in an AtoN role later in their career. Since they were not constructed for AtoN use, all exhibited twin drawbacks inherent to sailing vessels. The hull shape of sailing vessels allowed them to tilt, or heel, over to one side (leeward) when under sail. Unfortunately, this shape also meant they heeled when attempting to work heavy objects suspended over the side. Vessels built for speed under sail, like RICHARD RUSH, tended to be particularly narrow and heeled the most. Flat bottom sailing vessels equipped with centerboards did exist by the middle of the nineteenth century, but a flat bottom design was more suitable for protected, inland waters. Plus, such vessels, while useful for buoy tending in inland waters, were unseaworthy in the ocean and thus unsuitable for coastal applications. The sailing buoy tenders were generally schooner-rigged, meaning their sails were mounted along a fore-and-aft orientation. This rig allowed excellent performance to windward and when combined with square sails offered good downwind performance. Schooners were maneuverable, and a small crew could handle large schooners. In many ways schooners were the apex of commercial sailing vessel development. When it came to buoy tending, steam vessels were superior to schooners in terms of maneuverability and station keeping. Steam vessels also offered the ability to move when there was no wind at all or to move directly into the teeth of the wind, both of which were impossible for sailing vessels. A sailing vessel could only move upwind by taking a zigzag course to windward and could never travel with its bow pointed directly into the wind. This entailed covering far more ground and using more time than a vessel that could simply point its bow in the direction of its destination and steam straight ahead. Once on station, the captain of a steamer could alternate the engines between forward and reverse to hold position. The captain of a sailing vessel could attempt to

⁶ Marshall, "Frequently Close to the Point of Peril," 31.

⁷ Marshall, "Frequently Close to the Point of Peril," 31.

do the same by backing and filling sails but the result was rarely as effective and staying on station was a challenge.

The Light-House Board began experimenting with steam tenders in 1857. That year they built and outfitted the SHUBRICK for tending AtoN, at a cost of approximately \$60,000. SHUBRICK set a precedent in the role of the first steam tender, but she also claims the honor of being the first major vessel expressly designed and built as a tender. This was a departure from the prior practice of retrofitting an existing vessel for a new career handling buoys and ferrying supplies to manned lights. SHUBRICK was the first buoy tender with a black hull. Whether the initial intention or not, this practice has been maintained because it minimizes the appearance of scuffs and blemishes incurred when a buoy tender handles AtoN alongside.⁸

SHUBRICK and the steam tenders that followed were beamier, or wider, than their sailing counterparts. This gave them greater initial stability than a sailing vessel and meant they did not heel as dramatically when working with heavy objects suspended over the side. Equally important was their ability to steam into the face of contrary winds and maneuver to stay on station. The stability of the steam tenders sparked development in the design and construction of the AtoN themselves. As more capable tenders came into service, AtoN designers and builders produced larger, more visible, buoys. A parallel trend was increasing standardization in buoy appearance. In the early days of AtoN in this country, buoys were constructed according to local custom, with whatever materials were handy, or to unique specifications. This lack of standardization meant mariners faced a confusing and haphazard array of markers as they traveled from port to port. Throughout the early decades of the nineteenth century, efforts to implement guidelines for buoy appearance were unsuccessful. But this effort eventually culminated in a law passed by Congress in 1850 that laid out guidelines for the appearance and placement of navigational markers. These guidelines form the basis for the "Lateral System" of buoyage still in use today.⁹

The transition from sailing to steam tenders proceeded rapidly after SHUBRICK's entry into service. By 1890, the federal fleet totaled thirty tenders, of which twenty-eight were steamers. The fleet of steam tenders grew to fifty-eight vessels by 1925. As was the case with the introduction of steam power to commercial shipping, the first steam tenders were paddle wheel vessels. During the second half of the nineteenth century, design improvements made the propeller, or screw, a viable alternative to paddle wheels. In 1865 the Light-House Service purchased its first propeller driven tender, IRIS.

⁸ Marshall, "Frequently Close to the Point of Peril," 31, 55.

⁹ Marshall, "Frequently Close to the Point of Peril," 50-52; Marshall, *History of Buoys and Tenders*, 4.

Over the following years, in a trend mirrored throughout the maritime world, paddle wheels gave way to propellers as the propulsion system used by most AtoN tenders.¹⁰

Technological changes relating to buoys and tenders did not occur in a political or administrative vacuum. AtoN administration began under the laissez-faire guidance of the U.S. Light-House Establishment (LHE). This agency was part of the Treasury Department and nominally directed by the Secretary of the Treasury. During the 1830s and 1840s the LHE began assuming some duties that contractors had handled exclusively in the past. The pace of change was not rapid enough for many interested parties and criticism of the system mounted. In 1848 Congress appointed an investigative group to study the LHE and offer solutions to problems pointed out by critics. The investigators, mainly military officers with scientific and engineering backgrounds, issued a 760-page report that advocated installing a panel of experts at the head of the LHE. Leaders in the legislative and executive branches of government concurred with the investigative panel, and the Treasury Secretary formally established the U.S. Light-House Board in October 1852. The Light-House Board took responsibility for overseeing all AtoN matters involving the federal government. Not long after its inception, the Light-House Board moved to revamp the American AtoN system. A district system, utilizing government employees and a higher degree of technological and administrative standardization, completely replaced the contractor system. In the new system, government tenders, under the local direction of district superintendents, worked to maintain unmanned AtoN and carried supplies to manned lighthouses.

The Civil War caused a great deal of dislocation in the AtoN system and resulted in the destruction or neglect of existing tenders. At war's end, however, the Union Navy and Army were both in possession of vastly expanded wartime fleets and were downsizing to peacetime levels. The Light-House Board acquired surplus military vessels for service as AtoN tenders. Some were traditional schooners but many were steam tugs. Once retrofitted with cargo handling gear, the surplus tugs proved very adept at servicing floating and shore-based AtoN. These tugs were the nucleus of the steam tender fleet, and as they wore out, new steam vessels replaced them, rather than revert to the schooner model.

The Light-House Board commissioned a class of identical tenders in 1908. Until this point, tenders had been retrofitted naval vessels or vessels built individually for AtoN service, but never part of a group or class designed for tender work. This first class of AtoN tenders was named the Manzanita or '8-Tender' class. Personnel in the Navy Department designed these 190' vessels and the New York Shipbuilding Company in Camden, New Jersey built them for just under \$200,000 apiece. Many design attributes reflected their intended use as buoy tenders. The Manzanita class vessels had vertical sides rather than the curving hulls common on vessels of the day. The lack of curvature reduced the

¹⁰ Marshall, "Frequently Close to the Point of Peril," 90; Douglas Peterson, *U.S. Lighthouse Service Tenders, 1840-1939* (Annapolis, Maryland: Eastwind Publishing, 2000), 20.

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tendency of buoys to slip under the vessel when brought alongside. Deck edges on the fo'c'sle and in the buoy handling areas were rounded to prevent snags. The steel cargo-handling boom utilized wire hawsers and was superior to its wooden predecessors. Twin oil fired triple expansion steam engines powered each vessel and the two screws could push the Manzanita class vessels 2,500 miles at 10 knots.¹¹

In general appearance the Manzanita tenders exhibit many of the same attributes as modern buoy tenders. A high superstructure gave a clear view over the bow and sides to ship handlers on the bridge. The bridge itself had wings on either side and a lookout station above. A mast and boom apparatus for handling cargo was mounted forward of the superstructure and just aft of an open well deck suitable for carrying and working buoys. The well deck was accessible by breaks in the bulwarks on either side of the vessel. The tenders carried small craft for AtoN inspections and other errands on davits aft of the bridge.

Control over the AtoN system passed to a new administrative entity, the Bureau of Lighthouses, in 1910, as did control over the estimated forty-seven tenders engaged in AtoN work. The Bureau of Lighthouses and its operational arm, the Light-House Service (LHS), were established as part of the Commerce Department. During World War I, the military took control of many tenders and assigned them coastal defense missions. AtoN tenders were generally used to plant mines and handle antisubmarine nets. A few served as armed coastal patrol craft. The regular civilian crews manned the tenders during World War I.

World War I, much like the Civil War, took a heavy toll on America's fleet of buoy tenders. Enemy action was not the problem; rather, lack of adequate maintenance and hard usage wore out many vessels. The Bureau of Lighthouses sought to implement an ambitious program of new construction to replace the vessels worn out by wartime service but, despite repeated appearances before Congress by the head of the Lighthouse Service, legislative approval and funding was not forthcoming. Eventually, the Bureau agreed to make do with six former mine planters surplused by the U.S. Army. Congress also approved a very limited program of new construction. Ship fitters extensively rebuilt the mine planters and they entered service as buoy tenders beginning in 1923.¹²

Throughout the inter-war years, the Bureau of Lighthouses added buoy tenders to its fleet in piecemeal

¹¹ Robert L. Scheina, *U.S. Coast Guard Cutter and Craft of World War II* (Annapolis, Maryland: Naval Institute Press, 1982), 140-141.

¹² Scheina, *U.S. Coast Guard Cutter and Craft of World War II*, 132-133; Marshall, *History of Buoys and Tenders*, 11.

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fashion. Occasionally, the government funded individual vessels designed and built for service as buoy tenders; usually these were built for some set of regional conditions rather than as all-purpose craft. In other cases the LHS acquired vessels from other sources and retrofitted them for AtoN service. The Bureau of Lighthouses made no further efforts to design and build an entire class of buoy tenders.

This is not to say that technological advancement did not occur during the inter-war period. In the late 1930s the Bureau of Lighthouses ordered a new tender from the John H. Mathis Company Shipyard in Camden, New Jersey. The vessel, named JUNIPER upon completion, was 177' overall with a maximum beam of 32'. JUNIPER was the first buoy tender built using all welded steel construction. Shipyard workers built earlier steel hulls by riveting plates together on a steel frame, whereas welds joined JUNIPER's plates. JUNIPER was also the first diesel-electric buoy tender. Steam engines, or in the case of small tenders, internal combustion engines, powered JUNIPER's predecessors. JUNIPER carried two powerful diesel fueled generators, which supplied electrical power to twin electric engines that in turn powered the vessel's two propeller shafts. With her diesel-electric system and 18,000 gallons of fuel storage, JUNIPER had a range of 7,000 miles at a cruising speed of 11 knots, making her a tender with true transoceanic capabilities.¹³

Other aspects of JUNIPER's design were not as revolutionary but nonetheless made the vessel suited to buoy tending. She displayed a low turtleback forecastle offering excellent visibility with no sharp edges to catch dangling buoys or mooring chains. The foremast combined with a steel boom and electric winch provided up to 20 tons of lifting capacity. The high superstructure immediately abaft an open well deck provided an excellent vantage point for the ship's officers and helmsman. Her well deck provided a large open workspace for buoy maintenance and storage.

JUNIPER was destined to be a one-off design and the last major design effort of the Lighthouse Bureau. Even as she was taking shape in the shipyard, control of the AtoN system shifted once again. In May 1913 the U.S. Congress had passed an act that served to combine the Life-Saving Service, charged with aiding mariners in distress, with the Revenue Cutter Service, charged with enforcing trade and customs laws in U.S. waters. The new organization responsible for maritime search and rescue and law enforcement was the U.S. Coast Guard. The Coast Guard was set up to operate under civilian control in peacetime but to transfer to the control of the U.S. Navy in times of war. Twenty-six years after Congress founded the U.S. Coast Guard, President Roosevelt's Reorganization Plan Number 11 joined it with the Bureau of Lighthouses. Under the new arrangement the Bureau was "... transferred to and consolidated with and administered as a part of the Coast Guard. This consolidation made in the interest of efficiency and economy" The newly enlarged Coast Guard continued to be responsible for Search-and-Rescue (SAR) and Law Enforcement (LE) as well as approximately

¹³ Scheina, *U.S. Cutters and Craft of WWII*, 104.

30,000 AtoN maintained by the Bureau's 5,200 employees and sixty-four buoy tenders operating out of thirty AtoN depots and seventeen district offices.¹⁴

When the U.S. Coast Guard absorbed the Bureau of Lighthouses on July 1, 1939, JUNIPER was still under construction and plans for a successor were on the drawing board. Plans initiated by the Bureau of Lighthouses called for the construction of several identical buoy tenders to replace existing coastal buoy tenders. The preliminary designs generated by the Bureau were for a vessel similar to JUNIPER. When the AtoN system transferred to Coast Guard jurisdiction, U.S. Coast Guard planners reviewed the preliminary plans for the new class of buoy tenders and modified them to meet the service's multi-purpose role. To be an effective part of the Coast Guard the new buoy tenders needed to be multipurpose platforms. They had to be capable of conducting Search and Rescue and Law Enforcement missions as well as their primary AtoN mission.

The 180s¹⁵

*Old mother Hubbard went to the cupboard
to borrow her daughter's best dress.
But when she got there,
only some trousers were there.
Daughter's a welder at Zenith, I guess!*¹⁶

On January 20, 1941, the U.S. Coast Guard contracted Marine Iron and Shipbuilding Company of Duluth, Minnesota to build the design based on JUNIPER and modified to meet the service's requirements. This was not Marine Iron and Shipbuilding's first experience building an AtoN tender. In 1938-1939 the company built MAPLE, a 122' steel hulled vessel powered by twin diesel engines,

¹⁴ U.S. Coast Guard History Center <www.laesser.org>

¹⁵ WLB is the designation used by the USCG to denote an oceangoing buoy tender. At the time of construction, the 180s were designated as WAGL, which is a U.S. Navy designation denoting an 'auxiliary vessel, lighthouse tender.' The designation changed from WAGL to WLB in the 1965. A few of the 180s have been designated as other types of vessels over the years; three have been changed to WMECs (medium endurance cutters), one of those, EVERGREEN, was a WAGO (oceanographic research vessel) before it became a WMEC. GENTIAN was a WMEC for a time and was then designated a WIX (training cutter) in 1999. Though designations have changed over time, each vessel's hull number has remained the same since commissioning.

¹⁶ Larry Oakes, *Minneapolis Star Tribune*, 7 December 1999.

for the Light-House Service.¹⁷

On March 31, 1941, Marine Iron and Shipbuilding employees laid the keel for the first vessel of the new U.S. Coast Guard buoy tender class. The new vessel measured 180' overall and had a beam of 37' at the extreme. She had a displacement of 935 tons and drew 12'. The new design was similar to JUNIPER in appearance but did exhibit some important differences, such as the removal of the turtleback forecastle. A notched forefoot, ice belt at the waterline, and reinforced bow gave the vessel icebreaking capabilities. Extending the superstructure to the ship's sides increased interior volume above the main deck. A single propeller, turned by an electric motor powered by twin diesel generators, replaced the twin-screw arrangement. The 30,000 gallon fuel capacity gave the new design a range of 12,000 miles at a 12-knot cruising speed; at 8.3 knots the cruising range increased to 17,000 miles. Finer lines at the bow and stern increased the new tender's sea keeping ability in rough weather, while an increase in draft also promoted seaworthiness. Numerous minor alterations increased the vessel's utility as a SAR platform.¹⁸

Marine Iron and Shipbuilding launched the prototype vessel on November 25, 1941, even as three more took shape and preparations went forward to begin a fifth vessel. By the time CACTUS had been commissioned as the first 180 on September 1, 1942, twelve vessels were under construction at the Marine Iron shipyard and at the Zenith Dredge Company shipyard, also in Duluth. Six "B" or MESQUITE class tenders followed the initial production run of thirteen vessels in the "A" or CACTUS class. The first MESQUITE class tender hit the water on November 14, 1942. Marine Iron and Shipbuilding built all but one of the MESQUITE class. The U.S. Coast Guard built the lone exception, commissioned as IRONWOOD, at the service's shipyard in Curtis Bay, Maryland. Twenty IRIS or "C" class vessels followed the MESQUITE class tenders. The first launch of an IRIS class vessel took place on June 18, 1943, and the final addition to the class slipped off the ways on May 18, 1944. The individual ships in the classes were named after trees, shrubs, or flowers. This was a continuation of a longstanding Light-House Service practice of naming tenders after foliage found in the tender's intended area of operations. Even though the 180s were not built with specific sites in mind, the practice nevertheless continued.¹⁹

Differences between the three classes were minimal. Their basic dimensions, length and beam were the same and draft varied based on loading. All were built of welded steel along the same framing pattern and with very similar internal and external layouts. All three classes could steam 8,000 miles at 13 knots, 12,000 miles at 12 knots, and 17,000 miles at 8.3 knots; though the "B" and "C" class vessels

¹⁷ Peterson, 143.

¹⁸ Scheina, *U.S. Coast Guard Cutters and Craft of World War II*, 92-100.

¹⁹ Peterson, 2.

had engines with 20 percent more power than the "A" class. The "A" class vessels could carry the most fuel with a tank capacity of 30,000 gallons. The "C" class carried 29,335 gallons and the "B" class about 700 gallons less.²⁰ The layout of the Commanding Officer's cabin and the radio room differed slightly in the "A" class vessels. The bridge wing door on the "B" and "C" vessels opened to the side while the doors on the "A" vessels opened forward. The cargo holds as originally laid out in the "C" were slightly larger than those in the other vessels.²¹

Other than these differences the vessels, as built, were virtually identical. The CACTUS, MESQUITE, and IRIS class buoy tenders were all-steel vessels built according to accepted mid-twentieth century methods. Each vessel's hull was begun by building a frame of steel I-beams. The framing arrangement looked much like a skeleton with frames radiating from a longitudinal scantling called a keel. Steel plates were welded to the frame and to each other to form the vessel's hull. Regular divisions in the form of transverse watertight bulkheads subdivided the open space within the hull and gave it reserves of buoyancy should a leak develop. The underwater portions of the hull were pierced by through-hull fittings for intake and outflow applications. The hull was also pierced by an opening for the propeller shaft. Steel deck beams fitted across the top of the hull provided the foundation for steel plating to form the vessel's main deck. Portions of the main deck were topped with a steel superstructure.

Forward of the buoy deck was a raised fo'c'sle. At the main deck level the forecastle contained spaces for a workshop aligned on the vessel's centerline. There was a boatswain's locker to port of the central workshop area and a lamp locker to starboard. All the way forward, accessible through the workshop, was a paint and oil locker. Atop the deckhouse containing the workshop and storage lockers was the anchor handling gear consisting of an anchor windlass with two independently operating winches. Chain coming up from chain lockers below the main deck passed through the windlass and led to chock assemblies and then down through hawsepipes on either side of the vessel to the anchor stocks. The usual configuration called for an anchor on each side of the bow. Also located atop the forecastle were large mooring bits outboard of the anchor handling gear on either side. Below the main deck level was a forepeak tank and chain lockers.

Aft of the forecastle at the main deck level was a large open deck space known as the buoy deck. This space stretched almost a third of the vessel's length and from bulwark to bulwark, providing a large open area for handling and transporting various buoys. Poised above the buoy deck was the cargo handling boom, which attached to the deck along the centerline at the aftermost end of the buoy deck. Located at many points on the buoy deck were padeyes and bits for securing deckloads. The bulwarks along the buoy deck were pierced at deck level by freeing ports and fairleads. Below the

²⁰ Scheina, *U.S. Coast Guard Cutter and Craft of World War II*, 92-99.

²¹ D.R. Peterson, "Black Hulls and Blue Water," *Pacific Shield* (January-March 1984): 4.

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forward section of the buoy deck was the forehold that reached down two deck levels; it was accessible through a hatch on the buoy deck. Aft of the forehold were fuel oil tanks; these also reached down two deck levels. The remainder of the space below the buoy deck was taken up by the main cargo hold, also accessible through a hatch on the buoy deck.

The superstructure began immediately aft of the buoy deck. Two levels up from the main deck was the bridge deck. This level contained the enclosed wheelhouse, which faced out over the buoy deck. There were exposed wings on either side of the wheel house. Atop the wheelhouse was a lookout post with a fifty caliber machine gun and searchlight. The lookout post was connected to the wheelhouse via a speaking tube. Immediately aft of the lookout position was the main mast, which supported various antennas. The vessel's radio room and chart room were aft of the wheelhouse and half a deck lower, located immediately forward of the stack. Aft of the stack was an open deck space where the tender's 3" gun was mounted. From its mounting position the weapon could traverse the areas astern and abeam of the vessel, but targets dead ahead could not be engaged with this weapon.

The upper deck was located immediately below the bridge deck. Most of the enclosed portion of the upper deck was taken up by the commanding officer's (CO) suite. This included his office, sleeping cabin, and head. Aft of the CO's suite was space devoted to piping and ductwork leading to the stack. Behind the stack was a small shelter space accessible from the deck. Aft of this was an open expanse of deck space that extended all the way to the stern. This upper deck space contained towing bits and a windlass for towing operations or handling stern lines. This deck also had a fifty caliber machine gun mounted aft of the towing machinery and depth charge launching racks mounted in the stern. Life rafts were mounted along the bulwarks in the after sections of the deck space. The after third of this deck was surrounded by bulwarks, with the rest surrounded by a chain railing that followed a walkway leading forward on either side of the superstructure. There were davits and racks for small vessels located even with the stack but outboard of the superstructure on port and starboard sides.

The interior portion of the superstructure on the main deck was subdivided by two longitudinal passages hereafter referred to as the starboard and port passages. At the forward end of the superstructure along the centerline were storage spaces and electrical controls. Immediately aft of these spaces was the vessel's gyrocompass. Aft of the gyrocompass was the galley and scullery. Across the port passage from the forward storage and electrical spaces was an enlisted head and wash room. Aft of the crew's sanitary facilities was a head and washroom for the Chief Petty Officers (CPO). Aft of this head was the vessel's operating room and dispensary. On the opposite side of the vessel, across the starboard passage, the crew mess extended from the forward edge of the superstructure aft as far as the scullery. Aft of the open crew's mess and across from the scullery was an enclosed compartment used as the Chief Petty Officer's mess, followed by the vessel's office. The centerline portion of the vessel aft of the scullery was devoted to machinery spaces, aft of which was a compartment housing the auxiliary generator. Across the port passage from the machinery and

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generator spaces was berthing for the CPO followed by an officer's stateroom. There was a mirror image officer's stateroom on the starboard side of the vessel. On the port side, a smaller officer's stateroom was located aft of the first. Aft of this second stateroom were head and shower facilities for the officers. On the starboard side, the longitudinal passage terminated after the single stateroom. The wardroom and officer's pantry extended from the port passage to the starboard side of the vessel and aft as far as the officer's head on the port side. The port longitudinal passageway terminated at the officer's head. Aft of the wardroom and officer's head was the steering gear. A small armory room was located on the starboard side of the steering room and additional officer's stores were located on the port side of the compartment.

Below the main deck was the second deck; second deck features located forward of the superstructure are described in the sections detailing the forecabin and buoy deck. The forward half of the second deck below the superstructure was the crew berthing compartment. This area contained tiers of bunks, a crew lounge, and lockers for storing uniforms and personal effects. Aft of the crew compartment was the upper generator room. This space housed the top half of the large diesel generators that supplied electrical current to the main engine. Immediately aft of the upper generator room were three diesel oil tanks that stretched the width of the vessel. Aft of the fuel storage was the compartment housing the top half of the main electrical motor; access to the bottom half of the motor was on the next deck down. A series of fresh water tanks extended the width of the vessel aft of the upper motor room. Aft of the water tanks was a space for engineer's stores and in the very stern of the vessel was the lazarette.

Below the second deck was the hold level, which was the lowest level of the vessel. Details concerning the layout of the hold level forward of the superstructure are in the sections describing the forecabin and buoy deck. Aft of the main cargo hold were storage compartments for cold stores and dry stores. Aft of the storage compartments was the lower generator room. This space was followed by the three diesel fuel tanks described in the section detailing the second deck; these tanks were two deck levels in height. The lower portion of the main motor room was located aft of the fuel storage. The propeller shaft led from the main motor aft to where it passed through the hull at the stuffing box. The propeller itself was located directly below the forward half of the lazarette. The leading edge of the rudder began directly below the center of lazarette and the blade extended aft to a point even with the stern. The rudder stock passed up through the lazarette to the steering room on the main deck. The rudder also attached to the vessel by a shoe leading from below the leading edge forward to the keel. Over time, the interior layouts changed as the vessels passed through renovation and overhaul programs. Additionally, machinery was replaced and upgraded to keep pace with technological change. The basic dimension, however, remained unchanged.

From the outside, the three classes were almost indistinguishable. During the first production run, one difference was the use of an A-frame. To hoist buoys and cargo, the "A" vessels carried an A-frame structure that straddled the superstructure and supported the cargo boom. The other two classes were

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fitted with power vangs that attached to the bridge wings and manipulated the cargo boom. The "A" vessels were originally fitted with manilla line as part of the cargo handling system while the second and third generation vessels used wire rope.²² Over the years, any internal differences and variation in equipment would be minimized by successive overhauls and improvements. Moreover, it does not appear that any one of the three classes was superior to the other two in the eyes of the USCG administration or the men who manned the buoy tender fleet. The three classes were of comparably good construction as well since tenders from each of the three classes remained in use past the turn of the century.

It usually took from two to four months between the time shipyard workers laid a keel and the day the vessel slipped off the ways. Once launched, however, the tenders were far from ready for service. The practice was to build the superstructure, finish the interior, and complete the machinery installation while the vessel was floating. Hence, on launch day the tenders were little more than finished hulls. As the shipyard workers neared the end of the building process, the U.S. Coast Guard would begin assigning officers and men to the vessels. Once each vessel was complete and ready to enter active service, the U.S. Coast Guard commissioned her as part of the fleet. Often the commissioning ceremonies took place after the tender had departed from Duluth and arrived at an initial duty station. For the 180s as a whole it took an average period of 308 days to go from the beginning of construction to commissioning. Divided according to sub-class, elapsed time from keel laying to commissioning averaged 360 days for the Cactus class, 323 days for the Mesquite class, and 269 days for the Iris class. The building process entailed an average of 192,018 man-hours of labor per vessel.²³

Though the design work for the 180s was completed before U.S. entry in World War II, indeed several vessels were already under construction when the Japanese attacked Pearl Harbor, the tenders were very much a product of WWII. The number of tenders built and the rapidity with which the shipyards turned them out is indicative of this nation's massive industrial output during the war years. Before the war, no group of thirty-nine steel ships had been produced in three years. During the period 1941-1944, however, the entire production run of the class went from blueprints to completed ships during a time when the U.S. was producing thousands of other ships at yards around the country.

With the lone exception of the tender built by the Coast Guard in Baltimore, two commercial shipyards in Duluth, Minnesota built all the 180s. Duluth's contributions to the wartime industrial effort were significant. Workers shifted much of the iron ore mined in Minnesota from rail cars to cargo ships in Duluth. Those ships carried the ore to steel mills throughout the Great Lakes region. The mills

²² RADM John L. Linnon, On-line interview response form, 21 August 2001.

²³ Marine Iron and Shipbuilding File, University of Wisconsin (Duluth-Superior) Library Maritime Collection; Scheina, *U.S. Coast Guard Cutter and Craft of World War II*, 92-99.

transformed the raw ore into steel and sent it on to become ships, tanks, and other weapons of war. Beyond its role as a transshipment center, Duluth became an important production center in its own right. Duluth's seven commercial shipyards produced 191 steel ships with an estimated value of \$200 million during the war years. Besides the ships, Duluth produced hundreds of smaller vessels such as barges and lifeboats.²⁴

To achieve this level of production, even as much of the prewar workforce volunteered or was drafted for military service, the shipyards turned to a new source of labor. Duluth's shipyards, like industrial operations nationwide, began to recruit women. As Duluth's men filed off to war as soldiers, sailors, airmen, and marines, Duluth's women filed into the shipyards to become welders, machinists, and electricians. By the end of the war Duluth's "welderettes" numbered 3,500 of the 14,000 persons laboring through the cold Minnesota winters to turn out ships for the war effort. The total number of civilian shipyard workers employed by Marine Iron and Zenith Dredge peaked at 1,200 and 1,500 respectively.²⁵ Thus, the U.S. Coast Guard 180s are historically significant not only as the first class of modern buoy tenders and as part of an unprecedented military build-up but also as milestones in labor history. American women helped build the 180s during the period when women first began to enter the industrial workforce.

Even after commissioning most vessels did not immediately enter regular service. Instead the tenders embarked on shakedown cruises to test the various mechanical, electrical, and hydraulic systems. The shakedown cruises also offered an opportunity for crew orientation and training. It was rare that the shakedown cruise did not reveal some defective system, so most vessels returned to a shipyard to have any glitches repaired. Occasionally the return to the shipyard meant going back to Zenith Dredge or Marine Iron and Shipbuilding in Duluth. Other vessels were sent east and entered the USCG yard at Curtis Bay for the final repairs before being deployed to their duty stations. Visits to the Curtis Bay facility also provided an opportunity to outfit the vessels with any additional equipment or carry out any necessary modifications.

The work done by the men and women of Duluth produced finished buoy tenders but not warships. It would be up to military technicians to make the 180s part of the U.S. war machine. Many of the buoy tenders were destined to operate far from home in a variety of war zones as part of a navy locked in a two-ocean war, and they needed the tools of the trade. To defend themselves against air attack the tenders were fitted with 20mm guns, usually four of them, mounted high on the superstructure and on the aft portions of the main deck. Armorers outfitted the 180s with a single 3" cannon mounted aft of

²⁴ Larry Oakes, *Minneapolis Star Tribune*, 7 December 1999.

²⁵Oakes; Roger Losey, "Pride of the Coast Guard- The 180s From Duluth," *The Nor'Easter, Journal of the Lake Superior Marine Museum Association* 10, no. 4 (1985): 2.

the stack to defend against aircraft and engage small surface or shore targets. They installed depth charge racks as well as K and Y-type launchers on the stern to deploy depth charges in case the vessels ever encountered submerged enemy submarines. Some 180s were also fitted with a device known as a 'mousetrap.' This weapon system launched rocket-propelled explosive charges that would explode on contact with a submarine's hull. The mousetrap system was generally mounted on the bow so the launchers could fire ahead of the vessel. Besides the heavier weapons systems, the tenders carried assorted small arms. Technicians installed radar and sonar systems to guide the 180s through dangerous waters and to help them find targets or avoid enemy units. The U.S. Coast Guard ship yard at Curtis Bay, Maryland carried out the bulk of the work that prepared the buoy tenders for duty in overseas war zones.²⁶ Besides the installation of weapons and sensors, common additions and modifications to war-zone bound 180s included: the addition of diving gear, welding machinery, extra firefighting pumps, and extra salvage pumps.²⁷

From Duluth and Curtis Bay, the tenders fanned out across the globe to assignments within Coast Guard districts and with U.S. Navy units. Most departed for their first assignments with loaded weapons and the orders to: "Attack and destroy enemy vessels encountered. Make report of any contact with the enemy immediately if doing so will not jeopardize the possibility of a successful attack." The official orders also warned the commanding officers to be alert for mines and enemy vessels disguised as neutral or friendly forces.²⁸

The 180s that steamed off to war were, of course, not just machines. Rather than being mere reflections of burgeoning U.S. industrial might, the 180s were also a human microcosm of the American war effort. Like the other armed services, the Coast Guard faced the need to expand its size many times over to meet the demands of wartime. Activated reservists and hastily trained new recruits, volunteers or draftees, soon outnumbered the relatively small number of professional Coast Guardsmen. Perhaps if the emergency had been somehow limited to a maritime defense problem the Coast Guard could have drawn the bulk of its new members from suitable civilian maritime trades. It was, however, a global war requiring a greatly expanded navy and merchant marine. Even the U.S. Army built a vast fleet of small and medium size vessels, each requiring crew. In the face of expansion and competition for experienced mariners, the Coast Guard, as well as the other services, had to make do with whatever human resources they could acquire.

²⁶ CLOVER Decommissioning Pamphlet, CLOVER Cutter File, U.S. Coast Guard Historian's Office.

²⁷ "Versatile is the Word for Buoy Tenders," *Coast Guard Magazine*, June 1945, 35-36.

²⁸ Orders to CO of MESQUITE, 1 October 1943, MESQUITE Cutter File, U.S. Coast Guard Historian's Office.

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Coast Guard cutters steamed off to war, not with crews of grizzled fishermen and well-traveled merchant mariners but with a handful of professional Coast Guardsmen, most newly promoted as the service expanded, a few men drawn from civilian maritime fields, and a majority of recent civilians from all walks of life. One sailor who served on a 180 recalled the crew on his vessel:

Her skipper was Frank Rados, a chief boatswain with the temporary rank of lieutenant. Her crew included a cadre of regulars augmented by typical wartime Reserves — among whom were salesmen, a railroad brakeman, a production director in an advertising agency, a newspaperman and a red-headed ship's cook whose civilian forte was playing jazz music in Detroit nightclubs.²⁹

Buoy tenders from the 180 classes operating in the Atlantic Theater saw service from the frigid waters around Greenland to the tropics, where they operated as far south as Brazil. They worked at tending buoys, breaking ice, and aiding other vessels. They also served as armed escorts for merchant convoys, hunted U-boats, and carried supplies to far-flung installations. The 180s were not limited to coastal duty. Several of them steamed thousands of miles out into the Atlantic to collect important meteorological data that allowed military planners to schedule and route aircraft flights to Europe.

In the Pacific Theater, the 180s covered thousands of miles of open ocean in pursuit of their varied duties. Several vessels worked to establish LORAN station chains in the South Pacific while others conducted similar operations in the Bering Sea. Navy commanders regularly dispatched 180s to carry supplies and personnel between installations throughout the war zone. The lift capacity and towing features of the tenders helped them carry out salvage work. The 180s fought shipboard fires and rescued Allied personnel from damaged vessels. Besides this range of duties, all the tenders fulfilled their design function on a regular basis. They serviced AtoN along the West Coast, in the waters of the Bering Sea, and across the Pacific. They also set and serviced moorings and mooring buoys for naval and merchant vessels throughout the war zone. Their AtoN work was especially important since many of the areas in which U.S. forces operated were very poorly charted or uncharted altogether. The work done by the 180s allowed thousands of Allied ships to operate along routes and in harbors far removed from prewar shipping lanes. The buoy tenders never received the acclaim afforded larger warships but their efforts did not go unnoticed. In the words of a contemporary observer:

As the battleships and assault troop and cargo ships do the heavy work, the Coast Guard tenders scurry alongside, paving the broken way for the miracle of supply which follows. They'll lay cables in the ocean bed, fight fires and perform rescue and salvage chores. A tender may moor an anchor for battleships or tow a Navy seaplane caught on a reef, — it's all in a

²⁹ "'Sweetgum' Fought 'Battle of Coco Solo,'" *U.S. Coast Guard Magazine*, July 1956, 34.

day's work.³⁰

None of the 180s were lost to enemy action during the war. Those in the Atlantic Theater operated under the threat of attack by German U-boats, but the few encounters that occurred saw the cutters dropping depth charges on the suspected positions of submerged U-boats and receiving no return fire. A German U-boat sank one U.S. Coast Guard buoy tender from another class, the ACACIA (WAGL-200), while operating in the Caribbean Sea. The ACACIA was one of the ex-Army mine-planters acquired by the Light-House Bureau after WWI. The U.S. Coast Guard named a "C" class 180 in honor of the sunken vessel.

Though the 180s serving in the Pacific came under enemy air attack on many occasions, no severe damage resulted from these assaults. The 180s contributed to the screen of anti-aircraft fire around the fleet during air raids and shot down several enemy aircraft while contributing to the destruction of others. One tender suffered significant damage from an explosion attributed to a floating Japanese mine. There were no encounters between the buoy tenders and Japanese submarines or surface units.

Weather was an adversary as formidable as the Axis forces. Tenders operating in the northern reaches of both oceans frequently battled ice and snow as they went about their work. Tenders in the Atlantic Theater battled dangerously high winds and waves during storms, especially during winter storms on the North Atlantic, and they also had to dodge hurricanes sweeping up from the tropics during the summer and fall months. The Pacific 180s, besides normal ocean storms, were subjected to the fury of powerful typhoons that regularly sank large ships. Heat was a problem in both theaters and, while never a grave threat to the vessels, it made life miserable for crews operating near the equator in the days before air conditioning.

The 180s survived enemy action and the dangers of operating in the maritime environment in any weather. Every vessel survived the conflict, and the class provided valuable service in the war effort. Their endeavors made possible the safe navigation of thousands of warships and merchantmen as the Allied powers dispatched convoys, battle groups, and invasion fleets to the far reaches of the Pacific and set up a floating conveyor belt carrying millions of tons of war materiel across the Atlantic.

Most of the class returned stateside after the war as the United States pulled the bulk of its military forces back and discharged the millions of men and women that had donned uniforms. A few vessels assigned to the Pacific during the war remained overseas to repair and improve AtoN systems in the various island groups. Most of the 180s returned to the United States where their wartime crews returned to civilian life. The drop in military manning levels was so precipitous that several buoy tenders

³⁰ "Versatile is the Word," 35.

were temporarily decommissioned simply because there were no crews available.

Coast Guardsmen returning to civilian life were not the only ones shedding their wartime accouterments; the buoy tenders themselves underwent a radical change in appearance. Black hulls and gleaming white topsides replaced the haze gray and oceanic camouflage schemes that helped to hide the tenders from enemy eyes during the war years. Shipyard workers stripped depth charge racks and mousetrap launchers from the vessels. Cutters reassigned to the Great Lakes had their 3" and 20mm guns removed as well. Those remaining overseas or assigned to coastal districts kept some of their armament, but the guns spent most of the time concealed beneath canvas covers.

Service on the buoy tenders was more mundane in the wake of World War II. Post-war operations did not include the threat of submarine attack or require manning of anti-aircraft weapons at a moments notice. Instead of operating as part of vast naval fleets and anchoring in the company of battleships, the 180s went about their prescribed missions alone. For the most part they spent their time tending buoys and other AtoN. This was an especially important part of returning American maritime commerce to a peacetime footing as some AtoN had been neglected during the war while others were purposely disestablished to prevent their use by enemy forces. Similarly, many AtoN established during the war required removal, as they were nonessential to normal maritime commerce. Most buoy tenders returning stateside quickly joined their domestic counterparts in an unending routine of hauling buoys, carrying out maintenance on various AtoN, and delivering supplies to out of the way navigational installations.

The process of tending or servicing buoys has been the basic mission of the 180s throughout their careers. It is a process that has evolved through several important technological changes but one that has not changed in any appreciable way over the years. Tending an AtoN begins with traveling to its location and making contact. Once on scene, the conning officer maneuvers the vessel alongside the buoy so the deck force can snag it with reaching poles. Approaching a buoy is often a tricky and hazardous proposition since the marker's very purpose is often to mark shallow water or other hazards to navigation. The difficult nature of the task is reflected in the records of frequent groundings by the buoy tender fleet. The 180s original design, specifically single screw propulsion, meant they were not the most maneuverable platforms and required a skilled ship handler to bring them alongside an AtoN. The addition of bow thrusters during later renovations made them more nimble during close quarters maneuvering. Once alongside a buoy the deck crew snags it and attaches the hook from the cargo boom to a lifting eye on the marker. Then the boom operator lifts the buoy out of the water and deposits it on the open well deck in front of the superstructure where it is secured using several tie downs.

Bringing the buoy on board is less than half the recovery process. A concrete block or “sinker” weighing many thousands of pounds anchors each buoy. Heavy steel chain links the anchor block to the floating buoy. In order to conduct a thorough inspection of the whole system, the chain and sinker must be brought up. The mooring chain is led through a chain stopper on the edge of the well deck. The chain stopper is a mechanical device that prevents chain from slipping back overboard, so it is essentially a one-way valve for chain. After the chain is secure in the chain stopper the boom operator reaches as far down the chain as possible and snags a length of chain, which is pulled up, laid in the chain stopper, and secured on deck. Once the chain is secure, the boom snags another length and hauls it up. In this hand over hand fashion the boom operator hauls up the entire mooring. Often the sinker is left hanging overboard on the outside of the chain stopper. This part of the recovery process has changed since the 180s entered service. Initially, the vessels did not have a chain stopper mechanism, and chain was secured only by tie downs when the boom released one length to grab another. The crew of TUPELO is credited with inventing and demonstrating the value of a prototype chain stopper in 1948.³¹

With buoy, chain, and sinker resting on the buoy deck, or secured in the chain stopper, the deck force can begin working. This is the opportunity to inspect the whole system and do any needed painting, repair any structural damage, and check the batteries if it is a lighted AtoN. The biggest change in this area over the years has been the switch from compressed gas to electricity as the illumination source for buoys and, later, the addition of solar panels to lighted buoys. The panels greatly extend battery life, thereby making battery replacement a less common chore. SWEETGUM conducted the first at-sea ‘solarization’ of a lighted buoy. At present all lighted buoys mount solar panels to extend battery life and improve the reliability of the light.³²

Once serviced, the buoy must be returned to its charted position. Similarly, new or replacement buoys must be placed exactly on station. To accomplish this task navigators feed information from the ship’s satellite navigation system to the conning officer who guides the vessel to the correct place over the sea-bottom. Once on station, the bridge crew tells the deck force to release the sinker. This is done by tripping the chain stopper’s release mechanism with a sledgehammer. This release sends the sinker plummeting toward the bottom. Any tie downs securing the chain to the deck are cut or released. The process of locating the exact position where the sinker should be dropped has changed dramatically over time. Prior to the introduction of GPS, the conning officer was directed to the correct spot by a team of at least three crewmembers using survey sextants to measure horizontal angles to known

³¹ “Cutter Tupelo Experiments with New Method of Handling Buoys,” *Coast Guard Magazine*, January 1950, 12.

³² Stafford Campbell, “Maintaining the Reliability of U.S. Nav aids,” *The Practical Navigator* (1995): unpaginated proof copy.

landmarks visible from the vessel. This process, while accurate when done by experienced navigators, was time consuming and entailed more chance for error than today's use of computerized navigation systems. The shift from sextants to differential GPS has improved the efficiency of repositioning AtoN.³³ Not all buoys are positioned within sight of land and sextant angles can only be taken from fixed landmarks. In the days before GPS, the Coast Guard used LORAN or radar ranges to position these offshore markers. GPS is more accurate than these older navigational tools and has increased the accuracy of placement for offshore buoys.

Any discussion of buoy tenders and their activities would be incomplete without at least a brief discussion of the buoys themselves. The earliest buoys in America were floating wooden casks anchored to the ocean floor. Spar buoys, essentially poles that stuck upright out of the water, joined cask buoys in marking U.S. waterways during the early part of the nineteenth century. Buoys fashioned from riveted iron began to replace their wooden forerunners in the middle of the nineteenth century. Until the 1880s, buoys were silent and unlit, but that decade saw the introduction of gas and electrical lights as well as sound making devices, all of which made buoys of more use to mariners. Throughout the twentieth century buoys continued to evolve in complexity and grow in size. Steel joined iron as a common construction material in the early years of the century and wooden buoys began to disappear. More efficient, not to mention safer, electrical lighting systems relying upon batteries started to supplant the standard acetylene gas powered lights in the 1950s. Battery powered lights benefitted from the addition of solar panels beginning in the 1980s. Two trends paralleled the evolving design of navigational buoys: an increase in their size and an increase in their numbers. Eighteenth century buoys were small structures, limited in size to what a few men on a sailing tender could handle using block and tackle. The advent of steam tenders and powered lifting devices meant buoys could grow in size and thereby become more visible, a plus for mariners. The trend continued throughout the nineteenth and twentieth centuries, especially as large unmanned buoys replaced lightships. As the buoys grew in size, AtoN of all types grew in number to accommodate the ever-increasing levels of maritime commerce. The estimated seventeen markers in existence when Congress formed for its first session grew to more than 30,000 AtoN by the time the 180s took shape on a designer's drawing board. By 1999, the U.S. Coast Guard was responsible for maintaining over 50,000 AtoN.

Though the mission of the 180s became more mundane after World War II, it was not without the possibility of excitement and danger. The U.S. Coast Guard designed the 180s as functional SAR platforms and that capability, proven by rescues during the war, allowed them to respond to emergency calls throughout U.S. waters. As the buoy tenders went about their AtoN work, they were always on

³³ Benjamin Ramsey, "Down East with the Hornbeam; U.S. Coast Guard Magazine Visits a Cape Cod Buoy Tender," *Coast Guard Magazine*, March 1955, 14-15; Thomas Rau, "Buoy Tending: Underway with CGC Acacia's Deck Warriors," *Coast Guard Reservist* (April 1997): 4-5.

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standby for dispatch to the aid of nearby mariners in distress. Dovetailing nicely with other SAR features was the ability of the tenders to break ice on frozen waterways. This meant they could not only clear shipping lanes for routine commerce, but also could go to the aid of other vessels trapped in the ice. Hence, they could complete rescues that were impossible for most USCG cutters and patrol boats. Beyond their seaworthiness and icebreaking capabilities, the buoy tender's SAR value was augmented by equipment for towing other vessels and the ability to fight fires on ships or along the shore.

By the late 1940s all temporarily decommissioned buoy tenders had returned to service as manpower levels stabilized. All thirty-nine members of the type were engaged in AtoN, SAR, and, depending on their location, icebreaking duties. Their combined operations covered the entire shoreline of the continental U.S., the waters around Hawaii and Alaska, and large portions of the Pacific Ocean.

REDBUD was transferred to the U.S. Navy in 1949. It entered service as a light cargo vessel and continued operating as such under naval and, later, Military Sea Transport Service (MSTS) control until the early 1970s. Another tender, EVERGREEN, began conducting increasing amounts of oceanographic research in the North Atlantic and by the 1950s spent most of her time underway collecting scientific data. In 1964 the tender was officially designated the service's first oceanographic research vessel. Other than these two exceptions, the 180s continued to pursue their traditional missions throughout the 1950s and 1960s.

During the postwar years the 180s were also increasingly involved in law enforcement activities. These efforts centered on two disparate pursuits. The buoy tenders helped enforce various federal fishing laws and regulations, with particular attention devoted to those fishing fleets operating in the Gulf of Alaska and Bering Sea. These efforts emphasized keeping foreign fishing vessels out of U.S. waters and enforcement of international agreements on the high seas. Tenders stationed farther south along the California coast and those in the southeastern U.S. targeted drug smuggling more than illegal fishing. As the flow of illicit drugs entering the U.S. increased, many USCG cutters, 180s included, went out to sea to meet vessels headed for American ports, not to provide aid or check their fishing catch, but to search them for cargoes of contraband. The efforts to interdict drug smugglers increased throughout the latter half of the century as the volume of smuggling increased. In the 1980s and 1990s, preventing undocumented immigrants from entering the U.S. by sea became a priority for all U.S. Coast Guard vessels, including the 180s.

The 180s saw limited duty in the Korean War and significant action in Vietnam. Five of the buoy tenders served in the waters around South Vietnam. None were permanently assigned to the theater; instead, they rotated through short tours from homeports in the Philippines and elsewhere in the Pacific. The vessels spent most of their time placing and maintaining AtoN marking coastal and inland waterways. Simultaneously, they conducted extensive training of Vietnamese nationals in preparation

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for the day when the AtoN system passed into Vietnamese hands. This transfer officially took place in 1972. Other missions carried out by the 180s serving in the war zone included cargo transport, survey work, and support of efforts to interdict enemy supply lines.

Most of the 180s did not see wartime action after their service in World War II. This does not mean, however, that military training was not part of the buoy tender's overall mission. The U.S. Coast Guard has always occupied a unique position within the U.S. government. In peacetime, a civilian agency administers it - at first it was the Treasury Department followed by the Department of Transportation. In wartime, the service passes to the operational control of the U.S. Navy. This potential military role combined with the Coast Guard's mandate to contribute to the defense of American waters means USCG units participate in periodic military exercises and operations with the U.S. Navy and allied maritime forces. As part of the U.S. Coast Guard, the buoy tenders regularly drilled to improve their ability to find enemy forces, engage potential targets, survive battle damage, and work in concert with naval units. These maritime defense activities have been ongoing throughout the class' history and continue today.

In the early 1970s the 180s reached their thirtieth anniversaries as USCG cutters. It was during this decade that the inventory of these buoy tenders began to shrink. Appropriately enough, the first to go was CACTUS, the first built. CACTUS ran hard aground in 1971 and the damage was so extensive that the U.S. Coast Guard decided to decommission the vessel rather than repair her. She left service two days shy of the thirtieth anniversary of her launch. Two more 180s left active duty, albeit less traumatically and according to longstanding plans, the following year. A fourth vessel left service in 1973 and two more followed in 1975. These vessels, even CACTUS, went on to second careers in the hands of foreign governments or private owners.

The U.S. Coast Guard only decommissioned one 180 by design in the 1980s; SAGEBRUSH left active duty in April 1988, more than forty-four years after she was commissioned. It was, however, a hard decade on the 180 fleet. On January 28, 1980, BLACKTHORN collided with a commercial tanker in Tampa Bay, Florida. The collision holed and capsized the buoy tender. BLACKTHORN sank quickly, killing twenty-three members of the crew. In December 1989, MESQUITE grounded on a rock pinnacle jutting from the bottom of Lake Superior. The cutter's crew safely abandoned ship in lifeboats but the vessel suffered severe damage after pounding against the rocks during winter storms. It was decommissioned soon after the accident and scuttled in 1990. Three of the buoy tenders underwent conversion to Medium Endurance cutters (WMEC) during the 1980s. These conversions entailed the removal of the buoy handling gear and reassignment to predominately LE and SAR patrol duties.

The U.S. Coast Guard decommissioned fourteen buoy tenders in the 1990s and seven more in the early years of the next decade. In early 2002, eight of the thirty-nine 180s remained in service as

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USCG buoy tenders. A ninth remains in commission as a U.S. Coast Guard cutter but operates in the role of a training and support vessel. Few of the decommissioned cutters have actually been destroyed or dismantled. Instead, they can be found throughout the world. A number were transferred overseas under the Foreign Military Sales Program and serve the navies of countries friendly to the United States. Two embarked on careers as fishing vessels. One serves as a mobile base and supply ship for a missionary group working in the Pacific. Even CACTUS, first of the 180s built, first wrecked, and first decommissioned, still exists. The remains of the tender built in 1941 are used as a barge in the Pacific Northwest. The 180s that have passed out of use entirely were sunk as reefs or ended their lives as targets for naval munitions tests.

The design of the 180s, drawn up before WWII and built in the early 1940s, has demonstrated remarkable longevity. The U.S. Coast Guard decommissioned the bulk of the class only within the last decade and nine vessels continue to serve on active duty, sixty years after they were built and well past the projected lifespan of any military vessel. This is not to say that the 180s simply steamed out of the shipyard after their completion and were so well built that they lasted for five or six decades. There is an axiom regarding boats and ships that the process of replacing parts on a vessel begins the moment it is launched, and the 180s were no exception to this rule.

To keep these buoy tenders on active duty the U.S. Coast Guard has expended millions of dollars, not to mention countless hours of labor by Coast Guard personnel and private contractors. The efforts that kept the 180s operating into the twenty-first century began in the early 1940s. Even as they went about their duties in the midst of war, maintenance remained a regular part of every tender's routine. Maintenance carried out by the tender crews as part of the everyday routine was interspersed with 'availability' periods. During these periods, scheduled at the request of the tender's captain or by orders sent down the chain of command, the individual tenders temporarily left service while the regular crew, often augmented by ship repair specialists, addressed maintenance issues that could not be handled while the vessel pursued its regular mission. The availability periods took many forms. In the simplest incarnation, the tender would anchor out of the way or tie up alongside a dock after a long voyage or operation and the whole crew would devote a few days to putting everything in order. In instances where more complex work was required, the tenders visited shipyards in the U.S. or at naval bases overseas. A visit to a shipyard entailed any number of repairs including time in a dry-dock for work on the hull and exterior propulsion equipment.

After the war the 180s entered into a cyclical maintenance schedule. Exact timetables varied from ship to ship and according to the service's needs, but, on average, each cutter visited a shipyard for a yard period or 'availability' on a biannual basis. Time in the yard allowed for major repairs and improvements as well as routine maintenance chores. Some of these yard periods took place at the U.S. Coast Guard's yard in Curtis Bay but most occurred at commercial shipyards near the individual tender's homeport. Buoy tenders were, of course, sent to the nearest yard equipped to handle the

problem after groundings or other mishaps. In a few instances the U.S. Coast Guard carried out special work at the Curtis Bay yard to prepare vessels for special projects. This was the case when SPAR and BRAMBLE were readied for a trip through the Northwest Passage and when EVERGREEN underwent conversion to become an oceanographic research vessel.

Cyclical yard periods and the efforts of personnel stationed on the buoy tenders kept them in proper shape for many years. Nevertheless, by the 1970s the vessels had reached the end of their projected thirty-year life spans and many needed substantial overhauls if their service careers were to continue. The first round of overhauls to affect the 180 fleet, titled the "AUSTERE Renovations," began in 1974.

Improvements carried out as part of the AUSTERE Renovation program consisted of habitability improvements, engineering improvements, and equipment upgrades. The habitability improvements included modernization of the WWII-era crew quarters and sanitary facilities, installation of a crew lounge, remodeling of the dispensary area, and improved climate control systems. Work in the engineering spaces centered on an overhaul of the propulsion systems and a general modernization of the engineering plant. Equipment upgrades elsewhere included installation of modern electronics and replacement of aging deck machinery. Four buoy tenders went through the AUSTERE Renovation program.³⁴

At about the same time the AUSTERE renovations commenced, the U.S. Coast Guard began rotating other 180s through shipyards for more extensive improvements as part of the "Major Renovation" (MAJREN) program. Under the MAJREN program, vessels received new diesel engines while the main electrical motor and its control systems underwent a thorough overhaul. New electrical wiring and switchboards were installed, as were entirely new water piping and sewage handling systems. Each vessel received a bow thruster to improve its maneuverability in close quarters. Future crews benefitted from the replacement and modernization of all furnishings in the living areas. The living area itself was expanded by decreasing the size of the forward hold. Fourteen 180s went through the MAJREN program renovations. This program was intended to extend their service life by ten to fifteen years.³⁵

The third renovation program to affect members of the 180 class was the Service Life Extension

³⁴ USCG Memorandum #5752, From Chief Short Range AtoN Branch to Chief Asset Management Branch, 1 January 1995, 4; CLOVER Decommissioning Pamphlet, CLOVER Cutter File, U.S. Coast Guard Historian's Office; R. J. Papp, Jr., "Coast Guard Buoy Tenders: Asset, Or Anachronistic Liability?" (Newport, Rhode Island: Naval War College, 1990), 17; Dana V. O'Hara, "180' WLB Service Life Extension Program," *Coast Guard Engineers Digest* 24-227 (Summer 1985): 33-35.

³⁵ O'Hara, 33-35; Papp, 18.

Program (SLEP). This program began in 1983 and culminated a decade later. These renovations all took place at the Curtis Bay yard in Maryland and involved vessels that were previously overhauled under the MAJREN program. Whereas, AUSTERE and MAJREN had entailed significant overhaul, the SLEP was by far the most extensive effort to extend the class' lifespan. During the yard periods new main engines and generators replaced the aging power plants. Upgrades and replacement components served to modernize the electrical systems. Shipyard technicians installed new navigational systems and computer controls for the engineering systems. SLEP work was far more than the replacement or upgrade of various systems or simply the addition of new equipment; it also entailed significant structural changes. Each vessel was sandblasted throughout to remove all paint and expose the underlying steel for careful inspection. Shipyard workers tore away the existing deckhouse and replaced it with a new structure that included an expanded pilothouse, ship's office, and radio room. Internal changes included the installation of smaller forward tanks and the conversion of the forward cargo hold to make room for the installation of more berthing space, including bunks and heads for female sailors, and a crew lounge. The reconfigured space also included bosun, electrical, damage control, and electronics workshops. Work in the internal spaces improved the watertight integrity of the vessels. Up on deck, the electrical weight handling gear was replaced with a hydraulic system and the boom operator's booth moved to a new location. For Cactus class vessels SLEP included removal of the A-frame and reconfiguring the cargo-handling system so the boom attached to the bridge wings. Hydraulic weight handling systems were also added to the boat davits on either side of the superstructure.³⁶

The SLEP overhauls were extensive, and they were also time consuming and costly. The average cost for a single tender to pass through the SLEP was \$11 million. Time spent in the yard averaged eighteen months or, according to the analysis of two representative overhauls, 210,000-215,000 man-hours by shipyard workers.³⁷

Like the earlier programs, the SLEP helped to extend the service lifespan of the aging buoy tenders. Coast Guard projections, made as part of the program, estimated the SLEP would extend vessel lifespans by fifteen to twenty years. Three SLEP vessels remain in service as of 2002. All other 180s

³⁶ Fred Jane, *Jane's Fighting Ships 1987-1988* (New York: Jane's Publishing Company, 1988), 805; "Coast Guard Yard Renovates CGC GENTIAN," *Coast Guard News*, 10 August 1983, 1; "Coast Guard Yard Renovates CGC Cowslip," *Coast Guard News*, 11 July 1984, 1; R. J. Papp, Jr., 17-18; "Renovation of CGC Sorrel Completed: First Vessel to be Finished Under SLEP," *Coast Guard Engineers Digest* 22-218 (Spring, 1983), 14-15; O'Hara, 33.

³⁷ *Jane's Fighting Ships*, 805; "Coast Guard Yard Renovates CGC GENTIAN," 1; "Coast Guard Yard Renovates CGC Cowslip," 1.

that went through the SLEP overhauls left service beginning in 1999.³⁸

Renovating and improving the 180s bought time, but it did not ameliorate a basic problem facing the service. The U.S. Coast Guard would eventually need replacements for the 180s. A steel vessel can, barring any catastrophes, be kept functioning almost perpetually. The cost of doing so, however, grows over time and eventually reaches a point where replacing a vessel or class is cheaper than continuing to use the older platform. The savings are often measured in monetary terms with regards to maintenance costs. They can also be measured in improved efficiency resulting from fewer breakdowns, less frequent yard periods, and the use of more advanced technologies.

By the 1990s it was time to begin the lengthy process of creating a successor for the vessels. An initial planning and consultation period ended in January 1993 when the U.S. Coast Guard awarded a contract to Marinette Shipbuilding of Manitowac, Wisconsin for the production of a new class of seagoing buoy tenders. Marinette Shipbuilding won a second contract in June 1993 for the construction of a new class of coastal buoy tender. The new seagoing tender class was named for the prototype vessel: JUNIPER. The coastal tenders became the Keeper class, each named for a well-known lighthouse keeper from the past.³⁹

The Juniper class vessels measure 225' in length, 46' in beam, and are propelled by two diesel engines driving a single reduction gear and a Controllable Pitch Propeller (CPP). They are equipped with bow and stern thrusters, which combined with the CPP makes for a maneuverable platform. Like the 180s, they can handle limited icebreaking duties. The new seagoing tender incorporates many advances in maritime technology that allow the tenders, though larger than their predecessors, to operate effectively with a smaller crew. Perhaps the most significant advance is the use of a dynamic positioning system (DPS) to help keep the tender on station. The DPS involves computerization of the systems that maneuver the vessel, namely propulsion and steering, combined with the latest in satellite navigation technology. This system allows the Juniper class vessels to maintain position within a 10-meter radius in 30 knot winds and 8' seas. JUNIPER passed from Marinette Shipbuilding to the U.S. Coast Guard in 1996. Projections call for a total of sixteen Juniper class tenders.⁴⁰

Keeper class tenders measure 175' in length and have a beam of 36'. They are the first U.S. Coast Guard cutters propelled by a twin Z-Drive. This propulsion system is essentially a propeller installed

³⁸ O'Hara, 33.

³⁹ Papp, 3, 14.

⁴⁰ Harry Benford ED, *A Half Century of Maritime Technology, 1943-1993* (Jersey City, New Jersey: The Society of Naval Architects and Marine Engineers, 1993), 443; Marshall, *History of Buoys and Tenders*, 13.

within a nozzle that can rotate 360 degrees. This means thrust, in any amount manageable by the vessel's diesel engine, can be applied in any direction. The Z-Drive system, popular with many newer tugboats, is combined with a bow thruster in the Keeper class tenders to give them excellent maneuverability and station-keeping qualities. Each vessel also carries dynamic positioning systems, further honing the vessel's ability to hover on station. As of 2002 the USCG has fourteen Keeper class tenders in service.

As the new seagoing and coastal tenders entered service, the U.S. Coast Guard began decommissioning many of the 180s. As of early 2002, there were nine of the old buoy tenders still in commission, which will be slowly phased out. Tentative plans call for ACACIA to be the last in service with a decommissioning date sometime in 2006.⁴¹

The 180' buoy-tending cutters built for the U.S. Coast Guard during the early 1940s are remarkable in terms of their longevity. With the exception of the U.S. Coast Guard's STORIS, no other military vessels on active duty today served in World War II. Not one of the mighty battleships or carriers that cost millions of dollars remains part of the U.S. Navy. None of the largest cutters that hunted submarines and rescued drowning sailors continue to patrol the oceans. The 180s longevity is not a case of superior construction, though they were undoubtedly built quite solidly. The methods and materials used by their builders were substantially the same as any used at the time, and the 180s have required as much maintenance and repair as any other steel work vessel. The sixty plus years of service performed by the class can be attributed to their design rather than their construction. The 180s were extremely versatile and perfectly suited for their multifaceted role. They could break ice, replace a buoy, and save a sinking ship all in the course of a day's work. Moreover, they could complete these missions within sight of their homeport or steam across thousands of miles of open ocean to complete an assigned task. They did not become outmoded until computers, satellites, and automation changed the way ships are built and equipped. The U.S. Coast Guard spent time and money keeping the 180s in service long beyond their projected lifespan because that was the best option until very recently. These ships that fought U-boats more than half a century ago have spent millions of hours making the world's waterways a safer place for science, commerce, and recreation. Obsolescence crept up on the 180s very slowly, granting them tenure unmatched in twentieth century American naval history.

History of Individual Vessels

She is so old we don't know all that she's done.

⁴¹ Jeff Beach, Decommissioned Boat Manager, U.S. Coast Guard, interview by author, 10 February 2002, Washington, D.C.

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---RADM W. Ted Leland USCG, in speech honoring USCGC HORNBEAM's fiftieth birthday

The 180' buoy tenders proved to be extremely versatile vessels over the course of their long-lived careers. Though all spent some portion of their time afloat servicing buoys, they served in many other pursuits as well. Many of these alternate activities revolved around the vessel's intended secondary missions like Search and Rescue, Law Enforcement, and icebreaking. Often, however, the tenders carried out missions never envisioned by their designers, ranging from transporting rare tropical fish to landing scientific parties on drifting icebergs. This plethora of pursuits when combined with the wide geographic distribution of the 180s makes it difficult to describe a typical or generic career for a 180. The oceangoing buoy tenders built for the U.S. Coast Guard in the early 1940s served around the world and fulfilled the service's requirement for a true multi-mission capable platform.

APPENDIX A — Terms and Abbreviations

AtoN — **Aid(s)-to-Navigation** — Any marker or signal that imparts navigational information to mariners or aviators.

Bridge — The compartment or area from which a vessel is navigated. Usually contains a wheel and electronic equipment such as radar, radios, navigational computers. The bridge is typically located high on the forward end of the superstructure as this is the best vantage point.

Galley — Kitchen facilities on a ship.

Bulkhead — Transverse partition that divides a vessel's hull into sections. If the bulkheads are watertight, the vessel's ability to survive damage is significantly improved as flooding will only affect the area immediately adjacent to the damage instead of spreading to fill the entire vessel.

B-52 — Heavy bomber deployed by the U.S. Air Force as a strategic weapon during the Cold War.

B-29 — Army Air Force heavy bomber used to strike the Japanese home islands at the end of World War II. Many of the islands taken by amphibious assault were used as primary or alternate airfields for the B-29 raids.

CINCLANT — Commander in Chief, Atlantic — The admiral in charge of all U.S. naval operations in the Atlantic Ocean; also refers to the officer's office or headquarters.

CINCPAC — Commander in Chief, Pacific — The admiral in charge of all U.S. naval operations in the Pacific Ocean; also refers to the officer's office or headquarters.

Coast Guard District — This is an administrative division of the U.S. Coast Guard. As of 2002 the United States is divided into nine Coast Guard Districts. During World War II there were fifteen Coast Guard Districts.

Curtis Bay — The location of the U.S. Coast Guard's primary shipyard. This facility handled most major repair and renovation tasks associated with the 180s. This is also where IRONWOOD was built.

DEW Line — **Defensive Early Warning** — Line of radar installations deployed across the northern reaches of North America. This system was installed during the Cold War to warn American leaders of any surprise raid by Soviet forces by way of the Arctic.

GPS — Global Positioning System — Electronic navigation system utilizing satellites in geosynchronous orbit. Shipboard receivers measure the direction to several satellites. Each measurement yields a line of position and the intersection of several lines results in a position fix. The position information yielded by GPS can be accurate within a few feet. GPS receivers can display position information as coordinates or as part of a graphic display. GPS has become the electronic navigation system of choice for most maritime operations and has largely supplanted the older, less accurate Long Range Navigation system.

Head — Toilet.

Helm — Wheel or other control device used to steer.

Hold — Cargo storage area on a ship.

IIP — International Ice Patrol — A collaborative effort begun by maritime nations of the North Atlantic after the TITANIC collided with an iceberg and sank. Participating nations task ships to spot and track icebergs as they move south from the Arctic and into Atlantic shipping lanes during spring and summer months.

Keel — Primary structural member in modern ship construction using wood, iron, or steel. The keel runs longitudinally and is located at the lowest point in the hull. It usually takes the form of a large wood or metal beam.

LOP — Line of Position — This is a navigational term that describes an imaginary line on the Earth's surface with the vessel somewhere on the line. A single LOP is of limited use to a navigator but two or more intersecting LOPs yield the navigator's current position. LOPs can be derived from bearings or distances to objects on shore or calculated from the position of a celestial body.

LORAN — Long Range Navigation — Electronic navigation system that was introduced during World War II. The LORAN system is organized in chains of broadcasting stations located at fixed and known points on the earth's surface. Each chain consists of a "master" station and one or more "slave" stations. The "master" broadcasts a radio signal at prescribed times, each slave transmits its own signal after receiving the "master" signal. Since the speed at which radio waves travel is a known constant, shipboard navigators can fix their position by measuring the time at which various signals are received as compared to the time they were transmitted. In recent years LORAN has given way to GPS systems for most marine applications.

LST — Landing Ship Tank — Large amphibious assault vessel used to land men and material during amphibious invasions.

Marine Iron and Shipbuilding — A commercial shipyard located in Duluth, Minnesota. This company produced twenty-one of the thirty-nine 180s.

Mess — Dining area on a ship.

Midget Submarine — Small undersea vessel used to launch torpedoes, attached mines, or otherwise deliver an explosive payload. The midget submarines were primarily employed by the Japanese and Italian Navies during World War II. Though they did have limited and local success against larger vessels they were never a significant factor in determining the outcome of any naval campaign. The first overt warning of the Japanese attack on Pearl Harbor came when a U.S. destroyer attacked and sunk a Japanese midget submarine approaching Pearl Harbor.

OOD — **O**fficer of the **D**eck — The officer in charge of a vessel's safe operation. This term denotes who is on watch or on-duty on the bridge rather than indicating absolute rank. Hence, a junior officer can be the OOD and nominally in charge of a vessel even though more senior officers are aboard.

PBM — World War II era seaplane used mainly for patrol duties.

Radar — **R**adio **D**etection and **R**anging — Electronic instrument that consists of a transmitter and receiver. The transmitter sends out radio waves and the receiver measures the return or echo of those waves after they bounce off objects. Analysis of the return can provide information about distant objects including: size, location, speed, and number.

SAR — **S**earch and **R**escue — One of the primary functions of the U.S. Coast Guard; entails finding and assisting persons in trouble on the water.

Seabees — Construction arm of the U.S. Navy during World War II. These units, usually battalions, built runways, docks, and other military installations in newly occupied areas. They often worked close to the front-lines and under enemy fire.

Sextant — Precision navigational instrument used to measure angles. Most applications involve using sextants to measure the altitude of celestial bodies in order to determine position on the high seas. Sextants can also be used to measure angles from a vessel to landmarks on shore; if three or more known landmarks are used this will yield a position fix. Buoy tender crews used this method to determine where to drop buoys in the days before electronic navigational systems.

SLEP — **S**ervice **L**ife **E**xtension **P**rogram — Program of modernization intended to extend the careers of selected 180s. These extensive overhauls were done at the U.S. Coast Guard's shipyard in Curtis

Bay, Maryland.

Sonar — **S**ound **N**avigation and **R**anging — Acoustic device used by submarines and surface vessels to detect other vessels and to navigate. Sonar systems operate by emitting a pulse of sound and measuring the return or echo. Analysis of the return can provide information about distant objects, including: size, location, speed, and number. Sonar information is also useful in mapping undersea topographical features. Sonar can also refer to 'Passive Sonar,' which is simply the analysis of underwater sounds using microphones and audio filtering systems.

Superstructure — Portion of a vessel above the main deck.

Typhoon — Large anti-cyclonic storm occurring in the Pacific Ocean. This weather phenomenon is analogous to a hurricane in the Atlantic and is characterized by winds in excess of 74 miles per hour.

Weather stations — During World War II Allied vessels were often assigned to take up patrol stations at selected locations in the North Atlantic; from these stations they transmitted meteorological data back to headquarters. This data allowed military leaders to pick optimal times for launching trans-Atlantic flights and improved the chances of aircraft making the long over-water journey.

Yard — A shipyard or installation where extensive repair or construction work can be carried out on a ship. In referring to the 180s this means the U.S. Coast Guard Shipyard at Curtis Bay, Maryland, unless otherwise noted.

YP — **Y**ard **P**atrol **C**raft — Small naval vessel used for various duties within harbors and other protected areas.

Zenith Dredge Company — A commercial shipyard located in Duluth, Minnesota. This company produced seventeen of the thirty-nine 180s.

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Vessel Name	Builder	Hull Number	Days to Build	Class	Keel Laid	Launch	Commis- sioned	Decommis- sioned	Renovations	Cost (in dollars)
WOODRUSH	Zenith	407	292	Iris	2/4/44	4/28/44	11/22/44	3/01	1979 Major Renovation	926,156
MALLOW	Zenith	396	240	Iris	10/10/43	12/9/43	6/6/44	5/97	1975 Austere 1993 SLEP	926,926
SPAR	Marine	403	273	Iris	9/13/43	11/2/43	6/12/44	2/97	1977 Major Renovation	865,941
IRIS	Zenith	395	245	Iris	12/10/43	5/18/44	8/11/44	6/95	1974 Austere	926,446
BITTERSWEET	Zenith	389	238	Iris	9/16/43	11/11/43	5/11/44	8/97		926,769
BLACKHAW	Marine	390	307	Iris	4/16/43	6/18/43	2/17/44	2/93	1992 SLEP	871,771
REDBUD	Marine	398	286	Iris	7/21/43	9/11/43	5/2/44	3/1/72		926,926
SAGEBRUSH	Zenith	399	261	Iris	7/15/43	9/30/43	4/1/44	4/26/88	1990 SLEP	925,134
SALVIA	Zenith	400	240	Iris	6/24/43	9/15/43	2/19/44	4/91	1991 SLEP	923,995
BLACKTHORN	Marine	391	311	Iris	5/21/43	7/20/43	3/27/44	1/28/80 Sunk		876,403

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Appendix C – Comparison of buoy tenders (Figures 1-3)

	Cactus Class	Mesquite Class	Iris Class
Built	3/ 31/1941 - 8/30/1943	8/20/1942 - 11/20/1943	3/21/1943 - 9/22/1944
Builder	Mar. Iron / Zenith Dredge	Mar. Iron / Zenith Dredge*	Mar. Iron / Zenith Dredge
# Built	13	6	20
LOA	180'	180'	180'
Beam	37'	37'	37'
Draft	12'	12'	12'
Displacement	935(1945), 1025 (2002)	935(1945), 1025 (2002)	935(1945), 1025 (2002)
Max Range	17,000 miles	17,000 miles	17,000 miles
Max Speed	13 knots	13 knots	13 knots
Powerplant	Diesel Electric	Diesel Electric	Diesel Electric
# of Propellers	1	1	1
Horsepower	1000	1200	1200
Cargo handling gear	20 ton capacity electric boom	20 ton capacity electric boom	20 ton capacity electric boom
Positioning System	Sextant Angles, GPS	Sextant Angles, GPS	Sextant Angles, GPS
Electronics	Radio, Radar, Sonar	Radio, Radar, Sonar	Radio, Radar, Sonar
Crew	80 (1945), 49 (2000)	80 (1945), 49 (2000)	80 (1945), 49 (2000)
Cost to build	\$782,381-952,103	\$870,836-1,388,227	\$861,589-927,156

	RICHARD RUSH	SHUBRICK	JUNIPER
Built	1831	1857	1940
Builder	Webb and Allen, New York	Philadelphia Navy Yard	John Mathis and Co.
# Built	1	1	1
LOA	73'6"	140'8"	177'
Beam	20'2"	22'6"	32'
Draft	6' 8"	11'	8'7"
Displacement	112	305	790(1945)
Max Range	NA	unknown	7,000 miles
Max Speed	11 Knots (estimate)	unknown	12.5 knots
Powerplant	Sail (Schooner Rig)	Steam, single expansion steeple engine	Diesel Electric
# of Propellers	NA	side paddle wheels	2
Horsepower	NA	284	900
Cargo handling gear	Unknown	unknown	20 ton capacity electric boom
Positioning System	Sextant Angles	Sextant Angles	Sextant Angles
Electronics	None	None	unknown
Crew	20-24	unknown	38 (1945)
Cost to build	Unknown	\$60,000	\$396,464

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	Juniper Class	Keeper Class
Built	1994-	1995-
Builder	Marinette Shipbuilding	Marinette Shipbuilding
# Built	7 (9 more under contract)	14
LOA	225'	175'
Beam	46'	36'
Draft	13'	7.9'
Displacement	2000	845
Max Range	6000 miles	2000 miles
Max Speed	16 knots	12 knots
Powerplant	Diesel	Diesel - "Z" Drive
# of Propellers	2	NA
Horsepower	3100 (2)	1710(2)
Cargo handling gear	20 ton capacity hydraulic boom	10 ton capacity hydraulic boom
Positioning System	DGPS	DGPS
Electronics	DGPS, DPS, Radar, Radio	DGPS, DPS, Radar, Radio
Crew	44 (2000)	20 (2000)
Cost to build	\$41,700,000	?

Appendix D – Map of North American Circumnavigation by SPAR, BRAMBLE, and STORIS

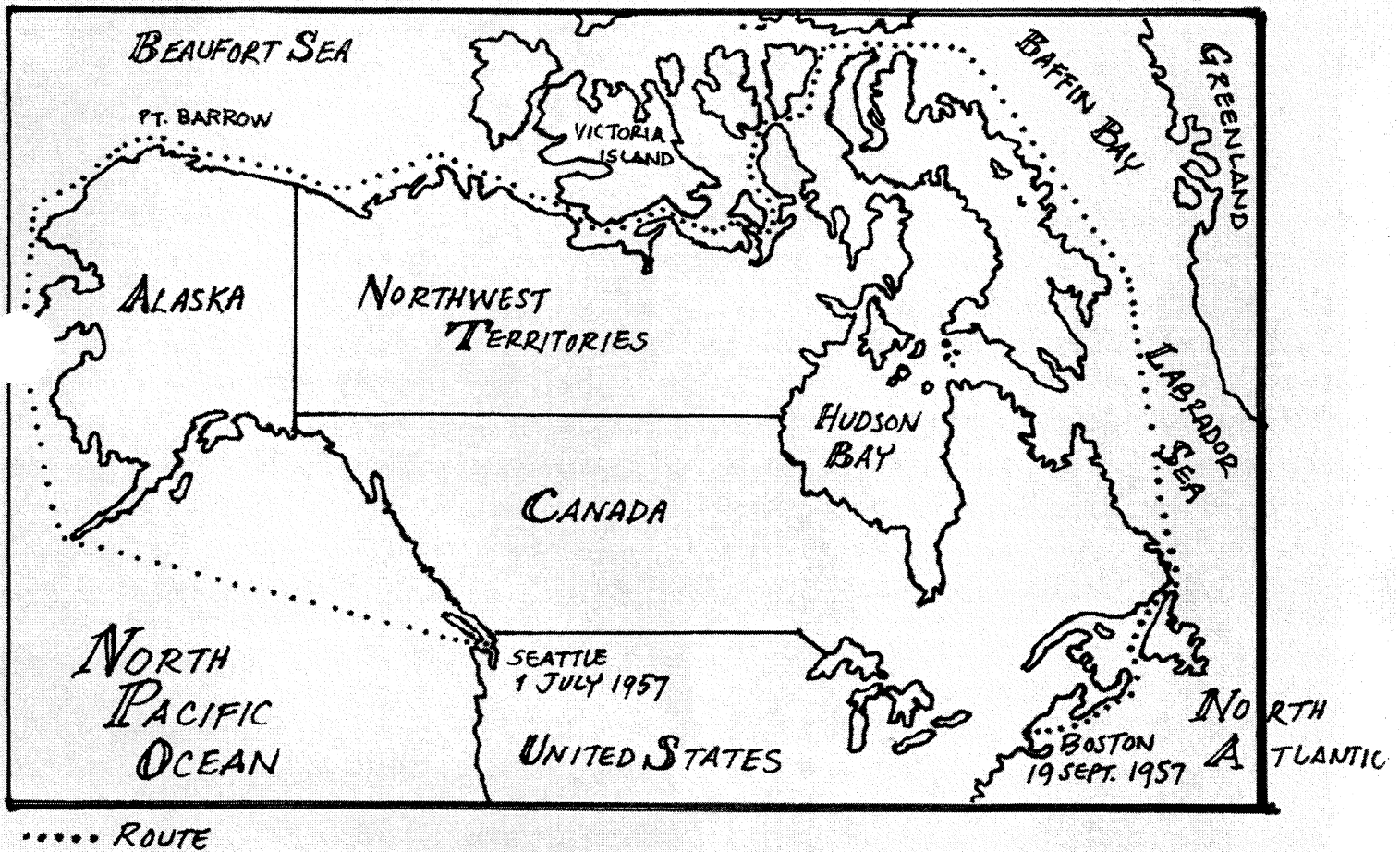


Figure 4 Circumnavigation Route

APPENDIX E – Renovation Programs

COMPARISON OF 180 RENOVATIONS

	AUSTERE VESSELS	MARJEN VESSELS	SLEP VESSELS
BOOM CAPACITY (tons)	20	20	20
SHAFT HORSEPOWER	1000	1200	1200
FULL SPEED	12.8 knots	13.0 knots	13.4 knots
ECONOMICAL CRUISING SPEED	7.4 knots	7.5 knots	8.0 knots
DIESEL OIL CAPACITY	28,694 gallons	27,875 gallons	29,211 gallons
FRESH WATER CAPACITY	56,002 gallons	30,499 gallons	30,954 gallons
FUEL ENDURANCE AT FULL POWER	13 days	13 days	13 days
RANGE AT FULL POWER	4600 miles	4500 miles	4500 miles
FUEL ENDURANCE AT CRUISING SPEED	71 days	75 days	50 days
RANGE AT CRUISING SPEED	13,500 miles	13,500 miles	9600 miles
FRESH WATER ENDURANCE	35 days	21 days	21 days
REEFER ENDURANCE	30 days	30 days	30 days
DRY STORES ENDURANCE	30 days	30 days	30 days
OVERALL ENDURANCE	35 days	21 days	21 days

APPENDIX F – Additional Coast Guard Photographs



Figure 5 Crew of a buoy tender hauls aboard a navigational buoy off the coast of South Vietnam.
(Courtesy of U.S. Coast Guard)

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Figure 6 BLACKHAW underway off the coast of South Vietnam. (Courtesy of U.S. Coast Guard)



Figure 7 The deck crew aboard BLACKHAW prepares to service a navigational buoy. (Courtesy of U.S. Coast Guard)



Figure 8 BASSWOOD in Southeast Asian waters. (Courtesy of U.S. Coast Guard)



Figure 9 IRONWOOD works with a USCG helicopter off the coast of Alaska.
(Courtesy of U.S. Coast Guard)



Figure 10 SUNDEW pushes through thick ice. (Courtesy of U.S. Coast Guard)

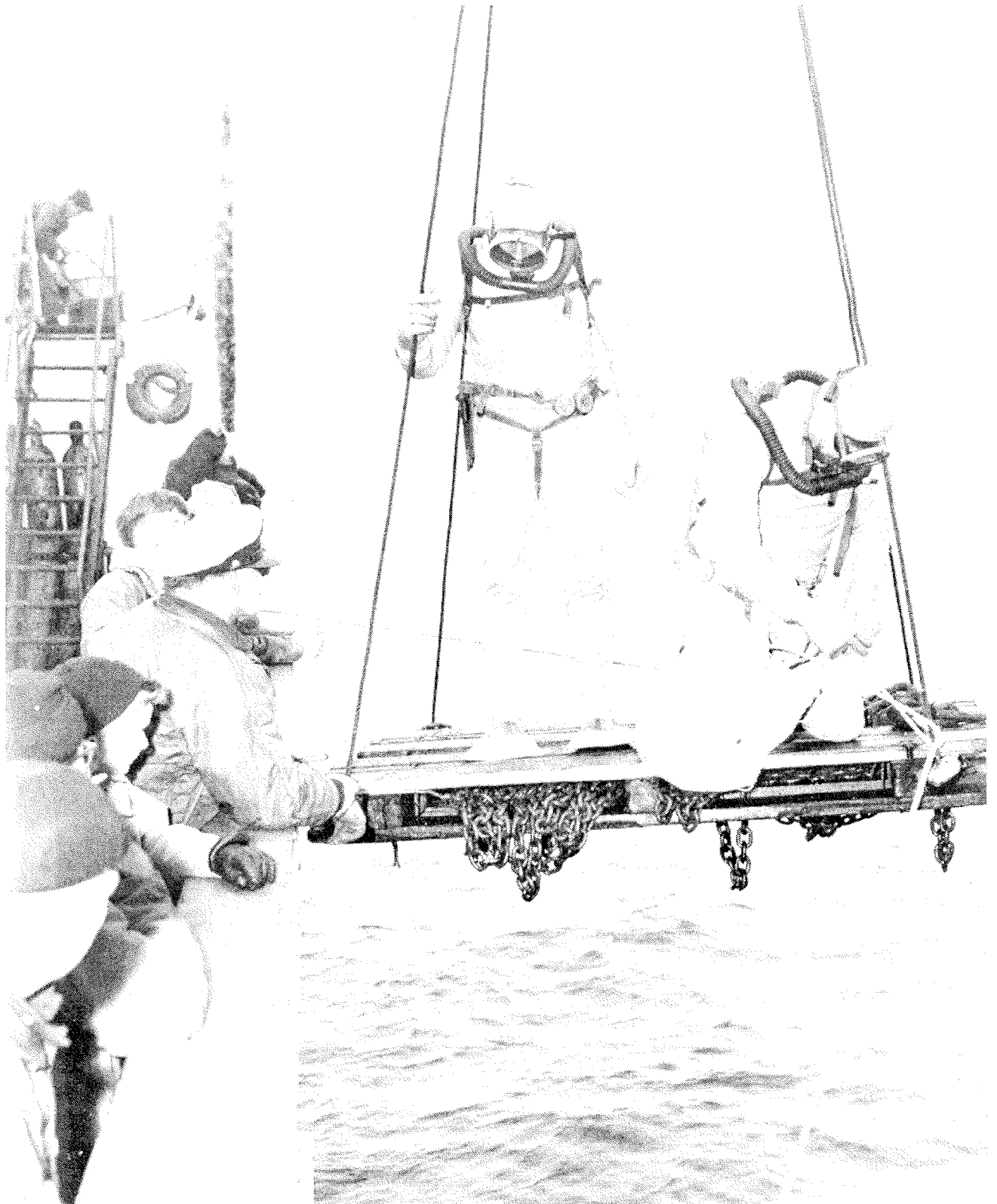


Figure 11 Divers prepare to inspect SPAR's hull and propeller for damage after she broke through thick ice during her circumnavigation of North America. (U.S. Coast Guard)

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Figure 12 A new Juniper class buoy tender nears completion at the Marinette Shipbuilding Yard.
(Courtesy of U.S. Coast Guard)

SELECTED BIBLIOGRAPHY

PUBLISHED RESOURCES

- "Ailing Coast Guard vessel battling high Pacific waves." *Tribune* (Alameda, CA), 27 January 1983.
- Babcock, Lisa. "Report: Human error caused ship grounding." *Petoskey News-Review* (Michigan), 12 January 1990, 25.
- _____. "Mesquite rests in watery grave." *Petoskey News-Review* (Michigan), 16 July 1990, 1.
- Beach, Jeff, Decommissioned Boat Manager, U.S. Coast Guard. Interview by author, 10 February 2002, Washington, D.C.
- Bender, Bryan. "Blackhaw ready for 'typical' CG day." *Bay Express* 1, no. 7 (1990): 1-4.
- Benford, Harry ED. *A Half Century of Maritime Technology, 1943-1993*. Jersey City, New Jersey: The Society of Naval Architects and Marine Engineers, 1993.
- Bruner, Eric L. "No buoy too big for Oregon tender." *Commandant's Bulletin* September (1991): 25.
- "'Cactus'-Class Cutters are Seagoing 'Jack-of-All Trades.'" *Coast Guard Magazine* (Jul 1956): 32-35.
- "Cactus Faces Decommissioning." *Daily Astorian*, 8 November 1971.
- Campbell, Stafford. "Maintaining the Reliability of U.S. Nav aids." *The Practical Navigator* (1995), unpaginated proof copy.
- Capelotti, Pete. *Oceanography in the Coast Guard*. Washington, DC: U.S. Coast Guard Historian's Office, 1996.
- Chatterton, Howard. "Buoytenders--Looking Ahead." *Coast Guard Engineers Digest* No. 185 (Oct-Nov-Dec, 1974): 22-28.
- "Civilian-manned Buoy Tender [Redbud]." *Coast Guard Magazine* (Feb 1957): 22.

"Clover Nabs 13 Tons" *SCAN* (11th USCG District Newsletter) 8, no. 7 (1983): 1.

"Coast Guard Launches Atomic Buoy." Coast Guard Academy Alumni Association *The Bulletin* (Nov-Dec 1961), 39-41.

"Coast Guard Begins Search for Sunken Oil Tanker." *Commander's Digest* 3, no. 64 (1967): 4.

Congressional Record, 14 February 2001, S1291.

"Construction and Repair Topics: Lighthouse Tenders." *Coast Guard Engineers Digest* No. 37 (Sep 1939): 30-(1)

Cox, J. Lee. *Historical Context and Statement of Significance: USCGC CITRUS (WMEC-300)*. Philadelphia: Dolan Research, 1994.

_____. *Historical Context and Statement of Significance: USCGC MALLOW (WLB-396)*. Philadelphia: Dolan Research, 1997.

_____. *Historical Context and Statement of Significance: USCGC SPAR (WLB-403)*. Philadelphia: Dolan Research, 1997.

Cradick, Alan. "46-Year Old Cutter Madrona Returns to Tending Buoys." *Coast Guard Engineers Digest* 28-240 (Fall 1989/Winter 1990):18.

_____. "Madrona's Maritime Metamorphosis." *Commandants Bulletin* (Oct 1989): 20.

"Cutter 'Mesquite' finally scuttled." *The Milwaukee Journal*, 16 July 1990, sec. A, p. 4.

"Cutter [Redbud] Prepared Site for Atomic Bomb Experiment." *Coast Guard Magazine* (Jul 1946): 32-33.

"Cutter SPAR to be Refurbished." *Times* (Bar Harbor, Maine), 19 Feb 1976.

"Cutter Tupelo Experiments with New Method of Handling Buoys." *Coast Guard Magazine* (Jan 1950), 12.

"Damaged Coast Guard ship survives storm." *The Sun* (San Bernadino, CA), 27 January 1983.

"Damaged vessel awaits towing." *Oregonian* (Portland), 26 April 1980.

U.S. COAST GUARD BUOY TENDERS, 180' CLASS
HAER No. DC-57
(Page 55)

“Disabled buoy tender Iris to be towed home to Astoria from Umpqua today.” *Statesman Journal* (Salem, Oregon), 26 April 1980.

French, Bob, Director, Stockton, California chapter, Sea Scouts. Interview by author, 4 March 2002, Washington, D.C.

Frost, J. “New Blood in the Buoytender Fleet” *Commandant’s Bulletin* (August 1990): 21-22.

Goff, David. “Mallow seizes 11 tons of pot, arrests 8.” *Pacific Shield* (April 1988): 1.

Goldstein, Richard. *Desperate Hours: The Epic Rescue of the Andrea Doria*. New York: John Wiley & Sons, 2001.

Gordon, David. “Spar Brings Back New Data On Fractures in Ocean Floor.” *The Providence Journal* (Rhode Island), 11 October 1966, 34.

Haberman, Margaret. “Ship repairs pump \$13 million into economy.” *Bellingham Herald* (Washington), 5 November 1989, sec. A, p. 1,12.

Hall, Wes. *Historical Context and Statement of Significance: Cactus, Mesquite, and Basswood Classes, United States Coast Guard 180-foot Buoy Tenders (WLBs)*. Castle Hayne, North Carolina: Mid-Atlantic Technology and Environmental Research, 1997.

“Harbor Sands Claim Vessel.” *Montessano Vidette* (Montesano, Washington), 18 November 1971.

Hendrickson, Robert. *The Ocean Almanac*. New York: Doubleday, 1984.

Jane, Fred ED. *Jane’s Fighting Ships 1986-1987*. New York: Jane’s Publishing Company, 1988.

Jennings, Frank “Grounded — Lake Superior claims CGC Mesquite — Crew safely evacuated.” *Commandant’s Bulletin* (n.d.): 1-3.

Kaplan, H.R. and James Honer. *This is the Coast Guard: A Pageant of United States History Spanning 182 Years*. Centerville, MD: Cornell Maritime Press, 1972.

Ledger-Star (Norfolk), 26 May 1972, sec. A, p.9.

Lemieux, L.A. “Tending Buoys One of Hardest Tasks Given Coast Guardsmen.” *U.S. Coast Guard Magazine* (August 1948): 19-20.

Linnon, John L. On-line interview response form, 21 August 2001.

Losey, Roger "Pride of the Coast Guard- The 180s From Duluth." *The Nor'Easter, Journal of the Lake Superior Marine Museum Association* 10, no. 4 (1985): 1-5.

Marine Iron and Shipbuilding File, University of Wisconsin (Duluth-Superior) Library Maritime Collection

"Mariposa Shifted Back Home." *Coast Guard Magazine* (Mar 1955): 18.

Marshall, Amy K. "Frequently Close to the Point of Peril: A History of Buoys and Tenders in U.S. Coastal Waters, 1789-1939." Master of Arts Thesis, East Carolina University, 1998.

Marshall, Amy K. *A History of Buoys and Tenders*. Washington, DC: U.S. Coast Guard Historians Office, 1995.

McCloskey, Bill. "Coming of Age in Alaska." *National Fisherman* (October 2000): 28-31.

Neeley, Elizabeth. "Buoy Work." *Commandant's Bulletin* (June 1991): 36-37.

"New lives for old buoy tenders." *The Fishermen's News*, 2nd Issue June 1979, 29.

Oakes, Larry. "Welderettes of Duluth." *Minneapolis Star Tribune* 7 December 1999, R9.

O'Hara, Dana V. "180' WLB Service Life Extension Program." *Coast Guard Engineers Digest* 24-227 (Summer 1985): 33-35.

Papp, R.J., Jr. "Coast Guard Buoy Tenders: Asset, Or Anachronistic Liability?" Military Essay. Naval War College, Newport, Rhode Island, 23 Feb 1990.

Peterson, Douglas. *United States Lighthouse Service Tenders: 1840-1939*. Annapolis & Trappe, MD: Eastwind Publishing, 2000.

Peterson, D.R. "Black Hulls and Blue Water." *Pacific Shield* (January-March 1984): 4.

Poe, W.E. "Northwest Passage: The Voyage of the Cutter SPAR." *Sea Classics* (n.d.): 12-17, 76-79.

Ramsey, Benjamin. "Down East with the Hornbeam; U.S. Coast Guard Magazine Visits a Cape Cod

Buoy Tender.” *Coast Guard Magazine* (Mar 1955): 14-15.

_____. “Down Yonder with the Sweetgum.” *Coast Guard Magazine* (May 1955): 30-31.

Rau, Thomas. “Buoy Tending: Underway with CGC Acacia’s Deck Warriors.” *Coast Guard Reservist* (Apr 1997), 4-7.

“Renovation of CGC Sorrel Completed: First Vessel to be Finished Under SLEP.” *Coast Guard Engineers Digest* 22-218 (Spring, 1983): 14-15.

Santos, Dave. “Juniper Brings Buoy Tending Into the 21st Century.” *Commandants Bulletin* (Sep 1995): 2-5.

Scheina, Robert L. *U.S. Coast Guard Cutters and Craft, 1946-1990*. Annapolis, Maryland: Naval Institute Press, 1990.

_____. *U.S. Coast Guard Cutter and Craft of World War II*. Annapolis, Maryland: Naval Institute Press, 1982.

_____. “180-footers Celebrate 40th Birthday.” *Commandants Bulletin* (May 25 1984): 16-17.

_____. *U.S. Coast Guard: A Historical Overview*. Washington, D.C.: U.S. Coast Guard Historian’s Office, nd.

“Ship awaits help after battering from storm.” *Daily Times Advocate* (Escondido, CA), 26 January 1983.

Small, Anthony M. (Driver Associates) Letters to LCDR B. Newlin, USCG, 13 March 1980, 11 February 1980.

“Spar Homecoming Marks End of 17,000 Mile Expedition.” *Bristol Phoenix* (Rhode Island), 14 October 1966, 1.

Spence, Hal. “Homecoming joyous as Sedge returns.” *Homer News* (Alaska), 17 May 1990, sec. A, p. 14.

“Storm swings north but still packs punch.” *South Bay Daily Breeze* (Torrance, CA), 26 January 1983.

U.S. COAST GUARD BUOY TENDERS, 180' CLASS
HAER No. DC-57
(Page 58)

Stewart, LL, owner Maritime Equipment and Sales Inc. 10 January 2002, Baltimore, Maryland.

"Sweetbrier, Soft Name for a Rugged Ship." *Coast Guard Magazine* (Aug 1951): 17.

"The Black Fleet." U.S. Naval Institute Proceedings 115 (Oct 1989): 90-95.

"The Mighty 'B' [Bramble] Puts to Sea, or, with the Atom Bomb at Bikini." *Coast Guard Magazine* (Jan 1947): 28-29.

Tulich, Eugene N. *The United States Coast Guard in South East Asia During the Vietnam Conflict*. U.S. Coast Guard Historical Monograph Program. Washington: U.S. Coast Guard Public Affairs Division, 1975.

"Two Tender-Class Cutters to be Launched." *Coast Guard Bulletin* I, 33 (Mar 1942): 165-266.

United States Coast Guard, Statistical Division/Historical Section. *The Coast Guard At War*, Vol. XV "Aids to Navigation." Washington: Public Information Division, U.S. Coast Guard Headquarters, 1949.

"U.S. Coast Guard Magazine Visits a Buoy Tender and Learns How to Plant a Mooring Buoy." *Coast Guard Magazine*, July 1947, 20-22.

"Versatile is the Word for Buoy Tenders." *Coast Guard Magazine*, June 1945, 35-36.

Willoughby, Malcom F. *The U.S. Coast Guard in World War II*. Annapolis, Maryland: Naval Institute Press, 1957.

Witter, Robert W. "Conversion of the USCGC SUNDEW (WAGL-404)--A 180-Foot IRIS Class Cutter." *Coast Guard Engineers Digest* No. 84 (Jan-Feb, 1954): 8-13.

Wright, Walter. "2nd half of trap sprung in pot sting on high seas." *The Honolulu Advertiser*, 3 March 1988, sec. A, p. 3.

"Yard Completes Major Activation of CGC COWSLIP." *Yard News* 30, no. 10 (1981): 1.

ELECTRONIC RESOURCES

U.S. Coast Guard Cutter, Aircraft, and Boat Data-Sheets.
<<http://www.uscg.mil/datasheet/dataindx.htm>>

U.S. Coast Guard listing of Congressional Bill that created the service.
<<http://www.uscg.mil/hq/g-cp/history/USCGBill.html>>

U.S. Coast Guard District 13 information about 180s.
<<http://www.uscg.mil/d13/dpa/background/ships/180.htm>>

Chronology of U.S. Coast Guard History, U.S. Coast Guard Historical Center.
<<http://www.laesser.org>>

RESOURCES AT U.S. COAST GUARD HISTORIAN'S OFFICE

Bass, E.D. EVERGREEN History, EVERGREEN Cutter File, U.S. Coast Guard Historian's Office.

"Buttonwood Bids Farewell to Pacific." *Coast Guard News*. 5 February 1981, 1.

"Coast Guard Cutter Blackhaw- Lamplighter of Southeast Asia." *Coast Guard News*. 25 December 1969, 1.

"Coast Guard Cutter Damaged by Fire." *Coast Guard News*. 25 April 1980, 1.

"Coast Guard Yard Renovates CGC Cowslip." *Coast Guard News*. 11 July 1984, 1.

"Coast Guard Yard Renovates CGC GENTIAN." *Coast Guard News*. 10 August 1983, 1.

"Damaged Buoy Tender to be Escorted to Ketchikan." *Coast Guard News*. 26 January 1990, 1.

"Holed Coast Guard Buoy Tender Gains on Flooding." *Coast Guard News*. 26 January 1990, 1.

"Redbud Goes to the Philippines." *Coast Guard News*. 7 March 1972, 1.

"REDBUD — Ship's History." REDBUD Cutter File, U.S. Coast Guard Historians Office.

"Release No. 49-73-3, COWSLIP Decommissioned — ." *Coast Guard News*. 16 March 1973, 1.

Rumsfeld, Harvey J. Letter to Dr. Robert Browning, U.S. Coast Guard Historian. n.d.

U.S. Coast Guard communication COMLANTAREA to U.S.C.G.C. CONFIDENCE, 24 May 1989.

“U.S. Coast Guard Cutter Citrus to be Decommissioned September 1.” *Coast Guard News*. 30 August 1994, 1.

U.S. Coast Guard Incident Memo, 21 September 1971.

U.S. Coast Guard Memorandum #5752, From Chief Short Range AtoN Branch to Chief Asset Management Branch, 1 January 1995.

U.S. Coast Guard Memorandum, From Chief Short Range AtoN Branch to Chief Asset Management Branch. “Historicity Determination.” 19 January 1995

Pamphlets

ACACIA Welcome Aboard Pamphlet. ACACIA Cutter File. U.S. Coast Guard Historian’s Office, n.d.

BASSWOOD Decommissioning Ceremony Pamphlet. BASSWOOD Cutter File. U.S. Coast Guard Historian’s Office.

BLACKHAW Deployment Report, DOT-USCG, From CO BLACKHAW to CO 14th USCG District. 22 May 1970.

BLACKHAW Welcome Aboard Pamphlet. BLACKHAW Cutter File. U.S. Coast Guard Historian’s Office.

BRAMBLE Welcome Aboard Pamphlet. BRAMBLE Cutter File. U.S. Coast Guard Historian’s Office.

CITRUS Decommissioning Ceremony Pamphlet. CITRUS Cutter File. U.S. Coast Guard Historian’s Office.

CLOVER Decommissioning Ceremony Pamphlet. CLOVER Cutter File. U.S. Coast Guard Historian’s Office.

EVERGREEN Decommissioning Ceremony Pamphlet. EVERGREEN Cutter File. U.S. Coast Guard Historian’s Office.

EVERGREEN Decommissioning Ceremony Pamphlet. EVERGREEN Cutter File. U.S. Coast Guard Historian’s Office.

GENTIAN (WIX-290) Commissioning Ceremony Pamphlet. GENTIAN Cutter File. U.S. Coast Guard Historian's Office.

GENTIAN Welcome Aboard Pamphlet. GENTIAN Cutter File. U.S. Coast Guard Historian's Office.

MALLOW Decommissioning Ceremony Pamphlet. MALLOW Cutter File. U.S. Coast Guard Historian's Office.

MARIPOSA 50th Anniversary Pamphlet. MARIPOSA Cutter File. U.S. Coast Guard Historian's Office.

MARIPOSA Decommissioning Ceremony Pamphlet. MARIPOSA Cutter File. U.S. Coast Guard Historian's Office.

PAWPAW Welcome Aboard Pamphlet. PAWPAW Cutter File. U.S. Coast Guard Historian's Office.

SAGEBRUSH Decommissioning Pamphlet. SAGEBRUSH Cutter File. U.S. Coast Guard Historian's Office.

SALVIA Welcome Aboard Pamphlet. SALVIA Cutter File. U.S. Coast Guard Historian's Office.

SALVIA Decommissioning Pamphlet. SALVIA Cutter File. U.S. Coast Guard Historian's Office.

SPAR Change of Command Pamphlet. SPAR Cutter File. U.S. Coast Guard Historian's Office.

SPAR Welcome Aboard Pamphlet. SPAR Cutter File. U.S. Coast Guard Historian's Office.

SUNDEW Welcome Aboard Pamphlet. SUNDEW Cutter File. U.S. Coast Guard Historian's Office.

WOODBINE Welcome Aboard Pamphlet. WOODBINE Cutter File. U.S. Coast Guard Historian's Office.

ADDENDUM TO:
U.S. COAST GUARD BUOY TENDERS, 180' CLASS
U.S. Coast Guard Headquarters, 2100 Second Street Southwest
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