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THE LIGHTS SHINE ON

History of Lighthouses

2003 Oregon fce Lesson Leader's Guide

Presented by
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Over the past century, dramatic advances in technology have swept through virtually every field, bringing especially drastic changes to transportation, communication, and navigation. With all the traffic on the water there was a need for lighted beacons to guide the boats along the coasts. The oldest lighthouse is still standing in Dover, England. This lighthouse dates back to about 280 B.C. There were not very many lighthouses in the world when the first lighthouse was built in the United States, which was Great Brewster Island at Boston Harbor in 1716. Most people think of lighthouses as being a tall white tower on a point of land. Lighthouses come in many shapes, sizes and heights, including cylindrical, conical, square, octagonal, and even triangular shaped, with towers that stand as tall as 193 feet. Some of the things that influenced lighthouse design was politics, special needs, cost, location, geography at the site, and available technology at the time of constructions. Some of today's light stations would be almost unrecognizable to lighthouse engineers of previous eras. Yet the essential role of the lighthouse as guardian of the shores and protector of seafaring vessels remains fixed in our imaginations. And beyond their practical functions, lighthouses stand as architectural monuments, solid and long-lasting evidence of cultural progressions through the millennia. When viewed in relation to its ancient traditions, the lighthouse has known sophisticated automatic equipment for only moments in its illustrious history. The height of its development occurred in much earlier times, when technical development came much more slowly. The study of lighthouses is known in English as pharology, another word that owes its derivation to this ancient structure.

Lighthouses may be highly specialized structures, but their stories seem to have almost universal appeal. All over the country—and indeed, all over the world—people are fascinated by lighthouses. Some are drawn to the diverse architectural styles; though the quintessential model may be a tall tower with a light on top, quite a wide array of design types have been employed in different regions and different eras. Others like the mechanics: how the various lenses were developed, what sources of light were used, and how the fog signal worked. Still others enjoy the human interest aspects of how the keepers and their families lived day to day, how they coped with extreme conditions, and how they risked their lives to rescue mariners in distress. In today's high-speed world, the traditional lighthouse is something of an anomaly; it is perhaps the poetry of the lighthouse that keeps the subject alive. The study of lighthouses offers one the opportunity to dream, to imagine what life was like in other times, to picture one's existence transformed into a life of gentle solitude with only the sea as a constant companion.

Travel has always been an inherent part of human civilization. For thousands of years, people have journeyed to find new sources of food, to establish new settlements, or to explore new lands. From earliest times, voyages by sea posed a particular kind of danger, since primitive navigation methods proved little help in negotiating unknown

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coastlines or even pinpointing a ship's location in known territory. Natural markers such as familiar rock formations, groupings of tall trees, or mountains served as rudimentary navigational aids. The very first lighthouses were undoubtedly volcanoes, since their fiery effusions were visible both day and night, even far out at sea. Early mariners also learned to rely on bonfires lit along the shore. Once people discovered that elevated fires could be seen at greater distances than those on the beach, they started building tall stone towers to burn fires on top. And with this innovation began the legacy of one of the most important and fascinating structures in history.

The Pharos of Alexandria, Egypt built the largest and tallest lighthouse ever built. Reputedly built between 331 and 280 B.C., it was believed to be 350 to 400 feet high. The immense tower lit the harbor for more than a thousand years. The structure rested on a 100-foot square base that held 300 rooms for the workmen and keepers. Several earthquakes wrought damage over the years, and finally an earthquake in the fourteenth century brought the structure to ruins.

One of the earliest and most courageous offshore efforts to erect a lighthouse occurred 5 miles off the coast of France on the small island of Cordouan. Once building began it was discovered that the island was beginning to disappear, so a sturdy wall and parapet were constructed in an attempt to stave off the encroaching sea. Eventually a magnificent structure resulted, complete with statues, pillars, royal chapel, and a room for the king. The ornate tower attained the height of a sixteen-story building, only to lose 25 feet off the top when it was struck by lightning in 1612. It is also the world's tallest rock light, and was the site that Augustin Fresnel (pronounced Fruh-nell) chose in 1822 to test his revolutionary new lens.

Fueled by wood fires, the lights of early towers were generally exposed to the elements. Covered lanterns later provided some protection from the rain, and after that some structures add glass to further safeguard the flame. But constant burning devoured wood quite swiftly, so by the 16th century coal use became more common. Although coal fires presented an increased hazard (a strong wind could create a flame so hot it might melt the grate that contained it), coal fires offered better light and were therefore used for centuries until the mid-1800s.

In 1716, at the request of the area's merchants, the Province of Massachusetts that year erected a "Light Hous and Lanthorn on some Head Land at the Entrance of the Harbor of Boston for the Direction of Ships and vessels in the Night Time bound into the said Harbor." This harbor also became the site of the country's first fog signal when a cannon was installed in 1719. Over the next seven decades the Colonies erected twelve more lights, ranging from Brant Point Light in Massachusetts to Tybee Island Light in Georgia.

The early lighthouses were constructed mainly of wood or stone. Most of the ones built of wood ended up burning down. The stone ones were simply built by piling one stone on top of another. The walls had to be tapered to support the weight so that the tower would not become unstable. The higher the tower the thicker the base. The

maximum practical height of the tower was 90 feet. There were twelve lighthouses built before the Constitution became the law of the land. It was also at this time that the control went from the states to the federal government. During the period between 1789 and 1820, this was the first time that cut stones and bricks were used and this permitted them to be taller and stronger. Out of the first forty towers built only eleven survived. Most of these lighthouses did not survive the Civil War. Half of these towers were built in the North on a solid foundation. This is not really an impressive record of survival. During 1820 – 1852, the Fifth Auditor of the Treasury was responsible for the administration of the lighthouses. The Fifth Auditor was a bookkeeper and did not know anything about lighthouses. The ones built during this time were inferior and he also had to rebuild or repair the ones built before this time, for example, forty of the brick towers built in the South, twenty-five either blew over or sank into the soft ground. During this time, the United States was adding territories that required lighthouses.

The federal government, organized in 1789, undertook the building of several lighthouses, including one at Portland off Maine's southern coast, where construction had been spurred by a nearby sloop wreck in 1787. George Worthylake, Boston Light's first keeper, had served for two years when disaster struck. Returning to the lighthouse one day, he and his family drowned when their boat capsized during a storm. Benjamin Franklin, then thirteen years old, heard of the drowning and wrote a ballad called "Lighthouse Tragedy" to memorialize the incident. His brother printed sheet music of the song, which young Franklin sold on the streets of Boston. Citizens were saddened to learn of the great tragedy that had befallen their lighthouse.

Buoys were rarely put on the lists of navigational aids for the colonies. Most of these early aids were lighthouses. The exceptions were the cask buoys in the Delaware River recorded in 1767, and the spar buoys in Boston Harbor recorded as early as 1780. The spar buoys were made of long cedar or juniper poles. The United States didn't have a standard system of buoyage until 1848. Colors, shapes, and sizes varied from port to port. Also in 1848, Congress adopted the Lateral System for implementation nationwide. It is from the Lateral System that the familiar "right, red, return" has its origin. Under the stricter eye of the Lighthouse Board, buoyage in the United States steadily improved. Spars and cask buoys gave way to can and nun shaped riveted iron buoys. These buoys were set according to the Lateral System: Red runs to the starboard of channels as observed by ships returning to port, and black can buoys to the port as observed by ships leaving the port. The Board also standardized sizes to maximize visibility. The nun, can, and spar buoys are the oldest style of minor aids in America's coastal waters. Durable but unlit, these buoys are probably among the most familiar to the nonmarine.

The Lateral System continues in use today, except that can buoys are now painted green instead of black. Tests in 1970's showed that green is more highly visible from a greater distance. Audible signal buoys were also developed. The earliest recorded in the United States is the Brown's Bell Buoy developed by a Revenue Marine Captain in the 1850's. This simple buoy had a base supporting a superstructure upon which hung a bell with four clappers that struck as the buoy rolled in the sea. From this simple design, whistles, bells, and foghorn buoys developed. Plastic buoys were the subject of

A series of reinforced concrete towers of art deco design were constructed in Alaska during the 1920's and 1930's. The one at Scotch Cap was destroyed by a tidal wave in 1946 killing five men.

The newest reinforced concrete tower was completed in 1958 and is at Oak Island, North Carolina. This tower is 169 feet tall. This silo style tower was erected by using the Swedish developed moving slip form method. This method was that the concrete was poured and once that section dried, the form was moved up and another section was poured. The color is integrated into the concrete. The lantern room is aluminum.

In an effort to keep maintenance cost down, the fiberglass tower was issued by the Coast Guard. The color of the tower is molded into the plastic with pigments so painting is not necessary. There is very little metal used to keep the saltwater corrosion to a minimum. The light lens is plastic and no storm panes are required for protection. The first one used in the United States was in northern California in the 1960's. Three were built in New England in the early 1980's. The first of these is at Deer Island, Boston Harbor, Massachusetts, and is a white tower built in 1982. This replaced an iron tower on a caisson.

The United States lighthouse located farthest from shore is Stannard Rock Lighthouse. Standing some 23 miles north of Michigan on Lake Superior, the tower was erected in 1882 on a shoal the Lighthouse Board had called "the most serious danger to navigation in Lake Superior."

The only hyperradiant lens ever acquired by the United States was installed in 1909 at Makapuu Lighthouse. Located on the island of Oahu, this site was deemed in need of a lighthouse in 1905, when the Lighthouse Board declared, "All deep-sea commerce between Honolulu and Puget Sound, the Pacific coast of the United States, Mexico and Central America, including Panama, passes Makapuu Head, and... there is not a single light on the whole northern coast of the Hawaiian Islands to guide ships or warn them of their approach to land, after a voyage of several thousand miles." Now automated, the still-active light at Makapuu boasts an immense lens with an inside diameter of 8.5 feet.

Coastal lighthouses experience a wide range of treacherous conditions, but the salt of the oceans at least prevents a substantial amount of ice from building up. The stations along the Great Lakes are not lucky. The combination of high winds, subzero temperatures, and frequent blizzards acting upon sites surrounded by fresh water can lead to terrifying results. Surrounded by towering snowdrifts, entire towers have become encased in ice, impairing their function and imprisoning their keepers inside or preventing them from gaining access. Lake Huron's Spectacle Reef Lighthouse—built after two wrecks occurred on a dangerous reef in 1868—took several years to construct. When keepers arrived to open it for the first time in the spring of 1874, ice had piled more than 30 feet up the tower; they had to chop it away to reach the door.

Even in the absence of a storm, fog might present a serious navigational hazard, requiring keepers to tend the fog signals diligently until the air cleared. The first fog signal in the United States was a cannon installed in 1710 at the country's first lighthouse, Boston Light. The first fog signal on the West Coast was also a cannon; obtained from the army, it was at California's Point Bonita in 1855 and manned by a former army sergeant. Just two months later an infamous San Francisco fog settled in, lasting for three days straight and allowing the sergeant only two hour's rest. Within two years, the cannon had been replaced by a fog bell.

Bells had been introduced at several New England lights in the 1820s. At first they were rung by hand to answer passing vessels, but by the 1860s the Lighthouse Board had engines installed to sound them mechanically. Larger bells (weighing as much as 4,000 pounds) were later installed, utilizing striking machinery governed by clockwork to ring regular, recognizable characteristics. But even large bells were not really sufficient for seacoast use. Beginning in 1851, trumpets utilizing compressed air were used experimentally. These proved more penetrating than bells, but were still not entirely satisfactory. Steam whistles were investigated as early as 1855; though powerful, they took time to put it into operation, which presented a problem since fog often descended quickly.

The diaphone, invented by the Canadian Lighthouse service, proved an important innovation. Powered by compressed air, steam, or electricity, it gave a distinct, easily discernible sound. To enable vessels to distinguish locations by sound, each foghorn emits a particular sound and number of blasts. Today's light stations generally employ diaphones, as well as radio beacons, which not only provide navigational assistance in low-visibility periods but enable distant vessels to determine their positions in any weather.

Hazardous conditions were not limited to existing lighthouses. Certain regions required light stations to improve navigation, yet presented situations that made construction of a traditional lighthouse unfeasible. Originally called lightboats, lightships were intended to provide navigational aids in the many locations where a lighthouse was impractical. The world's first lightship was launched in the early 1730s in England, where the Medway River joins the Thames. It took nearly a century for one to be anchored in the United States; in 1820, Chesapeake Bay's Willoughby Spit (near Norfolk, Virginia) received the first United States lightship. Six more lightships were activated on bays, rivers, and harbors by 1823. That year also saw the launching of the earliest outside light vessels (those stationed in the ocean), activated around New York Harbor. The first one in New York supplemented the operations of New Jersey's Sandy Hook Lighthouse to mark the main channel leading to the Port of New York. The United States possessed twenty-six active lightships by 1837, and the number increased to forty-two by the time the Lighthouse Board assumed control about fifteen years later.

The lightship is a comparatively recent development in the field of navigation, yet its history was short-lived; the age of the active lightship lasted only about 160 years. Operation of the early lightships was often inefficient and less dependable. There were

no relief lightships, stations frequently were unmarked for weeks or months on end during periods when it was necessary to withdraw the assigned vessel for repair. Some of the early vessels were operated by contract, with officers and crew being drawn from the local civilian community. Such personnel could in no way be classed as seamen in terms of either inclination or competence. In the early 1800's, the crew on the early lightships ranged from one officer and four or five crewmen to two officers and eight or ten crewmen on the larger vessels. The Masters and Mates were classed as "Keeper" and "Assistant Keeper" respectively until November, 1892, at which time the classification was changed. Living conditions aboard were uniformly poor, discipline was frequently deficient, and the personnel turnover rate was enormous.

With the advent of the Lighthouse Board in 1852, the situation was somewhat improved, but it was not until 1910 when the United States Lighthouse Service came into being that lightships found a place in a truly reliable, service oriented organization emphasizing professional competence in officers and crew members and remedying longstanding problems with pay, living conditions, benefits and technology. These high standards were carried onward by the United States Coast Guard in operating the lightships from 1939 until they were phased out in 1983.

In 1966, the Coast Guard began investigating the possibility of replacing lightships with Large Navigational Buoys or LNB's. Far from being a minor navigational aid, these "monster buoys" have hulls up to 40 feet in diameter with a depth of up to 7 ½ feet. The LNB prototype, constructed in 1969, had a steel hull subdivided by six bulkheads. These more cost effective LNB's, along with "Texas Towers" huge permanent platforms, served as the discontinuation of lightships in the United States. The advances made possible by the screwpile light, and later the caisson structure, began the lightship's path toward obsolescence, since these types of lighthouse could be placed on previously impractical marine sites. By the 1960s, technology had enabled the replacement of lightships with stationary platforms similar to those used for offshore oil rigs. Fewer than thirty lightships are still on the water. Many have been converted into floating museums.

Although the lightship no longer sees duty as a navigational aid, it became noteworthy at the turn of the century for a particular occurrence. On August 23, 1899, the very first wireless transmission ever sent by the United States Lighthouse Service was made from one of these vessels, the San Francisco Lightship, to a station on the ocean front of San Francisco.

Shipwrecks, both accidental and premeditated, are as old as seafaring itself. The ancient Greeks and Romans salvaged shipwreck cargo and sold survivors into slavery. This practice, called "wrecking" was a highly profitable profession along the coasts of Britain for centuries. With its isolated and merciless coastline, Cornwall was a wreckers' paradise. Many in its impoverished population looked to wrecking as a path toward improving their station. It was even said that some vicars in remote Cornish fishing villages encouraged their congregation not necessarily to pray for wrecks, but to urge the Lord that if they had to happen, He help guide them in the right direction.

The fires that were kindled along the shores of New York's Fire Island during the last century may have earned the island its name. The flames were most likely meant to help guide ships through Long Island Sound, but some may also have been lit by wreckers to lure ships to their doom.

So important was this site as a navigational aid that in the 1850s the Lighthouse Board ordered a tall tower built there to replace the 1826 structure. The board declared the resulting 167-foot tower the most important lighthouse for transatlantic steamers, which set their course for this light on voyages from Europe and departed from it for the return trip.

The most horrifying aspect of wreckers was its active encouragement. Wreckers were often known as "mooncussers" due to their penchant for cursing the light of the moon and praying for dark nights, during which ships were more likely to run aground. Fog and storms were their allies as well. These unscrupulous types built fires or placed signals in dangerous spots to lure unsuspecting vessels onto the rocks. Thinking the light marked a harbor's entrance, a captain would steer his ship toward it, only to realize the deception too late. Dashed upon the rocky shore, the ship and whatever treasures it contained then fell prey to the looters.

To increase their powers of deception, mooncussers might carry a lighted pole across the beach, or attach lanterns to horses or cattle and lead the animals along the shore. To a ship out at sea, such lurching spots of brightness resembled another vessel moving through unobstructed waters. Or a wrecker might stand on a dangerous outcropping swinging a lantern that had been fastened to the end of a broom handle, thus fooling a ship's captain into thinking the light was hanging from a safely anchored vessel. If their evil labors succeeded, the wreckers would scramble swiftly aboard, claiming the ship and its cargo as their own.

Yet these legions of darkness were gradually overcome. The construction of Boston Light—the first lighthouse in the New World—resulted because Boston merchants in 1713 petitioned the General Court for a lighthouse, seeking to put a stop to this thievery. By 1774, Virginia had declared wrecking a crime punishable by death. The Massachusetts Humane Society began building rescue stations in the 1780s to provide food, firewood, and shelter to shipwreck survivors.

Surprisingly, the very first use of electricity in a lighthouse capacity did not occur in a lighthouse. When an electric arc was installed in the Statue of Liberty in 1886, it became the first electrified structure to serve as a lighthouse. Now a national monument, the statue is no longer considered a navigational aid, but for a brief time the lady and her torch did help to guide ships into New York Harbor.

Nowadays, only about seven hundred to eight hundred traditional lighthouses remain, fewer than two-thirds of which still see active service. In past decades, obsolete stations often ended up in private control, sometimes sold at public auction. Today many

inactive lights are administered by the National Park Service and the United States Forest Service. A number of them are centerpieces of state or national parks, or have been converted into maritime museums or tourist attractions filled with lighthouse artifacts. Others have been leased and restored by local historical groups, which often take action to preserve the traditional look of a light station after automation. Sometimes the keepers' quarters are restored to their original appearance to provide visitors with a glimpse of the keepers' lifestyle. Some lighthouses have even been transformed into elegant bed-and-breakfast accommodations, or into inexpensive youth hostels for those on a more limited budget. One of the country's most picturesque lights is southern Maine's Cape Neddick Lighthouse, generally referred to as Nubble Light because the little island on which it stands is known as a nubble. Situated near a popular resort, the station received considerable national television coverage years ago when the original 1879 tower underwent automation. Each year the town of York celebrates the holidays by decking its beloved lighthouse in thousands of Christmas lights.

To salute the charms of the lighthouse, and perhaps to increase awareness of the movement to preserve the lights, several states feature the structure on their license plates. North Carolina's first historical attraction license plate depicts the Cape Hatteras Lighthouse. Connecticut, Massachusetts, New Jersey, New York, Ohio, and Pennsylvania also offer lighthouse plates.

According to a list originally compiled by the United States Lighthouse Society in San Francisco, there are nineteen lighthouses around the country offering guest accommodation. Most of these range from bed-and-breakfast establishments resembling country inns to simple youth hostel setups. But the New Dungeness Light Station in Sequim, Washington, gives visitors first-hand experience at tending a lighthouse. Established in 1857 and overhauled in 1927, the station stands on a remote sandspit in the Straits of Juan de Fuca. The light is staffed entirely by volunteers, twenty-four hours a day, year round. Each Friday or Saturday, a new team of two couples arrives (sometimes with children), to spend the week living at the furnished keeper's quarters (built in 1904). For their week's tour of duty they are assigned specific tasks to maintain the house and grounds, and, of course, to keep the light burning.

The Little Red Lighthouse is the only tower ever to be saved due to the fame it acquired as the subject of a children's book. Originally part of the Sandy Hook Range Lights and known as North Hook Light, it was dismantled in 1917 to remove it from the line of fire of coastal artillery guns. Reassembled and re-lit in 1921 as the Jeffrey's Hook Lighthouse, it guarded the Hudson River for several years as the first lighthouse encountered by those journeying up the river. But once the George Washington Bridge was constructed in 1931, the bridge light guided river traffic, rendering the lighthouse obsolete.

Slated for removal in 1951, the tower's fate took a turn that administrators had not reckoned on. Thousands of children, who had come to love the structure through the book *The Little Red Lighthouse and the Great Gray Bridge*, flooded the Coast Guard with letters pleading that the lighthouse be saved. The organization obliged by granting it

to the City of New York, which made it a part of Fort Washington Park. Since the early 1990s, the Urban Park Rangers of New York have sponsored an annual family festival to gain attention and resources to maintain this landmark lighthouse.

In June of this year, the Coast Guard didn't want 301 of the remaining lighthouses and were willing to give them away to anybody who would offer a good home. Government and nonprofit groups would have first dibs. Six were turned over to public and private interests under the national Historic Lighthouse Preservation Program. Congress and former President Bill Clinton created the program in 2000. The lighthouses given away in June were Rondout Creek Light in Kingston, New York; Esopus Meadows Light, also known as the Middle Hudson River Light, near Esopus, New York; St. Augustine Light in St. Augustine, Florida; Tybee Island Light, near Savannah, Georgia; Little River Light, near Cutler, Maine; and Munising Range Lights, near Frankfort, Michigan. When the lighthouse giveaway is complete, only one lighthouse in the country will be required by federal law to have a lightkeeper: the Boston Harbor Light, the nation's first one, established in 1716 on Little Brewster Island. It was blown up by the British in 1776, rebuilt, and has had a light burning again since 1783. The Coast Guard automated the nation's lights and lacks the money to maintain the lighthouses, but hopes to put them in the hands of groups that can. Along the seacoasts and the Great Lakes, more than two hundred lighthouses are open for tours. People can sleep in about 15 of them in California, Maine, Michigan, Minnesota, New York, Oregon, Rhode Island, and Washington.

ANSWERS TO QUIZ ON LIGHTHOUSES

1. Where was the first lighthouse? (A.) Boston Lighthouse, Little Brewster Island, Boston, MA
2. Where is the oldest lighthouse in service now located? (C.) Sandy Hook, New Jersey
3. How tall is the tallest lighthouse? (B.) 193 ft. Cape Hatteras
4. The highest lighthouse, above sea level, is located where? (A.) Cape Mendocino, CA
5. The first American built lighthouse on the West Coast was? (C.) Alcatraz Lighthouse, CA
6. Which one was the first lighthouse to use electricity? (B.) Statue of Liberty
7. What was the most expensive lighthouse to build? (A.) St George Reef, CA
8. The first lighthouse built completely by the Federal Government? (B.) Portland Head, Maine
9. What was the year that the U.S. Lighthouse Service started? (A.) 1789
10. The U.S. Lighthouse Service merged with the Coast Guard in what year? (C.) 1939

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LIGHTHOUSES OF THE PACIFIC WEST

The lighthouses of the beautiful and dangerous wilderness coasts of Oregon and Washington are some of the greatest engineering stories of the late 1800's. Building lighthouses here required extraordinary ingenuity, courage and strength. This is an area of huge waves, high winds, towering cliff faces, rolling sand dunes and pounding surf. The coastline of California is a geologically young and highly active margin, with mountains rising up and sinking into the ocean. It is a navigator's nightmare. Faults and volcanoes have left scores of rocky capes and points reaching far into the sea. Sharp rocks and sandbars lurk just beneath the waves. California lighthouses dot a coastline that is rugged, forbidding, beautiful, often fog bound, and frequently deadly. Lighthouses on the western coast were built later in the nation's development, driven partly by the discovery of gold. Interesting note: the architecture of Point Arena, Pigeon Point, and Point Bonita is all the same; only Pigeon Point remains unchanged. Point conception is considered the Cape Horn of the West Coast.

Oregon

Cape Blanco Lighthouse, Sixes, 1870

This lighthouse is the oldest, most westerly and the tallest in Oregon. It stands at 59 feet and is 245 feet over sea level. Its light shines 21 miles. The cape was named Cape Blanco de Aguilar by Captain Aguilar for the chalky white cliffs.

During World War II this lighthouse served as a defense area with a coastal lookout. A Japanese submarine launched a small float plane which used the lighthouse to navigate by as it dropped incendiary bombs in nearby forest.

Coquille River (Bandon) Lighthouse, Bandon, 1895

It is a simple structure, yet it has an interesting architecture with elements of High Victoria Italiante. This makes it unique among West Coast Lighthouses. This was the last light built in Oregon and was not in service very long. It was the first lighthouse in Oregon to be abandoned when the Coast Guard took over in 1939.

Cape Arago Lighthouse, Coos Bay, 1857

This lighthouse was built on one of the most dangerous stretches of the Oregon Coast. It was built to guide the lumber freighters through the entrance of Coos Bay. It was built on a narrow island 100 yards from the mainland and was known as "Lighthouse Island". The island is composed mostly of sandstone, which made it susceptible to erosion. Because of the erosion there were 3 lighthouses built at this site, 1857, 1908 and 1933. Since the winds are so bad there, there is concern that the high seas would cut the island in half.

You could only get to the lighthouse by boat until 1876. A foot bridge was built in 1876 called the "Bridge of Sighs". This bridge washed away twice and was always in need of repairs. A 400 foot tramway was built with a hand pulled cable car in 1891. This lasted for 7 years. In 1896 they built a high bridge and it is still there today.

Umpqua River Lighthouse, Winchester Bay, 1894

The original Umpqua river Lighthouse was built in 1857 to mark the entrance to the Umpqua River and to warn mariners of a deadly shifting sandbar that had caused numerous shipwrecks. This lighthouse succumbed to floods and rains and the tower collapse 6 years after it was built. Thirty years later another lighthouse was built in its place. That was 1894 and it

still is standing today. The light is an unusual revolving, red and white beam, which shines 24 hours a day.

Heceta Head Lighthouse, Florence, 1894

Pronounced He-see-ta, which people think is correct Spanish, but it's not - Hey-they-ta is correct. Sometimes mispronounced Hecketa.

This is the most powerful marine light on the Oregon Coast at 1.2 million candlepower. Turned on in 1894. It became automated on July 20, 1963. Named for Portuguese explorer Don Burnos Heceta who set sail from Mexico in 1775 to explore the Northwest coast.

This lighthouse and the Umpqua River Lighthouse were built using the same architectural plans. The first order lens was from England, not from France. Heceta Head Lighthouse had its own post office and one room school house. It was placed on the National Register of Historic Places in 1978.

When the U.S. Forest Service took over the keepers dwelling, they then leased it to Lane Community Center as a study center. The lighthouse was restored in 1996 and was opened for tours as well as a Bed and Breakfast Inn with 3 guest rooms. This lighthouse has been the subject of local films and used in a TV movie.

Cleft of the Rock, Yachats, 1976

This lighthouse is owned by Jim Gibbs, author of several books on lighthouses of the West Coast and former Coast Guardsman and lighthouse keeper. Jim lives in Cleft of the Rock Lighthouse, which he established in 1976. This is the only privately owned working lighthouse on the West Coast.

Yaquina Bay Lighthouse, 1871, and Yaquina Head Lighthouse, 1873, Newport

Yaquina Bay Lighthouse has the distinction of being the Oregon lighthouse that has served the shortest period, just 3 years. There has been an incorrect assumption that Yaquina Head Lighthouse was built in error. It was suppose to be built at Cape Foulweather, 9 miles to the north. The error was that early reports mistakenly referred to the cape at Yaquina Head as Cape Foulweather. When Yaquina Head Lighthouse was built it caused the demise of Yaquina Bay Lighthouse. Yaquina Bay is now a museum and it is lit up at Christmas time.

Tillamook Rock, "Terrible Tilly", Tillamook, 1879-1880

Construction was done in secret with the crew sequestered, partially on the steamer U.S. Revenue Cutter Thomas Corwin, because of public opposition. There was a line from the Corwin to the rock called a "breeches buoy". It was a life ring fitted with old pants cut off at the knees. This contraption carried men on and off the rock until it was unmanned in 1957.

Crewman had to blast away tons of rock over the course of seven months, working through fog, rain and wind. They blast^{ed} away nearly 4600 cubic yards of basalt to create a pad for the lighthouse.

The lighthouse was often barraged by storms and the iron roof and lantern panes, which were 134 feet above the water, were often cracked or shattered from flying rock and debris. No women or children were ever permitted on Tillamook.

In 1978 it was converted into the world's first lighthouse Columbarium. They created 100,000 niches for urns and promised the purchasers of the services of a helicopter ride (weather permitting) for a loved one to see an ash filled urn placed in solitude inside the structure. As of 1996, only 17 urns have been placed in the Columbarium. Two of those have been stolen.

Tillamook rock has been placed on the National Register of Historic Places.

Washington

Cape Disappointment Lighthouse, Columbia River, 1856

This lighthouse is at the entrance to the Columbia River. It was built in Washington but it can also be listed under Oregon Lighthouses. It was built to warn mariners traveling in Oregon waters, going to the mouth of the Columbia River. It is one of the oldest operating lighthouse in the Pacific Northwest.

The cape got its name from a fur trader, John Meares, in 1778. He was looking for a river and when he decided no river existed, he called the area Cape Disappointment.

In 1864 the lighthouse received unwelcome neighbors when Fort Canby was erected to guard the Columbia River during the Civil War. The blasts from the big guns used to shake the lighthouse and occasionally break windows. During World War II, Japanese submarines surfaced off Fort Stevens on the South side of the river and lobbed in several shells at Fort Canby.

Destruction Island Light, Destruction Island, 1891

"Isolated, forlorn, deary, and barren" was the description given to this island. This island is 30 acres and is about 3 miles from an uninhabited section of the mainland. The nearest town, La Push, is 20 miles to the north. Reef and rocky shores make it difficult to land a boat on the island. The island sits like a flat grassy tabletop over the rocks. Construction of the lighthouse took 3 years because of the difficult conditions. The lighthouse still has its first ordered Fresnel lens, which is still operating.

Due to bad weather conditions in the Puget Sound, a steam powered fog signal was installed 2 years after the lighthouse was first commissioned. When it wore out, it was replaced by a diaphragm horn, that bellows in a deep voice like that of an angry bull. At the time there were a number of cows living on the island, as well as one contended bull. Grazing was good and there were no fences, since the island dropped off over the rocks. When the new foghorn sounded for the first time, the bull thought there was another bull around and he charged the source of the noise, the lighthouse. He crashed the fence surrounding the fog signal and then charged the fog signal house, in a several hour rampage. The keepers had to make a pen to contain the bull and it was months before he came to terms with the sound of the foghorn.

San Juan Islands Lighthouses

The San Juan Islands are an archipelago of more than 170 islands. They were discovered in 1790-93 by the Spanish explorer Manuel Quimper. They were the subject of a boundary dispute in 1859 between the U.S. and Britain known as the Pig War. The islands are ringed by 5 lighthouses. Lime Kiln and Cattle Point are on San Juan Island. One is Turn Point on Stuart island. Patos Island has 1 and Burrows Island has 1.

Lime Kiln was built in 1919, and was the last lighthouse in Washington to receive electricity. It became automated in 1962. This lighthouse is used as a shore based research lab for studying whales. A hydrophone picks up sounds of passing vessels and whales, which gets transmitted over AM radio.

New Dungeness Lighthouse, Dungeness, 1857

This lighthouse sits near the tip of the New Dungeness Spit, which is a narrow ribbon of sand and rock that curves gracefully for 7 miles into the Strait of Juan de Fuca. The spit is barely visible from a distance, making it a hazard to ships. It was originally 1/6 of a mile from the tip of the spit. It now sits approximately 1/2 mile from the tip. The spit continues to grow.

In 1915 President Woodrow Wilson decreed the New Dungeness Spit to be a Department of Agriculture Wild Bird Reservation. Today it is managed by the Fish & Wildlife Service and is called Dungeness National Wildlife Refuge.

Cape Flattery, Tatoosh Island, 1857

It is one of the original 16 lighthouses designated by the U.S. Lighthouse Service to be built on the West Coast and is at the entrance to Strait of Juan de Fuca. Tatoosh Island was named by Captain John Meares in 1788. It means thunderbird and is named after chief Tatooshe of the Makah Indians.

Because of the isolation, their fear of the Native Americans and with the difficulty in obtaining mail and supplies they had trouble keeping the keepers.

The Coast Guard maintains a lifeboat station and school at Cape Flattery. It is the only one of its kind on the West Coast and trains recruits for motor lifeboat duty. A weather station was put in 1883 and recorded on average of 215 inches of rain per year.

Grays Harbor (Westport) Light, Westport, 1898

One of the most majestic lighthouses on the West Coast. Set back from the ocean, its octagonal 107 foot tower rises over surrounding sand dunes and trees. Most of its original lighting system is intact.

California

St. George Reef Lighthouse, "The Dragon", 1892, (around Crescent City)

The St. George Reef Lighthouse is one of the greatest lighthouses in America. Of the 3 outstanding engineering feats among U.S. lighthouses, St. George Reef is truly the most outstanding. (the other 2 are Monot's Ledge and Tillamook Rock.) It was the most expensive lighthouse built in the U.S. at a cost of \$704,633 (Congress originally appropriated only \$100,000). It took George Ballantyne, who also built Tillamook Rock, 11 years to build. The St. George Reef Lighthouse sits on a concrete pier 70 feet high. Its tower is 134 feet, made of 1229 granite blocks with some blocks weighing up to 1 ½ tons each. The blocks were fit together with no more than a 3/16 gap and held together with metal dowels, cement, and stone shoved in the crevices.

During the construction, Ballantyne had to use a former lightship, La Ninfa, as a barracks for the workers because the rough sea washed over a 54 foot cliff. When he sailed out on the St. George Reef, intending to permanently secure the lightship, he discovered that the waters were far deeper than had been reported. Ballantyne had to return to Humboldt Bay for longer chains, while leaving La Ninfa on a single mooring. While he was in port, a storm blew in, and the crewless La Ninfa drifted away. It took Ballantyne a week to find his lightship. His first step in the construction was to build a foundation on Northwest Seal Rock. Ballantyne also devised an aerial boat to island tramway to get men to and from the island more quickly. They faced constant dangers from storms, high seas, and blasts. There was 1 death during 11 years of construction.

The St. George Reef is the peak of a submerged volcanic mountain 6 miles off the northern extreme coast of California. Rough weather with howling winds and crashing waves create a mist that obliterates the peaks and creates dangers for mariners. During heavy weather, the St. George Reef "smokes" (it produces thick, smoke-like spray) which obscures the rocks. During one storm, 160 foot waves swept over the lighthouse, shattering a window in the lantern

room which was 146 feet above normal sea water. It was dubbed the "Dragon Rocks" by explorer George Vancouver in 1792.

No families were allowed to live there. The families of keepers lived in houses on the St. George Point mainland. The only way to land on or leave the St. George Lighthouse was with a derrick and a 60 foot long boom. With a hook, lighthouse personnel hoisted small boats onto the rock. The sea could be rising or falling up to 15 feet while this was happening.

It was decommissioned in 1975 and the granite tower is still in very good shape.

Battery Point (originally Crescent City Lighthouse), Crescent City, 1856

The Crescent City Lighthouse was built to guide lumber ships in and out of Crescent City harbor as they carried lumber from ancient redwoods to build the city of San Francisco following the gold rush of 1849. The city was laid out in 1853, and in just one year there were over 300 houses and hotels. Crescent City was the port of entry for Oregon's gold mines. The lighthouse is built on an isthmus, and it is only accessible during low tide; during high tide, the isthmus becomes an island. After the St. George Reef lighthouse was built, the need for the Crescent City Lighthouse was questioned.

On March 27, 1964, a tidal wave hit Crescent city, but the lighthouse stood firm. Resulting from an earthquake in Alaska, 4 or 5 Tsunami waves swept far inland and destroyed most of the city's commercial area and homes. Eleven people were killed and 29 blocks were demolished.

Point Arena Lighthouse, Point Arena, 1870

This lighthouse was devastated in the 1906 earthquake along with the keepers' residence. Four new freestanding residences and tower were built. The tower was rebuilt of reinforced concrete, and it was the tallest in the U.S. at 115 feet.

The Japanese desperately wanted a face saving "victory" and in the summer of 1945 they came up with a plan to invade the U.S. mainland. With 3 destroyers, troops isolated Point Arena as their landing spot. The U.S. learned of the attack. At around 9p.m. on August 12, 1945, 2 days before the end of the war, the family of the lighthouse watched flashes of guns go off offshore. A few days later the beach was covered with plasma bags, Japanese rice bowls and scandals. The navy never did release the story. This same lighthouse keeper, Bill Owens, also witnessed one of the first submarines in 1941, 2 days after the start of the war. He reported it to the district office who told him it was not possible and go back to bed. Several nights later, the old tanker *Montebello* was torpedoed.

Point Reyes Light, Point Reyes National Seashore, Northern California, 1870

The Point Reyes Lighthouse is not exactly in a desirable location. It is located in the foggiest point on the Pacific Ocean, and possibly in all of America. Point Reyes is cloaked in fog for 9 months of the year, for a total of almost 2700 hours each year. It is the nation's windiest headland as well. The wind currents are confusing, and the sea is too deep for mariners to use lead lines to determine depth or position. Point Reyes is also a narrow finger of land which curves seaward for 10 miles.

A life Saving Station at Point Reyes was built in 1889, and a weather station was built at the turn of the century.

Farallon Island Light, 1856, and the Egg Wars

The Farallon Islands are a 7 mile stretch of rocky, barren islets 23 miles west of San Francisco Bay. In 1579, Sir Francis Drake used these islands to obtain seals and birds. During the Gold Rush days there was a rich supply of seabird eggs on the Farallon Islands, which

became a prime resource to feed the hungry newcomers to San Francisco. These eggs sold for \$1 each and soon there were competing egg gathering companies that were shipping millions of eggs to San Francisco. A boatload could carry 1,000 dozen eggs! Hunting bird eggs began to mirror hunting gold with numerous brawls and shoot outs.

In 1852 the Lighthouse Board decided to build a lighthouse on Southeast Farallon, the largest of the islands at 317 feet. When a construction crew arrived on the **Oriole**, armed egg men chased them away. They were afraid that a flashing light would frighten away the birds. Because of this a well armed crew of U.S. seamen in a Coast Survey steamer were sent in. They overpowered the egg gatherers.

Even after construction was completed competition between the lighthouse people and the egg gatherers continued. The Farallon Egg Company acquired exclusive gathering rights in 1856, but poachers were common and violence flared periodically. In 1881, a rival company decided to break Farallon Egg Company's monopoly and sent 3 boat loads of armed men to storm the island. The Farallon Egg Company was prepared to defend itself, but surrendered after 4 brawls. The situation was so out of hand that a platoon came and the egg pickers were ejected. The egg sales continued until 1890.

Construction was completed in 1853. They had ordered an enormous Fresnel lens, which turned out to be too large for the lighthouse. They had to tear down the lighthouse and rebuild it from the ground up. It was completed in 1856.

It had an interesting fog signal. It was powered by air forced through a blowhole by natural wave action. In California it is often foggy when the sea is calm, so the signal did not function correctly when it was most needed. It was used until storm waves smashed it in 1781.

The Farallon Island lighthouse was abandoned in 1972. It now has a solar light, and is a major research station.

Alcatraz Island Lighthouse, San Francisco Bay, 1854 and 1909

Alcatraz, which means "pelican" in Spanish, was placed in operation in June 1854. The Alcatraz Island Lighthouse was the first active lighthouse on the West Coast. Congress, recognizing that San Francisco was becoming the doorway to the west, appropriated funds to build one lighthouse after another into San Francisco's harbor.

When the military prison was expanded in 1909, it overshadowed the original lighthouse, which was replaced by an imposing tower built of reinforced concrete with connecting quarters for 3 keepers.

Housekeeping on Alcatraz Island (until the prison was closed in 1963) presented interesting challenges. Garbage could not be routinely tossed away. Anything that could be worked into a weapon had to be tossed into a special garbage security location to be beaten, broken, and cast into the San Francisco Bay. Keepers' children rode the prison boat to San Francisco to attend school, while keepers' wives rode with the guards on buses to catch boats to go shopping. All passengers were counted both when leaving the prison island and upon returning to the launch.

In 1970 while the Native Americans were occupying the island a fire broke out and destroyed the keepers' quarters and damaged the lighthouse.

Point Bonita Lighthouse, 1855 and 1877

The Point Bonita Lighthouse sits at the tip of a narrow ledge 124 feet over the sea. This point marks the seaward approach to San Francisco, just several miles north of the city.

Visitors transcend a paved path, pass a windy gap and through a tunnel, and then cross a suspension bridge to get to the tower.

The first type of fog signal was a gun, which was also used at Boston Light. Point Bonita was given a fog cannon in 1855. The cannon was replaced by a mechanical fog bell that struck automatically.

The existing Point Bonita Lighthouse is actually the second tower which was built in 1877. The first one stood 306 feet over the sea and was plagued with problems with fog at the higher elevation. The keepers' dwelling collapsed during the 1906 earthquake.

Pigeon Point, Pescadero, 1872 and Point Montara Light, Pacifica, 1900

Both of these lighthouses are now open to the public as hostels. Pigeon Point is one of California's most photographed lights and is unchanged from when it was built. Pigeon Point is also the best example of a classic California sea coast tower. It was automated in 1974.

Point Pinos Lighthouse, Pacific Grove, 1855

This lighthouse also suffered from the 1906 earthquake. There was considerable damage done and was torn down and rebuilt. The West Coast's oldest standing lighthouse is now a maritime museum. Alcatraz is a year older, but it is no longer in use.

The Lights of Los Angeles Harbor

The 4 lights of the Los Angeles area are notable dissimilar. The ornate gingerbread design of Point Fermin, the classic beauty of Point Vicente, the slight tilt of the Los Angeles Harbor monolith, and the almost comic robot like Long Beach Harbor Light show extreme contrasts in styles.

Point Vicente Light, Rancho Palos Verdes, 1926

The lighthouse sits at the edge of a cliff more than 100 feet over the Pacific and its light can be seen 20 miles out at sea. It is a coastal marker and helps guide ships to San Pedro harbor. It is 6 miles northeast of Point Fermin and 9 miles west of Los Angeles Light. This light was used as the set for several films and television productions.

Point Fermin, Los Angeles, 1874

The completely restored exterior of this beautiful Victorian structure is now the centerpiece of a Los Angeles park. It was built in the Italianate style with a square tower rising through the keepers' dwelling. There were several women keepers at Point Fermin. The light was blacked out 2 days before Pearl Harbor.

Angel's Gate (Los Angeles Harbor) Light, Los Angeles, 1913

A harbor or greeter light, which is classical in structure, guides a steady parade of ships entering San Pedro. It is a very popular landmark and impressive monument. It sits at the end of the San Pedro Harbor breakwater, and rises more than 77 feet out of the water. Automated in 1971, its third order lens was exchanged for a modern acrylic solar power green light.

It has been at a slight tilt ever since its early years, when a severe gale hammered tremendous breaking waves against it for 5 days. Despite the tilt, the tower has remained strong and steady. The lighthouse also survived a brush with a battleship years ago. It struck the rocks directly below. This incident probably inspired these lines by Don Newman entitled **Check You Bearings**: First voice: Our radar has you on a collision course with us. You should alter course 10 degrees south. Second voice: We have you on our radar. Suggest you alter course 10 degrees north. First voice: Admiral Goodman aboard. Strongly suggest you bear 10 degrees south, this is a battleship! Second voice: This is Seaman Fransworth. Still suggest you bear 10 degrees north. This is a lighthouse.

Long Beach Harbor Light, "The Robot Light", Long Beach, 1949

A departure from the style of traditional lighthouses, the Long Beach Harbor Lighthouse was designed to withstand earthquakes, winds, and waves. It was originally equipped with a 36 inch airway beacon, dual tone fog signals, and a radio beacon inside its frame. It was called the Robot Light because the rectangular base on 6 columnar legs resembles a 1950's version of a futuristic robot. Therefore, it has attracted media attention since it was built. This light creates a radical contrast with the other Los Angeles lights.

Old Point Loma, San Diego, 1855

One of the original 8 lighthouses built in California, the Old Point Loma Lighthouse is located at the tip of Point Loma, 11 miles from downtown. The Old Point Loma Lighthouse overlooks the city, and has a spectacular 360 degree view of San Diego and the Pacific Ocean.

When the year long construction effort was completed, builders discovered that the tower was too small to accommodate the first order Fresnel lens that had arrived for it. They substituted a third order lens originally meant for the Humboldt Harbor Lighthouse in northern California and this lens was sent to Cape Flattery Lighthouse in Washington. Nevertheless, the Point Loma Light was powerful enough to be seen for 25 miles (and some sea captains even claimed to have seen it 40 miles away).

Old Point Loma was originally located at an elevation of 460 feet. At the entrance of the San Diego Harbor, it was the loftiest tower in America. However, this location proved to be a disadvantage because it was often higher than low lying clouds. Therefore, in 1891, it was replaced by New Point Loma, which is still in use today. The Old Point Loma Lighthouse has been fully restored.

Lighthouse

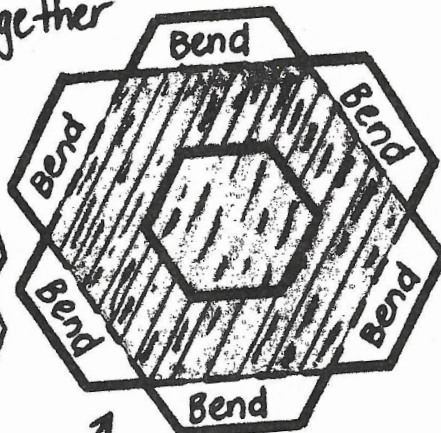
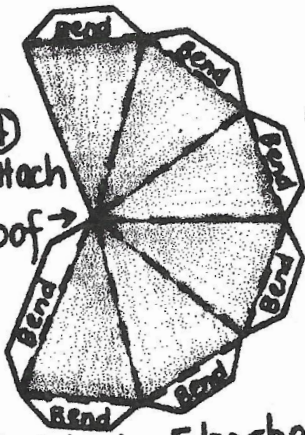


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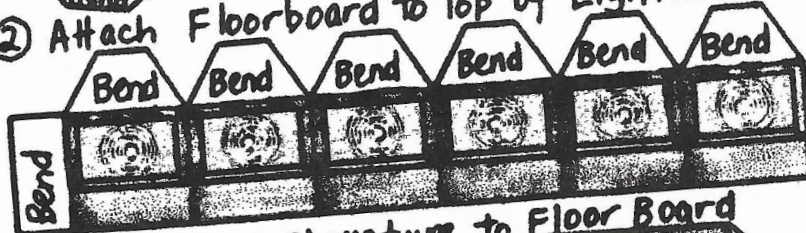


① Glue walls together

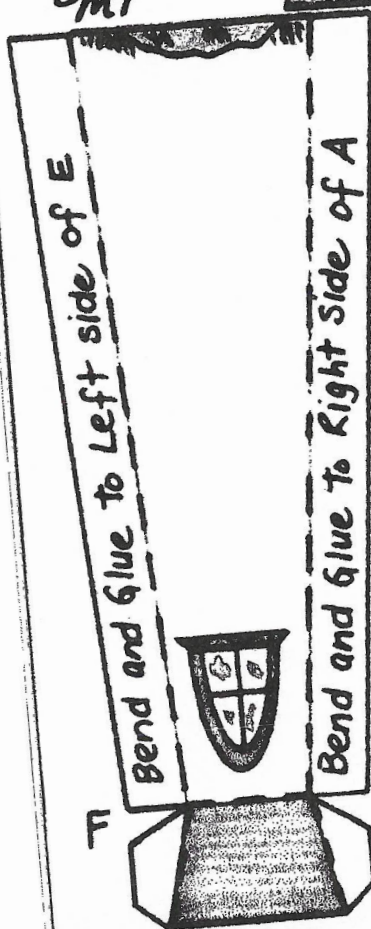
④ Attach Roof



② Attach Floorboard to top of Lighthouse

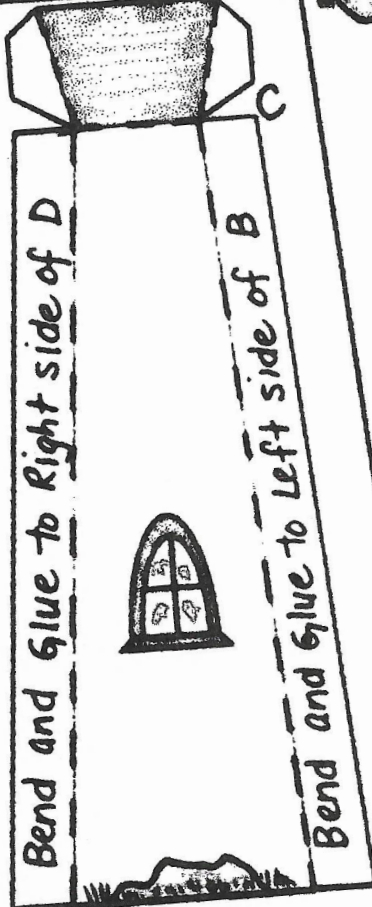


③ Glue Light structure to Floor Board



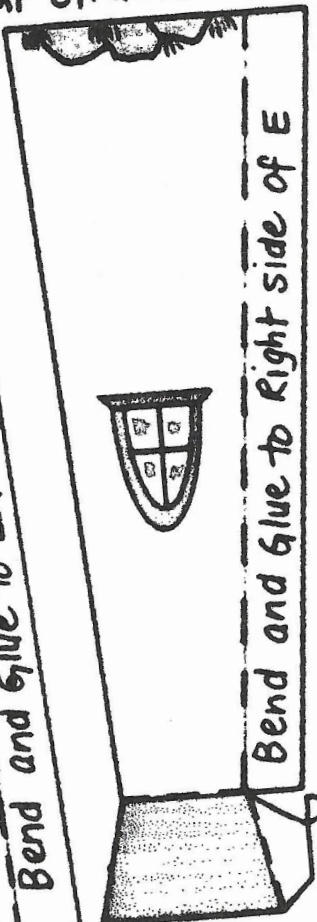
Bend and Glue to Left side of E

Bend and Glue to Right side of A

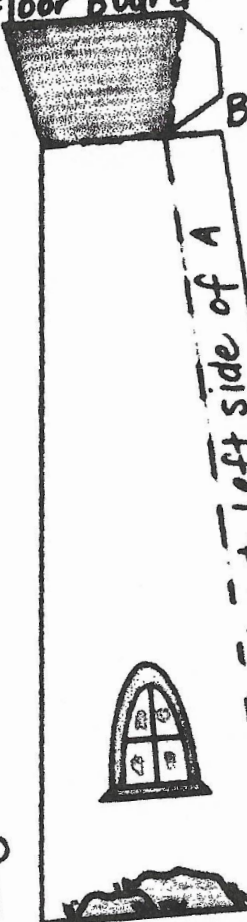


Bend and Glue to Right side of D

Bend and Glue to Left side of B



Bend and Glue to Right side of E



Bend and Glue to Left side of A

QUIZ ON LIGHTHOUSES

1. Where was the first lighthouse?
 - a. Boston Lighthouse, Little Brewster Island, Boston, MA.
 - b. Portland Head, Portland Harbor, Maine
 - c. Sandy Hook Lighthouse, Sandy Hook, New Jersey
2. Where is the oldest lighthouse in service now located?
 - a. Cape Hatteras, North Carolina
 - b. Cape Henry, Virginia
 - c. Sandy Hook, New Jersey
3. How tall is the tallest lighthouse?
 - a. 150 feet
 - b. 193 feet
 - c. 215 feet
4. The highest lighthouse, above sea level, is located?
 - a. Cape Mendocino, CA
 - b. Cape Blanco, OR.
 - c. Old Point Bonita, CA.
5. The first American built lighthouse on the West Coast was?
 - a. Cape Flattery Lighthouse
 - b. Cape Arago Lighthouse
 - c. Alcatraz Lighthouse
6. Which one was the first lighthouse to use electricity?
 - a. Twin Lights of Navesink
 - b. Statue of Liberty
 - c. Block Island Southeast
7. What was the most expensive lighthouse to build?
 - a. St. George's Reef, CA.
 - b. Tillamook Rock, OR.
 - c. Craysfort Reef Light, Florida
8. The first lighthouse built completely by the Federal Government?
 - a. Portsmouth Harbor, New Hampshire
 - b. Portland Head, Maine
 - c. Montauk Point, New York
9. What was the year that the U.S. Lighthouse Service started?
 - a. 1789
 - b. 1790
 - c. 1780
10. The U.S. Lighthouse Service merged with the Coast Guard in what year?
 - a. 1929
 - b. 1945
 - c. 1939