Boston Light

United States Coast Guard

Light Station Boston

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January 1998

Introduction

This booklet has been prepared, not as a comprehensive history of Boston Light or of lighthouses in general, but as a brief overview on those subjects. It contains general information about Boston Light, along with background material on lighthouses, lenses, lamps, and lighthouse administration.

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Boston Light

Boston Light was the first lighthouse to be operated in the United States and is presently the last remaining lighthouse manned by the U.S. Coast Guard. A lighthouse was authorized by the Massachusetts Legislature for Little Brewster Island in 1715 and the light was first lit on September 14, 1716. Boston Light was designated a Registered National Historic Landmark by the U.S. Department of the Interior in 1964.

Boston Light is located on Little Brewster Island in Boston Harbor. Little Brewster Island, formerly known as Beacon or Bacon Island, or Light House Island, is approximately 600 feet long and 250 feet wide at its widest point and has an area of about one acre at mean high water.

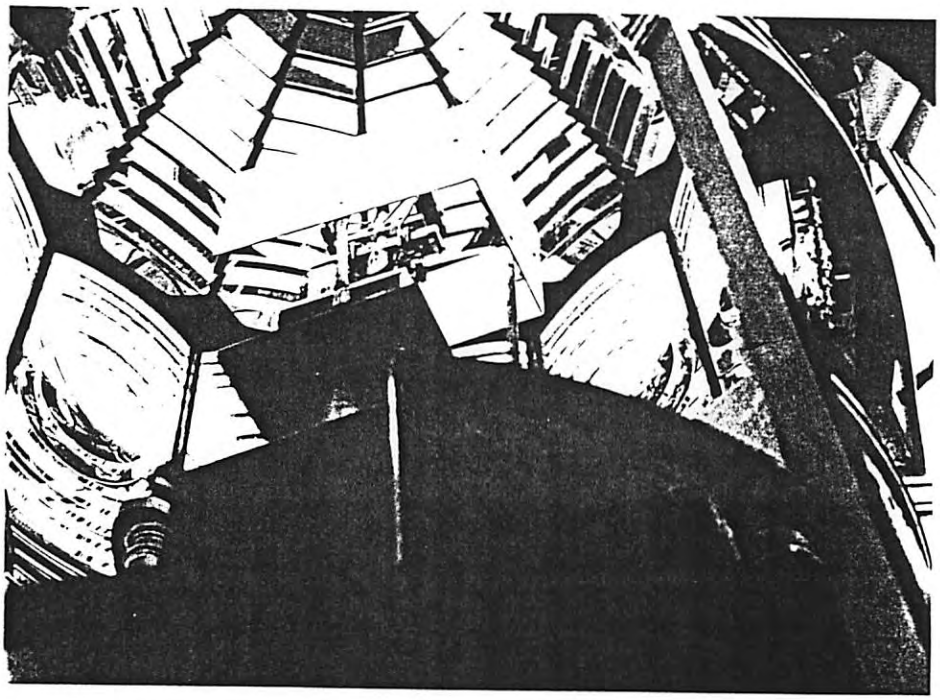
Boston Light as it looks today looking westward toward Boston. Structures are described in relation to the light tower: Fog Signal House (base of tower, front); Cistern Building (front, right); Lightkeepers' House (right rear); Boathouse (left rear- partially hidden), Oil House (left, only roof visible); Tower Entry Building (at rear of tower base). [Photo #1: Source Unknown]

Structures - there are now six structures on the island including the light tower, the lightkeepers' residence, the oil house, the fog signal building, the cistern building, and the boathouse. Two structures, the assistant lightkeepers' residence and a shed, have been demolished. At one time, a covered walkway connected the Assistant Lightkeepers' house to the small structure at the base of the light tower (Photo #19). This same photo, probably taken around the turn of the century, shows the Assistant Keepers' house before its exterior was modified.

Light Tower - located at the eastern end of the island. It was built in 1783 and raised to its present height of 98 feet in 1859. The exterior of the tower is white with black trimming at its top in the vicinity of the light. Five metal straps were installed in 1973 to bind together cracks in the masonry. Photographs from the 1920s show similar metal

rings. The tower is built of granite rubble stone with a red brick inner lining. The tower has diameters 25 feet and 15 feet at the base and top respectively. With wall thicknesses of 7.5 feet at the base and 2.5 feet at the top, a 10 foot diameter interior space is provided for the cast iron spiral staircase. The one-story building which provides entry into the tower is now used as a small museum for artifacts from Boston Light.

Seventy-six stairs on the spiral staircase (installed in 1844) and two ladders lead to the lamp room. The lantern is 11 feet high and is constructed of bronze with 336 separate glass prisms. The elements are priceless and irreplaceable because spare prisms do not exist. Oil from fingerprints can heat up and cause the prisms to chip; several of existing prisms are chipped. The lantern is a 2nd Order Fresnel lens (made by L. Sautter of Paris) weighing about five tons mounted on a rotating mechanism. The source of light is a fixed 1,000 watt bulb, spare bulb installed, inside the rotating lens which radiates 12 highly-concentrated, equally spaced, horizontal light beams in all directions. The focal point of the beams is 102 feet above sea level, and when seen from a ship or from land, the light appears to flash every 10 seconds. Each 1.8 million candlepower flash is visible for 27 miles, weather permitting. In a fog or haze, the 12 horizontal beams appear like the spokes of a wheel to an observer on Little Brewster. During daylight hours, pull-down shades are drawn around the perimeter of the lantern room to prevent the sun's rays from magnifying on the prisms of the lenses and causing lens damage or even a fire.



The lenses at Boston Light, looking up into the lantern. Several bullseyes are visible, as well as the prisms, the bulb (center), and a portion of the bronze rotating mechanism (Photo #2: McBrien, April 1997)

Principal Lightkeeper's Residence - is a two-story, wood frame, 28 x 40 foot house built in 1884. It was so named to differentiate it from the older two-family house used as the residence for the two assistant lightkeepers and their families in the past. The Assistant Lightkeepers' house was demolished in 1960. The remaining house is now used by the three-man Coast Guard crew assigned at Boston Light. It consists of 6 rooms, a kitchen, living room, and office area with communications center downstairs

and three bedrooms and bathroom upstairs. An oil burner and rectangular cistern are located in the cellar. This cistern supplies all household water except drinking water. When needed, rainwater collected from the roof of the cistern building is transferred by hose to the cistern in the house.

Oil House - a 6 x 8 foot shed of brick construction built in 1876. It's now used to store various flammable liquids, including paint and solvents.

Fog Signal Building - a 22 x 24 foot brick building with a loft was built in 1876. It houses the emergency electrical generator for the light, the fog detector, and air compressors for the old fog horns. The fog signal is completely automated.

Cistern Building - a 38 x 38 foot wood frame, single story building was built in 1884. It has also referred to as the rainshed. It contains a 20,000 gallon circular cistern for storing rainwater collected from its roof. The 25 foot diameter cistern projects 3 feet above the dirt floor. Rainwater stored in the cistern is used for all but drinking water purposes. Water from this cistern is transferred by hose periodically to the smaller rectangular water tank in the basement of the Keeper's house. In the past, the cistern building was used to store coal used to heat the houses and operate the fog signals.

Boathouse - a 21 x 36 foot, one-story wood frame building with a loft, was built in 1899. Originally, tracks of a marine railway ran from the beach to the boathouse but this system no longer exists. The concrete pier, adjacent to the boathouse, is 12 feet wide and 180 feet long. At the western end of the pier is a boat landing area with a hoist to raise the station's inflatable boat. A second concrete pier, parallel to the existing one, was destroyed during the Blizzard of 1978 and has never been rebuild. Remains of that pier, including both concrete and metal debris, are still visible at the site.

Assistant Lightkeepers' Residence - a three-story wood frame building for the two assistant lightkeepers and their families was located at mid-island in the vicinity of the low area. The building was demolished in 1960.

Shed - a small building (approximately 8 x 8 feet) was located several feet southwest of the light tower. A small window located in the southwest wall was used in the event the lantern in the light tower was not operating by placing a light in this window. The shed was demolished.

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Chronology of Boston Light

1679 a beacon was located on Little Brewster, probably erected by the Town of Hull

1715 the first lighthouse was authorized on July 23

1716 George Worthylake was chosen as first keeper of Boston Light. The tower was lit for the first time on September 14th. Worthylake drowned in 1718. The second keeper was Captain John Hayes.

1718 Keeper John Hayes requested a cannon to answer ships in the fog

1720 light tower damaged by fire

1723 Boston Light damaged by a great storm (the 16 foot tide caused by the storm is still the highest recorded in Boston's history)

1733 Robert Ball replaced Hayes as lightkeeper (Ball died in 1774)

1738 the light tower was painted white

1751 another fire damaged lighthouse; only the tower walls were left standing

1775 American troops burned lighthouse to prevent British from using it; 1 American and 20 British soldiers were killed

1776 British blew up the lighthouse when departing Boston Harbor

1783 the present light tower was built, under Governor John Hancock, and completed by November 1783

1790 all lighthouses in Massachusetts were ceded to the federal government

1844 many improvements made to tower including a cast iron stairway and large iron doors at the base of the tower. Both the doors and the spiral stairway remain there today.

1844 a Spanish cigar factory was established on Little Brewster. Young girls were transported to the island to manufacture the cigars. The cigars were sent into Boston into Boston to be sold as Spanish imports. When the truth was discovered, the Boston Light cigar factory was closed.

1850 a wind-up bell replaced the fog cannon

1856 fourteen 21 inch reflectors were installed in the lantern - Boston Light had a visibility of 16 miles

1859 the Fresnel lamp was lighted on December 20th

1860 tower raised to 98 feet and the lantern equipped with a revolving apparatus

1916 the $35,000 light had 100,000 candlepower. Keepers were Capt. Hart, Mr. Howard, Mr. Small

1920 Boston Light celebrated its 200th anniversary on Sept. 25th. The honorary committee consisted of Henry Cabot Lodge, Mayor James Michael Curley, and Senator John Week.

1920 an article in the Boston Evening Transcript noted that the tower was made of granite and it sat on a ledge 19.5 feet above high water. It also stated that of that time, cracks in the masonry walls were held together by bands of iron encircling the tower

1932 Georgia Norwood, known as the "Storm Child", was born on April 11th at Boston Light. She was the only child to be born at Boston Light and the first child to be born in a lighthouse on the Atlantic Coast.

1941 Maurice Babcock became the 25th and last keeper before the U.S. Coast Guard took control of the lighthouse.

1941-1945 the light remained darkened throughout World War II to avoid silhouetting ships for enemy submarines off the coastline.

1960 the two-family house (Assistant Lightkeepers' residence) was razed

1964 Boston Light was designated a Registered National Historic Landmark by the Dept. of Interior

1978 Blizzard of '78 (February) - the concrete boat dock was destroyed. Waist-deep seas were driven across middle of island and the crew sought shelter in light tower for several days

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Boston Light - Miscellaneous

Electrical Power - power for the light and the island is provided by an underwater cable from the Hull area. A second cable runs via Little Brewster to Graves Light. In the event of a power failure at Boston Light, electricity is provided by an automatic starting generator. Graves Light has its own emergency power generator.

Range Light - Boston Light also had a range light in the 1930s for ships leaving Boston Harbor at night. It was a kerosene lamp similar to an ordinary house lamp with a wick and chimney and simply lit with a match. The range light consisted of a white light in the middle and two red lights, one on either side. It was a steady light that did not flash. Ships coming from Quincy toward the anchorage at President's Roads (located west of Little Brewster) used the range light. A ship would come out of Quincy and proceed past the first red light. When the white light became visible, the ship would turn and come

straight toward Boston Light until it came into the main ship channel where it would turn into the channel and proceed seaward.

Coal - during the 1930s, 21 tons of coal in bags were brought to Boston Light each fall by boat and unloaded on the wharf. The Assistant Lightkeepers wheeled it the length of the island, up onto the roof of the rainshed (now called the cistern building), and dumped through a hole in the roof into three separate coal bins. One bin was used for the signal house, one for the Principal Keeper's house, and one for the Assistant Keepers' House .

Fog Signal - in the 1930s, the fog signal system consisted of two Chicago Pneumatic Air Compressor engines run by a semi-diesel. It was started by heating a plug in the cylinder head with a blowtorch. When this plug became cherry red, the air was turned on. It was water cooled by water from the rainshed. Two large tanks held the compressed air - one was used to blow the fog signal and the other for reserve air. A chart on the wall recorded fog signal operation; the chart was sent to Headquarters each month. The Signal House log recorded when the light was turned on and off , the fog signal operation, weather conditions, and any unusual events. Visitors to the light were recorded in a separate "visitors" log in the light tower.

Mechanical Drive - before the introduction of an electric motor to turn the lantern, a clockworks arrangement was used. It consisted of weights which descended down the tower on chains much like the weights on a grandfather clock. This arrangement powered a clockworks mechanism located in boxes located to the side of the lenses. Pulleys used for these chains and weights are still attached to the spiral steps in the light tower. The fixed light with variable flash and the flashing lenses typically rotated on chariot wheels. Other types of lenses rotated on ball bearings or mercury floats.

Fog Cannon - was first used as a fog signal, possibly as early as 1718 (Photo # 20). It was fired by the lightkeeper every half-hour during periods of poor visibility. When replaced fog signals, it was transferred to the U.S. Coast Guard Academy. In 1993, it was returned to Boston Light where it is today (Photo # 14).

Lighting the Light - during the 1930s, the lamp at Boston Light was an incandescent oil vapor lamp that burned pre-heated, vaporized kerosene. To heat the vaporizer, a small torch was placed underneath it. When the vaporizer was hot, kerosene flowed through a tube where it was heated and vaporized. The vaporized kerosene was injected into a 55 millimeter mantle where it burned with a brilliant, white light.

Storm Child - Georgia Norwood was the first child to be born at Boston Light and also the first child to be born in a lighthouse on the Atlantic Coast. She was born on April 11, 1932 and called the "Storm Child". Her parents were Ralph Norwood (First Assistant Lightkeeper) and Josephine (Clough) Norwood. Ralph Norwood had been a member of the U.S. Lighthouse Service since April 1929.

Routine Operation - during the 1930s, the three keepers worked four hour shifts around the clock so that the light was tended at all times. Each morning, the Headkeeper held a meeting with the Assistants to discuss operations and assign duties.

Operations for today's three-man Coast Guardsmen crew assigned at Boston Light consist of a normal work day from 8 AM to 5 PM, seven days a week, but with additional time as required by events. Crew members work fourteen days straight, then have seven days off. Coast Guard Auxiliarists are used on occasion to replace crew members who are on leave. The crew is responsible for all aspects of the Coast Guard operation, from operating and maintaining the light and fog signals to chipping paint on the flagpole. They provide information on weather and sea conditions to Group Boston every three hours between 6 AM and 6 PM. During 1997, the assigned crew consisted of:

April 1997

Reid Hair, BM1	Supervisor of the Light; reassigned 4 June
Matt Fendley, MK2	reassigned 26 April
Shawn McGarry, MK3	reassigned 14 May

November 1997

Scott Stanton, BM1	Supervisor of the Light; assigned June
Kevin Staples, MK2	replaced Fendley; assigned May
Jeremy Rohanna, MK3	assigned 23 April
Sam	a Black Lab, Boston Light's mascot

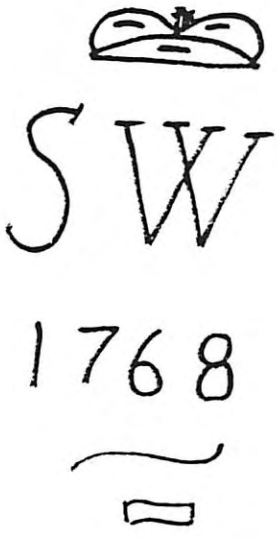
Auxiliarists volunteer for duty for a period of three to seven days. They are picked up and dropped off at Station Point Allerton by a crew member in Boston Light's 17 foot inflatable boat, weather permitting.

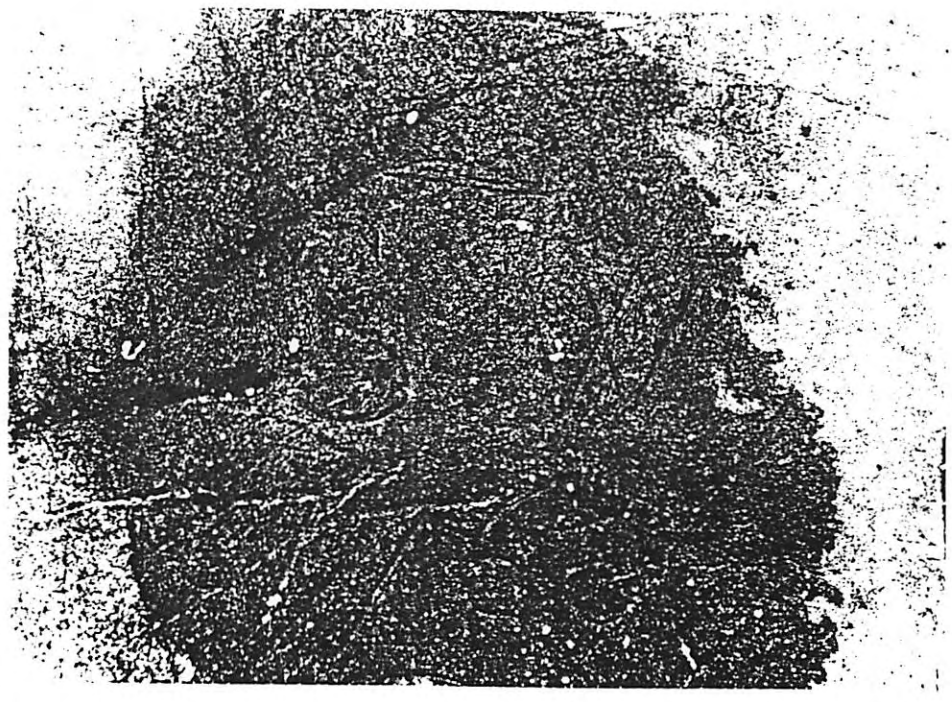
Ghosts - folklore indicates that ghostly beings inhabit the island. A Boston TV station visited Boston Light in late October 1997 to obtain material for a story which it ran on Halloween night. Recent stories indicate that two crew members while in the living room watching TV saw the specter of a woman walk down the stairs and into the kitchen. They went immediately into the kitchen, but found no one there. There have been instances where crew members outside the house reported seeing strange figures moving around inside the house.

Lightkeepers' Pay

1785	Massachusetts allowed Knox 120 pounds for himself and 2 assistants It's not known how much money the federal government to him.	
1909	Principal keeper	$74.30/month
	First Assistant Keeper	$54.30/month
	Second Keeper	$49.30/month
	(included is a ration allowance of $9.30, $.30/day x 31 days)	

Keepers' Initials - a tradition of lightkeepers through the years has been to carve their initials into the rocks on the island. The oldest that can be found are about thirty feet southeast of the Principal Lightkeepers house and date back to 1768 and contains the initials "SW" and a crown.





Initials and Symbols carved into the rocks located adjacent to the Principal Lightkeeper's House [Photo #3: McBrien, April 1997]

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Shipwrecks at Boston Light

November 3, 1861 - the square-rigged vessel of 991 tons, the MARITANA, sailing from Liverpool to Boston under the command of Captain Williams, ran aground on Shag Rock at about 1 AM in a snowstorm and heavy seas. Shag Rock is located approximately 750 yards northeast of Little Brewster. MARITANA had Boston Light in sight when it went aground and the ship broke in two. Twelve survivors were rescued from Shag Rock while the remainder were drowned and their bodies washed up on Little Brewster. The body of the last crew member was found in March 1862 and buried in an unmarked grave on Little Brewster.

January 31, 1882 - the sailing vessel FANNY PIKE ran aground on Shag Rock. The vessel broke up but the crew was able to get to Shag Rock where they were rescued by Lightkeeper Thomas Bates and Assistant Keeper Bailey.

December 25, 1909 - the five-masted schooner DAVIS PALMER, under the command of Captain Leroy M. Kowen, with a cargo of coal ran aground in a gale on the ledges off Little Brewster. It sank with a loss of the entire crew. Lightkeeper Levi B. Clark helped in recovering the drowned to Little Brewster.

February 3, 1918 - U.S.S. ALACRITY ran aground on the ice-covered ledges of Little Brewster at 3:45 AM. The Lightkeeper, Charles H. Jennings, and the Assistant Keepers, Lelan Hart and Charles Lyman, rescued all 24 men on board with four trips in the dory.

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Keepers at Boston Light

Civilian Keepers

George Worthylake	1716-1718	drowned
Robert Saunders	1718-1718	temporarykeeper
John Hayes	1718-1733	
Robert Ball	1733-1774	died on the job; longest term of service
William Minns	1774-1776	keeper when light was blown up by British
Thomas Knox	1783-1811	
Jonathan Bruce	1811-1833	
David Tower	1833-1844	
Joshua Snow	1844-1844	
Tobias Cook	1844-1849	
William Long	1849-1851	
Zebedee Small	1851-1853	
Hugh Douglas	1853-1856	
Moses Barrett	1856-1862	
Charles E. Blair	1862-1864	
Thomas Bates	1864-1893	Assistant Bailey
Alfred Williams	1893-1893	
Albert Horte	1893-1894	
Henry Pingree	1894-1909	
Levi Clark	1909-1911	
George Kezer	1911-1911	
Mills Gunderson	1911-1916	
Charles H. Jennings	1916-1919	Assistants Lelan Hart & Charles Lyman
Lelan Hart	1919-1926	
Maurice A. Babcock	1926-1941	First Assistant Keeper Bickford Haskins Second Assistant Keeper Ralph Norwood

Coast Guard Officers-in-Charge

Ralph C. Norwood	1941
Franklin A. Goodwin	1945
Julio DiFuria	1945

Eldon W. Beal	1946
Leo F. Gracie	1946
Stanley Batt	1948
Joseph F. Lavigne	1948
John D. Hall	1950
Robert C. Merchant	1950
Clinton M. Davis	1951
Ray O. Beard	1951
Robert A. Reedy	1952
John Curran	1952
Paul B. Guy	1953
Hubert B. Jones	1954
John E. Horner	1955
J.B. Collins	1960
G. Schiffers	1961
W.F. Mikelonis	1962
V.T. Springer	1966
Allick Rust	1969

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Lighthouse Administration - United States

The Congress officially established the Lighthouse Board in October, 1852. The Board established twelve districts - seven along the Atlantic Coast, one on the Pacific Coast, two in the Great Lakes, and two in the Gulf of Mexico. This was eventually expanded to eighteen districts. By the time of the Civil War, the Lighthouse Board had installed Fresnel lenses in all lighthouses and new lanterns in most of them.

The Lighthouse Board maintained control of lighthouse administration until 1910 when Congress replaced it with the Bureau of Lighthouses, known also as the U.S. Lighthouse Service. In 1939, the aids to navigation function of the U.S. Lighthouse Service was merged into the U.S. Coast Guard. At this time, the employees of the Lighthouse service were given the option of remaining as civilian employees or becoming uniformed-members of the Coast Guard. During the 1960s, the Coast Guard undertook a program which eventually automated all U.S. lighthouses except one - Boston Light.

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Classes of Lighthouses

Lighthouses are divided into five groups according to their principal function; the classes include:

Landfall (or Making) Lights - those lighthouses which a vessel would first see when approaching land from overseas. They are equipped with the most powerful lens, i.e., 1st and 2nd Order lenses.

Warning Lights - lighthouses used to mark a reef or shallow water. Their lenses are powerful but usually are the mid-range, i.e., 3rd and 4th Order lenses.

Coasting Lights - lighthouses that a vessel uses to "fix" its position as it navigates along the coast. These lights are usually situated so the vessel can take a bearing on two or three lighthouses at one time.

Leading Lights - lighthouses which show a harbor entrance or channel. They are usually range lights (i.e., two light towers placed one behind the other). Fourth and 5th Order lenses are typically used.

Port or Entrance Lights - are small lights (i.e., 5th and 6th Order) marking the ends of piers. These lights may serve several functions, such as an entrance light and warning light for a shoal with the addition of a red sector showing where the hazardous water is.

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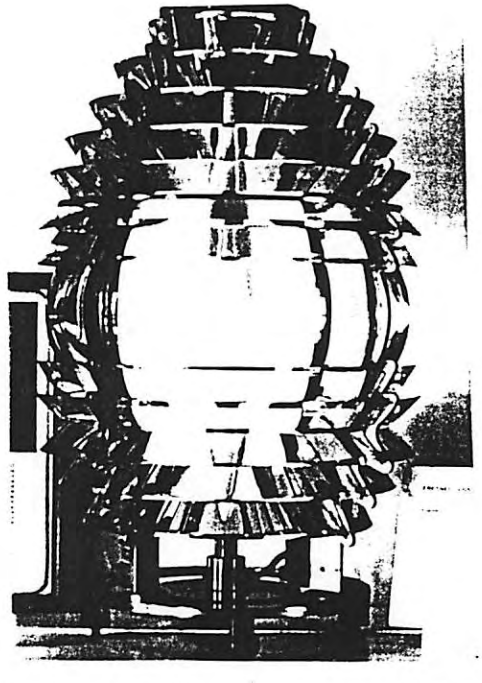
Size of Lens (Orders)

During the middle of the nineteenth century, a decision was made in Europe to standardize on six sizes of lenses, referred to as Orders. A 1st Order lenses was the largest and most powerful, while the 6th Order lenses the smallest and weakest. A 1st Order lens would be slightly over 6 feet in diameter and the prisms would be approximately 10 feet high. First Order lenses do not vary in height. With the pedestal and clockworks, an entire 1st Order apparatus would stand about 19 feet high. The 6th Order lenses would have a diameter of 12 inches and a height of 18 inches.

Most lenses manufacturers came to the realization there was a need for a lens less powerful and expensive than a 3rd Order but more powerful than a 4th Order. Therefore they



A 5th Order Fresnel Lens, Designed as a Harbor Light [Photo #4; McBrien, April 1997)

developed a seventh classification, the 3 1/2 Order. The French designated the 3rd Order as 3rd Order Large and 3rd Order Small. Toward the end of the 19th century, the Chance Brothers in England developed a meso-radial lens with a diameter of 7 feet and a hyper-radial lens with a diameter of 8 feet 10 inches. Although very few meso-radials were constructed, several hyper-radials were made and installed at important points of land like Cape Race, Newfoundland and Makapuu Point, Oahu, Hawaii.

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Fresnel Lenses

Fresnel lenses employ both catadioptric prisms and dioptric prisms; in combination, they are referred to as a Catadioptric System. The catadioptric prisms, installed at the top and bottom of the lenses, refract or bend the light from the central lamp to an inside face of the prism. The rays are then reflected again as a horizontal beam toward the horizon. The development of the catadioptric lens allowed approximately 85% of the light generated by the lamp to be redirected from the lenses toward the horizon.

During the middle of the 19th century, there were three types of lenses and six orders. The principal manufacturers were:

Henry Lapaute - Paris
Francois Soeil & Tabouret - Paris
L. Sautter - Paris
Barbier & Fenestre - Paris
Chance Bothers - England

An Austrian firm also made Fresnel lenses and the Russians began manufacturing them at the end of the 19th century. In most cases, the French manufacturers provided most of the lenses, as well as lantern rooms, and prefabricated towers. Chance Brothers started manufacturing lenses and lighthouse apparatus in 1850. Most Fresnel lenses in America are French but the U.S. Lighthouse Service purchased prefabricated lantern rooms from Chance Brothers around the turn of the century.

In the early days, a lamp inside the lenses supplied the light. Lamps for smaller lenses contained one or two circular wicks while in the larger lenses the lamps had four or five circular wicks. The wicks were placed one inside the other. Order was determined by the focal distance, i.e., the distance of the flame from the lens. First Order lenses had the greatest focal length while a 6th Order lenses had the smallest.

After the Fresnel lens came into use in 1822, most European countries adopted it. Most American lighthouses continued to use the Argand lamp backed by parabolic reflectors because they were concerned about the high cost of oil to illuminate the Fresnel type lens. By the outbreak of the Civil War, all American lighthouses had Fresnel lenses in their lantern rooms.

Consumption of oil in Fresnel lenses was proportional to lens size. Typical annual consumption rates for the various size lenses were:

1st Order Lamps	2300 gallons/year
2nd & 3rd Orders	685
3 1/2 Order	286
4th Order	243
5th & 6th Orders	155

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Fuel For Lighthouse Lamps

Early U.S. lighthouses used sperm oil in their lamps. However, the cost of sperm oil rose dramatically between 1840 and the early 1850s. Lighthouses in England and France used colza, made from rapeseed, at this time and it was hoped that American farmers would increase their output of rapeseed in response to this potential demand. Unfortunately, the farmers failed to respond, so the Lighthouse Board experimented with lard oil. Early results were unsatisfactory but further testing showed that it burned well when it was preheated. So U.S. lighthouses converted to lard oil.

About 1870, the Lighthouse Board prescribed the use of mineral oil or kerosene. Kerosene worked well but extra caution was necessary due to its increased volatility. It was used until about the end of the nineteenth century. It was replaced by the incandescent oil vapor lamp which used pressurized fuel and a heated mantle. This was used in U.S. lighthouses until electricity became available which was generally in the 1930s. In some cases, conversion to electricity didn't take place until after World War II.

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Early Lamps

In the early 1800s, spider lamps were the light source in all U.S. lighthouses. They were replaced with a lighting apparatus designed by Winslow Lewis. It was modeled after the Argand lamp and parabolic reflector used in European lighthouses. After Lewis designed his system, he ran tests for the U.S. government at Boston Light. Lewis' system was found to be superior to the spider lighting systems. Congress passed an appropriation for $60,000 for a program to install this new system. The program was started in 1812, was suspended during the War of 1812, and resumed in 1815. When this program was completed, all U.S. lighthouses had this new system.

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Types of Fresnel Lenses

Fixed Lenses - show a steady white light all around the horizon. In cases where it's not necessary to provide light in one direction, such as to the land side, the prisms of the

lenses may extend only 180 or 270 degrees around the optic, or glass or brass reflectors may be installed to redirect the light rays back toward sea. This provides a more concentrated light in one sector.

Flashing Lenses - a lenses which consists of an annular, or curved, dioptric and catadioptric prisms above and below the bullseyes. These prisms focus the light into concentrated, horizontal beams. As the lens apparatus rotates, a flash is seen by the vessel when the center of the bullseye, and its accompanying dioptric and catadioptric prisms, pass its position. Then there is darkness until the next panel (bullseye and prisms) passes. A rotating lens may have as few as 2 back-to-back panels, termed a clam shell or bivalve lens, or as many as 24 panels. The speed at which the lens rotates determines the number of flashes per minute. A 24 panel lens rotating at one half revolution per minute will provide a flash, or characteristic, every 5 seconds.

The configuration of the lenses provide unique characteristics, i.e., two bullseyes close together produce a group flash. Some lenses have been constructed to furnish a "numbered" characteristic. Minots Ledge Lighthouse off Cohasset, MA shows a 1-4-3 characteristic - the sequence being one flash, then darkness, 4 flashes, then darkness, 3 flashes, and then a long period of darkness before the sequence starts over.

Fixed Varied With Flash - Type A - consists of a fixed lens showing a steady white light for 360 degrees, with one, or several, flash panels, mounted on rollers or chariot wheels. When the flash panel is in line with the vessel, the steady light becomes an intense flash. The advantage of this lens is that a light is always visible and that it has a unique characteristic which can be used to identify a particular lighthouse.

Fixed Varied With Flash - Type B - consists of a rotating lens with horizontal prisms (a fixed rotating lens) with occasional bullseyes and annular prisms. As the fixed, or horizontal, prisms of the lens rotates, a steady light is seen by the vessel. When the bullseye portion crosses its position, a flash is seen.

Colored Lenses - in a typical situation, use of colored lenses in lighthouses reduces effectiveness dramatically. A red or green lens causes a loss of more than 70 percent of its light strength because of the color. Because the light transmitted through a colored lens will not be seen at a great distance, colored lens are usually not used for major seacoast lights. When colored lens are used, the Light List will specify differing ranges for the colors (i.e., white light visible at 18 miles, red to 14 miles). In some cases, colored panels, usually red, are placed in a lens to indicate a danger bearing. This should alert a mariner that he is off course and should correct the heading until only the white light is seen. In some cases, a rotating lens may be equipped with a red panel over every second flash panel - provides an alternating red and white characteristic. A characteristic of white-white-red is produced by installing a red panel over every third flash panel.

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Range of a Light

The distance at which a light can be seen by a vessel is determined by its candlepower. This is determined by the lamp providing the light and the lenses redirecting it. Other factors that determine range include:

Lens Height - the distance at which a light may be seen is limited by the curvature of the earth. Regardless of the candlepower of a light, its range will be restricted if it is mounted too low.

Cleanliness - the cleanliness of both the lens and the lantern room windows are another factor in determining range. Eight percent of the lamp's power is lost when the light is transmitted into a clear, clean glass; another 8 percent is lost as the light exits the glass. Dirt on either the lens or the windows increases this loss significantly.

Transmissivity - transmissivity is the normal quality of air in a specific location during clear periods, i.e., without rain, snow, or fog. Geographic areas that are perfectly clear are assigned a transmissivity factor of 1.0. Los Angeles has a low factor of 0.60 while Hawaii has a high factor of 0.91. To calculate the range of an optic or lens, the power of the light (candlepower, CP) is multiplied by the transmissivity factor for that area. For example, at Los Angeles, a 1,000 CP lens produces only 600 CP (1,000 x .60). Inclement weather, such as fog, rain, or snow drastically reduces the light's range further. Even the most powerful light cannot penetrate heavy fog and becomes ineffective. In heavy fog, a light is replaced by audible signals (fog signals) and electronic signals (radio beacons).

Speed of Rotation - the human eye can detect a slowly rotating lens which produces a flash every 20 seconds better than one which rotate quickly and produces a flash every 2 seconds. The slowly revolving lens produces an indistinct image of the light prior to the to the actual flash which helps the viewer locate the light, as well as seeing it at a greater distance.

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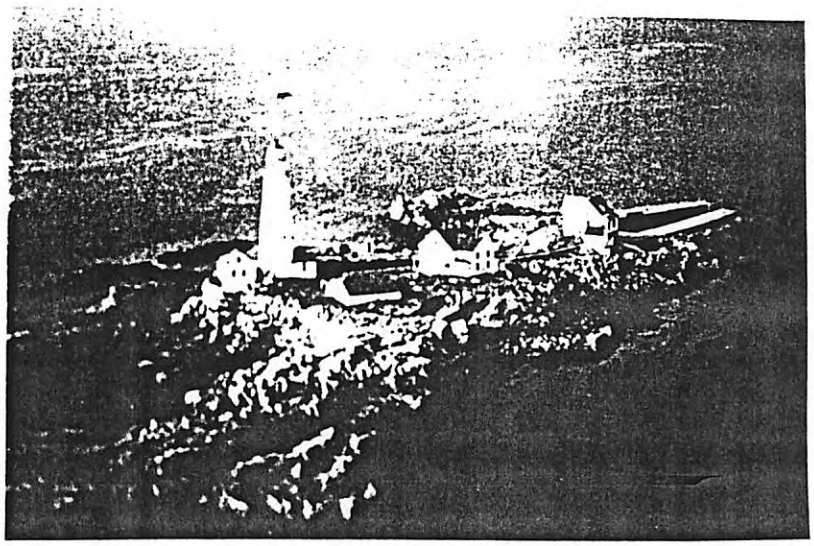
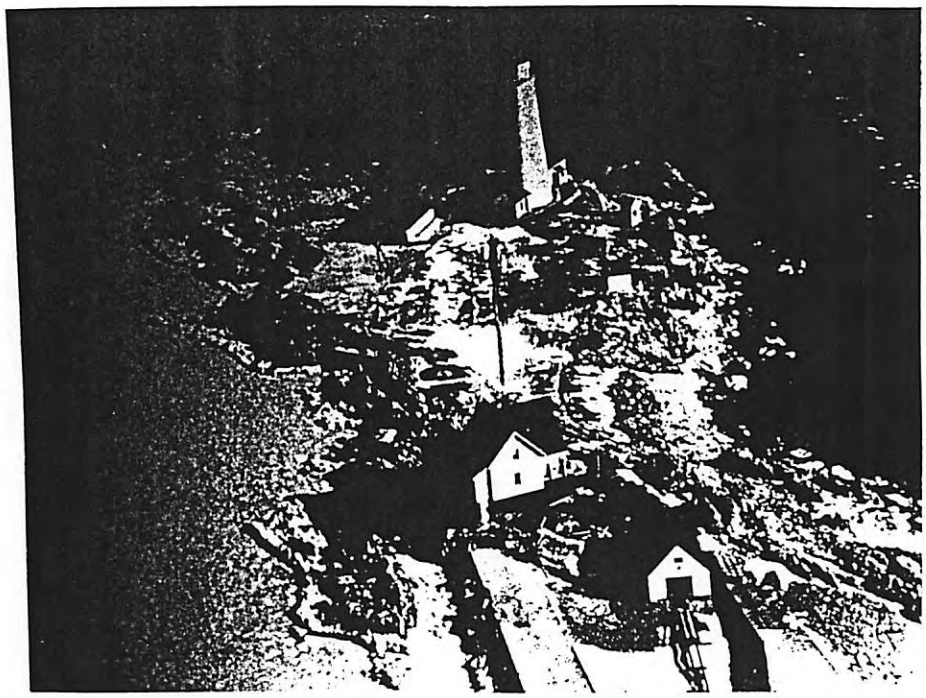
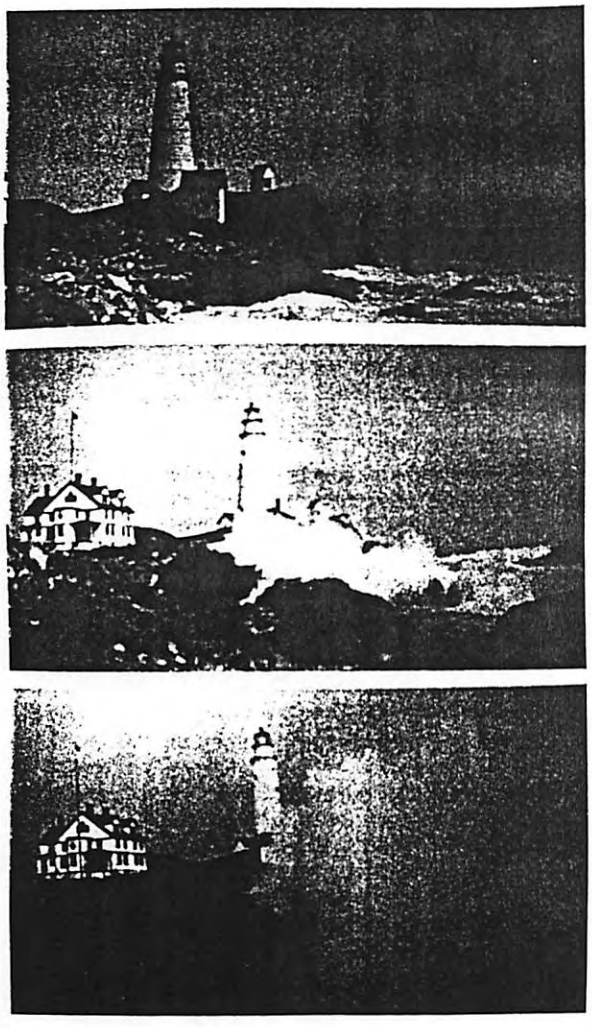


Aerial View of Boston Light - Before 1960
[Photo #5; source and date unknown]



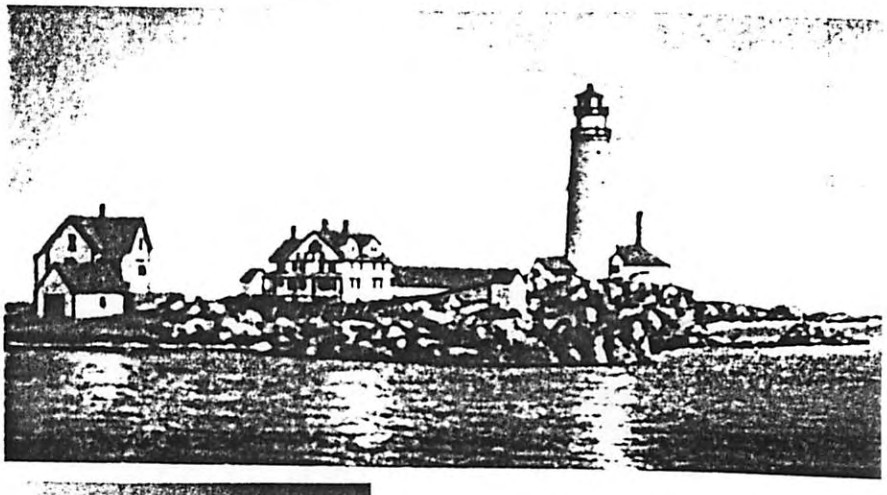
Boston Light - Between 1960 & 1973
[Photo #6: "The Lighthouses of New England", Snow]

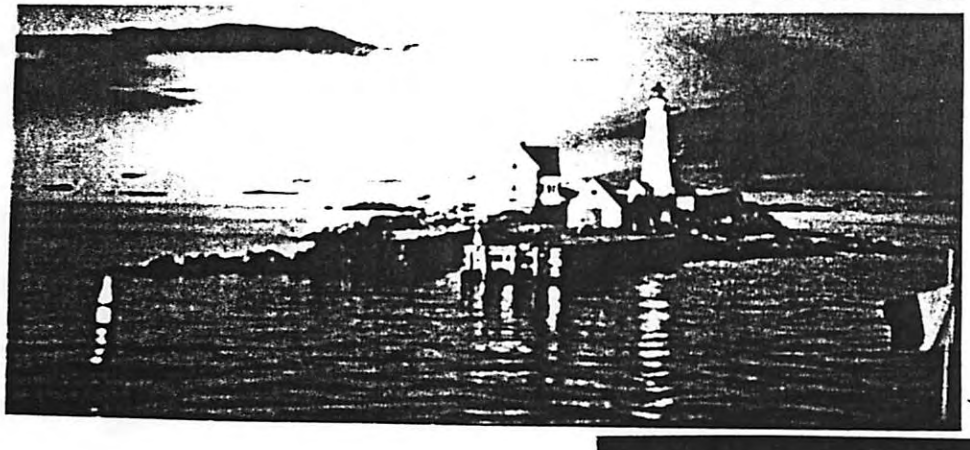
Assistant Lightkeepers' House
[Photo #7; source and date unknown]

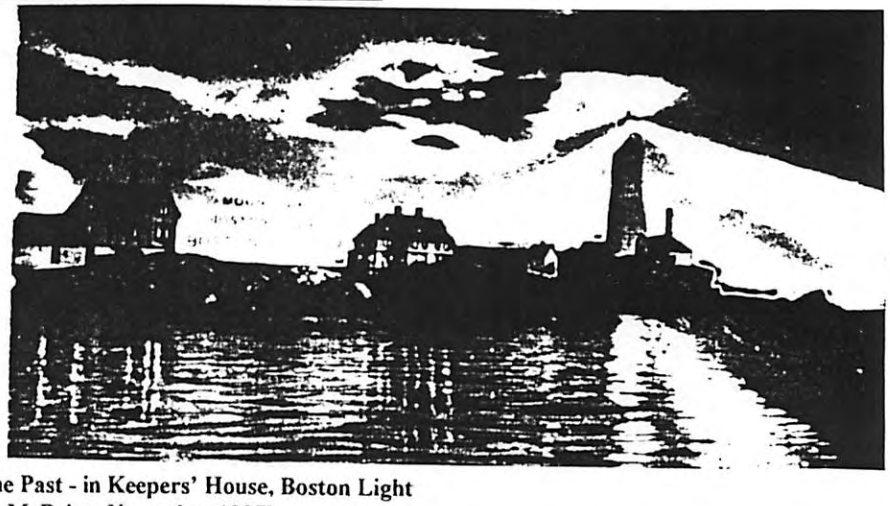


Boston Light
[Photo #8 - source and date unknown]

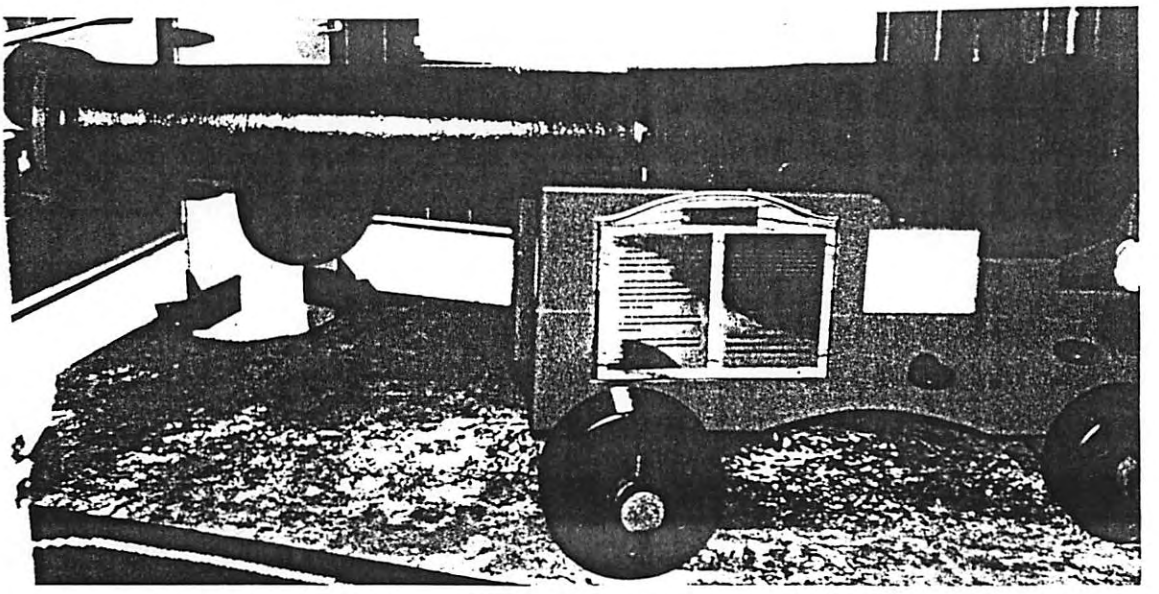
Assistant Lightkeepers' House - 1930s; Insert - Georgia Norwood, the first child born at Boston Light
[Photo #9; Source First Light, Emerson]



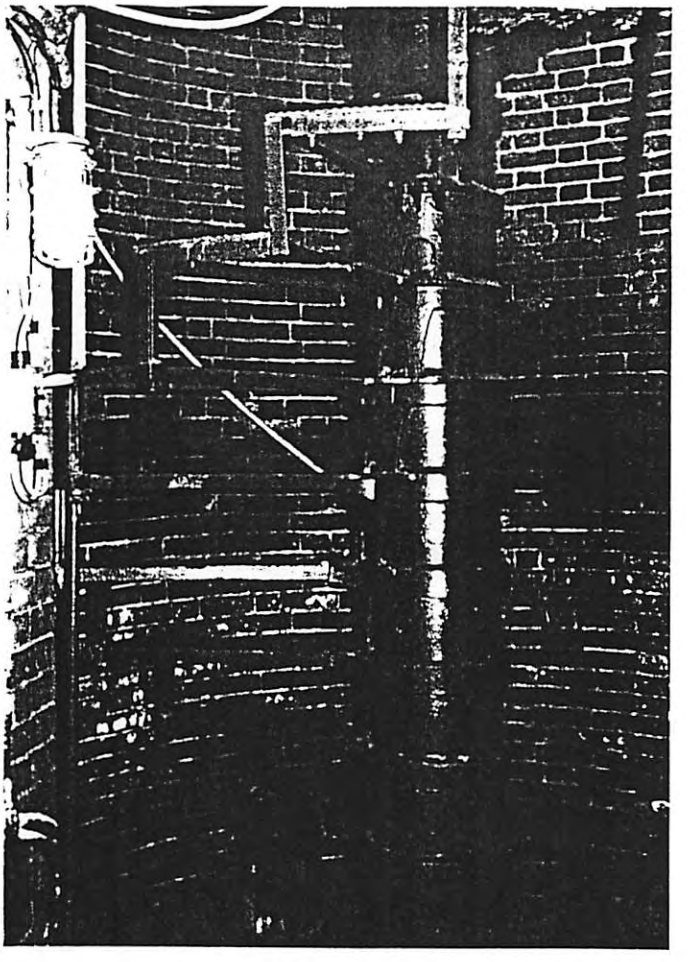




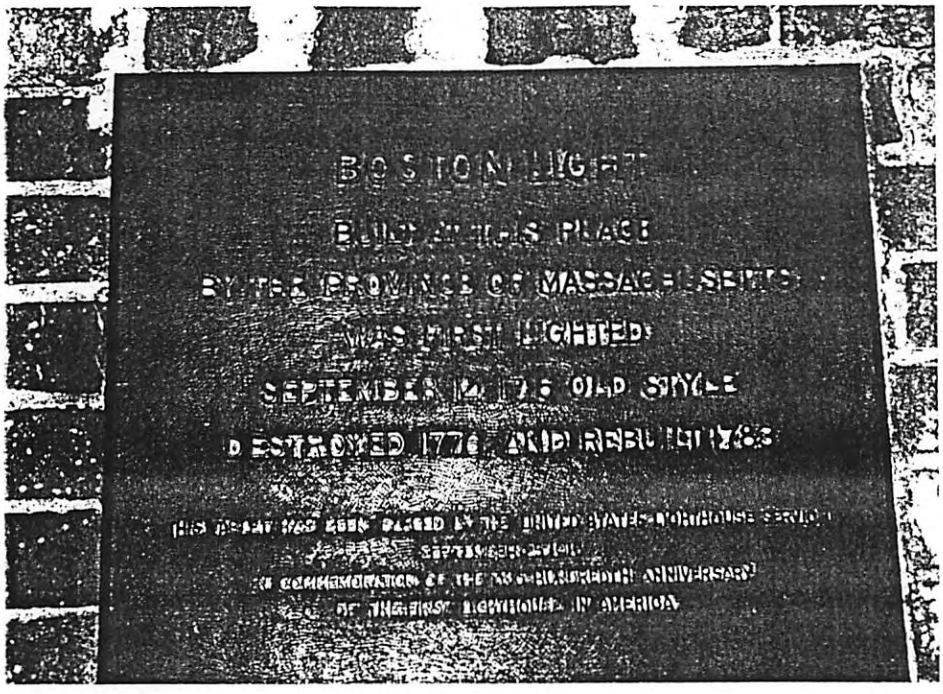
Photos of Postcards From The Past - in Keepers' House, Boston Light
[Photos #10-13: McBrien, November 1997]



Fog cannon used at Boston Light in the early 1700s. It was transferred to the U.S. Coast Guard Academy when the new fog signal was installed. It was returned to Boston Light in 1993. [Photo #14; McBrien, Nov. 1997]



Base of the spiral stairway in the light tower which was installed in 1844. The red-brick lining of the tower can be seen [Photo #15; McBrien, April 1997]



Metal plaque mounted at entrance to tower at Boston Light. It reads: "Boston Light - Built At This Place By The Province of Massachusetts - Was First Lighted September 14, 1716 - Old Style - Destroyed 1776 And Rebuilt 1783 - This Tablet Has Been Placed By The United States Lighthouse Service - September 25, 1916 - In Commemoration Of The Two Hundredth Anniversary Of The First Lighthouse in America". [Photo #16; McBrien, April 1997]

Metal plaque mounted on the exterior of the light tower base. It reads: Boston Light Has Been Designated A Registered National Historic Landmark Under The Provisions Of The Historic Sites Act of August 21, 1935. This Site Possesses Exceptional Value In Commemorating And Illustrating The History Of The United States - U.S. Department Of The Interior - National Park Service - 1964". [Photo #17; McBrien, April 1997]

Boston Light - Year Unknown - Note the ramp to the water - later replaced by a concrete pier (Photo #18; USCG)

Assistant Keepers' House - around the turn of the century; note covered walkway from house to light tower [Photo #19; USCG]

The last three civilian keepers at Boston Light in 1941 Left to Right: Charles Jennings 1916-1919, Maurice Babcock 1926-1941, Leland Hart 1919-1926 [Photo #20: USCG]

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