



150 Years of Service

Past and Present of Japanese Aids to Navigation

Japan Coast Guard
Maritime Traffic Department

History of Lighthouses

Origin



Faros Lighthouse

In the history, lighthouse was originated by tower style architecture at capes, islands and other prominent land places to indicate their positions by fire or smoke to ships for navigational purposes.

The oldest lighthouse in the history is said to be Faros Lighthouse built in 279 BC at Faros Island, at the entrance of Port of Alexandria, Egypt. This lighthouse was as tall as 135m and its fire light reflected by marble stone mirror was said to be visible from over 10km away.

Japanese early lighthouse was an open fire/smoke emitting facility, or NOROSHI.

NOROSHIs built at IKI-TSUSHIMA Islands in 664 for coastal defense had also been useful for the navigation of diplomatic envoy fleet to China.



Lantern House



Joga-Shima
(Miura, Kanagawa)

Modern Lighthouses

As open fire of burning woods, coals, etc. had been used as light sources until 19th Century, their visible distances were limited. However, Fresnel lens invented by French scientist Augustin Fresnel in 1822 and new light sources as kerosene or gas fire significantly improved lighthouse functions.

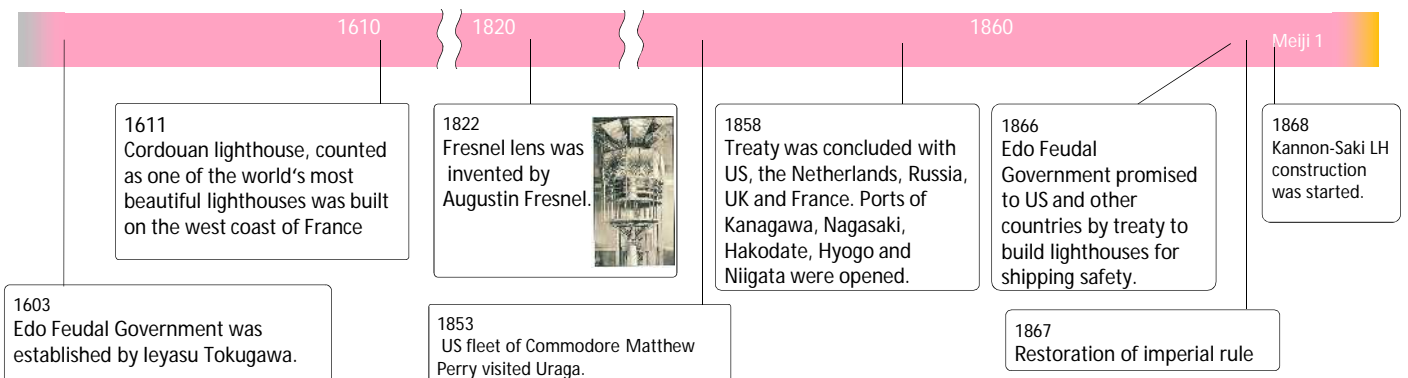
The first Fresnel lens was installed in 1823 at Cordouan Lighthouse in France and achieved as long as 21 nautical miles (39km) of visible distance.



Cordouan Lighthouse (France)

Courtesy of Seizando, 'Sekai no Toudai'

Edo Era



Origin of Modern Lighthouses in Japan

Modern lighthouse in Japan dates back to the end of Edo Era. The treaty concluded between Japan and UK, France, the Netherlands and the US required the construction of lighthouses at 8 locations including Tokyo Bay area. As Japan did not have the necessary architecture technology for lighthouses, Edo Feudal Government requested help to France and the UK for the procurement of necessary components and the construction of lighthouses. The Meiji Government thereafter overtook this project and French engineering group with chief engineer F. VERNY started the first lighthouse construction work on 1 November 1868 at Kannon-Saki.



First Kannon-Saki LH
(Yokosuka)



Government hired foreign engineers
(1869)



Francois R. VERNY

French engineers constructed 3 lighthouses including Kannon-Saki by 1870. British chief engineer Richard Blanton thereafter continued the project and 30 lighthouses were built by him by 1877 and formed the basis of Japanese lighthouse engineering.

Lighthouse Construction by Japanese Engineers

After Richard Blanton and his successor returned home upon their contract expiration in 1879, lighthouse construction project was handed over to Japanese engineers.

Kentatsu Fujikura, an ex-interpreter of R. Blanton learned lighthouse construction technology from him and built Kura-Saki lighthouse in 1844.

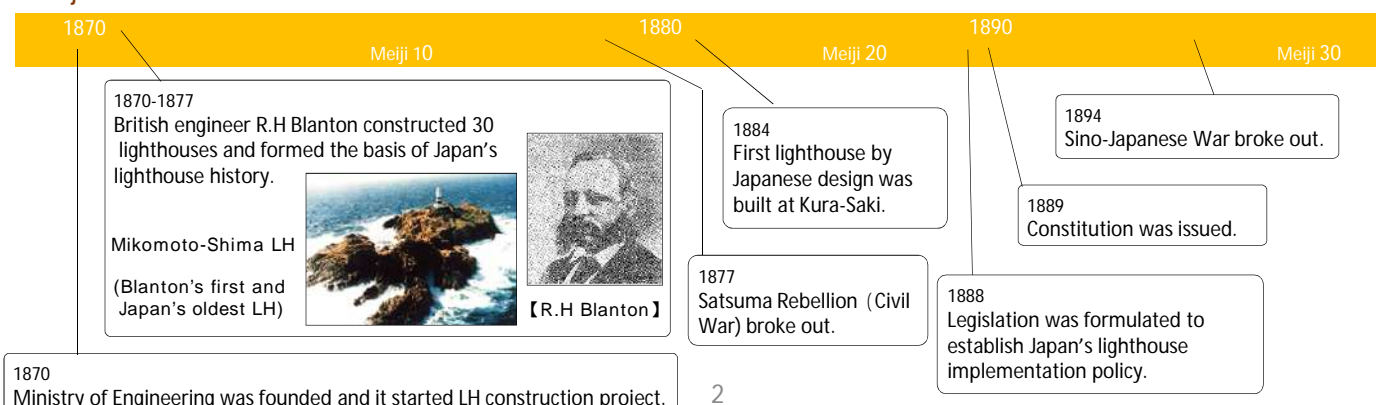


Kentatsu Fujikura



Kura-Saki LH
(Nichinan)

Meiji



History of Aids to Navigation

Lives of Lighthouse Keepers

Lighthouse keepers and their families had lived in co-located facilities at islands or at remote rural areas, having to bear difficult day to day life under harsh environment. One lighthouse keeper said in his memoir of 1930s that their lives had to be self contained by growing vegetables, feeding hens for eggs and meat, catching fish at sea, all of which had been deemed to be parts of official services. Agricultural gears and allotments were officially fed and they were government properties. Self-medication by 'Domestic Medicine Guidebook' was necessary. Water had to be obtained mainly from rain and shortage was supplemented by carrying well water over the dangerous cliff. Kerosene lamp was the only domestic light but as reading under it was difficult, radio set granted by Empress Dowager for 10 minutes per day broadcast was an important entertainment. As refrigerator was of course unavailable, dry food stocks were the last life line.



Radio broadcast was an important part of life at lighthouses (1937)



Empress Teimei's mercy radio set



Lighthouse family kids at play



Kinka-San LH in 1950s (Ishinomaki)



Lighthouse services in 1950s
(Lens polishing work at Mikomoto-Shima LH and radio direction finding service at Iro-Saki LH)

Meiji

Taisho

Showa



1904
Russo-Japanese War broke out.

1909
Tide signal stations started operation at Kanmon and Kurushima straits.



【Tide indicator arm】

1914WWI broke out.

1922
First Kannon-Saki LH destroyed by earthquake and the Second LH



【Destroyed LH and the new LH (Yokosuka)】

1923
Second Kannon-Saki LH was destroyed by Kanto Earthquake.

1925
The third LH was constructed at Kannon-Saki.

1925
Radio broadcasting was started by NHK.

Lighthouses at War

By the agreement between the Navy and the Ministry of Telecommunications in 1942, lighthouses were integrated in the air defense system to engage in surveillance, meteorological observation, etc. Lighthouses were camouflaged and lights were weakened or temporarily disabled and their directions were changed downward for military operational reasons.

Ashizuri-Misaki lighthouse (Tosa-Shimizu) was first air raided in March 1944 and since then, other lighthouses across the country were also attacked however, lighthouse service staffs were not allowed to leave the lighthouses, as they were assigned with military duties as reporting. Therefore on 10 October 1944, 3 men and their 5 family members lost their lives when Ie-Shima lighthouse (Okinawa) was air raided and 5 bombs hit the lighthouse. Many others also gave their lives for service at lighthouses across the country including Shiriya, Kiritappu, Kinka-San, Inubo-Saki. A memorial monument was built at Ie-Shima lighthouse in 1977 by former lighthouse service members and memorial service is conducted on 21 April (day of attack) every year.



Pre-war Ie-shima LH
(Okinawa)



Post-war Ie-Shima LH



Memorial monument

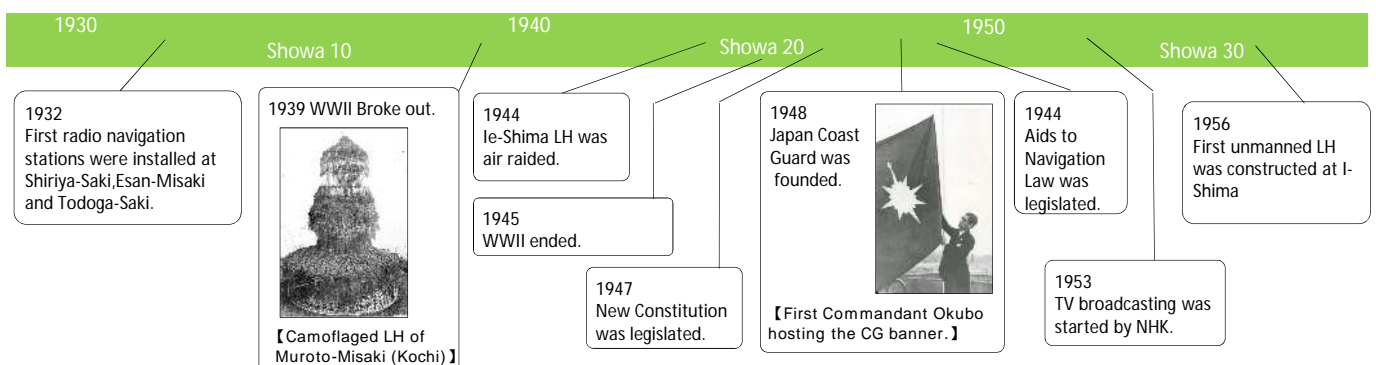


Destroyed Gaja-Shima LH
(Kagoshima)

Post-war Recovery of Lighthouses

Although total number of lighthouses as of 1945 was about 1,100, 30 % of them had been destroyed by air raid and most of others had lost their functions due to attack damage or power fuel shortage. Japanese coastal waters were totally dangerous with numerous mines and sunken ships and maritime crimes as illegal migration, smuggling, piracy were prevailing.

GHQ therefore, requested the government of Japan to remove navigational obstructions and the recovery of aids to navigation with top priority. Japan Coast Guard, established in May 1948 with responsibilities for maritime safety and security, assumed the lighthouses recovery work and recovered the lighthouses almost to the pre-war level by 1950.



History of Aids to Navigation

New Era of Nav aids

Japan's first radio navigational aids was the radio directional beacon built in early 1920s. This was to inform ships of their directions from the beacon upon interrogation from them but by the spreading use of radar, they became less popular rapidly.

Hyperbolic radio navigation system was developed and put into practical use in Europe and the US. After WWII, Loran-A in 1959, Decca in 1967, Omega in 1975 and Loran-C 1993 were respectively introduced to Japan and started operations however, they were all decommissioned by 2015 as use of GPS became popular.

Differential GPS (GPS accuracy augmentation system by MF radio) started operation in 1997.

In 1977, first Vessel Traffic Advisory Center was established at Yokosuka for Tokyo Bay area and started operation of vessel traffic services for other maritime traffic congested areas.

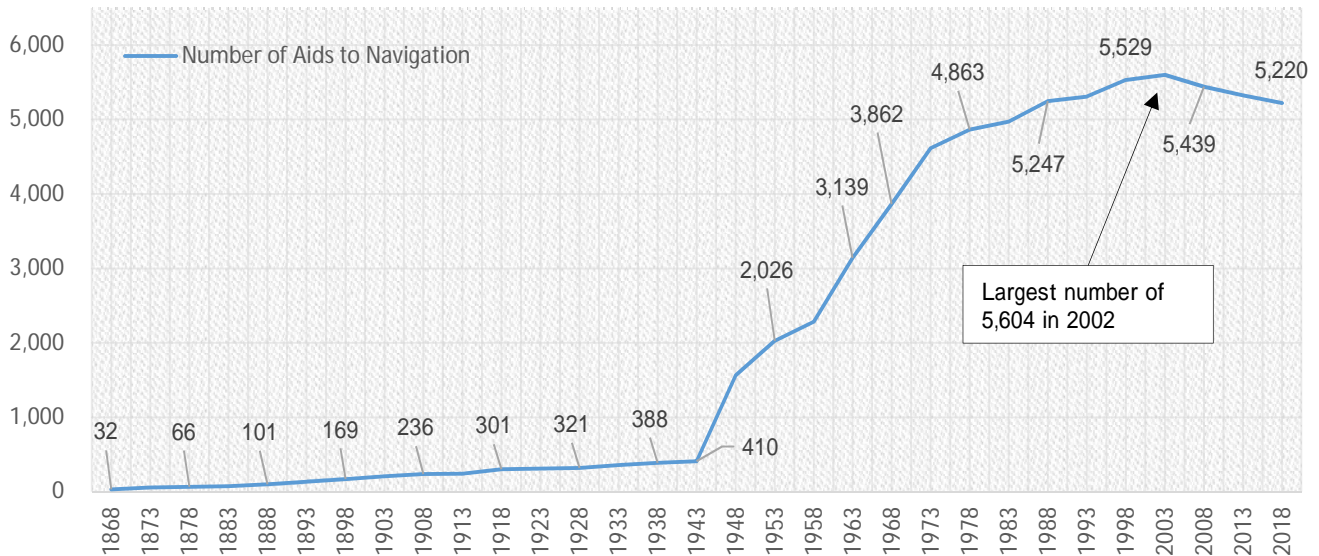


Omega Station
(Tsushima, Nagasaki)



DGPS Station
(Sakata, Yamagata)

Number of Aids to Navigation



Showa



State of the Art Technologies

High power LED (COB-Chip on board) under development will be used as new light source.



COB (Chip on Board : numerous LED chips directly embedded on the circuit board

64 historical lighthouses of Meiji Era have been preserved to contribute to the local communities.



Kakezuka LH (Shizuoka) Lit on March 25, 1897

150th Lighthouse Anniversary



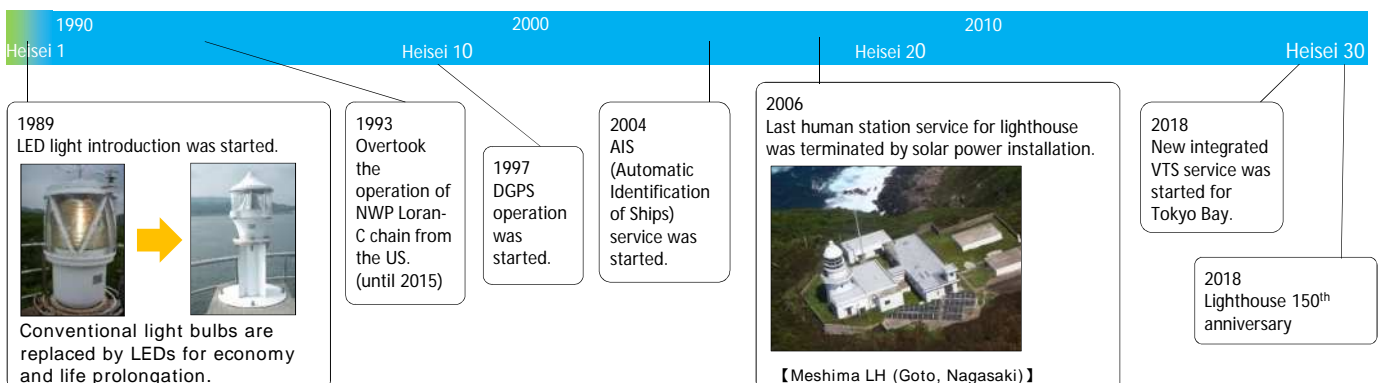
Memorial Logo

- Open lighthouse events
- Digital lighthouse cards
- Anniversary postage
- Exhibitions
- Other events

2018 marks the 150th anniversary of Japanese first modern lighthouse. Construction of Kannon-Saki lighthouse was commenced on 1 November 1868. Taking this opportunity, the Coast Guard will conduct a number of events as follows, to further promote maritime traffic safety as well as to enhance local public relations across the country.



Heisei



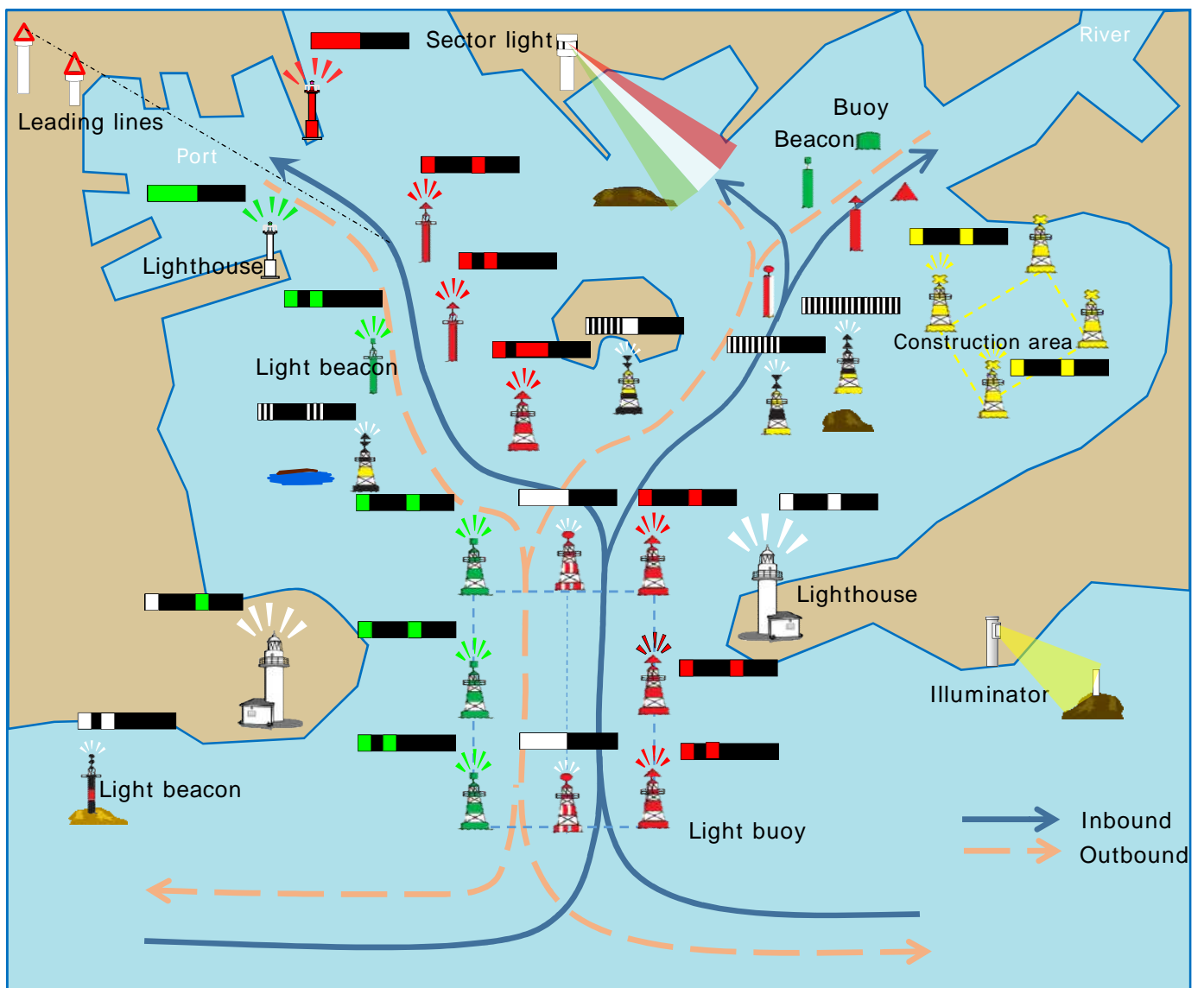
Roles of Aids to Navigation

Aids to navigation are so designed and constructed to assist coastal shipping by means of lights, objects, colors, sounds, radio waves, etc. typically represented by lighthouses at capes, light poles to indicate obstacle rocks, light buoys to indicate entrances of traffic routes and so on, each of which are of different types depending on their objectives. As they are widely used by many ships including foreign flag vessels, their characteristics are internationally standardized, which is also the case with Japan.

Except in case special rules exist, ships are in principle have a freedom of navigation at sea. They make their own navigational plans safely and efficiently at their discretion based upon waterways depth and ship's draft. Based on such navigational plans, ships constantly fix their positions and stay away from dangerous obstacles until they safely reach their destinations.

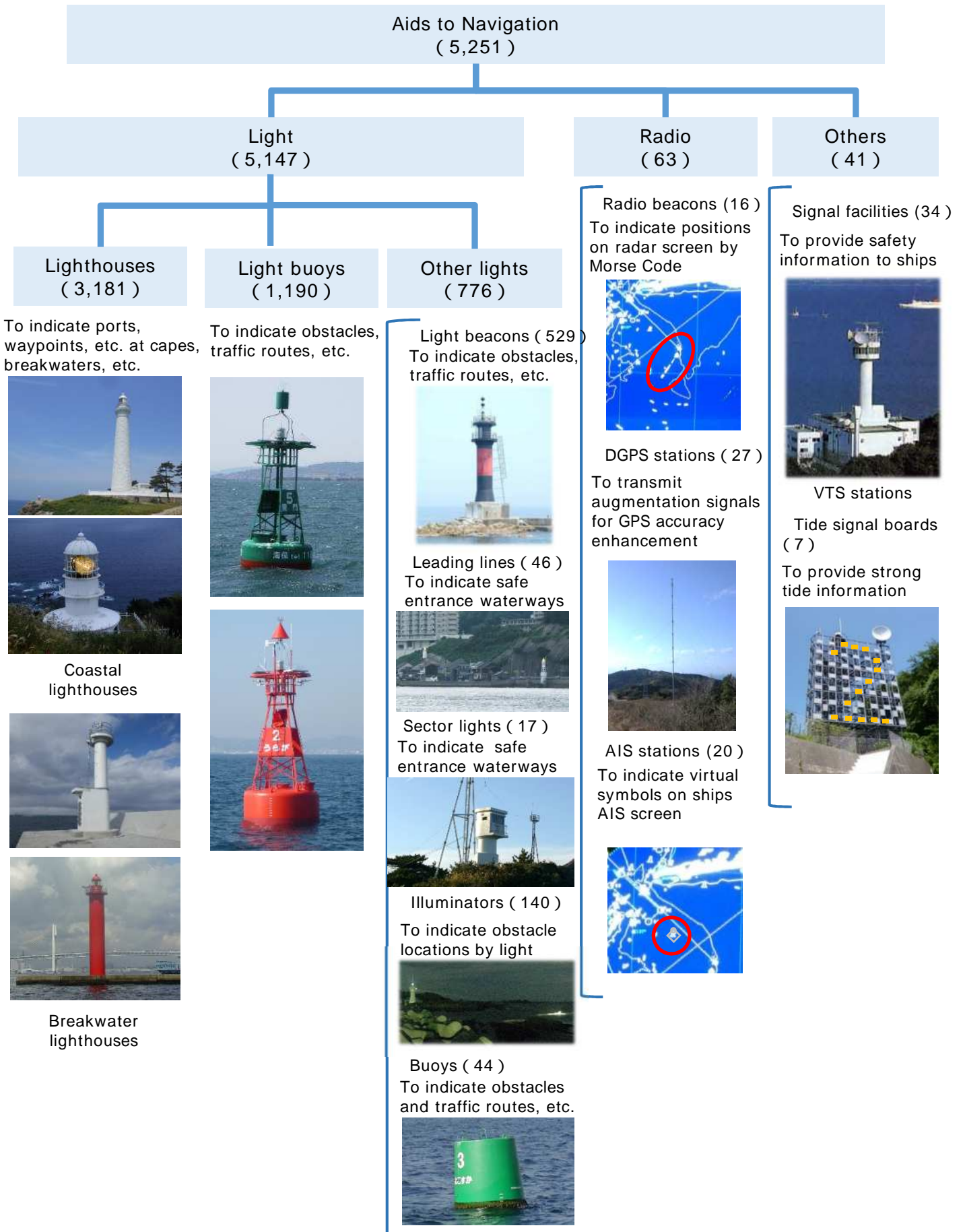
Aids to navigation are indispensable for them to fix positions and to avoid dangers en route.

Typical Aids to Navigation



Aids to navigation JCG Administration

() Numbers as of 1 April 2018



Major Coastal Lighthouses

22 Kyoga-Misaki Meiji A
 Kyotango, Kyoto
 Lit on 25 Dec. 1898
M



21 Nokogiri-Saki
 Ooi, Fukui
 Lit on 26 Feb. 1951



Nokogiri-Saki (Location site) H



20 Tateishi-Misaki N
 Tsuruga, Fukui
 Lit on 20 Jul. 1881
Meiji C



24 Izumo-Hinomisaki Meiji A
P.O
 Izumo, Shimane
 Lit on 1 Apr. 1903
N
M



23 Mihogaseki Meiji A
 Matsue, Shimane
 Lit on 8 Nov. 1898
N
M



Meiji Class A : 2 3

Publicly open : 1 6

Cultural Heritage : 1 8

26 Mutsure-Shima L
 Shimonoseki, Yamaguchi Meiji B
 Lit on 21 Nov. 1871



25 Tsuno-Shima Meiji A
 Shinomoseki, Yamaguchi P.O
 Lit on 1 Mar. 1876
L
C
M

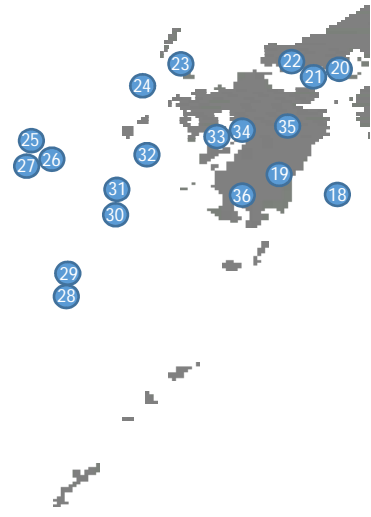


- H Historical site
- N National registered heritage
- L Local heritage
- M Modernization heritage
- C Civil engineering heritage

28 Toi-Misaki P.O
 Kushima, Miyazaki
 Lit on 22 Dec. 1929



27 Hesaki Meiji A
 Kitakyushu, Fukuoka
 Lit on 11 Jan. 1872
M

30 Mizunoko-Shima Meiji A
 Saeki, Oita
 Lit on 20 Mar. 1904
M



29 Kura-Saki Meiji A
 Hyuga, Miyazaki
 Lit on 15 Aug. 1874
M



34 Ogi-Shima Meiji A
 Takamatsu, Kagawa
 Lit on 10 Dec. 1875
C
M



33 Nabe-Shima Meiji A
 Sakaide, Kagawa
 Lit on 15 Nov. 1872
M




32 Tsuru-Shima Meiji A
 Matsuyama, Ehime
 Lit on 15 Jun. 1873
M



31 Sata-Misaki N
 Ikata, Ehime
 Lit on 1 Apr. 1918



38 Henna-Saki P.O
 Miyakojima, Okinawa
 Lit on 15 May 1972



37 Zanpa-Misaki P.O
 Yomitan, Okinawa
 Lit on 30 Mar. 1974



36 Muroto-Misaki Meiji A
 Muroto, Kochi
 Lit on 1 Apr. 1899
M



35 Esaki Meiji A
 Awaji, Hyogo
 Lit on 27 Apr. 1871
M



1 Rokko-Saki Meiji A
Suzu, Ishikawa
Lit on 10 Jul. 1873



2 Hime-Saki Meiji A
Sado, Niigata
Lit on 10 Dec. 1895



3 Nyudo-Saki P.O
Oga, Akita
Lit on 8 Nov. 1898




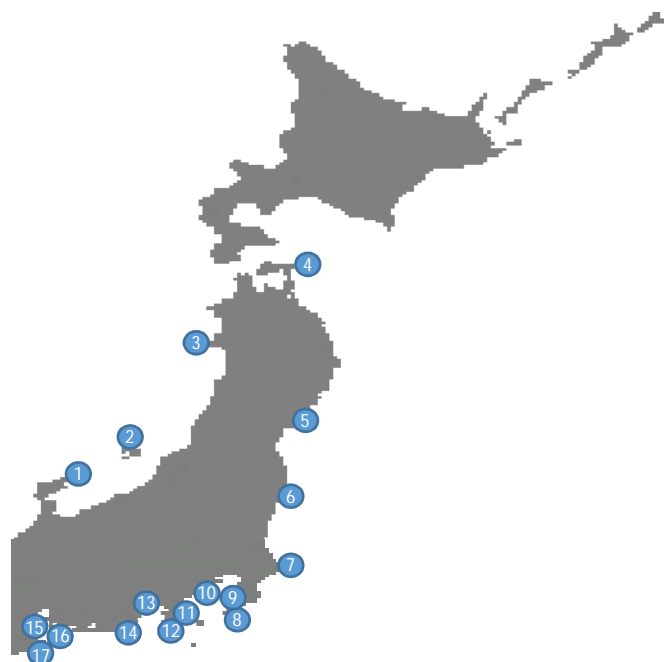
4 Shiriya-Saki Meiji A
Higashidori, Aomori
Lit on 20 Oct. 1876

P.O

N

C

M

5 Kinka-San Meiji A
Ishinomaki, Miyagi
Lit on 1 Nov. 1876

N

M



6 Shioya-Saki P.O
Iwaki, Fukushima
Lit on 15 Dec. 1899




7 Inubo-Saki Meiji A
Choshi, Chiba
Lit on 15 Nov. 1874

P.O

N

M



Inubo-Saki Fog Signal Facility (not in use) N



8 Nojima-Saki P.O
Minamiboso, Chiba
Lit on 18 Dec. 1869

N



9 Suzaki N
Tateyama, Chiba
Lit on 15 Dec. 1919



Others

- Meiji B.C Existing historical LHs of Meiji Era (Rank B and C)
- C Designated by Japan Society of Civil Engineering
- M Designated by the Ministry of Economy and Industry
- Mechanical Designated by Japan Society of Mechanical Engineering

10 Kannon-Saki P.O
Yokosuka, Kanagawa
Lit on 1 Jan. 1869

M



11 Hatsu-Shima P.O
Atami, Shizuoka
Lit on 25 Mar. 1959



12 Mikomoto-Shima Meiji A
Shimoda, Shizuoka
Lit on 11 Nov. 1870

H

M



13 Shimizu Meiji A
Shizuoka, Shizuoka
Lit on 1 Mar. 1912

C

M



14 Omae-Saki Meiji A
Omaezaki, Shizuoka
Lit on 1 May 1874

P.O

M



15 Suga-Shima Meiji A
Toba, Mie
Lit on 1 Jul. 1873

N

M



16 Anori-Saki P.O
Shima, Mie
Lit on 1 Apr. 1873

N



17 Daio-Saki P.O
Shima, Mie
Lit on 5 Oct. 1927

N



18 Shiono-Misaki Meiji A
Kushimoto, Wakayama
Lit on 15 Sept. 1873

P.O

M



19 Tomoga-Shima Meiji A
Wakayama, Wakayama
Lit on 25 Jun. 1872

N

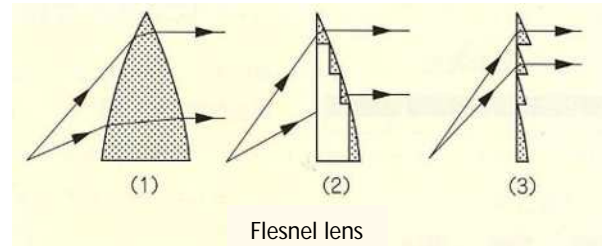
M



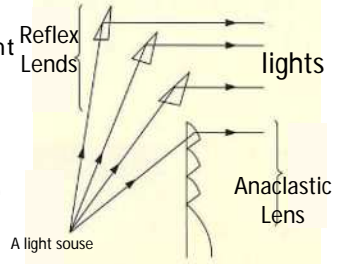
Lighthouse Mechanisms

Fresnel Lens

Fresnel lens was named after Augustin Fresnel, a French engineer who invented it in 1822. Depending on their focus lengths, they are classified into class 1 through 6. Special light bulbs are used as light sources however, kerosene or gas lights had been used in Meiji Era.



Fresnel lens was intended to overcome heavy weight and thickness of lenses while making it easier to manufacture. Principle is shown in (1)~(3). Combination lenses as (4) are used when specially strong light is needed.

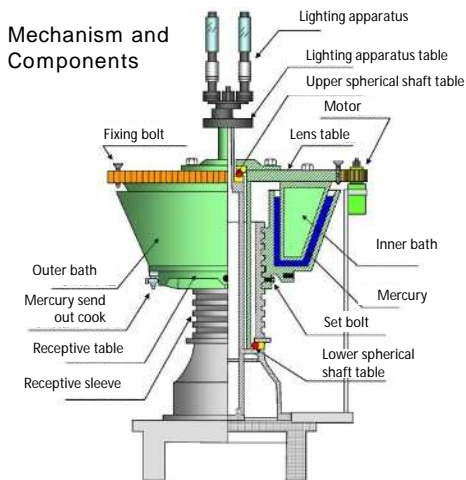


Section of Large-scale Fresnel lens

Lens Rotating Mechanism

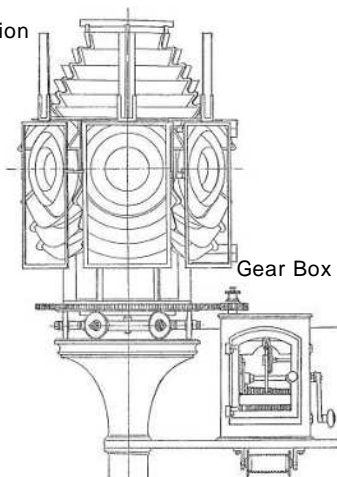
Mercury bath rotator has been used to smoothly rotate very heavy lighthouse lens, in which lens of several tons is kept floating in the mercury pool.

Gravity rotation system had been used to rotate lens but it has been replaced by electrical motor. (55 lighthouses still use mercury bath rotator.)



Mercury Bath Rotator

Transmission Gears



Gear Box



Gravity Weight

Mercies from the Imperial Family

On 12 June 1872, Meiji Emperor visited Mutsure-Shima lighthouse while travelling in the west of the country. Since then, the Imperial family has granted merciful opportunities to lighthouse service personnel in various ways.

Imperial Visit

On 18 March 1875, Meiji Emperor and Empress Shoken visited and reviewed the brand new trial lighthouse model in Yokohama at the Ministry of Engineering facility.



Meiji Emperor



Imperial Visit Monument
(Yokohama CG Office)

Mercies granted from Empress Teimei



Empress Teimei



Radio set granted by the Empress



Flower vase granted by the Empress

Her Majesty had deep sympathies to the difficult lives of lighthouse service personnel and their families and granted a lot of mercies from time to time.

Imperial Review for lighthouse service officials



(1951~2003)

Ceremony Visits



10th anniversary of
Tokyo-Wan VTS Center



Joga-shima LH

Invitation to the Imperial Tea Ceremony



2015



100th lighthouse anniversary

Imperial Graveyard clean-up volunteers
Toko-kai, established in October 1924 by the fund granted by Empress Teimei volunteers for Tama graveyard cleaning service with Coast Guard Traffic Department staffs on 17 May (the day Her Majesty passed away) every year.



Co-operation for Local Tourism Promotions

In recognition of historical and cultural values of lighthouses, Coast Guard continues to promote the promulgation of maritime safety spirit through a variety of co-operation activities for local tourism.

In practice, lighthouses public open day events in co-operation with local communities are more frequently held, in addition to the publicly open lighthouses throughout the year. Information related to lighthouses and their service staffs' lives are also widely promulgated.



Samekado LH (Hachinohe, Aomori) Open Day (April 2013~)



Shiriya-Saki LH Public open event (June 2018~)



Exhibition at Inubo-Saki LH (Choshi, Chiba)

Unique Design Lighthouses

Some lighthouses are uniquely designed to match their local historical views, specialties, tourism resources, etc. based on the coordination with local communities.



Odawara breakwater LH No.1 (Odawara, Kanagawa)

(Designed after hand held lantern)



Mitarai Port breakwater LH (Mitarai, Hiroshima)

(Designed to match the surrounding historical architectures)



Tanwa Port west breakwater LH (Misaki, Osaka)

(Designed to yacht sail for the national race event held here)

Topic - Otsuchi Port lighthouse (Otsuchi, Iwate)



Design by public competition



Otsuchi Port LH (Otsuchi, Iwate)

Otsuchi Port lighthouse on Horai Island, said to be the model location of a famous NHK TV program 'Hyokkori Hyotan Jima' was destroyed by tsunami of Tohoku earthquake on 11 March 2011.

In the recovery work of the lighthouse, Coast Guard invited the public competition of the local residents for the new lighthouse design and chose the 'sun and sand clock' design.

This implies the town's future brightness and the wish for the time to recover.

Lighthouse Lovers and Supporters

There are many persons and groups that are fond of lighthouses and support lighthouse services.



'Lighthouse girl'



Hesaki LH Association



Nippon Foundation / Japan Romanticist Association

Inubo-Saki Blanton Association provides kind understanding and support for lighthouse services.

Lighthouses of the World

Casquets (UK)

Lit in 1723
Built on a dangerous rock of English Channel.



Ji Angxinyu (China)

Lit in 869
Built on both sides of the island and used for beacon guide lights.
Designated in 1981 as Chinese Cultural Heritage.



Kereon (France)

Lit in 1916
Built on the underwater rock in the southeast of Ouessant Island



Boston (US)

Lit in 1716
First lighthouse in the United States



Photos are from SEIZANDO 'Sekai no Todai'



Cape Agulhas (South Africa)

Lit in 1849
Built at Cape Agallas, southernmost cape of the African Continent



Horsburgh (Singapore)

Lit in 1851
Singapore's oldest lighthouse overlooking the strait of Malacca.



Bahi Afelix (Chile)

Lit in 1905
Located at the south of Latin American Continent and oversees the Strait of Magellan.

Contact information

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3 rd Regional CGHQ	231-8818	5-57 Kitanaka-dori Naka-ku Yokohama	045-211-1118
4 th Regional CGHQ	455-8528	2-3-12 Irifune Minato-ku Nagoya	052-661-1611
5 th Regional CGHQ	650-8551	1-1 Hatoba-cho Chuo-ku Kobe	078-391-6551
6 th Regional CGHQ	734-8560	3-10-17Ujina-kaigan Minami-ku Hiroshima	082-251-5111
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11 th Regional CGHQ	900-8547	2-11-1 Minato-machi Naha, Okinawa	098-867-0118

< Staff recruitment for maritime traffic safety related services >

Note : Japanese nationals only

Engineering career staff
University graduate level

Coast Guard School

- IT System Course
 - VTS Operator Course
- High school graduate level

Civil engineers

Civil engineer license holders with field service experience



Coast Guard recruitment website

<http://www1.kaiho.mlit.go.jp/saiyo/index.html>

Civil services recruitment info-site

<http://www.jinji.go.jp/saiyo/saiyo.htm>

Coast Guard School recruitment website

<http://www.kaiho.mlit.go.jp/ope/saiyou/bosyu.html>

Coast Guard School website

<http://www.kaiho.mlit.go.jp/school/index.html>



Coast Guard