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AIDS TO NAVIGATION KNOWLEDGE AND INNOVATION

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HERITAGE

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Heritage Session

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SUMMARIES AND PROCEEDINGS

10 HERITAGE PRESERVATION, THE CHILEAN EXPERIENCE IN ITS 175th ANNIVERSARY

James Crawford. Directorate General of the Maritime Territory and Merchant Marine, Chile

The history of lighthouses in Chile has been linked with this nation from its beginnings. In fact, only 19 years after the establishment of Chile as a sovereign republic, the first lighthouse keepers appeared with the commissioning of the lighthouse Valparaiso, in the bay of the same name.

Considering that the spirit and direction of every organization are founded upon and reflected in its historic heritage, the Chilean Aids to Navigation Service carried out a number of activities for its 175th anniversary, celebrated two years ago, in order to preserve the history of Chilean lighthouse keepers for future generations.

The need for further development work, standardization and implementation on board and ashore, is discussed.

La historia de los faros en Chile ha estado ligada con esta nación desde sus orígenes. De hecho, solo 19 años después del establecimiento de Chile como república independiente aparecieron los primeros fareros con la puesta en servicio del faro de Valparaíso, en la bahía del mismo nombre.

Considerando que el espíritu y la orientación de cada organización se basan y se reflejan en su patrimonio histórico, el Servicio Chileno de Ayudas a la Navegación realizó numerosas actividades con motivo de su 175 aniversario, celebrado hace dos años, con el fin de preservar la historia de los fareros chilenos para las generaciones futuras.

Se analiza la necesidad de fomentar el trabajo de desarrollo, normalización e implementación a bordo y en tierra.

L'histoire des phares du Chili est liée à celle de la nation depuis ses débuts. En fait, 19 ans après que le Chili ait été reconnu comme une république souveraine, les premiers gardiens de phare sont apparus au phare de Valparaiso, dans la baie du même nom.

Considérant que l'esprit et la direction de toute organisation sont fondés sur son passé historique et s'y reflètent, le Service de signalisation maritime du Chili a organisé quelques activités, il y a 2 ans, pour célébrer son 175ème anniversaire, et préserver l'histoire des gardiens de phare chiliens pour les générations futures.

Le rapport présente aussi les travaux de développement, d'harmonisation et d'installation à bord et à terre.

Heritage Preservation, the Chilean Experience in its 175th Anniversary

James Crawford

Directemar

Chile

James Crawford
Directemar
Chile

INTRODUCTION

In the context of the instant global communication and the displacements of people from one place to another, there is the risk of a standardized culture. However, each person needs to be witness to their daily lives, express their creativity and preserve the traces of its history, which can only be achieved through cultural heritage.

This heritage bases its importance on providing a conduit for connecting people with their history. Embodies the symbolic value of cultural identities and the key to understand other people. It contributes to a continuous dialogue between civilizations and cultures, and to establish and maintain peace among nations.

Under this context, DIRECTEMAR and the Chilean Aids to Navigation Service carried out a number of activities for its 175th anniversary, in order to recover the recent history of Chilean lighthouse keepers.

The origins of the Chilean Aids to Navigation Service

On November 9, 1837, Chile's first lighthouse was opened at the request of the Honorable City Council of Valparaiso, in order to guide ships approaching to the port of the same name. Some years later, in 1855 the "Regularized and Fiscal General Service of the Maritime Lighting" was established in order to carry out the installation of the first lighthouses. Throughout the history of Chilean lighthouses, two names have stand out among generations of lighthouse specialists, George Slight and Sabino Lopez. In 1892, the Chilean government hired George Slight, a Scottish engineer who filed for retirement in 1918, after having participated in the construction of more than 72 lighthouses and beacons. The Chilean engineer Sabino Lopez, replaced him in the position of head of the current Aids to Navigation Service, reaching during his administration, the construction of about 130 lighthouses, 6 beacons, 10 lighted buoys, 15 radios, some leading lights and other signals along the coast of Chile.

Activities developed for heritage preservation

On the occasion of the celebration of the 175th anniversary of the Aids to Navigation Service, it was decided to carry out activities that allowed the preservation of the human element associated with the history of Chilean lighthouses. All these activities were presided by the Commander in Chief of the Chilean Navy, and the Director General of the Maritime Territory.

James Crawford
Directemar
Chile

In this way, the George Slight exhibition room, opened in 1996, was reopened, after a complete upgrade, which considered the modification of its museological and museographic concepts. Also, a square was inaugurated by the exhibition room, with the name of Sabino Lopez. These activities considered the presence of relatives of both lighthouse keepers.

Also, during this ceremony, the anthem of lighthouse keepers, written in 1976, was declared official; the launch of a book containing the history of the aids to navigation in Chile until today was made, and also, a documentary about the same topic was exhibited. A couple of other activities were carried out, as a drawing and painting competition for children and the creation of a reminder medallion.

Conclusions

The preservation of history is important and it depends on each organization to develop initiatives or activities that tend to this end. The Chilean Aids to Navigation Service has assigned a priority to this issue, generating a series of activities, which along with protect the historical heritage of lighthouse specialty, has favored the diffusion towards social groups that have no connection to this activity. An example of this is the 800% increase in the number of visits to the George Slight exhibition room, allowing the Chilean Aids to Navigation Service, to spread the history of lighthouses in the country, and its importance to the world. ■

44 DESIGN AND SET-UP OF A WEB SITE ABOUT LIGHTHOUSES IN THE BALEARIC ISLANDS

Jorge Martín Jiménez. Ports de Balears, Spain

In 2011 we opened a website on the lighthouses of the Balearic Islands, with the aim of publish the current status of our lighthouses along the islands coasts, as well as show to lighthouses lovers their relevance as part of the cultural heritage in the archipelago.

In this website you can find 360º photos in every one of the 34 lighthouses currently operating, some video interviews on the life of the former lighthouses keepers (now retired) and their relatives, and fun teaching materials for scholars in relation with the world of lighthouses. In this website we also offer the opportunity to take a virtual tour through the Maritime Aids Museum located in Portopí lighthouse. Besides of technical data on all of these historical maritime signals, you can find here large information from the historic documentation generated by our lighthouses.

Additionally, we are placed outside the restricted areas of lighthouses, information panels from which can be access the web by QR codes using electronic devices.

En 2011 creamos un sitio web sobre los faros de las Islas Baleares con la intención de dar a conocer el estado actual de nuestros faros a lo largo de las costas de las islas, así como mostrar a los amantes de los faros su relevancia como parte del patrimonio cultural del archipiélago.

En este sitio web puede encontrar fotografías de 360º de cada uno de los 34 faros actualmente en servicio, algunas entrevistas en vídeo sobre la vida de los antiguos fareros (ya retirados) y sus familias, y divertidos materiales didácticos relacionados con el mundo de los faros para escolares. En este sitio web también ofrecemos la oportunidad de realizar una visita virtual por el Museo de Ayudas Marítimas situado en el faro de Portopí. Además de datos técnicos sobre todas estas señales marítimas históricas, aquí puede encontrar una gran cantidad de información procedente de la documentación histórica generada por nuestros faros.

Además, hemos instalado en el exterior de las áreas restringidas de los faros paneles de información a través de los que puede accederse al sitio web mediante códigos QR utilizando dispositivos electrónicos.

Nous avons ouvert en 2011 un site sur les phares des Iles Baléares, dans le but de faire connaître l'état actuel de nos phares, et aussi pour montrer aux amoureux des phares leur part dans le patrimoine culturel de cet archipel.

Sur le site on peut trouver des photos à 360° de chacun des 34 phares actuellement en service, quelques vidéos d'interview d'anciens gardiens de phare (maintenant à la retraite) et de leur famille, et des objets ludiques en relation avec le monde des phares, destinés à l'enseignement des écoliers. Il offre aussi une visite virtuelle Musée des aides maritimes du phare de Porto Pi. A côté des données techniques de tous ces signaux historiques, vous pouvez y trouver d'importantes informations et documentation historique sur nos phares.

Design and set-up of a web site about lighthouse in the Balearic Islands

Jorge Martín Jiménez

Ports de Balears, Spain

1. THE IDEA BEHIND A WEB SITE ABOUT LIGHTHOUSES

The geographical location of the ports managed by the Port Authority of the Balearic Islands means it is responsible for the largest number of lighthouses of any port authority in Spain: 34 in total. Many of these lighthouses are difficult to reach and have annexes which, in the past, were used so that their lighthouse keepers could live in them with their families.

In the 21st century, technological advances revolutionised the maritime signalling service in Spain and, as a consequence, keepers no longer had to live in the lighthouse itself. Simultaneously, public interest and media impact in the world of lighthouses grew in terms of their operational aspects as did curiosity about the history of the lighthouses and of their keepers.

The Port Authority aims to promote this heritage and feed the curiosity that lighthouses arouse. There are a number of important buildings adjoining the lighthouses, which have to be maintained and preserved using considerable resources, although they are not used.

With this in mind, the Port Authority of the Balearic Islands aimed to take advantage of the opportunities afforded by the internet for businesses and other institutions by creating a web site whose main objective was to offer online information about the geographical location and technological features of Balearic Island lighthouses, and to showcase the importance of an area of historical and cultural heritage for which it is responsible. It also aims to encourage interest amongst institutions and companies in putting forward alternative uses for these adjoining buildings.

To achieve the aforementioned objectives, the need to establish a dialogue on lighthouses between the Port Authority, as the managing authority in charge of them, and the general public was put forward. Linking this web site to Facebook and Twitter has shown that the best way to carry out this interaction is via public involvement on these social networks, which has increased constantly in the first two years of this online project to publicise these lighthouses.

Work on designing this web site got underway in 2010 and the site was launched in May 2011.

2. LAYOUT

The default language of the web, entitled Balearic Lighthouses (a New Light on the Islands' Lighthouses) is Spanish; however, on the home page the language can be changed to English or Catalan.

The home page has six tabs at the top:

- Archive
- Lighthouses
- Lighthouse keepers
- Portopí exhibition
- Navigational aids

The "Archive" tab is divided into another five sub-sections including one on art (photography, painting, etc.) and a glossary of the most common terms used when describing historical lighthouses, as well as the key discoveries that have most influenced the history and evolution of maritime signalling.

The "Lighthouses" tab is the most comprehensive, information-wise, as it provides access to details on each of the 34 lighthouses currently in service in the Balearic Islands. The information on each lighthouse includes technical data, a brief history, a collection of photographs in the "images" and "art" sections, and a 360° panoramic view from the top of the lighthouse and from ground level. Information on and photos of lighthouses that are no longer in use, but which are part and parcel of the history of maritime signalling in the Balearic Islands, are also available.

The "Lighthouse keepers" section provides information about the history of this body of civil servants from its creation in 1851 until it was dissolved in 1992. Eleven videos are also available, featuring interviews with retired lighthouse keepers (some of whom have passed away) and their family members, in which they recount their experiences at the lighthouses. Finally, this section provides a list of all the keepers and experts who have worked at the lighthouses.

One of the most unique sections on the web site is the teaching materials area which features a series of worksheets on the world of lighthouses and especially focuses on the material on display at the Portopí lighthouse museum. This enables students who visit the lighthouse to work on the material before and after their trip. The worksheets have been designed according to the children's ages and school year. All the worksheets can be downloaded from the web site and printed out. This educational material can be accessed via the Portopí museum's virtual tour.

The "Navigational aids" section can be accessed from the web site's home page or via a link to the State-owned Ports Body's online platform which features a geo-browser of the entire maritime signalling system which enables users to find maritime signals currently in operation in the Balearic Islands via Google Maps. It also provides general information about these aids to navigation including their coordinates, colour, light characteristics, nominal range, name, photo, and managing organisation.

3. WEB SITE FOLLOWING (2011-2013)

Since the lighthouse web site and its related Facebook and Twitter accounts were launched, public participation has increased considerably, especially on the Facebook page, which had over 1,200 fans at the end of 2013.

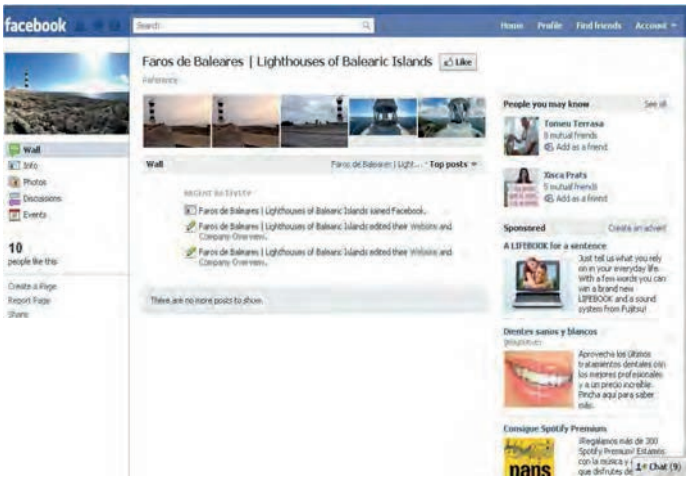
During this period (from 01/05/2011 to 01/10/2013), a total of 36,325 unique users were recorded, generating a total of 49,903 visits with 191,051 pages viewed (an average of 3.83 pages per visit).

Visitors were mainly Spanish although users from a total of 109 different countries also accessed the site. It is interesting to note that Germany generated the second largest number of visitors, followed a long way off by the USA (Germany 2,323 visits, USA 921 visits).

In Spain, the cities that generated the largest number of visits were Palma de Majorca with 17,500 visitors, Barcelona with 6,323, Madrid with 4,928, and Valencia with 2,146 visitors.

4. INTERACTION WITH QR CODES

One of the Port Authority of the Balearic Islands' aims when setting up this online project was to create an informative space which would be open to technological innovations that were compatible with the web site and which also complemented it. This led to the idea of adding a series of information panels outside the lighthouses that can be accessed by car. In addition to containing a brief history and technical characteristics of the lighthouse, these panels also have a QR code so that visitors who have a smartphone, tablet or similar device can directly access the lighthouse web site and audio guide with additional information.



So far, two phases to implement these audio guides have been completed. The first one included five lighthouses which have good 3G coverage, whilst the second added all the lighthouses with information panels. A total of 21 audio guides were compiled in these two phases. The third phase, which is pending, will include those lighthouses which do not have information panels and historical lighthouses which are no longer in service. Access to these audio guides will be solely through the web site as there are no panels with QR codes near these lighthouses.

5. MARITIME SIGNALLING EXHIBITION AT THE PORTOPÍ LIGHTHOUSE

The web site also invites users to go on a virtual tour around the permanent maritime signalling exhibition at the Portopí Lighthouse. This exhibition plays a prominent role on the web site, which is logical given its historical value.

When users access the www.farsdebalears.org web site, they will come across a tab entitled "Portopí exhibition". There is also a banner with the same name which accesses the same information as that contained in the tab.

This tab about the Portopí lighthouse and its museum has two different sections: a virtual tour around the entire museum and teaching materials related to the information given in the exhibition. In this virtual tour, users can "stroll" around the five exhibition rooms and enjoy a 360° view of their contents. In addition, a cross (+) appears on the information panels. When the cursor is placed over it, visitors can click on this cross, which opens a window containing all the information on the panel.

Finally, there are also a number of worksheets for children of different ages and school years. The materials are suitable for children aged 3-12 and are divided into four age ranges:

- Children aged 3-5
- Children aged 6-8
- Children aged 8-10
- Children aged 10-12

The material for each age range works on different educational areas such as visual discrimination, mathematical reasoning, art, writing, vocabulary, and science.

Although the Portopí lighthouse is located within a port area and visits have to be organised beforehand for safety reasons arising from the need to cross an area of port traffic, over a thousand people visit the exhibition each year. Since the lighthouse web site was launched and the related social network accounts were opened, we have seen a feedback process between visits to the web and visits to the Portopí lighthouse which demonstrates that people show greater interest in the Portopí exhibition when they have previously browsed the lighthouse web site and vice versa, i.e. those who visit the museum subsequently decide to investigate the web site.

6. LINKS TO SOCIAL NETWORKS

When the lighthouse web site was launched, accounts were simultaneously opened on Facebook and Twitter to boost public involvement in our new online ventures. Two years after it began, the Facebook page Faros de Baleares (in English language Lighthouses of Balearic Islands) had a thousand fans.

A significant number of these fans are regularly involved in the web site and upload their own

photos of Balearic Island lighthouses. The Facebook lighthouse page has thus become an online exhibition space and an area to publicise the history of the Islands' lighthouses and announce related events, as well as a meeting point for lighthouse lovers.

53 INTEGRATED LIGHTHOUSE VALUE INDICATOR

Juan Francisco Rebollo. Puertos del Estado, Spain

The aim of this project was to establish a model that would allow us to assign to each lighthouse an indicator representing its INTEGRATED VALUE, taking into account four basic aspects or criteria: history, architecture, surroundings and nautical value.

Each one of these basic criteria has up to 22 sub-criteria, and each sub-criterion includes a series of up to 85 evaluation elements. Each element was assigned a score of between 1 and 10 and a weighting of between 1 and 5 was assigned to each criterion. These scores were obtained after conducting a Delphi process, which included people from different backgrounds.

El objeto de este proyecto era establecer un modelo que nos permitiera asignar a cada faro un indicador que representara su VALOR INTEGRADO, teniendo en cuenta cuatro aspectos o criterios básicos: historia, arquitectura, entorno y valor náutico.

Cada uno de estos criterios básicos tiene hasta 22 subcriterios, y cada subcriterio incluye una serie de hasta 85 elementos de evaluación. A cada elemento se le asignó una puntuación entre 1 y 10, y a cada criterio se le asignó una ponderación entre 1 y 5. Estas puntuaciones se obtuvieron tras realizar un proceso Delphi, que incluyó personas de diferentes procedencias.

Se desarrolló una hoja de cálculo para facilitar la aplicación del modelo.

Le but de ce projet était d'établir un modèle qui puisse nous permettre d 'assigner à chaque phare un indicateur de sa Valeur Intégrée qui tienne compte de quatre aspects de base ou critères: son histoire, son architecture, son environnement et sa valeur maritime.

Chacun de ces critères de base a jusqu'à 22 sous-critères, et chaque sous-critère comprend jusqu'à 85 éléments d'évaluation. Chaque élément reçoit une note de 1 à 10, et une valeur de 1 à 5 a été assigné à chaque critère. Ces notes ont été obtenues par la procédure Delphi, incluant la participation de personnes de différents secteurs.

Un tableur a été développé pour faciliter l'application de ce modèle.

Integrated Lighthouse Value Indicator

Juan Francisco Rebollo

Puertos del Estado, Spain

1. INTRODUCTION

Following the guidelines set by IALA and more specifically by the marine cultural heritage conservation group, the Marine Aids to Navigation Area of Puertos del Estado broached the suitability of having a methodology available that would enable each lighthouse to be assigned an indicator, which has been called "Integrated Lighthouse Value" (ILV).

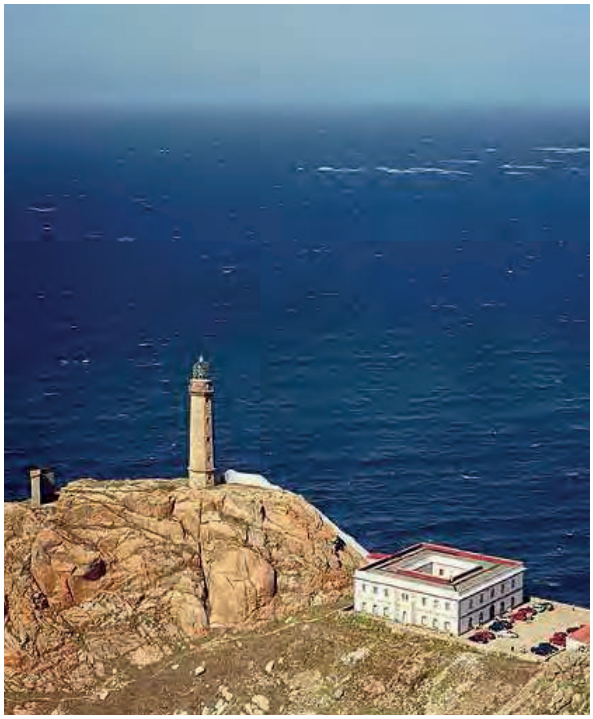
The work consisted of drawing up a series of weighted criteria and reducing, as much as possible, local and personal perceptions on each specific lighthouse, thereby allowing comparisons to be made with the rest of the lighthouses.

Technical aids to navigation staff from the Port Authorities and staff from the Marine Aids to Navigation Area of Puertos del Estado took part in this project's development. Special mention should be made of the participation in the project of Puertos del Estado's Ms Carmen Martínez, who retired in September 2012.

2. METHODOLOGY

The Delphi method was used to assign weightings to each of the criteria and sub-criteria in order to make quantifiable something as subjective as "What do you think is relevant in a lighthouse for society?"

The first step consisted of setting the criteria and sub-criteria from which the Integrated Value would be obtained. In order to do so, our model considers that the four aspects below should be taken into account when establishing a lighthouse's value: history, architecture, the place where it is located (surroundings) and its importance as an aid to navigation (nautical value).



These aspects were taken as the main criteria. Several sub-criteria, up to a total of 22, were then defined for each one of them. Each sub-criterion in turn allows for several responses. The resulting questionnaire therefore contemplates up to 85 situations to be taken into account to obtain the Integrated Lighthouse Value.

A questionnaire was designed to assign the weight of each response. This questionnaire was circulated among the group of experts chosen to take part in the project, who had to give a score of between 1 and 10 on the importance they gave to each criterion and sub-criterion.

Technical staff from the marine aids to navigation service of the Port Authorities was chosen to form part of the group of experts. They were in turn charged with bringing together a group of four or five people from different backgrounds to give scores by consensus and avoid biases resulting from the scores being given only by people having a direct link with the lighthouses' technical aspects.

The first time the questionnaire was circulated, the experts received the questionnaire to make any changes they felt necessary to the criteria and sub-criteria defined by the project's management team (Puertos del Estado), make suggestions and comments, and conduct a preliminary evaluation.

The Marine Aids to Navigation Area then synthesised and selected the responses received in order to define each element of the questionnaire as clearly as possible and to draw up a new generic file. The new criteria put forward and a preliminary statistical analysis was included in this file by calculating the average value and the deviation of each one of the weightings given.

This new file was circulated once more among the group of experts. It included the data derived from an analysis of the first round in order to keep fine-tuning the model. The experts were asked to assign a weighting to each question (criteria and sub-criteria).

Whenever the deviation was above 1, it was deemed that no consensus had been reached in the experts' responses. In such cases, they were asked to reconsider the initial evaluation and to score the element once again after the different points of view of other participants were known,

information on which was also provided in this second round. The response could either change or not, in which case they were asked to explain their stance.

Each criterion had to be evaluated on its own, taking only the aspect under consideration into account in a generic way and without reference to a specific lighthouse. Each box had to contain a single figure of between 1 and 10.

Finally, in order to obtain the integrated value and see how some criteria had an impact on others, the questionnaire asked them to assign a weighting to each one of the four aspects: history, architecture, surroundings and nautical value. The importance of each of these was to be evaluated with a single figure ranging between 1 and 5.

After the questionnaire was circulated once more and the responses were consolidated, the Marine Aids to Navigation Area conducted another statistical analysis, which revealed that a sufficient level of consensus had been reached to decide the Delphi iteration had come to an end.

Lastly, the people responsible for marine aids to navigation at the Port Authorities had to apply the model to the lighthouses under their management to establish their Integrated Lighthouse Values. A total of 112 ILV were determined during the time the project was being carried out.

The model used to obtain the ILV is shown in the table that appears below. A spreadsheet was designed to make its application easier.

CONCLUSIONS

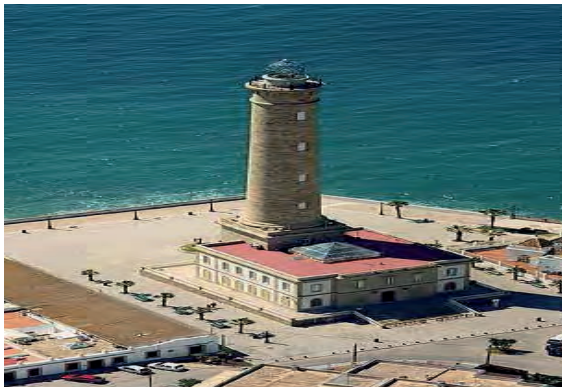
Although each Port Authority worked with a group of 4 or 5 people from different backgrounds to establish the importance of the lighthouses, the results underline technical and, in general terms, classical aspects. No great differences have been detected in the assignment, which means that the differences in ILV values are not very significant.

The model is flexible and allows the weightings to be reviewed, though the criteria and sub-criteria (and the questions/elements) to be evaluated seem to be stable and can be considered as the model's bases.

A study of the records received (112 out of a total of 187 existing lighthouses in service) allows us to make some observations:

Cabo Tiñoso Lighthouse

The highest ILV corresponds to the Formentor Lighthouse. From a historical standpoint, the most emblematic lighthouse would be the Caballería Lighthouse, as it is connected to significant events. The Chipiona Lighthouse has the greatest architectural value. The lighthouse located in the most highly valued surroundings is the Cabo Peñas Lighthouse, and the lighthouses which obtained the highest scores for their nautical value are the Lastres, Chipiona, Cabo Tiñoso, Cabo de La Nao and Cabo de San Antonio lighthouses.



Chipiona Lighthouse

Twenty-nine lighthouses are equipped with an old cut-glass optic. The Chipiona Lighthouse has the highest tower. Seventeen lighthouses are located in urban areas, but only the Chipiona, Favàritx and Portopí lighthouses are open to visitors. Thirty-four lighthouses have complementary uses.

Of the four criteria considered as main criteria, the aspect having the greatest weight is that the lighthouse continues in service as an aid to navigation. Historical and architectural aspects have a similar value, while the evaluations deemed to be least important are the aspects connected with the surroundings and complementary uses. ■

MODEL TO DETERMINE THE INTEGRATED LIGHTHOUSE VALUE INDICATOR - Ed. 2012.

INTEGRATED LIGHTHOUSE VALUE TEMPLATE

TABLE OF CRITERIA AND SUB-CRITERIA VALUES

LIGHTHOUSE:

1	HISTORICAL CRITERIA		VALUE
1.1	Date built	Before the 19th century	**10**
		19th century (prior to 1847 Plan or belonging to it)	**8**
		Designed/refurbished during the 1902 Plan	**6**
		Designed/refurbished during the 1967 Plan	**5**
		Designed/refurbished during the 1985-89 Plan	**5**
		After 1989	**3**
1.2	Order of lighthouse	1st order	**9**
		2nd order	**7**
		3rd order	**6**
		Lower than 3rd order	**4**
1.3	Is the technical equipment in operation or present at the lighthouse especially old or interesting?	The optic is of the same age as the existing building	**8**
		The lighthouse uses old technical equipment	**8**
		The lighthouse conserves old equipment, but it is not in operation	**7**
		The lighthouse contains recent technical equipment which may become heritage assets in the future	**6**
1.4	Is the lighthouse's history linked to significant historic, technical or cultural events?	Played an important role in wars	**7**
		Was involved in salvages or shipwrecks	**8**
		Played a role in a literary, scientific, cinema, etc. work	**6**
		Its history is linked to other historic events	**6**
1.5	The lighthouse is relevant due to its emblematic nature	Is the lighthouse internationally famous?	**8**
		Is the lighthouse well known at a national level?	**7**
		Is the lighthouse well known at a regional level?	**6**
		The lighthouse is of no specific interest	**3**

1	HISTORICAL CRITERIA		VALUE
1.6	The lighthouse is equipped with:	Reflector optic	7
		Cut-glass optic	8
		Moulded glass optic	7
		Optic with sealed beam lamps	6
		Acrylic optic	5
		Lantern can be visited	7
1.7	The rotating machinery uses/is:	Mercury vat	8
		Rollers	7
		Magnetic	6
		Electronic	5

2	ARCHITECTURAL CRITERIA (CIVIL ENGINEERING WORKS)		VALUE
2.1	Does the lighthouse have an outstanding architectural element? Is it representative of a specific architectural style or the history of lighthouses?	Isolated tower, without annex buildings	7
		Building with a central tower, with or without a corridor around it	7
		Building with tower attached to one side	7
		Isolated tower with detached annex buildings	6
		Lighthouses of modern design or built on refurbished structures	6
2.2	What is the tower's height above ground level?	More than 50m	8
		Between 30 and 50m	7
		Between 10 and 30m	6
		Less than 10m	5
2.3	What is the main building material?	Stonework (rubble work or ashlar masonry)	9
		Mortar and cement	6
		Brick	7
		Concrete	6
		Metal	7
		Wood	7
2.4	If the lighthouse has been refurbished after it was built	It has been conserved according to its original design	9
		Irreversible changes have been made to it	5
		It has been refurbished using modern technologies	6
		It is well maintained and has not needed refurbishment	9
2.5	The lighthouse was designed by a particularly famous architect or engineer in the history of lighthouses		7

3	CRITERIA RELATED WITH THE SURROUNDINGS		VALUE
3.1	Are the lighthouse and the annex buildings located in an especially protected place?	The lighthouse has been listed as an asset of cultural interest (BIC - *Bien de Interés Cultural*)	**8**
		The surroundings are a protected site (natural park, biotope park, flora and fauna reserve, etc.)	**9**
		Area without specific protection	**6**
3.2	Location of the lighthouse and weather conditions it bears	Harsh (lighthouse foundations in the sea or very close to it)	**8**
		Average	**6**
		Clement (lighthouse in an urban area)	**5**
3.3	Do the lighthouse and its annex buildings contribute to the development of culture, tourism and the local economy?	Lighthouse open to visitors (including the tower and the optic)	**7**
		Lighthouse open to visitors (excluding the optic)	**6**
		Only annex buildings are open to visitors	**6**
		Visits to the lighthouse form part of a tourist route	**6**
		The lighthouse is not open to the general public	**3**
3.4	The lighthouse is equipped with:	Exhibitions / museums / interpretation centres	**8**
		Cafeteria / restaurant facilities	**5**
		Hotel facilities / residential uses	**5**
		Panoramic viewing points	**7**
		Souvenir sales	**3**

4	THE LIGHTHOUSE AS AN AID TO NAVIGATION		VALUE
4.1	The lighthouse continues to operate as an aid to navigation	Belongs to the Coastal Network	**10**
		Is a secondary aid	**6**
		Is another kind of aid	**6**
		Is not operational	**3**
4.2	Height of the focal plane above the nmm	More than 50m	**9**
		Between 30 and 50m	**7**
		Between 10 and 30m	**6**
		Less than 10m	**5**
4.3	The lighthouse's range is	Over 20m	**8**
		Between 10 and 20m	**7**
		Less than 10m	**5**
4.4	The lighthouse could house new marine safety or power feed technologies that could have a visual impact	No probability	**4**
		Average probability	**5**
		Highly probable	**7**
4.5	Power to the lighthouse and annex buildings is fed by	Grid / generating set	**7**
		Solar / wind energy	**8**
		Mixed system	**8**

4	THE LIGHTHOUSE AS AN AID TO NAVIGATION		VALUE
4.6	How difficult is it to gain access to the lighthouse?	Difficult and potentially dangerous access	6
		Complicated access	6
		Access by road	6
		Organised access	7

WEIGHTING OF ASPECTS	VALUE
HISTORIC	4
ARCHITECTURAL	4
SURROUNDINGS	3
AS AN AID TO NAVIGATION	5

EXAMPLE OF APPLICATION TO A LIGHTHOUSE

FICHA PARA EL INDICADOR DEL VALOR INTEGRADO DE LOS FAROS

AUTORIDAD PORTUARIA DE : Santander

Faro de: Castro Urdiales

Criterio	Valor asignado	Criterio	Valor asignado	Criterio	Valor asignado	Criterio	Valor asignado
1.1	8	2.1	6	3.1	6	4.1	10
1.2	4	2.2	6	3.2	5	4.2	6
1.3	0	2.3	9	3.3	6	4.3	7
1.4	6	2.4	5	3.4	8	4.4	4
1.5	6	2.5				4.5	7
1.6						4.6	6
1.7							
TOTAL	24		26		25		40

INDICE	29,6875

EXAMPLE OF FINAL RESULTS

VALOR INTEGRADO DE LOS FAROS																										
			HISTÓRICOS								ARQUITECTÓNICOS						ENTORNO					COMO AtoN						
A.P.	Nombre	Valor integrado	1.1	1.2	1.3	1.4	1.5	1.6	1.7	TOTAL	2.1	2.2	2.3	2.4	2.5	TOTAL	3.1	3.2	3.3	3.4	TOTAL	4.1	4.2	4.3	4.4	4.5	4.6	TOTAL
	Conejera	37,125	8	7	8		6	14	6	49	7	6	9	9		31	9	6	3		18	10	9	7	4	8	6	44
	Bleda Plana	30,6875	5	4			3	19		31	7	5	6	9		27	9	6	3		18	10	6	7	4	8	6	41
	Vedrá	27,5625	6	4	6		3	5		24		5	6	9		20	9	8	3		20	10	6	7	4	8	6	41
	Punta Anciola	41,75	8	7	8	15	6	14	6	64	7	6	9	9		31	9	6	6		21	10	9	8	4	8	6	45
Mallorca	Cabo Salinas	36,0625	8	4	7		3	19		41	7	6	9	9		31	9	8	3	8	28	10	6	7	4	8	6	41
	Cabo Blanco	34,0625	8	4	8		3	15		38	7	6	9	9		31	9	6	3		18	10	9	7	4	7	6	43
	Porto Pi	41,6875	10	4	8	8	8	14	8	60	7	7	9	9		32	8	5	7	8	28	10	7	8	4	7	7	43
	Cala Figuera	37,1875	8	4	8	8	3	14	8	53	7	6	9	5		27	9	8	3		20	10	7	8	4	7	7	43
	La Mola (Andraitx)	28,25	5	4	8		3	7		27		6	6	9		21	6	6	3		15	10	9	7	4	7	6	43
	Tramontana	37,5	6	4	8		3	14	6	41	7	6	9	5		27	9	6	6	15	36	10	9	7	4	8	6	44
	Lebeche	40,8125	6	7	8	14	3	15	6	59	7	6	9	5		27	9	6	6	7	28	10	9	8	4	8	6	45
	Punta Grossa	33,625	8	4			6	12	5	35	7	6	9	9		31	9	6	3		18	10	9	8	4	7	6	44
	Cruz de Sóller	34,5625	6	4	8	7	6	14		45	7	6	6	9		28	6	8	3		17	10	7	7	4	7	7	42
	Formentor	44,5625	8	7	8	13	7	15	6	64	7	6	9	9		31	9	6	6	15	36	10	9	8	4	8	6	45
	Pollensa (Pta. Avanzada)	33,4375	6	4	8	7	3	14		42	7	6	9	5		27	9	6	3		18	10	6	7	4	7	7	41
	Aucanada	29,8125	8	4	6		3	5		26	7	6	9	5		27	9	8	3		20	10	6	7	4	8	6	41
	Capdepera	38,3125	8	6	8	8	7	14	8	59	7	6	9	5		27	9	6	3		18	10	9	7	4	7	6	43
	Porto Colóm	36,625	8	4	8	8	6	15	8	57	7	6	9	5		27	6	6	3		15	10	7	7	4	7	6	41
	Torre d'en Beu	25,9375	5	4			3	7		19		5	6	9		20	9	6	3		18	10	7	7	4	7	6	41
	na Foradada	26,25	6	4			3	5		18		6	6	9		21	9	6	3		18	10	7	7	4	8	6	42
Menorca	Dartuch	37,9375	8	4	8	8	6	14	8	56	7	7	9	5		28	6	5	6	5	22	10	7	7	4	7	6	41
	Ciudadela	32,1875	8	4			6	12	5	35	7	6	9	9		31	6	8	3		17	10	6	7	4	7	6	40
	Punta Nati	41,125	6	4	8	14	6	15	6	59	7	6	9	9	7	38	9	8	3		20	10	7	7	4	8	6	42
	Caballeria	43,1875	8	7	8	14	6	15	8	66	7	6	9	9		31	9	6	3	8	26	10	9	8	4	8	6	45
	Favaritx	41,5625	6	6	8	14	6	14	8	62	7	6	6	9		28	9	6	7	8	30	10	7	8	4	7	7	43
	Mahon (Pta de S. Carlos)	27,4375	6	4		6	3	5		24		6	6	9		21	9	6	3		18	10	6	7	4	7	7	41
	Isla del Aire	39,5625	8	7	9	6	6	14	6	55	7	7	9	9		32	9	8	3		20	10	9	8	4	8	6	45

7355 THE USE OF OTTER SHUTTERS IN THE NORTHWEST COAST OF SPAIN AND THE NATIONAL PLAN AND STUDY OF THE CHARACTERISTICS AND INVENTORY FOR PRESERVATION OF HISTORIC LIGHTHOUSES

Marisa Marco. Port Authority of Vilagarcia, Spain
José Carlos Díez. Puertos del Estado, Spain

Most actions in the preservation of historic lighthouses are aimed at the conservation of the buildings, towers, environment, civil works in general, while the optical rotation mechanisms and other technical elements of significant historical value, don´t receive the same attention.

Our commitment, is to keep using all optical and foundations that are possible, adapting to new sources of light and energy, so as to achieve the current service requirements, while retaining most of the existing historic equipment.

Three years ago, Puertos del Estado (State Ports) developed a project which has, as one of its main targets, checking the status of optical-bright facilities of the lighthouses.

Another aspect of this project was the cataloging of historical or unique equipment. As an example we found some uniqueness in several Lighthouses in the North Coast of Spain. Within these signals we can remark both for its complexity and uniqueness the lighthouses at Punta Insua, Corrubedo and Sálvora.

La mayoría de las acciones de preservación de los faros históricos están dirigidas a la conservación de los edificios, torres, entorno y obra civil en general, mientras que los mecanismos de rotación óptica y otros elementos técnicos de importante valor histórico no reciben la misma atención.

Nuestro compromiso es mantener en funcionamiento todos los elementos ópticos y bases que sea posible adaptándolos a nuevas fuentes de luz y energía, de modo que se alcancen los requisitos de servicio actuales, manteniendo la mayor parte posible del equipo histórico existente.

Hace tres años, Puertos del Estado desarrolló un proyecto que tiene como uno de sus objetivos principales revisar el estado de las instalaciones de óptica/brillo de los faros.

Otro aspecto de este proyecto fue la catalogación de equipo histórico o excepcional. Como ejemplo, hemos encontrado algunas singularidades en varios faros de la Costa Norte de España. Entre estas señales podemos remarcar tanto por su complejidad como por su singularidad los faros de Punta Insua, Corrubedo y Sálvora.

La plupart des actions de sauvegarde des phares historiques concernent la conservation des bâtiments, tours, environnement, génie civil en général, tandis que les mécanismes de rotation des optiques, et autres éléments techniques ayant une valeur historique, ne reçoivent pas la même attention.

Notre engagement est de continuer autant que possible à utiliser les optiques et leurs supports en adaptant les sources de lumière et d'énergie de façon à répondre aux besoins courants tout en conservant les équipements historiques.

Il y a trois ans, le Service national des Ports (Puertos del Estado) a développé un projet, dont l'un des buts principaux était de vérifier l'état des installations optiques des phares.

Un autre aspect de ce projet était de cataloguer les équipements historiques ou uniques. Par exemple, nous avons trouvé quelques équipements uniques dans les phares de la côte nord-ouest de l'Espagne. On a remarqué des cas de complexité et d'unicité dans les phares de Punta Insua, Corrubedo et Salvora.

The Use of Otter Shutters in the Northwest Coast of Spain and the National Plan and Study of the Characteristics and Inventory for Preservation of Historic Lighthouses

Marisa Marco

Port Authority of Vilagarcia

&

José Carlos Diez

Puertos del Estado

Spain

IALA·2014·AISM
XVIII Conference · A Coruña · Spain

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Spain

1. INTRODUCTION

Most actions in the preservation of historic lighthouses are aimed at the conservation of the buildings, towers, environment, civil works in general, while the optical rotation mechanisms and other technical elements of significant historical value, don´t receive the same attention.

Over time, successive adaptations to new light sources, energy sources, characteristics, etc. of the equipments, together with the lack of sensitivity by those responsible for service, more concerned with improving this service and its delivery, than the heritage conservation, has led to the disappearance of many of the historic features, losing much part of the industrial heritage of this area.

Our commitment is to keep using all optical and foundations that are possible, adapting to new sources of light and energy, so as to achieve the current service requirements, while retaining most of the existing historic equipment, including original rotation mechanisms as a backup system. We understand that, the best way to preserve the heritage, is to keep the equipment in its historical setting, providing the service for which they were designed to, and facilitating, as far as possible, their approach to society, for example through visits.

To achieve these objectives, three years ago, Puertos del Estado (State Ports) developed a project which has, as one of its main targets, checking the status of optical-bright facilities of the lighthouses. This project involved two aspects: firstly, an inventory of historical and technical condition of the facilities and, the other, checking the technical characteristics of the lighthouses light systems.

2. PROJECT

This project was developed throughout year 2009-2010, designing a form where the technical inventory, the necessary parameters for the verification of the technical characteristics of the luminous systems and the result of the calculations were reflected.

To check the technical lighting systems, we developed a computer program based on the methods described in the recommendations of the IALA (series E-200, 2008) and the Book of Standards (1986). This tool allowed the calculation of fast and simple features that could be achieved by testing different types of lamps at each facility, in order to choose the most appropriate or, if necessary, correct the current deficiencies.

As a result of this project, we found that, in most of the facilities was totally feasible to maintain historical equipments if we act, primarily, in the light sources; among other matters, we have worked on improving the width of the light source rotating optics, to increase the horizontal divergence and lengthen the duration of the flare; also, on the use of metal halide lamps with spherical bulb with large surface optical catadioptric rings, to improve performance. Moreover, we have identified the need to improve the information provided by the manufacturers of lamps, which sometimes is not enough in areas such as luminance, font width, etc.

As a result of this study, we have improved many lighthouses, proceeding to install new light sources compatible with the historical optical, increasing the range and the divergence of the light beams or the reduction of the angles of uncertainty in sector lights; we have also improved their electronic control or the spin and energy systems.

From the information received, in addition to the individualized analysis for each lighthouse, the following general technical aspects have been identified, result in most of the cases of an historical process inherited of previous times, and that requires a revision with object to adapt, in its case, the facilities to the service that they have to render.

2. Considerations on adapting the optical system

Throughout the years, the technological advance has allowed the automation of lighthouses and their original light sources were replaced by other available ones or made to size. Thus, although they have been modified the luminous source, from petroleum or the gas to the present lamps of incandescence or metal halide lamps, in most of the lighthouses of Spain has stayed the old optical system. The compatibility of the traditional optical systems with the new lamps presents some aspects that make a previous analysis necessary of the new lamps, on the other hand the present conditions of the market do not allow the manufacture of lamps to size, reason why we must adapt to us with the models of existing commercial lamps.

The main problem that has been identified is that the optical were designed for light sources with greater dimensions than the present ones, especially in optical with big focal length, so we were forced to take care of the following aspects:

2.1 Vertical divergence

The original height of the light source was of the order of the 80 - 40mm, in the case of the of vaporized petroleum systems or gas systems. Nowadays, with the halogen lamps the height is only 10-15mm, causing a considerable reduction of the vertical divergence, which decreases when the focal length is bigger, leaving, in some cases, the lighthouse without serving in an ample area, especially in those lighthouses located in a high altitude above sea level.

2.2 Flash length

Also with the reduction of the dimensions of the light source, in this case reducing the width,, a decrease of the horizontal divergence takes place. This reduction causes a decrease of the duration of the sparkle in the rotating optical. As an acceptable compromise solution it was settled down that the minimum duration of the flash never must be inferior to 0.15s.

2.3 Lighthouses with solar energy system

Due to the limitations of consumptions, these facilities need low powered and high light efficiency lamps; they are generally metal halide lamps, with powers between 35-150W, that have dimensions of light source quite reduced, reason why the problem of the divergences worsens, mainly in optic systems that have a big focal length.

2.4 Metal Halide Lamp Coated Bulb

In some occasions the use of coated bulb lamps can be a good solution to extend the duration of the flash, because the wide one of the luminous source is increased, although it must be used carefully, since the distribution of the flow is not totally uniform (it exists more in center than in the periphery), its performance is lower and in case of having to use high powers, its size could be excessive.

2.5 Light range

The election of the type of lamp, based on the distribution of the luminous flux, is determining to obtain a good performance of the optic. There are different discharge lamps which having the same power differ in the form of the arc tube. The cylindrical ones have more flux in the horizontal plane. These lamps would be appropiate to achieve good optical performances with little or no catadioptric surface. However, the laps with the spherical arc tube that distribute the flux uniformly are more suitable to optics with a bigger catadioptric surface.

2.6 Uniform distribution of the luminous flux

The distribution of the luminous flux of the lamps used in AtoN has to be always uniform in the horizontal plane, when this is not possible differences in the range and in the beam divergence will take place according to the zone from where the signal is observed.

This implies that the halogen lamps with grid or horizontal position filaments, should be avoided for their use in AtoN, as they don´t have uniform distribution of the flux in the focal plane. Anyhow, in some cases, this has not been possible due to the lack of availability of some commercial equipments.

2.7 Background lighting

In many occasions the urban development in the areas near the AtoN, has caused an increase of the background lighting, producing a reduction of the visual range. It was therefore necessary to check the luminous range in facilities in which these circumstances occurred, applying the appropriate coefficients to the new circumstances and in some cases it was necessary to change the installation to obtain the required range.

2.8 Colour temperature

It was also verified that the lights with high colour temperatues, as the Metal halide ones,, are more conspicuous in zones where there are great background lighting. In urban areas most of these backgroung lighting comes of the street lights , composed mainly by sodium vapour lamps with very yellowish light, therefore, the whiter we use our light the more contrast we get. In these conditions the flashing lights are more conspicuous that those of occulting lights.

2.9 Angle of uncertainty

The angle of uncertainty of a sector light, represents the transition zone that exists between two different colors or color and darkness, where is not possible to differentiate clearly a color from another one. This sector must of being smallest possible. In order to obtain this, it must be reduced, as far as possible, the breadth of the luminous source, whereas the distance to the filter must be increased.

The lamps used for sector lights must be always made of vertical filament; the grid filaments, or those with horizontal position, do not have to be used in lights of sectors. This has not always been possible to perform by the lack of availability of suitable lamps in the market.

Another aspect of this project was the cataloging of historical or unique equipment. As an example we found some uniqueness in several Lighthouses in the North Coast of Spain, as it is going to be related.

The Port Authority port in Vilagarcía de Arousa, in Galicia, in the Northwest of Spain manages the AtoN located on the Arousa Bay and the Muros Noia bay. Within these signals we can remark both for its complexity and uniqueness the lighthouses at Punta Insua, Corrubedo and Sálvora. Due to the existence of several dangerous low rocks low in the area, historically all of them used the Otter displays systems, which worked differently in each of the lighthouses.

The Otter Shutters are devices that working, as Venecian Blinds, are activated by mechanical ways, making that in a certain arc of circumference, the flow of light in a rhythmical way is interrupted , so one or several flashes are eliminated.

Working this way, with a unique luminous system, it is possible to get different light rhythms.

Next we are going to make a short explanation about how these 3 lighthouses used to work historically.

Beginning from the North, we first find the lighthouse of Punta Insua, in the province of La Coruña, where it was forced to mark out various groups of very dangerous for navigation rocks with different light character, and some of them located quite remote from the coast.

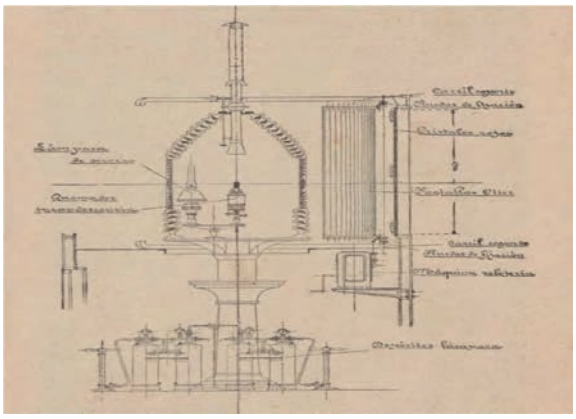
Formerly the configuration of the lighthouse was quite complex. A mechanism of occulting lights with screens Otter was installed.

The optic, in this particular case has no rotation at all. Red colour filters and Otter displays, arranged vertically and independent of the lens could be found also in the lantern. The mechanism of action of these displays was carried out by clockwork mechanism, by counterweight, triggering a rotating cam disc similar to those commonly used in optic rotation

So, by the combination of these elements it was possible to achieve:

- Red sector with three occulting lights
- White sector with three occulting lights
- White fixed light
- Red fixed light.

Following the resolution of the lighthouses Commission in 1987, the Otter shutters, were eliminated and light character in the lighthouse was simply transformed into a Fl(3), being either red or white depending on the sector in which we find ourselves, and that was achieved through a red filter.

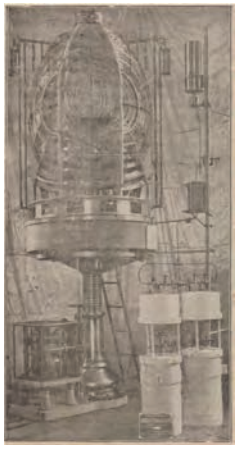


The same Optic is still staying and group of flashing light are made by a flasher mechanism which interrupts the supply of electricity to the lamp.

Faro de Corrubedo

Following some miles south we found the Corrubedo Lighthouse, between the Arousa on the Muros Noia Bay. This lighthouse, built in 1852 was historically known as "the Red Lighthouse". The reason was its light was red in all sectors.

With rotating lens, in two of its optical panels there were two Otter displays, so that they were just closed in the sector which was intended to indicate danger. In this case, the mechanism triggering these screens, was part of the same system of rotation of the optic

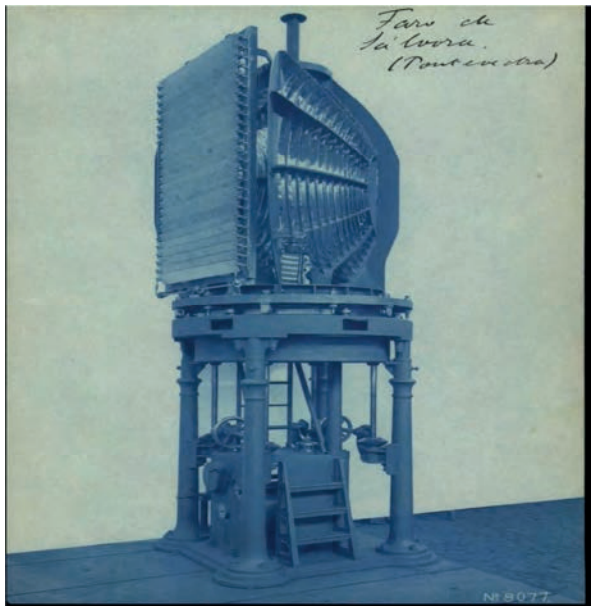


In this case, The Otter shutters had a vertical configuration. , in the past, the appearance of the lighthouse was fl (3 + 2) in free sector and fl (3) in the danger sector. After the resolution of the lighthouses Commission in 1987, both Otter shutters and red light were retired, placing red panels in the danger zone, withdrew so now the appearance is Fl (3+2) being white or red depending on the sector in which we find ourselves.

There have not been any changes in the optic which is still rotating.

On our way south, just entering the Arousa bay we find the Salvora lighthouse .It is this is located on the island of Salvora, that nowadays belons to the Atlantic Islands Maritime-Terrestrial National Park National. At the moment it remains inhabited by lighthouse keepers, dealing with the reliability of the AtoN the 365 days of the year.

Faro de Sálvora



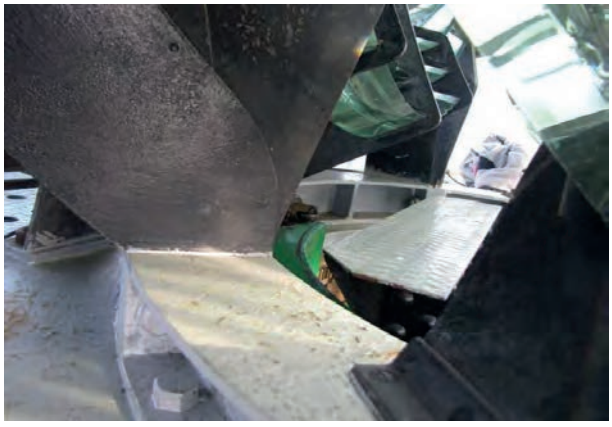
The equipment currently in service is the same as the original.(1921). The only elements that have changed are the light source being originally incandescent oil vapor, today is electric filament with photovoltaic energy and the system that activate the rotation of the optic, that though the clockwork mechanism this was driven by a falling weight a long of de tower is still there, it is not used, being an electric engine who activates the rotation.

It is a facility with a configuration similar to that described for the Corrubedo lighthouse, but in this case it's just a single flash to show or hide.

Marisa Marco, Port Authority of Vilagarcía & José Carlos Diez, Puertos del Estado
Spain

In the Sálvora lighthouse, the Otter shutters, with a total of twenty-five linked sheets, are arranged horizontally.

The movement of the sheets occurs by a mechanism powered by a cam next to the frame of the optic and making shutters open or close when passing by a selected sector.



Working this way, this Lighthouse features Fl(3+1)w in the free sector and Fl(3)w in the dangerous sector, in an arc of circumference of 34º

Despite the fact that the resolution of the lighthouses Commission of the year 1987, proposed the modification of the Light character making this system inconsistent, the resolution was never executed. Thanks to this we can still enjoy these shutters, which are a unique and historical industrial element, by the singularity when it comes to combine different rhythms in a unique luminous facility.

While this configuration of the system has been maintained and a recent action has tuned up the lantern, we are considering the idea to go a little beyond using technological advances to provide a better service to users. In essence it will be keeping running the original equipment to preserve its undoubted technological value and, at the time, making more noticeable the information that the lighthouse in Sálvora Island must facilitate to navigation.

The idea is to replace the Flash which is now hidden in the dangerous sector but not with the corresponding panel in the optic, since this will continue to be hidden by the Otter shutters, but a new equipment of red led projectors covering the same 34ª sector.

This new luminous signal would be powered and synchronized by the lighthouse optic but with the precision provided by the current teams with LED technology.

Would thus provide a red colour Flash and with a duration, if deemed suitable, significantly higher than the one the optic would produce. So, working this way, we´ll get a combination of a group of three white flashes followed by a Red Flash in de dangerous sector.. We believe this way the user will have a better interpretation of the information than with the current group of three white flashes. ■

575864 TOWER OF HÉRCULES. PAST, PRESENT AND FUTURE

Ana Goy Diz, Dulcemaría Trigo Cousillas, Juan Manuel Doce Porto, Juan Mario Crecente Maseda.
Spain

This work presents last investigations with importants innovations about Tower of Hercules. The Management Plan of the Tower of Hercules and its environment, has been promoted by the Council of A Coruña, with the support of Ministry of Culture, and the supervision of the regional administration of the Government of Galicia, having been awarded by public tender.

Este trabajo presenta las últimas investigaciones con importantes innovaciones en la Torre de Hércules. El Plan de Gestión de la Torre de Hércules y su entorno ha sido presentado por el Concejo de A Coruña con el apoyo del Ministro de Cultura y la supervisión de la administración regional del Gobierno de Galicia, adjudicado por licitación pública.

Le rapport présente les dernières recherches et innovations concernant la Tour d'Hercule. Le plan de gestion de la Tour d'Hercule et de son environnement a été initié par le Conseil de La Corogne avec l'appui du Ministère de la Culture et la supervision de l'administration régionale du gouvernement de la Galice a été attribuée par appel d'offres.

Tower of Hercules, Past, Present and Future

Ana Goy, Dulcemaria Trigo, Juan Manuel Doce,
Juan Mario Crecente

Spain

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1. THE PAST AND THE HISTORY

The Tower of Hercules was included in the list of World Heritage Sites in 2009 as an example of the only nearly 2000-year-old lighthouse still working today.

It was probably built in the first century A.D. by the Emperor Augustus, when the region of Gallaecia as well as the entire northern area of the Iberian Peninsula had been conquered by the Roman armies, after their victory in the Cantabrian Wars. At that time, one of the Emperor's objectives was to conquer Germany and Brittany; in order to do so he would need to use the army and the army's supply fleet. These ships, which came from the Mediterranean, sailed the Atlantic Ocean; thus, they passed close by the Galician coast. In order to orient them, the Tower of Hercules was built near the city of Brigantium, which is the city of A Coruña today.

The Tower of Hercules constitutes an exceptional testimony to Roman civilisation by being the only preserved example of a lighthouse of the ancient world, which, despite the time that has passed since its construction, continues to fulfil its function as a maritime signal in the 21st century.

Image 1: Tower of Hercules and Tower peninsula

In this sense, the Tower of Hercules is the last link in a great chain which is formed by the most important lighthouses of the ancient world; for instance, to cite some emblematic examples, the Lighthouse of Alexandria and the Colossus of Rhodes, which were recognised by Antipatrus of Thessalonica as belonging to the Seven Wonders of the ancient world.

Unlike other examples, which have been lost (for example the Lighthouse of Ostia, that of Naples-Italy or the afore-mentioned Lighthouse of Alexandria in Egypt), the Tower of Hercules is the only maritime signal which remains in operation of all the towers built by the Romans as navigational aids on both the Mediterranean and Atlantic coasts. The Tower of Hercules belongs to this second group of lighthouses which were erected on the shores of the ocean and were scattered from the mouth of the Guadalquivir River in Hispania to the English Channel, where the maritime traffic between Britannia and Gaul was concentrated.

These Atlantic lighthouses differ somewhat from the Mediterranean lighthouses, which were built in the entrances to quays or on the end of breakwaters, as was the case in Ostia (Italy) and Leptis Magna (Libya). In contrast, those that were erected on Atlantic shores were built on coastal cliffs in particularly dangerous areas in order to direct ships away from the shallows, which could threaten their wooden hulls.

Image 2:North and West façades of Tower of Hercules

For all of these reasons it can be concluded that the testimonies which have been preserved of Roman lighthouses are few and far between. Therefore, that which is preserved as the interior nucleus of the Farum Brigantium, or the Tower of Hercules, is so exceptional that it gives this monument the virtue of being an item of extraordinary hereditary value, as both a work of reference of Roman engineering and as a unique testament by way of which we can learn more of the navigational techniques, signalling systems and maritime routes used in the ancient world.

The Roman lighthouse known as the Tower of Hercules was built in the extreme West of Europe, on the edge of the known world, as a symbol of the real presence of Rome in the Western Provinces. In relation to this notable Roman presence in the north-western territory of Hispania, the remains of the city of Lucus Augusti (Lugo),

whose walls have already been included in the World Heritage List, the Roman camps of the Cohors I Celtiberorum and Aquis Querquernis and the mines of Las Médulas, which have also been recognised as a World Heritage Site, should be taken into account.

To all of this can be added the fact that it is the only Roman lighthouse of which the name of the architect and engineer who built it is known: Gaius Sevius Lupus, who immortalised his name by leaving it engraved on a commemorative inscription at the foot of his work, which he dedicated to the god Mars Augustus.

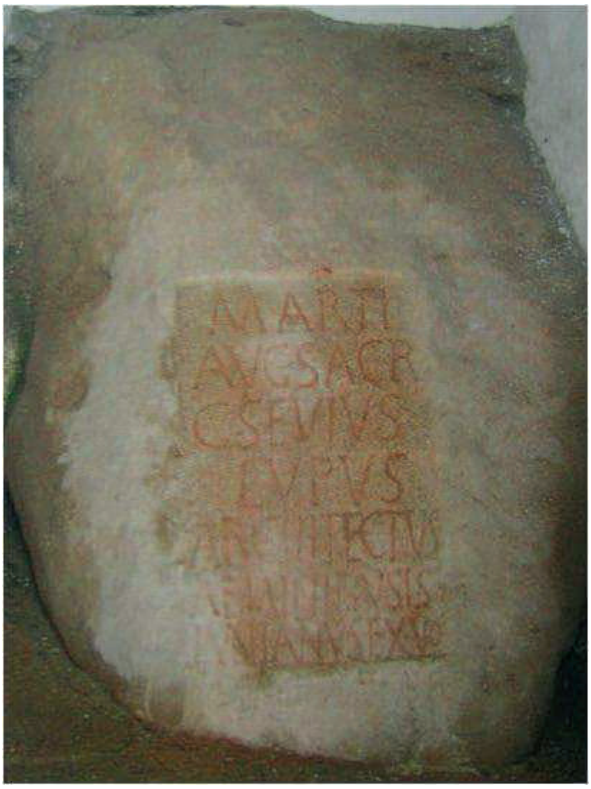

Image 3: Roman inscription commemorative

Its exceptional character is also determined by the fact that it is a building that, in spite of the reforms carried out throughout its history, which ensured its survival, has preserved the structure of the internal nucleus of the Roman tower in excellent condition, which has a height of 37.2 metres out of a total of the 41 metres it would have originally had. This structure is composed of tour chambers of differing height on each of the three floors which make up the total height. The specific function performed by these rooms, beyond their being purely structural, is unknown.

The Tower is a navigational aid with a square base of approximately 18 metres across and with a height of 41 metres, it was built in three levels, each of which is divided into four chambers measuring 2.55 metres across, which were accessed via an exterior ramp ascending in a spiral to the lantern of the lighthouse. Each of these rooms or chambers is covered by a barrel vault.

The structure is reinforced at the top by way of a system of interlinked stone blocks which act as a binding band for the vaults and the walls as can also be seen in other Roman structures, such as the Arch of Caparra and the Mausoleum of Theodoric (474-526), which would suggest the possibility that we are faced with Roman remains of particular significance. This constructive solution gives the Tower a great robustness, protecting it from any seismic movement which could endanger its stability. Indeed, earthquakes were, from ancient times, one of the most serious threats to this type of building as they were particularly vulnerable due to their great height. In fact, the disappearances of both the Lighthouse of Alexandria and the Colossus of Rhodes were attributed to earthquakes.

The internal nucleus of the Tower preserves the constructive systems used in Roman times, more specifically the opus quadratum for the jambs and the lintelled arches of the doors and windows, the opus vittatum for the interior and exterior walls and the opus caementicium for the vaults.

Image 4: Roman constructive systems in chambers of the internal nucleus of the Tower

What is more, the Tower of Hercules illustrates several significant periods of human history; its origin in the Imperial era, its later evolution in the Middle Ages, its recuperation in modern times and its consolidation and enhancement at the end of the 18th century.

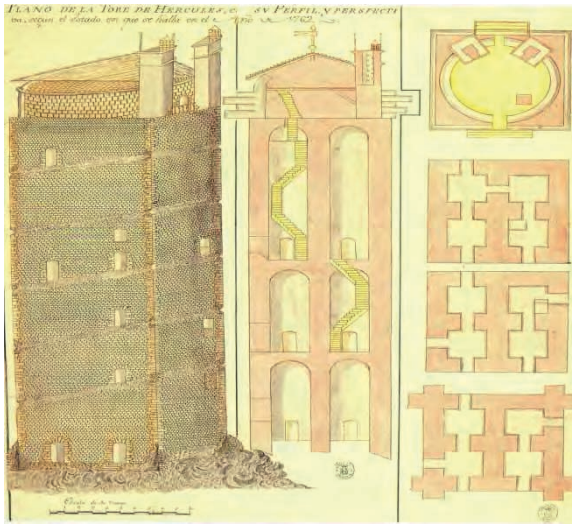

Image5: Tower of Hercules circa 1780 by Joseph Cornide

These latter reforms, which were essential to guarantee the maintenance and conservation of the Roman structure, are a paradigmatic example of the scientific restoration of an ancient monument according to the enlightened criteria which prevailed in the Spain of the 18th century.

Thanks to these reforms, the Tower of Hercules offered an image of modernity and development at the beginning of the 19th century as it now boasted new systems of maritime signalling and illumination. However, beneath this exterior facade, which protected the internal structure as if it were a bell jar, lay the Roman lighthouse, which had been consolidated thanks to the work carried out by the architect Eustaquio Giannini.

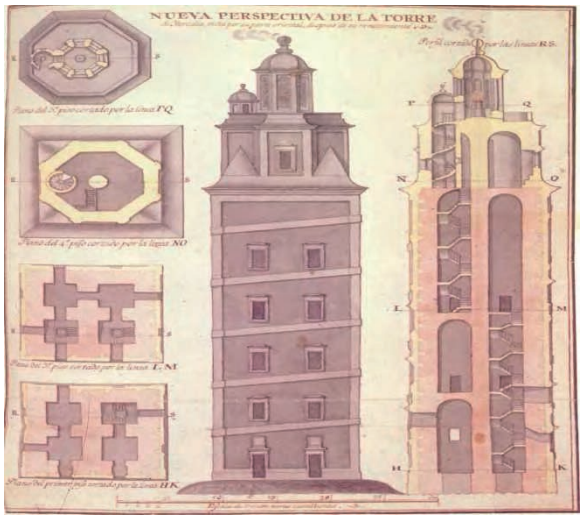

Image 6: Tower of Hercules project by Eustaquio Giannini

The restoration work carried out by Giannini achieved one of the goals proposed by José Cornide; that the Tower of Hercules should be known, valued and respected as a maritime signal but, above all, as an emblematic and allegorical monument for the people of the North-West of the Peninsula. Although it is true that, from 1448, the lighthouse was the symbol of the city and was shown on its coat of arms, it was from the beginning of the 19th century that its image began to be disseminated and popularised among society by way of calendars, postcards, picture cards, advertisements, posters, etc. This occurred in such a way that the Tower of Hercules came to be the most representative symbol with which the whole world could identify the city, as is the case with Big Ben in London, the Statue of Liberty in New York, the Eiffel Tower in Paris and the Coliseum in Rome.

2. HERCULES' TOWER: PRESENT

Conservation and maintenance of the building

In consequence of the incorporation to the WHL, there were done many works of conservation, restoration and adequacy. (At the same time there are works of maintenance on the beacon, which is a direct responsibility of the Port Authority).

We have to point out three fundamental aspects:

A. Analysis

B. Building Restoration

C. Improvement of the visitors care

A. Analysis

Before any intervention, and due to the nature of the Monument, we carried out analysis with respect to the conservation of the different stone-works (roman, neoclassic, and modern), historical evolution and morphological changes on the building, and external determining factors which could influence its condition, already climatological, geographical, or any other type of pressure on the building. We also analyzed inmaterial things such as legends and tales.

All these analysis started with the issue of the Proposal for the Inscription of the Monument as a World Heritage Site, in 2007, and they continue getting up-to-date in the successive interventions.

The Director Plan for the Hercules' Tower and its Environment establish all the works in the monument will be realized according to a few guidelines of action, setting the pace for it.

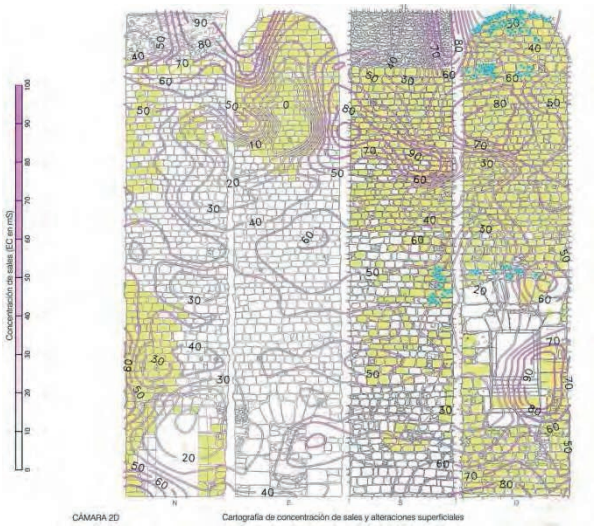

Image 7: Analysis of the Roman Façades. Rosa Benavides. 2012

B. Restoration

Image 8:Building works in the Tower of Hercules 2009

These works are also laid down in the Director Plan, and originally in the Proposal for the Inscription.

This is a protected building as monument, but that is submitted to a very aggressive climate and that also suffered ecological disasters caused by shipping accidents such as the petrol tankers "Uquiola", and the "Aegean Sea".

Because of it, the maintenance works affect mostly to the roman and neoclassic façades (the most damaged parts of the building).

Any building work in the Tower of Hercules has the habitual difficulties of a Historical Monument, to which there add the function of beacon and its condition of visitable monument with small-sized space of tour. From the year 2007 works have been realized supporting the building opened to the visitors. And of course, keeping the beacon at work.

C. Attention to visitors

In the last years, the spread of the Monument was improved and broadened through museum projects, building of a Interpretation Center, edition of leaflets,… The work was done both on the information about the building and on its environment, history and legends.

This knowledge continues its improvement because the team of professionals who work on it go on with investigations.

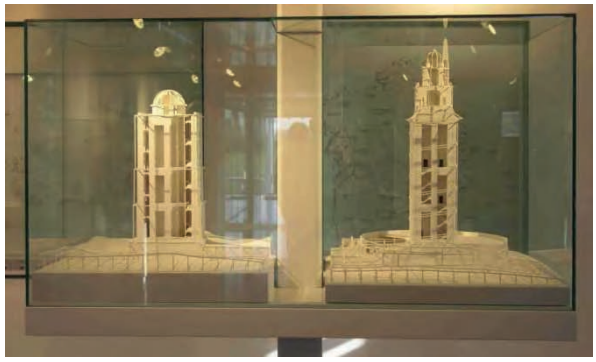

Image 9: The Roman Tower and the 21th Century Tower. Models in the CIAV

Relation of Works realized in Hercules Tower and its environment: 2008-2012

- 2008 Museum Project. Excavation area
- 2008-2009 Waterproofing of landscaped roofs
- 2008-2009 Restoration TH (mostly neoclassic façades)
- 2008-2009 Conditioning of toilets + improve accessibility as possible
- 2008-2009 Upgrading of the Electrical Installation
- 2009 Waterproofing entry + toilets roofs
- 2009-2010 CIAV 01 (Visitors´ Center)
- 2009-2010 Museum Project for Environment
- 2009-2010 Works in the environment
- 2009-2010 Arrangements in breakwaters
- 2009-2010 Virtual museum project
- 2009-2010 Webcasting TH
- 2010 Restoration TH (mostly roman façades)

- 2010 Museum Project in chambers TH
- 2010 Waste treatment + waterproofing
- 2011 CIAV 02 (Interpretation Center)
- 2012 Reform of information desk + main door
- 2012 Lightning rod
- 2012 Restoration TH

3. MANAGEMENT PLAN TOWER OF HERCULES AND ENVIRONMENT. "FROM ROMAN LANTERN, TO THE LIGHTHOUSE: 2000 YEARS OF THE TOWER OF HÉRCULES HISTORY"

The Management Plan of the Tower of Hercules and its environment, has been promoted by the Council of A Coruña, with the support of Ministry of Culture, and the supervision of the regional administration of the Government of Galicia, having been awarded by public tender.

The Plan has been drawn up by a multidisciplinary team, including several members of ICOMOS who bring an international vision being leading experts in the areas of: archaeology, architecture, history, engineering, tourism, etc.

The plan takes into account the standards and regulations on the World Heritage Convention, with special attention to the five "C"s: Credibility, Conservation, Capacity, Communication, Community, and most recently with the addition of Creativity, and has been coordinated and integrated with state and regional policies.

This new work presents the up to date situation based on the best knowledge available and the latest research concerning the monument including; presenting important new aspects of it, such as its age, functioning as a lighthouse, uses as a fortification, and details of construction. It is clear that in the past only a part of the role in history played by the Tower has ever been told.

It is organized into three main areas:

A. The Knowledge of the monument and the environment with the description of the methodology, analysis, and diagnosis.

B. The Management of the Tower, in terms of Conservation, Intervention, Musealization, Distribution, Promotion, Management, and future aspirations.

C. The Resources towards the phased plan, financial support to ensure the development and the implementation programme.

These proposals focus on three main areas: i) the Care of the Monument based on a maintenance and conservation plan including specific proposals for the cultural landscape and environment of the Tower, which will be the first to develop the new PGOM, eliminated all building construction, ii) the wider maritime setting of the Tower beginning with the Gulf, including archaeological, historical, immaterial and symbolism and myth, iii) and a new Management organisation which gathers together all the authorities involved whose primarily function is the conservation of the monument. Further detailed studies will need to be commissioned to support the careful preservation and improvement to the conditions for conservation at the Tower.

A primary objective of the Management Plan will be to engender the continued close involvement of the citizens of the city and the local communities whose pride and concerns for the future of the Tower were expressed in their overwhelming support and reaction following the successful nomination of the tower for inclusion on the World Heritage List.

Wider considerations also include the whole environment of the Tower extending beyond the Buffer Zone and with a focus on San Amaro Agra, and specifically access and traffic conditions, the treatment of public spaces and buildings, as well as providing the necessary services for the Monument and the surrounding park.

The plan also wants to embrace the wider concept and vision of the impact of the lighthouse's territorial phenomenon that goes beyond the physical fact of the Tower and its platform, and that explains the Cultural Landscape Portum Artabrorum Magnus, this influence goes as far as the light reaches from the Tower.

The plan recognizes the value of tourism to the City and Galicia, and proposes joint action with the other three top ten tourist landmarks of the region, in order to coordinate joint actions with the Secretariat for Tourism in Galicia and Turespaña.

It is proposed to create an edition of a scientific reference book that will form the World Heritage reference for the City and be a resource for the City's Ambassador in various languages. The presentation of the Tower will also be reflected in the design of quality souvenirs, special events, and

links to cultural routes in order to maintain the number of visitors, and increase the quality of their experience.

The Management Plan also takes into account the prevailing economic conditions, starting with the new Management organisation itself which is to receive grant aid from the Ministry of Culture and will phase the programme of works and development based on the available funds initially spread over a ten year period.

In the year 2014 A Coruña celebrates the congress of the International Association of Lighthouse IALA-AISIM, appropriately based near to the world's oldest operating lighthouse, and where the City will present the Management Plan of the Tower.

Image 10: The coast of A Coruña and Tower of Hercules

HERITAGE AND TOURISM RELATIONSHIP. PROGRAM WHC-12/36.COM/5E

Since the first phase of the Plan the team of specialists has been very attentive to making a significant contribution to the programme of cooperation between UNESCO and the World Tourism Organization (UN-WTO), concerning sustainable tourism development in World Heritage Sites with the conviction that this is one of the fundamental objectives of the of the Management Plan and the operation of such Sites.

So we enthusiastically welcome the Sustainable Tourism Program WHC-12/36.COM/5E World Heritage, and so we have taken into account when developing this Plan, and Management, objectives, actions and activities adapted to the reality of the Tower of Hercules and its environment, not only in the proposals considering the "tourist" and visitors, but in the overall management of the Monument, from preservation, intervention, musealization, diffusion, dynamic, and forward-looking management, to achieve an integrated approach to the complex phenomenon of tourism, especially in relation to goods of exceptional value.

From encouraging the participation of local people, workers and the monument guides, children, students and seniors, the non-profit associations, entrepreneurs and tourism stakeholders, to exchange with other World Heritage Sites through various media, experiences, actions and proceedings. The exceptional values and attributes (OUV) of the Tower will be promoted to generate and integrate networks and events held in the City, spreading sustainable tourism projects in World Heritage (IALA Congress 2014). Such a focal point could be used to generate a permanent grouping of World Heritage Sites with specific concerns and interests in maritime heritage and the maritime environment.

The Tower of Hercules and its environment has a special opportunity, being a World Heritage property only recently declared, with an approved Management Plan which includes Sustainable Tourism under the WHC-12/36.COM/5E. A consortium of tourism interests exists that support the integrated management of the Monument to the various public and private university centers of excellence in the City directly related to architecture, tourism, geography, economics and shipping backed by the City, the Province, the Region and the State.

Therefore with this, we propose that the Tower of Hercules in implementing its Management Plan can be a pilot project developing a sustainable tourism programme with the World Heritage Centre based on a cooperation agreement on the terms to be agreed. In the spirit of collaboration with these institutions, and supporting the dissemination of its objectives, the Management Plan proposed to hold an International Congress to address the programme of UNESCO and the UN-WTO, and publishing manuals or minute's book. ■

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62 MODEL FOR IDENTIFICATION OF COMPLEMENTARY USES IN LIGHTHOUSES

Gervasio Dopico. Port Authority of Ferrol-San Cibrao. Spain

Lighthouses are often found in environments of high natural and landscape value, and are a strategic element that will enhance the image of the institutions responsible for their management, given their wide social acceptance.

A SWOT analysis is used to assess the initial situation, highlighting not only the strengths and weaknesses of all the AtoNs, but also the threats and opportunities facing them. Subsequent analysis shows that whilst the service rate is high, conservation status is much lower and lighthouses incur heavy losses, since costs are much higher than the revenues they generate.

Establishing a plan that enables complementary uses, without neglecting their basic function, can alleviate the budget deficit, so we will have to establish a catalogue of possible uses that will be individualized for each lighthouse, since it will not generate the same value for the managing authority as for society.

A menudo los faros se encuentran en entornos de alto valor natural y paisajístico y, dada su amplia aceptación social, son un elemento estratégico que mejorará la imagen de las instituciones responsables de su gestión.

Se ha utilizado un análisis DAFO para evaluar la situación inicial, destacando no solo las fortalezas y debilidades de todas las AtoN, sino también las amenazas y oportunidades a que se enfrentan. Un análisis posterior muestra que mientras el índice de servicio es alto, el estado de conservación es muy bajo y los faros incurren en fuertes pérdidas, ya que los costes son mucho mayores que los ingresos que generan.

El establecimiento de un plan que permita usos complementarios, sin descuidar su función básica, puede aliviar el déficit presupuestario, por lo que elaboraremos un catálogo de posibles usos que serán individualizados para cada faro, puesto que no todos generarán el mismo valor para la autoridad gestora que para la sociedad.

Les phares sont souvent situés dans des environnements et paysages naturels de grande valeur et sont un élément stratégique qui, en raison de la sympathie que leur accorde la société, va améliorer l'image des institutions responsables de leur gestion.

Une analyse SWOT est utilisée pour évaluer leur état initial, mettant en lumière non seulement les avantages et les faiblesses de toutes les aides à la navigation, mais aussi les menaces et les opportunités qui peuvent se présenter. Une analyse suivante montre que plus le taux de service est haut, plus le statut de conservation est bas et le phare génère de lourdes pertes, car les coûts sont bien plus élevés que les revenus qu'il rapporte.

Etablir un plan prévoyant des utilisations complémentaires, sans négliger la fonction première, peut alléger le déficit; il faudra donc établir un catalogue d'utilisations possibles à adapter à chaque phare, car il n'aura pas la même valeur pour l'autorité gestionnaire que pour la société.

Model for Identification of Complementary Uses in Lighthouses

Gervasio Dopico

Port Authority of Ferrol-San Cibrao

Spain

1. CONCEPTUAL MODEL

1.1 Background

Under Spanish law a Port Authority's competences include the planning, design, construction, maintenance and operation of marine aids to navigation along the nation's coast Similarly, the functions of such an organisation cover the management, administration and control of port services, amongst which marine aids to navigation play an important role.

One of the most important elements within the network of marine aids are lighthouses, which are usually to be found in areas of high environmental value and natural beauty and constitute major assets of a nation's cultural heritage, located in unique sites from the geographical perspective.

Taken together, these aspects mean that some lighthouses and their surrounding areas receive large numbers of visitors, opening up a range of future possibilities for finding complementary uses for them which, without prejudicing their mission and primary function (i.e. being a marine aid to navigation), can generate profits for the port authorities that operate them, or at the very least partially defray their operating costs and those of maintaining not only the lighthouses themselves but also their surrounding area in the best possible condition, thereby avoiding any potential progressive decay.

In turn, and given the high degree of favour they find among the public, lighthouses can be a strategic element for enhancing a port's institutional image, an opportunity that may well turn into a weakness of visitors find the surrounding area run down or the nearby buildings poorly maintained and semi-abandoned.

As a result of these general ideas, almost all the state-controlled Port Authorities have put forward initiatives to foster a wide variety of alternative and complementary uses for the lighthouses under their jurisdiction.

In view of the wide variety of its lighthouses and the broad range of possibilities they offer, the Ferrol-San Cibrao Port Authority has introduced a systematic framework for establishing complementary uses for them, which in turn has led to the creation of a Model for identification of complementay uses in lighthouses for the lighthouses under its jurisdiction, one of the various Operational Plans that form part of its 2007-2015 Strategic Plan.

In the rest of this article we will briefly describe both the methodology we propose for drafting a generic resource use plan for lighthouses that can be applied by any Port Authority and its practical application in the specific case of the Ferrol-San Cibrao Port Authority.

1.2. SWOT analysis

The first step when designing a methodology for producing a resource use plan for lighthouses is to diagnose the current situation. To this end, and based on the experience acquired within the port management system, it was decided to use the SWOT methodology as an analytical tool, the results of which are shown in **Figure 1**.

STRENGTHS	WEAKNESSES
• High service indexes and a low incident rate. • Lighthouses are seen positively and highly appreciated by the l public. • Lighthouse personnel (marine aids to navigation technicians) are highly trained. • The investment made in refurbishment in recent years. • A deeply-rooted culture of "a heritage to be preserved".	• High operational and maintenance costs. • Aggressive environment that makes maintenance more expensive and difficult to perform. • Isolated location. Difficult to monitor. • Age of the buildings and their general state fo repair. • Limited access by land in many cases. • Non-availability/insufficiency of essential services (mains water, telephone, etc.) in many cases. • Current uses prevent or hinder the implementation of new uses.
OPPORTUNITIES	**THREATS**
• The current boom in tourism and leisure activities. • Synergies with uses undertaken by other bodies. • The ability to attract private capital and develop leasing models. • "Idle" building opportunities or space surplus to marine aids to navigation requirements. • Unique high-value surroundings (environmentally, geographically and historically speaking). • The monitoring and automation of aids to navigation enable them to be remote-controlled, freeing up space and current uses. • Application of the 1% culture levy to the conservation and enhancement of lighthouses.	• Planning restrictions that may affect extensions to current building capacity. • Environmental restrictions that may hinder the performance of certain actions or the implementation of certain uses. • Lobbying for conversion to "non-optimal" uses.

Figure 1. SWOT analysis for the development and implementation of alternative uses for lighthouses

The main points of our analysis are:

1. The lighthouses are overall poorly conserved, although they have a high service availability index (measured in terms of down time as a proportion of total time). This begs the question of why, if we can achieve excellent performance in the management of the marine aids to navigation service, are we unable to do so when it comes to conserving the buildings in which such aids are located and their surrounding areas? The answer to this question is provided in the following point.

2. Our lighthouses are highly unprofitable, if we compare the costs they generate (supplies, personnel, maintenance, etc.) to the income they bring in (marine aids to navigation duties), the difference being disproportionate.

3. As mentioned above, lighthouses are generally located in privileged surroundings from an environmental, geographical and historical point of view.

1.3. Aims of the lighthouse plan and the current state-of-the-art. Catalogue of uses

In view of the above, it would appear that in terms of opportunity as well as advisability there is room to develop comprehensive plans for additional lighthouse uses, with the following objectives in mind:

1. Creating additional resources associated with Marine Aids to Navigation.
2. Reducing costs associated with the operation and maintenance of Marine Aids to Navigation.
3. Leveraging the potential of lighthouses and their surrounding areas through the use of "idle" building opportunities.
4. Enhancing a Port Authority's institutional image by using lighthouses as a showcase for port activities and the contribution ports make to progress and social well-being.
5. Bringing the public into closer contact with the world of the sea and its lighthouses.

The next step in the diagnostic process is to draw up a catalogue of possible alternative uses. In our case, this was done in the form of a benchmark study involving all the state-controlled Port Authorities, the results being used to produce the said catalogue.

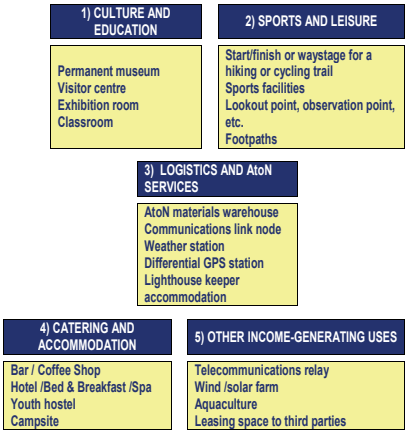


Figure 2.- Catalogue of potential

The 22 potential uses identified in the benchmark study have been divided into five different categories, as shown in Figure 2.

1.4. Value creation matrices

It is clear that not all the potential uses identified have the same value, whether for the Port Authority itself or for the lighthouse's surrounding area. For this reason it was decided to determine the value of each use according to two different criteria:

- **Value to the Port Authority**: the capacity to generate income through the use in question and/or to reduce costs by externalising expenses (e.g. maintenance, monitoring/surveillance, etc.
- **Socio-economic value**: the capacity of the use in question to benefit the area surrounding the lighthouse. This can include job creation, the fostering of tourism, helping to preserve a specific site, showcasing cultural and similar aspects, etc.[1]

In order to do so we defined a use value matrix, as shown in **Figure 3**, assigning to each of the uses described in **Fig. 2** a value for the Port Authority and a value for the local economy. This value ranges from 1 (least value) to 5 (most value) and four quadrants are defined, as shown.

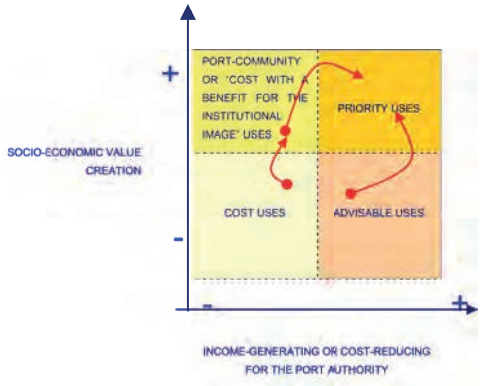


Figure 3. Use Value Creation Matrix

Priority uses are defined as those that in addition to generating income for the Port Authority also generate socio-economic value. Uses that generate income for the Port Authority without helping to generate socio-economic value are defined as **advisable uses**, although wherever possible efforts should be made to find implementation

mechanisms that enable this missing socio-economic value to be added to the use or uses in question. On the other hand, uses that generate no income for the Port Authority but help to create value for the surrounding area are classified as **port-community** uses, from which the port should try to obtain a benefit by implementing communication and institutional image-enhancing policies projecting it as the promoter of activities that create value for society as a whole. Finally, those uses that have a limited capacity for generating value for either the port or the local community are referred to as **cost uses**.

Values should be assigned individually for each specific use it is intended to introduce, since any given general use can create greater or lesser value for the port or for society depending on a set of specific variables that apply in each case. Nevertheless, and simply by way of example, we show in **Figure 4** the result of applying this system to each of the five major groups contemplated in the catalogue of uses.

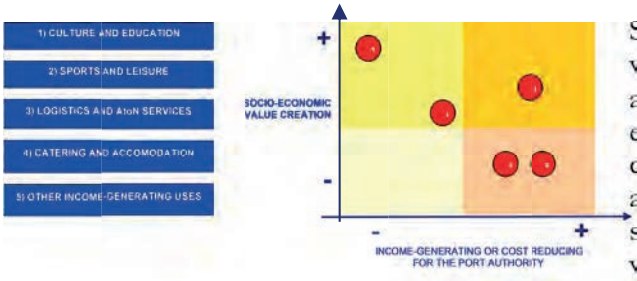


Figure 4. Use Value for each Use Category

1.5. Lighthouse assessment: criteria and assessment matrices

Just as not all the aids to navigation or lighthouses are able to accommodate the uses defined in the catalogue we have drawn up, neither do Port Authorities have unlimited resources that they can dedicate to a lighthouse optimisation plan if they are responsible for its implementation. It therefore becomes necessary to rank and establish priorities for the actions to be undertaken.

In order to achieve this, nine different assessment attributes were defined for each lighthouse, ranked on a scale of 0 (unfeasible) to 5 (easily implemented). These were divided into two groups, as follows: on the one hand we can consider the intrinsic quality of the aid to navigation, defined as that concerning the building, the plot of land it occupies and the extent to which the latter has been developed, whilst on the other we have its extrinsic quality, which affects other external variables that depend not so much on the building itself as on its surrounding area.

Figure 5 shows the two lighthouse assessment groups (intrinsic and extrinsic lighthouse quality) and the attributes they contain.

INTRINSIC LIGHTHOUSE QUALITY:	EXTRINSIC LIGHTHOUSE QUALITY:
Adaptability of lighthouse uses according to the characteristics of the aid to navigation itself.	Adaptability of lighthouse uses according to the characteristics of the surrounding area.
1. Size of the aid to navigation / building / lighthouse. 2. Size of the plot of land. 3. State of repair. 4. Current uses.	5. Environmental / Natural quality of the surrounding area. 6. Access from the land. 7. Geographical or historical importance of the surrounding area. 8. Utilities (water, electricity, telecommunications, etc.). 9. Synergies with other local amenities (e.g. hiking or cycling trails, seafront promenades, visitor centres, hotels, B & Bs, etc.)

Figure 5: Lighthouse assessment groups

Since not all attributes have the same influence when deciding whether to implement one use or another,[2] in order to assign a numerical value to each lighthouse each attribute is weighted with a coefficient determined by the team responsible for assessment and the creation of the plan. More specifically, it was decided to allot 50% of the total weighting to intrinsic lighthouse features and 50% to extrinsic ones, shared between attributes on the basis of a similar criterion as shown in **Figure 6** below.

INTRINSIC LIGHTHOUSE QUALITY:		EXTRINSIC LIGHTHOUSE QUALITY:	
Size of the aid to navigation / building / lighthouse.	20%	Environmental / Natural quality of the surrounding area.	15%
Size of the plot of land.	10%	Access from the land.	10%
State of repair	5%	Geographical or historical importance	15%
Current uses	15%	Utilities	5%
		Synergies with other amenities	5%
TOTAL	**50%**	**TOTAL**	**50%**

Figure 6: Assessment attribute weighting

These criteria were used to define a new value matrix for aids to navigation in which each lighthouse for which an additional or complementary use is considered was evaluated accordingly. As in the previous case, the

lighthouses were assigned to one of four groups, according to the mix of intrinsic and extrinsic value pertaining to each one. Thus, lighthouses with a high intrinsic value located in a territory of equally high quality were defined as **priority aids to navigation**. Those cases in which neither the lighthouse nor its surrounding area attained a minimum value threshold were classified as **unacceptable aids to navigation** from the point of view of implementing a new use.[3] A third group of aids to navigation includes those lighthouse with a high intrinsic value but located in a low-quality environment: these were defined as **productive aids to navigation** (in the sense that they could be used for certain of the Port Authority's own uses, such as a AtoN logistics warehouse, classroom, communications centre or the like). The final group consisted of lighthouses with a low intrinsic value (e.g. because of the small size either of the building itself or of the plot of land it occupies, or because of current uses that cannot be transferred elsewhere) but located in high value surroundings, defined as **image aids to navigation** because of their high potential for being a platform for disseminating port activities, given that they probably already receive a high number of visitors. This matrix is shown in **Figure 7** below:

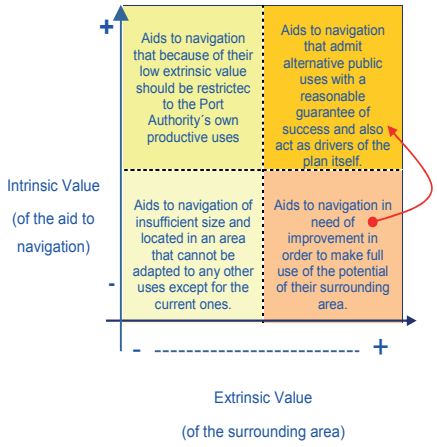


Figure 7: Aids to Navigation / Lighthouse Value Matrix

1.6. Use-attribute coherence matrices

Conceptually speaking, the following step is to assign a correlation between each use defined in the catalogue and the minimum threshold value for each attribute. To give an example, if the lighthouse itself is not big enough to accommodate an alternative use as a restaurant, bar or coffee shop, or the plot of land on which it is located is too small to accommodate a campsite or a sports field, the fact that the aid to navigation attains a high rating in the remaining attributes is of little or no worth. Our proposed use-attribute coherence matrix appears in **Figure 8** on the next page.

1.7. Use threshold and aid to navigation profiles. Defining actions.

In the model we propose, a threshold attribute profile is defined for each use that can be contrasted with the assessment profile of each individual aid to navigation. For those aspects in which the aid to navigation value is higher than the use threshold there will be no need to undertake any kind of "*use driver action*", but when the use threshold is higher than the value profile of the aid to navigation in question, it will be necessary to take action in order to attain the said threshold and eliminate the corresponding gap or "*use deviation*".

This model is conceptually identical to that of "*Competence-based management*" used by Human Resources departments and implemented in the state-controlled port system, with the "*job profile*" being replaced by the "*use profile*" and the "*employee competences*" by the "*aid to navigation competences*".

By way of example **Figure 9** (which is to be found on page 7) shows the profile of a fictitious aid to navigation (Aid to Navigation "A") and its comparison with three different use profiles (wind farm, AtoN logistics warehouse and museum/visitor centre).

From the graph it is possible to infer that for the majority of attributes the profile of "Aid to Navigation A" differs widely from that required by a museum, meaning that in principle it would be impractical to implement such a use. However, if we compare ti with the ideal profile for a wind farm, all the required attributes meet the corresponding criteria, and we could thus propose (at least in theory) such a complementary use in the area surrounding "Aid to Navigation A". If we then compare it with the profile of an Aids to Navigation logistics warehouse we can see that it meets all the requirements except for "building size" and "access", so if such a use were to be implemented it would be necessary to first increase the available surface area within the building and improve its access roads.

This final step is the one that allows us to design the different actions to be undertaken within the framework of the Lighthouse Uses Plan, establishing the corresponding budget and investment schedule for its implementation.

		EXTRINSIC QUALITY					INTRINSIC QUALITY			
		Size of the aid to navigation	Size of the plot of land	State of repair	Current uses	Environment/ Natural quality of the surrounding area	Access by land	Geographical or historical importance	Utilities	Synergies with other amenities
CULTURE & EDUCATION	Museum / Visitor centre	5	4	5	5	4	5	5	4	4
	Exhibition room	4	4	5	5	4	5	4	4	4
	Classrooms	3	4	5	5	3	5	2	4	3
	Premises for social / cultural associations	4	4	5	5	2	5	2	4	2
SPORTS & LEISURE	Hiking or cycling waystage	0	0	3	0	5	3	3	1	5
	Sports fields	0	5	2	0	3	3	1	1	4
	Lookout or observation point	0	2	2	0	5	5	5	1	4
	Footpaths, coastal promenade	0	0	2	0	5	5	4	1	4
LOGISTICS & AtoN SERVICES	AtoN logistics warehouse	4	1	2	4	0	5	1	2	1
	Communications link node.	2	1	1	2	0	1	0	2	0
	Weather stations	1	1	1	1	0	1	0	1	0
	DGPS station	1	1	1	1	0	1	0	1	0
	Lighthouse keeper accommodation	4	2	5	5	1	2	0	5	0
CATERING & ACCOMMOD.	Bar / Coffee shop	4	4	5	5	4	5	4	5	3
	Hotel / Hostel / B&B / Spa	5	5	5	5	5	5	5	5	5
	Youth hostel	5	5	5	5	4	4	4	5	4
	Camp site	0	5	5	2	4	4	4	5	4
OTHER AMENITIES	Shops	3	3	4	2	3	4	2	4	5
	Telecommunications relay	2	1	1	1	1	1	1	2	0
	Wind / solar farm	0	5	0	0	0	1	0	2	0
	Aquaculture	5	2	3	5	0	4	0	5	0
	Leasing space to third parties	2	2	4	5	2	4	2	3	5

Figure 8. Use-Attribute Coherence Matrix

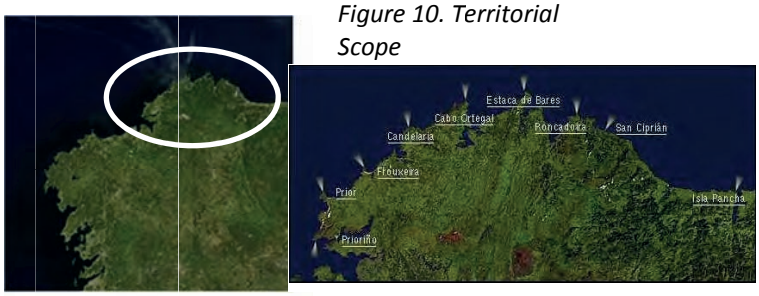
2. CASE STUDY: APPLICATION OF THE MODEL IN THE FERROL – SAN CIBRAO PORT AUTHORITY.

2.1. Territorial framework

The Ferrol – San Cibrao Port Authority manages two of the six state-controlled ports in the Autonomous Region of Galicia: that of Ferrol, in the province of A Coruña, and that of San Cibrao, in the province of Lugo. This broad territorial scope means that in addition to managing the two ports in question, the Port Authority is also responsible for the operation and maintenance of all marine aids to navigation between the Ares Estuary (Province of A Coruña) to the Ribadeo Estuary (Province of Lugo).

The active lighthouses managed by the Port Authority are, from north to south, those of Isla Pancha, San Cibrao, Roncadoira, Estaca de Bares, Ortegal, Punta Candelaria, Frouxeira, Prior and Prioriño, covering a truly privileged stretch of the Galician coastline featuring magnificent unspoilt beaches (e.g. Frouxeria, Doniños, Las Catedrales, etc.), stunning cliffs (San Andrés de Teixido) or inland estuary areas of high environmental and natural value (Foz, Ortigueira, Cedeira, etc.). As a result, many of these locations are subject to some type of protection or other (e.g. Natura 200 network – SCI, SPAs, etc.)

Figure 10. Territorial Scope



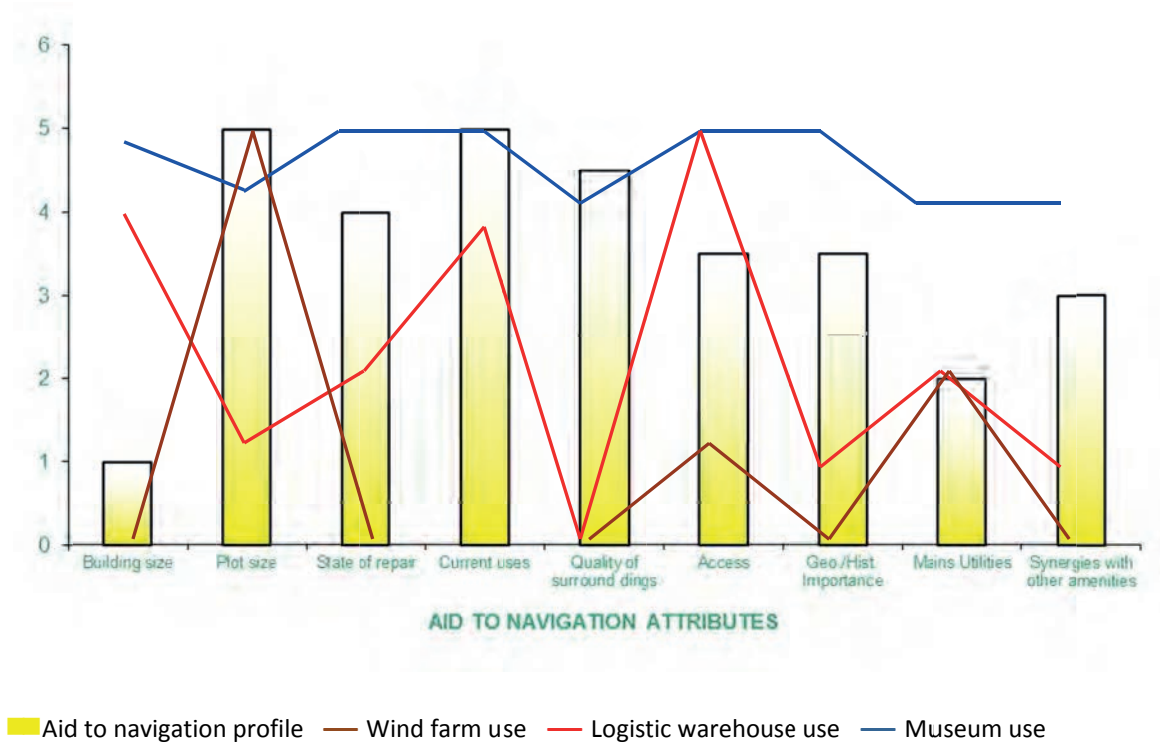


Figure 9. Aid to Navigation - Use Profile Comparison

In total the Port Authority is responsible for managing 99 different aids to navigation, since in addition to the lighthouses themselves there are other types of aid to navigation (buoys, beacons, range lights or markers, towers and other buildings), some of which could potentially accommodate alternative uses.

Figure11. Punta Candelaria Lighthouse

2.2. Preselection and assessment of aids to navigation

Employees working in the Port Planning and Investment Area took part in a practical exercise-cum-workshop on the preselection of aids to navigation and a use implementation assessment, using the conceptual model described above. This was done using the DELPHI technique, only two iterations being needed to reach a consensus as to the final assessment for each aid to navigation. A total of 15 aids to navigation were selected, and the members of the selection and assessment team, working independently, produced an initial assessment from which the mean values and standard deviations were calculated. The results of this first iteration are shown in **Figures 12 and 13.**

Working together, the team analysed the results obtained from the first iteration, and when the SD was greater than 1 they proceeded to jointly analyse and discuss the case in question, after which they produced a second assessment, having previously explained their individual criteria for awarding a given rating.

MEAN	INTRINSIC VALUE				EXTRINSIC VALUE				
	BUILDING SIZE	PLOT SIZE	STATE OF REPAIR	CURRENT USES	ENVIRONMENTAL QUALITY OF THE SURROUNDING AREA	ACCESS BY LAND	GEOGRAPHICAL IMPORTANCE OF THE SURROUNDING AREA	UTILITIES	SYNERGIES WITH OTHER AMENITIES
REAR RANGE MARKER BUILDING RIBADEO HARBOUR (RIBADEO)	3.3	3.3	4.0	3.0	3.0	5.0	4.0	5.0	4.3
OLD ISLA PANCHA LIGHTHOUSE (RIBADEO)	3.3	4.0	4.0	5.0	3.7	4.0	3.7	3.0	3.5
OLD PUNTA ATALAYA LIGHTHOUSE (CERVO)	3.3	5.0	4.0	3.3	3.3	4.0	2.3	4.7	3.7
HOUSE NEXT TO THE OLD PUNTA ATALAYA LIGHTOUSE BUILDING (CERVO)	2.0	5.0	4.0	1.3	3.3	4.0	2.3	4.7	3.7
ISLA COELLEIRA BEACON (O VICEDO)	3.0	3.3	4.0	5.0	5.0	1.0	4.7	0.0	1.7
ESTACA DE BARES LIGHTHOUSE (MAÑÓN)	5.0	4.0	4.0	3.0	5.0	3.3	5.0	3.3	3.0
PUNTA CANDELARIA LIGHTHOUSE (CARIÑO)	4.0	2.0	3.0	2.0	4.7	2.3	4.0	3.3	2.3
PUNTA PROMONTORIO BEACON (CEDEIRA)	1.7	2.0	3.7	5.0	4.3	1.3	2.7	0.0	1.7
A FROUXEIRA LIGHTHOUSE (VALDOVIÑO)	1.0	2.0	4.0	5.0	4.7	3.7	3.7	1.0	3.3
CABO PRIOR LIGHTHOUSE (FERROL)	4.3	3.3	4.0	5.0	4.3	3.3	3.3	3.3	3.3
CABO PRIORIÑO CHICO LIGHTHOUSE (FERROL)	3.0	4.3	5.0	3.0	3.7	3.3	3.7	4.7	4.7
CASTILLO DE LA PALMA BEACON (MUGARDOS)	2.7	2.7	4.0	5.0	3.3	3.0	4.0	2.0	5.0
OLD BEACON FACTORY AND WAREHOUSE AT A REDONDA (MUGARDOS)	4.0	3.3	4.0	1.0	3.3	3.7	4.0	4.7	4.7
RONCADOIRA LIGHTHOUSE (XOVE)	0.0	5.0	4.0	5.0	4.3	3.7	4.0	1.0	4.0
CABO ORTEGAL LIGHTHOUSE (CARIÑO)	0.0	2.0	4.0	5.0	5.0	4.0	5.0	2.0	4.0

Figure 12. Mean assessment values for each navigational aid. First iteration.

DESVIATION ESTANDAR ITERACION 1	INTRINSIC VALUE				EXTRINSIC VALUE				
	BUILDING SIZE	PLOT SIZE	STATE OF REPAIR	CURRENT USES	ENVIRONMENTAL QUALITY OF THE SURROUNDING AREA	ACCESS BY LAND	GEOGRAPHICAL IMPORTANCE OF THE SURROUNDING AREA	UTILITIES	SYNERGIES WITH OTHER AMENITIES
REAR RANGE MARKER BUILDING RIBADEO HARBOUR (RIBADEO)	0.6	0.6	1.0	0.0	1.0	0.0	1.0	0.0	0.6
OLD ISLA PANCHA LIGHTHOUSE (RIBADEO)	0.6	0.0	1.0	0.0	0.6	1.0	0.6	1.0	0.7
OLD PUNTA ATALAYA LIGHTHOUSE (CERVO)	0.6	0.0	1.0	1.5	0.6	1.0	1.2	0.6	0.6
HOUSE NEXT TO THE OLD PUNTA ATALAYA LIGHTOUSE BUILDING (CERVO)	0.0	0.0	1.0	0.6	0.6	1.0	1.2	0.6	0.6
ISLA COELLEIRA BEACON (O VICEDO)	0.0	1.5	1.0	0.0	0.0	1.0	0.6	0.0	0.6
ESTACA DE BARES LIGHTHOUSE (MAÑÓN)	0.0	0.0	1.0	0.0	0.0	1.2	0.0	0.6	1.7
PUNTA CANDELARIA LIGHTHOUSE (CARIÑO)	0.0	0.0	0.0	0.0	0.6	1.2	0.0	1.2	1.5
PUNTA PROMONTORIO BEACON (CEDEIRA)	0.6	0.0	0.0	0.0	0.6	0.6	1.2	0.0	1.2
A FROUXEIRA LIGHTHOUSE (VALDOVIÑO)	0.0	0.0	0.0	0.0	0.6	0.6	1.5	1.0	0.6
CABO PRIOR LIGHTHOUSE (FERROL)	0.6	0.6	0.0	0.0	0.6	1.2	1.2	0.6	0.6
CABO PRIORIÑO CHICO LIGHTHOUSE (FERROL)	0.0	0.6	0.0	1.7	0.6	0.6	1.5	0.6	0.6
CASTILLO DE LA PALMA BEACON (MUGARDOS)	0.0	0.6	0.0	0.0	1.5	1.0	1.0	1.0	0.0
OLD BEACON FACTORY AND WAREHOUSE AT A REDONDA (MUGARDOS)	0.0	0.6	0.0	0.0	1.5	1.2	1.0	0.6	0.6
RONCADOIRA LIGHTHOUSE (XOVE)	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0
CABO ORTEGAL LIGHTHOUSE (CARIÑO)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure 13. Standard deviations of the values for each navigational aid. First iteration.

MEAN	INTRINSIC VALUE				EXTRINSIC VALUE				
	BUILDING SIZE	PLOT SIZE	STATE OF REPAIR	CURRENT USES	ENVIRONMENTAL QUALITY OF THE SURROUNDING AREA	ACCESS BY LAND	GEOGRAPHICAL IMPORTANCE OF THE SURROUNDING AREA	UTILITIES	SYNERGIES WITH OTHER AMENITIES
REAR RANGE MARKER BUILDING RIBADEO HARBOUR (RIBADEO)	3.3	3.3	4.0	3.0	3.0	5.0	4.0	5.0	4.3
OLD ISLA PANCHA LIGHTHOUSE (RIBADEO)	3.3	4.0	4.0	5.0	3.7	4.0	3.7	3.0	3.5
OLD PUNTA ATALAYA LIGHTHOUSE (CERVO)	3.3	5.0	4.0	2.5	3.3	4.0	3.0	4.7	3.7
HOUSE NEXT TO THE OLD PUNTA ATALAYA LIGHTOUSE BUILDING (CERVO)	2.0	5.0	4.0	1.7	3.3	4.0	3.0	4.7	3.7
ISLA COELLEIRA BEACON (O VICEDO)	3.0	2.7	4.0	5.0	5.0	1.0	4.7	0.0	1.7
ESTACA DE BARES LIGHTHOUSE (MAÑÓN)	5.0	4.0	4.0	3.0	5.0	3.7	5.0	3.3	4.3
PUNTA CANDELARIA LIGHTHOUSE (CARIÑO)	4.0	2.0	3.0	2.0	4.7	2.7	4.0	2.0	2.0
PUNTA PROMONTORIO BEACON (CEDEIRA)	1.7	2.0	3.7	5.0	4.3	1.3	2.0	0.0	1.3
A FROUXEIRA LIGHTHOUSE (VALDOVIÑO)	1.0	2.0	4.0	5.0	4.7	3.7	3.7	1.0	3.3
CABO PRIOR LIGHTHOUSE (FERROL)	4.3	3.3	4.0	5.0	4.3	3.7	3.7	3.3	3.3
CABO PRIORIÑO CHICO LIGHTHOUSE (FERROL)	3.0	4.3	5.0	5.0	3.7	3.3	3.7	4.7	4.7
CASTILLO DE LA PALMA BEACON (MUGARDOS)	2.7	2.7	4.0	5.0	3.3	3.0	4.0	2.0	5.0
OLD BEACON FACTORY AND WAREHOUSE AT A REDONDA (MUGARDOS)	4.0	3.3	4.0	1.0	3.3	4.0	4.0	4.7	4.7
RONCADOIRA LIGHTHOUSE (XOVE)	0.3	5.0	4.0	5.0	4.3	3.7	4.0	1.0	4.0
CABO ORTEGAL LIGHTHOUSE (CARIÑO)	0.3	2.3	4.0	5.0	5.0	4.0	5.0	1.7	4.0

Figure 14. Mean assessment values for each navigational aid. Second iteration.

DESVIATION ESTANDAR ITERACION 1	INTRINSIC VALUE				EXTRINSIC VALUE				
	BUILDING SIZE	PLOT SIZE	STATE OF REPAIR	CURRENT USES	ENVIRONMENTAL QUALITY OF THE SURROUNDING AREA	ACCESS BY LAND	GEOGRAPHICAL IMPORTANCE OF THE SURROUNDING AREA	UTILITIES	SYNERGIES WITH OTHER AMENITIES
REAR RANGE MARKER BUILDING RIBADEO HARBOUR (RIBADEO)	0.6	0.6	1.0	0.0	1.0	0.0	1.0	0.0	0.6
OLD ISLA PANCHA LIGHTHOUSE (RIBADEO)	0.6	0.0	1.0	0.0	0.6	1.0	0.6	1.0	0.7
OLD PUNTA ATALAYA LIGHTHOUSE (CERVO)	0.6	0.0	1.0	0.5	0.6	1.0	0.0	0.6	0.6
HOUSE NEXT TO THE OLD PUNTA ATALAYA LIGHTOUSE BUILDING (CERVO)	0.0	0.0	1.0	0.6	0.6	1.0	0.0	0.6	0.6
ISLA COELLEIRA BEACON (O VICEDO)	0.0	0.6	1.0	0.0	0.0	1.0	0.6	0.0	0.6
ESTACA DE BARES LIGHTHOUSE (MAÑÓN)	0.0	0.0	1.0	0.0	0.0	0.6	0.0	0.6	0.6
PUNTA CANDELARIA LIGHTHOUSE (CARIÑO)	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0
PUNTA PROMONTORIO BEACON (CEDEIRA)	0.6	0.0	0.6	0.0	0.6	0.6	0.0	0.0	0.6
A FROUXEIRA LIGHTHOUSE (VALDOVIÑO)	0.0	0.0	0.0	0.0	0.6	0.6	0.6	1.0	0.6
CABO PRIOR LIGHTHOUSE (FERROL)	0.6	0.6	0.0	0.0	0.6	0.6	0.6	0.6	0.6
CABO PRIORIÑO CHICO LIGHTHOUSE (FERROL)	0.0	0.6	0.0	0.0	0.6	0.6	0.6	0.6	0.6
CASTILLO DE LA PALMA BEACON (MUGARDOS)	0.6	0.6	0.0	0.0	0.6	1.0	1.0	1.0	0.0
OLD BEACON FACTORY AND WAREHOUSE AT A REDONDA (MUGARDOS)	0.0	0.6	0.0	0.0	0.6	0.0	1.0	0.6	0.6
RONCADOIRA LIGHTHOUSE (XOVE)	0.6	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0
CABO ORTEGAL LIGHTHOUSE (CARIÑO)	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.6	0.0

Figure 15. Standard deviations of the values for each navigational aid. Second iteration.

MEAN	INTRINSIC VALUE				EXTRINSIC VALUE					TOTAL
	BUILDING SIZE 20%	PLOT SIZE 10%	STATE OF REPAIR 5%	CURRENT USES 15%	ENVIRONMENTAL QUALITY OF THE SURROUNDING AREA 15%	ACCESS BY LAND 10%	GEOGRAPHICAL IMPORTANCE OF THE SURROUNDING AREA 15%	UTILITIES 5%	SYNERGIES WITH OTHER AMENITIES 5%	
REAR RANGE MARKER BUILDING RIBADEO HARBOUR (RIBADEO)	3.3	3.3	4.0	3.0	3.0	5.0	4.0	5.0	4.3	**3.67**
OLD ISLA PANCHA LIGHTHOUSE (RIBADEO)	3.3	4.0	4.0	5.0	3.7	4.0	3.7	3.0	3.5	**3.84**
OLD PUNTA ATALAYA LIGHTHOUSE (CERVO)	3.3	5.0	4.0	2.5	3.3	4.0	3.0	4.7	3.7	**3.51**
HOUSE NEXT TO THE OLD PUNTA ATALAYA LIGHTOUSE BUILDING (CERVO)	2.0	5.0	4.0	1.7	3.3	4.0	3.0	4.7	3.7	**3.12**
ISLA COELLEIRA BEACON (O VICEDO)	3.0	2.7	4.0	5.0	5.0	1.0	4.7	0.0	1.7	**3.45**
ESTACA DE BARES LIGHTHOUSE (MAÑÓN)	5.0	4.0	4.0	3.0	5.0	3.7	5.0	3.3	4.3	**4.30**
PUNTA CANDELARIA LIGHTHOUSE (CARIÑO)	4.0	2.0	3.0	2.0	4.7	2.7	4.0	2.0	2.0	**3.22**
PUNTA PROMONTORIO BEACON (CEDEIRA)	1.7	2.0	3.7	5.0	4.3	1.3	2.0	0.0	1.3	**2.62**
A FROUXEIRA LIGHTHOUSE (VALDOVIÑO)	1.0	2.0	4.0	5.0	4.7	3.7	3.7	1.0	3.3	**3.18**
CABO PRIOR LIGHTHOUSE (FERROL)	4.3	3.3	4.0	5.0	4.3	3.7	3.7	3.3	3.3	**4.05**
CABO PRIORIÑO CHICO LIGHTHOUSE (FERROL)	3.0	4.3	5.0	5.0	3.7	3.3	3.7	4.7	4.7	**3.93**
CASTILLO DE LA PALMA BEACON (MUGARDOS)	2.7	2.7	4.0	5.0	3.3	3.0	4.0	2.0	5.0	**3.50**
OLD BEACON FACTORY AND WAREHOUSE AT A REDONDA (MUGARDOS)	4.0	3.3	4.0	1.0	3.3	4.0	4.0	4.7	4.7	**3.45**
RONCADOIRA LIGHTHOUSE (XOVE)	0.3	5.0	4.0	5.0	4.3	3.7	4.0	1.0	4.0	**3.38**
CABO ORTEGAL LIGHTHOUSE (CARIÑO)	0.3	2.3	4.0	5.0	5.0	4.0	5.0	1.7	4.0	**3.43**

Figure 16. Final assessment ratings of the Port Authority's Aids to Navigation.

A consensus was therefore swiftly established, since in the second iteration the standard deviation of all the values was less than 1. **Figures 14 and 15** show the assessment ratings and standard deviations obtained in this second iteration.

The weighting factors explained in section 1.5 were then applied to these assessment ratings, the result being a definitive table of the overall assessment of the potential for implementing new uses in the aids to navigation concerned, as shown in **Figure 16**.

These ratings were then used to produce an initial ranking of lighthouses according to the feasibility of implementing alternative uses: this was done by simply taking the total values obtained for each aid to navigation and listing them in ascending order (see **Figure 17**). The same information was also used to place each aid to navigation in its corresponding position on the value matrix explained in the first part of this article (see **Figure 18**).

Logically enough, almost all of the 15 preselected aids to navigation appear in the quadrant we referred to as "Priority Uses". The remaining aids to navigation (from the 99 that the Port Authority is responsible for in total) were not included in the first stage of this planning process and appear in other quadrants of the value matrix.

	Intrinsic Value	Extrinsic Value	Final Score
1. ESTACA DE BARES LIGHTHOUSE (MAÑÓN)	4.10	4.50	**4.30**
2. CABO PRIOR LIGHTHOUSE (FERROL)	4.30	3.80	**4.05**
3. CABO PRIORIÑO CHICO LIGHTHOUSE (FERROL)	4.07	3.80	**3.93**
4. OLD ISLA PANCHA LIGHTHOUSE (RIBADEO)	4.03	3.65	**3.84**
5. REAR RANGE MARKER BUILDING RIBADEO HARBOUR (RIBADEO)	3.30	4.03	**3.67**
6. OLD PUNTA ATALAYA LIGHTHOUSE (CERVO)	3.48	3.53	**3.51**
7. CASTILLO DE LA PALMA BEACON (MUGARDOS)	3.50	3.50	**3.50**
8. ISLA COELLEIRA BEACON (O VICEDO)	3.63	3.27	**3.45**
9. OLD BEACON FACTORY AND WAREHOUSE AT A REDONDA (MUGARDOS)	2.97	3.93	**3.45**
10. CABO ORTEGAL LIGHTHOUSE (CARIÑO)	2.50	4.37	**3.43**
11. RONCADOIRA LIGHTHOUSE (XOVE)	3.03	3.73	**3.38**
12. PUNTA CANDELARIA LIGHTHOUSE (CARIÑO)	2.90	3.53	**3.22**
13. A FROUXEIRA LIGHTHOUSE (VALDOVIÑO)	2.70	3.67	**3.18**
14. HOUSE NEXT TO THE OLD PUNTA ATALAYA LIGHTOUSE BUILDING (CERVO)	2.70	3.53	**3.12**
15. PUNTA PROMONTORIO BEACON (CEDEIRA)	2.93	2.30	**2.62**

Figure 17. Ranking of marine aids to navigation

1. ESTACA DE BARES LIGHTHOUSE (MAÑÓN)
2. CABO PRIOR LIGHTHOUSE (FERROL)
3. CABO PRIORIÑO CHICO LIGHTHOUSE (FERROL)
4. OLD ISLA PANCHA LIGHTHOUSE (RIBADEO)
5. REAR RANGE MARKER BUILDING RIBADEO HARBOUR (RIBADEO)
6. OLD PUNTA ATALAYA LIGHTHOUSE (CERVO)
7. CASTILLO DE LA PALMA BEACON (MUGARDOS)
8. ISLA COELLEIRA BEACON (O VICEDO)
9. OLD BEACON FACTORY AND WAREHOUSE AT A REDONDA (MUGARDOS)
10. CABO ORTEGAL LIGHTHOUSE (CARIÑO)
11. RONCADOIRA LIGHTHOUSE (XOVE)
12. PUNTA CANDELARIA LIGHTHOUSE (CARIÑO)
13. A FOROUXEIRA LIGHTHOUSE (VALDOVIÑO)
14. HOUSE NEXT TO THE OLD PUNTA ATALAYA LIGHTOUSE BUILDING (CERVO)
15. PUNTA PROMONTORIO BEACON (CEDEIRA)

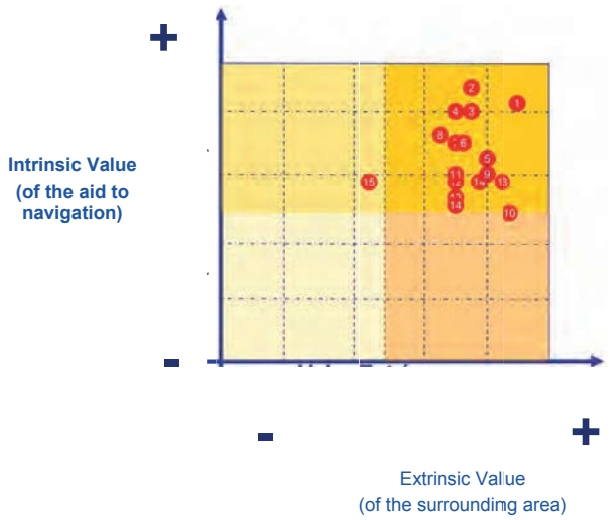


Figure 18. Value Matrix for the Port Authority's aids to navigation.

2.3. Creating alternative use scenarios

The next step in the process was to determine to what extent each use defined in the catalogue would fit the conditions of the preselected aids to navigation. This was done by creating a **distance algorithm** to compare each attribute and deduct the difference from the competence profile in the event of there being a negative gap with the aid to navigation in question (i.e. if the requirement for implementing the use was greater than the value assigned to the aid to navigation), a value equal to zero being assigned if the difference is positive or non-existent (in this case it is considered that no distance exists between one and the other, and the aid to navigation fulfils the attribute requirement).

After having obtained the said distances, the weighting coefficients referred to earlier were then applied in order to obtain a final aid to navigation / use distance. By way of example we show in **Figure 19** the comparison between each aid to navigation on the list and the use "CLASSROOM".

This operation was repeated for all 22 uses, the outcome being 22 use-aid to navigation matrices that we refer to as "**fit matrices**", the criterion being adopted that in the event of the gap being less than 0.5 the aid to navigation-use fit was classified as "feasible", and between 0.51 and 0.8, "viable". In the case in point of our example, the possibility of implementing the "classroom" use was considered feasible for the Isla Pancha, Cabo Prioriño Chico and Cabo Prior lighthouses, and viable for those at Punta Atalaya, Bares and La Palma. The full fit matrix is shown in **Figure 20**.

2.4. Catalogue of enhancement actions

With a view to reducing the distances or gaps of individual aids to navigation, it was decided to draw up a catalogue of **model enhancement actions**. These are shown in Figure 21; it should be noted that they are directed only at those aspects for which the Port Authority can act to improve the current situation.

This catalogue of model actions is cross-checked for each aid to navigation with the use fit matrices, generating planned action scenarios. Continuing with the example we have already used, when analysing the possibility of implementing a "CLASSROOM" use in the Cabo Prioriño Chico lighthouse we found a negative gap regarding accessibility by land: this indicated a need to improve land-based access and provide a car parking facility in the vicinity (work that is currently in progress). In the case of Cabo Prior lighthouse the areas in need of improvement were the state of repair of the lighthouse building, the size of the plot of land on which it stands (i.e. parking space), basic services (to permit the installation of restroom facilities) and land-based access (work is currently in progress on the first three of these).

	USE: CLASSROOM								
	INTRINSIC VALUE				EXTRINSIC VALUE				
	Building size	Plot size	State of repair	Current uses	Environmental quality of the surrounding area	Access by land	Geographical importance of the surrounding area	Utilities	USE GAP
RIBADEO RANGE MARKER	0	0.7	1	2	0	0	0	0	0.42
OLD ISLA PANCHA LIGHTHOUSE	0	0	1	0	0	1	0	1	0.20
OLD PUNTA ATALAYA LIGHTHOUSE	0	0	1	2.5	0	1	0	0	0.53
HOUSE NEXT TO P. ATALAYA LIGHT	1	0	1	3.3	0	1	0	0	0.85
ISLA COELLEIRA BEACON	0	1.3	1	0	0	4	0	4	0.85
ESTACA DE BARES LIGHTHOUSE	0	0	1	2	0	1.3	0	0.7	0.52
PUNTA CANDELARIA LIGHTHOUSE	0	2	2	3	0	2.3	0	2	1.13
PUNTA PROMONTORIO BEACON	1.3	2	1.3	0	0	3.7	0	4	1.18
A FROUXEIRA LIGHTHOUSE	2	2	1	0	0	1.3	0	3	0.93
CABO PRIOR LIGHTHOUSE	0	0.7	1	0	0	1.3	0	0.7	0.29
CABO PRIORIÑO CHICO LIGHTHOUSE	0	0	0	0	0	1.7	0	0	0.17
CASTILLO DE LA PALMA BEACON	0.3	1.3	1	0	0	2	0	2	0.54
A REDONDA FACTORY & WAREHOUSE	0	0.7	1	4	0	1	0	0	0.82
RONCADOIRA LIGHTHOUSE	2.7	0	1	0	0	1.3	0	3	0.87
CABO ORTEGAL LIGHTHOUSE	2.7	1.7	1	0	0	1	0	2.3	0.98

Figure 19. Fit matrix for "CLASSROOM" use.

		Ribadeo	Isla Pancha	Faro Punta Atalaya	Vivienda Punta Atalaya	Isla Coelleira	Estaca Bares	Candelaria	Punta Promontorio	Fouxeira	Prior	Prioriño	Castillo de la Palma	Punta redonda	Roncadoira	Ortegal
CULTURE	Museum / Visitor centre	1,06	0,81	1,29	1,67	1,34	0,52	1,53	2,08	1,56	0,66	0,81	1,20	1,28	1,42	1,38
	Exhibition room	0,71	0,46	0,94	1,32	1,10	0,52	1,18	1,73	1,21	0,37	0,46	0,85	0,93	1,07	1,18
	Classrooms	0,42	0,20	0,53	0,85	0,85	0,52	1,13	1,18	0,93	0,29	0,17	0,54	0,82	0,87	0,98
	Premises for social / cultural associations	0,56	0,34	0,67	1,05	1,00	0,52	1,08	1,33	1,13	0,29	0,37	0,74	0,82	1,07	1,18
SPORT & LEISURE	Hiking or cycling waystage	0,34	0,27	0,32	0,32	0,42	0,04	0,23	0,66	0,13	0,19	0,21	0,26	0,27	0,16	0,05
	Sports fields	0,17	0,34	0,02	0,02	0,60	0,10	0,43	0,66	0,34	0,21	0,07	0,23	0,17	0,00	0,27
	Lookout or observation point	0,45	0,52	0,67	0,67	0,61	0,13	0,53	1,11	0,41	0,47	0,56	0,61	0,51	0,39	0,10
	Footpaths, coastal promenade	0,30	0,37	0,52	0,52	0,57	0,13	0,38	0,96	0,26	0,32	0,41	0,46	0,36	0,24	0,10
LOGISCTIS & AtoN SERVICES	.AtoN logistics warehouse	0,29	0,24	0,47	0,85	0,70	0,28	0,53	0,93	0,78	0,13	0,37	0,46	0,55	0,92	0,86
	Communications link node.	0,00	0,00	0,00	0,05	0,10	0,00	0,00	0,16	0,25	0,00	0,00	0,00	0,15	0,39	0,36
	Weather stations	0,00	0,00	0,00	0,00	0,05	0,00	0,00	0,05	0,00	0,00	0,00	0,00	0,00	0,14	0,14
	DGPS station	0,00	0,00	0,00	0,00	0,05	0,00	0,00	0,05	0,00	0,00	0,00	0,00	0,00	0,14	0,14
	Lighthouse keeper accommodation	0,49	0,29	0,58	0,96	0,60	0,44	0,70	0,85	0,85	0,14	0,22	0,46	0,67	0,99	0,96
CATERING & ACCOMM.	Bar / Coffee shop	0,7	0,48	0,94	1,32	1,10	0,57	1,18	1,73	1,23	0,38	0,48	0,90	0,94	1,12	1,23
	Hotel / Hostel / B&B / Spa	1,35	1,16	1,50	1,88	1,54	0,70	1,78	2,39	1,81	0,96	1,06	1,50	1,56	1,63	1,58
	Youth hostel	1,01	0,71	1,05	1,53	1,35	0,57	1,43	1,98	1,46	0,56	0,65	1,10	1,14	1,22	1,43
	Camp site	0,37	0,37	0,34	0,38	0,95	0,27	0,78	1,32	0,66	0,42	0,25	0,64	0,49	0,28	0,49
OTHER USES	Shops	0,04	0,13	0,07	0,31	0,70	0,10	0,53	1,03	0,77	0,15	0,09	0,29	0,17	0,77	0,78
	Telecommunications relay	0,00	0,00	0,00	0,00	0,10	0,00	0,00	0,16	0,25	0,00	0,00	0,00	0,00	0,39	0,36
	Wind / solar farm	0,17	0,10	0,00	0,00	0,33	0,10	0,30	0,40	0,35	0,17	0,07	0,23	0,17	0,05	0,29
	Aquaculture	0,64	0,44	0,73	1,11	0,95	0,42	0,93	1,18	1,03	0,26	0,49	0,71	0,82	1,17	1,11
	Leasing space to third parties	0,34	0,08	0,44	0,56	0,62	0,37	0,83	0,68	0,42	0,12	0,09	0,15	0,62	0,52	0,46

Figure 20. Use- aid to navigation fit matrix.

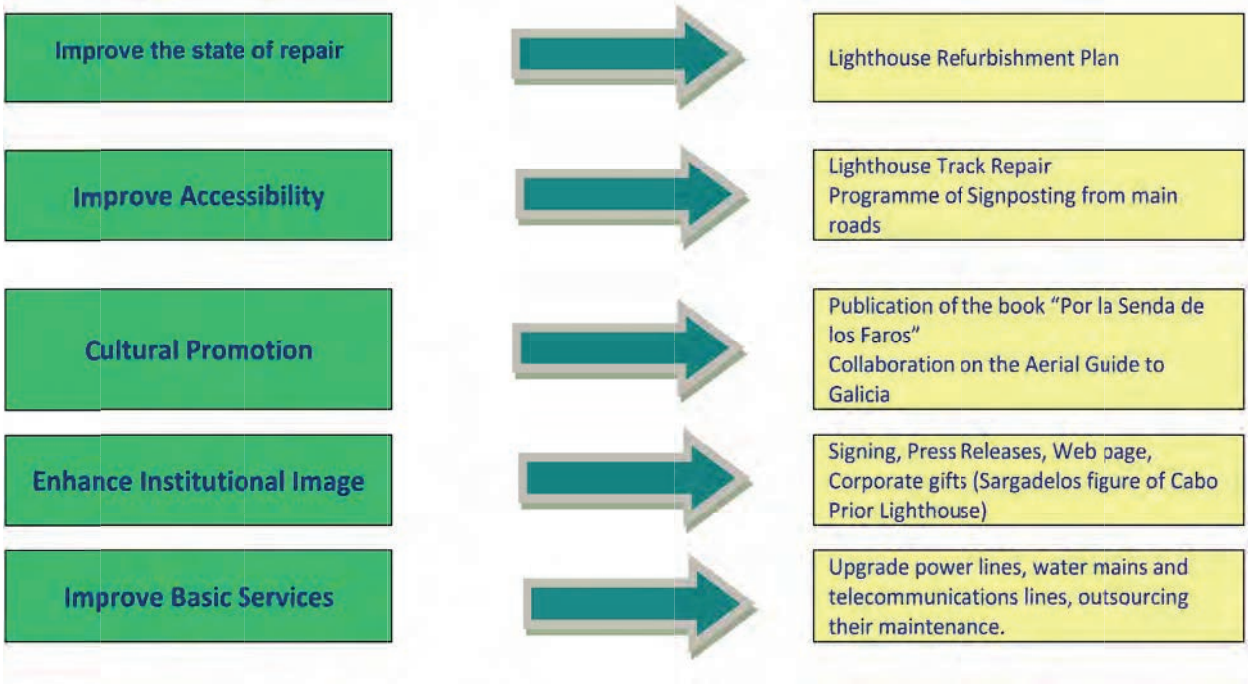


Figure 21. Enhancement Actions

To conclude this stage of the process, this kind of analysis enabled us to produce an action sheet for each lighthouse that also indicated the extent to which the actions to be undertaken would contribute to the creation of social and/or economic value or of a benefit to the Port Authority (i.e. the generation of income or reduction of costs). **Figure 22** shows the action sheet corresponding to the Cabo Prioriño Chico lighthouse. ■

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[1] It should be pointed out that the creation of socio-economic value becomes a benefit for the Port Authority if, through the use of the appropriate communication tools, its role in the creation of this value can be highlighted and drawn to the attention of the public.

[2] Obviously the influence of the size of the aid to navigation or the environmental quality of the surrounding area is different from that of its state of repair, an aspect that can easily be improved with the appropriate investment.

[3] This by no means excludes the need for the Port Authority to undertake the appropriate maintenance actions when necessary.

1. SIGNING (COMPLETED)
2. RELOCATION OF THE PUNTA VIÑAS GUN BATTERY (COMPLETED)
3. ARCHAEOLOGICAL DIG AT THE CANELAS GUN BATTERY (COMPLETED)
4. ARCHAEOLOGICAL INTERVENTION AT PRIORIÑO GUN BATTERY (IN PROGRESS)
5. CONSTRUCTION OF NEW VISITOR CENTRE (IN PROGRESS)
6. CONSTRUCTION OF A BIRD-WATCHING HIDE (IN PROGRESS)
7. IMPROVEMENT OF LAND-BASED ACCESS. RESURFACING OF ACCESS ROAD AND CONSTRUCTION OF A CAR PARK (IN PROGRESS)
8. REFURBISHMENT OF THE LIGHTHOUSE, CONVERSION TO HOUSING (COMPLETED)
9. CONSTRUCTION OF FOOTPATHS LINKING THE VARIOUS ELEMENTS (IN PROGRESS)
10. IMPROVEMENTS TO POWER, WATER AND TELECOMMUNICATIONS SERVICES (IN PROGRESS)
11. WIND FARM (FEASIBILITY STUDY IN PROGRESS)
12. DEMOLITION OF STRUCTURES AND BUILDINGS IN RUINS, CLEANLINESS AND IMPROVEMENT

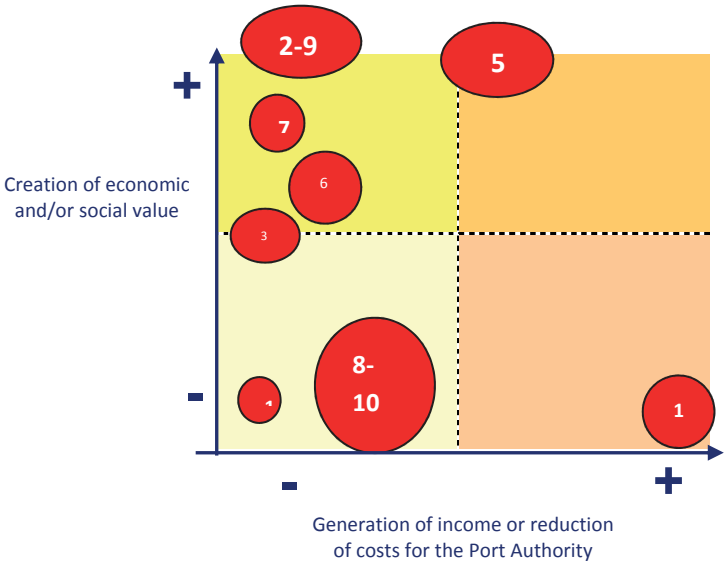

Figure 22. Action Sheet for Cabo Prioriño Chico.

68 LIGHTHOUSES AND THEIR LINK TO THEIR IMMEDIATE ENVIRONMENT

Eduardo Blanco. Port Authority of A Corunna, Spain

Marine signals have been fulfilling a key safety activity in maritime navigation ever since the old days. The evolution of the equipment installed in the lighthouses has greatly improved during the last few years, becoming more and more efficient as time goes by.

On the other hand, most of the buildings housing these signals have rarely changed since the day they were built. Consequently, those buildings have become real symbols of the neighbouring communities, which have incorporated them as a part of their culture.

As a result, these buildings -which formerly held the residences of the lighthouses keepers-, are increasingly attracting activities linked to the tourist and catering sectors, and their closest environment sees in them a key element for the development of the area.

Within the marine signals managed by the Port Authority of A Coruña we can find two premises that are perfect examples of this situation. We are talking about the Vilan Lighthouse, located in the Council of Camariñas and the Finisterre Lighhouse, located in the Council which shares name with the lighthouse.

In both cases, the lighthouse is the most outstanding touristic element of the council where it is located, not only because of its features as a building, but also due to the location where it stands.

As an example, we may say that the Finisterre Lighthouse is one of the most visited monuments in Galicia.

This paper deals with this particular feature of marine signals, which have become increasingly relevant on the course of their historical evolution, with a growing demand from their neighbouring communities to use these buildings for other purposes than navigation aids.
Here we will focus on the particular cases of Vilan and Finisterre Lighthouses.

Las señales marinas han estado desempeñando una labor de seguridad clave en la navegación marítima desde la antigüedad. La evolución de los equipos instalados en los faros ha mejorado en gran medida durante estos últimos años, siendo cada día más eficientes.

Por otro lado, la mayoría de los edificios que alojan estas señales casi nunca han sufrido modificaciones desde el día en que se construyeron, por lo que se han convertido en verdaderos símbolos de las comunidades vecinas, que los han incorporado como parte de su propia cultura.

Como resultado, estos edificios, que antiguamente albergaban la residencia de los fareros, atraen cada vez más actividades relacionadas con los sectores del turismo y la restauración, y su entorno más cercano los ve como un elemento clave para el desarrollo de la zona.

Entre las señales marinas gestionadas por la Autoridad Portuaria de A Coruña podemos encontrar dos instalaciones que son ejemplos perfectos de esta situación. Estamos hablando del faro de Cabo Vilán, situado en el concejo de Camariñas, y el faro de Finisterre, ubicado en el concejo con el que comparte nombre.

En ambos casos, el faro es el elemento turístico más destacado del concejo en que se localiza, no solamente debido a sus características como edificio, sino también al lugar donde se encuentra.

Como ejemplo, podemos citar que el faro de Finisterre es uno de los monumentos más visitados de Galicia.

Esta ponencia examina esta característica particular de las señales marinas, que se han convertido en cada vez más relevantes a lo largo de su evolución histórica, con una creciente demanda por parte de sus comunidades vecinas para que se utilicen estos edificios para otros fines diferentes a las ayudas a la navegación.

Aquí nos centraremos en los casos particulares de los faros de Cabo Vilán y Finisterre.

Les signaux maritimes jouent un rôle clé dans la sécurité de la navigation maritime depuis les temps anciens. Les équipements installés dans les phares ont beaucoup évolué ces dernières années devenant, avec le temps, de plus en plus efficaces.

D'autre part, les bâtiments abritant ces équipements ont rarement changé depuis le temps de leur construction. Ils sont donc devenus les symboles des communautés voisines qui les ont incorporés, comme faisant partie de leur culture.

Résultat, ces bâtiments, qui servaient de résidences aux gardiens de phare, attirent de plus en plus d'activités liées au tourisme et sont considérés dans leur proche environnement comme une clé du développement de la région.

Parmi les signaux maritimes gérés par l'Autorité du Port de La Corogne on trouve deux bâtiments qui sont de parfaits exemples de cette situation. Il s'agit du Phare Vilan, dans la commune de Camariñas et le phare de Finisterre, dans la commune du même nom.

Lighthouses and their link to their immediate environment

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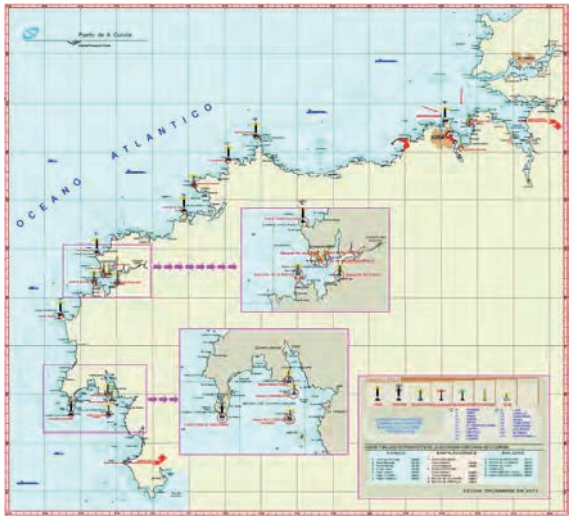
1. INTRODUCTION

In the year 1992, the management of marine signal lights was transferred from the Spanish Administration of Coastal Areas to Spanish Port Authorities, and also was the provision of their maintenance and repair services.

In this new scenario, Port Authorities were given not only the responsibility for the management of Aids to Navigation itself, but also for the maintenance of ancillary facilities involved in the operation of light signals, like buildings, roads, etc.

The marine light signals under Port Authority of A Corunna jurisdiction comprise the geographical strip comprised between Cape Punta Carboeira, in the Ría de Betanzos Inlet, and Cape Punta Remedios, South of Finisterre.

Within this coastal strip, there are seven lighthouses and six beacons, as well as four leading lights, among which two of them –Mera and Fieiteira- are linked to the access channels to the Port of A Corunna.



Among the lighthouses under the responsibility of the Port Authority of A Corunna, are found some of the most symbolic ones within the Spanish port system, for several reasons.

The Tower of Hercules lighthouse stands out from the rest for being the only fully preserved Roman lighthouse still in operation, and for being declared World Heritage Site since 2009 by UNESCO. Nevertheless, there are other premises that can be described as especially relevant in the national marine signal light system, either for their history or for their own architectural or geographical features.

Among those, the lighthouse at Cape Fisterra and the lighthouse at Cape Vilan merit special mention.

Fisterra lighthouse stands out not only for the beauty of the environment where it is located, but also for its significance throughout history as the "end of the earth", the Latin name for the cape where it is located (*Finis Terrae*).

On the other hand, the grandness of the building and the topographical uniqueness of its location are the most fundamental outstanding features in the case of the lighthouse of Cape Vilan.

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Both of them are located in the heart of the "Costa da Morte" (the Death Coast), the Galician coastal strip, witness of numerous founderings and shipwrecks, and well known for its roughen sea and steep cliffs. These features can only enlarge the beauty of the landscapes where these facilities are located.

These two lighthouses are closely linked to the immediate surroundings where they are built, and to the Councils where they are located, that is Fisterra and Camariñas.

This lecture will try to analyse the evolution of lighthouses up to the present date, as well as the increasing new social demands for their use, mainly focused on their most immediate geographical environment. Today we will take a close look at the lighthouses at Cape Fisterra and at Cape Vilan.

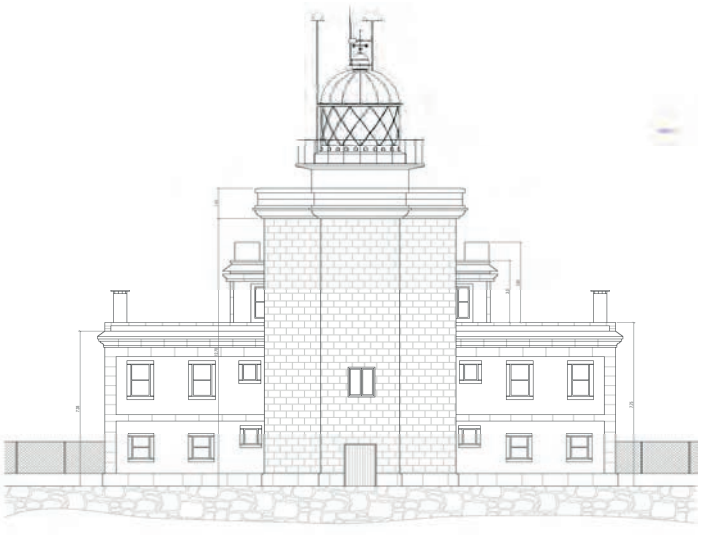
2. DESCRIPTION OF THE PREMISES

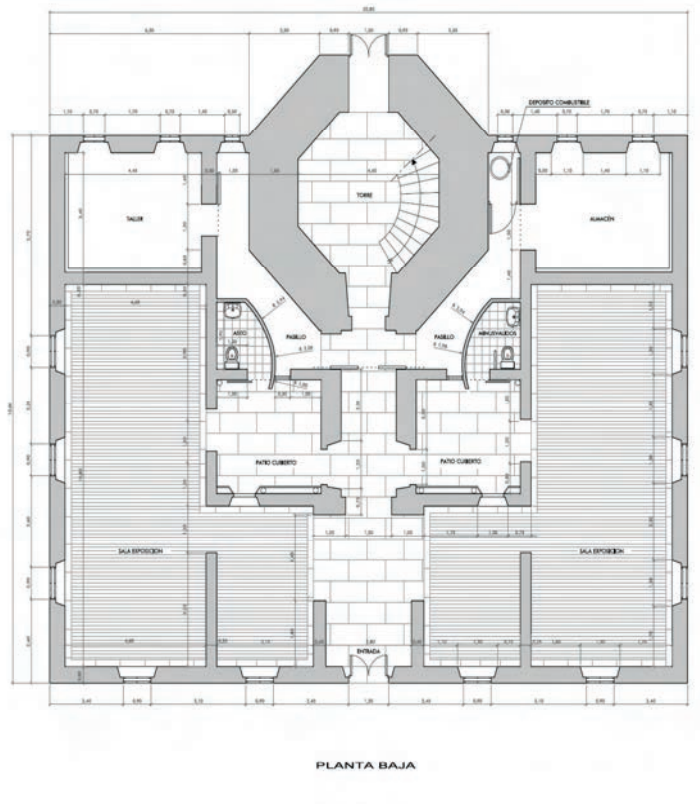
Before we go on with the main subject of this lecture, it may be necessary to start with a small description of both lighthouses, so as to enable afterwards a better understanding of the issues addressed.

2.1. The lighthouse of Cape Fisterra

This lighthouse was built in 1853. The existing facilities comprise two buildings. The first and most important is the lighthouse itself, which houses the tower and the lantern room, the auxiliary equipment (AIS, generators, communications, etc.), as well as the rest of the service rooms, like the original lighthouse keeper residence.

It is a rectangular based building, 20.80x15.20 metres, which originally consisted of ground and first floors. At a later date, a new space was added on the second floor.





The tower is located on the West façade and is 20.53 metres high. The lamp reaches 23 miles off.

The second building has a single floor, 15.45x8.40 metres, and it houses the machinery of the ancient foghorn, installed back on 1888 and currently out of work as a marine signal.

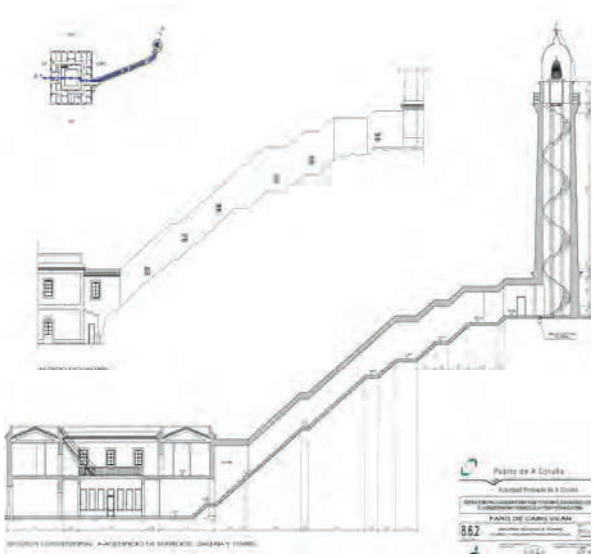
There is also a radio beacon, located on a small fenced plot. Furthermore, the Port Authority of A Corunna is responsible for the maintenance of the road from the village of Fisterra, some more of three kilometres long.

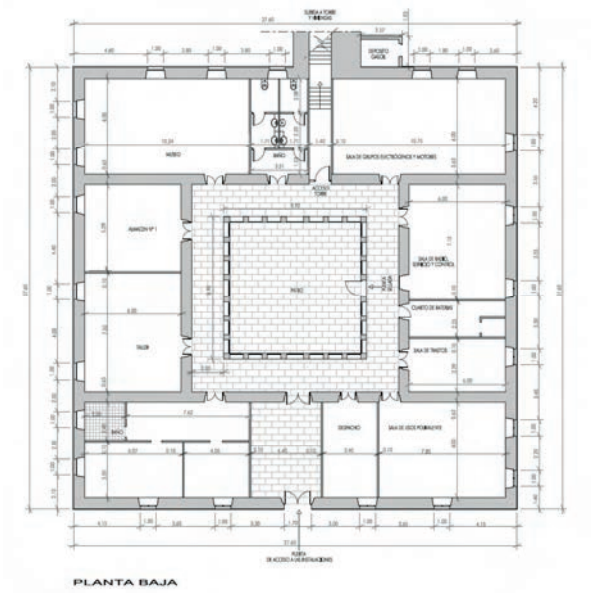
2.2. The Lighthouse of Cape Vilan

The premises managed by the Port Authority of A Corunna are, in this case, a two storey building (ground and first floor), with a square base of 27.60x27.60 metres. The ground floor houses all the rooms necessary for the operation of the lighthouse, whereas the first floor houses the residence of the lighthouse keepers. The building has an inner cloister on the ground floor, from where to access all the rooms, and which opens to an 8.90x8.90 metre patio.

A covered passageway, of approximately 40 metres long and built on the slope, gives access the lighthouse tower, which bridges a height difference of 21 metres. The tower is a separate structure, which has a circular base and it is perched on a rocky cliff standing out on the coast. It is 28.5 metres high from the base.

Near the building there are some small premises, dedicated to garage and storage, as well as the vestiges of the original lighthouse, built much deeper into the hill than the existing premises.

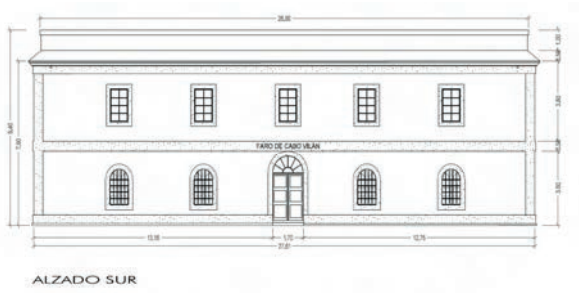




As in in the case of the Lighthouse at Cape Fisterra, the Port Authority of A Corunna is responsible for the maintenance of the road that connects the lighthouse to the nearby village of Camariñas. Moreover, the ancient foghorn –now out of use- is located nearby.

The existing lighthouse was built in the ends of the 19th century, even though the old lighthouse was built in 1854. We must point out the fact that this was the first electric lighthouse of Spain, firstly lit in 1896.

Eduardo Blanco
Port Authority of A Corunna, Spain



3. THE EVOLUTION OF LIGHTHOUSES

Generally speaking, coastal marine light signals were placed on spots located several kilometres apart from the nearest settlements, since their function required a concrete geographical position which was settled through the corresponding Lighthouse Plan.

This distance and their manual fashion operation made the presence of human means necessary to guarantee their on and off, as well as their correct functioning. In order to fulfil these needs, apart from the tower, they should build houses for the lighthouse keepers and staff on duty on the facilities.

In many cases these premises also housed the workers' families. This is the reason why in many of the so-called 'first order' facilities the buildings are of a significant size, with capacity for up to four homes, apart from the additional rooms for the auxiliary equipment of the lighthouse itself.

In the case of the Lighthouse of Cape Fisterra, the lighthouse tower is placed right inside the building itself, whereas in the case of Cape Vilan, the tower is free-standing, with a covered passageway that connects the tower to the building.

Automation process has dramatically increased over the last years. Initially through electric systems, and more recently, though the use of electronic devices. This has allowed for a greater autonomy of the marine signals, being even capable of notifying its operation status, thus enabling the port authority to see to their needs without requiring the permanent stay of the lighthouse keepers on the facilities.

Thus, the operation of the system of navigation aids is correctly fulfilled, since it also has several processes of preventive and corrective maintenance.

Nevertheless, this same fact has caused the emptiness of many of the spaces designed to house families into the original buildings; slowly, we are trying to fill in these vacant spaces with the help of different public and private associations.

These new demands mean a new challenge in the management of these facilities, so as to get an adequate operation of the facility, which would mean an adequate upkeep of the buildings, and, at the same time, guarantee the correct functioning and lack of interference over the systems of navigation aids.

3.1. The lighthouses at Cape Fisterra and Cape Vilan

The management of the systems of navigation aids, a responsibility of the Port Authority of A Corunna, is nowadays carried out by two groups of technicians.

One of them is responsible for keeping the marine signals located from the lighthouse of Point Nariga northwards, whereas the second group includes the coastal strip from the Ria of Cee and Corcubion, within which we may find the lighthouses of Cape Fisterra and Cape Vilan.

This second group is composed of four technicians, all of them belonging to the old Lighthouse Keepers Board of the State, who were transferred to the staff of the Port Authorities together with the responsibility over the management of marine signals, back in 1992.

That is why these four workers have the right to own a home within the lighthouse facilities; the right comes from their original contract, two of them in the lighthouse of Fisterra and the other two in the lighthouse of Vilan. These homes are still kept in both buildings nowadays.

Nevertheless, the ground floor on both buildings has no use linked to the navigation aid systems, except for the spaces needed for the operational purposes (accesses, equipment allocation, etc.).

4.LIGHTHOUSES AND THEIR ENVIRONMENT

Throughout history, lighthouses and their neighbouring settlements have been intimately linked; the villages have always felt the lighthouse as something of their own. This is particularly true in the case of the lighthouse of Fisterra with the homonym village of Fisterra and in the case of the lighthouse of Cape Vilan with the village of Camariñas.

They are settlements with a key maritime activity, mainly linked to the fishing sector, which have always perceived the lighthouse as a reference in their daily work.

But, furthermore, the lighthouse itself has become a source of extra income for the local people, not only at a heritage level, but also at a touristic one, since they are one of the most outstanding features in the tourist offer of the area.

In the particular case of Camariñas, its bobbin lace is famous worldwide and means an attraction in itself for visiting the village; but the lighthouse of Cape Vilan, due to the beauty of the environment and the impressiveness of the premises, adds to the attractions which enrich the existing offer.

As for the case of Fisterra, the major attraction is the history itself, as well as the legend of the area, always thought of as "the end of the earth". This is the second most visited spot of Galicia, right after the Cathedral of Santiago de Compostela, which helps anyone to realise the importance of the place. It is usual to find a great number of tourists strolling down the place any day at any given time.

It is a tradition to finish off the Way of St. James walking from the city of Santiago de Compostela towards the lighthouse of Fisterra to burn travelling clothes there; this is increasing more and more the number of visitors arriving there every year.

5. THE NEW DEMANDS FOR USE

The above mentioned circumstances generate in the lighthouse most immediate environment the need for providing additional facilities linked to the tourist activity (museum areas, catering industry, retail outlets, etc.), which in addition can constitute an additional source of income for local people.

These demands are not always met in a uniform fashion; being in some cases difficult to match with the structure and arrangement of existing buildings and their environment. Nevertheless, these demands remain a fact that all administrations should seek to address, always bearing in mind that ensuring navigation aids service is the main priority.

Together with this, visitors demand the possibility to access the lighthouse building, in particular the tower and the lantern, since they are the strategic spots of the lighthouse.

These demands have experienced an increasing trend for the last few years. Several social groups (schools, associations, etc.) and tourists request authorization to access and to visit the lighthouses facilities, and not limited to those open to general public.

This also arises within the local associations a growing interest in enhancing the lighthouses full tourism potential by means of using their interior rooms for alternative purposes (catering sector, museum, etc.).

5.1. Current situation of the lighthouses at Cape Fisterra and Cape Vilan

An agreement was signed in 2007 with Association Neria to authorize the use of a number of interior spaces within several lighthouses managed by the Port Authority of A Corunna to organise exhibitions and cultural activities.

Neria Association comprises the 16 municipalities that lie along the Costa da Morte (Death Coast) coastal strip, and the objective of this agreement is the cultural promotion of lighthouses for their architectural, historical and socio-cultural importance, as well as those of the areas where the lighthouses are located.

In practice, this agreement has been translated into the assignment for use of one small room located on the ground floor at the Lighthouse of Cape Vilán, and two rooms on the ground floor at the Lighthouse of Cape Fisterra. Authorization for using the ancient Touriñán lighthouse keeper's house is currently in process.

The room at the Lighthouse of Cape Vilán hosts a permanent exhibition of devices related to navigation aids, particularly lanterns, whereas the rooms at Finisterre are dedicated to exhibitions of all kind and several cultural events that take place along the year. In both locations, tourist information is provided and all exhibitions are free of charge.

Furthermore, in the case of the lighthouse of Cape Vilán, the Port Authority of A Corunna has signed an agreement with Camariñas Association of Entrepreneurs, authorizing the use of two rooms on the ground floor to organize cultural and touristic events. This Association has set up one of them to house a little shop and a cafeteria.

In both lighthouses, only the ground floor is open to the general public, and access to the upper floors or towers is not allowed, although a large number of applications for such permission are being received.

6. CONCLUSION. THE FUTURE OF LIGHTHOUSES

As it can be seen from the above, the immediate geographical environment of the lighthouses shows a growing demand for the use of their buildings. The number of applications related to the use of lighthouses and their access has constantly increased in the last years.

This partly arises from the perception of the lighthouse as a source of wealth, due to its great tourist appeal, thus seeking to enhance the economic performance generated by visits and tourism in the area.

Nevertheless, in my opinion, this close relationship is also related to the intimate link of the neighbouring populations with the lighthouse, which they feel as a property of their own.

In this sense, I believe that the existing premises related to marine signals which over time have lost their original purpose should be enhanced and made accessible for tourists and citizens alike, providing them with adequate offerings with a view to fostering their own values: history and legend, natural environment, …

Notwithstanding, these new uses cannot ignore the necessary sustainable economic performance, that must allow for an adequate level of maintenance of such premises, and this can only be achieved through uses that generate by themselves sufficient resources that guarantee a profitable business. This can only be obtained through a set of complementary projects working on one or several premises that either generate synergies or reduce operating costs, or enhance the offerings appeal. ■

106 ISSUES AND INNOVATION IN REMEDIATION OF CONCRETE ATON STRUCTURES-INCLUDING CASE STUDIES FOR HYDROGRAPHERS PASSAGE ATON STRUCTURES AND HISTORIC CAPE DON LIGHTHOUSE

Greg Hansen. Australian Maritime Safety Authority, Australia

AMSA utilises concrete structures in a variety of ways and locations within its aids to navigation (AtoN) network with some structures dating back to the late 19th century. Examples include concrete lighthouses, beacons, platforms and supporting columns, foundations, helipads and blockhouses surmounted by lanterns.

The paper will provide a detailed discussion of concrete issues within AMSA's AtoN network and innovation in repair methods. Aspects covered will include the evaluation of observed mechanisms of decay and the impact of patch repairs over time. There will be two case studies on larger remediation projects: Hydrographers Passage AtoN structures and historic Cape Don Lighthouse. Both projects were significant in terms of size, innovation achieved, complexity and cost. The paper will discuss the failure mechanism and testing process, repairs undertaken and outcome achieved.

Numerous images will be included to clearly demonstrate the issues and solutions achieved.

La AMSA utiliza estructuras de hormigón en diferentes pasos y lugares de su red de ayudas a la navegación (AtoN), siendo algunas de ellas de finales del siglo 19. Entre los ejemplos se encuentran faros, balizas, plataformas y columnas soporte, cimientos, helipuertos y fortines coronados por faroles.
La ponencia proporcionará un debate detallado de problemas con el hormigón dentro de la red AtoN de AMSA y la innovación en los métodos de reparación. Entre otros aspectos se tratará la evaluación de los mecanismos observados de deterioro y el impacto de los parches con el paso del tiempo. Habrá dos ejemplos prácticos en grandes proyectos de eliminación: Estructuras de AtoN en Hydrographers Passage y el histórico faro del cabo Don. Ambos proyectos fueron importantes en términos de tamaño, innovación alcanzada, complejidad y coste. La ponencia debatirá el proceso de comprobación y mecanismo de avería, las reparaciones llevadas a cabo y el resultado obtenido.

Se incluirán numerosas imágenes para probar claramente los problemas y las soluciones alcanzadas.

AMSA utilise des structures en béton de différentes façons et à différents endroits de son réseau d'aides à la navigation, et quelques structures datent de la fin du 19ème siècle. Il peut s'agir de phares en béton, de balises, de plates-formes et de leurs colonnes de soutènement, de fondations, de plates-formes d'hélicoptère et de bâtiments surmontés d'une lanterne.

Le rapport discutera en détails des problèmes de béton dans le réseau d'aides à la navigation d'AMSA et des innovations dans les méthodes de réparation. Les aspects abordés incluront l'évaluation des mécanismes de dégradation observés et l'impact des pièces de réparation au fil du temps. On présentera deux études de cas sur de plus grands projets de réparation: les structures de l'Hydrographers Passage et le phare historique du cap Don. Il s'agissait de deux projets d'importance en termes de taille, d'innovation réussie, de complexité et de coût. Le rapport présentera le mécanisme de dégradation et le processus de tests, les réparations entreprises et le résultat obtenu.

De nombreuses illustrations montrent clairement les problèmes et les solutions apportées.

Issues and Innovation in remediation of concrete Aids to Navigation (AtoN) structures
Including case studies for Hydrographers Passage Aton structures and historic Cape Don Lighthouse

Greg Hansen

Australian Maritime Safety Authority

Australia

IALA·2014·AISM
XVIII Conference · A Coruña · Spain

Issues and Innovation in remediation of concrete Aids to Navigation (AtoN) structures Including case studies for Hydrographers Passage Aton structures and historic Cape Don Lighthouse

Greg Hansen
Australian Maritime Safety Authority, Australia

1. INTRODUCTION

The Australian Maritime Safety Authority (AMSA) is an Australian Government regulatory safety agency with the primary role of delivering services in relation to maritime safety, maritime and aviation search and rescue and protection of the marine environment.

In the context of navigation safety, AMSA's primary responsibility includes the provision of the national aids to navigation network and navigational systems. One of the strategic objectives in this regard is to adopt technological advances to enhance the appropriateness, reliability and efficiency of the network.

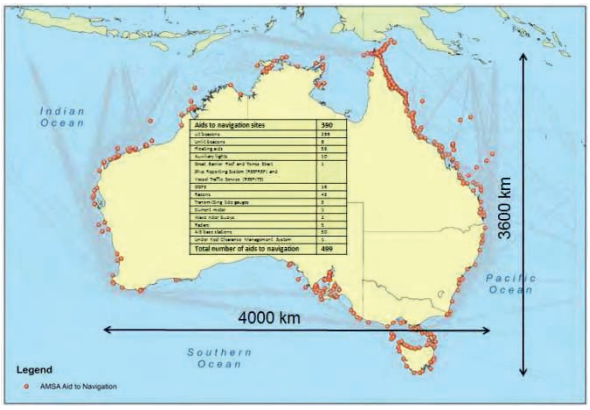


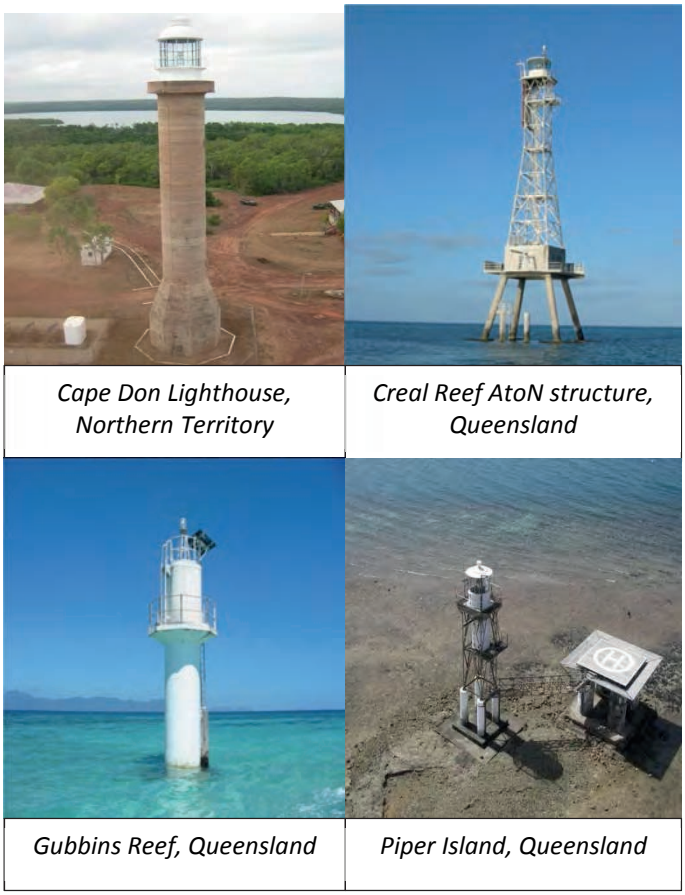
Figure 1: Map of AMSA's AtoN network

2 CONCRETE ATON STRUCTURES IN AUSTRALIA

AMSA has a wide range of concrete aids to navigation (AtoN) structure types within the AtoN network which have been installed from the early 1900's to current times. These range from traditional landfall lights to structures mounted in the water.

3 TYPICAL ISSUES OBSERVED IN CONCRETE

Situated primarily near or within the marine environment, AMSA's AtoN of concrete construction are subjected to a harsh life. The environmental conditions, and at times, some of the older construction methods have significantly influenced the rate of failure, cracking and delamination. The figures in **Table 1** show some typical deterioration, causes and age of structure.



Cape Don Lighthouse, Northern Territory | *Creal Reef AtoN structure, Queensland*

Gubbins Reef, Queensland | *Piper Island, Queensland*

Figure 2: Photos of AtoN structures with concrete materials

4 HYDROGRAPHERS PASSAGE AtoN STRUCTURES

4.1 Background

AMSA has a number of AtoN structures marking Hydrographers Passage in the Great Barrier Reef, approximately 110nm East of Mackay, Queensland. Hydrographers Passage was established in 1985 to provide a shorter route through the Great Barrier Reef for ships travelling to/from Japan, Korea or other northern Pacific ports to/from Hay Point, Queensland.

Hydrographers Passage consists of six lights built on top of Creal, Bugatti, Little Bugatti, Bond and White Tip Reefs.

These structures are of concrete pile construction with concrete decks and foundations, housing either stainless steel towers, concrete huts or a combination of the two. The solar power supply equipment is generally housed in the concrete huts and AtoN equipment at the top of the stainless steel tower.

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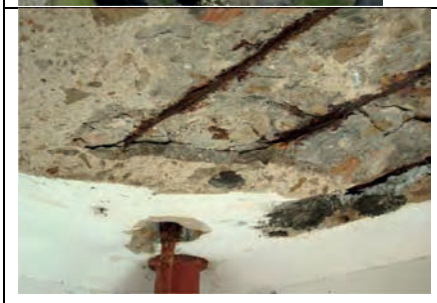
Defect photo	*Defect and cause*	*Age of structure*
	Spalling concrete on pile. Cause – high levels of chlorides at reinforcement levels.	Established 1985
	Spalling concrete ceiling inside concrete blockhouse. Cause - poor concrete mix, low concrete cover over reinforcement, evidence of shells in concrete. Assumed high concentration of chlorides corroding reinforcement.	Established 1921

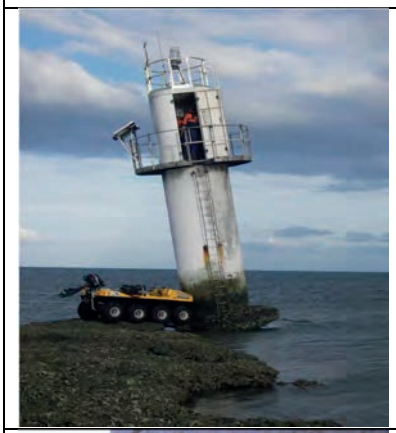
Defect photo	*Defect and cause*	*Age of structure*
	Concrete foundation failure. Cause - insufficient keying into reef, low mass of foundation.	Established 1975
	Cracking and spalling concrete on lighthouse barrel. Cause – chloride contamination however not purely propagating from the outside of the structure. May indicate salt water was used to mix the concrete.	Established 1916

Table 1: Typical concrete deterioration causes and age of structure

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Figure 3: Map of Hydrographers Passage

4.2 Issues

Progressively a number of the structures were showing signs of concrete reinforcement corrosion causing cracking and spalling of the concrete cover, primarily to the piles. An investigation undertaken by a corrosion specialist determined the cause of the spalling/cracking to be chloride contamination that had led to corrosion of the reinforcement.

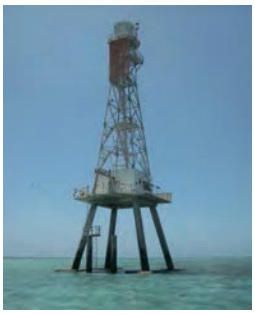
4.3 Remediation

Due to concern regarding the structural integrity of these important AtoN structures AMSA, undertook an open tender process to select a concrete repair and cathodic protection specialist to provide a long term repair solution.

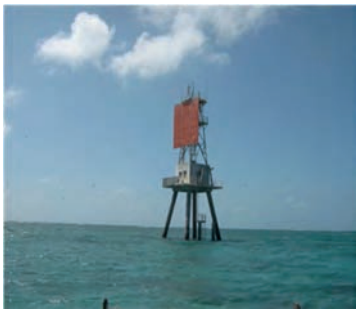
Due to the remote locations and exposed nature of the structures a robust, low powered solution was required that would reduce work within the tidal zone. As such a solution utilizing the "Lifejacket Galvanic Protection System," was proposed by Australian Maritime Systems Ltd (AMSL) to extend the life of the pylons by at least 20 years. The Lifejacket system consists of a fibre glass jacket lined with an expanded mesh zinc anode that does not require a permanent power supply.

When placed around the legs of the structure and filled with grout, the Lifejacket forms an electronic cell similar to a dry cell battery. The self induced current flowing between the two dissimilar metals significantly reduces the level of corrosion within the reinforcing steel of the structure.

As the successful tenderer, AMSL subcontracted US specialist company, ElectrotechCP, to supply the lifejacket system components, and Canadian company, Goal Engineering Ltd, to provide engineering design and material selection support.



Creal Reef



Little Bugatti

Figure 4 & 5: Example of Hydrographers Passage structures

4.4 How does the Lifejacket Galvanic Protection System work?

The LifeJacket Galvanic Protection System uses a proprietary zinc mesh anode placed directly against the inside face of a stay-in place fiberglass form, and is proven to stop corrosion by providing an electrical current to the affected region. The simple fiberglass jackets can be customized to fit any type of structural component with minimal effort required in the field.

One of the biggest advantages in using the LifeJacket System is that it restores concrete section loss and provides structural strengthening to deteriorated conditions. Once installed, the System does not require additional maintenance or monitoring. In addition, it does not require post-installation adjustments to keep the system operating properly. There is no need for wiring and complex conduit systems for routing current to the source. The System operates maintenance-free over its design life.

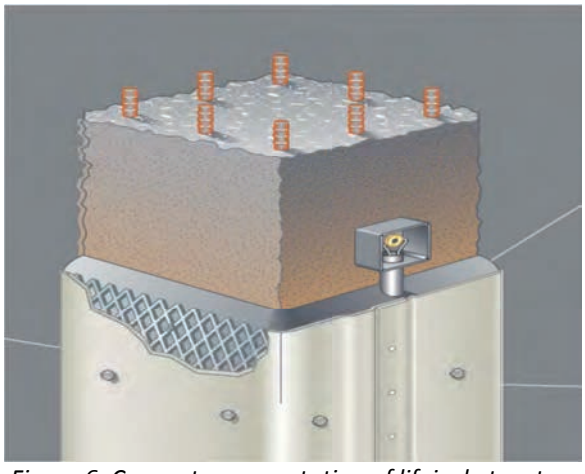


Figure 6: Concept representation of lifejacket system

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Australian Maritime Safety Authority, Australia

4.5 Site photo - Hydrographers Passage structure

As a result, five AtoN structures in the Hydrographers Passage are now proudly wearing their new lifejackets and will help guide ships safely for many years to come!

Figure 7: Hydrographers Passage structure with lifejacket fitted

5 CAPE DON LIGHTHOUSE

5.1 Background

The Cape Don Lighthouse situated on the western side of the Cobourg Peninsular, Northern Territory, was constructed to mark the eastern approach to Darwin, the passage between the Cobourg Peninsula and Melville Island.

The construction of the concrete lighthouse was completed in 1917. Over the last 20 years the structure has been progressively showing signs of concrete reinforcement corrosion, leading to spalling and delaminating of the surface concrete.

5.2 Issues

AMSA commissioned a condition survey and concrete investigation in 2007 to determine the mechanism causing the cracking and spalling of the concrete.

The report concluded that there were a number of contributing factors to the concrete degradation including Alkali Silica Reaction (ASR), carbonation and chloride contamination. The report also noted that the majority of the cracking in the concrete could be attributed to the ASR with some localised areas of reinforcement corrosion due to the carbonation and chloride contamination.

The tower can be considered to be constructed of two sections: the octagonal base and the cylindrical barrel upper section. The reinforcement in the tower consists of a single layer or bars extending from the foundation through to the balcony with a layer of expanded mesh on the outside of the octagonal base and inside of the shaft.

The octagonal base had large sections of spalling concrete on the external surfaces due to the corrosion of the external mesh believed to be due to the ingress of water through the cracks created by the ASR. As the barrel does not have the external layer of expanded mesh it only suffered from localised areas of spalling due to pitting corrosion of the main reinforcing bars. Further to this it was found that there was no continuity between the reinforcement.

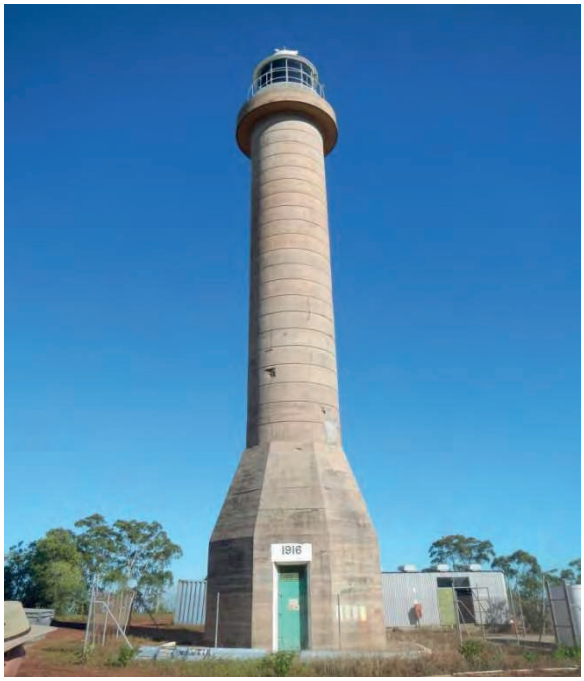

Figure 8: Cape Don lighthouse

5.3 Remediation

Over time the cracking and delamination was causing concrete to fall off the structure creating a risk to workers and people in the vicinity of the base of the lighthouse.

AMSA conducted a review on the best method for remediation of this structure. Impressed Current Cathodic Protection (ICCP), hybrid anodes

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systems, concrete jacket and electrochemical solutions were considered for their benefits. Factors that were considered were the remoteness of the site, solar power supply and a system which would require minimal through life monitoring and maintenance.

AMSA subsequently undertook an open tender process to select a concrete repair and cathodic protection specialist to provide a long term repair solution with the scope limited to the provision of an ICCP or hybrid anode system.

The successful tenderer, Marine and Civil Maintenance proposed the installation of a Duoguard Hybrid Anode system with a fifty year design life, this system offered the least monitoring and maintenance requirements of all systems proposed and no permanent power supply was required.

The Duoguard Hybrid anode system utilises discrete zinc alloy anodes installed in drilled holes with the anodes powered initially for a period of normally 7-10 days. The high initial cathodic protection current passivates the reinforcing steel, migrating chlorides away from the bars and restoring the alkaline (high pH) environment to the concrete. Following this initial impressed current phase, the power supply and temporary cables are removed, with the anodes then connected to the reinforcement via locally placed junction boxes to provide ongoing galvanic protection. The anodes provide a relatively low current that maintains the protection of the reinforcing steel and prevents further concrete damage. For the Cape Don Lighthouse repairs 4500 (DuoGuard D175,D500 and DuoGuard Plus) anodes were installed.

5.4 How does DuoGuard work?

5.4.1 Phase 1 – Short-term Impressed Current

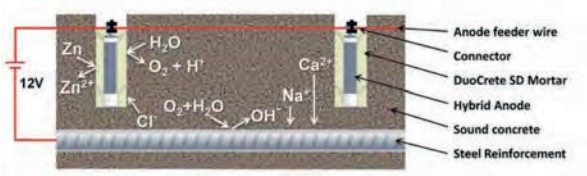

Figure 9: Phase 1 – Short-term Impressed Current Phase

The application of the ~7 day high current density treatment has the effect of halting corrosion activity on the reinforcing steel surface. It achieves this by moving corrosion to the installed anodes whilst reinstating the alkaline environment at the steel.

5.4.2 Phase 2 – Long-term Galvanic Current

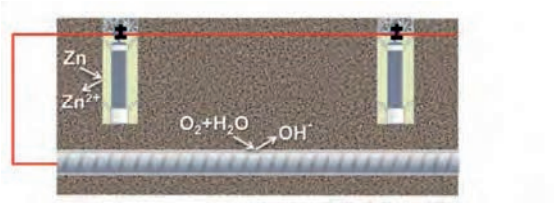

Figure 10: Phase 2 – Long-term Galvanic Current

Following the high current density treatment, the anodes are connected directly to the steel using the already installed XLPE coated titanium wire to pass a galvanic current without the need for a power supply. This has the effect of maintaining the environment created during Phase 1, preventing corrosion for years to come.

5.5 Site photos – Cape Don Lighthouse

Figure 11: Cape Don lighthouse repair photos

6 CONCLUSION

The majority of AMSA's AtoN structures are located in very remote locations that are difficult to access and have limited power supply infrastructure. Maintenance is generally only carried out annually or in some cases every two years.

Concrete failure can be caused by numerous factors. It is important to understand the failure mechanism before designing a repair solution to ensure that a durable long term repair can be achieved.

In selecting a suitable repair method for the Hydrographers Passage and Cape Don AtoN structures AMSA's goal was to implement durable long term repair solutions that required minimal through life maintenance.

111 "MAPPING OUR MARITIME HERITAGE" A METHOD FOR THE DOCUMENTATION AND PRESENTATION OF MARITIME HERITAGE, REACHING IT'S AUDIENCE THROUGH PHONES, PADS AND PC/MAC'S

Jo Van der Eynden, Jan Robert Jore. Norwegian Lighthouse Museum, Norway

We will present the pilot project "Maritime cultural landscape – Lindesnes", which is a project based on a digital map, where information in the form of text, photos and short films is geo-tagged to geographical positions. A technological platform has been developed, based on the use of digital maps and geo-tagged documentary films, photos and text. The pilot project is focusing on Lindesnes Lighthouse, and the local environment, presenting the lighthouse history, and the lighthouse as part of a wider cultural landscape with other ATONs, historical harbors, fishing communities, pilots and so on. The project has been developed in close cooperation with the national lighthouse authorities From the platform developed through the local pilot at Lindesnes, the project has now been widened for use in a national perspective, where a network of maritime museums will cooperate and contribute with information. The platform has also been used to do a Scandinavian pre-project, with the support from the Nordic Counsil, and hopefully the perspective can be extended to a wider international level, based on the contribution from maritime museums, lighthouse museums, and lighthouse authorities. Indeed, our aim is to use this project to build an international maritime heritage network that can be formally recognized at the IALA conference in Spain in 2014. The goals of the project are: Reach people with maritime history through smart phones, pads and PC/Mac. By utilizing net based mobile technology museums can reach new groups of interested people with the maritime history of their region. Tourists and students are obvious targets for the new service together with everybody else interested in maritime history. The content: Developing a technological platform has been one goal for the project, but the development of content for the service has been even more important. Five thematic documentary films have been made, covering topics from navigational installations, lighthouse history to weather and food from the sea. Short documentary films have been made covering specific geographical places and its maritime history. By using the digital map and assigning icons to geographical positions, the user of the service can get access to documentary films, photos and text telling the story of that specific geographical location

Presentaremos el proyecto piloto «Maritime cultural landscape – Lindesnes», que es un proyecto basado en un mapa digital sobre el que se etiqueta y asigna geográficamente información en forma de texto, fotografías y películas cortas a posiciones geográficas. Se ha desarrollado una plataforma tecnológica basada en el uso de mapas digitales y documentales, fotografías y textos etiquetados geográficamente. El proyecto piloto se centra en el faro de Lindesnes y el entorno local, presentando la historia del faro y el propio faro como parte de un panorama cultural más amplio junto con otras AtoN, puertos históricos, comunidades de pescadores, pilotos, etc. El proyecto se ha desarrollado en estrecha colaboración con las autoridades nacionales de faros. A partir de la plataforma desarrollada mediante el proyecto piloto local en Lindesnes, ahora se ha ampliado el proyecto para su utilización con una perspectiva nacional, donde una red de museos marítimos colaborará y contribuirá con información. La plataforma también se ha usado para realizar un anteproyecto escandinavo, con el patrocinio del Consejo Nórdico, y cabe esperar que la perspectiva pueda extenderse a un nivel internacional más amplio, basado en la contribución de museos marítimos, museos de faros y autoridades de faros. En realidad, nuestro objetivo es utilizar este proyecto para construir una red de patrimonio marítimo internacional que pueda ser formalmente reconocida en la conferencia de la IALA que se celebrará en España en 2014. Los objetivos del proyecto son: hacer llegar a la gente la historia marítima a través de smartphones, tabletas y PC/Mac. Utilizando tecnología móvil basada en red, los museos pueden llegar a nuevos grupos de personas interesadas en la historia marítima de su región. Los turistas y los estudiantes son objetivos obvios del nuevo servicio, además de todo aquel que también esté interesado en la historia marítima. Contenido: desarrollar una plataforma tecnológica ha sido uno de los objetivos del proyecto, pero todavía ha sido más importante el desarrollo del contenido para el servicio. Se han realizado cinco películas documentales temáticas, tratando temas que van desde las instalaciones de navegación y la historia de los faros hasta el clima y los alimentos del mar. También se han realizado documentales cortos

cubriendo lugares geográficos específicos y su historia marítima. Utilizando el mapa digital y los iconos asignados a posiciones geográficas el usuario del servicio puede acceder a películas documentales, fotografías y textos que relatan la historia de dicha localización geográfica específica.

Nous présenterons un projet pilote « Paysage culturel maritime - Lindesnes » basé sur une carte électronique où l'information, sous forme de textes, photos et courtes vidéos est géotaggée vers des positions géographiques. Une plate-forme technique a été mise au point, qui utilise des cartes numériques et des films documentaires, textes et photos géotaggés. Le projet-pilote se concentre sur le phare de Lindesnes et son environnement ; il présente l'histoire du phare et sa place dans un paysage culturel plus large en compagnie d'autres aides à la navigation, de ports historiques, de communautés de pêcheurs, de pilotes, etc... Il a été développé en étroite collaboration avec le service de signalisation maritime national. De la plate-forme développée pour le pilote de Lindesnes, le projet a maintenant été élargi pour être utilisé au niveau national avec la collaboration d'un réseau de musées maritimes fournisseurs d'informations. Cette plate-forme a aussi été utilisée pour un pré-projet scandinave avec l'aide du Conseil Nordique et on espère que sa portée deviendra internationale avec la coopération de musées maritimes, de musées des phares et des services de signalisation maritime. Vraiment, notre but est de nous servir de ce projet pour construire un réseau du patrimoine maritime international, qui pourra être officiellement reconnu à la Conférence de l'AISM, en Espagne en 2014. Ses buts sont les suivants : atteindre les personnes intéressées par le patrimoine maritime au moyen de smart phones, tablettes et PC/Mac. En utilisant la technologie du web mobile les musées peuvent toucher de nouveaux groupes de personnes intéressées par l'histoire de leur région. Les touristes et étudiants sont des cibles évidentes pour ce nouveau service, de même que toute personne qui s'intéresse à l'histoire maritime da sa région. Le contenu : Le développement d'une plate-forme technologique a été l'un des buts de ce projet, mais le développement du contenu a été encore plus important. Cinq films documentaires thématiques ont été réalisés, couvrant les installations de navigation, l'histoire du phare, la météorologie, la nourriture issue de la mer. Des films documentaires courts, décrivant des emplacements géographiques spécifiques et leur histoire ont aussi été tournés. A l'aide d'une carte électronique et de l'assignation d'icônes aux positions géographique, l'utilisateur du service a accès à des films documentaires, des photos et du texte qui racontent l'histoire de cette position géographique.

"Mapping our maritime heritage" A method for the documentation and presentation of maritime heritage, reaching it's audience through phones, pads and PC/Mac's

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1. WWW.COASTLIGHT.NET

The expression "cultural landscape" is used to identify how man has shaped nature and his surroundings through history. Usually this concept is referring to the agrarian cultures, and how farming and domestic animals have shaped our natural environment. But there is also a different cultural landscape: a landscape, both physical and mental, shaped by man's maritime activities and our relationship to the sea. This can be referred to as a "maritime cultural landscape" or just a "sea-scape", if you wish.

The lighthouses are of course, among the most obvious and important elements in such a sea-scape, but often the lighthouse is perceived and described as unike, single, isolated installation "at the end of the world" (literally speaking). Through the project "Maritime cultural landscape – Lindesnes", we have tried to show that the lighthouse is part of a diverse system of ATONs, and indeed also a part of a fascinating historical "sea-scape" with a great diversity of objects, installations and tangible and intangible symbols of our maritime past.

The project is based on the use of a digital map, where information in the form of text, photos and short films is geo-tagged to geographical positions. A technological platform has been developed, based on the use of digital maps and geo-tagged documentary films, photos and text. The pilot project is focusing on Lindesnes Lighthouse, and the local environment, presenting the lighthouse history, and the lighthouse as part of a wider cultural landscape with other ATONs, historical harbors, fishing communities, pilots and so on. The project has been developed in close cooperation with the national lighthouse authorities

From the platform developed through the local pilot at Lindesnes, the project has now been widened for use in a national perspective, where a network of maritime museums will cooperate and contribute with information.

The platform has also been used to do a Scandinavian pre-project, with the support from the Nordic Counsil, and based on the feedback from our international network of contacts and partners, an English version of the project has been developed under the title www.coastlight.net to make it possible to extend the perspective to a wider international level, based on the contribution from maritime museums, lighthouse museums, and lighthouse authorities. Indeed, our aim is to use this project to build an international lighthouse heritage network to document, present and promote our historical lighthouses and ATONs as part of our common world heritage.

The goals of the project are:

Reach people with maritime history through smart phones, pads and PC/Mac. by utilizing net based mobile technology museums can reach new groups of interested people with the maritime history of their region. Tourists and students are obvious targets for the new service together with everybody else interested in maritime history.

The content:

Developing a technological platform has been one goal for the project, but the development of content for the service has been even more important. Several thematic documentary films have been made, covering topics from navigational installations, lighthouse history to weather and food from the sea. Short documentary films have also been made covering specific geographical places and their significance to maritime history. By using the digital map and assigning icons to geographical positions, the user of the service can get access to documentary films, photos and text telling the story of that specific geographical location.

The presentation:

The presentation will focus on the technological platform and the structure and functionality of the concept. Since the time given for the presentation is very limited, we have chosen to make a short film (5 minutes) to explain the technological platform and the functionality, as well as giving some very short examples and extracts from some of the films. ■

119 ANALYSIS ON PROTECTION OF HISTORICAL LIGHTHOUSES IN CHINA

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Some protective measures on historical lighthouses were summarized by the description on the evolution and value of China's historical lighthouses. And some suggestions on some practical problems and how to improve the protective regulation were proposed.

Algunas medidas de protección sobre los faros históricos fueron resumidas mediante la descripción sobre la evolución y valor de los faros históricos en China. Se propusieron algunas sugerencias sobre problemas prácticos y cómo mejorar la regulación protectora.

Le rapport résume, par la description de l'évolution et de la valeur des phares historiques de Chine, quelques mesures de protection des phares historiques. Il propose également quelques suggestions pour résoudre des problèmes pratiques et pour améliorer la réglementation applicable à leur préservation.

Analysis on Protection of Historical Lighthouses in China

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I FOREWORD

China's lighthouses can be dated back to the Tang Dynasty about 1,400 years ago, and prospered after 1840, in the Qing Dynasty. The transformation of the historical lighthouses reflects the development and change of Chinese society.

More and more people came to understand the importance of protecting historical lighthouses with the further study of their value. To investigate how to establish a more perfect protective regulation, the paper attempts to summarize some protective measures on historical lighthouses by the description on the evolution and value of historical lighthouses at present. And some suggestions on some practical problems and how to improve the protection regulation to better carry on the traditional lighthouse culture were proposed.

II A GENERAL DESCRIPTION OF CHINA's HISTORICAL LIGHTHOUSES

1. Ancient China's lighthouses before 1840

It is a long story for the Chinese people making use of lighthouses. In the period of Zhenguan of Tang Dynasty (627-654), the Huaishen Temple was built at the Pearl River with a tower lit during the night guiding ships to enter the Guangzhou Port. This was the earliest man-made structure ever recorded in China's history that can be regarded as a lighthouse, and was the commencement of China's history of using lighthouses as an A-to-N.

Besides, quite a number of ancient pagodas, such as Maota in Qingpu, Shanghai, the Twin Pagoda on the Jiangxin Island of Wenzhou and the Six Harmony Pagoda in Hanzhou , were god examples of ancient China's A-to-Ns guiding ships' navigation. These pagodas, built at seaside or river side, were mostly Buddhist constructions funded by local people or alms collected by monks. They were lit at night by monks or religious people. The initial purpose of lighting them was not to help navigation, but in fact, they functioned as lighthouses at the same time they served religious purposes.

Maota, built in Qingpu, Shanghai more than 11 centuries ago

2. Ancient China's lighthouses from 1840 to 1949

China began to build lighthouses on a big scale after Opium War in 1840, when the Qing Dynasty allocated the work of building and maintaining lighthouses to the Customs House and established a Ship Financing Department, a special office in charge of the construction of A-to-Ns. From then on, the construction of lighthouses began to extand to the north and south of the Changjiang River Mouth. According to historial data, China built 137 lighthouses in all along the coast up to 1948, exclusive of those in Hongkong and Macao.

Influenced by west civilizations, the construction of China's lighthouses absorbed the advanced western ideas and technologies, equipment and management from the very start. Many of the lighthouses were strongly built with fine technologies and are still working as A-to-Ns.

3. The present situation of China's historical lighthouses

The ancient lighthouses in China still existing now are mostly placed in scenery as famous historical relics or historical interest for people to visit and are protected by the relevant cultural relics protection sectors and financed by the local government. This paper places the emphasis on the analysis of the lighthouses in modern history.

Hua-niao Hill Lighthouse built in 1870

With the passage of time, some of the lighthouses in modern times were destroyed in wars, or disued as a result of the change in navigation channels, or became extinct as a result of the development of the location. For example, the Hudunshan Lighthouse built in 1865. Because the mountain was leveled to leave room for the construction of a new port in the 1970s, the lighthouse was eliminated as a whole. Fortunately, most of the lighthouses built in modern times are still in work and continue to function as A-to-Ns, some of which are playing a more important role when installed with the more advanced A-to-N equipment such as the AIS shore station and Racon.

III THE VALUE OF HISTORICAL LIGHTHOUSES

China's historical lighthouses came into being and development together with navigation activity. Every lighthouse is a treasury of important data for the culture, economy, science and military, and there are historically, scientifically and artistically valuable.

1. Historical value

There are some interesting stories for each lighthouse and every lighthouse is a mirror of the ups and downs of the society and historical development.

The light tower in the Huaishen Temple, as mentioned above, is the lighthouse that was recorded earliest in the history. And the temple is the one that enjoys the longest standing in China. It was built by Ebi wakkasu, one of the disciples of Mohammad's, the creator of Islam, who arrived in Guangzhou from the Percian Gulf in the first years of the Tang Dynasty. From this temple, we can dig up the development of shipping industry and foreign trades in China at the time and other information concerning the desemination of Islam in China.

The Laotieshan Lighthouse, built at the southernmost part of Liaodong Peninsula in 1893, witnessed the Sino-Japanese War, the Japan-Russian War and World War II. Its ownership changed hands for seven times, from which we can discern China's unfortunate and miserable modern history.

2. Scientific value

The builders of the lighthouses were very particular in the choice of the sites, the style of the structure, the selection of material and the construction technologies. The lighthouses built in different time and different background were also different in the tower, the light equipment and auxiliary equipment. Therefore, they can reflect how the science and technology at the time developed. For example, the Huaniao Hill Lighthouse, built in Tongzhi 9 of the Qing Dynasty is a case in point. The optical lenses used on every of the four sides in the main light are 1.84 m in diameter bull-eye lenses. Every lens was assembled by 8 layers of three-edged crystal after precision abrasion.

The technology in abrasion and assembling are still marvelous even in modern times, for the lighthouse still functions very well after being in work for more than a century.

3. Artistic value

Ancient China's lighthouses are of different postures and grace in artistic construction styles as they were built for different purpose, influenced by different religions and by very different builders. For example, the Six Harmony Pagoda built at the Qiantang River, Hangzhou, in the period of Kaibao, North Song Dynasty (970 A.D.) is an excellent example in post and penal structure in China and is very precious in China's construction history.

The lighthouses in modern times in China are reflections of the construction styles of many European Countries, as a result of the in-coming of western culture. For example, the Naozhou Island Lighthouse was designed by a French engineer and built with basalt from the locality. The wonder lies in the structure of the twoer itself. The mainstay of the tower is the cylinder in the center that was an organic part of the steps in it, which were piled up in a spiral way. One end of the steps forms the central cylinder, while the other end forms part of the wall of the tower. The design was indeed terrific creation.

Most of China's modern lighthouses are still working as A-to-Ns, which reserved not only their structures, environments but also styles of usage. They are live relics and are valuable both in protection and use. So they are very precious.

IV RELEVANT PRACTICE ON THE PROTECTION OF HISTORICAL LIGHTHOUSES

At present, the society as a whole and the relevant administrative organizations have attached far greater importance to the protection of lighthouses with the strengthening of the intention to protect cultural relics on the part of the public. For the moment, apart from preserving as much as possible the original styles and the cultural relics data, our measures in this respect also include increasing the dissemination of the lighthouse culture so as to enrich their connotation and raise their social value.

1. Establishing relevant rules and regulations

The Maritime Safety Administration of the PRC promulgated the Administration of Historial Lighthouses in China's territorial Waters (Provisional) in 2004, which is a very good guide in how the A-to-N administration organizations should protect the lighthouses. Apart from that, some effective rules and regulations have come into shape in our routine work in this respect.

1) Some of the A-to-N administrative organizations have stipulated by-laws in this respect and have established work-teams to specially protect the lighthouses. And they have put down in writing the responsibilities of each member, the tasks being split down to concrete actions, methods, i.e., recourse and proof of liabilities and mode of financing, etc.

2) We have established a registration rule for the relics from the lighthouses. Any of the articles replaced from the lighthouses shall be inspected and qualitatively examined, registered, warehoused and recycled so as to ensure that the article in question is locked up in a closed loop.

2. Adopting technical protective measures by combining traditions and modern methods

The traditional skills and the modern technology were combined to repair seem old as possible in the process of repairing the lighthouses. It is means that not only to keep the structure and style of the original building features but also improving the navigational aids ability.

1) We have prospected and mapped the lighthouses using modern technology. Coordinating with surveying and mapping teams, we mapped the floor plans, the interior structures, axonometric charts and some of the important structural and geological parameters so as to perfect the fundamental data of these lighthouses.

2) Selection of Lighthouse construction material is important. The materials used at the time of construction were maily bricks, stones, brass, iron, etc. In the course of renovation, we pay proper attention to the use of material, especially the use of traditional material, such as the hooks and

hinges for the doors and windows, the locks and the hooks for the light shades. For these, brass is usually used to resist corrosion. We see to it that they are properly marked so as to ensure that the right material is used.

3) Implementing scientific methods of protection is important. While ensuring that the original structures, the quality of material, the outlook, decoration and colors are not changed, we apply new technology to protect historical lighthouses. For example, the exterior of lighthouses is painted with a multi-layer of aluminum thermoplastic spray and other protective measures are used, such as installing remote sensing systems. Besides, we built a new lighthouse exactly the same as the original one when it is impossible to preserve it at its original site. A successful example is the reconstruction of the Seven-mile Island Lighthouse. The old lighthouse is removed to the Lesser Seven-mile Island for people to visit.

3. Collecting lighthouse relics and setting up lighthouse museums (exhibition)

By collecting, preserving and exhibiting lighthouse relics, we construct the means pf spreading lighthouse culture so as to attract more and more people and social organizations to protection of historical lighthouses.

1) Laying stress on collecting relics to be exhibited at the original site of the lighthouses is recommended. In recent years, we set up exhibitions for lighthouse culture at some historical lighthouses that are attached with significance. Huaniao Hill lighthouse and Luojia Mount Lighthouse are cases in point. We collect and sort out the first-hand material about lighthouse construction and equipment, preserve and exhibit the original construction material, tools on the lighthouses, old fashioned lenses, charts for renovation and decoration, lighthouse logbooks, chronicles of important events and the photos and objects of former administrative personnel.

2) Building museums for historial lighthouses. China A-to-N Exhibition was set up at Qinhuangdao in 2000, which is one of the few national A-to-N exhibitions in the world, where numerous light equipment, models and written documents and pictures systematically describe the historical progress of lighthouses and thus becomes one of the bases to spread basic scientific knowledge. In 2005, the A-to-N administration department, coordinating with the local government, set up in Aoshan, Zhejiang, China Lighthouse Museum, China's first museum with lighthouse as the subject. Up to now the museum has accommodated 150,000 visitors with good results.

The Huaniao Hill Lighthouse Exhibition

4. Deseminating lighthouse culture by multi-media

In recent years, the MSA of the PRC has organized and published History of China'sA-to-Ns, Album of China's A-to-Ns and Chna's A-to-N Culture, etc. In 2002, China Post Office selected five of the historical lighthouses of great significance and put them on stamps. In 2010, the Central TV Station recorded and broadcast a documentary entitled Narration of China's Lighthouses, which introduced the history of lighthouse development. It is by these media that more of the public are informed of and love lighthouses, thus enhancing the social notability of historical lighthouses.

5. Actively apply for national cultural relics protection units

We actively apply for cultural relics protection units to better protect those lighthouses of different structural styles and historical backgournd. Up till now, 18 historical lighthouses, such as those in Laoteishan, Tuandao Island, Huaniao Hill, have been approved as historical relics units. These lighthouses enjoy very high local notability and are attached with great concern and become name cards for the historical styles and features of the locality.

V PROBLEMS ENCOUNTERED IN THE PROTECTION OF HISTORICAL LIGHTHOUSES

Due to the progress of science and technology and the necessity resulting from the navigation development, those historical lighthouses that still function as A-to-Ns are invariably faced with renovation and upgrading. Under the new circumstances, the historical lighthouses will encounter new problems that are hard to evade.

1. The uncertainty of lighthouse protection

Although some rules and regulations have been promulgated for the protection of cultural relics, there is a lack of operational bylaws for definitions, contents and procedures. Lighthouses, especially those that have not been listed as cultural relics protection units, are largely subject to the consciousness of the administration departments.

2. The strengthening of consciousness of protection and relevant knowledge and techniques

At presemt, som of the personnel at the lighthouses do not have a strong consciousness of lighthouse protection. They limit their duty of protection to taking care of them and lack the necessary techniques and knowledge needed for the protection and it is afraid that they would unconsciously destroy the relics in the lighthouses in the course of performing their duty.

3. The conflict of different duties of different administrative sectors

Lighthouses are precious historical relics as well as important A-toN facilities. However, the lighthouse administrative organizations require that they function as A-to-Ns while the cultural relics protection sectors tend to lay emphasis on the protection of the same. Therefore in practical work, there would arise some contradictions between the two sectors as a result of their different duties, which calls for earnest coordination between the two parties.

4. Impact caused by unreasonable construction plans around the lighthouses

In recent years, there appear increasingly frequent activities around many of the historical lighthouses. Some of the planned constructions fail to take into consideration the specific requirements of lighthouse protection, and build at random some constructions and facilities. In particular, some modernized structures, very tall signal emission stations for mobile phones invariably affect in various degrees the integration of the historical styles and features.

5. Balancing protection and commercial development

Some of the historical lighthouses are inside or by the side of some scenery spots and are important places of tourism. In the course of opening for the public, they are visited by a large number of tourists, which, to some degree, affect the daily administrative management. At the same time, the opening up for tourism constitutes a great challenge to the protection of the cultural relics.

VI . SUGGESTIONS AS TO THE PROTECTION OF HISTORICAL LIGHTHOUSES

To improve the effect to the protection of historical lighthouses, some practical problems were analyzed and some suggestions on how to improve the protective regulation were proposed.

1. Strengthening the support from laws and regulations for the protection of historical lighthouses, perfecting relevant by laws, clarify the standards and requirements thereof and improve the operational ability in practical work, so that the protection can be effected according to laws and regulations.

1) The quantitative assessment standards for lighthouses as cultural relics should be set up. It is recommended that such a system should be made in accordance with the national assessment standards, the the Assessment Table for Historical Lighthouses provided by IALA, so as to ascertain the protection stratum and priority for the lighthouses.

2) It is necessary to ascertain the protection scales and set up control areas in accordance with the Law of Cultural Relics Protection of the PRC for lighthouses that have been enlisted as cultural relics. Meanwhile, those administrative sectors concerned should also stipulate general principles for the protection of lighthouses and the medium and long term development plans for each and every historical lighthouses, so that all the activities concerned with our historical lighthouses are placed under the permissible range of law and regulations.

3) It is necessary to introduce standardized systems for the protection of cultural relics. Introducing such systems is a fundamental requirement--a large number of historical lighthouses are being enlisted as national key units for cultural relics protection--to coordinate the standards and requirements of protection and maintenance.

2. It is necessary to establish coordination organism between protection sectors and the A-to-N administrative departments. The two parties should sign cooperation agreement to clarify the duties and obligations of each party, to ensure the multiple sources of financing for the protection, and jointly stipulate protection methods and detailed rules so as to strengthen the protection of historical lighthouses while ensuring their normal function.

3. It is necessary to enforce special training for lighthouse administrative and maintenance personnel so that they are enriched in the knowledge and techniques and enhance their consciousness of protecting cultural relics. Meanwhile, it is paramount to set up the qualification certification for the units of cultural relics protection and renovation, and train qualified maintenance teams specializing in such.

4. It is necessary to build websites and database for lighthouse protection so as to spread information about the protection. It is feasible to use the 3D simulation to set up virtual 3D lighthouse museums. In this way, the broad mass of people can get a better understanding of lighthouses without leaving their homes.

5. It is necessary to promulgate guiding instructions about visiting lighthouses. Reasonable suggestions should be put forward as to the bounds, modes and tourist volume control and service chanrge of visiting areas. It is necessary to perfect the compensation organism for lighthouses so that the functions of the historical lighthouses can be brought about to full play while finding new sources for maintenance financing and better protect and use such cultural legacy.

VII. CONCLUSION

Historical lighthouses, as a precious and special ligacy from the past, should be meticulously cared for. In the minds of ordinary people, they are not preserved only as A-to-Ns. To some degree, they have risen to a spiritual interface and carry a great deal of fine expectation and imagination. We should earnestly inspect the possible impact of our actions on historical lighthouses and think hard how to better protect them so that they will not diminish or disappear with the passing of time. ■

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