

Paper for Consideration by TSMAD

Lights inS-101

Submitted by:	UK
Executive Summary:	This paper presents an overview of the development of a new lights structure for S-101. It presents a new model based on discussions at TSMAD23.
Related Documents:	1. S-101 DCEG
Related Projects:	1. S-101

Introduction / Background

1. The S-101 DCEG sub group has been developing the S-101 data model from the current S-57 ENC structure. One area which is being addressed is lights; this was first discussed as part of the creation of the initial S-101 Feature Catalogue. However at this time the only change was to replace structured text attributes with complex attribute structures. A number of revised models were considered by the DCEG sub group and a proposal presented to TSMAD23 for consideration. The comments on this proposal have been reflected in a revised structure which is presented in this paper.

Analysis/Discussion

2. In line with the principles of S-101 development, any change considered to the data model must deliver benefits or simplification of some kind. This can be a benefit to encoders or users but often benefits for both can be achieved. These principles were formalized in the TORs of the DCEG sub group. Therefore the justification for changes to the Lights structure are as follows;

- To avoid the need to capture multiple lights features for sectored lights.
- To avoid the need for complex conditional mandatory rules for encoding. E.g. Orientation - prohibited, except for directional or moiré effect lights
- To simplify Portrayal rules

3. The model proposed consists of five feature types, sectored light which includes a complex attribute light sector in order to support the encoding of lights with multiple sectors as a single feature. Rhythm of light is a sub attribute of light sector as different sectors may have different characters. The feature light is used for the most common light types and includes the Rhythm of light complex attribute to carry light characteristic information. The three other lights features are directional, fog detector light and air obstruction light. These are similar to the Lights feature but have different allowable attributes as currently defined using conditional mandatory attributes. Removing some allowable attributes from these specific types needs to be explored as some attributes may not be useful for these features. The revised model can be found at Annexe B with draft DCEG documentation in Annexe A.

Conclusion

4. Lights are one area where S-101 can deliver a real improvement over S-57 ENC. This paper proposes a model which uses S-100 constructs and new specific feature types to simplify encoding and portrayal whilst improving the user experience.

Action Required of TSMAD

- Consider the proposed lights model for inclusion in S-101

Annexe A

Light

<u>IHO Definition:</u> Light A luminous or lighted aid to navigation. (IHO Dictionary – S-32).				
S-101 Geo Feature: Light				
Primitives: Point				
<i>Real World</i>	<i>Paper Chart Symbol</i>	<i>ECDIS Symbol</i>		
S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Category of light	(CATLIT)	4 : leading light 5 : aero light 8 : flood light 9 : strip light 10 : subsidiary light 11 : spotlight 12 : front 13 : rear 14 : lower 15 : upper 17 : emergency 18 : bearing light 19 : horizontally disposed 20 : vertically disposed	C	0,1
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 8 : brown 9 : amber 10 : violet 11 : orange 12 : magenta 13 : pink	EN	1,*
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	EN	0,1
Date range			C	0,1
Feature name	(OBJNAM)		C	0,*
Height	(HEIGHT)		RE	0,1
Information	(INFORM)		C	0,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately	EN	0,*

		restricted 7 : obscured 8 : partially obscured 9 : visible in line of range		
Marks navigational system of	(MARSYS)	1 : IALA A 2 : IALA B 9 : no system 10 : other system	EN	0,1
Multiplicity of lights	(MLTYLT)		IN	0,1
<u>Rhythm of light</u>			C	1,1
Light character	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing	(S)EN	1,1
Signal period	(SIGPER)		(S)IN	1,1
<u>Signal group</u>	(SIGGRP)		(S)C	0,1
<u>Signal sequence</u>	(SIGSEQ)		(S)C	0,1
Scale maximum	(SCAMAX)		IN	0,1
Scale minimum	(SCAMIN)		IN	0,1
Sector limit one	(SECTR1)		RE	0,1
Sector limit two	(SECTR2)		RE	0,1
Status	(STATUS)	11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
<u>Textual description</u>	(TXTDSC)		C	0,1
Value of nominal range	(VALNMR)		RE	0,1
Vertical datum	(VERDAT)		EN	0,1

Comment [j1]: MD8 – 8.C1.8 and 8.Co.11.

INT 1 Reference: P 1-65

Lights (see S-4 – B-470)

If it is required to encode a light which does not consist of individual sectors it **must be encoded using the Lights feature.**

The IALA Maritime Buoyage System rules do not apply for most landfall lights and will apply to minor lights, but not to leading lights, some sector lights, landfall lights or major floating lights. In general, sector lights follow IALA convention when used for marking a channel.

Remarks:

- If it is required to encode details of the lighting technology (e.g. neon), it must be done using the attribute **Information**.
- If it is required to encode the purpose of a marine spotlight, it must be done using **Information**.
- **Light** features located in the water must have a master structure object, generally a beacon (e.g. **BCNLAT**, **Beacon special purpose**) or other fixed structure (e.g. **Offshore platform**), or a buoy structure (e.g. **Buoy lateral**, **Buoy special purpose**) for floating aids to navigation. When a light is located in the water with no indication on the source of the structure feature, regardless of the height of the light, a **Pile** or **Beacon special purpose** feature should be encoded as the master feature.
- Names of major lights are very important. If a light has a name which is unrelated to any other encoded feature, the name must be populated using the attribute **Feature name** on at least the largest scale optimum display scale ENC data. If the name of a light is obviously that of the named feature on which the light stands, e.g. Saint Catherine's Point, the name of the light need not be repeated for the **Light**.

Types and functions of lights (see S-4 – B-471.1)

If it is required to encode types and functions of lights, this must be done using the attribute **Category of light** (see clause X.X).

Distinction: Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light vessel; light float.

Fog detector light

<u>IHO Definition:</u> Fog detector light				
<u>S-101 Geo Feature:</u> Fog detector light				
<u>Primitives:</u> Point				
<i>Real World</i>		<i>Paper Chart Symbol</i>		<i>ECDIS Symbol</i>
S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 8 : brown 9 : amber 10 : violet 11 : orange 12 : magenta 13 : pink	EN	0,*

Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	EN	0,1
Date range			C	0,1
Feature name	(OBJNAM)		C	0,*
Height	(HEIGHT)		RE	0,1
Information	(INFORM)		C	0,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately restricted 7 : obscured 8 : partially obscured 9 : visible in line of range	EN	0,*
Marks navigational system of	(MARSYS)	1 : IALA A 2 : IALA B 9 : no system 10 : other system	EN	0,1
Multiplicity of lights	(MLTYLT)		IN	0,1
<u>Rhythm of light</u>			C	0,1
Light character	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing	(S)EN	1,1
Signal period	(SIGPER)		(S)IN	1,1
<u>Signal group</u>	(SIGGRP)		(S)C	0,1
<u>Signal sequence</u>	(SIGSEQ)		(S)C	0,1

Comment [j2]: MD8 – 8.C1.8 and 8.Co.11.

Scale maximum	(SCAMAX)		IN	0,1
Scale minimum	(SCAMIN)		IN	0,1
Sector limit one	(SECTR1)		RE	0,1
Sector limit two	(SECTR2)		RE	0,1
Status	(STATUS)	11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
Textual description	(TXTDSC)		C	0,1
Value of nominal range	(VALNMR)		RE	0,1
Vertical datum	(VERDAT)		EN	0,1
<p><u>INT 1 Reference:</u> P 1-65</p> <p>Fog detector lights (see S-4 – B-470)</p> <p>If it is required to encode a light which.....</p> <p>The IALA Maritime Buoyage System rules do not apply for most landfall lights and will apply to minor lights, but not to leading lights, some sector lights, landfall lights or major floating lights. In general, sector lights follow IALA convention when used for marking a channel.</p> <p><u>Remarks:</u></p> <ul style="list-style-type: none"> • If it is required to encode details of the lighting technology (e.g. neon), it must be done using the attribute Information. • Light features located in the water must have a master structure object, generally a beacon (e.g. BCNLAT, Beacon special purpose) or other fixed structure (e.g. Offshore platform), or a buoy structure (e.g. Buoy lateral, Buoy special purpose) for floating aids to navigation. When a light is located in the water with no indication on the source of the structure feature, regardless of the height of the light, a Pile or Beacon special purpose feature should be encoded as the master feature. <p><u>Distinction:</u> Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light vessel; light float.</p>				

Air obstruction light

<u>IHO Definition:</u> Air obstruction light				
S-101 Geo Feature: Air obstruction light				
<u>Primitives:</u> Point				
<i>Real World</i>	<i>Paper Chart Symbol</i>	<i>ECDIS Symbol</i>		
S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow	EN	0,*

		8 : brown 9 : amber 10 : violet 11 : orange 12 : magenta 13 : pink		
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	EN	0,1
Date range			C	0,1
Feature name	(OBJNAM)		C	0,*
Height	(HEIGHT)		RE	0,1
Information	(INFORM)		C	0,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately restricted 7 : obscured 8 : partially obscured 9 : visible in line of range	EN	0,*
Marks navigational system of	(MARSYS)	1 : IALA A 2 : IALA B 9 : no system 10 : other system	EN	0,1
Multiplicity of lights	(MLTYLT)		IN	0,1
Rhythm of light			C	0,1
Light character	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating	(S)EN	1,1

Comment [j3]: MD8 – 8.Cl.8 and 8.Co.11.

		29 : fixed and alternating flashing		
Signal period	(SIGPER)		(S)IN	1,1
Signal group	(SIGGRP)		(S)C	0,1
Signal sequence	(SIGSEQ)		(S)C	0,1
Scale maximum	(SCAMAX)		IN	0,1
Scale minimum	(SCAMIN)		IN	0,1
Sector limit one	(SECTR1)		RE	0,1
Sector limit two	(SECTR2)		RE	0,1
Status	(STATUS)	11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
Textual description	(TXTDSC)		C	0,1
Value of nominal range	(VALNMR)		RE	0,1
Vertical datum	(VERDAT)		EN	0,1

INT 1 Reference: P 1-65

Air obstruction light (see S-4 – B-470)

If it is required to encode a light which.....

The IALA Maritime Buoyage System rules do not apply for most landfall lights and will apply to minor lights, but not to leading lights, some sector lights, landfall lights or major floating lights. In general, sector lights follow IALA convention when used for marking a channel.

Remarks:

- If it is required to encode details of the lighting technology (e.g. neon), it must be done using the attribute **Information**.
- **Light features located in the water must have a master structure object, generally a beacon (e.g. BCNLAT, Beacon special purpose) or other fixed structure (e.g. Offshore platform), or a buoy structure (e.g. Buoy lateral, Buoy special purpose) for floating aids to navigation. When a light is located in the water with no indication on the source of the structure feature, regardless of the height of the light, a Pile or Beacon special purpose feature should be encoded as the master feature.**

Distinction: Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light vessel; light float.

Directional light

IHO Definition: **Directional light**

S-101 Geo Feature: **Directional light**

Primitives: **Point**

<i>Real World</i>	<i>Paper Chart Symbol</i>	<i>ECDIS Symbol</i>		
S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 8 : brown 9 : amber 10 : violet 11 : orange 12 : magenta 13 : pink	EN	1,*
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	EN	0,1
Date range			C	0,1
Feature name	(OBJNAM)		C	0,*
Height	(HEIGHT)		RE	0,1
Information	(INFORM)		C	0,1
Is moire effect			BO	0,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately restricted 7 : obscured 8 : partially obscured 9 : visible in line of range	EN	0,*
Marks navigational system of	(MARSYS)	1 : IALA A 2 : IALA B 9 : no system 10 : other system	EN	0,1
Multiplicity of lights	(MLTYLT)		IN	0,1
Orientation	(ORIENT)		RE	1,1
<u>Rhythm of light</u>			C	1,1
Light character	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing	(S)EN	1,1

		11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing		
Signal period	(SIGPER)		(S)IN	1,1
<u>Signal group</u>	(SIGGRP)		(S)C	0,1
<u>Signal sequence</u>	(SIGSEQ)		(S)C	0,1
Scale maximum	(SCAMAX)		IN	0,1
Scale minimum	(SCAMIN)		IN	0,1
Sector limit one	(SECTR1)		RE	0,1
Sector limit two	(SECTR2)		RE	0,1
Status	(STATUS)	11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
Textual description	(TXTDSC)		C	0,1
Value of nominal range	(VALNMR)		RE	0,1
Vertical datum	(VERDAT)		EN	0,1
<p><u>INT 1 Reference:</u> P 1-65</p> <p>Directional lights (see S-4 – B-470)</p> <p>If it is required to encode a light which.....</p> <p>The IALA Maritime Buoyage System rules do not apply for most landfall lights and will apply to minor lights, but not to leading lights, some sector lights, landfall lights or major floating lights. In general, sector lights follow IALA convention when used for marking a channel.</p> <p><u>Remarks:</u></p> <ul style="list-style-type: none"> • If it is required to encode details of the lighting technology (e.g. neon), it must be done using the attribute Information. • Light features located in the water must have a master structure object, generally a beacon (e.g. BCNLAT, Beacon special purpose) or other fixed structure (e.g. Offshore platform), or a buoy structure (e.g. Buoy lateral, Buoy special purpose) for floating aids to navigation. When a light is located in the water with no indication on the source of the structure feature, regardless of the height of the light, a Pile or Beacon special purpose feature should be encoded as the master feature. <p><u>Distinction:</u> Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light vessel; light float.</p>				

Comment [j4]: MD8 – 8.Cl.8 and 8.Co.11.

Sectored light

IHO Definition: Sectored light A light which consists of one or more sectors of different characteristics.				
S-101 Geo Feature: Sectored light				
Primitives: Point				
<i>Real World</i>	<i>Paper Chart Symbol</i>	<i>ECDIS Symbol</i>		
S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Date range			C	0,1
Feature name	(OBJNAM)		C	0,*
Height	(HEIGHT)		RE	0,1
Information	(INFORM)		C	0,1
<u>Light sector</u>			C	1,*
Colour	(COLOUR)		(S)EN	1,*
Exhibition condition of light	(EXCLIT)		(S)EN	0,1
Is directional			(S)BO	0,1
Light visibility	(LITVIS)		(S)EN	0,*
Orientation	(ORIENT)		(S)RE	0,1
Sector limit one	(SECTR1)		(S)RE	0,1
Sector limit two	(SECTR2)		(S)RE	0,1
Value of nominal range	(VALNMR)		(S)RE	0,1
Marks navigational system of	(MARSYS)	1 : IALA A 2 : IALA B 9 : no system 10 : other system	EN	0,1
<u>Rhythm of light</u>			C	1,1
Light character	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing	(S)EN	1,1

		11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing		
Signal period	(SIGPER)		(S)IN	1,1
Signal group	(SIGGRP)		(S)C	0,1
Signal sequence	(SIGSEQ)		(S)C	0,1
Scale maximum	(SCAMAX)		IN	0,1
Scale minimum	(SCAMIN)		IN	0,1
Status	(STATUS)	11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
Textual description	(TXTDSC)		C	0,1
Vertical datum	(VERDAT)		EN	0,1

Comment [j5]: MD8 – 8.Cl.8 and 8.Co.11.

INT 1 Reference: P 1-65

Sector light (see S-4 – B-470)

If it is required to encode a light and its sectors, each sector of the light must be encoded using one separate LIGHTS feature. These features must be slave features of the same master feature, which is either the structure feature or one of the LIGHTS, so that the relationship between them is indicated using the master/slave relationship mechanism described in clause X.X.

The IALA Maritime Buoyage System rules do not apply for most landfall lights and will apply to minor lights, but not to leading lights, some sector lights, landfall lights or major floating lights. In general, sector lights follow IALA convention when used for marking a channel.

Remarks:

- If it is required to encode details of the lighting technology (e.g. neon), it must be done using the attribute INFORM.
- If it is required to encode the purpose of a marine spotlight, it must be done using INFORM.
- LIGHTS features located in the water must have a master structure object, generally a beacon (e.g. BCNLAT, BCNSPP) or other fixed structure (e.g. OFSPLF), or a buoy structure (e.g. BOYLAT, BOYSPP) for floating aids to navigation. When a light is located in the water with no indication on the source of the structure feature, regardless of the height of the light, a PILPNT or BCNSPP feature should be encoded as the master feature.
- Names of major lights are very important. If a light has a name which is unrelated to any other encoded feature, the name must be populated using the attribute OBJNAM on at least the largest scale optimum display scale ENC data. If the name of a light is obviously that of the named feature on which the light stands, e.g. Saint Catherine's Point, the name of the light need not be repeated for the LIGHTS.

Types and functions of lights (see S-4 – B-471.1)

If it is required to encode types and functions of lights, this must be done using the attribute CATLIT (see clause X.X).

Distinction: Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light vessel; light float.

Rhythms of lights (see S-4 – B-471.2)

The principal character of a light is its rhythm (although, strictly, fixed lights and some alternating lights are not "rhythmic").

If it is required to encode the rhythms of lights, this must be done using the attributes LITCHR and SIGGRP.

The use of these attributes is defined in the following table; it contains the most common examples of coding; other coding combinations are possible:

Rhythms of lights	F	Oc	Oc(2)	Oc(2+3)	Iso	FI	FI(3)	LFI
LITCHR	1	8	8	8	7	2	2	3
SIGGRP	prohibited	(1)	(2)	(2+3)	(1)	(1)	(3)	(1)

Rhythms of lights	Q	Q(3)	IQ	VQ	VQ(3)	IVQ	UQ	IUQ
LITCHR	4	4	9	5	5	10	6	11
SIGGRP	(1)	(3)	()	(1)	(3)	()	(1)	()

Rhythms of lights	Mo(K)	FFI	Q(6)+LFI	VQ(6)+LFI	Al.WR	Al.FI.WR	Al.FI(2W+1R)	Al.Oc(4)WR
LITCHR	12	13	25	26	28	19	19	17
SIGGRP	(K)	(1)	(6)(1)	(6)(1)	()	(1)	(2+1)	(4)

Some lights recently constructed may appear to the mariner as "fixed and flashing - FFL" by night, while the real world feature actually comprises two separate lights vertically disposed, one fixed and the other flashing (F&FI). When it is known that two separate features actually exist, they must be encoded as **separate features**, in this case **two LIGHTS features**, one with attribute LITCHR = 1 (fixed) and the other with LITCHR = 2 (flashing), and not as one **LIGHTS** with LITCHR = 13 (fixed and flashing).

Elevations of lights (see S-4 – B-471.6)

The elevation of a light is the vertical distance between the light source and the plane of reference for heights for the ENC data (see clause X.X).

If it is required to encode the elevation of a light on a fixed structure, it must be done using the attribute HEIGHT.

If it is required to encode the height above the water surface of a light on a floating structure, it must be done using the attribute INFORM on the **LIGHTS feature**.

Times of exhibition and exhibition conditions (see S-4 – B-473)

Night lights

If it is required to encode a night light, it must be done using a **LIGHTS feature** with attribute EXCLIT = 4 (night light).

Unwatched lights (see S-4 – B-473.1)

This information should not be encoded, but unwatched (unmanned) lights, with no standby or emergency arrangements, may be encoded using attribute STATUS = 17 (unwatched).

Occasional lights (see S-4 – B-473.2)

If it is required to encode an occasional light, it must be done using attribute STATUS = 2 (occasional). If it is required to encode a private light that is not regularly exhibited, it must be done using STATUS = 2,8 (occasional, private).

Daytime lights (see S-4 – B-473.4)

If it is required to encode a daytime light, it must be done using attribute EXCLIT = 1 (light shown without change of character).

If it is required to encode a light having characteristics shown by day different to those shown at night, it must be done by encoding **two LIGHTS features** sharing the same point spatial feature:

- one LIGHTS feature with EXCLIT = 2 (daytime light),
- one LIGHTS feature with EXCLIT = 4 (night light).

Fog lights (see S-4 – B-473.5)

If it is required to encode a fog light, it must be done using a LIGHTS feature, with attributes EXCLIT = 3 (fog light) and STATUS = 2 (occasional).

If it is required to encode a light having characteristics shown in fog that are different to those shown in conditions of normal visibility, it must be done by encoding **two LIGHTS features** sharing the same point spatial feature:

- one LIGHTS object with EXCLIT = 3 (fog light) and STATUS = 2 (occasional)
- one LIGHTS object with EXCLIT = 2 (daytime light) or 4 (night light) and attribute INFORM = *Character of the light changes in fog.*

Sector lights and lights not visible all round (see S-4 – B-475)

Sector lights (see S-4 – B-475.1-5)

Each sector in which the light is visible from seaward must be encoded as one LIGHTS feature.

There must not be a feature created to encode a sector where no light is exhibited.

Limits of sectors must be encoded using attributes SECTR1 and SECTR2.

Lights obscured by obstructions (see S-4 – B-475.3)

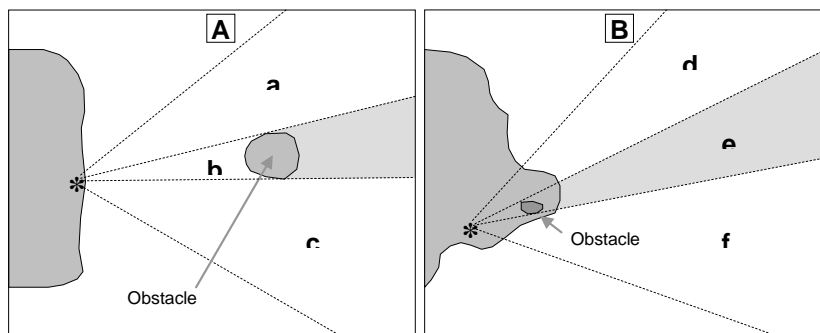


Figure 17 – Obscured light sectors

If an encoded light is obscured in a part of the navigable area of a sector (see Figure A above) beyond an offshore obstruction, it must be encoded as **several LIGHTS features**. The partially obscured sector of (b), seaward of the island, must be encoded as a LIGHTS feature, with attributes LITVIS = 8 (partially obscured) and INFORM = *Sector obscured only beyond* The sectors in which the light is visible from seaward ((a) and (c)) must be encoded as **separate LIGHTS features**.

If there is no navigable water between the light and the obstruction (see Figure B above), the masked sector must be encoded as a LIGHTS feature, with LITVIS = 3 (faint) or 7 (obscured).

White fairway sectors (see S-4 – B-475.5)

The light sectors must be encoded as separate **LIGHTS features**. The fairway defined by the succession of navigable areas in the white sectors may be encoded using the **feature FAIRWAY** (see clause X.X).

Leading lights (see S-4 – B-475.6)

If it is required to encode a leading light, it must be done using a **LIGHTS feature**, with attribute:

CATLIT = 4,12 - front leading light
4,13 - rear leading light
4,14 - lower leading light
4,15 - upper leading light

Remarks:

- The attribute ORIENT must not be used for leading lights, except for directional lights.
- Even if, on the source, the leading lights are merged into a single symbol, at least one **LIGHTS feature** must be created for each light. These lights must be placed in their true position, i.e. where the source (e.g. paper chart) shows a single light with a legend such as 2FBu, further investigation must be done in order to determine the true position of each light, and its full attribution. Compilers should note that where this occurs on paper charts, the position of the light shown on the chart normally corresponds with the rear leading light.
- The leading line must be encoded using the method described in clause X.X.

Directional lights (see S-4 – B-475.7)

Direction (or directional) lights of several types are in use but all have in common a very narrow sector intended to mark a direction to be followed. The narrow sector may be flanked by:

- Unlit sectors or unintensified light.
- Sectors of different colour or character. Some direction lights are so precise that a complete colour change at a sector boundary occurs over an angle of less than 1 minute (0.02°). This corresponds to a lateral distance of just 1 metre at a viewing distance of 3.5 km. In addition the intensity may be maintained right to the edge of the beam, and does not reduce the further the observer is away from the axis.

If it is required to encode a directional light, it must be done using a **LIGHTS feature**, with attribute CATLIT = 1 (directional function) and, if the light is intensified in this sector, with attribute LITVIS = 4 (intensified). If it is required to encode a directional light that comprises a narrow (and sometimes intensified) sector, the sector must be encoded using the attributes SECTR1 and SECTR2, and the attribute ORIENT must be populated with an empty (null) value.

Comment [j6]: ENC EB No. XX.

The mandatory attribute ORIENT must only be encoded to indicate the orientation, measured from seaward, of the leading line of the directional light when the attributes SECTR1 and SECTR2 are not populated, and there is no **RECTRC** or **NAVLNE feature** associated with the directional light. Where the **LIGHTS** has attributes SECTR1 and SECTR2, and/or there is an associated **RECTRC** and/or **NAVLNE**, ORIENT for the **LIGHTS** must be populated with an empty (null) value.

If it is required to encode the recommended track and/or navigation line associated with a directional light, it must be done using the methods described in clause X.X.

Oscillating light sectors

Evolving technology in the development of navigational lights has resulted in the installation of complex directional navigation lights with multiple sectors, colours and characteristics, some with oscillating sectors, in many areas where navigation is restricted. These lights may have up to 7 sectors, with the central sector being a very narrow, sometimes intensified, fixed white sector performing the directional function of the light. In the IALA A System, the sectors flanking this directional light may be alternating and oscillate increasingly from white to green (to starboard) and red (to port) with increasing deviation from the track defined by the directional light. These lights will normally be flanked by narrow sectors of fixed green (to starboard) and red (to port). Additionally, there may be outer sectors that are occulting green

(to starboard) and red (to port) which oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light. For the IALA B System the colours are reversed. In some cases these complex lights may not conform to IALA. Each of the outer sectors may be very narrow.

If it is required to encode an oscillating light sector, it should be done as follows:

For lights in the IALA A system that are alternating and oscillate increasingly from white to green (to starboard) and red (to port) with increasing deviation from the track defined by the directional light:

LIGHTS: LITCHR = 28 (Alternating); COLOUR = 1,2 (White, Red); SECTR1; SECTR2; SIGPER; SIGGRP; INFORM = *White phase decreases as bearing to light increases*

LIGHTS: LITCHR = 28 (Alternating); COLOUR = 1,4 (White, Green); SECTR1; SECTR2; SIGPER; SIGGRP; INFORM = *White phase increases as bearing to light increases*

For lights in the IALA B system that are alternating and oscillate increasingly from white to red (to starboard) and green (to port) with increasing deviation from the track defined by the directional light; transpose the colours red and green in the above encoding.

For lights in the IALA A system that are occulting green (to starboard) and red (to port) which oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light:

LIGHTS: LITCHR = 8 (Occulting); COLOUR = 3 (Red); SECTR1; SECTR2; SIGPER; SIGGRP; INFORM = *Light phase decreases as bearing to light increases*

LIGHTS: LITCHR = 8 (Occulting); COLOUR = 4 (Green); SECTR1; SECTR2; SIGPER; SIGGRP; INFORM = *Light phase increases as bearing to light increases*

For lights in the IALA B system that are occulting red (to starboard) and green (to port) which oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light; transpose the colours red and green in the above encoding.

Oscillating lights which are not IALA should be encoded similar to the above. For instance, where a light contains white sectors that are occulting and oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light:

For the sector to port of the track defined by the directional light:

LIGHTS: LITCHR = 8 (Occulting); COLOUR = 1 (White); SECTR1; SECTR2; SIGPER; SIGGRP; INFORM = *Light phase decreases as bearing to light increases*

For the sector to starboard of the track defined by the directional light:

LIGHTS: LITCHR = 8 (Occulting); COLOUR = 1 (White); SECTR1; SECTR2; SIGPER; SIGGRP; INFORM = *Light phase increases as bearing to light increases*

Moiré effect lights (see S-4 – B-475.8)

A moiré effect mark (or variable arrow mark) is a short-range (normally up to 2 km) type of directional "light". Sodium lighting gives a yellow background to a screen (up to 3 m square) on which a vertical black line will be seen by an observer on the centreline, or variable arrow marks when course alteration is needed. The system can be used by day and night. It can also be used as a stop line (seen abeam) for vessels berthing along quays.

If it is required to encode a moiré effect light, it must be done using a **LIGHTS** feature, with attribute CATLIT = 16 (moiré effect).

The mandatory attribute ORIENT must only be encoded to indicate the orientation, measured from seaward, of the leading line of the moiré effect light when the attributes SECTR1 and SECTR2 are not populated, and there is no **RECTRC** or **NAVLNE** feature associated with the moiré effect light. Where the **LIGHTS** has attributes SECTR1 and SECTR2, and or there is

an associated **RECTRC** and/or **NAVLNE**, **ORIENT** for the **LIGHTS** must be populated with an empty (null) value.

If it is required to encode the recommended track and/or navigation line associated with a moiré effect light, it must be done using the methods described in clause **X.X**.

Lighthouses (see S-4 – B-457.3)

If it is required to encode a lighthouse, it must be done using a **LNDMRK feature** (see clause **X.X**), with attributes **CATLMK = 17** (tower) and **FUNCTN = 33** (light support) for towers, or using a **BUISGL feature** (see clause **X.X**), with the attribute **FUNCTN = 33**, for any other shapes.

If it is required to encode the attributes **ELEVAT**, **HEIGHT** and **VERLEN** for a lighthouse, this must be done as described in clause **X.X**.

If the lighthouse is permanently extinguished/unlit, this must be indicated by population of the attribute **STATUS = 4** (not in use) for the **LNDMRK/BUISGL**, and the **LIGHTS feature** must be removed. Where a lighthouse is illuminated by floodlights, the additional value of **STATUS = 12** (illuminated) must also be populated. For lights that are temporarily extinguished, see clause **X.X**.

Various special types of lights

Type	S-4	CATLIT	Remarks
Subsidiary light	B-471.8	10	
Aero light	B-476.1	5	
Air obstruction light	B-476.2	6	
Fog detector light	B-477	7	
Bearing light		18	
Flood light	B-478.2	8	Only to encode flood lights that are visible from seaward. The illuminated structure should be encoded using appropriate object classes, with attribute STATUS = 12 (illuminated)
Synchronised lights	B-478.3		STATUS = 15 . Synchronised lights may be associated using the collection object C_ASSO
Strip light	B-478.5	9	See below for strip lights performing the function of an aid to navigation.
Spot light		11	Only to encode spot lights that are visible from seaward. The illuminated feature should be encoded using appropriate object classes, with attribute STATUS = 12 (illuminated)
Emergency light		17	Must be encoded as a separate object to the main LIGHTS object
Horizontally disposed lights	B-471.8	19	The number of lights must be encoded using attribute MLTYLT
Vertically disposed lights	B-471.8	20	The number of lights must be encoded using attribute MLTYLT

For ECDIS display reasons, where an encoded strip light serves the purpose of an aid to navigation, the attribute **CATLIT = 9** (strip light) for the **LIGHTS feature** should not be

populated. To identify that the aid to navigation is a strip light, the attribute INFORM should be populated with *Strip light* or equivalent for the **LIGHTS**.

Light structures

If a light that is on a fixed structure is located in a water area and the structure that supports it is unknown, a **PILPNT feature** of type point or a **BCNSPP feature** must also be encoded at the same position as the light. This will ensure that a symbol will be shown on ECDIS systems when the **LIGHTS features** are not displayed during daytime navigation.

X.X Light sector

IHO Definition: -?				
Attribute	Acronym	Allowable Encoding Value	Type	Multi
Colour	(COLOUR)		EN	1,*
Exhibition condition of light	(EXCLIT)		EN	0,1
Is directional			BO	0,1
Light visibility	(LITVIS)		EN	0,*
Orientation	(ORIENT)		RE	0,1
Sector limit one	(SECTR1)		RE	0,1
Sector limit two	(SECTR2)		RE	0,1
Value of nominal range	(VALNMR)		RE	0,1

X.X Rhythm of light

IHO Definition: -?				
Attribute	Acronym	Allowable Encoding Value	Type	Multi

Light character	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing	EN	1,1
Signal period	(SIGPER)		IN	1,1
Signal group	(SIGGRP)		C	0,1
Signal sequence	(SIGSEQ)		C	0,1
Signal sequence interval			(S)C	1,* Ordered

Comment [j7]: MD8 – 8.Cl.8 and 8.Co.11.

X.X Signal sequence

IHO Definition: -?				
Attribute	Acronym	Allowable Encoding Value	Type	Multi
Signal sequence interval	-		(S)C	1,* Ordered

X.X Signal group

IHO Definition: -?				
Attribute	Acronym	Allowable Encoding Value	Type	Multi

Signal element	-		TE	1,* Ordered
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X.X Signal sequence interval

IHO Definition: -?				
Attribute	Acronym	Allowable Encoding Value	Type	Multi
Signal status	-	1. Lit 2. Eclipsed	EN	1,1
Signal duration	-		RE	1,1

Annexe B – Proposed lights structure

