Document Revisions

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**IALA Guideline No. ####**

**On**

**Technical Features and Visualisation Technology Relevant for Simulation of AtoN**

**Edition 0.1**

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Revisions to the IALA Document are to be noted in the table prior to the issue of a revised document.

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Technical Features and Visualisation Technology Relevant for Simulation of AtoN

# Introduction

Followed by body text

# SCOPE

Followed by body text

# Definitions

Body Text

# User needs and requirements

Simulation is in the context of the present guideline used for

* Research;
* Development;
* Design; and
* Test.

of individual of combinations of AtoN

The ‘Probability of Detection’ of an AtoN shall be identical or similar in a simulated and real environment.

# Modelling and Simulation of AtoN

## Introduction

* Modeling;

A model is a simplified representation of a system at some particular point in time or space intended to promote understanding of the real system.

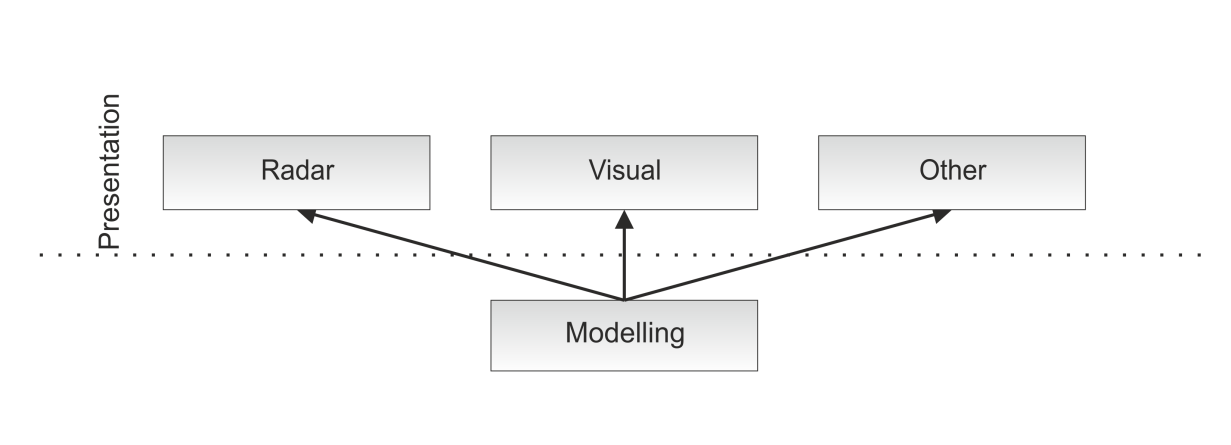
* Simulation;

A simulation is the manipulation of a model in such a way that it operates on time or space to compress it, thus enabling one to perceive the interactions that would not otherwise be apparent because of their separation in time or space.

* Presentation.

Definition to be added.

Body Text



1. AtoN’s modeling and presentation

Only the visual appearance is covered in the present guideline.

## Relevant IALA Recommendations and Guidelines

The following recommendations and guidelines has been reviewed and identified as relevant for the visual simulation of AtoN.

### IALA Recommendations

R101 On Maritime Radar Beacons (racons) (January 1995 – Revised 2004)

O-104 On “Off Station” Signals for Major Floating Aids

E-106 For the Use of Retroflecting Material On Aids to Navigation Marks within The IALA Maritime Buoyage System

E-107 On Moorings for Floating Aids to Navigation

E-108 For the Surface Colors used as Visual Signals on Aids to Navigation (specifications for ordinary and fluorescent colours)

E-109 For the Calculation of the Range of a Sound Signal

E-110 For the Rhythmic Characters of Lights on Aids to Navigation (Edition 2.0)

E-111 For Port Traffic Signals

E-112 For Leading Lights

A-123 On the Provision of Shore Based AIS

O-133 On Emergency Wreck Marking Buoy (for use on trial basis)

O-138 On the Use of GIS and Simulation by Aids to Navigation Authorities

E-141 On Aids to Navigation Training

E-143 On Virtual Aids to Navigation Edition 1

E-200 On Marine Signal Light, Part 0 - Overview

E-200-1 On Marine Signal Light, Part 1 - Colours

E-200-2 On Marine Signal Light, Part 2 - Calculation, definition and notation of luminous range

E-200-3 On Marine Signal Light, Part 3 - Measurements

E-200-4 On Marine Signal Light, Part 4 - Determination and Calculation of Effective Intensity

E-200-5 On Marine Signal Light, Part 5 - Estimation of the Performance of Optical Apparatus

### IALA Guidelines

1023 For the Design of Leading Lines

1038 On Ambient Light Levels at which Aids to Navigation should Switch On and Off

1041 On Sector Lights

1043 On Light Sources Used in Visual Aids to Navigation

1047 On Cost Comparison of Buoy Technologies

1048 On LED Technologies and their use in Signal Lights

1049 On the Use of Modern Light Sources in Traditional Lighthouse Optics

1051 On the Provision of Aids to Navigation in Built-up Areas

1058 On the Use of Simulation as a Tool for Waterway Design and Aids to Navigation Planning

1061 On Light Applications Illumination of Structures

1065 On Vertical Divergence

1066 On the Design of Floating Aid to Navigation Moorings

1069 On the Synchronization of Lights

Appendix A, provides a summary list of phenomena’s discussed in the IALA guidelines and recommendations summarized of relevance for modelling and simulation of AtoN.

## Modelling

In the following sections relevant phenomena’s are presented in a conceptual model hierarchy.

This guideline recommends considering these phenomena when using simulation systems as an assessment tool of ATON’s, to the least.

As also stated later, a model of phenomena may contain elements that compensate for the deficits in the visual presentation system.

The proposed conceptual model needed in order to perform a adequate and realistic for the simulation is shown in full length in the following figures. In the later sections each element will be elaborated on.

The model presented below shall be considered preliminary and incomplete.

The top level of conceptual modal encompasses the following elements shown on Figure 2.



1. The top level hierarchy of the conceptual model

The fixed ATON is modelled as shown in Figure 3.



1. Conceptual model of the fixed AtoN

The floating AtoN is modelled as shown in figure X



1. Conceptual model of the floating AtoN



1. Conceptual model of the environment

Input from EEP16-output-7, that need further integration into the conceptual model and the requirements for individual phenomena’s.

1. Colours of lights and daymarks
2. Size of daymarks
3. Background light intensity:
   1. Sky glow covering both ambient light
   2. Glare above cities
   3. Influence of moving objects onshore like e.g. cars, port operations, aircraft ground movements
   4. Reflection of light from structures
   5. Cultural lights dispersal in the atmosphere
4. The influence of on-shore background lights (rival lights)
5. Use of fluorescent paint on daymarks
6. Flickering lights
7. Contrast (colour and luminance)
8. Day/Night/Dusk/Dawn light conditions (linked to contrast and visibility)
9. Flashing light caused by rotating wind turbine blades
10. The nature of light distribution by atmospheric conditions. For example:
    1. Visibility
    2. Humidity
    3. Air temperature
    4. Pollution
11. Light affected by angle of sun
12. Effect of AtoN failures
13. Synchronised and sequential lights
14. Tide and sea-state conditions

## Simulation

## Software implementation

# Presentation Technology

## Introduction

The Presentation Technology is responsible for the emission of light to the observer.

A number of presentation technologies are available, such as:

* Projectors;
* Ddd;

It is the aim that the observer receives the same amount of photons as in reality for all directions of viewing.

As current affordable presentation system has limitations, the simulation models should include effects that strive to compensate for such limitations.

## Display systems

### Projectors

Input from EEP-16-output-7 about projection technology

* The resolution of the screens was insufficient to simulate the resolution of the human eye;
* The maximum illuminence of the projectors was about 100-300 Candelas per metre; real-world illuminence is around 10,000 candelas per metre;
* Contrast is not comparable either; contrast of computers, projectors and screens is around 1:1x104, actual real-world contrasts are around 1:1x107.

### Monitors

### Head-mounted and Hand-held Displays

## Projection Theatres

### Warping and bending

### Colour matching

## Video walls

## IR and Night Vision

# Radars

1. list of phenomena covered in relevant IALA Recommendations and Guidelines

Preliminary list of phenomena covered in relevant IALA Recommendations and Guidelines. Keywords need to be elaborated.

|  |  |  |
| --- | --- | --- |
| References - IALA Recommendations and Guidelines | | |
|  |  |  |
| **1023** | **Leading Lines** |  |
|  | Lights | Beam width |
|  |  | Beam fading |
|  |  | Range fading |
|  |  | Intensity |
|  |  | Characteristics |
|  |  | Daytime |
|  |  | Nighttime |
|  | Marks | Range fading Calibrate with table E6-1 |
|  |  |  |
| **1038** | **Ambient Light swith on/off** | |
|  | Clouds |  |
|  | Fog, snow, etc. |  |
|  | Switch to control one or several lights | |
|  | Shadows from eg passing ships | |
|  | Sensor direction |  |
|  |  |  |
| **1041** | **Sector Lights** |  |
|  | Type of light |  |
|  |  | Point source |
|  |  | Projected |
|  |  | Slot |
|  |  | Range |
|  |  | Diverged Beam (Laser) |
|  | Sector boundaries | Width |
|  | Oscillating boundaries | |
|  | Intensity variation between sectors | |
|  | Daytime/nighttime intensity levels | |
|  | Vertical divergence |  |
|  | Character |  |
|  | Weather | Ice on lense |
|  |  |  |
| **1043** | **Light Sources used in Visual Aids to Navigation** | |
|  | Spectral content |  |
|  | Scattering in atmosphere | |
|  | Light Pipes |  |
|  | Point Lights |  |
|  |  |  |
| **1047** | **Cost Comparison methodology of Buoy Technologies** | |
|  | Radar reflector |  |
|  | Vertical divergence |  |
|  | Day mark quallity |  |
|  | Anchor system |  |
|  |  |  |
| **1048** | **LED Technologies and their use in Signal Lights** | |
|  | Should colors be different to indetify LED light sources? | |
|  | Color variation due to temperature | |
|  | With or without service allowance | |
|  | Simulate beyond FFF? |  |
|  |  |  |
| **1049** | **The Use of Modern Light Sources in Traditional Light Optics** | |
|  | Correct CIE color for each | lamp |
|  |  | lense |
|  |  |  |
| **1051** | **Provision and Identification of Ais to Navigation in Built-up Areas** | |
|  | background lighting | Flashing, cars, street lights, commercial, houses |
|  | shadowing |  |
|  | obstruction |  |
|  | atmospheric polution |  |
|  |  |  |
| **1061** | **Illumination of structures** | |
|  | Direct |  |
|  | Indirect |  |
|  | Auto switch on/off (light level) | |
|  |  |  |
| **1065** | **Aids to Navigation Signal Light Beam Vertical Divergence** | |
|  | geographical range for fixed platforms | |
|  | geographical range for floating platforms | |
|  | Dynamic effects for buoys | geometry, mass and mooring system |
|  | wind, waves, current |  |
|  | Vertical intensity profile | |
|  | Spherical model of the Earth | |
|  |  |  |
| **1066** | **Design of Floating Aid to Navigation Moorings** | |
|  | Chains | Trash, rider, ground, bridle, etc. |
|  | Elastic |  |
|  | Sinker |  |
|  | Anchor |  |
|  | Environmental loads | wind, current, waves |
|  |  |  |
| **1069** | **Syncronization of Lights** | |
|  | Syncronized |  |
|  | Sequential |  |
|  | Syncronization mthodology | Master-slave, GPS,etc. |
|  | Failure modes |  |
|  |  |  |
| **R-101** | **Marine Radar Beacons (racons)** | |
|  | Polarization |  |
|  | Frequency agility and swept | |
|  | Character |  |
|  | Duration and periodicity | |
|  | Range |  |
|  |  |  |
| **O-104** | **"Off Station" Signals for Major Floating Aids** | |
|  | Relevance of provission of such signals | Spheres |
|  |  | Red lights |
|  |  | Flags |
|  |  | Flares |
|  |  |  |
| **E-106** | **The Use of Retroflecting material on Aids to navigation Marks** | |
|  | Shall buoy models include the retroflective material codes (stripes) | |
|  |  |  |
| **E-107** | **Moorings for Floating Aids to Navigation** | |
|  | Refering to guideline 1066 and 1024 | |
|  |  |  |
| **E-108** | **The Surface Colours used as Visual Signals on Aids to Navigation** | |
|  | Glossyness |  |
|  | Color type | fluorescent, ordinary |
|  | Symbols and characters | |
|  | CIE chart matching |  |
|  |  |  |
| **E-109** | **Recommendation on the calculation of the range of sound signal** | |
|  | frequencies | harmonics |
|  | Intensity |  |
|  | dispersion |  |
|  | transmitivity |  |
|  | obstacles |  |
|  | platform motions |  |
|  |  |  |
| **E-110** | **Rhythmic Characters of Lights on Aids to Navigation** | |
|  | temporal variations | rotation ON/OFF |
|  | model | incandescence and nigrescence |
|  | frequency limits | flickering |
|  |  |  |
|  |  |  |
| **E-111** | **Recommendation on Port Traffic Signals** | |
|  | 3 lights on top of each other | colors, characters |
|  |  |  |
| **E-112** | **On Leading Lights** |  |
|  | Light point model |  |
|  | Day mark with illumination | |
|  |  |  |
| **O-133** | **Emergency Wreck Marking Buoy** | |
|  | Lights, buoys, AIS, racons, sound | |
|  |  |  |
| **O-138** | **The Use of GIS and Simulation by AIDS to Navigation Authorities** | |
|  | No technical input |  |
|  |  |  |
| **E-141** | **Standards for Training and Certification of AtoN Personnel** | |
|  |  |  |
| **O-143** | **Virtual Aids to navigation** | |
|  | Real AIS |  |
|  | Synthetic AIS |  |
|  | Virtual AIS |  |
|  |  |  |
| **E-200** | **Marine Signal Light** |  |
|  |  |  |
| **E-200-0** | | **Overview** |
|  |  |  |
| **E-200-1** | | **Colors** |
|  | Chromaticity coordinates of light source and filter | |
|  |  |  |
| **E-200-2** | | **Luminous Range** |
|  | Nominal range |  |
|  | Lumance as function of | range |
|  |  | meterological visibility |
|  | Service allowance |  |
|  |  |  |
| **E-200-3** | | **Measurement** |
|  |  |  |
| **E-200-4** | | **Effective Range** |
|  | Effective range | Function of frequency and spectral content |
|  |  |  |
| **E-200-5** | | **Optical Apparatus** |
|  | Horizontal and vertical beam intensity variation | |
|  | Rotations performing character generation | |
|  | Filters (boundaries) |  |
|  |  |  |