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

**On**

**Planning an E-Navigation Testbed**

**Edition 1**

**[Date issued]**

**[Previous Edition; Date issued]**

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

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| **Date** | **Page / Section Revised** | **Requirement for Revision** |
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Guideline on Planning an E-Navigation Testbed

# Introduction

E-Navigation testbeds are the primary means to demonstrate proof-of-e-navigation concepts that have been developed thus far.

1.1 Purpose of the document

The purpose of this document is to provide a guidance for project managers to

1. design a testbed;
2. plan tests; and
3. analyse and report the results of test cases.

In addition. it provides a basis for testbed-in-the-loop (TITL) for further testbed activities & implementation of e-navigation solutions. The guideline was developed with three overarching design goals - reciprocity, transparency, and productivity:

1. Reciprocity – means the possibility for stakeholders for their own interpretation (what does interpretation mean)
2. Maximum transparency and traceability to the original testbed aims?
3. Easy-to-use templates for reporting testbed results

In order to ensure the goal achievement, the following design solutions have been applied:

1. Systems engineering approach (for G1)
   1. Stakeholder identification & analysis
   2. Requirement identification & analysis
   3. Validation & verification
2. Distinction among testbed, test and test case (for G2)
3. Use of IALA Guideline No. 1107 on “The Reporting of Results of e-Navigation Testbeds” (for G3) http://www.e-navigation.net/index.php?page=test-beds

1.2 Related documents

IALA Guideline No. 1107 on The Reporting of Results of e-Navigation Testbeds, Edition 1, December 2013

# Background

The E-Navigation committee has identified the need to establish a structured process to learn from the experience made in e-Navigation testbeds.

Benefits of the process would be the harmonization of future testbed activities, improved interoperability and cooperation of testbeds as well as support of the implementation of e-Navigation solutions. Therefore, the ENAV committee has outlined the “e-Navigation Lessons Learnt (eNavL²)” process to collect, exchange and consolidate experiences from existing and (currently) emerging e-Navigation testbeds.

However, the consolidated interim results of eNavL² process showed that this would need too much effort for existing e-Navigation testbeds to provide inputs with the process. Thus, the ENAV committee suggested to use this interim result to set up a guideline to support planning of new e-Navigation testbeds and to provide guidance for project managers to include this during the planning phase of projects.

This document is based on the experiences from testbeds so far including academic and industrial perspectives.

# PLAN a testbed

In figure 1 describes the class diagram of e-navigation testbed and its components that were identified…

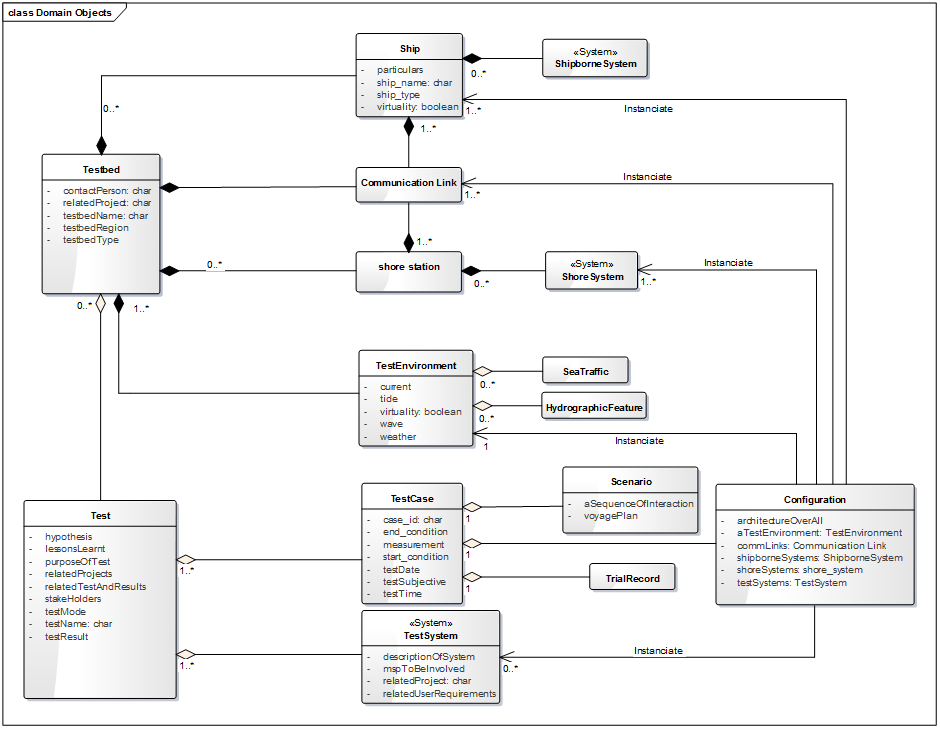


Figure 1. class diagram of testbed and its components

## Design a testbed

A testbed[[1]](#footnote-1) is a well-organized environment where tests of a concept or hypothesis are conducted. In the case of an e-Navigation testbed there are normally four main components:

1. One or multiple number of ships where shipborne systems are installed and tested;
2. Communication links between ship-to-ship, ship-to-shore, shore-to-shore;
3. One or multiple number of shore-stations where shore-based systems are installed and tested; and
4. A realistic test environment that is characterized by:
   1. Representative samples of users;
   2. Representative sea-traffic levels and densities; and
   3. Realistic meteorological and hydrographic conditions including tidal heights, tidal streams, sea state, visibility and weather.

A testbed can be categorized as:

1. a real-world testbed;
2. a virtual testbed that is implemented with simulator(s); and
3. a hybrid testbed which is a combination of a virtual testbed and a real-world testbed.

# Plan tests

A test is a series of activities for testing an e-Navigation systems or solution to find out about it. Tests determine the properties or functional capabilities of the tested item. Because a test is normally more exacting than demonstration, it requires specialized test equipment, configuration, data, and procedure in order to verify that the item satisfies some requirements or a hypothesis that is laid on the item. Hypothesis, a set of test cases, results and lessons learnt are the main components of tests.

A test case comprises a set of conditions under which an e-Navigation solution is determined and whether it is working as expected by the hypothesis of the test, an execution scenario and measurement. The conditions of a test case include start conditions and end conditions. The start conditions define the conditions under which an instance of test case is generated. The end conditions define when each test case finishes. The execution scenario is a combination of an instantiation of testbed components and interactions between these components.

# Analyse and report the results of test cases

1. Description of the studied problem
2. Detailed description of the target of the analysis – specify objective of the analysis and define requirements to the expected results
3. Description of the question, implementation, results and recommendation
4. Comparison with similar analysis (optional)
5. Recommendation for further studies / evaluations (optional)
6. Summary

# LESSONS LEARNT

1. Annex
2. TemplateS
   1. Testbed description

|  |  |  |  |
| --- | --- | --- | --- |
| **ID** | **Item** | | **Description** |
| 1 | Name | | Name of testbed for referring |
| 2 | Region | | Geographical description on the location or area of the testbed. A combination of google map and small scale chart image can be useful to depict the region of the testbed. This should at least be supplemented by adequate sea charts |
| 3 | Related projects | | The name of project which established the testbed |
| 4 | Testbed type | | A testbed can be virtual, physical or hybrid. |
| 5 | Contact Person | | Contact information on the personnel in charge |
| 6 | (List of) Ship(s) and particulars | Ship name | Name of the ship that is deployed in the testbed |
|  | IMO number | The IMO number of the ship |
|  | Particulars | The particulars of the ship including LOA and GT. |
|  | Ship type | Type of ship such as ferry, fishing vessel and tanker. |
| 10 | Communication link provided | Location | All types of the communication network that can be used in the testbed. When the testbed/test involves exchange of information, a description of the information contents and format would be useful. |
| How to access |
| Bandwidth |
| 11 | Shore station applicable | | List of shore stations that can be include in tests |
| 12 | Test environment | Hydrographic features | Hydrographic features of testbed |
|  | Sea traffic | The characteristic of traffics within the testbed such as traffic density, TSS and frequency of encountering ship |
|  | Meteorological condition | Meteorological characteristic of testbed. |
| 13 | URLs | | URLs for official webpage of testbed |
| 14 | Access the data and test results | | How to access the data and test results |
| 15 | Access the equipment / software | | * How to access the equipment * Open Source or freely available software? |
| 16 | Economic business case | | Would the testbed be looking at the economic business case? If yes, how? |
| 17 | Related testbeds | | Relation to other IALA testbeds |

* 1. Test description

|  |  |  |  |
| --- | --- | --- | --- |
| **ID** | **Item** | | **Description** |
| 1 | Test case ID | | An arbitrary unique identifier for test case for referring the test case. “Testbed Name”+”Test name”+”Date of test”+ “serial nuber” can be one the candidates for the ID. |
| 2 | Test date and time | | yyyy/mm/dd when the test case was studied |
| 3 | Conditions | | Conditions for staring the case and closing the case |
| 4 | Configuration | Ship | Instantiations of the components of testbed. |
|  | Ship-born system |
|  | Shore-based system |
|  | Ship-to-ship comm. |
|  | Ship-to-shore comm. |
|  | Shore-to-shore comm. |
|  | Tested system |
| 5 | Test subjective | | Information on the person(s) who was experimented during the trial |
| 6 | Scenario | | A designed and recorded flow of interactions among the instances of testbed components during the trial. |
| 7 | Measurement | | A set of properties that was measured and way of measurement |
| 8 | Trial record | | Raw records that were collected throughout the trial including measured values by special equipment and ship track record. |

* 1. Test case description

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1. There have been many numbers of e-navigation testbeds which was or have been implemented during a research project. In this reason, a testbed is often confused with the project where the testbed is implemented. [↑](#footnote-ref-1)