

# **IALA Generic Risk Model Tool Submission to IMO**

Submitted by IALA Secretariat



SUB-COMMITTEE ON SAFETY OF  
NAVIGATION  
50th session  
Agenda item 18

NAV 50/INF.3  
5 April 2004  
ENGLISH ONLY

## ANY OTHER BUSINESS

### SAFETY MEASURES FOR SHIPS NAVIGATING IN NARROW WATERWAYS AND/OR AREAS OF DENSE TRAFFIC

Submitted by the International Association of Marine Aids to Navigation and Lighthouse  
Authorities (IALA)

#### SUMMARY

- |                                   |  |
|-----------------------------------|--|
| <b><i>Executive summary:</i></b>  | Report on the work undertaken by IALA on the development of a Risk Management Tool |
| <b><i>Action to be taken:</i></b> | Paragraph 5  |
| <b><i>Related documents:</i></b>  | NAV 49/INF.6 and NAV 49/19, paragraphs 18.11 and 18.12                             |

1 At its forty-seventh session, the Sub-Committee considered *measure 17* of the report on Oil-tanker safety – Post-**Erika** discussion, and after being informed by the observer from IALA on the current work by IALA on operational procedures, risk analysis, pilotage, VTS and AIS issues for confined waterways, expressed the opinion that the outcome of IALA's work could form the basis for some future work, and invited IALA to keep the Sub-Committee informed of the work.

2 At its forty-ninth session, the Sub-Committee noted the progress of the work being undertaken by IALA on the development of a Risk Management Tool for use by VTS and Aids to Navigation Authorities.

3 Since the forty-ninth session, the initial development of the Risk Management Tool has been completed and a brief description of it is given in the annex to this Note. It is intended to keep the Tool under review so that it can be refined and improved as and when experience in its use indicates this to be necessary.

4 In addition to the various validation tests carried out during the development of the components of the Tool, it was used in its entirety to assess the risk in the Torres Strait in support of the submission to the Sub-Committee by Australia to introduce mandatory pilotage on ships transiting the Strait.

For reasons of economy, this document is printed in a limited number. Delegates are kindly asked to bring their copies to meetings and not to request additional copies.
--

5 The Sub-Committee is invited:

- .1 to note that the IALA Risk Management Tool is now complete and has been used on one international application; and
- .2 to consider whether the IMO Secretariat should be invited to convene a Joint IMO/IALA Workshop or Seminar of one or two days duration to enable the Risk Management tool to be introduced in detail to the Sub-Committee, including the principles on which it is based and examples given of its use.

\*\*\*

## ANNEX

### IALA RISK MANAGEMENT TOOL FOR AIDS TO NAVIGATION AND VTS AUTHORITIES

#### Introduction

1 The development of a Generic Port and Waterway Risk Management Tool for use by Aids to Navigation and VTS Authorities is now virtually complete. The Tool is capable of:

- Assessing the risk in ports or waterways, compared with the risk level considered by Authorities and stakeholders to be acceptable. The elements that can be taken into consideration include those relating to vessel conditions, traffic conditions, navigational conditions, waterway conditions, immediate consequences and subsequent consequences;
- Identifying appropriate risk control options to decrease the risk to the level considered to be acceptable. The risk control options available include improved co-ordination and planning; training; rules and procedures including enforcement; navigational, meteorological and hydrographical information; radio communications; active traffic management and waterway changes.

2 The Risk Management tool can also assist in assessing the risk level of existing ports and waterways as well as determining the probable risk level of proposed new ports and waterways or when substantial changes to existing ports and waterways are being planned. It is based on the co-ordination of a Preliminary Risk Assessment and a Quantitative Risk Assessment. A flow diagram of the procedure is given in Figure 1. However, the use of the tool is flexible and depending on the requirements, only one of the two Risk Assessment models may be used or both can be used either consecutively, as shown in the flow diagram, or in parallel.

3 The tool could also be used to quantify the effect on the risk level of an existing port or waterway resulting from the possible reduction or change of any of the risk control options in use.

#### Preliminary Risk Assessment

4 The Preliminary Risk Assessment model has been developed by the United States Coast Guard as the “Port and Waterway Safety Assessment model” (PAWSA).

#### Overview

5 PAWSA can provide an accurate risk assessment of an existing port or waterway in a short time frame and with limited expenditure. It is undertaken by carrying out a subjective assessment of the risk level of a waterway, based on the experience and expert opinion of stakeholders.

The assessment by this model indicates whether the existing risk level in the waterway is:

1. **Acceptable** and no further work is needed unless changes occur in important criteria, such as the traffic pattern or the types of ships using the waterway;
2. **Not Acceptable** but the risk control options necessary to make the risk level of the waterway acceptable have been identified adequately;
3. **Not Acceptable** and more detailed study is necessary to enable the risk control options that will make the risk level of the waterway acceptable to be identified adequately.

The PAWSA process has been completed in over 30 ports/waterways in the United States. The process has generally been well received by local maritime communities and has resulted in some resounding successes. PAWSA is an effective process for evaluating risk and enabling local authorities and waterway communities to work toward long term solutions tailored to suit local circumstances. The aim of the process is to find solutions that are both cost effective and meet the needs of waterway users and stakeholders.

### Methodology

6 A workshop of a selected group of waterway users and stakeholders from the local community is held. During the workshop participants discuss safety-related issues relating to the waterway and then provide numerical inputs to quantify those discussions. These quantitative assessments are organised into the following five logical segments: Team Expertise; Risk Factor Rating Scales; Absolute Risk Levels; Present Risk Levels and Intervention Effectiveness.

The participants use the results from each the last three segments as the springboard for discussions during the subsequent phase of the process when the following six risk categories are considered:

- Vessel Conditions – the quality of vessels and their crews that operate on the waterway.
- Traffic Conditions – the number of vessels that use a waterway and their interactions.
- Navigational Conditions – the environmental conditions that vessels must deal with in a waterway relating to wind, currents and weather.
- Waterway Conditions – The physical properties of the waterway that affect how easy it is to manoeuvre a vessel.
- Immediate Consequences – The immediate impacts of a waterway casualty.
- Subsequent Consequences – The subsequent effects of waterway casualties that may be felt hours, days, months and even years afterwards.

The output of the Workshop includes an in-depth analysis of the waterway and provides specific recommendations regarding the mitigation strategies that should be implemented.

## **Quantitative Risk Assessment**

7 The Quantitative Risk Assessment model has been developed by the Canadian Coast Guard in conjunction with the Danish Technical University and the Maritime Simulator Centre Warnemünde as the “IALA Waterway Risk Assessment Programme” (IWRAP).

IWRAP is capable of carrying out an in-depth study into the navigation requirements of waterways to enable the required risk level to be met. It can provide information on the appropriate risk control options to be:

- Used in an existing port or waterway where the preliminary risk assessment has shown that the risk level is not acceptable and that more detailed study is needed to identify the risk control options;
- Incorporated in the planning for substantial changes to existing ports and waterways;
- Incorporated in the planning of new ports and waterways.

## **Overview of IWRAP**

8 The algorithms of IWRAP are quite complex. The key features of the programme being:

- Vessel positional accuracy - determined from a set of rules developed by a study of marine aids by Canadian Coast Guard;
- Safety margin, drift angles and bank affect - calculated using formulae developed by PIANC;
- Probabilities of grounding and collision - derived from the formulae developed by Prof. Pedersen of the Technical University of Denmark (DTU) and in conjunction with Prof. K. Benedict of the University of Wismar and Prof. E. Topuz of the Istanbul Technical University.

As part of the validation process, IWRAP has been applied to the Straits of Bosporus, Tampa Bay, and parts of the St. Lawrence River with results indicating a strong correlation between theoretical and actual incident data.

## **Methodology**

9 The waterway is broken into discrete reaches and bends and modeled using available traffic data. Using a combination of vessel types and differing requirements for the waterway, a number of scenarios are created. The results of these scenarios provide quantitative data for assessment of risk within the waterway.

10 The geographical arrangements of any waterway that is set out on a vector chart can be applied directly to the model and the values of traffic management tools in the waterway, such as radionavigation services, aids to navigation, VTS, Pilotage and AIS can be inserted in it.

11 The operational traffic pattern that can be set up in the model includes the number and types of ships using the waterway and their speeds, ships' critical domains, traffic routes in use and spatial distribution of traffic in the waterway related to time. Various meteorological and hydrological conditions can also be applied.

12 Standards can be set for the probability of incidents and for the overall risk level. Information to assess the effect of mitigating factors being obtained from historical data, modelling or expert opinion.

**Figure 1**  
**Risk Management Tool - Flow Diagram**

