

Prof. Josip Kasum, Sc. D.; e-mail: jkasum@pfst.hr; Croatian Hydrographic Institute, Zrinsko Frankopanska 141; Split; Croatia

Pero Vidan, Graduate Engineer; e-mail: pvidan@pfst.hr; Faculty for Maritime Studies; Zrinsko Frankopanska 38; Split; Croatia

Krešimir Baljak, Graduate Engineer; e-mail: kbaljak@pfst.hr; Faculty for Maritime Studies; Split; Croatia

## **THREATS AND NEW PROTECTION MEASURES IN INLAND NAVIGATION**

### **ABSTRACT**

The density of navigation in the world waterways is considerable, especially because it is more profitable, when compared to other forms of transport.

In this paper the authors propose new measures for security protection of inland waterways and of ships and ports in inland navigation. Because of various kinds of threats in inland waterways navigation it is proposed to develop the *International Ship and Port facility Security Code* (ISPS) code suited to such navigation. Therefore the working title of the document is proposed as *International Ship and Port Facility Security Code in Inland Waterways* (ISPSIW).

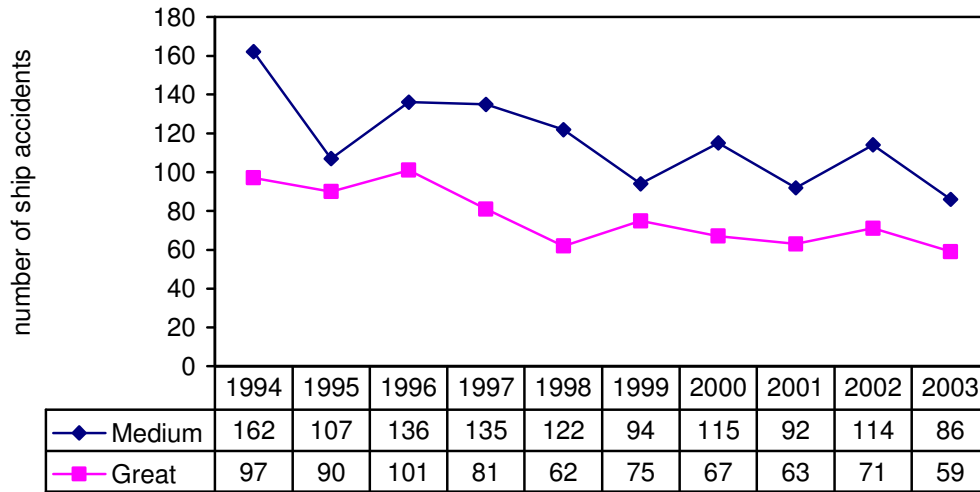
**KEY WORDS:** *safety, threats, protection, inland navigation*

### **1. INTRODUCTION**

In the last twenty years there has been a growth of traffic of containers, general and liquid cargo in inland waterways [1]. It is estimated that, the same as sea waterways, the areas of inland navigation are also threatened by terrorist attacks. It is assumed that the consequences may also be significant (Graph 1).

However, *International Maritime Organization* (IMO) [2][3] or any other organization has not yet been enacted measures to protect the security of ships and ports to inland waterways used by Convention and Non-Convention maritime and inland ships.

Convention ships are the ships included in the provisions of *Safety of Life at Sea* (SOLAS) Convention. Non-Convention ships are all other ships which are not subject to SOLAS regulations, e.g.: fishing boats, yachts, boats, recreational boats and war ships [4][5].



Notice: **Medium** damage in the range of \$ 50,000-250,000, with no human injury, with small contamination (0,04-4 t).  
**Great** damage ranged from \$ 250,001 and higher, with at least one man hurt (injury, death), and the pollution is more than 4 tons.

### Graph 1: Statistical presentation of injuries and damage in the United States 1994-2003

(Source: US Coast Guard and US Army Corp of Engineer, available at [16])

## 2. THREATS AND NEW MEASURES

Besides navigational threats like shoals, waterway junctions, etc., inland waterways are intersected by road and rail bridges which are another danger to the safety of navigation [6][7]. Rivers connect towns with the sea and have numerous tributaries used for irrigation of farmland, in industrial plants etc. Ports in such areas have smaller capacities than marine ports, but significantly increased traffic [8][9]. It is proposed to use measures for estimation of potential human, material and other threats [5]. Therefore it is necessary to determine the density of various infrastructures in inland waterways based on the following:

- density of populated places in the waterway  $G_{nm}$ ,
- density of population in the waterway  $G_{na}$ , and
- density of potentially threatened objects in the waterway  $G_{no}$ .

Density of populated places in the waterway ( $G_{nm}$ ) is defined as the ratio between the total number of populated places in the waterway ( $N_m$ ) and the length of the waterway ( $l$ ).

$$G_{nm} = \frac{\sum_{i=1}^n N_m}{l} \quad (1)$$

Density of population in the waterway ( $G_{na}$ ) can be defined as the ratio between the number of inhabitants in the waterway ( $S$ ) and the length of the waterway ( $l$ ).

$$G_{na} = \frac{\sum_{i=1}^n S}{l} \quad (2)$$

Density of potentially threatened objects in the waterway ( $G_{no}$ ) is defined as the ratio between the number of threatened objects ( $O$ ) and the length of the inland waterway ( $l$ ).

$$G_{no} = \frac{\sum_{i=1}^n O}{l} \quad (3)$$

Human error is a crucial factor in an emergency situation [10][11]. It may be unintended pollution of water, improper running of sluices and dams, incorrect estimation at manoeuvring, etc. The coefficient of threats caused by human error  $K_{hm}$  is defined as the ratio between a number of accidents caused by human error ( $\sum_{i=1}^n n_{hm}$ ) and the length of the inland waterway ( $l$ ):

$$K_{hm} = \frac{\sum_{i=1}^n n_{hm}}{l} \quad (4)$$

Because of various kinds of threats in inland waterways navigation [12] it is proposed to develop the ISPSIW code suited to such navigation [2].

### 3. SECURITY AND SAFETY IN INLAND NAVIGATION

Upon imposing the ISPSIW code for Convention and Non-Convention ships, it is proposed to divide it to basic levels:

- 1) Convention and Non-Convention inland navigation ships,
- 2) Organisation,
- 3) Ports, and
- 4) Other.

The first level refers to Convention and Non-Convention inland navigation ships. The main references of ISPS Code should be observed, but additional attention should be given to the issues relating to inland waterways. Navigation along dark sides of rivers and lakes, passages under bridges etc. are immediate hazard for forced entry of terrorists and explosives. It is, therefore, proposed to install *Automatic Identification System (AIS)* and *Ship Security*

*Alert System (SSAS)*. The ships need to be adequately lit and areas of limited access marked. It is also proposed to implement *Ship Security Plan (SSP)* and appoint a *Ship Security Office (SSO)* [2]. Military and public ships can be considered as well-protected ships. It is assumed that tourist ships, sport and recreation ships, ferries and fishing ships are not adequately equipped with navigational and protection equipment. It may also be assumed that the crew aboard such ships is not sufficiently trained for conducting those ships. Such ships are more frequent than Convention ships and are more difficult to control [9]. A proposal for the protection of Non-Convention ships in sea areas and nautical tourism ports should be considered [9]. There are differences in skills, required competences and state control which vary from country to country. It is, therefore, proposed the following: to standardise educational programmes for training crews of inland navigation ships and Non-Convention ships and to conform at international level official forms of various permissions and control system.

In the second level of ISPSIW Code development various forms of organisations, legal forms of the companies at inland waterways need to be determined. For instance, the majority of Non-Convention ships in inland navigation are sports and recreational ships. The owners of such ships are generally physical persons, but also legal persons. It is proposed to organise them into sports associations, companies, charter companies, various sports clubs, etc.

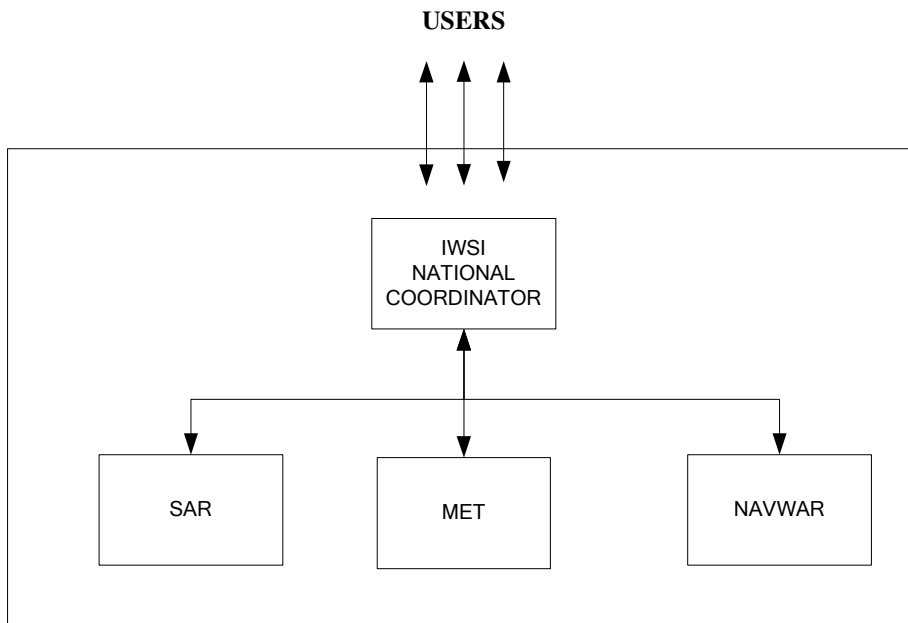
The third level refers to ports, shelters and winter harbours [2]. Shelters and winter harbours are places suitable for accommodating ships, accommodation and dispatch of cargo and passengers. Ports and winter harbours are usually located in larger industrial centres and towns. They are protected from various hydrographic and climatic influences. River ports are most often the ports of large cities, situated by the cities or city centres [13][14]. The security of such ports is important from the aspect of inhabitants and safety of navigation. The approach to ports from the coast is not controlled or is not controlled sufficiently. For instance, it is possible to enter a port in a smaller vessel without being controlled [2][5]. Hence, the arrivals of ships into ports have to be systematically announced, and the sojourn in the port, entrance and exit of people and cargo need to be constantly controlled. Like sea ports open for international traffic, inland traffic ports should have security standards as well. It is proposed to install the following equipment in inland waterways ports: port radars, AIS system, video surveillance, system for indirect detecting container content etc. It is proposed to train the teams for various forms of safety protection [8][10][15]. It is also proposed to appoint a *Company Security Officer (CSO)*.

The fourth level refers to the protection of other relevant elements, primarily to various control and management systems. Control and management of river navigation is not equally performed in various countries. Some countries do not keep adequate records about transit of ships, river navigation is done without announcement and without information about destination, kind of voyage and kind of cargo [13][16][17]. The countries which have their jurisdiction over inland waterways should have a full control of the navigation. For instance, besides coast and port radars, River Information System (RIS) should be established.

It is proposed to treat all information regarding the safety of navigation along inland waterways as *Inland Water Safety Information (IWSI)*. They will have to be distributed to the user through different media:

- regular broadcast of radio notices related to IWSI,
- published in river navigational charts, and
- published in river navigational publications.

Regular broadcast of radio notices related to IWSI need to be classified to *Search and Rescue* (SAR) messages, *Meteo* (MET), *Navigational Warnings* (NAVWAR), and the national coordinator for each category has to be determined (Figure 1). It is necessary to introduce *Inland Water Information Service* (IWIS) for monitoring data about the safety of the waterway in all critical areas. The data may become available through, for instance, *Very High Frequency* (VHF) or *Medium Frequency* (MF) device, *Navigational Telex* (NAVTEX), *International Maritime Satellite Organization* (INMARSAT) etc. It is also proposed to organise a world-wide service for the coordination of such data *World-Wide Inland Water Information Service* (WWIWIS).



**Figure 1 Model of the IWSI distribution**

Standards relating to the production of river navigational charts have to be defined, similar to *Electronic Chart Display and Information System* (ECDIS) which has already been applied in river navigation. In order to increase the level of navigation safety their information content needs to be broadened with, for instance, information about new measures.

It is proposed to organise the standards in the production of river navigational publications by integrating IWSI into them, which would congest the information content of the river navigational charts. It is also proposed to use the presented approach in the development of new measures with the aim to reach international standards and their world-wide implementation.

## 4. CONCLUSION

Despite the fact that in the global economy inland navigation routes have been increasingly used for transport and the fact that they are most profitable method of transportation of people and goods within a continent, they are not sufficiently safe. Ships, cargo, lives, cities, villages and infrastructure objects of inland navigational routes are exposed to various kinds of threats. Therefore, for the further development of the protection standard ISPSIW, it is proposed to implement new measures presented in this paper.

Using available technical information and communication equipment such as IWSI, RIS, ECDIS, NAVTEX etc. higher level of security and safety is obtained. New measures are considered to be functional for an accurate estimation of potential human, material and other threats. Human error is also considered as one of possible threats. It can be estimated by calculating the proposed measure in relation to the coefficient of threat caused by human error. It is proposed to make new hydrographic survey which would include proposed measures. As result, in such way navigator would have insight to potential threats on particular water area. The navigation area is meant to comply with the proposed measures which gave an insight into the danger area from the point of security. State which has jurisdiction over certain areas should develop regulations to protect people, ships and the environment. The implementation of the proposed measures is considered as a contribution to the increase of security and decrease of potential threats to lives and goods in internal navigational routes.

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