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Dedicated to the 150th Anniversary and
The 1st Congress of World Engineers and
Riga Polytechnical Institute / RTU Alumni

DIGEST

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E-guided Vessel – Introduction to Collision Avoidance System

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Keywords **– vessel collision avoidance, traffic systems, automatization.**

I. Introduction

Statistical data and accident rate at sea allow determine and understand the human role in today's shipping, its interactions with electronic navigational aids and process automation in general. The majority of accidents are caused by human error and the right approach to automation could help to reduce the number of accidents.

II. Economic aspect

The number of crew members has been reduced as a result of cost cutting due to the prevailing economic situation, together with the fact that fewer people have wanted to work on a board ship over the last years. The inevitable results are that safety levels decrease and the amount of work load increases for deck officers. For example, the large container ships with 8,000 TEU capacity may have a crew of 15-17 people. A few years ago when the world economy was not hit by the global crisis, the same ship were served by 22-25 people. One vessel crew cost reduction can reach up to $ 250,000 per year [1], which is really an impressive figure, considering that an average of one sailor costs $ 30,000 per year [2]. Despite this Drewry Shipping Consultants' studies predict that in 2013 the ship's officers and ratings shortage will reach 7% of the total number of seafarers, it is 32,153 and 46,881 person respectively [3].

III. Collision Avoidance Systems

As an already working analogue of such a system one could name the following:

Traffic Alert and Collision Avoidance System (TCAS) – mandatory on all large transport aircraft (on more than 25,000 aircraft worldwide) and has been in operation for more than a decade, prevented several catastrophic accidents.

Vehicle Collision Avoidance System (VCAS) – uses millimetre-wave radar to detect vehicles and obstacles on the road ahead and to help to reduce the severity of collisions, along with newly developed stereo camera to detect pedestrians and support evasion manoeuvres by the driver, retracts the seatbelts and warns the driver when it determines a high possibility of a collision.

Railway collision avoidance system (RCAS) – calculates own position and movement vector and broadcasts this information as well as additional data like vehicle dimensions to all other trains in the area. The system can take into account different danger sources, like advancing trains or road vehicles or obstacles, and classify them according to a specific scale.

Whale anti-collision systems (WCAS) – represents a chain of buoys with sensors and other equipment that analyses sounds, locate each particular whale in 3D. There is also communication system buoy – shore installed both ways in such a way that all vessels in the vicinity of whales receive relevant information.

IV. The ways of introduction ACAS on board

Considering the opportunity of such system introduction on board of the merchant vessel, several moments should be taken into account – it should be simple enough and safe at the same time. It could be introduced as an additional computer on the bridge (or as a part in the Integrated Bridge System) with the corresponding software which would receive input data process into a warning message and possible situation decision. Automatic Collision Avoidance System (ACAS) leads to the idea of equipping the ship with 3G system (the latest Dynamic Positioning ships are equipped with 2G – GPS and GLONASS satellite receivers, which provide the highest vessel positioning accuracy.

There also raises a question, whether ACAS should be introduced on all the vessels, the same as TCAS or RCAS, where there is an information exchange between retransmitter of two vehicles or it could work the same as VCAS independently to avoid the collision situation. No doubts that the second option has an advantage, it also makes possible for the ship owner to implement such system step by step on all the vessels. The first option – like single requirements that could concern ships of certain tonnage and navigation area would be too complicated and time consuming process.

Considering the ships manoeuvre as an action which has to be done timely, in certain point and to the certain course according to the collision regulations and bearing in mind all the manoeuvring characteristics at the same time fully automatic system would have more opportunities in this situation. However it is impossible to exclude absolutely the human from ship operating chain for now.

Besides the initial information the main attention should be paid to the way of data processing, i.e. to the software of the ACAS. Here as well different options are possible: using fuzzy sets, catastrophe theory, expert systems, neural networks, hypothesis-based reasoning system etc. None of these methods can be employed singly to solve the problem. A new way needs to be introduced that would combine probably a mix of several different methods.

V. Conclusions

Besides the human factor reduction, ACAS provides safety at sea, as an aid to vessel traffic service VTS to control the traffic in restricted waters. More and more tasks have been taken over by electronic systems – it is likely that ACAS is going to be one of the most effective ways to overcome its occurrence. Although such a system is not used on merchant vessels now, it could be implemented in the near future.

VI. References

[1] Welcome A., "Training in needed to remedy unfamiliarity with ENCs", Seaways, International Nautical Institute, March 2010.

[2] Seaman Jobs, "Overall Outlook for Surrounding Area", 03.10.2007, URL: http://jobs.aol.com/jobs-by-city/seaman-oh-jobs.

[3] "Моряков не хватает по-прежнему", 26.07.2010, URL:http://www.surpr.ru/news.php?n=770.