Analysis of the Performance of a Medium Frequency Offshore Grid for the Identification of Vessels Sailing in High Density Maritime European Routes

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ABSTRACT

This paper analyzes the performance degree of an Automatic Vessel Identification System on Medium Frequency (AVISOMEF), which works with the Grid Method (GM) in high density maritime European routes using real data and uniformly distributed data. This system, AVISOMEF, compared to others brings the novelty that is not a satellite system nor is limited by a given coverage distance, as happens with the Automatic Identification System (AIS), though in exceptional circumstances it leans on it. To perform the analysis, a simulation Software was developed, as well as the selection of the maritime routes which will be studied along with their traffic density data. For each route, we have performed two simulations; the first one belongs to the uniform traffic distribution along the same, and the second providing the software with real AIS data positioning vessels sailing in them. Finally, in base to the obtained results for both simulations, conclusions are formulated regarding the capacity of the selected routes to support AVISOMEF.

KEY WORDS

1.Ships Identification Systems 2.Grid Method 3.Traffic Control Centre 4.SITOR

1.- INTRODUCTION.

The system, whose implementation in European high-density routes is discussed in this paper, came up after an academic analysis of Global Maritime Distress Security System (GMDSS). We checked that this last was obsolete upon arriving at vessels. We were aware of the high investment and that the difficulties to reach world-wide agreements to remove a system that is beginning. So that, we concluded that is a highly improved system if complemented with new equipment. This could be as a large input/output communication portal for the vessel. Combined with proper equipment and taking part of the GMDSS equipment, there are a huge range of possibilities which would increase security and control over navigation. (López 2012)

AVISOMEF is an automatic vessel identification system on medium frequency, MF. This system, compared to others brings the novelty that is not a satellite system nor is limited

by a given coverage distance, as happens with the Automatic Identification System (AIS) (Høye et al. 2008, Inoue et al. 2005, Larrabel et al. 2010), though in exceptional circumstances it leans on it.

Since AIS is used, it has been revealed as an effective way to perform an efficient control. Its only weakness is the limitation of visual range (more/less 30 miles), characteristic of Very High Frequency (VHF), frequency range in which AIS works. This limitation is overcome through the use of frequencies present in the frequency band of High Frequency (HF), or by the use of some satellite-based techniques if the target is not to have coverage limitations, as the system LRIT (Long-Range Identification and Tracking). The first solution is ruled out despite of global coverage, due it depends on the different times on day, or even year seasons. It would not be possible to reach vessels located at a distance less than the estimated by the atmospheric rebound, besides there could appear some side effects like fading. The second solution is quite good, technically speaking, but has the disadvantage that satellite connections are rather expensive and that space is saturated.

AVISOMEF will be the result of the symbiosis of one transmitter, four receivers - two of which should include a Digital Selective-Calling system (DSC) - and a control computer capable of supporting a determined digital mapping that should be implemented (Hekmat, Van Mieghem 2006).

This mapping will match with the maritime area to be controlled, and it is made up of a grid composed of cells. These will be squares of side 44 nautical miles; the only condition is that the message radiated at the beginning of each cell will reach the end of the following one. These grids will have one row and as many columns as needed to cover the mapping area to control. All vessels situated on this elemental surface (cell) will adjust the AVISOMEF transmitters and receivers automatically in order to work in a series of channels already predetermined for each cell, corresponding to the MF frequency assigned to the Maritime Mobile Service. The information of these channels will be provided to the computer integrated into the digital mapping of the controlled area (Akyildiz, Wang & Wang 2005, Ge et al. 2007).

The system will allow ships sailing in the area inside the squares to act as receivers - and therefore acknowledgement emitters- of a message launched from a Traffic Control Center (TCC). But they could also work as simple repeater stations for a message that is not targeted at them, making the message advance in the grid and arrive at the ship that has been called.

To avoid the conflict between possible repeaters when gaining access to the respective channel, it is important to establish a criteria, for example the vessel working as a repeater would be, the one located further to the south and further from the following cell. It could serve any criteria; the only important thing is establishing one. These waiting times are controlled by the computer from the positioning information given by the G.P.S. (Global Positioning System) or any other positioning system (López 2009).

The aim of AVISOMEF system is to identify a ship through a radio-packet launched by a Traffic Control Centre (TCC). This radio-packet is aimed at a certain ship using his call sign, the one corresponding to the digital selective calling (DSC), Maritime Movil Service Identity (MMSI) . This radio-packet moves forward from cell to cell until a certain vessel detects that it is for him, and therefore it will not work as a repeater of the message for the ships located in the following cell in the same line. Automatically, the