Lightning Protection of Ships in Maritime and Costal Environment

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1. INTRODUCTION

An electromagnetic pulse due to a nearby lightning stroke generates a high intensity magnetic field. Thin metal layers as applied in composite structures cannot shield such a magnetic field. Electronic equipment inside such structures will suffer from high-induced voltages and damage and interference will occur. If a lightning stroke hits the composite structure directly the material will be damaged due to the heat generated in the composite material. A direct lightning stroke is even more complex. The current path for the fast transient and the long tail, with the largest portion of the energy, is different, and different protection measures have to be developed.

2. THE STANDARDS IN THE LITTORAL AREAS

2.1 Existing standards

The current IEC–62305 [1] standard is the book of laws that govern the lightning protection. During the first part of our investigations, some flaws into this standard emerged. The fact that this standard concerns only the continental area represents a problem. In the case of maritime and costal environment, some particularities emerge. The influence of seas and oceans together with the influence of continents modify drastically the way thunderstorms behave in these littoral areas. Some important modifications to the standard where needed.

2.2 Littoral areas.

According to NASA [2], in the last years the lightning activity during thunderstorms in the costal environment intensified.

As a consequence of the intense electric field over the surface of water, the moist gasses from the ocean are highly polarized. And around the coastline they mix with the hot air from the continent and intensify the convection. The differences in temperature between the two masses of air are one of the factors to create instability and a high number of flashes per thunderstorm.

In the 80's[3] and in 2004[4] various scientists have looked for answers at the lightning activity over islands. But in this quest, the selection of a particular island can be considered delicate. On normal ground, on continents, the updraft can reach values 5 times bigger then over the oceans. Finding this type of conditions on an island turned to be a difficult task. Like the temperatures of the two colliding masses, the speeds of the updraft influence the development of a thunderstorm, and the number of flashes. The updraft plays an important role in the process of electrification. The water and dust particles in the air collide and exchange charge during the process as a consequence of the updraft.

3. CONCLUSIONS

The lightning protection, in the case of a ship, starts from analyzing its chances of being struck by lightning and continues with how to create a good shielding for the equipment on that ship. Because the standard is incomplete, urgent measures are imposed. With our work we plan to contribute on filling that gap.

4. REFERENCES

[1] IEC – 62305 Protections Against Lightning, January 2006;

[2] NASA Global Lightning Map – Global distribution of lightning April 1995 – February 2003 from the observations of the NASA OTD and LIS instruments;

[3] L. R. Lemon, C. A. Doswell III: Severe thunderstorm evolution and mesocyclone structure as related to tornado genesis; Monthly Weather Review, Vol. 109 – Issue 9, 1979;

[4] Colin Price, 2008: Thunderstorms, Lightning and Climate Change; 29th ICLP Proceedings, June 2008.