IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (IP)

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LIGHTNING PROTECTION SYSTEM: CURRENT STRATEGY AND EVOLUTIONS

Abstract

When installed on its launching pad, the launcher must be protected against lightning strikes and all the possible subsequent electromagnetic (EM) induced effects. The IEC 62305 international standard provides all the regulatory requirements to carry out a proper design of Lightning Protection Systems (LPSs). They take the form of long vertical poles acting as lightning rods surrounding the launch pads. Their function is to capture high intensity lightning strikes and to evacuate them to the ground. The Electrogeometric model and its "rolling sphere" procedure is a widely spread procedure adopted in the community to design LPSs. In addition, LPSs must also cope with the reduction of the magnetic (H) field at the launcher level in order to guarantee EM compatibility with the launcher and its payload by balancing the evacuation of the lightning currents to the ground. The evaluation of the measures applied to reduce the H field generally relies on numerical electromagnetic (EM) simulations having the capability to account for all the relevant features involved in the EM response: the current injected on a LPS pole, the large geometry of the site up to buildings outside the launching pad, the soil characteristics, the grounding networks... Once the LPS is built, verification of the H Field reduction is generally made experimentally with local current injections. Such verification is necessarily partial because the real physics of the lightning channel cannot be simulated experimentally. However, such tests help comforting the hypotheses of the simulation model and their combination generally provides a good confidence on the efficiency of the LPS. Nevertheless, the design hypotheses are conservative and significantly constrain the construction and maintenance of LPSs. Optimization is required in order to relax those constraints. For this a feed-back on the lightning activity on the existing LPSs seems to be a solution for understanding the LPS "in action". This is why ONERA is developing a prototype for monitoring this activity, based on the measurement of various EM indicators on the site in order to be able to evaluate the net currents

in the poles. This paper will present a synthesis of the numerical and experimental means developed up to now at ONERA to design LPSs. Application to LPS design of launch pads at the Guiana Space Center will illustrate the presentation.