Evaluation of grounding impedance of a complex lightning protective system using earth ground clamp measurements and ATP modeling

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ABSTRACT: A new Lightning Protection System (LPS) was designed and built at Launch Complex 39B (LC39B), at the Kennedy Space Center (KSC), Florida, which consists of a catenary wire system (at a height of about 181 meters above ground level) supported by three insulators installed atop three towers in a triangular configuration. A total of nine downconductors (each about 250 meters long, on average) are connected to the catenary wire system. Each of the nine downconductors is connected to a 7.62-meter radius circular counterpoise conductor with six equally spaced 6-meter long vertical grounding rods. Grounding requirements at LC39B call for all underground and above ground metallic piping, enclosures, raceways, and cable trays, within 7.62 meters of the counterpoise, to be bounded to the counterpoise, which results in a complex interconnected grounding system, given the many metallic piping, raceways, and cable trays that run in multiple direction around LC39B. The complexity of this grounding system makes the fall of potential method, which uses multiple metallic rods or stakes, unsuitable for measuring the grounding impedances of the downconductors. To calculate the downconductors grounding impedance, an Earth Ground Clamp (a stakeless grounding resistance measuring device) and a LPS Alternative Transient Program (ATP) model are used. The Earth Ground Clamp is used to measure the loop impedance plus the grounding impedance of each downconductor and the ATP model is used to calculate the loop impedance of each downconductor circuit. The grounding impedance of the downconductors is then calculated by subtracting the ATP calculated loop impedances from the Earth Ground Clamp measurements.

Figure 1. New lightning protection system at Launch Complex 39B, at the Kennedy Space Center, Florida.