Vehicular HF Antenna Fabrication

Saurabh Sanghai*[(1)], Matthew Arendall, Allen Bradley [(1)], Maxim Ignatenko[(1)] and Dejan S. Fillipovic[(1)]
(1) Department of Electrical, Computer, and Energy Engineering
University of Colorado, Boulder, CO 80309-0425

Exchange of information through different modes of communication has gained unprecedented importance in recent times. Amidst the plethora of communication platforms available today, HF communications still proves to be the most reliable and robust means of communication over large distances. The adoption of HF into the tactical on the move type of communications has given rise to a new set of challenges. HF antennas typically operate within the 2-30 MHz frequency band. The size of these antennas is defined by their lowest frequency of operation. In such cases, the design and fabrication of these antennas for the vehicular platforms is particularly challenging in terms of the weight, physical size and performance specifications of the antenna over the vehicular platform.

This paper describes the fabrication process adopted for the realization of two HF antennas that are candidates for vehicular HF communication. The first candidate is an offset fed inverted-L antenna designed to work over the 2 – 10 MHz frequency range for the Near Vertical Incidence Sky wave (NVIS) mode while the second antenna is a capacitive loaded monopole designed to operate over the rest of the 10 – 30 MHz frequency band. The vehicular platform of interest is the Assault Amphibious Vehicle (AAV). Both the antennas are designed with a magnetic mount base for quick deployment over the vehicular platform without much modification to the vehicle geometry. The physical size of the Inverted-L antenna is 1.3 m (H) x 8 m (L). The antenna structure is fabricated using appropriate size aluminum pipes and couplings that provide good structural integrity while having a minimal weight penalty. The capacitive loaded monopole antenna has a physical size of 0.9 m (H) with a 1 sq. m capacitive top hat. The monopole is fabricated using a custom fabricated two element telescopic mast made from brass tubes. This allows for adjusting the antenna height once deployed, thereby offsetting the drifts in the antenna performance due to the surrounding environment and the small sized vehicular roof which acts as a ground. Numerous other factors and design decisions regarding the fabrication of these two antennas such as weather proofing, choice of materials, custom machining of parts, wind loading, realization of the antenna feed and the connector assembly are also discussed in detail in this work.