Real-Time Specification of HF Propagation Support Based on GAIM Models of the Ionosphere

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Abstract: AFRL has developed an HF propagation program that takes advantage of the world-wide USU-GAIM electron density profiles, which are updated every 15 minutes. In the initial planning stage, it was proposed that a current program such as VOACAP or ITU Rec-533 be modified, replacing the monthly median world maps of foF2 and M(3000)F2 by equivalent maps of GAIM values. However, the USU-GAIM profiles were found to be not amenable to this approach because of the presence of strong particle E (night E) profiles at high dip latitudes during the night, which preclude the determination of foF2 and M(3000)F2 in those regions. The lack of real-time observations of HF absorption and HF noise at the receiver also means that it is not possible to provide real-time specifications of the signal-to-noise ratio (SNR), the key parameter for HF communications.

AFRL has therefore concentrated on determining the range of frequency support for a specified circuit, from the lowest usable F-layer frequency (FLUF) to the highest (FMUF), together with the ELUF and EMUF. The FMUF, for example, is derived by first calculating the vertical incidence ionogram at the control point(s), and then transforming that ionogram to the oblique incidence (OI) ionogram for the given circuit length. The nose frequency in the OI ionogram is then the FMUF (or EMUF for a particle-E reflection). The amalgamated frequency range could be provided to an HF operator, or directly in terms of a task list to an Automatic Link Establishment (ALE) system.

This paper will provide a general overview of the methodology, and then present results of comparisons of the FMUF with observed values for several circuits. The discrepancies will be interpreted largely in terms of errors in the USU-GAIM electron density profiles.