LOW LATITUDE IONOSPHERIC MODIFICATION EXPERIMENTS WITH THE SPACE SHUTTLE

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The Space Shuttle OMS engines inject 20 kg/s of exhaust vapors that are highly reactive in the F-region ionosphere. Using dedicated engine burns scheduled by the Air Force Space Test Program (STP), the Naval Research Laboratory has conducted OMS burns over the low latitude radars located in Jicamara, Peru and Kwajalein, Marshall Islands. Future OMS burns are scheduled near the equator with observations from ground stations in Hawaii and from space using the Air Force C/NOFS satellite and the Canadian CASSIOPE satellite. The objectives of the low latitude experiments are (1) provide seeds to stimulate the formation of equatorial bubbles and (2) investigate radar scatter for electrostatic waves excited by the high speed exhaust. For the first objective, the OMS burns will occur along an orbit nearly tangent to the magnetic field direction. These burns will reduce the plasma density along the Space Shuttle Trajectory and consequently produce a localized reduction in flux tube integrated Pedersen conductivity. After sunset, this Pedersen conductivity hole will become unstable to form an equatorial bubble. The evolution of the bubble will use the in situ and radio beacon diagnostics on the C/NOFS and CASSIOPE satellites which are in 15 and 80 degree inclinations, respectively. For the second objective, the high speed exhaust vapors will be injected over the Air Force Maui Optical Site (AMOS). The exhaust molecules such as water vapor and carbon dioxide will charge exchange with the ambient oxygen ion to yield 10 eV molecular ions. These ions will stream in spiral orbits to create unstable velocity distributions. The unstable ions will stimulate lower hybrid and ion acoustic waves. Radars located on the west coast of Hawaii will be operated to detect backscatter from these waves. If possible, in situ observations of these waves will be made with plasma wave receivers on satellites.

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