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**Title:** The Charged Aerosol Release Experiment (CARE) Program

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### Abstract

A new experiment called the Charged Aerosol Release Experiment (CARE) employs the release of dust in the upper atmosphere to form a dusty plasma in space. Two solid rocket motors strapped side-by-side in opposition will provide a pin-wheel high speed dust dispenser for the CARE experiment. A spherical dust cloud will form as a radial expansion around the CARE dust release module. The release will occur between 200 and 250 km altitude in the F-region where the 10 to 1000 nm diameter particles will become charged by electron attachment. As the charged dust particle stream through the ionosphere, plasma irregularities will be produced by streaming and fluid plasma instabilities. The plasma turbulence will driven by large electric fields at the surface of the cloud resulting from the separation of unmagnetized negatively charge dust from the background positive ions which are tied to magnetic field lines. In addition, two stream instabilities from the charge particles moving through the plasma will cause plasma wave structures. The effects of the CARE dust release will be diagnosed with in situ electric field booms, dust detectors, and Langmuir probes. Remote sensing of the CARE release will involve ground backscatter radars in the HF, VHF, and UHF frequency ranges. At late times, the dust cloud will settle into the mesosphere where an artificial mesospheric cloud will be formed. Satellite imagery using the AIM satellite will measure the long-term dispersal of the artificial dust cloud. The results of the CARE experiment will be compared with radar, optical and rocket measurements of natural polar mesospheric clouds.

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