

STUDY OF ATMOSPHERIC PARAMETERS MEASUREMENTS USING MM-WAVE RADAR IN SYNERGY WITH LITE-II

Dr. Madeleine Andrawis
Electrical Engineering Department
South Dakota State University
Brookings, S.D. 57007-0194

The *Lidar In-Space Technology Experiment*, (LITE), has been developed, designed, and built by NASA Langley Research Center, to be flown on the space shuttle "Discovery" on September 9, 1994. Lidar, which stands for *light detecting and ranging*, is a radar system that uses short pulses of laser light instead of radio waves in the case of the common radar. This space-based lidar offers atmospheric measurements of stratospheric and tropospheric aerosols, the planetary boundary layer, cloud top heights, and atmospheric temperature and density in the 10-40 km altitude range.

A study is being done on the use, advantages, and limitations of a millimeter-wave radar to be utilized in synergy with the Lidar system, for the LITE-II experiment to be flown on a future space shuttle mission.

The lower atmospheric attenuation, compared to infrared and optical frequencies, permits the millimeter-wave signals to penetrate through the clouds and measure multi-layered clouds, cloud thickness, and cloud-base height. These measurements would provide a useful input to radiation computations used in the operational numerical weather prediction models, and for forecasting.

High power levels, optimum modulation, data processing, and high antenna gain are used to increase the operating range, while space environment, radar tradeoffs, and power availability are considered.

Preliminary, numerical calculations are made, using the specifications of an experimental system constructed at Georgia Tech. The noncoherent 94 GHz millimeter-wave radar system has a pulsed output with peak value of 1 kW. The backscatter cross section of the particles to be measured, and are present in the volume covered by the beam footprint, is also studied.