

TITLE: Warm Fog Dispersal

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SIGNIFICANT ACCOMPLISHMENTS TO DATE IN FY-83:

The charged particle generator was further tested after some design modification. The generator performance was measured with additional instrumentation and found to confirm previous measurements. Plans for a field testing were then developed.

The overall status of the program and the field test plans were presented to a group of atmospheric scientists and electrostatic experts at the NASA/MSFC sponsored USRA Workshop on Electrostatic Fog Dispersal at NCAR, Boulder, Colorado discussed in previous sections. The recommendations from this workshop are being evaluated as to whether NASA should proceed with the field test or whether further theoretical research on the phenomenon of electrostatic fog dispersal and additional development of the charged particle generator should be carried-out.

FOCUS OF CURRENT RESEARCH ACTIVITIES:

Information obtained from the USRA Workshop clearly identified three physical mechanisms that could possibly influence the fog dispersal process, which heretofore have not been considered, and which may provide additional insight to the direction of further fog dispersal work.

These mechanisms are: (1) the effect of corona discharge on the electric field strength at the surface, (2) the influx of fog into the cleared volume by turbulent diffusion, and (3) the increase in supersaturation as liquid water is removed, activating haze particles, and thus generating more fog. Plans are being formulated to investigate these mechanisms.

The limited electrostatic fog dispersal field studies carried out at the Panama Canal reported measured electric field values of  $10^5$  volts/meter at ground level. It was the general concensus of the committee, however, that these fields were one to two orders of magnitude high because of corona discharge at the surface. Interestingly enough, no one could provide a verifiable magnitude of the electric field possible at the surface. FWG Associates has pursued this and found that the agricultural insecticide community, who sprays with charged droplets, has made rough measures of the maximum surface electric field that can be sustained without excessive corona discharge. This new information should be incorporated into the final report, and a number of design values recomputed with this new information. An order of magnitude reduction of the electric field at the ground, if real, will drastically change the conclusions of the overall studies and should be verified before publishing the final document.

A second physical effect identified at the workshop was that the turbulent diffusion of fog into the cleared volume element could be considerably larger than predicted. The premise at the workshop was that the fog would diffuse back into a volume element which is fixed in space. This is not exactly correct, since the

volume element to be cleared drifts with the flow, and thus a Lagrangian rather than an Eulerian turbulence must be considered. However, based on the strong committee recommendation, it is necessary to recheck the magnitude of fog influx due to turbulence.

Finally, a phenomenon was identified which has not been considered in prior analyses or even discussed in the vast literature relative to electrostatic fog dispersal techniques. This is that by removing liquid droplets from the volume element, the supersaturation will be raised sufficiently to activate previously unactivated haze particles. These then form cloud droplets bringing the fog droplet population back to near original levels. The physically possible growth rates of droplet density should be analyzed at least on an order of magnitude basis to assure this effect is not significant.

#### PLANS FOR FY-84:

Analyze the order of magnitude effect of the three physical mechanisms identified at the fog dispersal workshop which affect the electrostatic fog dispersal process:

- a) The effect of corona discharge on the maximum electric field values achievable at ground level.
- b) The influx of fog into the cleared volume element due to turbulence.
- c) The growth of new fog droplets due to increasing supersaturation by migration of existing fog droplets out of the volume element.

Respond to the workshop finding relative to either carrying-out additional basic research, proceeding with the field test or beginning to look at new modern technology relative to penetrating fog (such as the "Majic Window Concept") rather than dispersion.

#### LIST OF PUBLICATIONS:

1. Walter Frost and Kao-Hyah Huang: "Test Results of Modified Electrical Charged Particle Generator for Application to Fog Dispersal," NASA CR-3674; February, 1983.
2. Walter Frost: "Preliminary Test Results of Electrical Charged Particle Generator for Application to Fog Dispersal," NASA CR-3654, November, 1982.