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A Balloon-Borne High-Definition Videosonde to Measure Thunderstorm Microphysics

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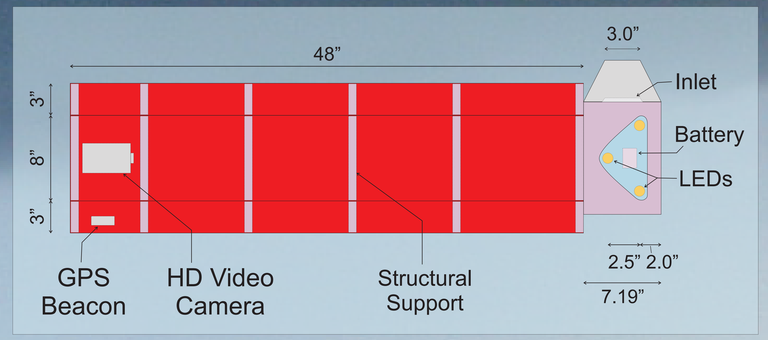
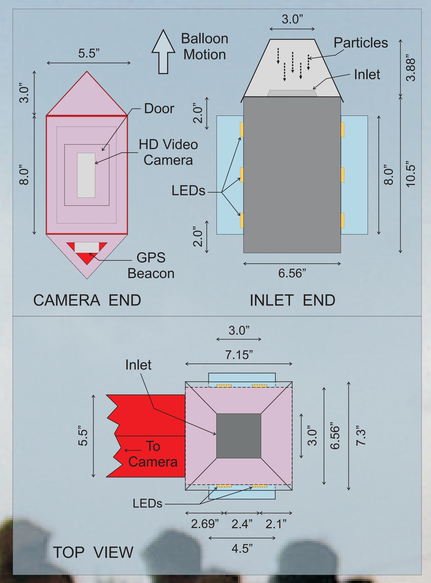




NSSL and CIMMS are developing the high-definition videosonde for several applications: ground truth for hydrometeor classification schemes of polarimetric radars, improving microphysical parameterizations in numerical cloud models, improving understanding of hydrometeor processing of chemical species, and improving understanding of thunderstorm electrification and lightning production.

The videosonde shown here uses a consumer-grade high-definition video camera at 24 frames/s, each frame being shot at 1/8000 s shutter speed to keep instrument motion from smearing the images. The circuits from six high-intensity LED flashlights provide illumination to discern particles at this shutter speed. Hydrometeors fall through a 7.6 cm x 7.6 cm (3” x 3”) opening as the balloon rises (typically at 3 - 5 m s^{-1}). Video data are recorded by the camera’s USB SD memory card, with time recorded on the audio channel. A ruler (see image above) is briefly inserted in the field of view prior to launch to provide a length scale in the video images. The back of the videosonde is painted flat black to improve contrast with the images.

The housing frame is constructed of construction-grade styrofoam and is covered with shrink wrapping for protection against the elements and to give structural rigidity. The particle intake is shaped as a truncated pyramid and is constructed of plastic coated with Vellox, which repels water and ice, to minimize particle collection and instrument icing. The shape also is intended to minimize splashing into the field of view.

A Vaisala GPS radiosonde is flown with the videosonde to provide the location and standard thermo-dynamic parameters corresponding to the video images. The electric field also is measured by a separate instrument in the balloon train. A parachute lowers the instruments to the ground after the balloon bursts, and a GPS radio beacon sends the instrument location for data recovery.

Dashed or dotted lines indicate a feature below the surface

Bright red shading indicates surface wrap

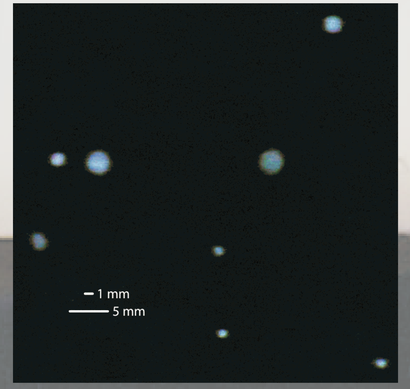
Pink and blue shading indicate styrofoam structures

Preparing the Videosonde for Launch

Examples of Videosonde Images

Data from a Snow Shower at the Ground

Data from a Flight through a Storm



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