Global Environmental Micro Sensors Test Operations in the Natural Environment

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ENSCO, Inc. is developing an innovative atmospheric observing system known as Global Environmental Micro Sensors (GEMS). The GEMS concept features an integrated system of miniaturized *in situ*, airborne probes measuring temperature, relative humidity, pressure, and vector wind velocity. In order for the probes to remain airborne for long periods of time, their design is based on a helium-filled super-pressure balloon. The GEMS probes are neutrally buoyant and carried passively by the wind at predetermined levels. Each probe contains on-board satellite communication, power generation, processing, and geolocation capabilities. ENSCO has partnered with the National Aeronautics and Space Administration's Kennedy Space Center (KSC) for a project called GEMS Test Operations in the Natural Environment (GEMSTONE) that will culminate with limited prototype flights of the system in spring 2007.

By leveraging current advances in micro and nanotechnology, the probe mass, size, cost, and complexity can be reduced substantially so that large numbers of probes could be deployed routinely to support ground, launch, and landing operations at KSC and other locations. A full-scale system will improve the data density for the local initialization of high-resolution numerical weather prediction systems by at least an order of magnitude and provide a significantly expanded *in situ* data base to evaluate launch commit criteria and flight rules. When applied to launch or landing sites, this capability will reduce both weather hazards and weather-related scrubs, thus enhancing both safety and cost-avoidance for vehicles processed by the Shuttle, Launch Services Program, and Constellation Directorates.

The GEMSTONE project will conclude with a field experiment in which 10 to 15 probes are released over KSC in east central Florida. The probes will be neutrally buoyant at different altitudes from 500 to 3000 meters and will report their position, speed, heading, temperature, humidity, and pressure via satellite. The GEMS data will be validated against reference observations provided by current weather instrumentation located at KSC. This paper will report on the results of the GEMSTONE project and discuss the challenges encountered in developing an airborne sensor system.

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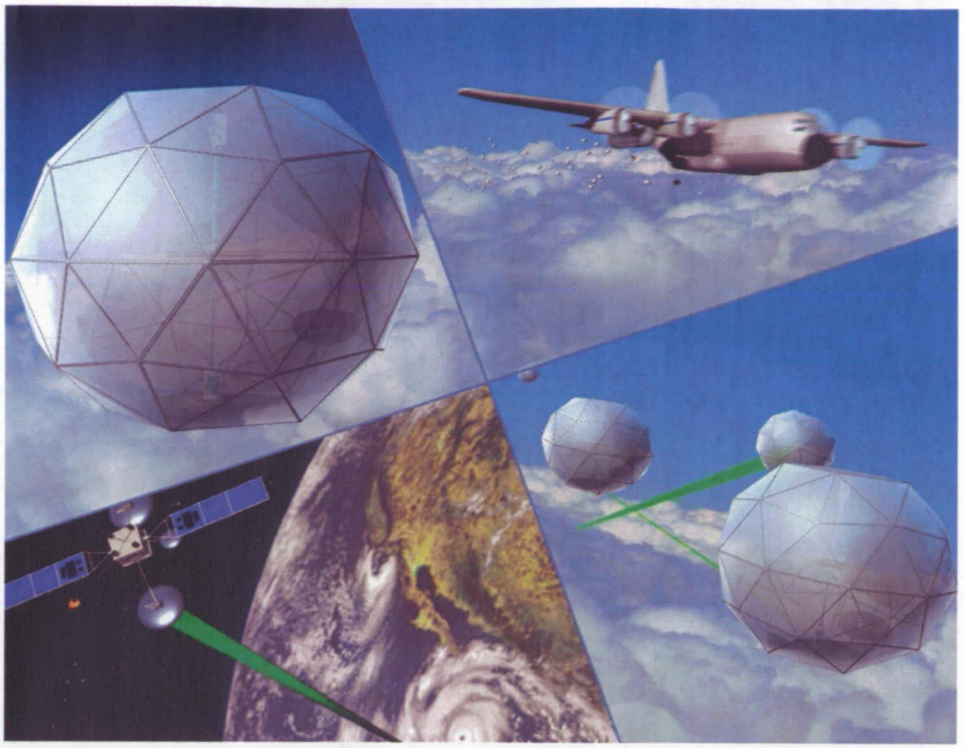

Figure 1. Conceptualization of GEMS illustrating possible probe design, deployment, dispersion, and communication/networking.