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Applications for Smart Balloons in Atmospheric Research

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This paper will provide a brief overview of the development of the NOAA Smart Balloon and its use in recent field experiments. Four smart balloons, specially instrumented with new lightweight ozone sensors, were released during the AIRMAP campaign conducted over New England and the Atlantic Ocean during July and August 2004. Smart balloons are designed and constructed at the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory Field Research Division (ARLFRD) in collaboration with the University of Hawaii. The 10.3-foot diameter Spectra balloon shell has been redesigned to allow the transponder and sensors to reside inside the balloon shell to help protect them from turbulence and rain that may be encountered in storm environments. The temperature and relative humidity sensors are no longer passively aspirated but are housed in a radiation shield and are fan aspirated to increase accuracy. A rain gage has been added to provide information on the precipitation rate as the smart balloon moves through rain bands within a cyclone. An infrared temperature sensor has also been added to provide remote sea-surface temperature data. Satellite communications replaces the point-to-point radio system to allow continuous monitoring of the balloon position and sensor data without requiring an aircraft to be in close proximity to the smart balloon. To keep the smart balloons within a user-determined altitude range, the buoyancy of the balloons automatically adjusts by pumping ballast air into or out of the balloons.

The improved smart balloons will be deployed as a part of a Lagrangian experimental strategy to better characterize the evolution of the energy content of the marine boundary-layer inflow to a hurricane and its relationship with hurricane intensity

changes. This paper provides an overview of the architecture and performance of the smart balloons during AIRMAP. Future applications of the smart balloons as instrument platforms for targeted observations and boundary layer research in storm environments will be discussed.