BEACON Atmospheric Sensor Cluster

Executive Summary

The **Balloon Enabled Atmospheric Conditions Observation Network (BEACON)** project is a real-time, high-resolution, remotely-deployed sensor cluster designed to provide insight into convective weather patterns at spatial resolutions unavailable until now, through all phases of system lifecycle. Through the integration of current state-of-the-art, self-healing RF network protocols with a powerful distributed processing approach and a custom sensor suite, the understanding of the structure and properties of convective weather phenomena of all types – especially at altitudes well beyond the cloud structure – can be significantly deepened.

This effort focuses on initial instrument integration and infrastructure development as well as proof of functionality and ConOps through the successful completion of clear-sky (baseline) and in-weather test missions.

Ultimately, the effort will result in an instrument package and support infrastructure ready for research operation, as well as a substantial initial body of data for analysis against current convective weather structure understanding.

The **BEACON** System

There are 4 main components which comprise the BEACON system:

1. **Command Station**
      Tracks mobile units, manages cluster launches, monitors weather radar

2. **Mobile Launch and Recovery Units** (5 total)
      Carry 6 sensor sondes each, along with surface instrumentation; remotely commanded to launch each sonde in coordination with other launch units without crew intervention; crews responsible for sensor sonde recovery

3. **Network Control Sondes** (2 total)
      Redundant, altitude-keeping data server (embedded Linux) payload and repeater, provides BVLOS communication between mobile launch units and command station, as well as data processing and forwarding of sensor data.
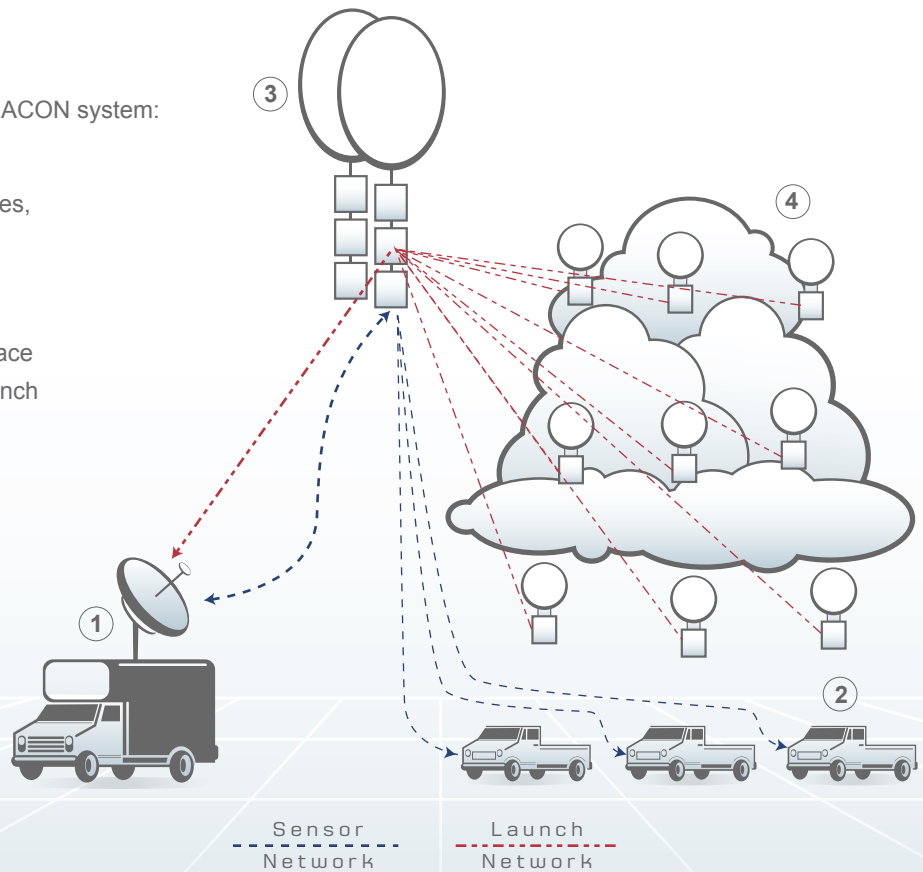
4. **Sensor Sondes** (30 total)
      Small, rapid-ascension sondes capable of ascent rate control equipped with sensors for 3-axis electric potential gradient, constituent gas (including NO_2 and O_3), temperature, atmospheric pressure, relative humidity, and sensor orientation; simultaneous 100Hz sampling timed via closed-loop feedback locked to GPS PPS signal (+/- 300 nSec accuracy), 20Hz position update rate, and 80 MHz, 32-bit processor for data processing and logging.

Sensor Network

Launch Network