Airborne Measurements in Support of the NASA Atmospheric Carbon and Transport – America (ACT-America) Mission A238-0291

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NASA announced the research opportunity Earth Venture Suborbital - 2 (EVS-2) mission in support of the NASA’s science strategic goals and objectives in 2013. Penn State University, NASA Langley Research Center (LaRC), and other academic institutions, government agencies, and industrial companies together formulated and proposed the Atmospheric Carbon and Transport – America (ACT – America) suborbital mission, which was subsequently selected for implementation. The airborne measurements that are part of ACT-America will provide a unique set of remote and in-situ measurements of CO₂ over North America at spatial and temporal scales not previously available to the science community and this will greatly enhance our understanding of the carbon cycle.

ACT – America will consist of five airborne campaigns, covering all four seasons, to measure regional atmospheric carbon distributions and to evaluate the accuracy of atmospheric transport models used to assess carbon sinks and sources under fair and stormy weather conditions. This coordinated mission will measure atmospheric carbon in the three most important regions of the continental US carbon balance: Northeast, Midwest, and South. Data will be collected using 2 airborne platforms (NASA Wallops C-130 and NASA Langley’s B-200) with both in-situ and lidar instruments, along with instrumented ground towers and under flights of the Orbiting Carbon Observatory (OCO-2) satellite.

This presentation provides an overview of the ACT-America instruments, with particular emphasis on the airborne CO₂ and backscatter lidar, and the rationale, approach, and anticipated results from this mission.

Aircraft and Instrument Suites

Wallops C-130

Langley B-200

The overarching goal of the Atmospheric Carbon and Transport-America (ACT-America) mission is to improve regional-to-continental scale diagnostics of carbon dioxide (CO₂) and methane (CH₄) sources and sinks.

- The mission will enable and demonstrate a new generation of atmospheric inversion systems for quantifying atmospheric CO₂ and CH₄ fluxes.
- These inversion flux estimates will be able to:
  - Evaluate and improve terrestrial carbon cycle models, and
  - Monitor carbon fluxes to support climate-change mitigation efforts.

1. Quantify and reduce atmospheric transport uncertainties
2. Improve regional-scale, seasonal prior estimates of CO₂ and CH₄ fluxes
3. Evaluate the sensitivity of Orbiting Carbon Observatory-2 (OCO-2) column CO₂ measurements to regional variability in tropospheric CO₂

These goals address the three primary sources of uncertainty in atmospheric inversion: transport error, prior flux uncertainty and limited data density.