

(9-220412-A) **The NOAA High-altitude Operational Returning-Uncrewed System (HORUS) for Atmospheric Observing**

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NOAA's Global Monitoring Laboratory (GML) collects balloon-borne measurements of ozone and water vapor at high accuracy with long-standing observational records dating back to 1967 and 1980, respectively. Recent development of NOAA's balloon-borne AirCore atmospheric sampling system (circa 2011) has enhanced these stratospheric observational records with the ability to derive calibrated trace gas profiles from approximately 30 km MSL to the ground. The AirCore must also be efficiently recovered upon landing for subsequent laboratory analysis of air samples and reusability of high-cost instrumentation.

Driven by the need to both expand AirCore trace gas sampling locations and improve its feasibility of recovery, we have combined small-balloon technology with the idea of a low-cost, portable small uncrewed platform to develop a custom glider capable of returning balloon-borne atmospheric instrumentation from the stratosphere in a highly-controlled manner. The High-altitude Operational Returning Uncrewed System (HORUS) has a high-volume payload capacity and a glide ratio that allows for a slow descent rate from the stratosphere to the ground. As such, it uniquely enables efficient AirCore sample intake in the stratosphere, while allowing for accompanying onboard instrumentation to profile the atmosphere on glider ascent and/or descent. Comprehensive atmospheric sampling with this platform can uniquely contribute to our understanding of stratospheric composition and dynamical change in a changing climate. The HORUS also can expand atmospheric trace gas and aerosol profiling locations, increase satellite evaluation efforts in remote areas, and provide high-quality observational datasets for the improvement of weather and climate forecast model prediction. Here, we detail its development and design, its technology readiness level (TRL) advancement over the past three years, and its next steps forward for operational use by GML in Northeastern Colorado.



Figure 1. The NOAA HORUS platform equipped with AirCore scientific payload successfully completes a flight from 75,000 ft MSL at Edwards Air Force Base, CA.