NASA SBIR/STTR Technologies

Proposal No. S3.05-8263– In-Situ Atmospheric Sampler for Advanced Guided Dropsonde

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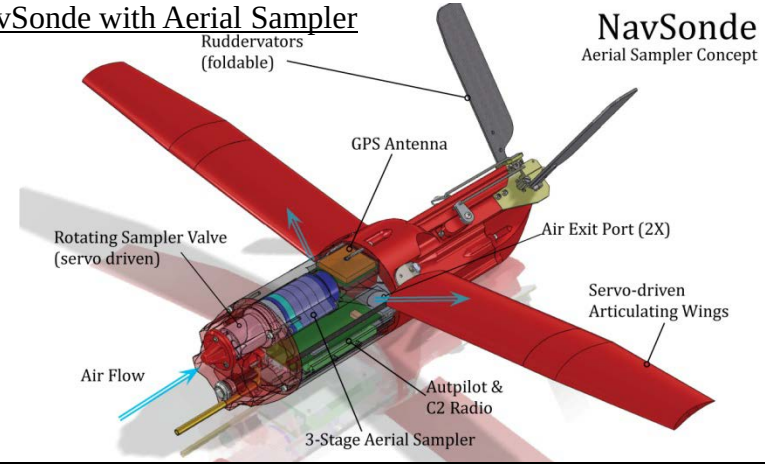
Identification and Significance of Innovation

The ability to retrieve high altitude particulate and gas samples from volcanic plumes is a crucial task in assessing and evaluating the danger these plumes pose to aviation traffic. The economic impact volcanic eruptions may have on travel, commerce, and supply logistics is substantial as recently shown by the 2010 Eyjafjallajökull eruption in Iceland and the 2011 Puyehue eruption in Chile. While satellites provide valuable data to inform prediction models, they lack the ability to accurately estimate particle size and to determine how particles track with gases present in the plume. Collecting particle and gas samples is important to validate plume models and to determine the safety of flight for air traffic routes that may be affected by volcanic activity. Unmanned autonomous aerial vehicles (UAVs) hold great promise in performing in-situ sampling to assist with these efforts. Advanced guided dropsondes, and the NavSonde in particular, will have a significant logistic advantage as they will be regulated by the FAA as dropsondes and not UAVs. This will open up many research opportunities currently denied to most commercial UAVs and may make advanced guided dropsondes the platform of choice for conducting low-cost airborne atmospheric research, particularly with regard to in-situ atmospheric sampling.

Expected TRL Range at the end of Contract (1-9): 5

NavSonde with Aerial Sampler



Technical Objectives and Work Plan

The technical objectives of the proposed effort were to:

1. Demonstrate the capability of the NavSonde to be released from a host manned aircraft and achieve stable flight.
2. Collect an atmospheric particulate sample from a pre-programmed altitude and location.
3. Deliver the protected sample to a pre-programmed recovery area.

The work plan included:

- Design and prototype an AVAPS sized guided dropsonde (NavSonde);
- Design and integrate a prototype aerial sampler into the NavSonde;
- Integrate the Piccolo Autopilot into the NavSonde and perform flight simulations;
- Conduct two autonomous test flights of the NavSonde; and
- Perform tests to validate the function of the aerial sampler.

NASA and Non-NASA Applications

Dropsondes have been employed to assist in validation of satellite data such as the NASA GloPac mission which included measurements for the Aura earth-monitoring satellite. The NavSonde system would provide increased utility for this type of application. The NavSonde has several advantages over current dropsondes–the main one being its ability to fly to regions of interest and to perform pre-programmed actions at specified locations and/or altitudes (e.g. sample). In polar regions where NASA balloon-based and airborne research is active, the proposed design would be versatile enough to be used with such host platforms.

While the design intent of the NavSonde is an aerial sampling platform, Non-NASA applications include national and international universities, research institutes and government organizations involved in the full range of atmospheric and meteorological studies—particularly volcanology. All research and non-research groups currently using dropsondes in their programs are potential consumers, as well as those that have interest in small UAS. US DOD and DHS are potential large-scale users of the proposed technology as it offers advantages in situational awareness and the ability to identify hazards without human risk or significant cost compared to conventional systems.

Firm Contacts

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NON-PROPRIETARY DATA