A Ruggedized UAS for Scientific Data Gathering in Harsh Environments, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Accurate predictive modeling of certain atmospheric chemical phenomena (i.e. volcano plumes, smog, gas clouds, wildfire smoke, etc.) suffers from a dearth of information, largely due to the fact that the dynamic qualities of the phenomenon evade accurate data collection. In situ measurements are currently made through the use of ground sensors and dropsondes. ? Ground sensors, such as seismometers, tiltmeters, in-ground gas monitors and near-field remote sensings instruments[,]? have limited measurement density and provide only information about atmospheric boundary conditions. Dropsondes can provide measurements over the entire vertical profile, but are limited to sampling over a small time period. In situ measurements can be augmented with satellite-based remote sensing systems, such as ASTER, MODIS, AIRS and OMI, however, satellite-based data suffers from its relatively small spatial density and limited frequency of measurement. A need exists for additional targeted in situ data from volcanic ash clouds, particularly to assess ...particle size distribution, ash cloud height, and ash cloud thickness including spatial (horizontal and vertical) and temporal variability of ash concentration. The proposed innovation, the SuperSwift XT, will meet NASA's need to enhance [the] performance and utility of NASA's airborne science fleet by providing a durable, terrain-following UAS that will be adapted for use in harsh environments containing environmental phenomena that impacts societal activity (i.e. volcanic emissions impacting the safety of passenger aviation). The sUAS will provide targeted, in situ observations from previously inaccessible regions that can significantly advance NASA?s goal of safe, efficient growth in global aviation by aiding in the collection of scientific data from which predictive Volcanic Ash Transport and Dispersion models (VATD) used to inform air traffic management systems.

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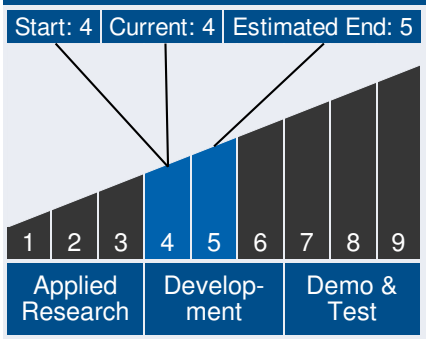
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Multi-year observations of volcanoes with a variety of systems has already been conducted by by the Jet Propulsion Laboratory's CARTA-UAS project, along with its partners. These observations have occurred and various distances and locations around the volcanoes. Use of a multiple UAS system with appropriate architecture for cooperative and coordinated surveys by durable yet affordable (attrition acceptable) vehicles will greatly improve the coverage available when collecting useful science data. Other volcano-studying robot projects could also benefit from the addition of UAS for heterogenous vehicle deployment (also supported by Black Swift Technologies architecture) or a transition to exclusively aircraft for the collection of valuable science data.

To the commercial space industry:

Potential Non-NASA Commercial Applications: A number of post-research and development applications exist, commercial and scientific. The proposed innovation, including the total sensor suite, can be utilized for scientific research by federal and state public agencies and other state-funded laboratories to collect data on coherent atmospheric structures such as smog, volcano plumes, wildfire smoke, chemical fires, forest humidity, etc. Commercial applications for private industry exist as well, such as utilizing the SuperSwift XT to determine chemical composition of smokestack exhaust so as to remain within EPA-permitted levels of pollutant gasses and to assess the composition, and relative danger, of chemical fires at refineries. Additionally, the specially trained Incident Meteorologists (IMETs) from NOAA use portable weather stations near large wildfires to generate critical weather forecasts for the effectiveness and safety of fire crews. The stationary and ground-based nature of these ground stations can be greatly expanded by using expendable fleets of sUAS aircraft to gather

Management Team *(cont.)*

Principal Investigator:

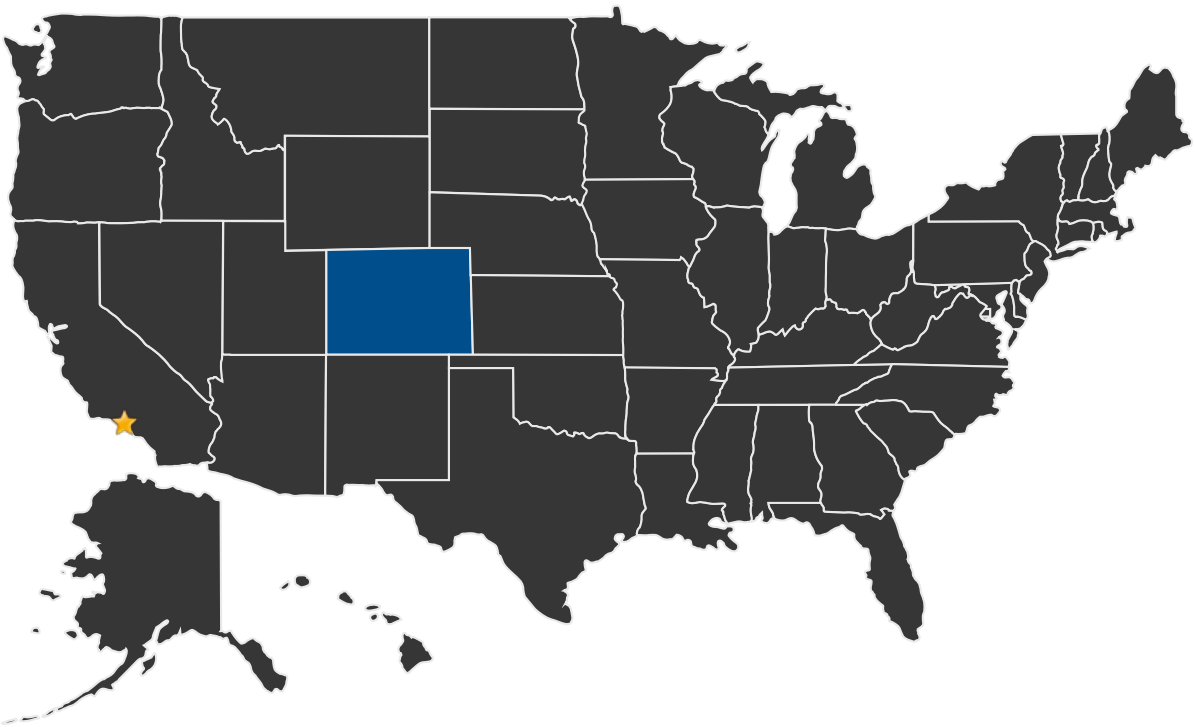
- Jack Elston

Technology Areas

Primary Technology Area:
Science Instruments, Observatories, and Sensor Systems (TA 8)
└ In-Situ Instruments and Sensors (TA 8.3)
└ In-Situ (other) (TA 8.3.3)

richer simultaneous information from the prevailing and fire-driven weather patterns.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Jet Propulsion Laboratory

Other Organizations Performing Work:

- Black Swift Technologies LLC (Boulder, CO)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23595)

A Ruggedized UAS for Scientific Data Gathering in Harsh Environments, Phase I Project

IMAGE GALLERY

A Ruggedized UAS for Scientific Data Gathering in Harsh Environments, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

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Potential Applications

Multi-year observations of volcanoes with a variety of systems has already been conducted by by the Jet Propulsion Laboratory's CARTA-UAS project, along with its partners. These observations have occurred and various distances and locations around the volcanoes. Use of a multiple UAS system with appropriate architecture for cooperative and coordinated surveys by durable yet affordable (attrition acceptable) vehicles will greatly improve the coverage available when collecting useful science data. Other volcano-studying robot projects could also benefit from the addition of UAS for heterogenous vehicle deployment (also supported by Black Swift Technologies architecture) or a transition to exclusively aircraft for the collection of valuable science data.