

# Multi-Sensor System to Enable Comprehensive Earth Science and Environmental Investigations

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Key Participating units: College of Engineering (Texas A&M Engineering Experiment Station)  
College of Agriculture and Life Sciences (AgriLife Research)  
College of Geosciences  
Center for Geospatial Sciences, Applications and Technology (GEOSAT)

Anticipated Request Amount: \$750K

**Scope/Objective:** Population expansion and environmental risks have produced an urgent global need to better understand climate and water quality/resource dynamics, soil and agricultural productivity and yield, ecosystem and wildlife habitat conditions, landscape stability and hazards, and many other scientific and applied issues at the state, national and global scales. The applications involved demand that multiple disciplines work together to improve our ability to measure things from Unmanned Aerial Systems (UAS) to get high visual detail, cover a large area quickly, and obtain a perspective not available through other methods. New technology in sensor systems can help us do this, but substantial research is needed to develop UAS-based sensors for specific applications. A thorough understanding of these applications is a prerequisite for assessment, inventory and management of natural and built resources, which are ultimately related to the sustainability of the Earth's critical zone that supports resource availability and organisms.

**Capabilities Gap:** *Access to a much more capable multiple-sensor suite than is currently possessed by TAMU or commercially available will lower the barrier to entry for TAMU researchers to become global leaders through new discovery and action across science, agriculture and engineering.*

**Benefit to the Research Enterprise and Anticipated Outcome:** Our ability to be early adopters, developing and implementing an operational sensor system that can acquire needed critical information, will create a leadership position for multi-million dollar funding opportunities that involve (a) annual state government assessment and inventory of natural resources, (b) large agricultural companies involved in precision agriculture, (c) companies that conduct large scale engineering assessment of built infrastructure, and (d) agencies like NASA, National Institute for Food and Agriculture, and the National Science Foundation that funded advanced research to address water resources, environmental change, agricultural management, natural hazards and critical zone sustainability.

TAMU is strategically poised to take advantage of the requested multiple-sensor suite for use by several Centers, including the TEES Center for Autonomous Vehicles and Sensor Systems (CANVASS), AgriLife's Research and Extension agencies as well as its Borlaug Institute for International Agriculture, the TAMU Center for Geospatial Sciences, Applications and Technology (GEOSAT), the TEES Center for Aerospace Technology Research & Operations (ASTRO), as well as other TAMU entities in order to develop a multidisciplinary strategy to address critical science, agricultural and engineering problems.

**Request:** This proposal requests funds to acquire a custom built sensor suite which is widely useful across many science and engineering domains and will be made available to researchers across in the entire TAMU research community. It will be usable for *both* ground based and airborne applications. The sensor suite consists of three distinct sets of complimentary sensors that *together provide a complete engineering and scientific picture that is beyond the state of the art with current sensors*. The first set is a long range LIDAR (range of between 1km – 3km) coupled with a hyperspectral camera, that will provide three-dimensional visual images that are overlaid with data in the non-visible spectrum (e.g., infrared, near-infrared, etc). The second set is a thermal infrared camera coupled with a 4-band multispectral camera. The third set is an ultra-high resolution Digital Single Lense Reflex (DSLR) camera, which will provide extremely detailed high-resolution images in the visible spectrum over large areas. This is useful for a range of uses that are not possible with current remote sensing systems, from detecting cracks in buildings to detecting soil erosion to detecting the emergence (sprouting) of crop plants.