Small Unmanned Aircraft System Operations

Delivering safe, value-driven data collection, remote monitoring, and inspection services.

The commercial applications for the operation of small Unmanned Aircraft Systems (sUAS), commonly referred to as drones, continue to evolve in safety-critical industries such as oil and gas, power, mining, and construction. Growing regulatory acceptance and recent technology advancements in flight payload and remote sensing have created opportunities to leverage sUAS platforms for tasks such as environmental assessment, asset inspection, field compliance monitoring, data collection, and other emerging applications.

Groundwater & Environmental Services, Inc. (GES) provides specialized sUAS services in support of your infrastructure development and compliance programs. We have put professional grade sUAS technology in the hands of degreed environmental professionals who are FAA-licensed and trained to enhance our field monitoring and data management capabilities.

Our clients benefit from the seamless integration of sUAS technology in their existing workflows, providing scientific evaluation of environmental conditions and data that is accurate, quantifiable, and defensible. We leverage state-of-the-art imaging and remote sensing technologies to improve data quality and reduce investigation costs. Our deployment of GPS-guided aircraft capable of autonomous and repetitive flights, equipped with anti-collision sensing and redundant power systems, also provides a higher level of overall project safety.

Our sUAS program offerings are backed by the following unique qualifications:

- FAA-certified remote pilots on staff
- FAA-compliant standard operating procedures (SOPs)
- sUAS pilot training, certification, and recertification programs
- Robust sUAS equipment maintenance and inspection program
- Industry-leading and cutting edge sensors and processing software
- sUAS-specific health and safety plans developed in accordance with GES' Loss Prevention System (LPS) behavior-based program

Service Capabilities

Visual line of Sight (VLOS) Drones

Beyond Visual Line of Sight (BVLOS) Drone

High Resolution Visible Light Camera/Video

Zoom Photography

Methane Monitoring and Quantification

Thermal Imaging

Orphan and Abandoned Well Locating

Photogrammetric Mapping

LiDAR Survey

Infrastructure and Asset Inspection

Digital Elevation Mapping

Construction Monitoring

Right-of-Way (ROW) Corridor Inspection

Imagery for Facility Compliance plans

Emergency/Rapid Response Support Services including:

- Pre and Post Event Imagery
- Preliminary Condition Assessments
- Safe Acess Evaluations

Wetland Mitigation and Monitoring

Stockpile Volumetrics

Relevant sUAS Experience

Locating Abandoned and Orphaned Oil and Gas Wells

The need for locating abandoned and orphaned oil and gas wells is growing rapidly. Their locations are often largely unknown due to historical practices and poor record keeping. Trapsing through usually uneven and densely vegetated areas is often unsafe and time-consuming. In all too many cases, the well search party is unable to locate the missing asset.

An aerial drone-based search greatly increases the success rate in locating orphaned and abandoned wells. Using a magnetometer sensor mounted on a drone, such as the MagArrow, enables coverage of large areas in short periods of time by a much smaller search party.

Magnetometers detect anomalies in the earth's natural magnetic field to help define where a former oil or gas well is located and can locate wells within a few hundred square feet in dense vegetation, beneath tree canopies, and even where the casing is buried under several feet of soil. By narrowing down the search area, drone-based magnetometry reduces effort to locate orphaned and abandoned wells or other metallic objects of interest.

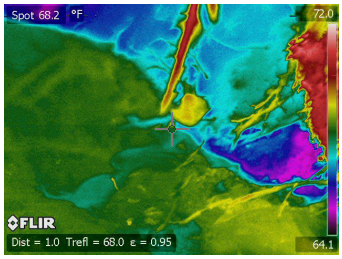
Natural Gas Pipeline sUAS-Enhanced Inspection

GES fast-tracked inspection of 101 miles of natural gas pipeline in Pennsylvania and West Virginia to comply with federal regulations to monitor for methane emissions along the Right-of-Way (ROW). The inspection was performed by two-person teams operating quadcopter drone equipped with a Sierra Olympia Ventus 1 OGI (Optical Gas Imaging) camera. This powerful sensor is capable of detecting and visualizing 11 different hydrocarbon gases, including methane. Flying at an altitude of approximately 100 feet above ground surface, the ROW was mapped using the on-board global positioning system (GPS) continuously documenting the presence/absence of methane. Using these sUAS technologies, the team was able to cover about one mile in 10 minutes. A total of 101 miles of a series of pipeline sections were inspected in 18 flight days.

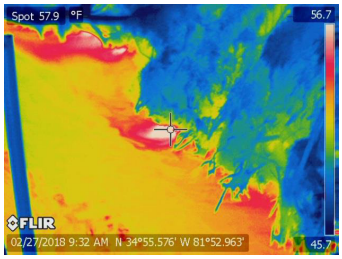
The OGI camera data obtained from these inspections provided real-time documentation of where and when the inspections were performed. Completing these presence/absence methane inspections using sUAS technologies allowed the client to rapidly and confidently demonstrate regulatory compliance.

Right-of-Way Monitoring and Inspections

A national midstream energy client required routine monitoring and inspections of pipeline right-of-ways located within areas that were difficult to access and considered environmentally sensitive. GES' sUAS was utilized for pipeline installation monitoring and progress documentation as well as other inspections, including compliance with pipeline installation permit conditions, such as erosion and sedimentation controls.



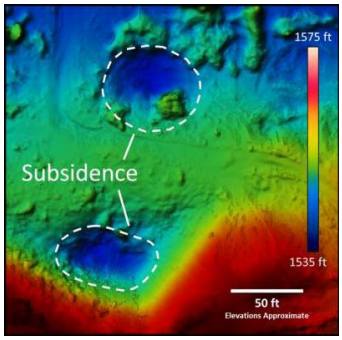
Late Summer 2017



Winter 2018

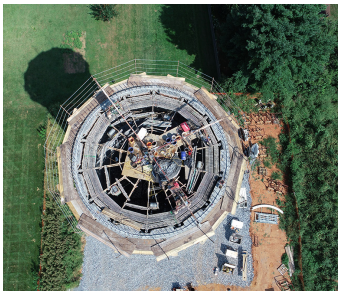
Thermal Imaging to Identify Discharges to a Stream

GES conducted two stream-survey events that included a visual inspection in conjunction with the use of thermal imaging equipment to identify groundwater discharges to a stream. GES used a FLIR camera to photograph the banks of the stream, to locate and characterize thermal anomalies. The temperature of groundwater stays relatively constant, whereas surface water is subject to greater temperature variability due to climate/air temperature. These temperature differences can be discerned by thermal imaging equipment and used to locate groundwater seepages into the stream. The first event was completed in September 2017, in late summer, when the air and surface-water temperatures were warmer than groundwater. GES looked for cooler water emerging from the bank or into the stream. The second event was conducted in February 2018, during late winter, when the air and surface-water temperatures were cooler than groundwater. The warmer water discharge from groundwater would therefore appear lighter in color than the surrounding surface temperatures of the stream water. GES looked for this temperature signature emerging from the bank or into the stream.



Subsidence Identification and Monitoring

GES conducted a detailed analysis of surficial sinkhole expressions that appeared in the vicinity of an active pipeline. GES utilized video and orthomosaic images taken from an sUAS flyover and conducted elevation modeling to determine the location and extent of the sinkholes. These findings are now being used to monitor any continued subsidence.



Pre-Construction Analysis

Prior to the construction of a municipal water-well field and treatment plant, GES conducted a detailed photogrammetry analysis of the planned construction area. Utilizing a sUAS, the photogrammetry was used as an underlay for the construction drawings, providing real-time analysis of current structures and terrain features that will be disturbed during construction. Additionally, the analysis provided documentation on the accuracy and progress of the construction effort.