Environmental Applications for Unmanned Aerial Vehicles

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d deployment Compared to anned aerial tforms, UAVs ca be deployed quickly and can operate closer-in to sites

Safety – UAVs can be deployed in hazardous locations, and are relatively inexpensive compared to other equipment that might suffer damage



REGULATORY ENVIRONMENT

- Commercial use of UAVs is highly regulated
- In the US, the FAA requires commercial pilots to be licensed
- There are many regulations constraining flight in

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- Controlled airspace
- Nightime
- Populated areas
- Etc.



Micasense

In addition to physical measurements, quantitative analysis of image spectrum (often going beyond the visible range) can provide insight into factors such as vegetative health and stress



urfaces can be created using overlapping stereo imagery. istances from cameras to points appearing o ple images. The topographic model is then used to render scale consiste oss a mosaic made from the



The locations of ground control targets or other photo-identifiable points can be surveyed in to increase the positional accuracy of output, compared to positions derived from GPS receivers on-board the UAV



CASE STUDY: TOPOGRAPHIC ANALYSIS

UAVs provide a powerful platform for photogrammetric analysis. A UAV can fly in a semi-automomous fashion to collect a regular grid of images with a consistent overlap to create a stereo imagery dataset with very small ground sample distance (GSD). This dataset is used to create both an orthorectified mosaic and an elevation model using 3D trigonometry



Topographic model used to estimate the volume within a parcel for holding dredge material.

	Traditional Survey
Time	180 mins
Date Points	197
Data Points Per Minute	1
Equivalent Cost Per Point	\$3

Elevation profile



Photogrammetric techniques provide a dense, three-dimensional point cloud. This not only results in a lower cost per datapoint than traditional methods, but may provide added significant detail.

Eleventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds



UAV Survey 20 mins 1,539,964 77,000 \$0.0004



CASE STUDY: INCIDENT RESPONSE

Compared to manned aerial platforms, UAVs can be deployed very quickly in the event of an incident or emergency.





Ortho-rectified imagery of train derailment produced the same day as the accident. UAVs allowed for rapid deployment and collections. GPS on the UAV allowed for instant absolute georeferencing within approximately a meter. Ground sample distance of image cells were a few centimeters, giving crews a great deal of detail.





Each day following the derailment, more frames were collected in the same flightpath, allowing documentation of cleanup and repair

ARCADIS Design & Consultancyfor natural and built assets

CASE STUDY: PLUME DELINEATION

Thermal sensors mounted onboard a UAV provide a method for detecting and delineating plumes for liquids of varying temperatures in open water.



es in thermal image analysis include the fact that abrupt changes in surface temperature betweer land and water can overwhelm the sensitivity of an instrument, and reflected sunlight can obscure changes in emitted radiation

Thermal imagery for leak detection is not limited to use in water – leaks can also be detected in the air and underground, if they cause a change in temperature



CONCLUSIONS

Unmanned aerial vehicles provide a powerful and flexible tool for a wide range of environmental applications. The planning process for using UAVs should involve an understanding of both regulations the complexities of analysis.