POSTER GROUP [1/2]

Unmanned Aerial Systems for Environmental Assessment Applications

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Unmanned Aircraft Systems (UAS)

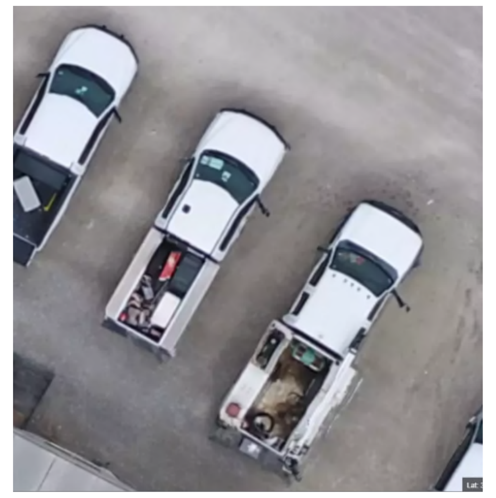
Also known as sUAS (Small Unmanned Aircraft System), or drone.

UASs come in a variety of sizes, capabilities, and payloads.

Benefits of UAS

A UAS can mitigate the safety concerns associated with sending employees into the field and use high-quality cameras to pick up details and information that the human eye cannot detect. Capturing sharper, more insightful images and gathering more data points faster, drones are reshaping the realities of site monitoring, remediation and emergency response.

Compared to manned aerial platforms, UASs can be deployed quickly, and navigate tight spaces that other data collection methods can not.



UASs provide high-resolution imagery with very small ground sample distance (pixels on the order of one inch or less).

UAS Challenges

UASs require specific certification and training as well as specific sensors and software which can be costly for in house purchase. They are less efficient than manned aircraft and satellite platforms when it comes to mapping larger areas and have relatively short flight endurance between battery changes (particularly in the case of multirotor craft) requiring multiple sets of batteries to complete larger missions. Some instruments and payloads are too large for the typically commercial UAS and may require a larger UAS platform and additional certification or waivers to operate.

Photography and Videography

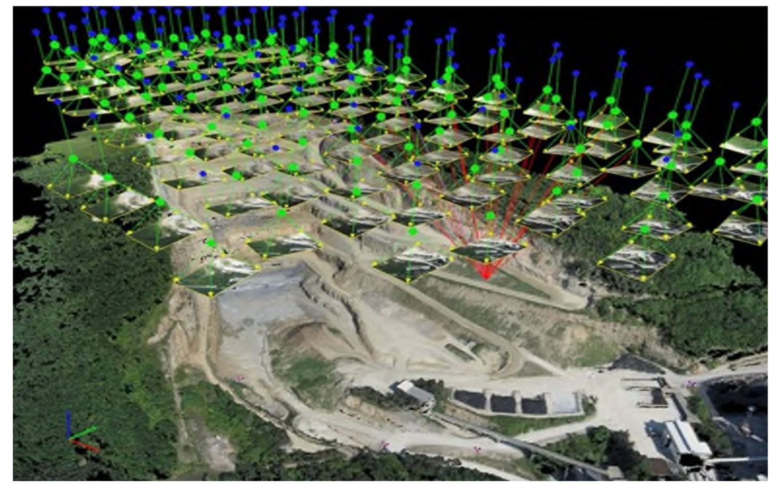
UASs can be deployed in unsafe locations, and obtain highly detailed site documentation through photography and videography.

A UAS can obtain close-up views of otherwise inaccessible damage or areas that need inspection.

Direct Sampling

In addition to image collection, UASs can perform tasks such as surface water sampling.

Photogrammetry and Topographic Analysis



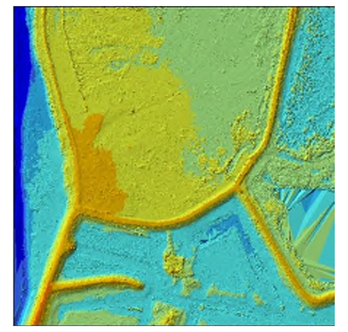
Orhorectified mosaics are mosaics that appear to be viewed from directly above from all locations, and have consistent scale.

Overlapping photos are first used to model the terrain using trigonometric measurements of points viewed from multiple angles.

The 3D point cloud created from these photos is used to develop the final mosaic.

Individual frames have varying scale and show lean of objects.

Orthorectified imagery produced from overlapping photos has consistent scale and distortion is removed.

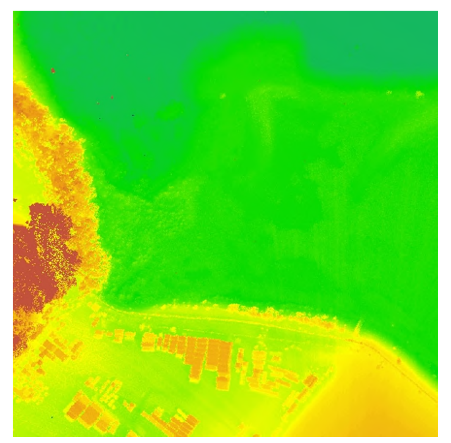


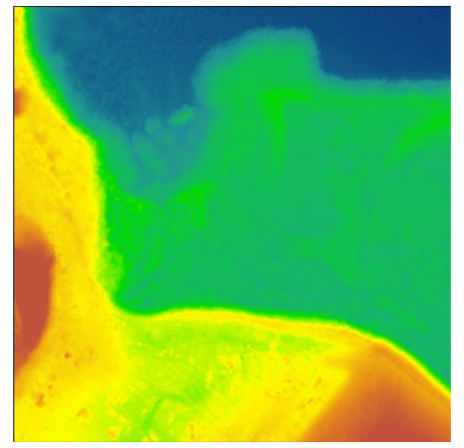
The 3D surface produced by a UAS provides more detailed, high-resolution data capture, and is more efficient than those produced by manned aerial or ground surveys.

	Traditional Survey	UAV Survey
Time	180 minutes	20 minutes
Data Points	197	1,539,964
Points Per Minute	1	77,000
Equivalent Cost Per Point	$3	$0.0004

Lidar

Lidar (a portmanteau of "light" and "radar") is an active sensor that uses laser beams to measure distance from the sensor. It is also known as LIDAR (Laser Imaging Detection and Ranging) or LiDAR (Light Detection and Ranging).

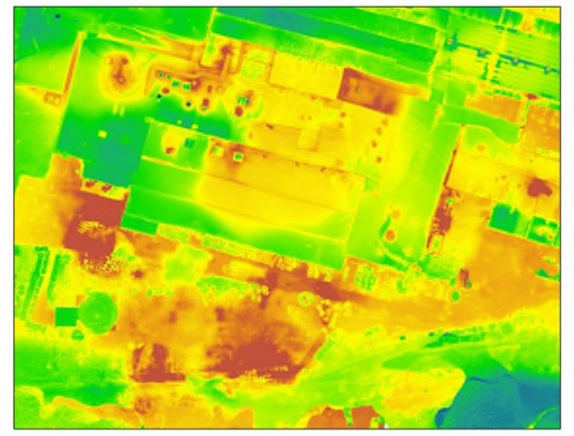




Because lidar pulses are narrow and rapid (typically more than 60,000 pulses/second), some pulses over any location will strike vegetation and others will strike the ground before returning to the instrument. Once points in a lidar point cloud have been classified, the classes can be used to strip away initial returns and show the difference between elevation that includes objects and vegetation versus bare ground.

Thermal Imagery

Unlike most imagery, which senses sunlight reflected from objects, thermal imagery is emitted heat. Because of this, sunlight is not needed for thermal imagery collection, and in fact it works best in the absence of sunlight, which can cause interference.

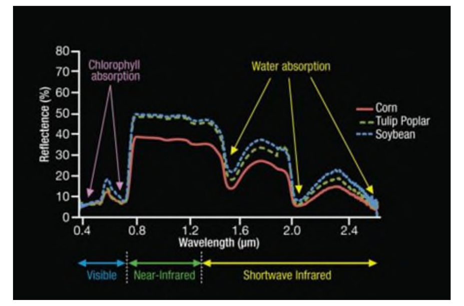


Thermal imagery can be used for a variety of environmental assessments, including underground fires, mapping surface water plumes, and detecting groundwater seeps.

Multispectral Imagery

Multispectral imagery stores each spectral band separately, and each band is calibrated so that quantitative methods can be applied to the intensity of response of each portion of the electromagnetic spectrum.

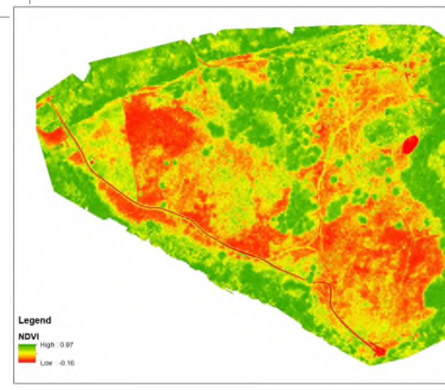
Because a large percentage of sunlight is reflected by vegetation in the near-infrared, this portion of the electromagnetic spectrum provides a great deal of information about the health and species of vegetation.

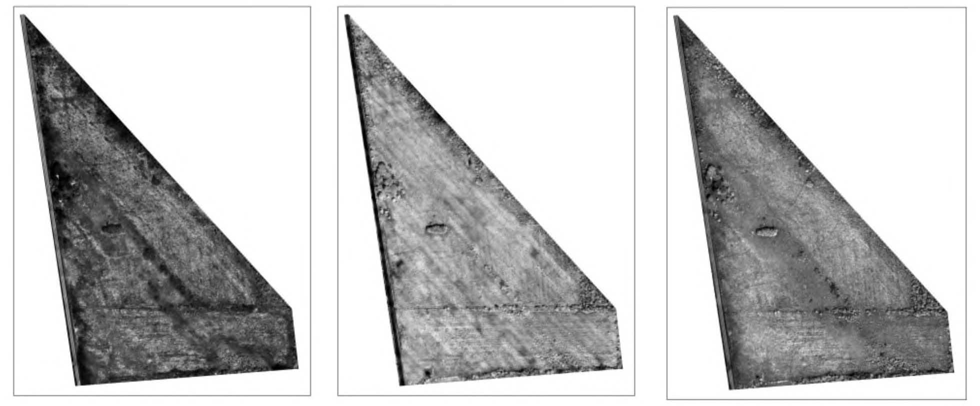


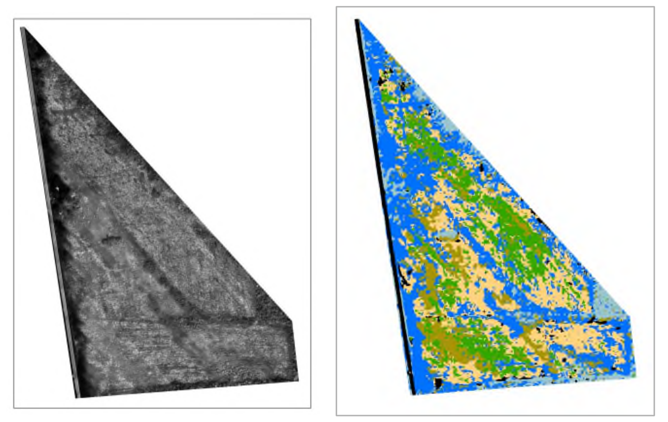
National Aeronautics and Space Administration, Science Mission Directorate. (2010). Reflected Near-Infrared Waves (Eric Brown de Colstoun)

The quantitative spectral response of each spectral band can be considered separately, or viewed and analyzed in different combinations (such as natural color or color-IR) to examine patterns in space and the electromagnetic spectrum.

Bands can also be combined to create vegetative indices that show stress in vegetation before it can be seen by the naked eye.







Because of subtle variations in reflectivity of different plant species, individual bands of multispectral imagery can be used to classify vegetation. The high spatial resolution of UAS imagery allows for a very detailed classifications.

A Complete UAS Program

Regulations and Safety

Certifying pilots is only the first step in a safe and effective UAS program. Arcadis has additional qualifications and programs for flight training, Risk Assessment and H&S as well as UAS specific checklists and standard operating procedures for pilots to follow.

Data Management

In a world going digital and focused on data, UASs allow for large amounts of information to be captured in a short period of time. Because of the high level of detail captured by UAS, management and dissemination of UAS imagery (often many GB worth) can be a challenge. Data security is also an issue for sensitive information. Having a secure, cloud-based software solution is a must in this digital age.