



Applications for Heritage Resource Management

- Preservation Monitoring
- Site Identification
- Photogrammetry
- Thermography
- Geo-referenced orthophotos
- Remote Sensing
- LIDAR
- Integration with GIS

Photogrammetry

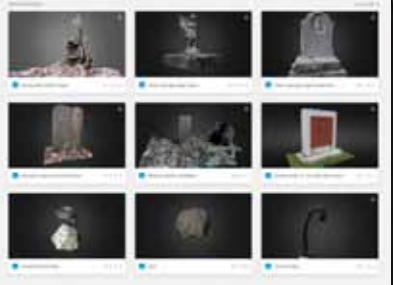
- Photogrammetry is acquiring measurements from 2D pictures
- Structure From Motion (SfM) is the process for rendering 2D pictures into a 3D object
- Not cost-prohibitive for most
- Increasingly accurate

How Photogrammetry Works

Photos taken around object > Sparse Point Cloud > Dense Point Cloud > Mesh > Texture


Small-scale Examples

<https://sketchfab.com/models/dcca5b8cd662428c9df68edf8268ad05>
<https://sketchfab.com/models/3a2745d61b5342049896e6c9a2e34059>



Large-scale Examples

<https://sketchfab.com/models/02c4e194c6d64a385a30990ed9899bf>
<https://sketchfab.com/models/fa94d763e89d437e84c31d5110a3c6a4>

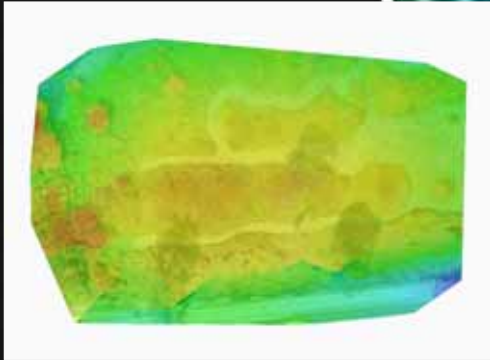


Digital Surface Models (DSM)

Polygonal meshes are needed to generate Digital Surface Models (and Digital Elevation Models) that vividly capture entire landscapes and their associated topography, vegetation, geomorphology, and anthropogenic elements.



Digital Surface Models



Large-scale Examples



Aerial Photography for Site Identification and Preservation Monitoring



Aerial Photography
for Site Identification and Preservation Monitoring



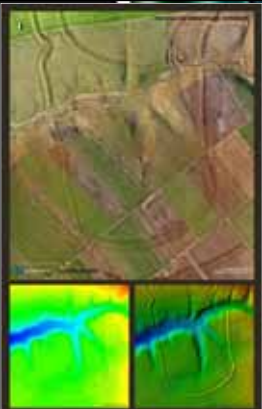
Aerial Photography
for Site Identification and Preservation Monitoring



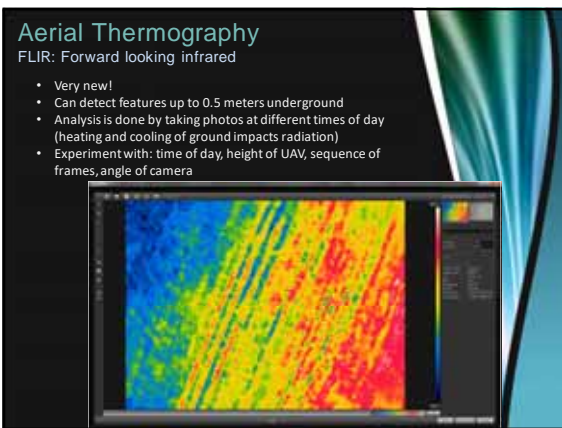
Image by Rob Nelson, Frank's Hill, Wisconsin

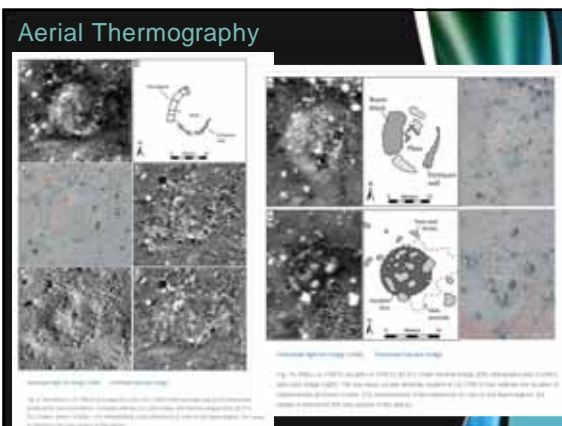
Orthophotos

- An orthophoto is an aerial/overhead photograph that has been geometrically corrected or "ortho-rectified" so that the scale is uniform
- The photo has the same lack of distortion as a map
- Increased quality of recording information (over manual drawings)
- Documents texture

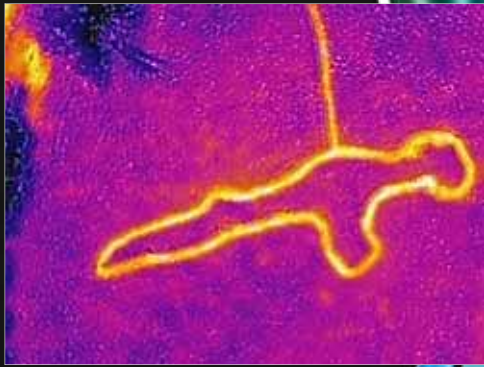








Aerial Thermography



LiDAR & Remote Sensing



Considerations



Equipment

There are different types of drones... What should you look for?



Accessories

The drone is only an aerial platform! Data acquisition needs to be performed by remote sensors, in this case by digital photographic cameras, i.e. a GoPro.

Factors: **weight**, **memory**, **batteries**, interval of shots

Besides your camera and battery, you need additional accessories for: FLIR, Magnetometry, LIDAR, etc.



Accessories



Pix4D

Cost: Ranges from \$1990 (Educational single license), \$350/month or \$3500/year (Pix4Dmapper Pro), to \$8700 (perpetual license)

Agisoft PhotoScan

Cost: \$59 (standard educational license) to \$3499 (Professional stand-alone license)

Licensing and Contracting

	Fly for Fun	Fly for Work
Pilot Requirements	No pilot requirements	<ul style="list-style-type: none"> Must have Remote Pilot Airman Certificate Must be 16 years old Must pass TSA vetting
Aircraft Requirements	Unless exclusively operated in compliance with Section 336 of Public Law 112-95 (Special Rule for Model Aircraft), the aircraft must be registered if over 0.55 lbs.	<ul style="list-style-type: none"> Must be less than 55 lbs. Must be registered if over 0.55 lbs. (online) Must undergo pre-flight check to ensure UAS is in condition for safe operation
Location Requirements	5 miles from airports without prior notification to airport and air traffic control	Class G airspace*
Operating Rules	<ul style="list-style-type: none"> Must ALWAYS yield right of way to manned aircraft Must keep the aircraft in sight (visual line-of-sight) UAS must be under 55 lbs. Must follow community-based safety guidelines Must notify airport and air traffic control tower before flying within 5 miles of an airport 	<ul style="list-style-type: none"> Must keep the aircraft in sight (visual line-of-sight) Must fly under 400 feet Must fly during the day Must fly at or below 100 mph Must yield right of way to manned aircraft Must NOT fly over people Must NOT fly from a moving vehicle
Example Applications	Educational or recreational flying only	<ul style="list-style-type: none"> Flying for commercial use (e.g. providing aerial surveying or photography services) Flying incidental to a business (e.g. doing roof inspections or real estate photography)
Legal or Regulatory Bias	<ul style="list-style-type: none"> Public Law 112-95, Section 336 – Special Rule for Model Aircraft FIA Interpretation of the Special Rule for Model Aircraft 	Title 14 of the Code of Federal Regulation (14 CFR) Part 107

The FAA Test...

There is a series of regulatory steps that any operator will have to take to fly commercially or for academic research

Study time, practice tests, cost



Flying Above Tribal Lands

"The FAA is not likely to give up much jurisdiction over the greater U.S. airspace, even if it is above tribal lands, especially for flights at higher altitudes. However, it is possible that Tribes can realize sovereign control over low flying flights over tribal lands or create regulations for such flights over tribal lands, that are consistent with FAA standards."

"While the issue of Native American nation's airspace is largely unlitigated in American courts, Native American nations have asserted authority over their own airspace and federal courts have upheld the rights of municipalities of lower authority than the federal government to create their own restrictions.

Several tribes have asserted the right to sole control over their airspace. The Constitution of the Citizen Potawatomi Nation includes, "all waters and air space within the Indian Country . . . over which the Citizen Potawatomi Nation has authority."

The FAA asserts it is the one with exclusive right to determine flights.

"A tribe has no authority over airspace and cannot charge people for using it. The federal government has sole jurisdiction over the nation's airspace," said FAA spokesman Ian Gregor."

However, the Supreme Court has stated that "a hallmark of Indian sovereignty is the power to exclude non-Indians from Indian lands."

State Regulations

Beginning in the 2013 legislative session, state lawmakers have frequently considered many pieces of legislation addressing UAS. To learn more about state UAS laws, bills and resolutions, please follow the link covering measures from a specific session below.

Wisconsin:

Flying related activities, including but not limited to, hang gliding, parasailing, hot air ballooning, land sailing, flying model airplanes or sky diving on state parks, state recreation areas, state natural areas, Kettle Moraine and Point Beach state forests and Lower Wisconsin state riverway shall be restricted to areas posted for their use.

Questions?
Need More Information?



Research Technology:
mary-delagarza@uiowa.edu

Strategic Initiatives:
elizabeth-reetz@uiowa.edu
