Use of New Technologies – Unmanned Aerial Vehicles Panel

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www.tetratech.com
Tetra Tech Overview

- $2.3 billion in revenue
- 16,000 people
- 400 offices
- Working on 6 continents
- $1 billion US bonding capacity
Geomatic Technology Services

- Photogrammetric Mapping
- Digital Orthoimagery
- Airborne Light Detecting and Ranging (LiDAR)
- Multi & Hyperspectral Technology
- Satellite Imagery Collection & Analysis
- Geographic Information Systems (GIS)
- Data Management & Visualization
- Web Mapping Applications

- Historical Aerial Photography
- Oblique Imagery
- Thermal Imagery
- Magnetometry
- Inspection Surveys
- Mobile and Terrestrial LiDAR
- Land Survey
Precision Mapping and Imagery Tools

Current and Historical Aerial Photography
- provides information about land use and change detection. CIR imagery detects stress or vigor of vegetation.

3D Terrain Models & Topographic Maps
- shows detailed changes in terrain elevation to support engineering design, hydrologic modeling, linear routing or line of site assessments.

Airborne Magnetometry
- identify subsurface anomalies such as pipelines, abandoned wells, etc.

Light Detecting & Ranging (LiDAR)
- feature extraction to create as-builts of existing structures, vegetation and high resolution terrain mapping.

Hyperspectral Technology
- identify, map and analyze spectrally unique plant communities, soil types, and water conditions for baseline & monitoring.

Airborne Thermal Sensing
- thermal infrared imagery overlaying digital ortho photographs depicts the distribution of water temperatures.
Unmanned Aerial Systems

• **DJI Phantom and Inspire (Multi-Rotor)**
  - Inexpensive Consumer Grade ($1350-$3000)
  - Sufficient Electronics to Meet FAA Restrictions
  - High resolution Video (1080P and photographs)
  - Limited georeferenced output with Pix4D
  - Semi-Autonomous
  - Vertical landing

• **SenseFly ebee (fixed wing)**
  - Longer flight duration time
  - Ideal for larger area collection
  - GSD down to 1.5 cm pixel
  - Limited georeferenced output with Pix4D
  - Semi-Autonomous
  - Beyond line-of-sight
  - Requires a larger landing area
UAS for Mapping – Advantages

- **Small Area Projects**
  - Faster mobilization to remote areas
    - Emergency Response
  - Faster product generation
    - Time sensitive projects
  - Ability to collect with multiple sensors
  - Ability to change sensors in the field
  - Cost effective
UAS for Mapping and GIS Data Solutions

- **Sensors**
  - Color imagery cameras
  - High definition video cameras
  - 4-band RGBI cameras
  - Thermal sensors (FLIR)
  - Topographic LiDAR
  - Hyperspectral
Sensors

- Standard frame camera
- Frame based video camera
- Metric frame camera
- LiDAR
- FLIR
Data Collection

- Ground control
- Specialized pre-flight planning software
- Airspace considerations
- Safety considerations
Processing

- Orthoimagery
- Digital Surface Model (DSM)
- Digital Elevation Model (DEM)
- Contours
- Planimetrics
- 3-D Point Cloud
- Feature extraction
- Classification
UAS for Mapping and GIS Data Solutions

- Deliverables
  - Orthoimagery
  - Contours
  - Planimetrics
  - Classified LiDAR
  - Topographic DEM
  - Intensity/Reflectance
  - NIR Imagery
  - Volumetric Calculations
Project Example: Willamette Confluence
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Project Example: Willamette Confluence
Project Example: Pismo Beach Cliff
Products derived from UAS data
Using UAV outputs in a GIS

- Orthoimagery
- Digital Surface Model (DSM)
- Contours
Project Example: Mussell Rock Landfill

Considerations:
- Flight Planning
- GCPs
- Accuracy
- Datasets
  - Data points are a DSM (surface, not ground)
- Size of Project
- Turn-around Time
Drone at Mussel Rock

Drone?  Nope.

Drone?  Nope.

Drone?  Yes!
UAS Lessons Learned

- Value of UAS comes from the data, not the platforms.
- Project objectives determine approach.
- Size matters.
- Even “easy to fly” systems can be challenging.
- Not everyone who has a UAS can fly commercially.
- Accuracy and mapping requirements are not just processing.
- Ground checkpoints/targets for accuracy reporting.
- FAA Regulations for UAS are set to aviation industry standards – practice them, keep our standards high.
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