

Unmanned Aircraft Systems (UAS) Capabilities and Expertise

Applications of UAS in the Water Resource Industry

Alonso Morales
Commercial UAS Pilot
Joint Unmanned Systems
Management Services

March 23rd, 2018

Agenda

AECOM Government Experience

Commercial Approach

Projects

Inspections with UAS/Drones

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Government Experience-Foundation for Commercial Expertise

Nearly three decades of experience delivering superior UAS services to the Department of Defense in a zero mistakes tolerated operating environment



- Design, develop, create, & build critical C2 systems
- Operate & sustain critical C2 systems at 99.99% reliability ratings
- Engineer and install communication systems
- Conduct engineering analysis of critical systems & networks



- Ground Control Station Maintenance and Support
- Contract Logistics Support to include remote/austere
- Depot level maintenance for both aircraft & components



- Analysis of Alternatives—Right Systems at Right Time for the Right Jobs
- Engineering Support Services—Software, Data Management, Design
- Acquisition, Sustainment, Decommissioning
- Operations—Pilots and Sensor Operators



- Scalable Simulator Products and Services
- Instructor and Course Development Training Support
- Field Training Support

Results Driven Solutions



- *SAFE*
- *REGULATORY COMPLIANT*
- *COST CONSCIENCE*
- *TAILORED FOR THE PROJECT*
- *RESULTS ORIENTED--MEASUREABLE*
- *MULTI-DISCIPLINED*
- *SECURE OPERATIONS & DATA*
- *SCALABLE*



Service lifecycle – *Cradle to Grave, Short Duration to Long Term for Both Unique and Enterprise Level Projects*

Project Experience

Commercial Approach

Project Types

- Inspection: Levees, Dams, Power Lines, Power Substations, Towers, Stacks
- Survey: Digital Terrain Map (DTM), Contour Mapping, Ortho-rectified Mosaics
- Environmental Monitoring/Assessment: Thermal, Multi-Spectral, HD Imagery



Environmental Support on Alaska's North Slope 2015



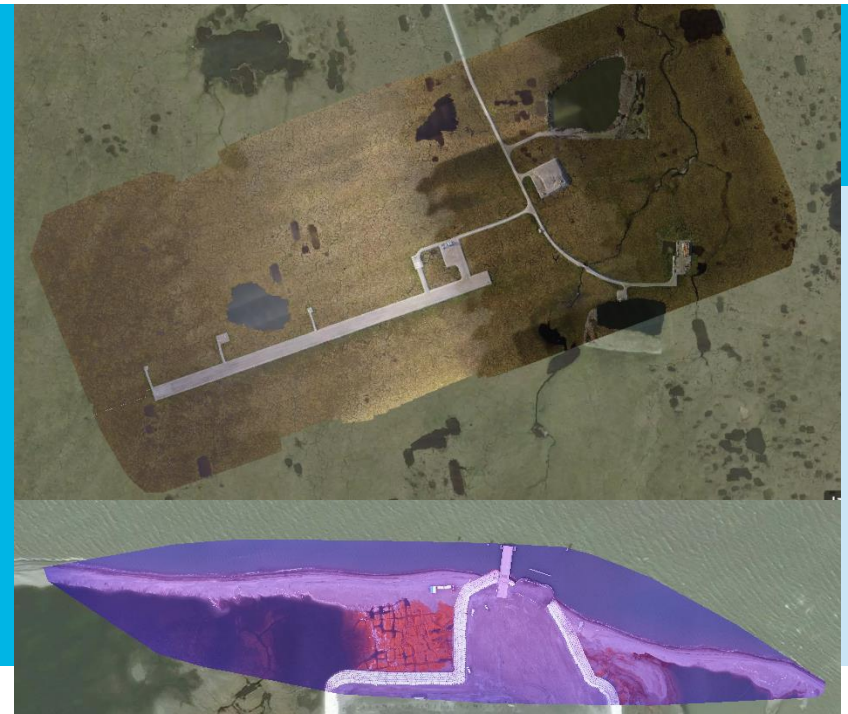
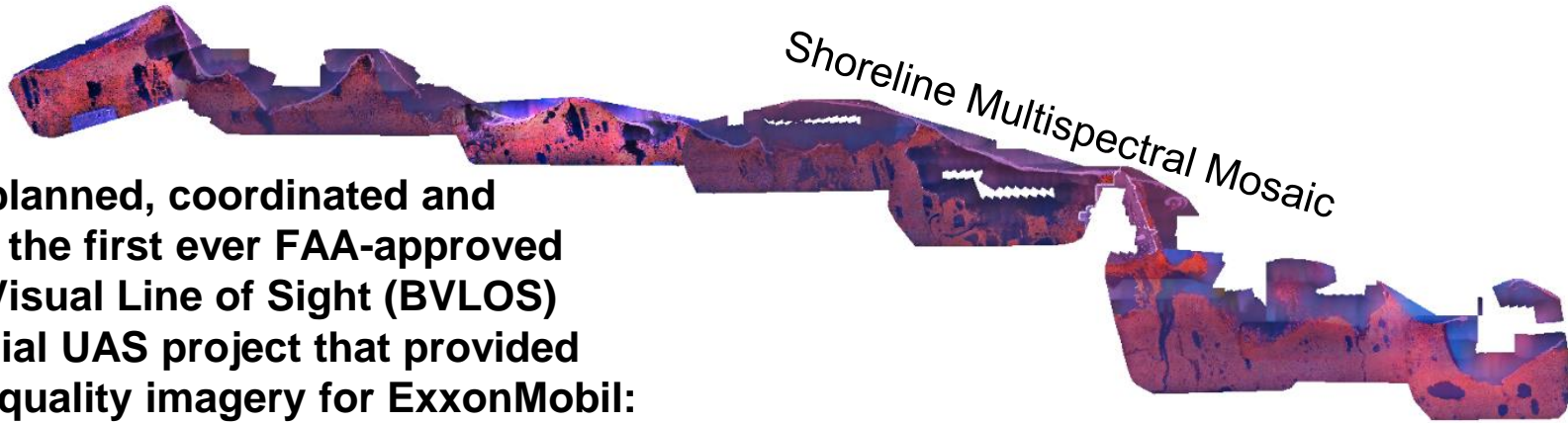
AECOM conducted an Analysis of Alternatives (AoA) and UAS Aerial Survey on the Alaska North Slope for Exxon Mobil:

- Imaged tundra vegetation and hydrology conditions for XOM environmental assessment requirements
- Employed two types of UAS (quadcopter and fixed wing) in a harsh environment
- Flew multiple flights from airstrip and roads over tundra with no-tundra encroachment
- Flew 60 hours, provided extensive high fidelity still photo and video imagery

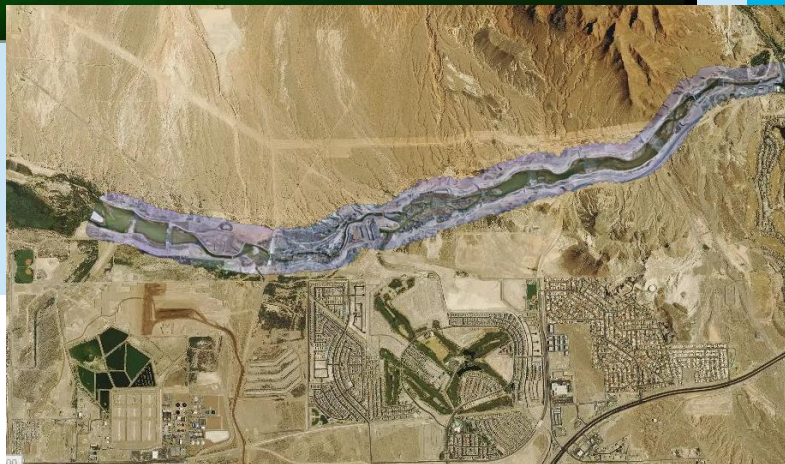
Environmental Support on Alaska's North Slope 2017

AECOM planned, coordinated and executed the first ever FAA-approved Beyond Visual Line of Sight (BVLOS) commercial UAS project that provided decision quality imagery for ExxonMobil:

- Shoreline erosion assessment – collected and mosaicked 6 miles of multispectral (BGNIR) imagery and 1 mile of high fidelity photo (RGB) imagery of the Alaska North Slope shoreline.
 - Operated BVLOS on portions of multiple flights
- Tundra hydrology and vegetation monitoring - BGNIR and RGB imagery of the airfield and surrounding area and river crossing sites
- Pipeline Vertical Support Member (VSM) assessments – videoed three VSMs recently installed at pipeline sag points.
- Mine site monitoring – extremely high fidelity NIR imagery (50' AGL)
- Flew 49 Quadcopter SUAS flights in harsh conditions



Thermal Levee/River inspection



- Using Thermal camera sensors on UAS in support of river downgradient study. Additionally, the implementation of UAS thermal sensors have been used for detecting of leaks and intrusion through levees.
- Imagery captured enabled visual presentation of leaks or intrusions into these primary waterways from outside sources.
- Over 5 miles of river imaged using thermal.
- Experience in this area further supports:
 - Hydrology flow
 - Erosion Assessments
 - Vegetation Management
 - Survey and Mapping
 - Digital Terrain Modeling

Critical Infrastructure Inspections

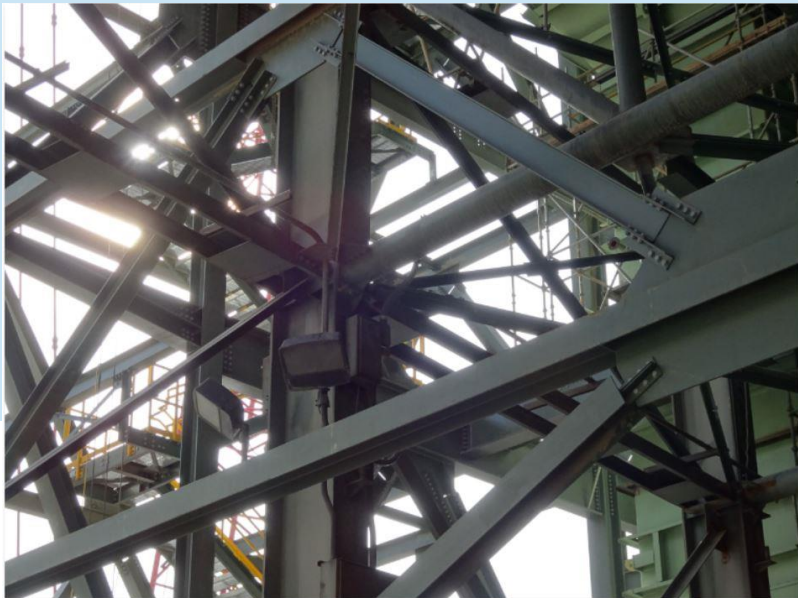


- Complex dam inspections that complement traditional rope access inspections
- Imagery fed real-time to an inspector monitor for on-site decisions
- Experience in this area further supports:
 - Hydrology flow
 - Erosion Assessments
 - Vegetation Management
 - Survey and Mapping
 - Digital Terrain Modeling

APS Power Station 4 Corners NM



- AECOM conducted UAS inspection of structural steel members supporting SCR ducts.
- Inspection focused on identifying rust and missing hardware. Employed small DJI Inspire UAS to fly in and amongst the steel in a non-GPS supported environment, to capture desired high resolution imagery.
- Required close, controlled, manual flight profiles to capture required imagery



AECOM

Imagine it.
Delivered.

Ameren Transmission Tower UAS Inspection

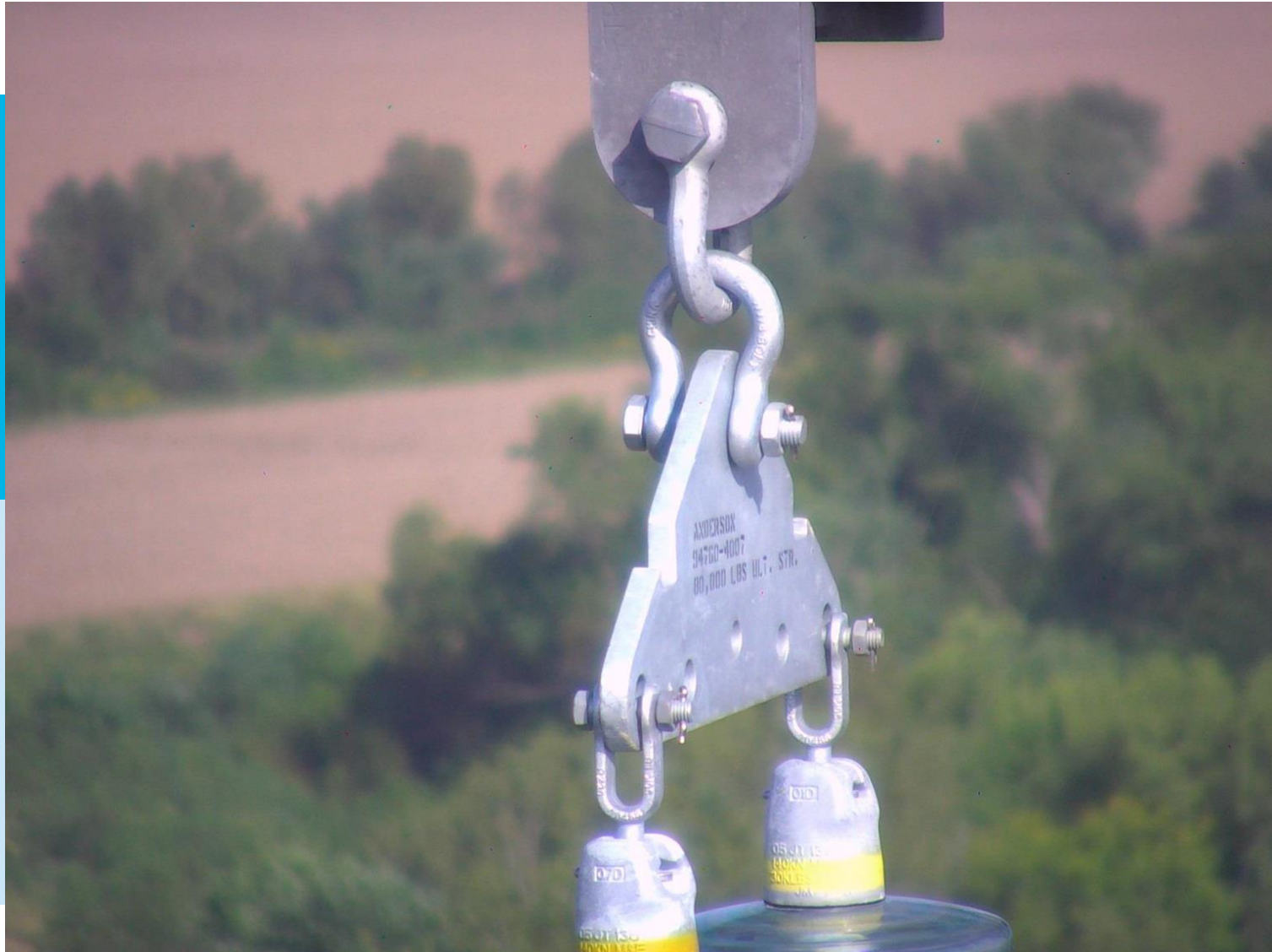


- AECOM conducted UAS inspection of 165 power transmission towers along a 30 mile corridor near Champaign, IL. Documented critical connection points, grounding straps, insulators etc. Employed small DJI Inspire UAS to fly in and amongst the towers and powerlines to capture desired high resolution still imagery.
- Every tower along the corridor was imaged providing an accurate condition/status and historical documentation prior to the entire line being entered into service and powered on by customer.
- Required close, controlled, manual flight profiles to capture required imagery

Transmission Tower UAS Inspection



Transmission Tower UAS Inspection



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Delivered.

Industrial Stack Inspection: External and Internal



- **AECOM created UAS solution to inspect the interior of the chimney safely and cost effectively while reducing the inspection time from days to hours and achieving higher level of detail**
- **1 of 3 ---250' Chimney—requires periodic internal inspection to determine integrity.**
- **Traditional method requires a crane to lower an inspector into the chimney resulting in costly/lengthy shutdowns, safety concerns**
- **Using UAS Stack Shutdown to Inspection Completion was just over 1 hour**

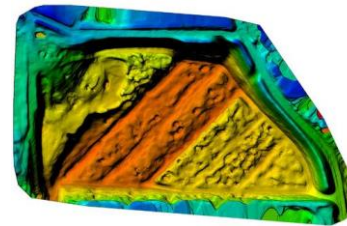
AECOM

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Delivered.

Aerial Imagery and Mapping

AECOM completed multiple UAS projects in support of Partners in Wisconsin:

- Provided aerial imagery of landfills, an ash bark pile, and riverside environmental conditions for a paper company.
 - Imagery provided geo-rectified, decision quality volumetric information and mosaicked imagery of three sites
 - 1 day event operating sUAS quadcopter
 - Successfully de-conflicted airspace and gained Government approvals
 - Demonstrated safe and effective UAS aerial survey operations
- Provided aerial imagery a major city's Industry Park Site under construction.
 - Imagery provided geo-rectified, decision quality volumetric information of three drainage basins and mosaicked of a site covering over 200 square acres
 - 2 day event operating UAS quadcopter
 - Successfully de-conflicted airspace and gained Government approvals
 - Demonstrated safe and effective UAS aerial survey operations



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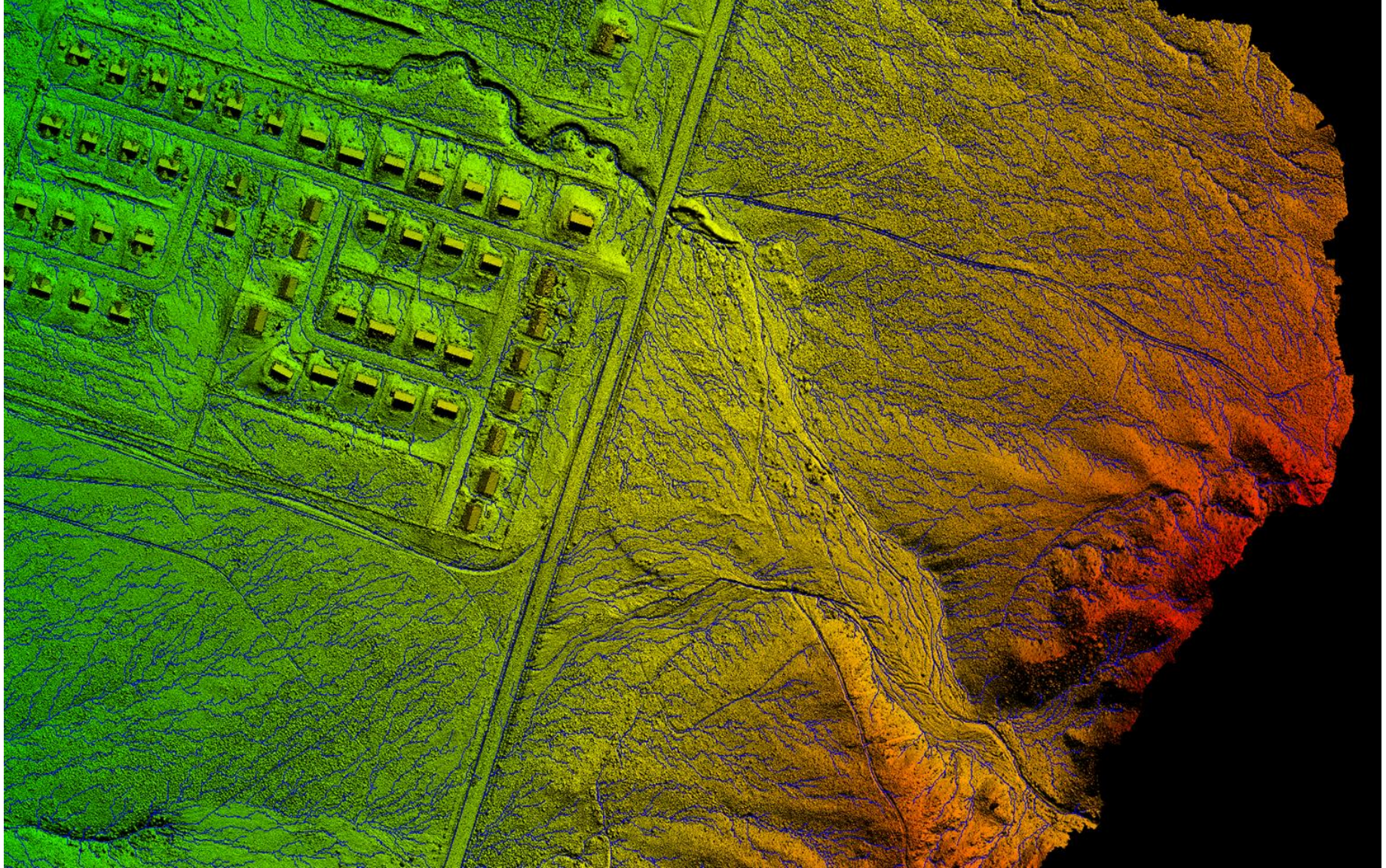
Aerial Imagery and Mapping

AECOM completed an AoA and multiple UAS Projects for mining partners in Georgia & Florida:

- Provided aerial imagery of mine site for environmental reclaiming required inspections.
 - Imagery provided geo-rectified, decision quality information and aerial mapping to support:
 - 3-D Terrain Modelling (DTM)
 - Volumetric calculation
 - Inspection measurements
 - Silt fence placement and condition
 - Vegetation
 - Erosion
 - Contour map
- Provided aerial imagery of potash stock pile and reclaimed waste area.
 - Imagery provided geo-rectified, decision quality information and aerial mapping to support:
 - 3-D Terrain Modelling (DTM)
 - Volumetric calculation
 - 2 day event operating UAS quadcopter
 - Successfully de-conflicted airspace and gained Government approvals
 - Demonstrated safe and effective UAS aerial survey operations



Navajo Reservation Flood Plain Mapping



Environmental Support in Western Australia

AECOM completed an Analysis of Alternatives & Proof of Concept Aerial Survey for a Global Oil & Gas partner:

- Aerial survey to image marine turtle nesting activities (turtles, tracks, and nests)
- 6 day event flying two UAVs simultaneously
- Required multiple flights over beaches with flights to/from the beaches
- Flew 60 hours, provided extensive high fidelity still photo and video imagery
- Captured >1 terabyte of environmental compliance & baseline relevant data
- Demonstrated safe and effective UAS aerial survey operations
- Successfully de-conflicted airspace and gained Government approvals in 2-3 weeks
- Processed geo-rectified and ortho-rectified data for precision analysis



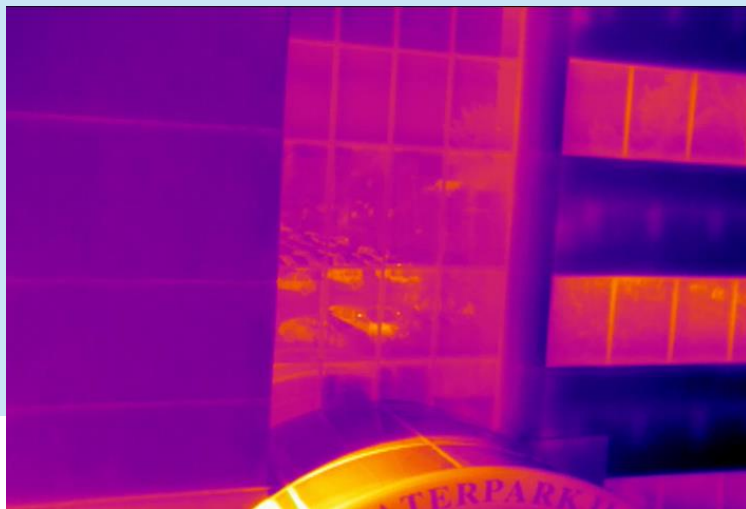
Idaho Mine Terrain Modeling



Thermal Building Inspection



- 2 Office complex's reporting water entering the building. Roof tops Mapped with traditional RGB camera and with FLIR XT camera.
- Building fronts scanned and video documented of the facades and rooftops.



Missing Insulator



AECOM sUAS Expertise in Action

Image taken at 3:00 pm

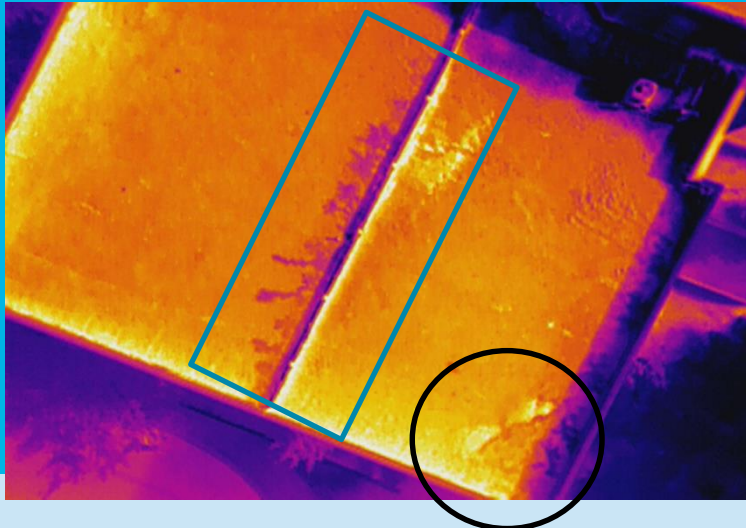
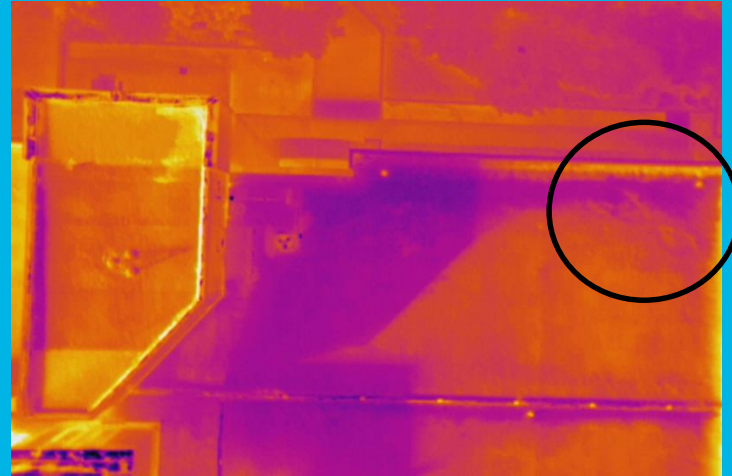
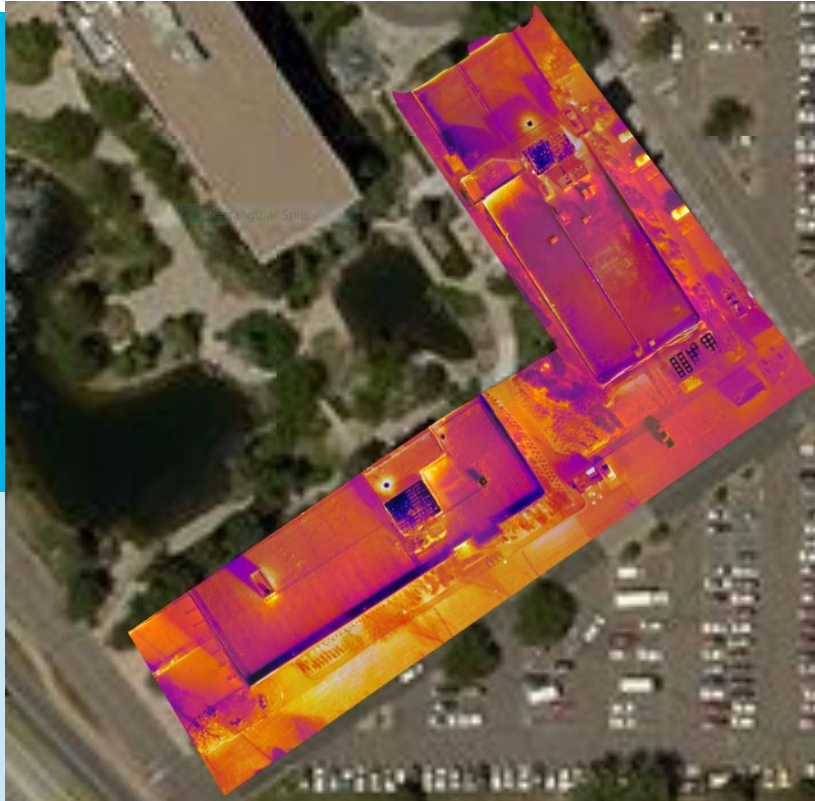


Image taken at 9:00 am



AECOM sUAS Expertise in Action

AECOM
Built to deliver a better world



AECOM
Built to deliver a better world

UAS/Drones Inspections

1- FAA Regulations

By a show of hands how many here are
Part 107 Certified?

2- Platforms

a- Fixed wing

b- Quadcopter

3- Best Practices

FAA

<http://knowbeforeyoufly.org/resources/>

Platforms

- Fixed wing
- Quadcopters

Best practices

Know before you fly

Create and use checklists

Read manuals and inspect drones
before/after every flight

Call the airport's ATC if within 5miles

Mind the weather <18mph

Keep drone within line of sight

Avoid flying over people

Respect privacy

Q & A

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