

Using the RQ-11 Raven-A and the T-Hawk for Oversight Inspections of Surface Coal Mines in West Virginia

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Project Overview

- **Background**
- **Timeline**
- **Data collected**
- **What we do with the data?**
- **How successful was it?**
- **Future Study**

Why are we doing this?

- Helicopter over-flights
- Satellite Imaging
- The U.S. Geological Survey coordination



2011

The RQ-11 Raven



Specifications:

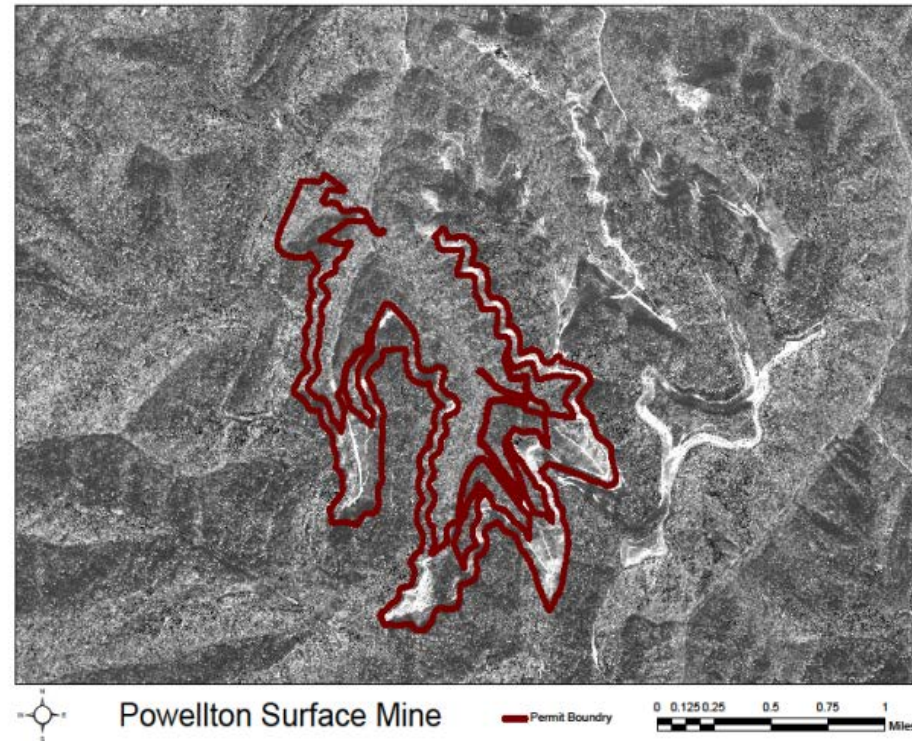
- Weight: 4.2 lbs
- Length: 3 ft 7 in.
- Wingspan: 4 ft 3 in.
- Cruising speed: 60 mph
- Range: 6.2 miles
- Flight time: 60-80 minutes
- Interchangeable payloads
- Cost : \$35, 000

The Raven Methodology

- The Bridge Fork West Surface Mine
- Fayette Co., WV
- Issued June 21, 2004
- 463.8 acre Contour strip mine
- Site mostly reclaimed



- Site selection
- Must be a mine site
- Multiple on the ground features
- Underground mine fire



What did we get?

Optical and Thermal Video Images



The Raven Conclusions

- Image quality is sufficient.
- Multiple views
- Different cameras
- Inspector safety
- Historical record
- Time Savings
- Paperwork
- Personnel
- Visual line of Sight
- Data Duplication
- Aircraft Maneuverability
- No Scale

2012

The RQ-16A T-Hawk

- **Micro Air Vehicle (MAV) with ducted fan**
- **Vertical Take Off and Landing**
- **Weight: 20 lbs**
- **Capable of up to 81 mph speed**
- **Flight time: 40 minutes**
- **One person operation**
- **Fuel : Aviation fuel**
- **Cost \$500,000**



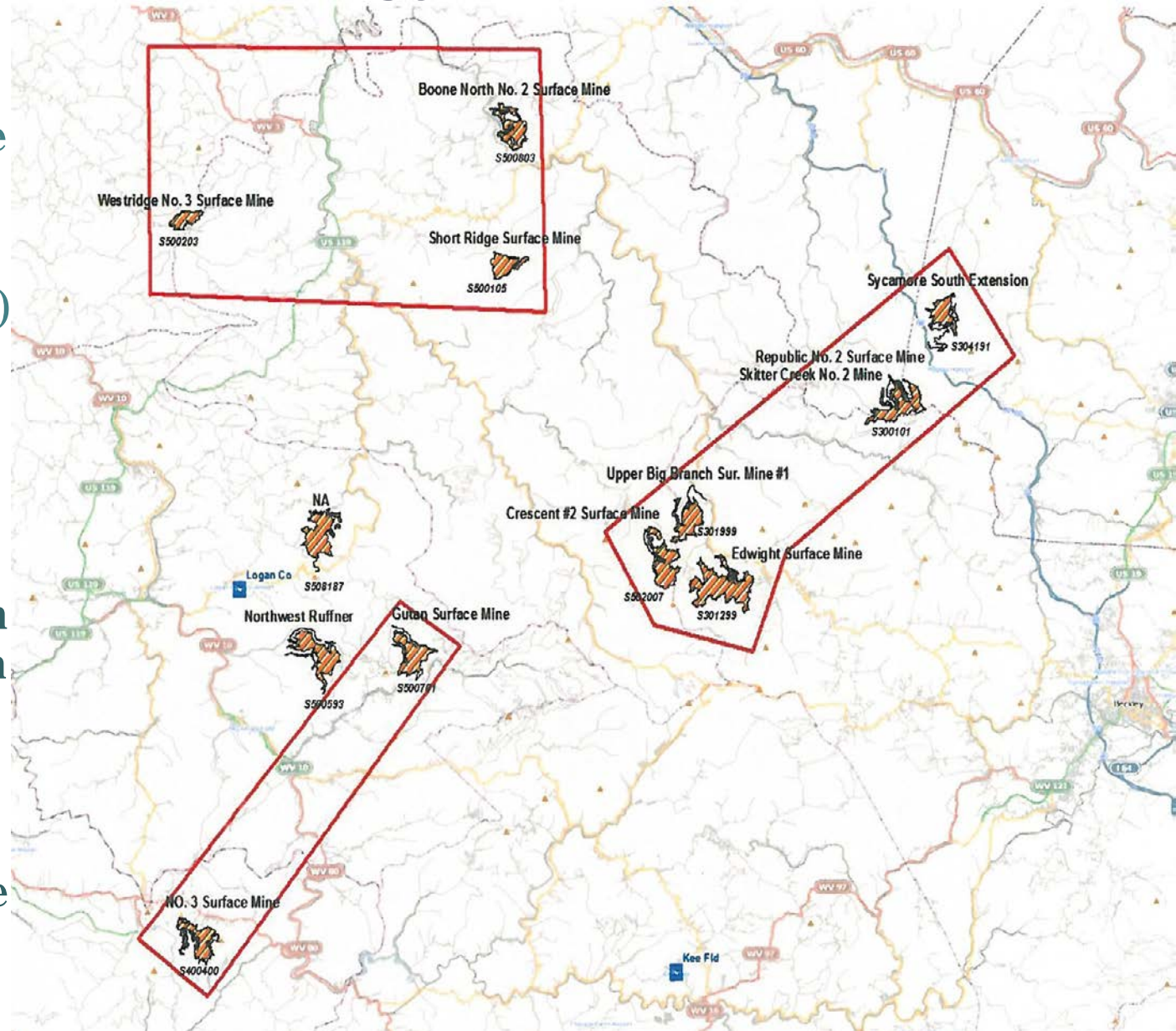
T-Hawk Methodology

- **The Plan**

- 15 randomly selected Mine sites with Raven and T-Hawk side by side (2 teams)
- 3 days
- Thermal and Optical data

- **The Reality**

- 8 sites flown
- Only 1 flown with Raven
- 3 ½ days
- Thermal camera not effective due to weather conditions



Results



Permit overview-Quick look



Drainage Control Inspection



Large Features



Adjustable Camera



- **Helps identify potential problem areas**



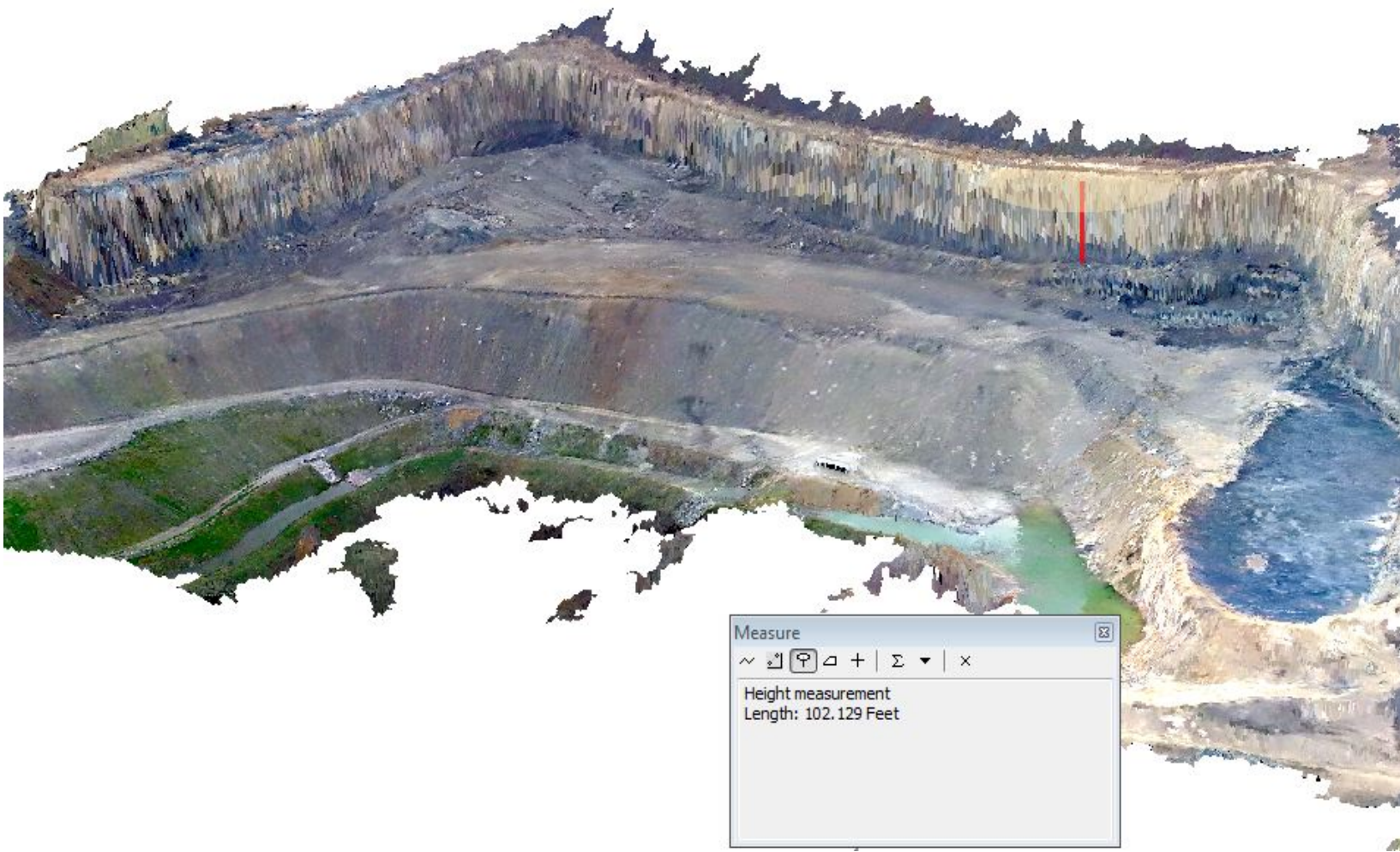
Scale

- **Pond 1A-
Spillway bottom**
 - 45' measured
 - 42.96' certified
 - 43' calculated
- **Top**
 - 65' measured
 - 66.10' certified
 - 69' calculated

- **Pond 1B-
Spillway bottom**
 - 42' measured
 - 44.6' certified
 - 43' calculated
- **Top**
 - 65' measured
 - 67.5' certified
 - 65' calculated



3D Models



Measure ✕

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Height measurement
Length: 102.129 Feet



Results

- 6500 acres flown
- 4 miles of drainage structures
- Average time per permit 50 minutes
- 90% of each permit inspected
- Improved Imagery Quality
- Time saving
- Increased safety



Results cont.

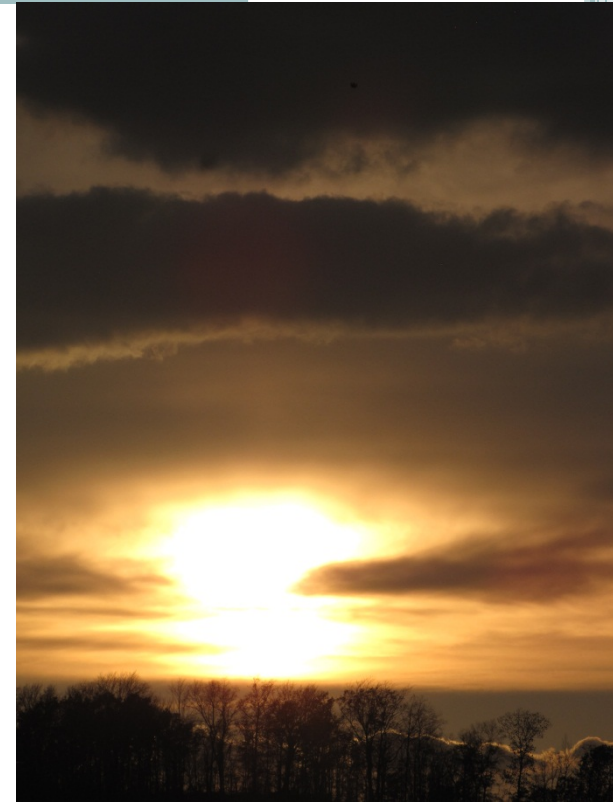
- **Scale**
- **Maneuverability**
- **Inspector safety**
- **Historical record**
- **Time Savings**
- **Paperwork is still an issue**
- **Visual line of Site still applies**
- **Cost/Benefit Ration is in the works**
- **Further study is needed**
- **No trained pilots in OSM to date**





Questions?

Thank You For Your Attention!



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