Improving Drone Output with High Precision Ground Control
With a history dating back to 1886, American Water (NYSE: AWK) is the largest and most geographically diverse publicly traded water and wastewater utility company.

- 16 million in 46 states & Canada
- 6,900 dedicated professionals
- 51,000 miles dist & collection
- 1,500 water production facilities
- 800 water treatment facilities
- 2,700 water storage facilities
- 500 wastewater facilities
A Bit About Safety

• AW has a formal UAV policy under draft to include guidelines for an SMS, training, licensure, insurance, operating parameters

• A Robust SMS:
  • Modeled after traditional Airmen safety standards
  • Creates a powerful safety culture among crew members
  • Prevents accidents / provides SOP for flights and incident reporting
  • Tracks equipment maintenance & pilot history
  • Significantly helps obtain FAA waivers to operate in any airspace

• The NJAW SMS is FAA & ICAO Compliant and includes:
  • Flight Operations Manual (FOM)
  • Pre/Post Flight Checklists
  • Risk Assessment Matrix
  • Incident Root Cause Analysis
  • SMS Manual
  • Accident-Incident Response (AIR) Plan
  • Aviation Training Manual
Mission Planning

FAA Airspace Maps
• Packed with information

Simplified Flight Planning Maps
• Drone flight requests
• Pilot planning
Post Processing (GIS)

Stitches thousands of photos into 2D & 3D maps
UAV Requirements

- Executive Safety / Program Sponsor
- FAA Part 107 licensed pilot
- Hull & Liability Insurance
- “Prosumer” Drone (FAA registered)
- Autopilot & Post-Processing software
- SMS & SOP, including log-book software
- Data Management Plan
When You Don’t Need Ground Control Points

- If you intend to use the output like you would a CAD file, then don’t bother
- Schematics
- Graphics / Marketing
- Free floating
- Self-contained
What Do You Need

- PPE
  - Safety first!
- Targets
  - Paint
  - Markers
  - Visible Items
- GPS / GNSS
  - Collector App
UAV Software – Mission Pre-Planning and Auto Pilot (GIS)
GROUND CONTROL TO
MAJOR TOM
TAKE YOUR PROTEIN PILLS
AND PUT YOUR HELMET ON
No Ground Control

• Processing Report
  • Blue Dots = Initial image positions
  • Greed dots – Computed image positions
  • Dark green ellipses – absolute position uncertainty (magnified 50 times)
The GCP must be linked to at least 2 images. Linking to 3-8 images is recommended for best results.

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<th>Images</th>
<th>Label</th>
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<th>Long [X]</th>
<th>Elevation [Z]</th>
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Remove Image Link
The GCP must be linked to at least 2 images. Linking to 3-8 images is recommended for best results.
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Links | Label | Lat [m] | Long [m] | Elevation [m]
------|-------|--------|---------|-------------
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Images
- DI10053.jpg
- DI10046.jpg
- DI10047.jpg
- DI10050.jpg
- DI10053.jpg
- DI10011.jpg
- DI10004.jpg
- DI10016.jpg
- DI10012.jpg
- DI10007.jpg
- DI10005.jpg
- DI10004.jpg
- DI10003.jpg
- DI10002.jpg
- DI10001.jpg

OK
The GCP must be linked to at least 2 images. Linking to 3-8 images is recommended for best results.
Reminder - No Ground Control

- Processing Report
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Reminder - No Ground Control

Figure 3: Offset between initial (blue dots) and computed (green dots) image positions as well as the offset between the GP's initial positions (blue crosses) and their computed positions (green crosses) in the rosary (37 planes), trefoil (25 planes), and side cross (72 planes). Both green ellipses indicate the absolute position uncertainty of the bundle block adjustment result.
Questions?

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American Water

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