MONTANA DEPARTMENT OF TRANSPORTATION

Unmanned Aerial Systems (UAS)
CURRENT UAV EQUIPMENT

Two DJI Phantom 4 Pro
Both drone models have the Zenmuse X4s camera which has a leaf shutter.
• Aircraft weight < 55 pounds
• Certified Pilot
• Daylight or Civil Twilight
• < 400 feet AGL
• Class G airspace
• Within unaided line of sight
• Visibility 3 miles or more
• No flights over non participants
FLIGHT PLANNING

• Flight Restrictions?
• Notices to Airmen?
• Weather?
• Landowner Permission?
• Traffic Control Needed?
EQUIPMENT CHECK

• Charge Batteries for AC, RC, IPAD, GPS
• Firmware Updates
• Memory Cards
• AC preflight check
• Calibrate Compass if Necessary
MDT’S CURRENT APPLICATIONS

- Imagery/Video
- Inspections:
  - Aircraft Beacon
  - Rockfall/Landslide Sites
  - Construction Sites
- Stockpile Measurements
- Mapping- Topo Surveys
- Modeling- 3D terrain models
Dearborn River High Bridge. Photo taken 1 week before 25+ Ton vehicle crossed. Bridge is rated at 7 Tons.
Beartooth Pass Condition Inspection prior to Snow Removal Operations
MDT Owned Aircraft Beacon Inspection
Aerial Video of Construction Site
UAV Imagery Uploader

1. Select the site location:
   - ROCKVALE - LAUREL (2 LANES) (FED W/HIP)
   - Nelson's Pit +/- 360+00
   - Flown at Altitude of 200'

2. Add all the images for the site you measured:

- Generate Stockpile Measurements
- Optional notes:

Make sure the computer doesn't go into sleep mode while uploading your imagery.

If you interrupt an upload, just select all the images again. The uploader will automatically detect what you've already uploaded and pickup where it left off.

- Confirm the flight is flown as per the required specifications

PDF: Stockpile Reports UAV Flight Requirements and Checklist

Select Images

OR

Drag-n-drop the images onto this box

Reset  Upload Imagery
• 11.2 acres site measured
• Flight time 10 minutes
• 1 hour total labor (field and office)
• Measured 7 stockpiles
• Total Quantity of 83,744 yd³
MAPPING
MAPPING

Vertical RMS of 0.078’ and NSSDA accuracy of 0.153’ (ideal conditions)

(Currently, MDT Photogrammetry targets 0.3’ or better NSSDA)
ROCK SCALING PROJECT: BASIN-BOULDER

Rock Slope was modeled and rock scaling quantities were derived for the contract.
## SCALING

<table>
<thead>
<tr>
<th>STATION</th>
<th>SCALING</th>
<th>cubic yards</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROM</td>
<td>TO</td>
<td>HOURS</td>
<td></td>
</tr>
<tr>
<td>1245+00.00</td>
<td>1257+00.00</td>
<td>560</td>
<td>1,250</td>
</tr>
<tr>
<td>1245+00.00</td>
<td>1257+00.00</td>
<td>1,040</td>
<td>2,300</td>
</tr>
<tr>
<td>1268+00.00</td>
<td>1278+00.00</td>
<td>590</td>
<td>1,300</td>
</tr>
<tr>
<td>1268+00.00</td>
<td>1278+00.00</td>
<td>890</td>
<td>2,000</td>
</tr>
<tr>
<td>1268+00.00</td>
<td>1278+00.00</td>
<td>940</td>
<td>2,100</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>4,020</td>
<td># 8,950</td>
</tr>
</tbody>
</table>
LITTLE DRY CREEK

• Mapped ~3400 feet of project
• 734 images
• 10 control points
• Two 18 minute flights
POST PROCESSING SOFTWARE

Pix4D

Virtual Surveyor
Little Dry Creek

Check stations every 500’
NSSDA accuracy .16’ on pavement.

Accuracy off vegetated areas heavily dependent on post processing software and skill level. We have a lot to learn still.
• 125 acres
• 3x20 minute flights
• PPK GPS using Base Station and LOKI unit
CAMERA POSITION ACCURACY REDUCED FROM 8 FEET TO .09 FT WHEN USING LOKI GPS
NEXT STEPS

- Refine Workflows for Preconstruction Mapping
- Construction Projects — Earthwork Measurement
FUTURE

• Fixed Wing
• LIDAR
• Machine Learning / Artificial Intelligence to optimize data processing
FUTURE

• Thermal imagery
• In-service Bridge Inspection
• Beyond Line of Sight Operations