High Resolution Bathymetry and Fly-Through Visualization

Paul Clouse
Lockheed Martin / U.S. Army Corps of Engineers
Why Visualize?

- See scour and accretion patterns
- See structures
- Determine hazards
- Examine habitat
- Differentiate bottom type (hard vs. soft)
- Added value to survey
- View surveys in unprecedented details from virtually any angle
Bathymetry

The measurement of depths of a body of water
Bathymetric Data Collection

- Data is collected in an X Y Z format
- Produces a copious amount of data points
- Several million points per river mile
- 1 million dimes placed end to end would stretch over 11 miles!
- 1 million dimes stacked on top of each other would be over 1/2 mile tall!
St. Louis District’s High Resolution Surveying Vessels

M/V Boyer
Multi-beam

M/V Simpson
Multi-transducer

One Corps Serving the Armed Forces and the Nation
One Corps Serving the Armed Forces and the Nation

Bathymetric Modeling

XYZ Data → TIN Model (Optional) → Grid Elevation Model → Color Coded Model

TIN Data → GRD Elevation Data → GRD Color Coded Data
Grid Model
Color Coded Model
Methods for Visualization

- Static Fly Through
- Interactive
Visualization Workflow

- Setup the scene
- Setup up the flight
- Record the flight
Scene Properties

- Vertical Exaggeration
- Sun Elevation
- Sun Azimuth
Scene Properties

Vertical Exaggeration

Normal 10x Exaggeration

One Corps Serving the Armed Forces and the Nation
Scene Properties
Sun Positioning – Elevation

Position

90 degrees

Elevation above Horizon

0 degrees
Scene Properties
Sun Positioning – Azimuth

- 0 degrees
- 90 degrees
- 180 degrees
- 270 degrees

Position
Azimuth
Compass Direction

One Corps Serving the Armed Forces and the Nation
Flight Properties

- Flight Path
- ASL & AGL
- Look Azimuth
- Look Pitch
- Field of View
- Roll
- Speed
Flight Properties
Flight Path

Key in X Y Coordinates

Digitize

---

One Corps Serving the Armed Forces and the Nation
Flight Properties
Look Azimuth

- degrees

0 degrees

+ degrees
Flight Properties
Look Pitch

0 degrees

+ degrees

- degrees
Flight Properties
Field of View

Total Angle in degrees

---
One Corps Serving the Armed Forces and the Nation
Flight Properties
Speed

Motion
### Completed Flight Properties

**Flight Path Editor**

<table>
<thead>
<tr>
<th>Point #</th>
<th>X</th>
<th>Y</th>
<th>ASL</th>
<th>AGL</th>
<th>Look Azimuth</th>
<th>Look Pitch</th>
<th>FOV</th>
<th>Roll</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>219766.837</td>
<td>28221.014</td>
<td>45.00</td>
<td>20.63</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>219768.123</td>
<td>281911.788</td>
<td>45.00</td>
<td>25.63</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>219769.535</td>
<td>281612.117</td>
<td>45.00</td>
<td>25.42</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>219740.204</td>
<td>281670.050</td>
<td>45.00</td>
<td>21.20</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>219763.634</td>
<td>281574.196</td>
<td>45.00</td>
<td>17.09</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>219752.749</td>
<td>281664.879</td>
<td>45.00</td>
<td>16.81</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>219753.141</td>
<td>281572.348</td>
<td>45.00</td>
<td>14.72</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>219752.501</td>
<td>281243.462</td>
<td>45.00</td>
<td>17.05</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>219749.215</td>
<td>281156.222</td>
<td>45.00</td>
<td>17.69</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>219754.215</td>
<td>281069.412</td>
<td>45.00</td>
<td>16.66</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>219753.350</td>
<td>280269.033</td>
<td>45.00</td>
<td>15.76</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>219764.513</td>
<td>280350.066</td>
<td>45.00</td>
<td>15.62</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>219763.625</td>
<td>280262.602</td>
<td>45.00</td>
<td>15.63</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>219759.521</td>
<td>281672.627</td>
<td>45.00</td>
<td>14.91</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>219743.675</td>
<td>281143.361</td>
<td>45.00</td>
<td>17.90</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>219743.445</td>
<td>28249.462</td>
<td>45.00</td>
<td>15.15</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>219733.800</td>
<td>281258.779</td>
<td>45.00</td>
<td>14.89</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>219732.539</td>
<td>281428.448</td>
<td>45.00</td>
<td>18.31</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>219732.073</td>
<td>281536.701</td>
<td>45.00</td>
<td>16.46</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>219741.649</td>
<td>281631.371</td>
<td>45.00</td>
<td>18.30</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>219745.787</td>
<td>281324.578</td>
<td>45.00</td>
<td>27.68</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>219792.002</td>
<td>281515.003</td>
<td>45.00</td>
<td>25.94</td>
<td>-35.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>219792.002</td>
<td>282123.636</td>
<td>45.00</td>
<td>24.90</td>
<td>-60.00</td>
<td>90.00</td>
<td>0.00</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Recording a Flight

- Set the output movie type i.e. mpg or avi
- Set the output file
- Begin the flight
Anaglyph

- A moving or still picture consisting of two slightly different perspectives of the same subject in contrasting colors that are superimposed on each other, producing a three dimensional effect when viewed through two correspondingly colored filters.
Anaglyphs are Child’s Play
Warning: Some visualizations may make you dizzy or cause headaches and nausea

If you experience symptoms, please remove your anaglyph glasses and close your eyes
Anaglyph Test

Can you see 3D?

Hint: The top coin should be floating above the bottom coin
Learning to Fly

The Movie
Questions??

One Corps Serving the Armed Forces and the Nation
Contact Information

Paul Clouse

(314) 331-8390

Lockheed Martin \ U.S. Army Corps of Engineers

Paul.Clouse@usace.army.mil