Converting Aerial Imagery to Vegetation Index and Prescription Maps

Chenghai Yang, Clint Hoffmann
Fred Gomez, Lee Denham,
Dan Martin, Brad Fritz, Phil Jank

USDA-ARS
Aerial Application Technology
Research Unit
College Station, TX

50th NAAA Convention & Exposition, Long Beach, CA, Dec. 5-8, 2016
Single- and Dual-Camera Imaging Systems

Monitor
Trigger
GPS
<table>
<thead>
<tr>
<th>Imaging System Components</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nikon D90 camera with Nikon 24mm lens</td>
<td>$1000</td>
</tr>
<tr>
<td>Modified Nikon D90 camera with 720-nm filter</td>
<td>$1300</td>
</tr>
<tr>
<td>Nikon GP-1A GPS unit</td>
<td>$200</td>
</tr>
<tr>
<td>Giga T Pro II Wireless timer remote control</td>
<td>$100</td>
</tr>
<tr>
<td>Optional LCD monitor</td>
<td>$100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2700</strong></td>
</tr>
</tbody>
</table>
Imaging from 1000 ft to 10000 ft AGL

Canon 5D: 5616 x 3744 pixels
At 10000 ft altitude
3.5 mi x 2.3 mi (5000 ac)
pixel size = 1.0 m
Imaging from 400 ft to 10000 ft AGL

At 10000 ft altitude
3.4 mi. x 2.3 mi. (5000 ac)
pixel size = 1.0 m

60% overlap -> 4000 images
80% overlap -> 16000 images

At 400 ft altitude
720 ft x 480 ft (8 ac)
pixel size = 4 cm

10000 ft – 625X
400 ft – 1X
AgNav PhotoNav System

- PhotoNav software will turn your Platinum system into a dual system for spraying and imaging.
- Flight lines and photo target points are defined based on camera type, overlap and flight height.
- The way you plan and conduct an imaging mission is very much the same as for crop spraying.
Mission Planner – Free Software

http://ardupilot.org/planner/

4 mi x 8 mi
20480 ac
Use Mission Planner to Create Flight Plans for Taking Images

- **Nikon D90**
- **5000 ft AGL**
- **120 knots**
- **60% overlap**
- **11 flight lines**
- **1966 ft interval**
- **6.5 s per image**
- **337 images**
- **48 minutes**

4 mi x 8 mi
20480 ac
Take Images along Flight Lines

- Nikon D90
- 5000 ft AGL
- 60% overlap
- 140 MPH
- 11 flight lines
- 2000 ft interval
- 6 s per image
- 418 images

4 mi x 8 mi
20480 ac
Create Mosaicked Image Using Pix4D
Example: 10 Images on Two Flight Lines
Create and Visualize 3D Point Cloud
Visualize Mosaic on Google Earth
Ground Control Points to Improve Accuracy
Visualize Mosaic on Google Earth
Orthomosaic and Digital Surface Model
Band Reflectance Image
Band Ratio (Green/Red) Vegetation Index
Digitize Field Boundary
Band Ratio (Green/Red) Vegetation Index
The prescription map is exported to a Shapefile that can be directly imported to a variable rate application system.
RGB and Near-Infrared (NIR) Orthomosaics
Normalized Difference Vegetation Index (NDVI)
Two-Zone Prescription Map
Thank You!

USDA Aerial Image Processing Workshop

8:00-9:30 am
Wednesday, December 7, 2016
Room 101B