Aerial Imaging with Manned and Unmanned Aircraft

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

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

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Single- and Dual-Camera Imaging Systems
**Imaging System Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nikon D90, D7100 or D7200 camera with Nikon 24mm lens</td>
<td>$1100</td>
</tr>
<tr>
<td>Modified Nikon D90, D7100 or D7200 camera with 830-nm filter</td>
<td>$1500</td>
</tr>
<tr>
<td>Nikon GP-1A GPS unit</td>
<td>$200</td>
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<tr>
<td>Hahnel Captur Wireless Remote Timer</td>
<td>$130</td>
</tr>
<tr>
<td>Optional LCD monitor</td>
<td>$70</td>
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**Total:** $3000
Imaging Systems Based on Consumer-Grade Cameras

Single D7100
$1500

Dual D7100
$3000

Dual D810
$7000
Airborne Image Acquisition

- Altitude: 1000-10,000 ft
- Speed: 100-150 mph
- Weather: Clear and calm days
- Time: 10:30 am to 3:30 pm
Unmanned Aircraft System

- HSE-UAV AG-V6A hexacopter
- Payload = 13 lb
- Speed <= 25 mph
- Endurance < 15 min
- Dual-camera D7100 (RGB + NIR)
Unmanned Aircraft System

Weight: <55 lb
Max altitude: 400 ft
Max speed: 100 mph
Imaging at Different Altitudes

**8000 ft – 1000 ac**

Nikon D7100 at 8000 ft
8000 ft x 5333 ft (1000 ac)
Pixel size = 40 cm (16 in)

**4000 ft – 250 ac**

**400 ft – 2.5 ac**

At 400 ft
400 ft x 267 ft (2.5 ac)
Pixel size = 4 cm
Imaging from 400 ft to 8000 ft AGL

0% overlap -> 400 images
50% overlap -> 1600
60% overlap -> 2500
80% overlap -> 10000

400 ft – 1X

Nikon D7100 at 8000 ft
8000 ft x 5333 ft (1000 ac)
pixel size = 40 cm (16 in)

At 400 ft
400 ft x 267 ft (2.5 ac)
pixel size = 2 cm
Mission Planner – Free Software

http://ardupilot.org/planner/

8000 ft x 5330 ft
1000 ac
Flight Plans for Taking Images Using HSE UAS with Nikon D7100

Nikon D7100
400 ft AGL
25 mph
60% overlap
34 flight lines
160 ft interval
3 s per image
2700 images
2.5 hours

8000 ft x 5330 ft
1000 ac
Mapping Cotton Root Rot

- Serious cotton disease
- Tends to occur in the same areas year after year
- Fungicide can control the disease, but it is expensive
- Site-specific treatment is more economical
Use Mission Planner to Create Flight Plans for Mapping Cotton Root Rot

- 14 mi x 11 mi
- Nikon D810 RGB/NIR
- 10,000 ft AGL
- 60% overlap
- 150 mph
- 8 flight lines
- 7000 ft interval
- 10 s per image
- 256 images
- 1 hour

14 mi x 11 mi (100,000 ac)
Airborne Image Acquisition

100,000 ac
256 images
1 hour
Mosaicked RGB and CIR Images

RGB

Color-infrared (CIR)
Subset Color-infrared Image

6 mi x 4 mi (15,000 ac)
CIR Image and Prescription Map

CIR Image

Prescription Map

Total Area = 204 ac
Treated = 75 ac (37%)
Nontreated = 129 ac (63%)
Savings = 129 ac x $50/ac
= $6450

Cotton Root Rot
Flight Plans for Taking Images Using HSE UAS with Nikon D810

Nikon D810
400 ft AGL
25 mph
60% overlap
288 ft interval
5 s per image
191 flight lines
72,000 images
106 hours

14 mi x 11 mi (100,000 ac)
Thank You!

USDA Booth #948

USDA Image Processing Workshop
8:00-9:30 AM, Wed., Dec. 6
Room CC202