

Roles and Responsibilities

11/14/2000

[Click here to start](#)

Table of Contents

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[PPT Slide](#)

[Roles and Responsibilities](#)

[Hawaii Program](#)

[Islands of Hawaii](#)

[Island Information](#)

[Aerial Platform](#)

[Imaging Camera](#)

[Output and Principal Products](#)

[Sensor Mounting](#)

[GPS Geometry](#)

[Product Accuracy](#)

[Flying Height \(H\), Focal Length \(f\) and GSD](#)

[Emerge Process Flow](#)

[Pearl Harbor, HI](#)

[Reef at Port Entrance](#)

[EWA Beach, Oahu](#)

[Pineapple Crops](#)


[Tropical Rain Forest on Oahu](#)

[Poi on Oahu](#)

[Turtle Bay, Oahu](#)

[Hiiaka and Pauhi Craters, Hawaii](#)

[Sugar Cane Crops, Maui](#)



Mapping Hawaii by Airborne Direct Digital Imaging

Don Light
LAI & PAR Government

Joan Zelinski
PAR Government



Slide 1 of 22

Roles and Responsibilities

Organization

Major Function

Emerge
Billerica, MA

**Prime Contractor, Production
Mosaicing and Geo-Positioning**

Landcare Aviation
Oriskany, NY

**Aircraft flier with Imaging
System**

**PAR Government
Systems Corp.**
Rome, NY

**QC, Datums, and Formatting
the imagery into the National
Digital Ortho Quad Program**



Hawaii Program

- **One-meter CIR digital aerial collection of the state of Hawaii**
 - 1:12000 NMAS
 - National Digital Ortho Quad Program formatting
- **Customer: The USDA**
 - Natural Resources Conservation Service (NRCS)
 - Farm Service Agency (FSA)



Slide 3 of 22

Islands of Hawaii



Island Information

| | Length (mi) | Width (mi) | Square Miles | Highest Pt (ft) | DOQQs |
|------------------|----------------|---------------|-----------------|--------------------|-------|
| HAWAII | 93 | 76 | 4,038 | 13,796 | 272 |
| KAHOOLAWE | 11 | 6 | 45 | 1,477 | 7 |
| KAUAI | 33 | 25 | 553 | 5,170 | 43 |
| LANAI | 18 | 13 | 140 | — | 17 |
| MAUI | 48 | 26 | 729 | 10,023 | 60 |
| MOLOKAI | 38 | 10 | 261 | 4,970 | 28 |
| NIIHAU | 18 | 6 | 73 | 1,281 | 12 |
| OAHU | 44 | 30 | 608 | 4,025 | 57 |
| TOTALS | | | 6,447 | | 496 |



Slide 5 of 22

Aerial Platform

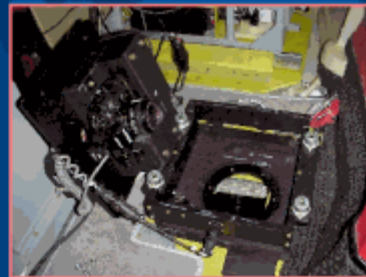


| | |
|---------------------------------|----------------------|
| Piper Aztec | Twin engine |
| Altitude | 25,000 feet |
| Navigation | GPS |
| Position of each frame | Kinematic GPS |
| Orientation angles | IMU |
| Ground velocity miles/hr | 180 mph |



Imaging Camera

| | |
|--------------------------------------|-------------------------------------|
| Solid State CCD, full frame | 3072 x 2048 pixels |
| Frame camera | Kodak DCS 460 / 560 |
| Format size | 27.65 mm x 18.43 mm |
| Pixels per frame | 6 M |
| Spectral sensitivity | 400 to 800 nm |
| Dynamic range collected | 4096 Counts per pixel |
| Pixel size | (9 x 9) microns |
| Pixel spacing | 9 microns center to center |
| Color | Red, green, blue |
| CIR | Red, green, IR |
| Lenses | Nikon |
| Focal lengths | 24, 28, 50 & 105 mm |
| Filters | Minus blue and IR |
| Quantization | 12 bit sensing, 8 bit output |
| Color or CIR, band registered | 24 bits / pixel output |
| Cycle time | 8 seconds |
| Shutter speed | 1/500 to 1/8000 |



Slide 7 of 22

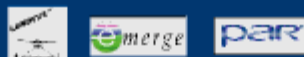
Output and Principal Products

Output

| | |
|------------------------------|------------------------|
| Onboard Storage | Hard disk drives |
| Ground sample distance (GSD) | 1, 2, 3 to 3.3 ft |
| Distribution media | CD-ROM ISO 9660 |
| Format of image data | TIFF or GeoTIFF |
| Datum | NAD 83 |
| Coordinate system | UTM |
| Pixel placement accuracy | Meets NMAS at 1/10,000 |

Principal Products

| | |
|-------------------------------|---------------------------------|
| Original imagery | CD-ROM 650 MB |
| Single frame or mosaics on CD | Ortho-rectified, geo-positioned |
| Hard copy prints | 250 ppi, RGB color or CIR |
| Transparency on stable media | 250 ppi, RGB color or CIR |
| Scale hardcopy | 1:24,000 or custom scale |



Sensor Mounting



Camera-IMU mount



Fairing

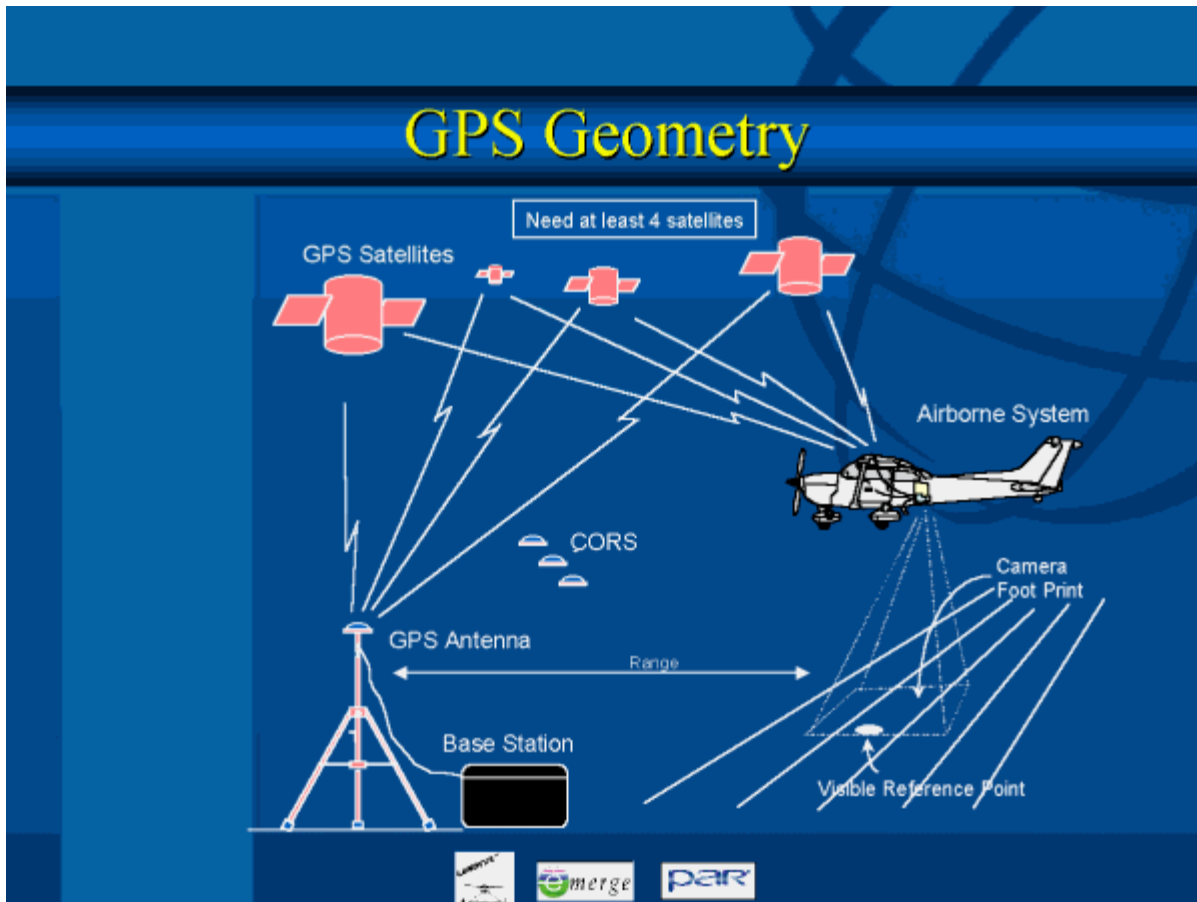


Camera door & switch



Camera-IMU assembly, removed from mount





Product Accuracy

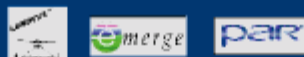
- Emerge has validated sensor performance over calibrated test ranges
 - Accuracy meets NMAS 1:10,000
 - No aerial triangulation or ground surveyed control required
- Lenses calibrated at USGS calibration facility



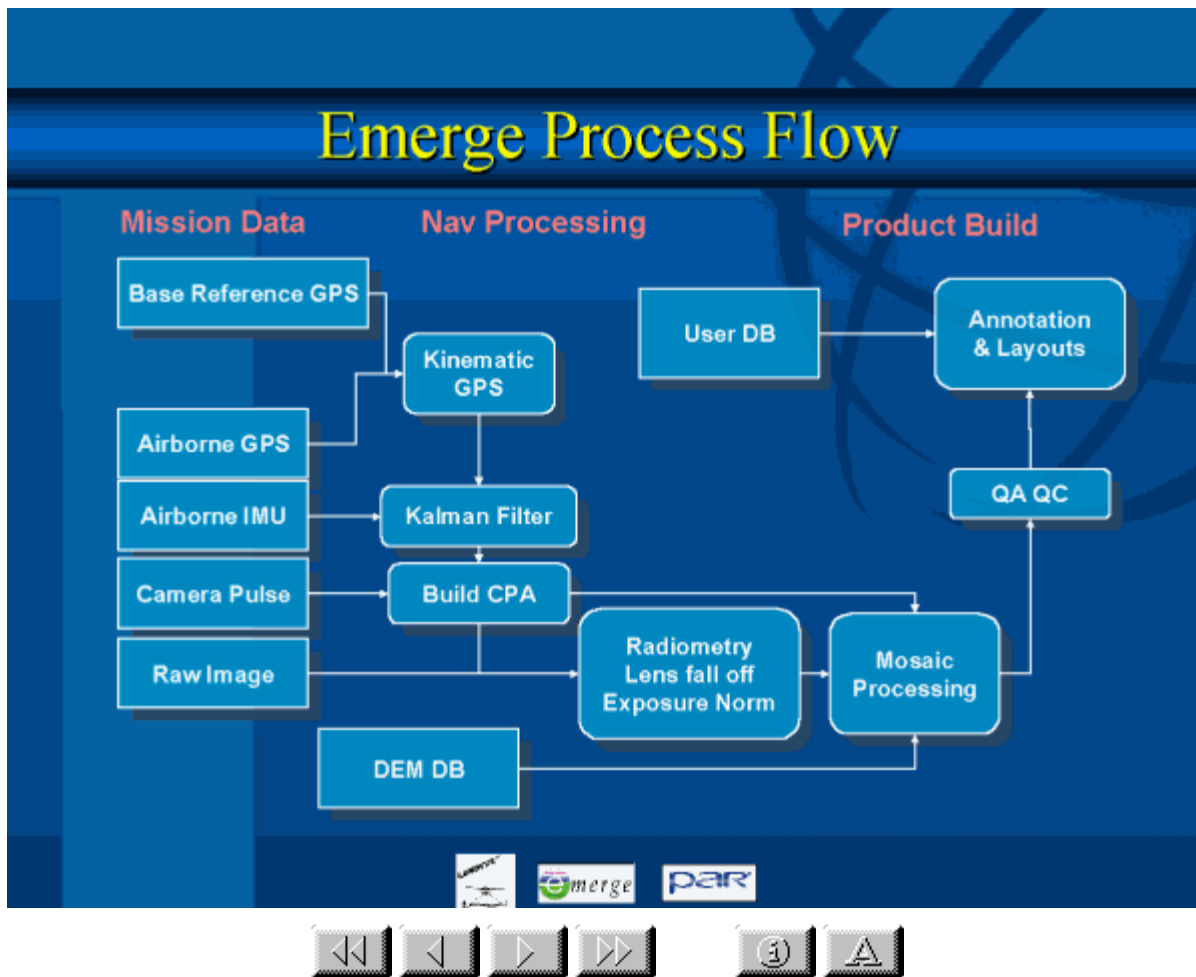
Slide 11 of 22

Flying Height (H), Focal Length (f) and GSD

| H (ft) | f (mm) | Collection Scale | GSD (ft) | Ground L (ft) | Ground W (ft) | Output Scale |
|--------|--------|------------------|----------|---------------|---------------|--------------|
| 3,110 | 28 | 1:33,850 | 1 | 3,072 | 2,048 | 1:3,000 |
| 6,220 | 28 | 1:67,710 | 2 | 6,144 | 4,096 | 1:6,000 |
| 9,330 | 28 | 1:101,560 | 3 | 9,216 | 6,144 | 1:9,000 |



Slide 12 of 22



Pearl Harbor, HI

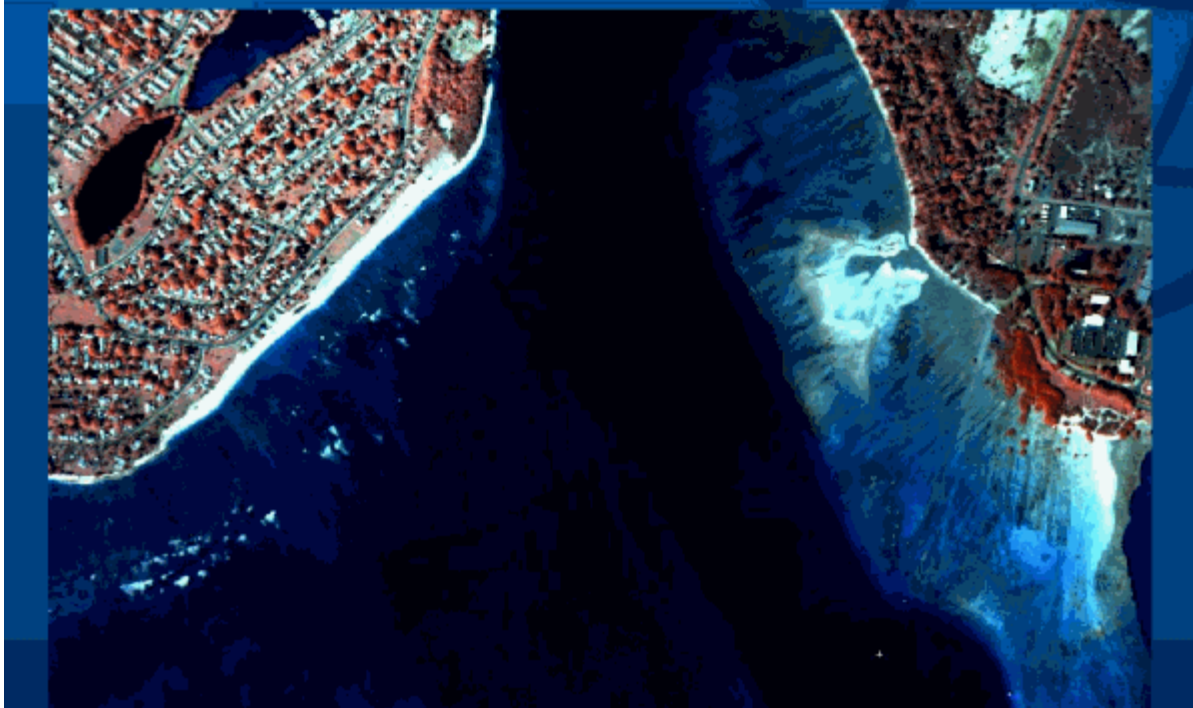


Slide 14 of 22

Notes:

Fords Island in Pearl Harbor, Ohao. The locations of the battleships on 7 December 1941 are shown. From the lower left corner heading northeast is the submerged California, Offer Neosho, Oklahoma, Maryland, West Virginia, Tennessee, Arizona, and Nevada. Image acquired 30 January 2000.

Reef at Port Entrance



Slide 15 of 22

Notes:

Entrance to Pearl Harbor where reef features are visible. Image acquired 30 January 2000.

EWA Beach, Oahu

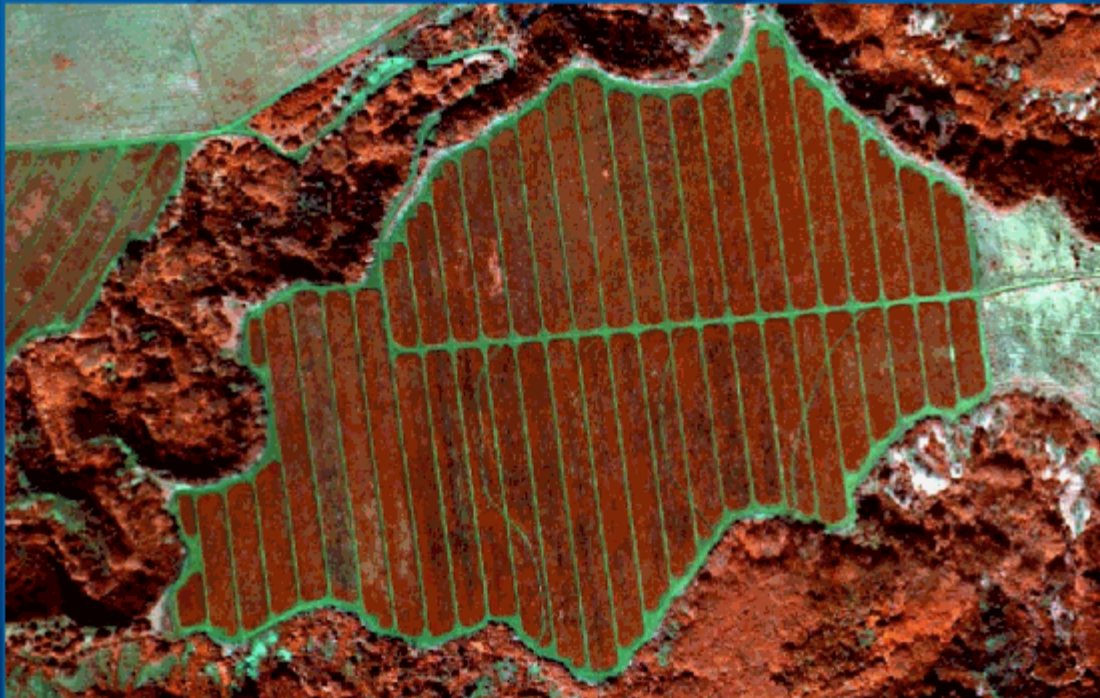


Slide 16 of 22

Notes:

Ewa Beach on Oahu, just outside of Pearl Harbor and west of Waikiki Beach. This site is much less commercialized than Waikiki.

Pineapple Crops

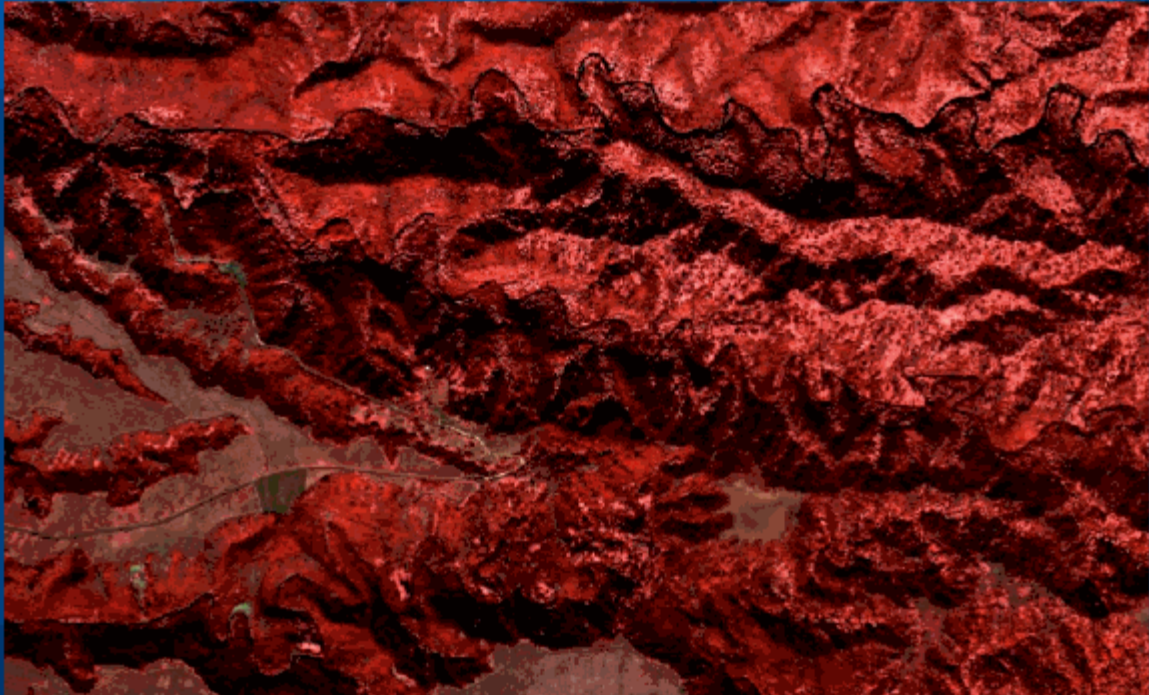


Slide 17 of 22

Notes:

Pineapple fields outside of Wahiawa and 12 miles north of Pearl Harbor. Imagery acquired 31 January 2000.

Tropical Rain Forest on Oahu

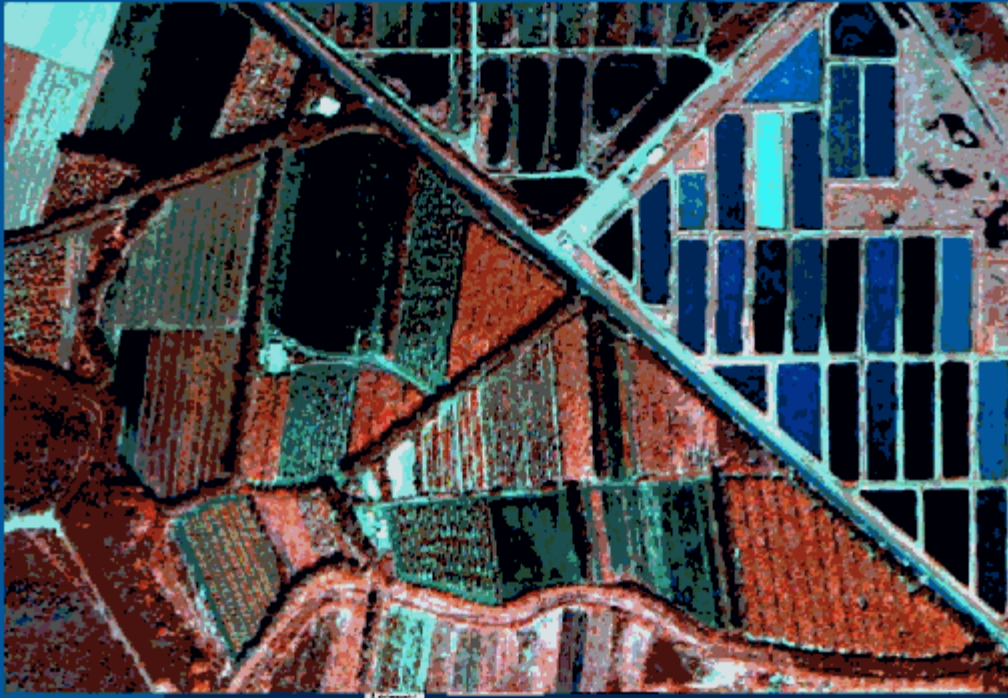


Slide 18 of 22

Notes:

Tropical rain forest 5 miles north of Wahiaw on Oahu. Green sideways V is a road just north of Opaepa Stream. Center of image 21° 24' 08" N and 158° 00' 23" W. Imagery acquired 31 January 2000.

Poi on Oahu



Slide 19 of 22

Notes:

Close to the north shore of Oahu just northwest of Kahuki. Poi is grown in water and thus the bluest hue to the vegetation. Route 83 or Kamehameha Highway cuts through the image. Center of image is $21^{\circ} 41' 0.3''$ N and $157^{\circ} 57' 34''$ W. Imagery acquired 31 January 2000.”

Turtle Bay, Oahu

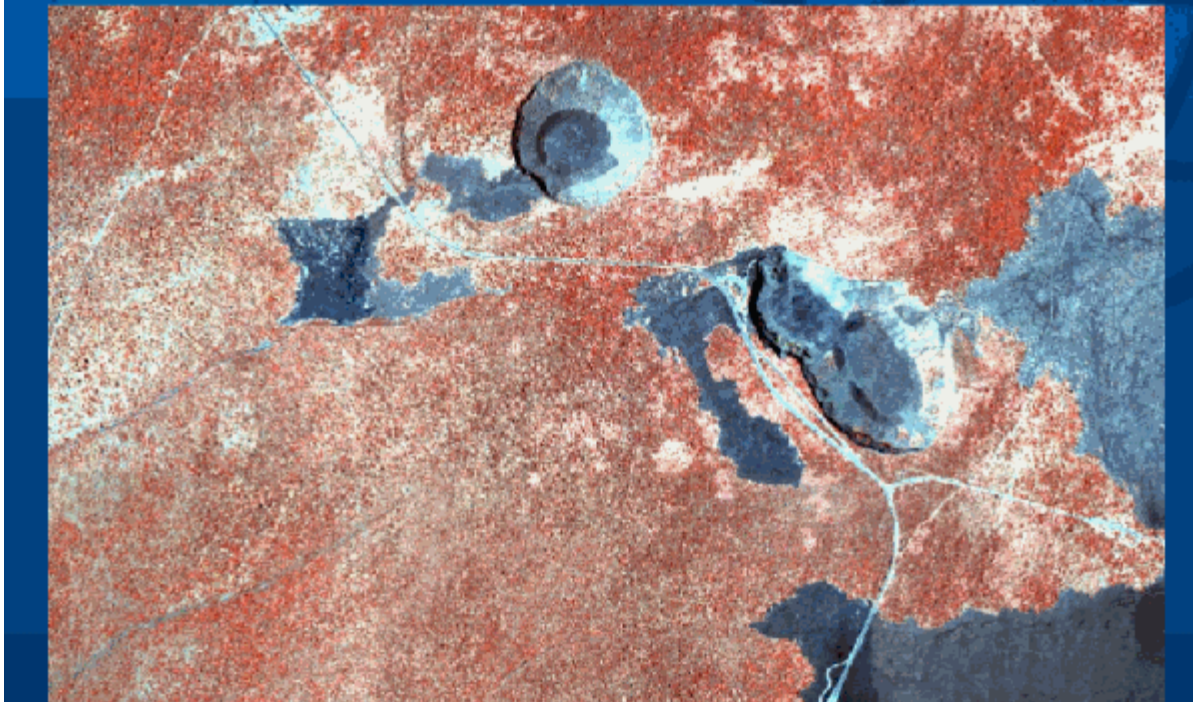


Slide 20 of 22

Notes:

Turtle Bay on the north end of Oahu. A large windmill is out on the point. A poi patch is in the lower right hand corner. Imagery acquired 30 January 2000.

Hiiaka and Pauhi Craters, Hawaii



Slide 21 of 22

Notes:

The Hiiaka and Pauhi Craters are on the big island of Hawaii. Elevation here is about 3400 feet. Center of image approximately 19° 12' 10"N and 155° 13' 00"W. Imagery acquired 8 May 2000.

Sugar Cane Crops, Maui



Slide 22 of 22

Notes:

Sugar cane crop on Maui just east of the Alexander & Baldwin Sugar Museum outside of Kahului at the junction of Haleakala Highway and Keahula Rd. Image acquisition date 12 April 2000.