PRODUCTS AND SOLUTIONS FOR MOBILE MAPPING AND POSITIONING
CAPTURE EVERYTHING

DSS 439
RapidOrtho™ DualCam System

USDA Imagery Planning Meeting
Salt Lake City, Utah
December 4, 2008

Kevin D. Perkins, OLS, OLIP
Executive Account Manager

The Applanix Corporation – Who are we??

- **Pioneered the commercial use of GPS-Aided Inertial Navigation for Direct Georeferencing of airborne sensor data in 1995**
- **Almost 20 years R&D into Direct Georeferencing applications**
- **100+ person company with a proven track record**
  - Over 500 airborne systems delivered around the world
- **Worldwide support network with offices in Toronto, Houston, UK, Germany, Japan**
- **Owned and backed by Trimble Navigation**

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Digital Capture vs (in addition to?) Film?

The migration of capturing aerial survey data with digital sensors continues but with what benefit?:

- cost savings over film materials, scanning facilities / staff
- higher radiometric quality, dynamic range
- easier storage, archiving, dissemination of data

Medium vs (in addition to?) Large Format?

- **CIR mapping is very efficient: flying in a small, inexpensive aircraft at a reasonable height**
  - Assuming requirements of 1-foot GSD, the DSS 439 with 40mm lens can fly at 6000 feet
- **Extremely cost-effective solution for small areas, corridors**
- **Flexibility and Completely application driven!**

Why use the DSS Digital Sensor System?

- **Ideal for high-accuracy mapping of small, linear, and irregular areas**
- **Direct georeferencing**
  - computes position of points on ground to corresponding points in the mapping frame without GCP – no AT required
- **Mapping grade camera**
  - calibrated, stable over time,

Why use the DSS Digital Sensor System?

- **Flexibility of variable focal lengths: 40mm, 60mm, 250mm**
- **Modular system**
  - can be flown with dual cameras for greater productivity, simultaneous CIR/NIR, LiDAR integration,
  - DTM generation, and more
- **Radiometric accuracy**

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DSS System Design

DSS™

Complete Airborne Solution.
Ready-to-Use.

POS AV™
Direct Georeferencing

POS Track™
Flight Management System

DSS™
39 MP Medium-Format, (60mm, 40mm, 250mm) lenses, Airborne Camera Sensor (VIS/CIR) and Azimuth Mount

DSS™
Integrated Electronics Unit, Environmentally Controlled, 500 GB Drives

POS Pac™ MMS
Mobile Mapping Suite for Post-Processing

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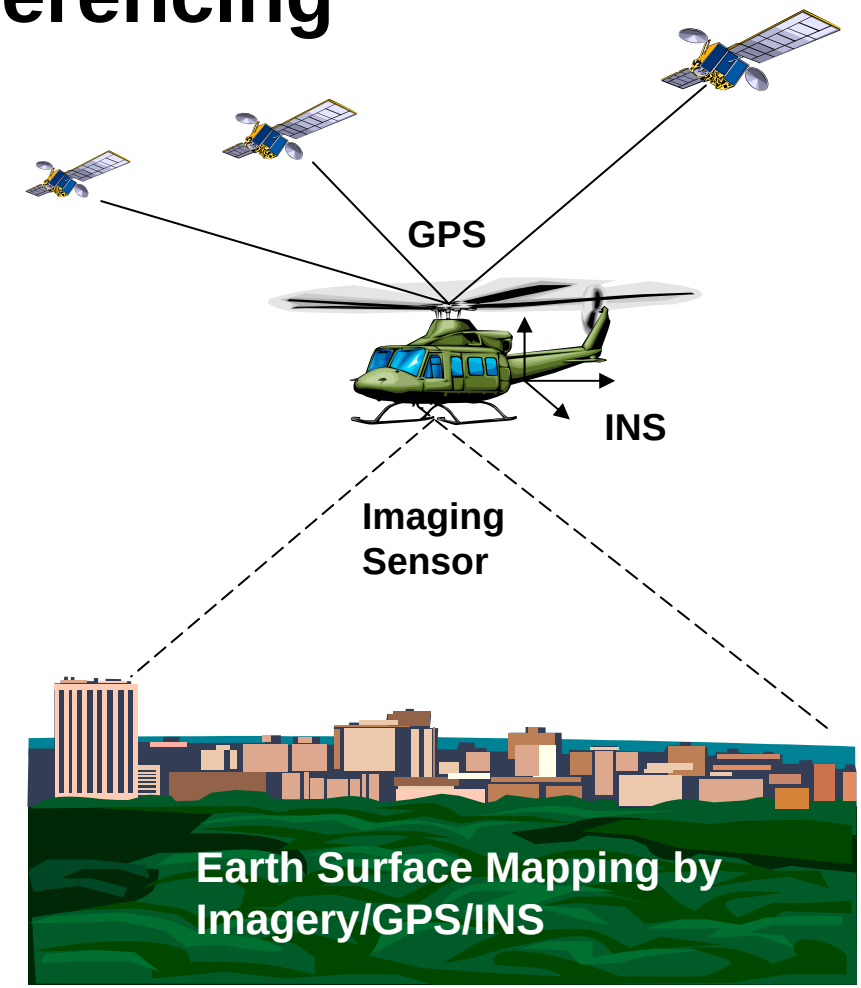
Direct Georeferencing

- Measures translation and rotation using Navigation Sensors
- Measures range and bearing to points on the ground using the Imaging Sensor
- Computes position of points on ground to corresponding points in the mapping frame without GCP

Can be used with any type of Imaging Sensor (active or passive)



Ideal for medium-format digital camera where traditional AT would be extremely difficult & costly due to large number of images & GCP required

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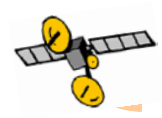
Embedded GNSS-Aided INS



POS AV and POSPac MMS

- Produces highly accurate position and orientation from the GNSS and Inertial data
- Import, manage and assess the data from POS AV system and GNSS reference stations

POS AV and POSPac has also been integrated with film cameras, providing Direct Georeferencing capability to augment and enhance *film to digital* workflows!

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Mapping Grade Camera System

DSS is a calibrated metric imager employing the advantages of Direct Georeferencing:

System is calibrated and remains stable over time

- **Radiometry**
- **Boresight**
- **Principle Point**
- **Lens Distortion**
- **Focal Length**

+ Shock, Vibe and Pressure Tested = *Mapping Grade Camera!!*

VS.

Self-calibration method using AT to determine interior orientation using tie-points and ground control points

No radiometric calibration resulting in image artifacts in mosaics

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Applanix AeroLens™

Custom-Manufactured for Applanix

- Two high performance lenses with fixed focus, fixed aperture and ruggedized barrel, purpose-built for the airborne environment.
  - 60 mm
  - 40 mm
  - 250 mm (though likely not suitable for USDA programs
- Customized lens mount with an *easy-switch* capability for stable and repeatable calibration during lens-change operations

.....AND one more reason to consider DSS

USGS-Certified. Mapping-Grade. Airborne Digital Mapping System.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
National Center for Earth Resources Observation and Science
Sioux Falls, South Dakota 57198

September 4, 2007

Subject: Successful Completion of the USGS Manufacturer Certification Process for Applanix Digital Sensor System (DSS) 422 and DSS 439

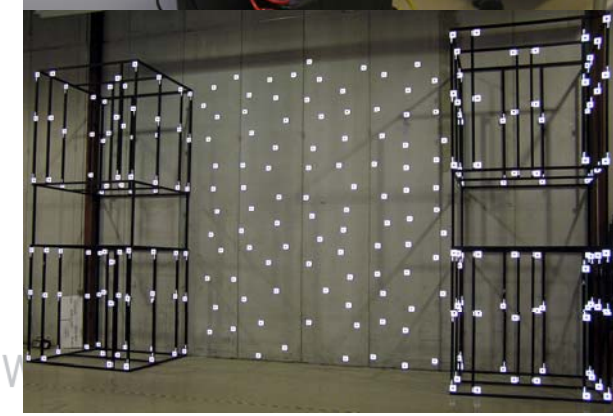
The United States Geological Survey (USGS) certifies that the Digital Sensor System (DSS) 422 and 439 manufactured by the Applanix Corporation, of Richmond Hills, Ontario, Canada meets the claims of the manufacturer and is capable of providing quality, consistent image data to support civil government mapping and ortho-photography product development.

The USGS provides this certificate to Applanix Corporation for successful completion of the USGS Manufacturer Certification process which included presenting and providing all appropriate information to address the certification requirements as defined in the USGS Plan for Quality Assurance of Digital Aerial Imagery and the USGS Manufacturer's Certification Checklist.

This certification is valid for Applanix DSS 422 and DSS 439 sensor types evaluated by the USGS. Any design changes that change the effective output of the system will require additional evaluation and re-certification if necessary. This certification joins the certification previously provided to Applanix for their DSS 322 sensor type.

To discuss manufacturer certification, please contact the manufacturer, or the USGS certification team via the following web mail link - http://calval.cr.usgs.gov/.

Gregory L. Stensaas
USGS Manufacturer Certification Team Lead
Remote Sensing Technologies Project Manager
Geography Discipline



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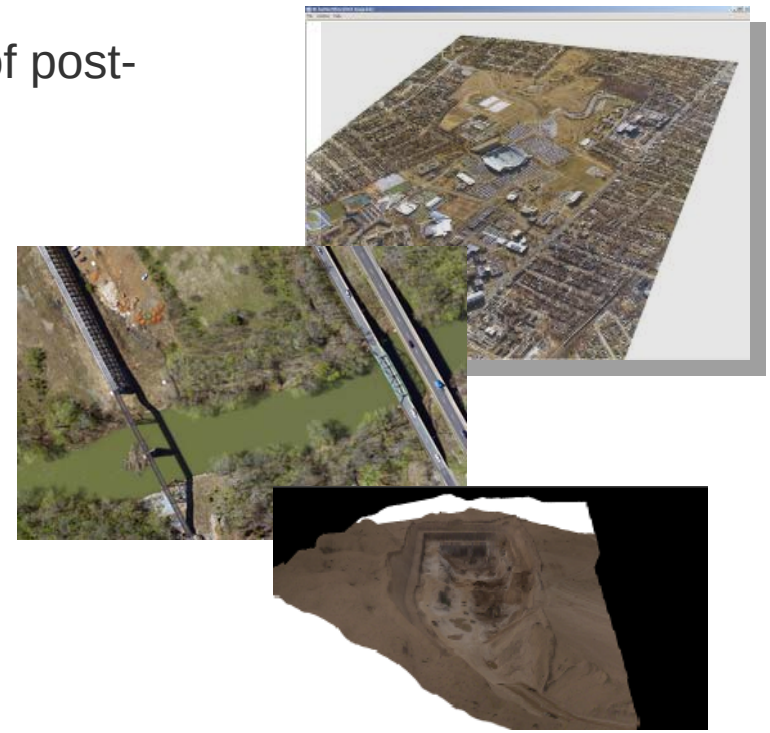
DSS for USDA Programs

How the Applanix DSS can be utilized in USDA programs?

- **For national imagery programs (such as NAIP)**
  - DSS can supplement large-format work, capturing smaller areas that would be expensive to capture with large-format sensor
- **For small area sites (such as the annual 70,000 National Inventory Program sites, typically 160 acres)**
  - DSS is *ideal* for the National Inventory program
  - Efficient system specifically designed for small, linear and irregular sites
- **For acquiring traditional resource imagery (over 18,000 sq miles of 1-ft imagery acquired in 2008)**
  - DSS is a proven system for capturing high-resolution, true-color imagery for remote sensing applications

New technologies and Developments

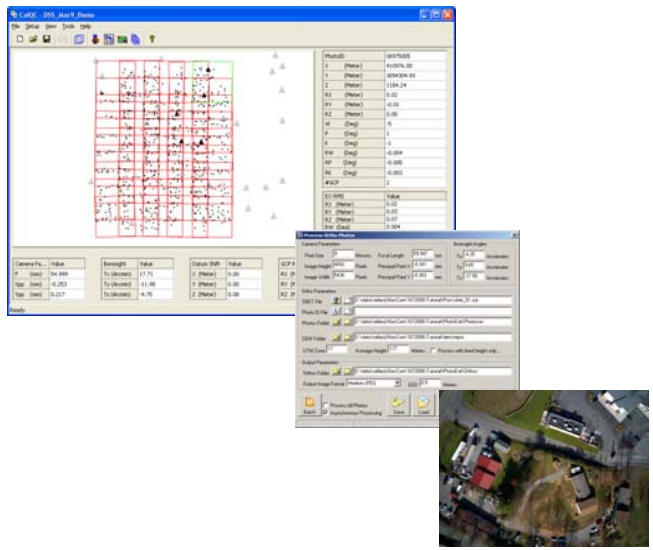
- **DSS RapidOrtho™ solution**
  - complete workflow for rapid delivery of post-mission orthos



RapidOrtho™ System!!

Fully integrated airborne solution generating mapping grade orthophoto products for rapid response and mapping applications:

- Integrated POS AV Direct Georeferencing System
- POSTrack Flight Management System (FMS)
- Ruggedized data logger and pressurized drive
- Complete post-mission processing software to generate directly georeferenced orthophoto map products immediately upon landing



Mapping-grade orthos within hours, not days!

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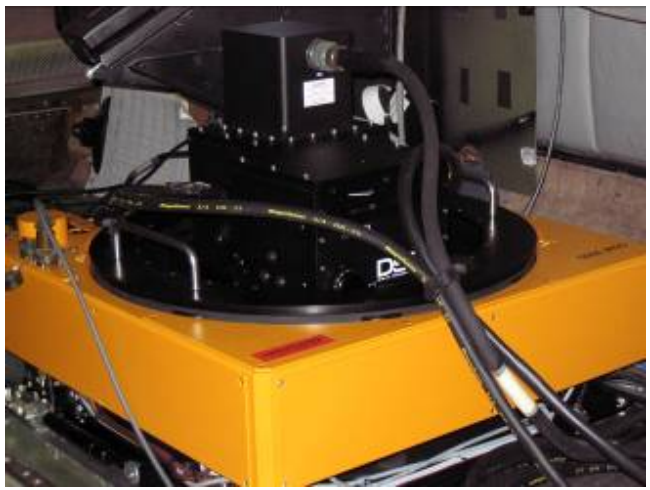
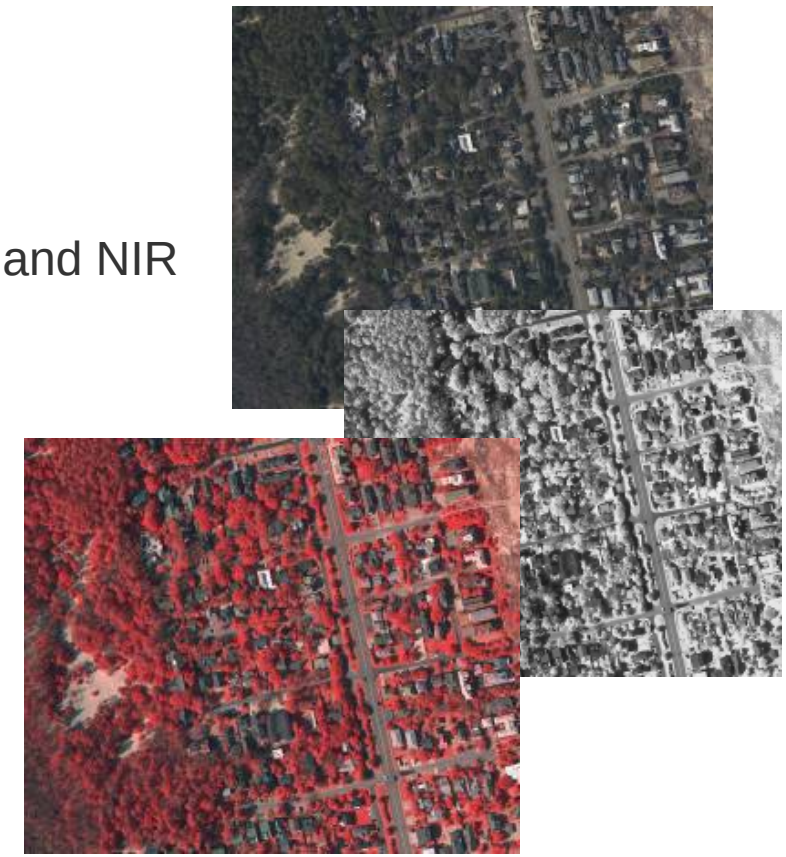
DSS DualCam!!

DSS DualCam configuration

- two cameras for high productivity
- two cameras for simultaneous CIR and NIR



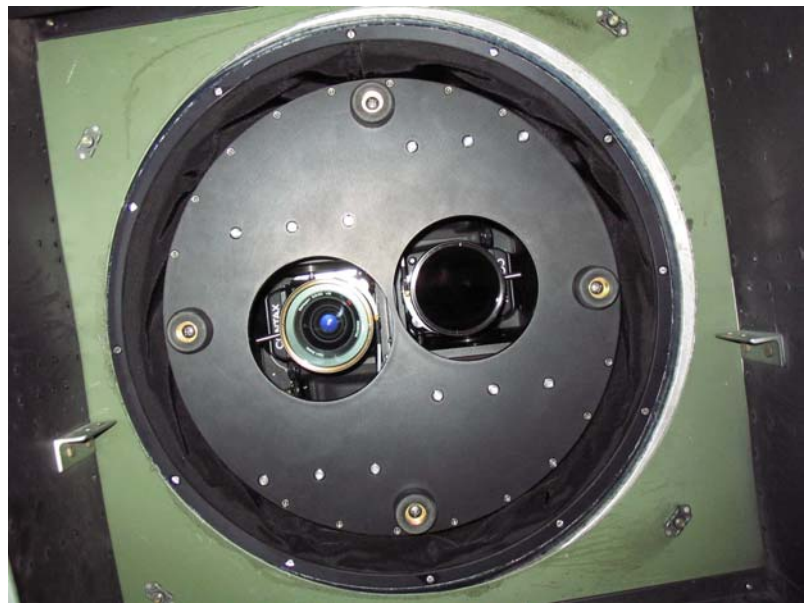


DSS DualCam!!

- **Standard DSS 439 RapidOrtho system expanded to add 2nd nadir camera configured for NIR**
- **Allows simultaneous collection of RGB and NIR imagery for mapping and remote sensing applications**

DSS DualCam!!

- **Allows high-productivity in a single flight**
- **All hardware modules, camera heads, and workflow software of DualCam compatible with standard DSS 439**
- **Provides 100% interchangeability of modules for support and flexible re-configuration**



Complete Digital Workflow!!

POSPac™ MMS

Mission Planning → Flight Operation Mission Execution → GNSS/INS Processing → Ortho Photo & DEM Extraction → Server Provisioning

POSTrack™

POSAV™

Direct Georeferencing

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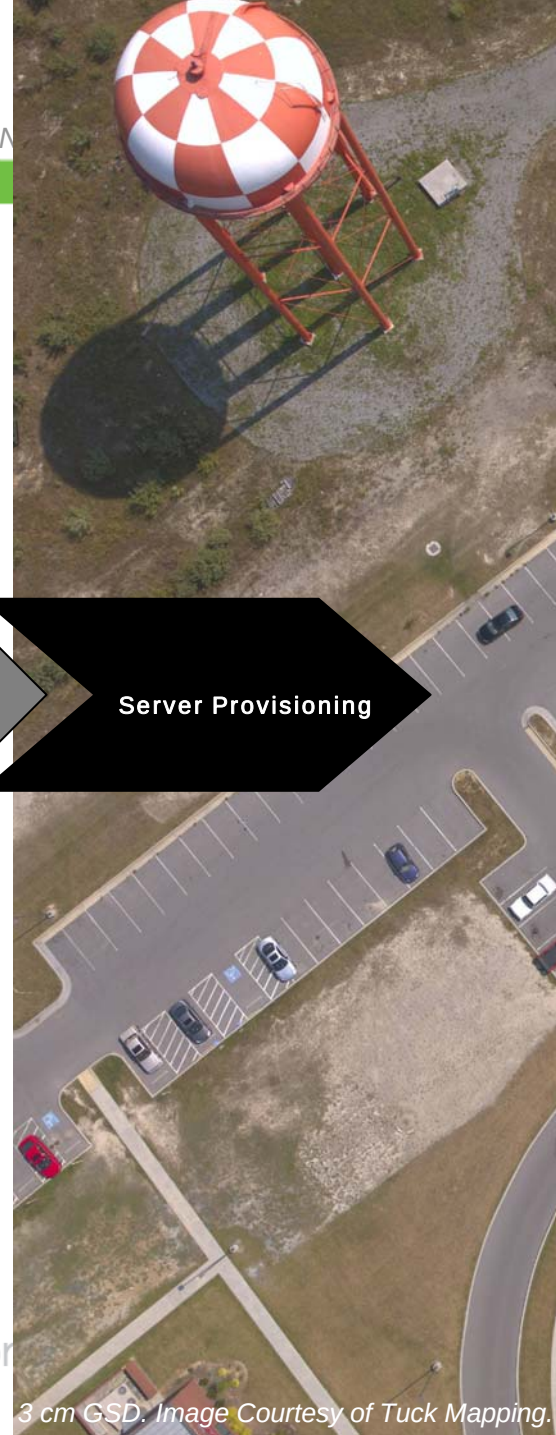

3 cm GSD. Image Courtesy of Tuck Mapping.

Complete Workflow = Complete Solution!!!.

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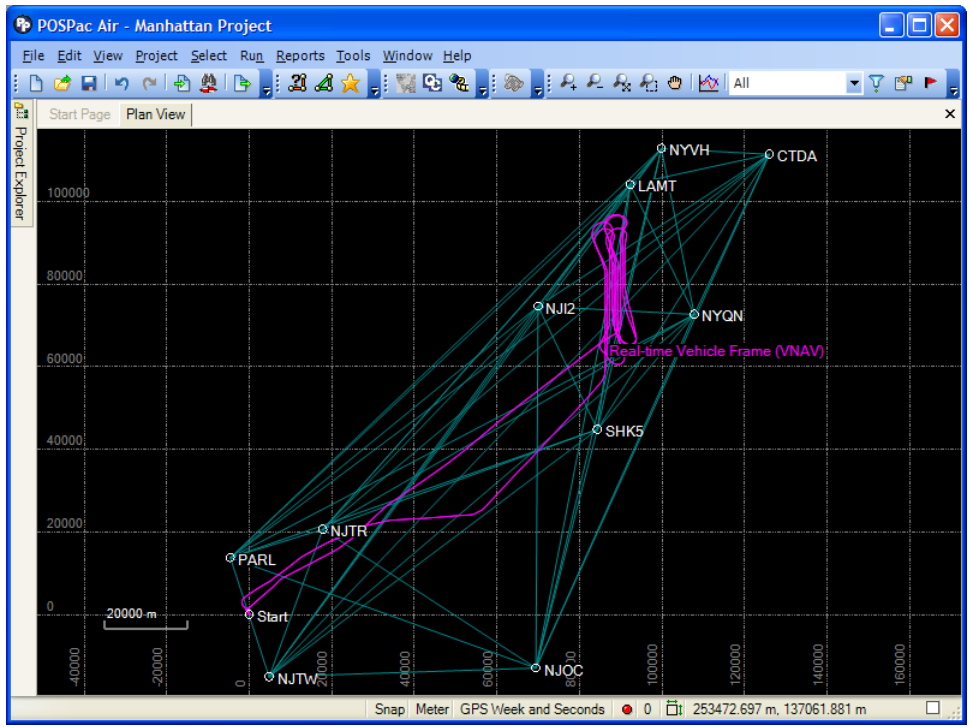
v=d/t. Because the Wor

Applanix SmartBase & IN-Fusion!!

- Fly ***high banked turns*** up to 70 km from nearest station in a SmartBase network & maintain centimeter level accuracy during flight lines
- Ensures efficient flights, reducing in-air time and associated costs
- Reduce expenditures associated with setting up dedicated base stations
- ***DSS POSPac automatically downloads the CORS reference station data!***

"Fly sharp turns over long baselines"



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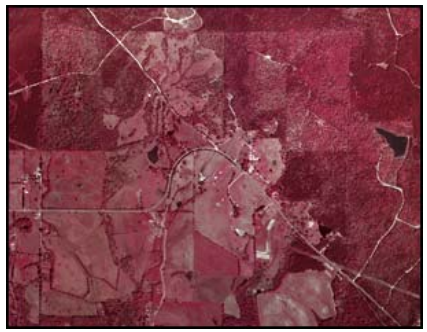
TruSpectrum™ technology!!

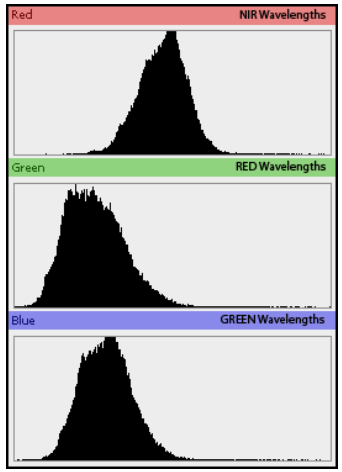
- High radiometric accuracy
- For both true color and false color applications

TruSpectrum™ Technology!!

Providing unparalleled Radiometric Accuracy for:

- Standard mapping applications requiring true color representation
- NIR/CIR (near infrared/color infrared) remote sensing applications utilizing false-color imagery





Feature	Function	Benefit
TruSpectrum Image Chain Analysis	Individual components of the imaging process are modeled in order to understand how changes in the chain may affect image quality	Seamless Mosaics for better product delivery in remote sensing and digital mapping applications

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Applications

DSS Applications

- Agriculture
- Change Detection
- Coastal Zone Monitoring
- Corridor Surveys
- DEM Extraction
- Forestry
- Photogrammetric Mapping
- Rapid Response
- Remote Sensing / GIS Imaging
- Urban Planning

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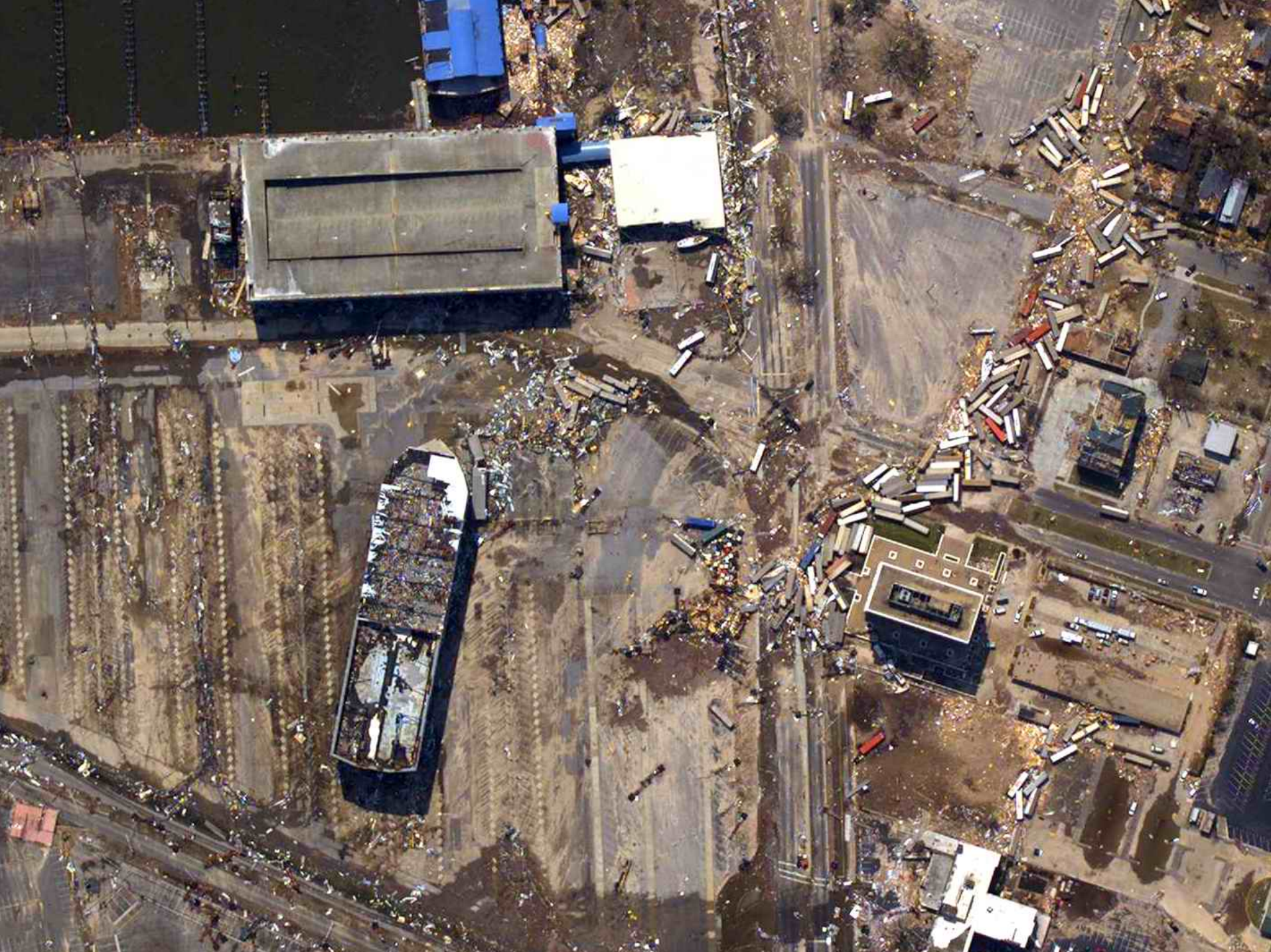


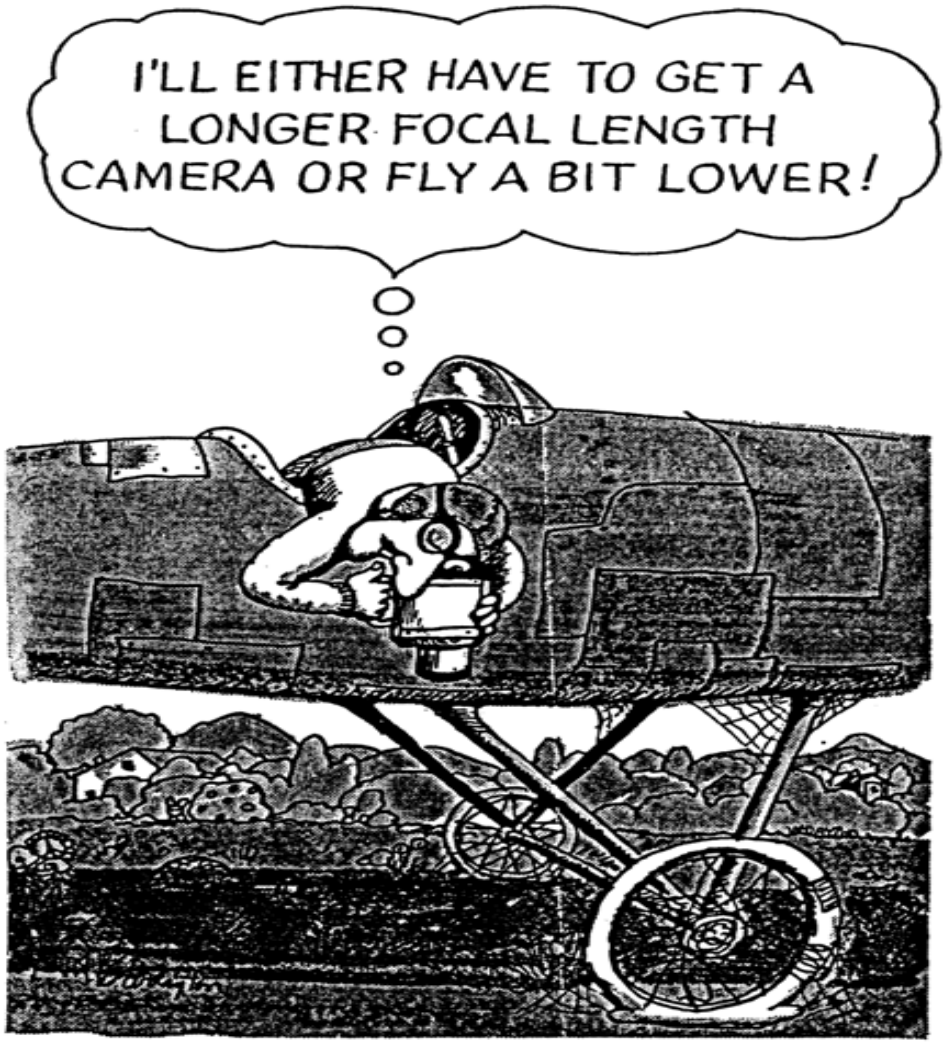

Orthophoto taken at 10,000 ft AGL

Some US and Cdn Gov't Agencies using medium format DSS and DualCam

- Cdn Department of National Defense
- Naval Research Laboratory
- National Oceanaic and Atmospheric Admin.
- Federal Bureau of Investigation
- Royal Canadian Mounted Police

Sooo….after all you'll have seen and heard today…all the presentations…the discussions of using digital sensors for various USDA programs….

you're still likely going to be left with only ONE "REAL" choice to make……



(Courtesy Rapid Color, Inc.)

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Thank you for your attention!