

# **Applanix RapidOrtho™**

## **Airborne Ortho-Mapping for Rapid Response**



**JACIE Conference 2007**  
**Fairfax, VA**

**Presented by: Eric Liberty**  
**DSS Product Manager**

**APPLANIX**  
A TRIMBLE COMPANY

# Introduction of Topics

- **Digital Imagery Collection- Current Situation & Trends**
- **Evaluation of Enabling and Available Technologies**
- **Rapid Response Market and Segmentation**
- **RapidOrtho Solution and End-Products**

# Current Industry Situation and Assumptions

- **Timeline for organizations moving from conventional film based products to digital environments is being compressed**
- **There is a mix of available digital technologies and platforms (i.e. Large Format, Medium Format) that cater to different markets**
- **In the last decade, temporal requirements have become a user priority in order to get final products processed as quickly as possible, while remaining sensitive to image quality expectations (market segmentation)**

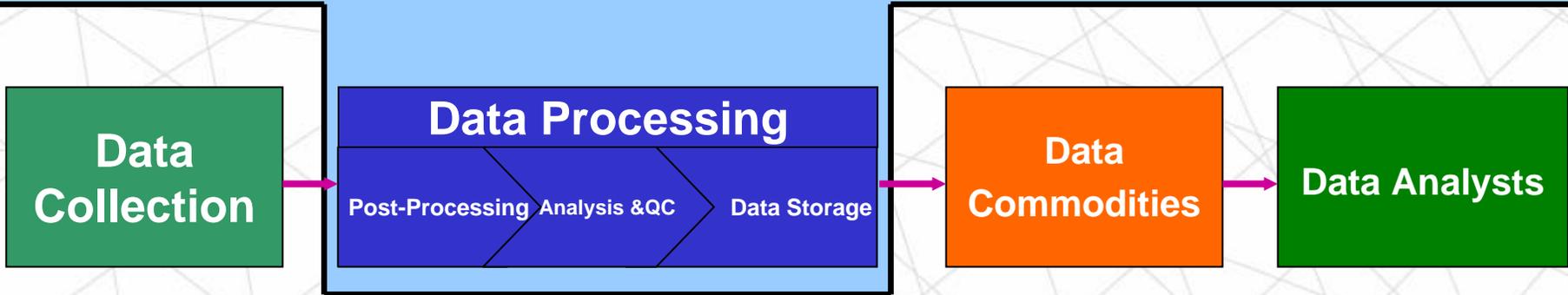
# The Aerial Mapping / Remote Sensing Business System

Government

Commercial

Photo and Remote Sensing

GIS



# Active Markets for Imagery Acquisition & Data Analysis

1. Mapping- ie County Gov'ts
2. Change Detection
3. Infrastructure- Corridor, Utility & DOT
4. Telecommunications
5. Environmental & Agriculture
6. Forestry
7. Disaster Management
8. Insurance
9. Military
10. Securities & Law Enforcement

# The Challenge Ahead.....

Data acquisition firms are challenged to educate themselves on what systems can do and ultimately to choose the “right tool for the job”

**Land**



**Satellite**



**Airborne**



# Choices in aerial platforms are changing with industry demands and deliverables...



Frame film Camera



Large Aerial frame (digital)



Aerial linear array, digital pushbroom



Medium Format Frame (digital)



LIDAR scanning range and intensity imager



Hyperspectral and Thermal Imagers

# Most organizations welcome the opportunity to simplify workflow



# **Applanix has introduced DSS RapidOrtho™ System for Airborne Rapid Response Geospatial Imaging**

**The DSS RapidOrtho system showcases a RapidOrtho orthorectification product that enables users to design a workflow to match specific data delivery needs**

**The potential of the Applanix Digital Sensor System (DSS) for rapid response service was first put to the test as part of disaster survey/recovery operation in 2004 over the Eastern United States coastline following Hurricane Isabel**

# Digital Sensor System (DSS) 322

The first complete turn-key, all-digital medium-format mapping system with:

Integrated POS AV Direct Georeferencing System

5.5 k x 4k True Color and CIR Digital Imager (22 Mega Pixels) with Yaw stabilized Azimuth mount

Ruggedized data logger and pressurized drive

Built in Flight Management System (FMS)

Imagery and POS AV data post-processing software



# Capabilities

**Metric imager for geometrically accurate, all-digital Orthomosaic production without GCP**

**12 Bit radiometry, True Color and CIR modes for remote sensing**

**Stereo capability for:**

- **DEM extraction to support orthophoto production**
- **Visualization**
- **Feature extraction**



# The Direct Georeferencing Concept

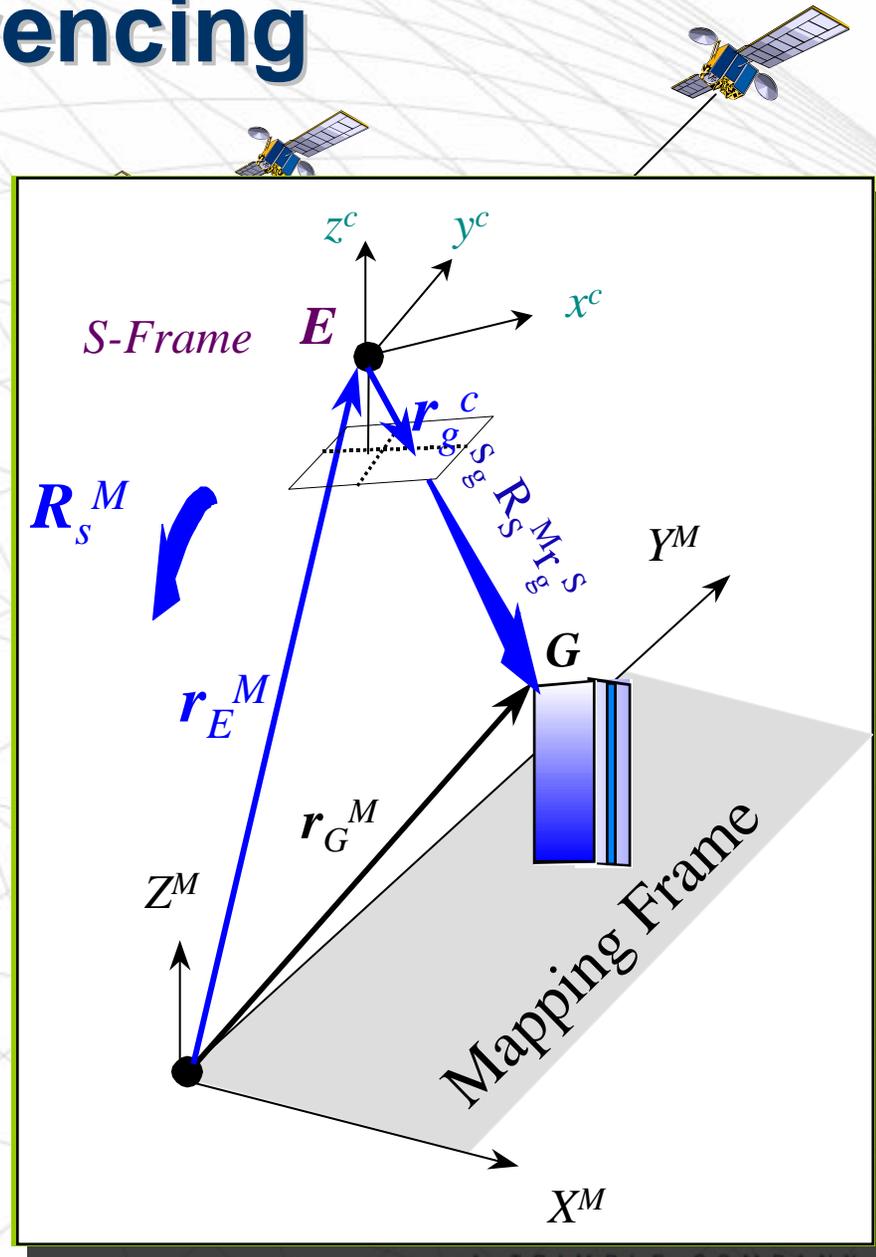
Measures translation and rotation using Navigation Sensors

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 and costly due to large number of images and GCP required*



# DSS gets USGS Certification in 2006



United States Department of the Interior

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

12/15/06

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

The United States Geological Survey (USGS) certifies that the Digital Sensor System (DSS) 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 define in the USGS Quality Assurance of Digital Aerial Imagery plan and the USGS Manufacturer Certification Checklist.

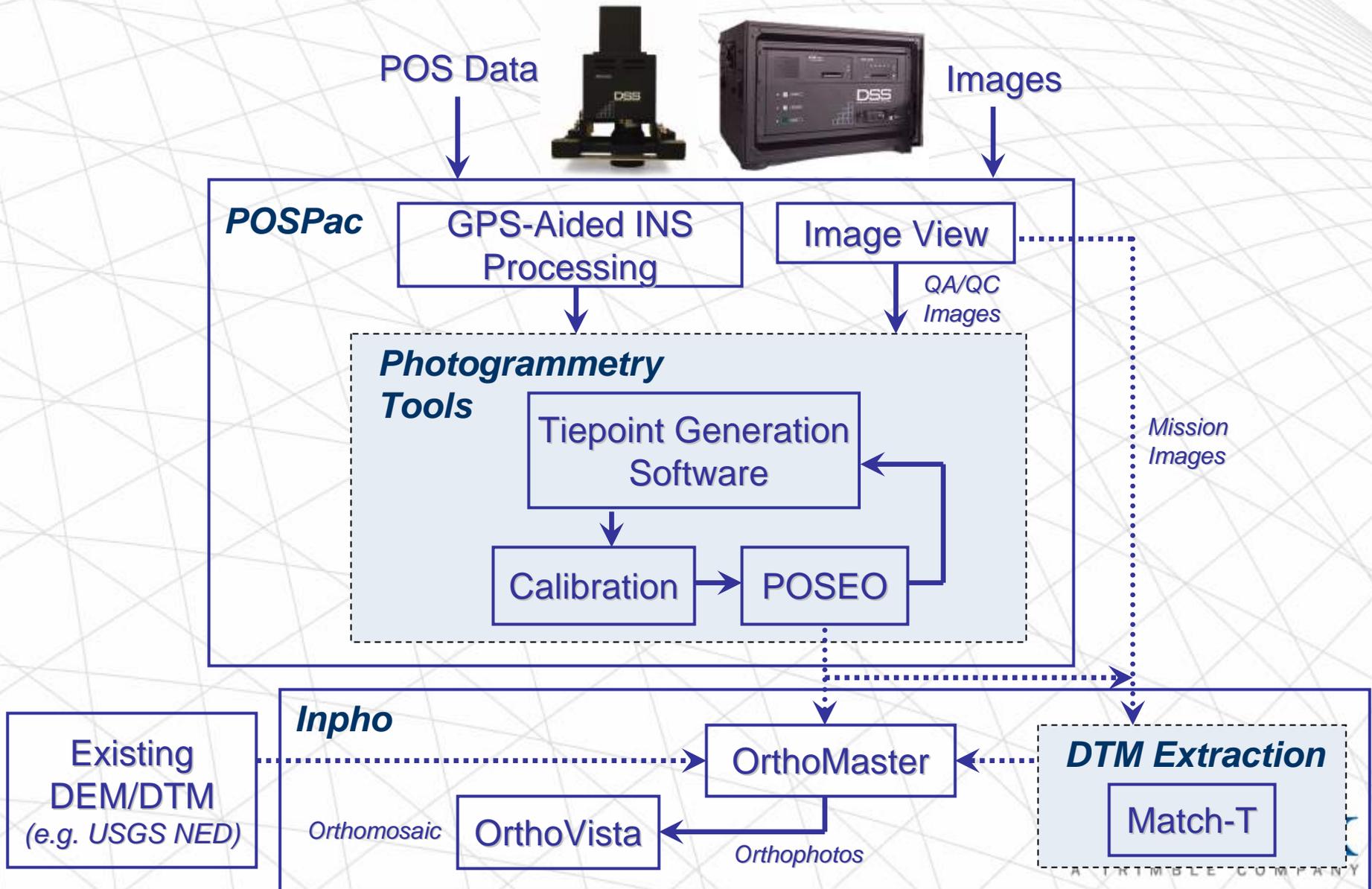
This certification is valid for all Applanix DSS camera systems that match the system type evaluated by the USGS during the 2006 site inspection. Any design changes that change the effective output of the system will require additional evaluation and re-certification if necessary.

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

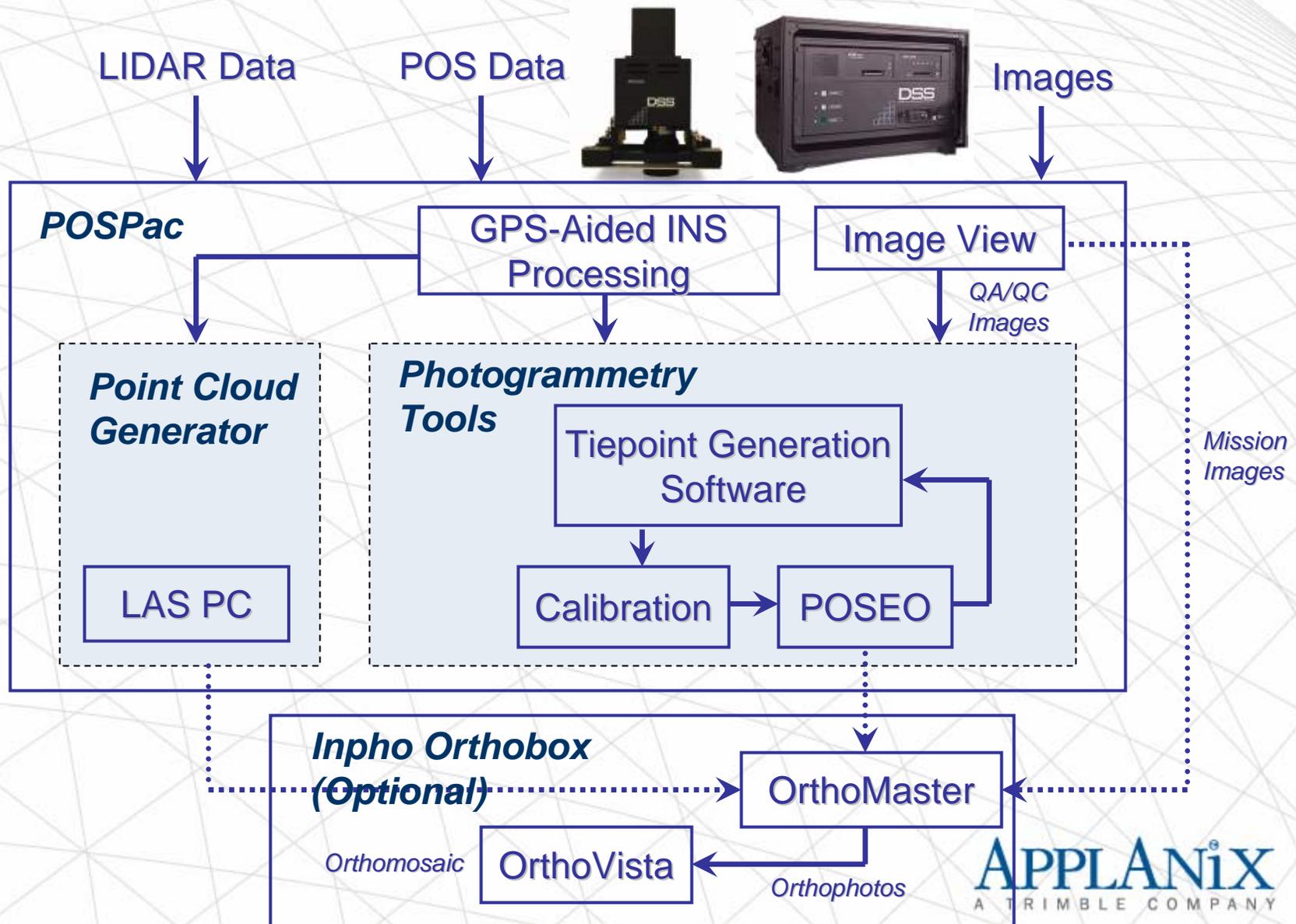
Gregory L. Stensaas  
USGS Manufacturer Certification Team Lead  
Remote Sensing Technologies Project Manager  
Geography Discipline

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# DSS Standalone Workflow



# DSS / LIDAR Workflow



# Aircraft Installations

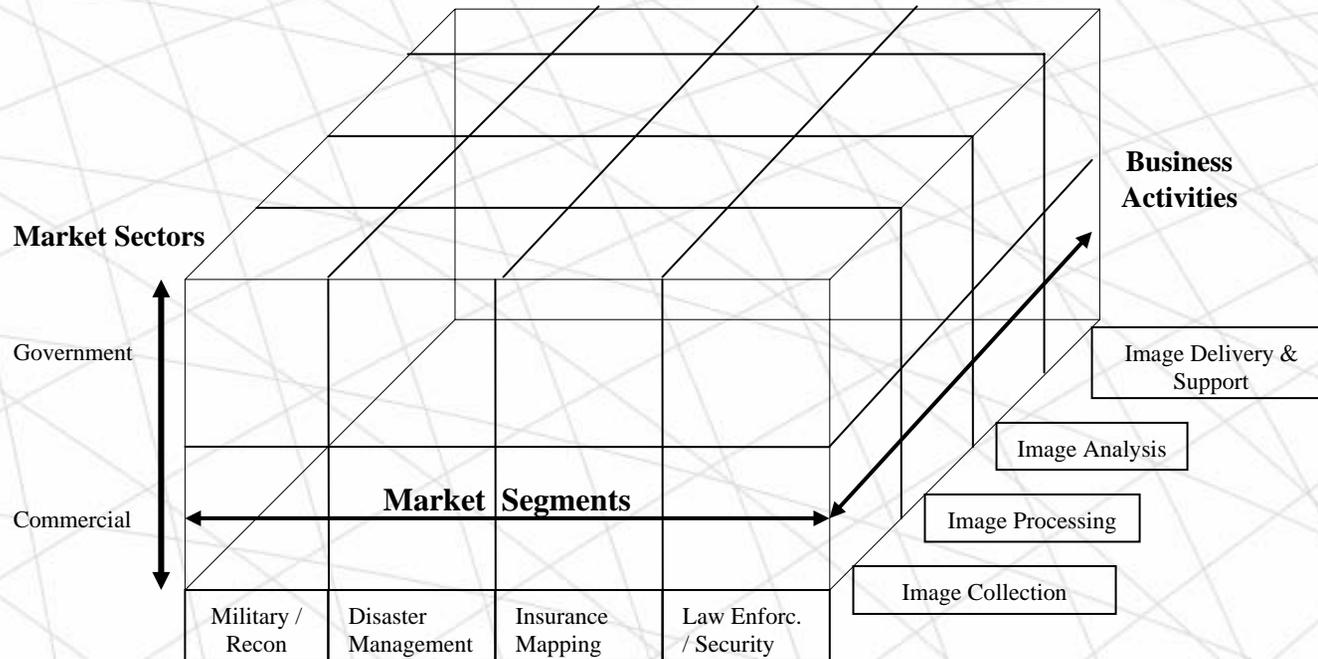


## Flexible Performance

Rapid deployment with installation on single engine aircraft or light helicopter platforms completed within an hour

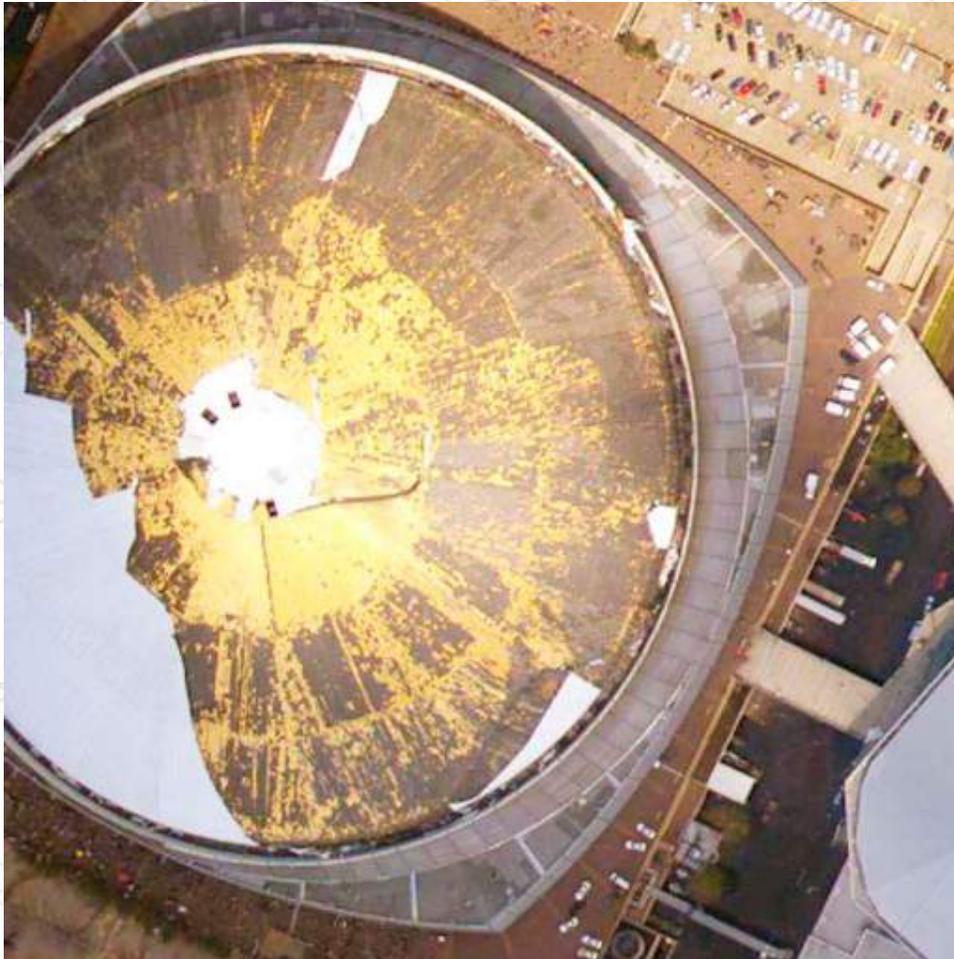
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# DSS RapidOrtho™ Market Segmentation



# Rapid Response: Assessing Results

## NOAA Hurricane Katrina Support Activities Aerial Photography Flights Yield Thousands of Images

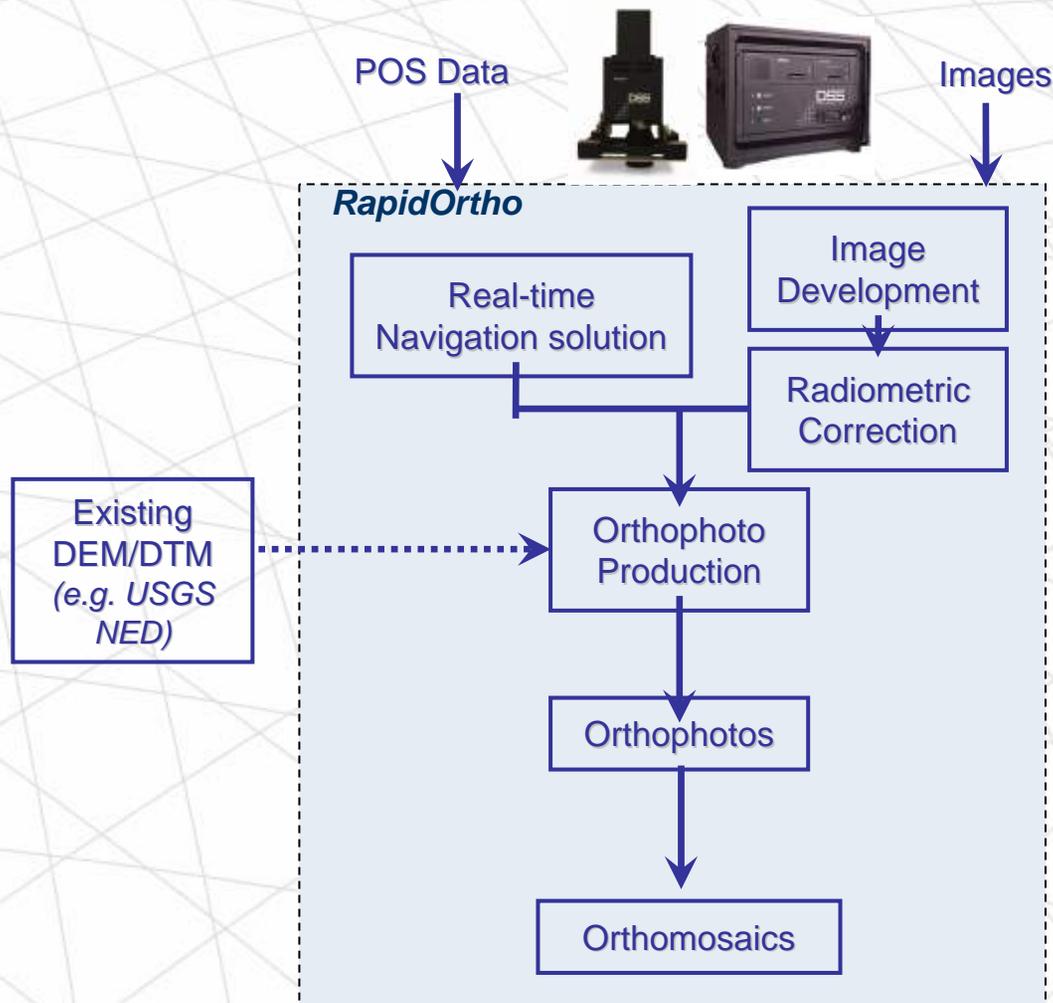


### Data Needed Immediately:

- Navigational Response Teams
- Rescue Operations
- Logistics and Order
- Damage Assessment
- Evacuation
- Progress Monitoring
- Infrastructure Reconstruction

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# RapidOrtho™



# RapidOrtho- Rapid Location

- More focused on small isolated areas for first responders requirement immediate evaluation of imagery
- Locating areas of interest

## Results:

Individual Orthophoto generation within 20 seconds (Dual Processor or better)

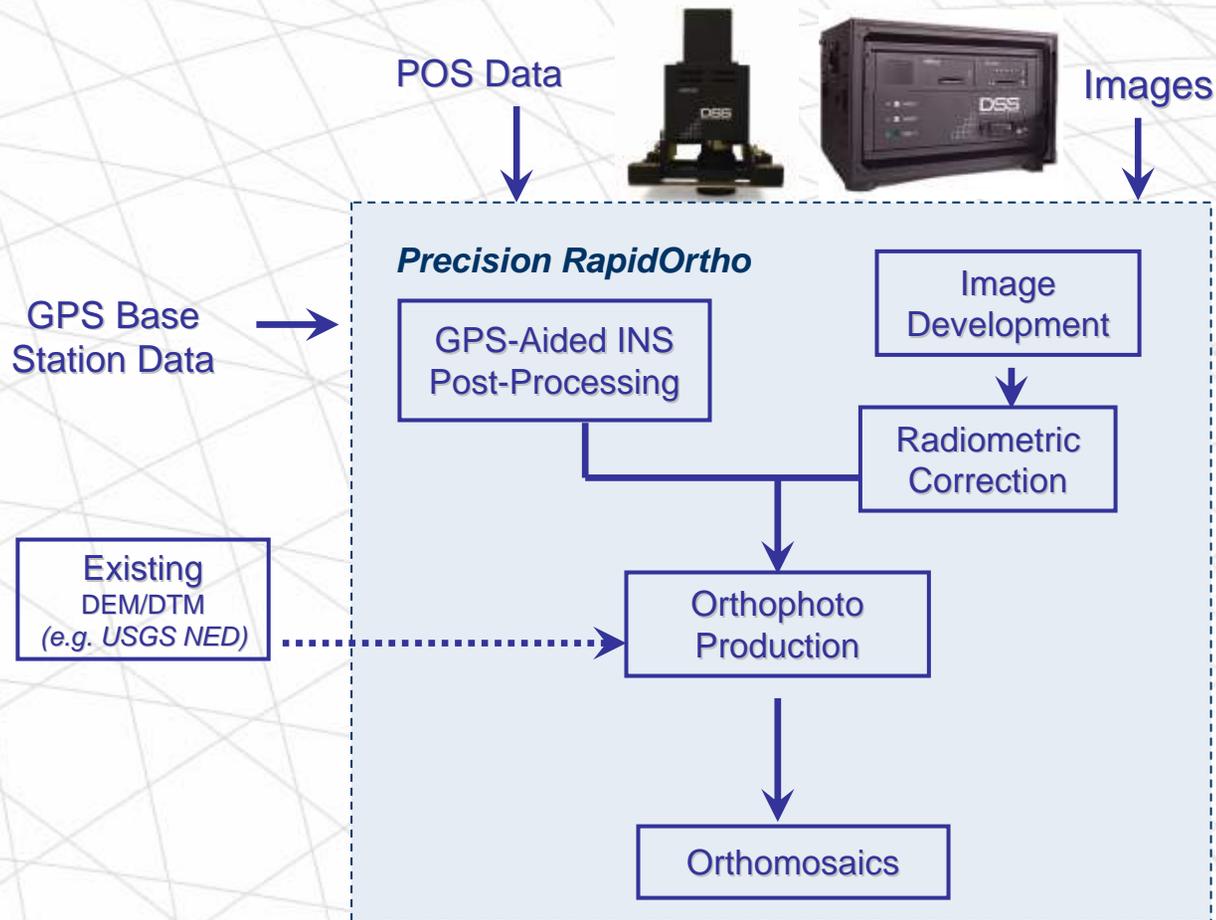
Accuracy of <1m RMS

60% endlap, 30% sidelap:

36 km<sup>2</sup> Orthomosaic at 20 cm GSD within 4 hours, in 9 orthomosaic tiles.

Accuracy of < 1 m RMS

# Precision RapidOrtho™



# Precision RapidOrtho

## Rapid Location + Rapid Change Detection

- Larger area and limited mosaicing requirements
- Applications requiring measurements (i.e. area calculation) on maps - GIS Analysis
- Effective for successive surveys requiring change detection analysis

**Results:**

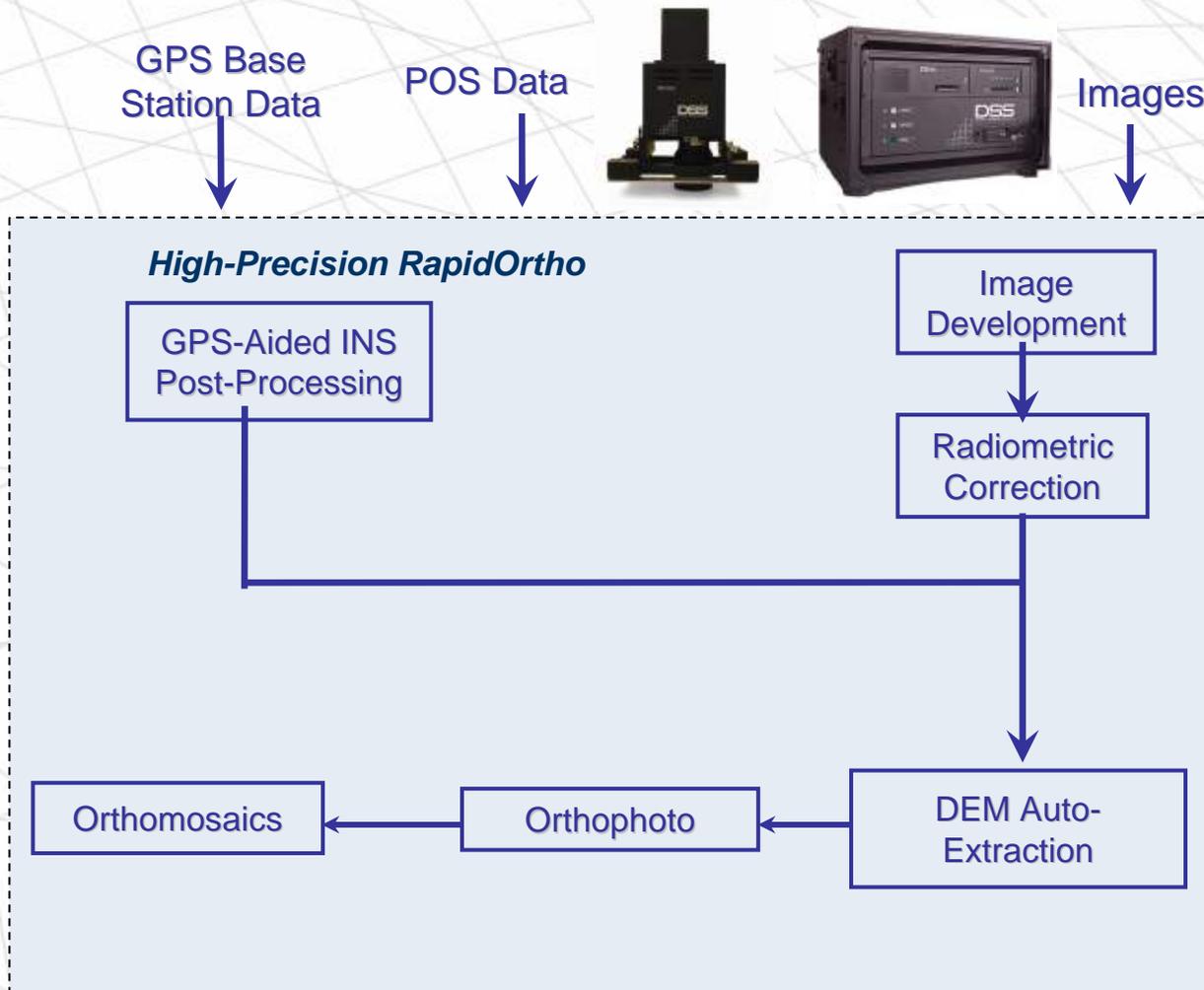
**Post-processed GPS-Aided INS Solution:**

**Typically 15 minutes per 3 hour flight**

**36 km<sup>2</sup> Orthomosaic at 20 cm GSD within 5 hours, in 9 orthomosaic tiles**

**Accuracy of 40 cm RMS (2 X GSD) or max of POS AV position accuracy**

# High-Precision RapidOrtho™



# High-Precision RapidOrtho

## Rapid Location + Rapid Change Detection + Rapid 3D Visualization

- Areas that DEM may be out of date, changed terrain, or remote areas
- Rapid 3-D Visualization tool

### Results:

DEM at 5 X GSD resolution

2 stereopairs per minute (60% endlap, 30% sidelap)

Accuracy: Max of 3 X GSD RMS (max) or POS AV Position accuracy

Accuracy of 1.2 X GSD RMS (max) or POS AV Position accuracy

36 km<sup>2</sup> DEM at 1 m resolution +

36 km<sup>2</sup> Orthomosaic at 20 cm GSD within 10 hours, in 9  
orthomosaic tiles.

Accuracy of 24 cm RMS

# Advanced Airborne Surveillance

## **DIRECT GEOREFERENCING**

Position and orientation data, no GCPs needed to correct data, therefore no personnel placed in harm's way

## **AUTO ORTHORECTIFICATION/CORRECTION**

Takes raw aerial image, makes each pixel map ready

## **STEREO IMAGE DEM EXTRACTION**

Using parallax between two overlapping images, can accurately measure and map elevation, as well as perform building extraction, automatic texturization

## **VISUALIZATION/MAPPING**

Prepare personnel for surroundings before ever being placed at risk

## **ADVANCED HARDWARE**

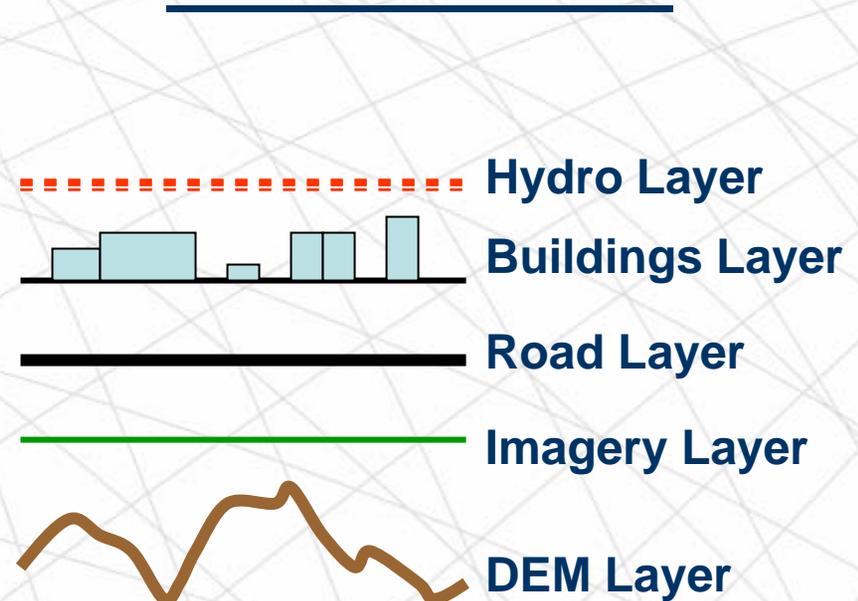
High resolution Digital Sensor System (DSS) with accurate and precise GPS/IMU technology, faster processors, larger data storage capabilities, better sensors, full automation...

# Advanced Airborne Surveillance

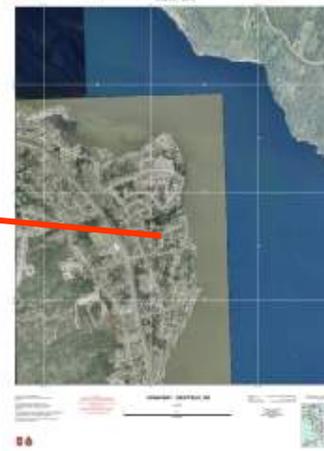
## Results:

- More aerial data product derivatives – GIS, DEM, Temporal/Change Detection
- Sharing hands-on information faster for rapid response
- Higher accuracy, higher geospatial measurement precision
- Eases the burden of volume – quality data from airborne cameras, drones, satellites, existing maps, and older reconnaissance

# Cartographic – From Images to Maps



# Cartographic



Collection produces a map series at different scales for different ends of the spectrum – data for both the **strategic** and **tactical** levels of command.

# Urban Planning Changes Over Time

Temporal – CFB Gagetown, Then and Now



## Long Term Detection/Assessment:

Long-term structure change

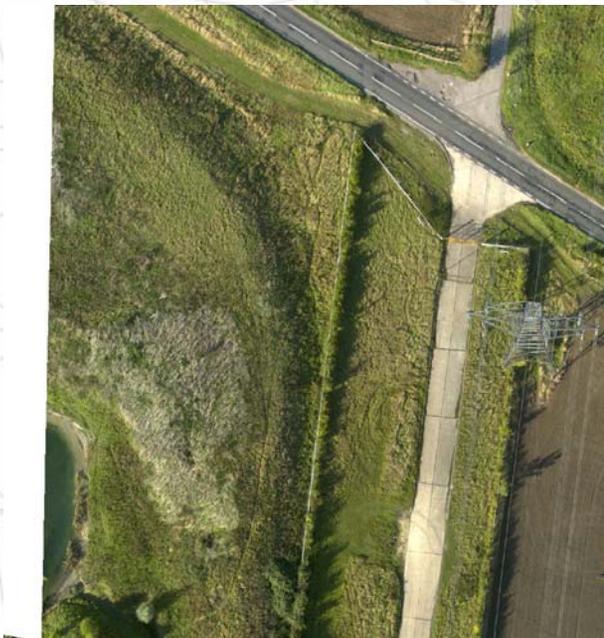
Before/After damage  
assessment

Cultural site protection

Soil disruptions (spectral  
signature combined with  
shape detection)

e.g., IED detection

# Infrastructure Corridor Mapping



# Border / Coastal Monitoring



- Large motivation for advancing change detection technology and rapid data collection
- DSS high resolution aerial/overhead imagery is effective for repeatable surveillance of long border regions, unmonitored coastal zone areas, and remote travel routes



# Border / Coastal Monitoring

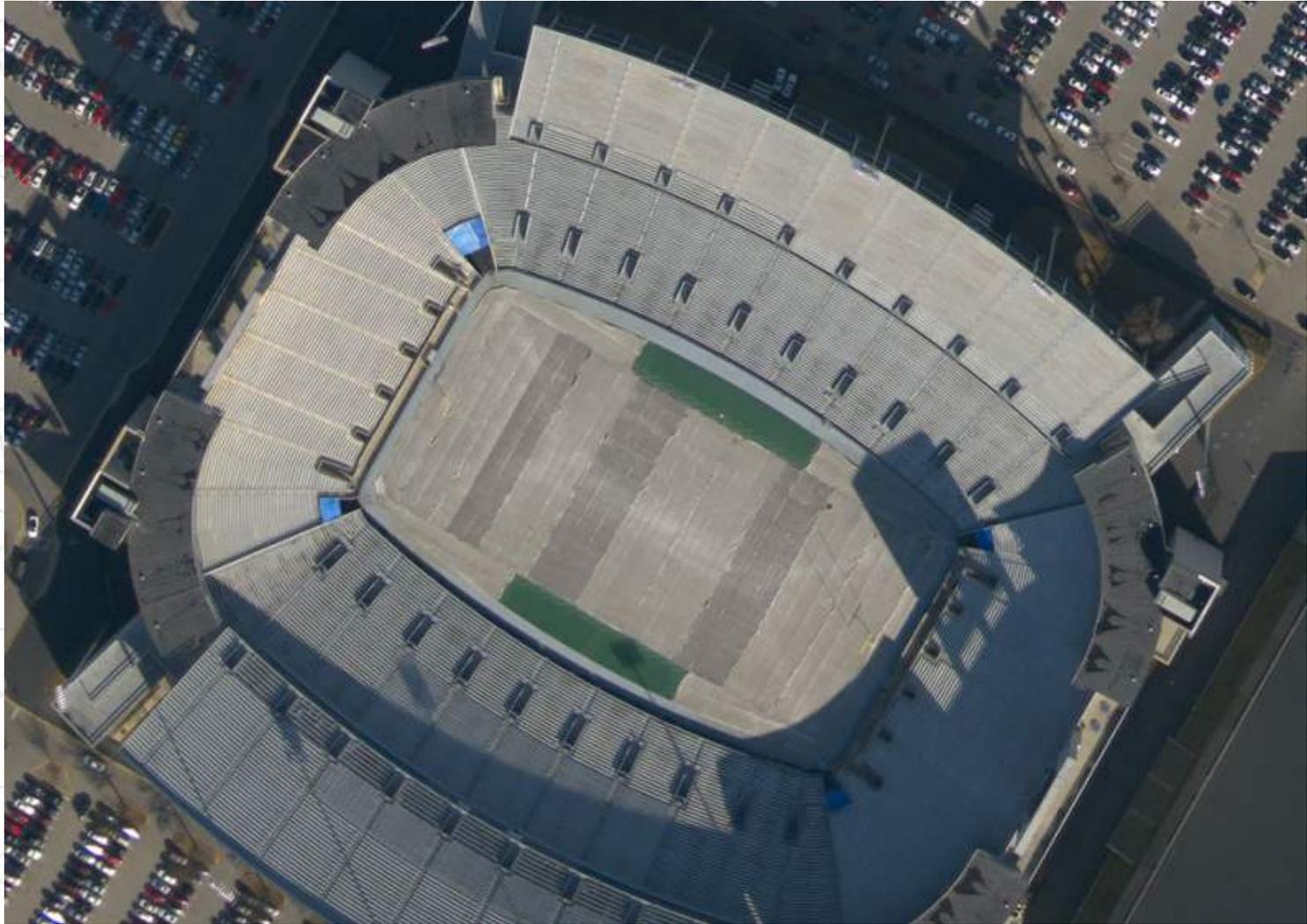
- Enhances standard continuous watch operations taking place 24/7
- Identify/locate “new” environmental changes that indicate unwanted presence, threat, and/or activities in need of further investigation
- Effectively deploy resources exactly where needed



# Border / Coastal Monitoring



# Critical Infrastructure- Securities



# Port Facility & Ship Traffic Security

Higher pixel resolutions make object identification and change detection easier, especially in active port areas. Even a small ship is identifiable on a low resolution image. But in a higher definition digital aerial image, details are far more identifiable and changes readily noticed.

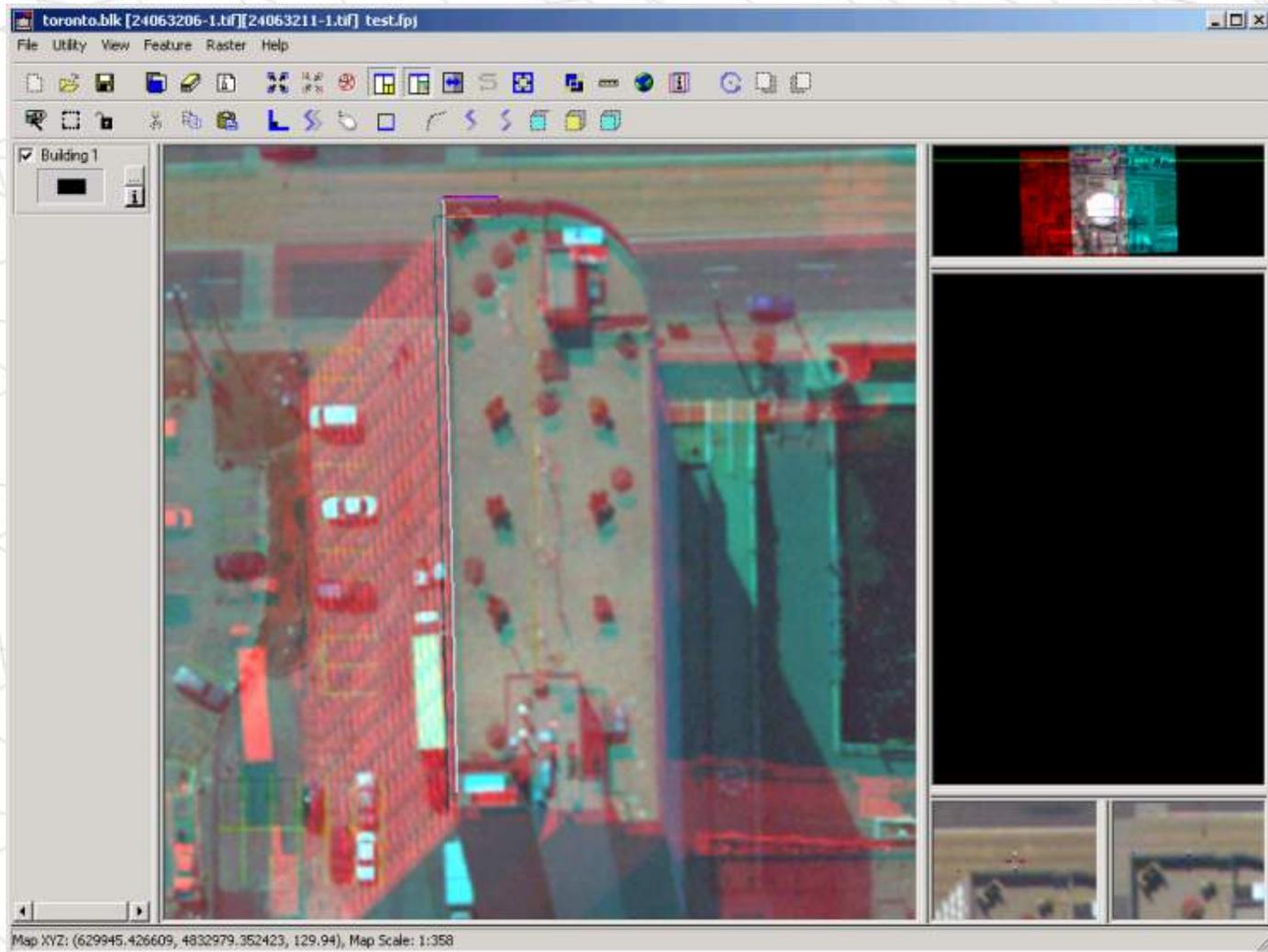


# 3D Feature Extraction

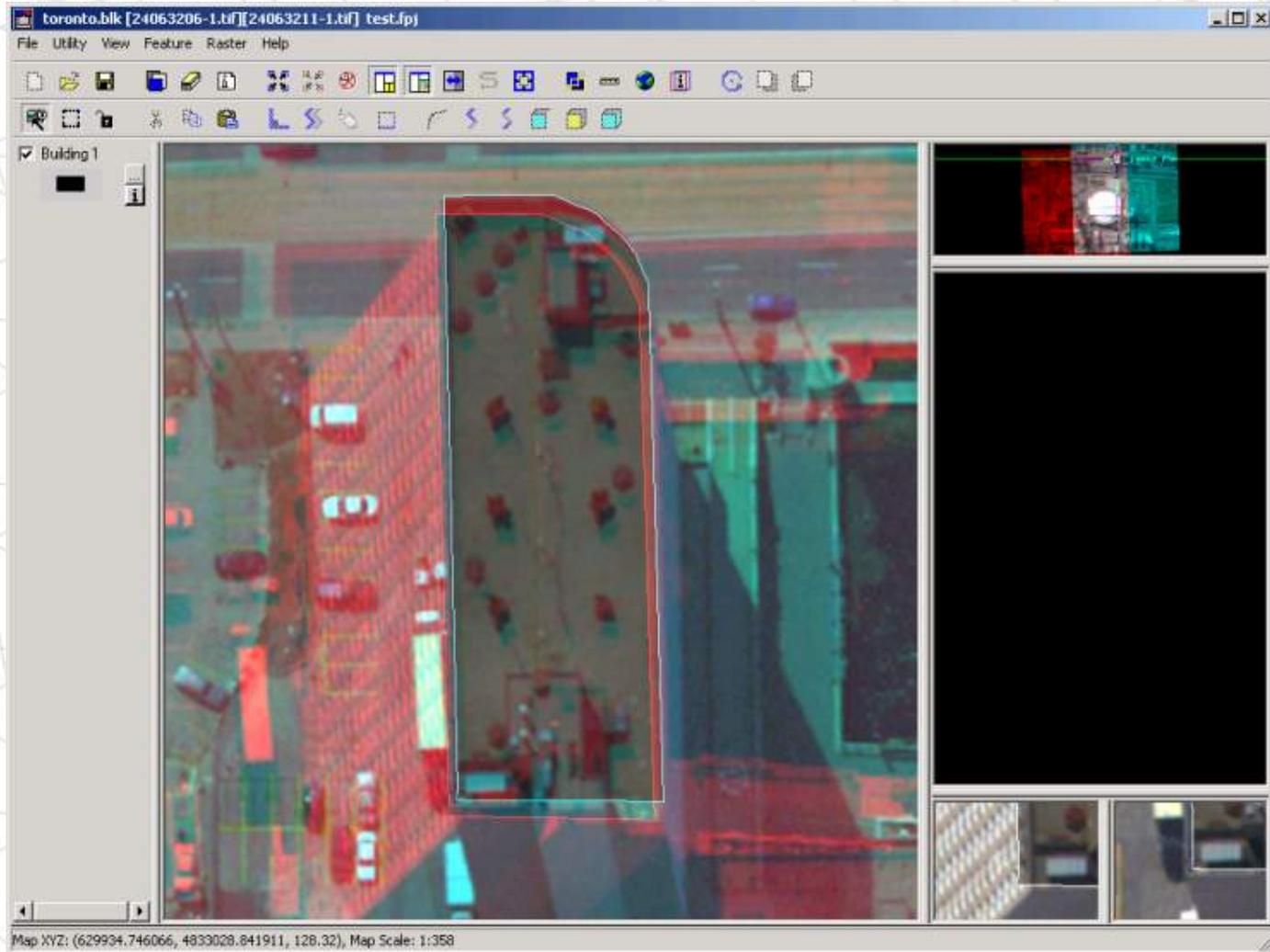
3D feature extraction with stereo overlapping photo images will allow All Source Intelligence Centres (ASIC) to distribute data in such a way as to allow personnel to **visualize** a building **long before ever visiting it**.

The added confidence gained by familiarization becomes an advantage by reducing decision times, hesitation, and uncertainty that a soldier, a decision-maker, or rescue team may experience at a **critical** moment.

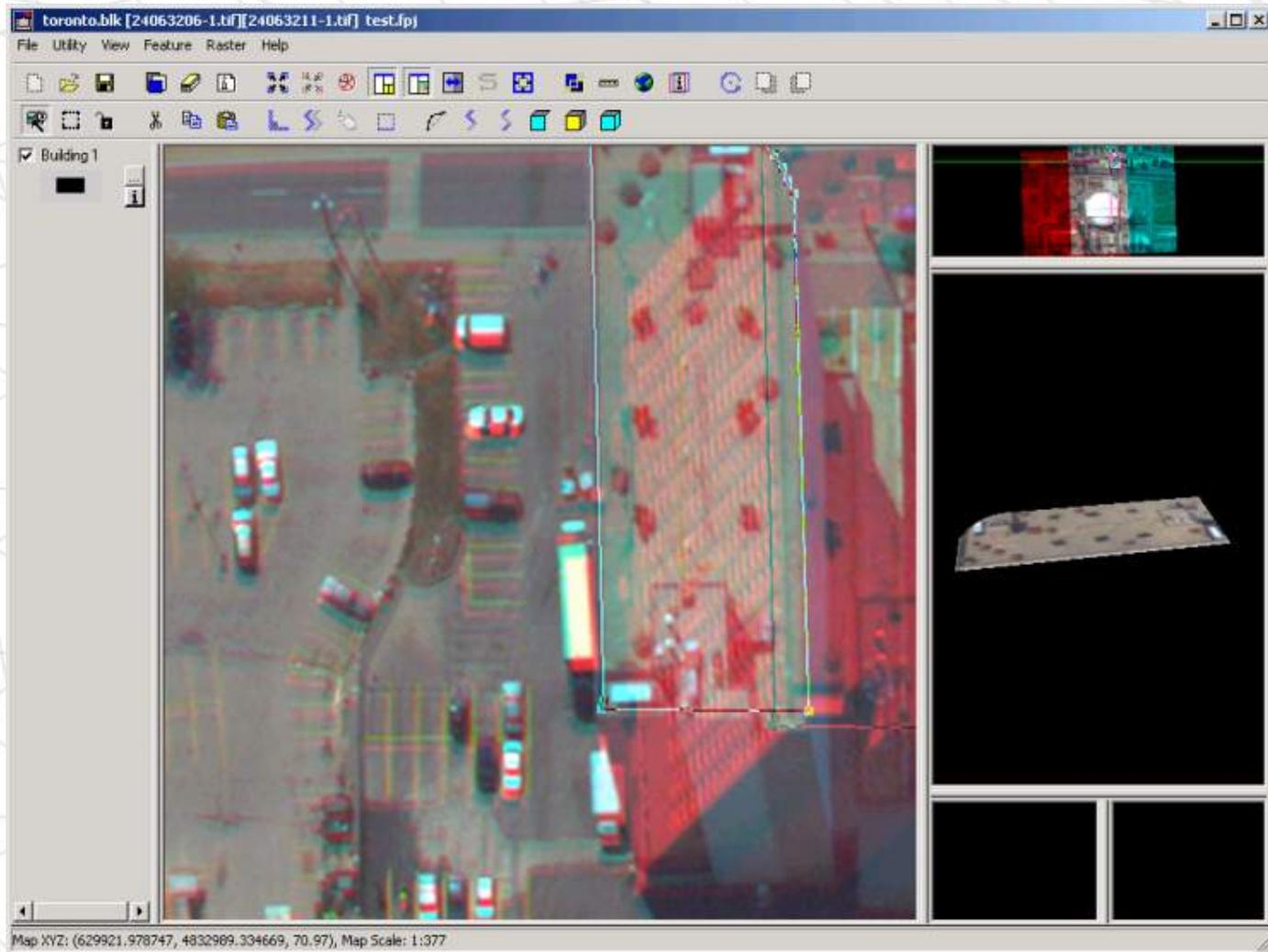
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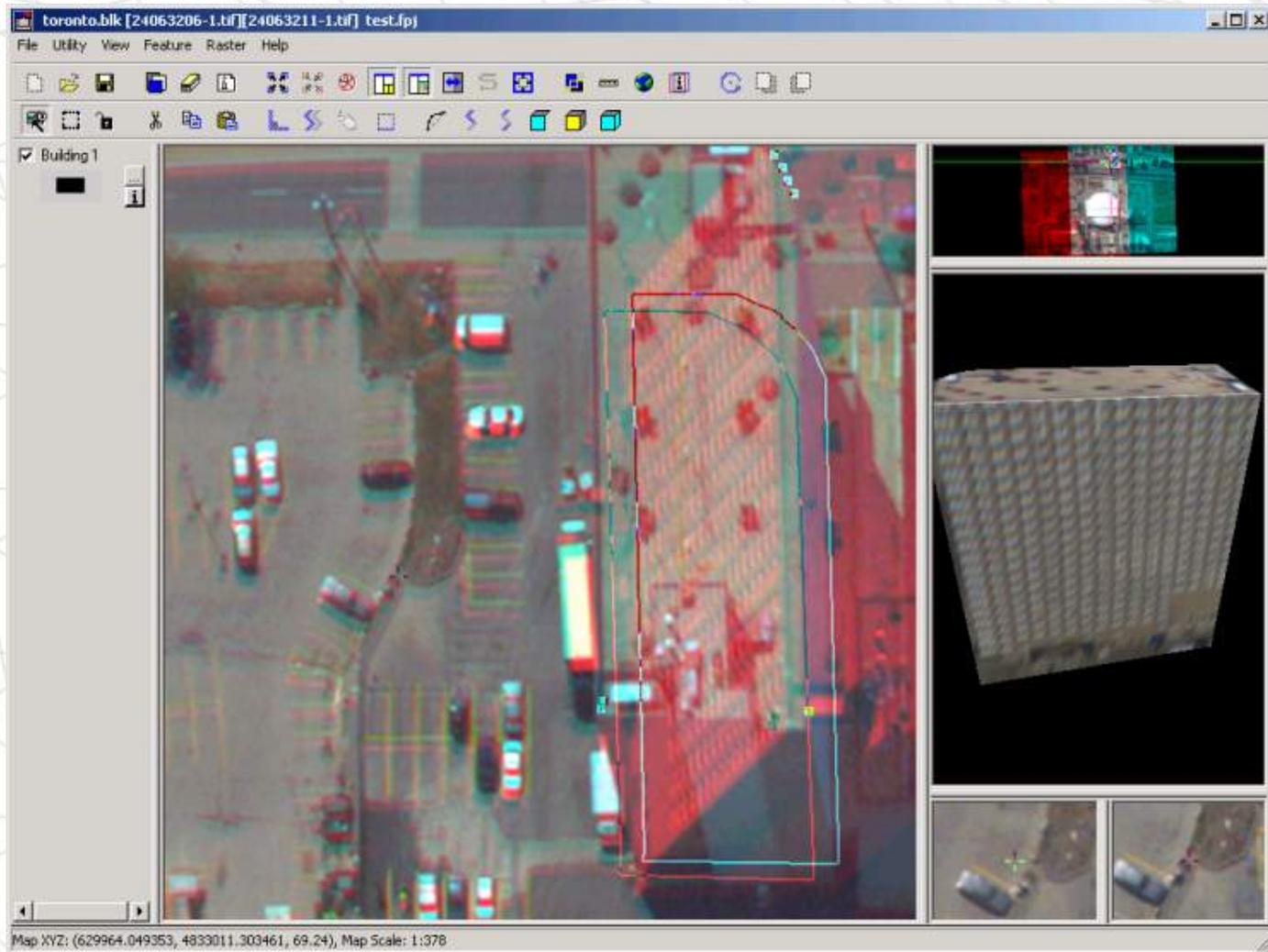
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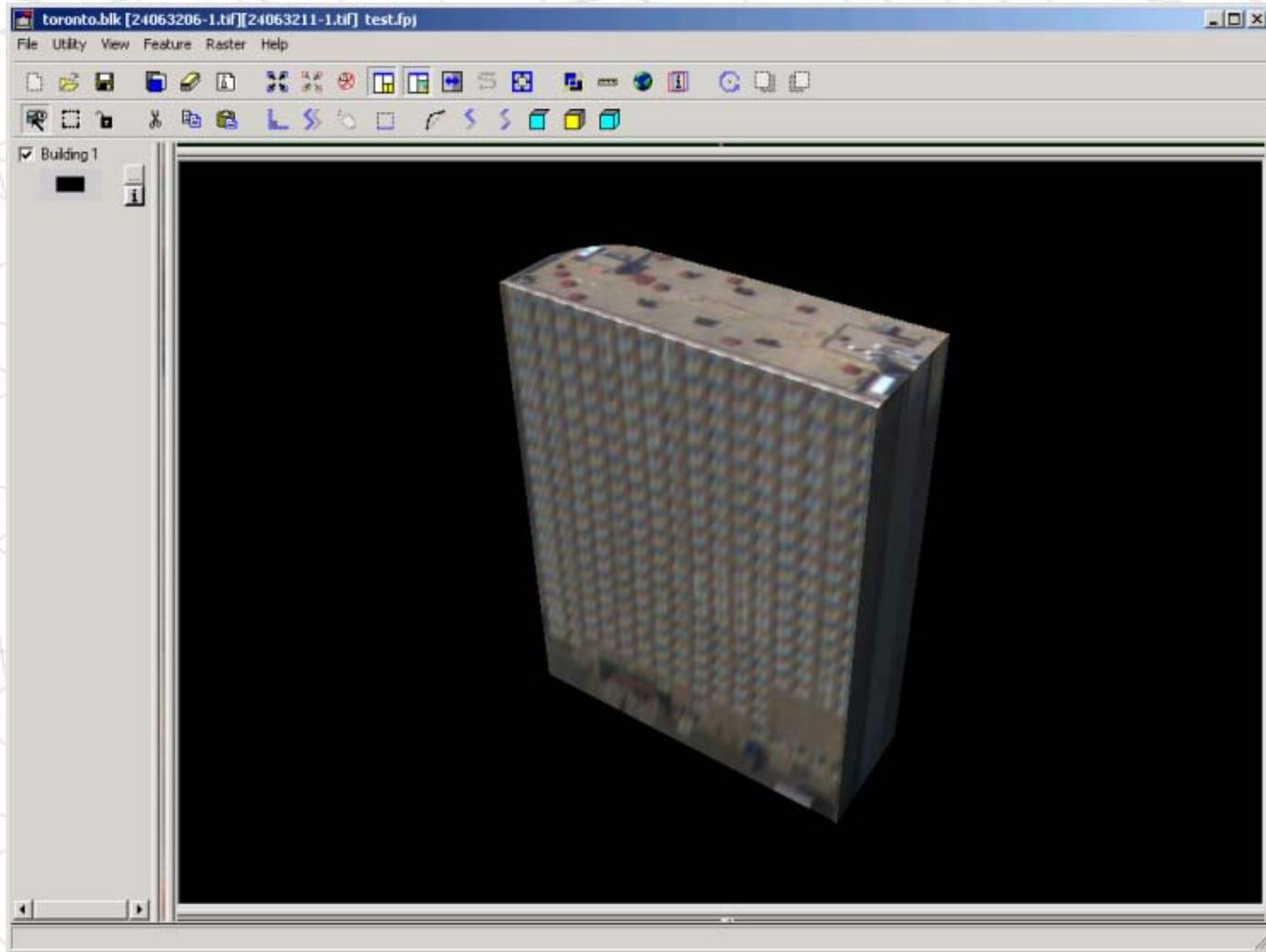
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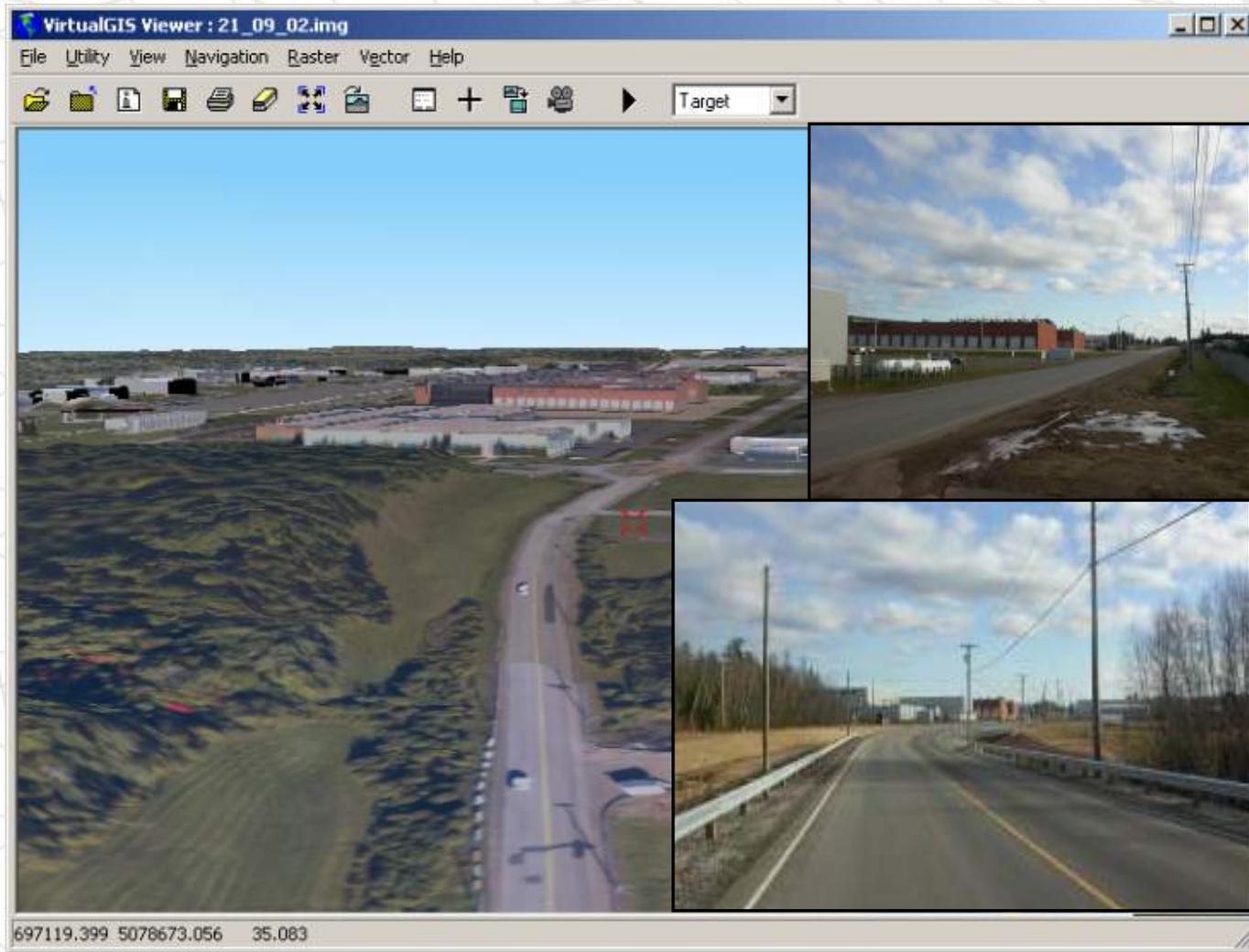


Can now be exported to be utilized in 3D visualization...

# Visualization

Visualization tools help familiarize personnel with their operational environment before arriving on scene. Digital data can be reviewed even while en route to a location to help plan initial actions even as circumstances rapidly evolve – from base site selection to security operation prioritization.

# Visualization – CFB Gagetown



Proposed 3D Area Of Operation...

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