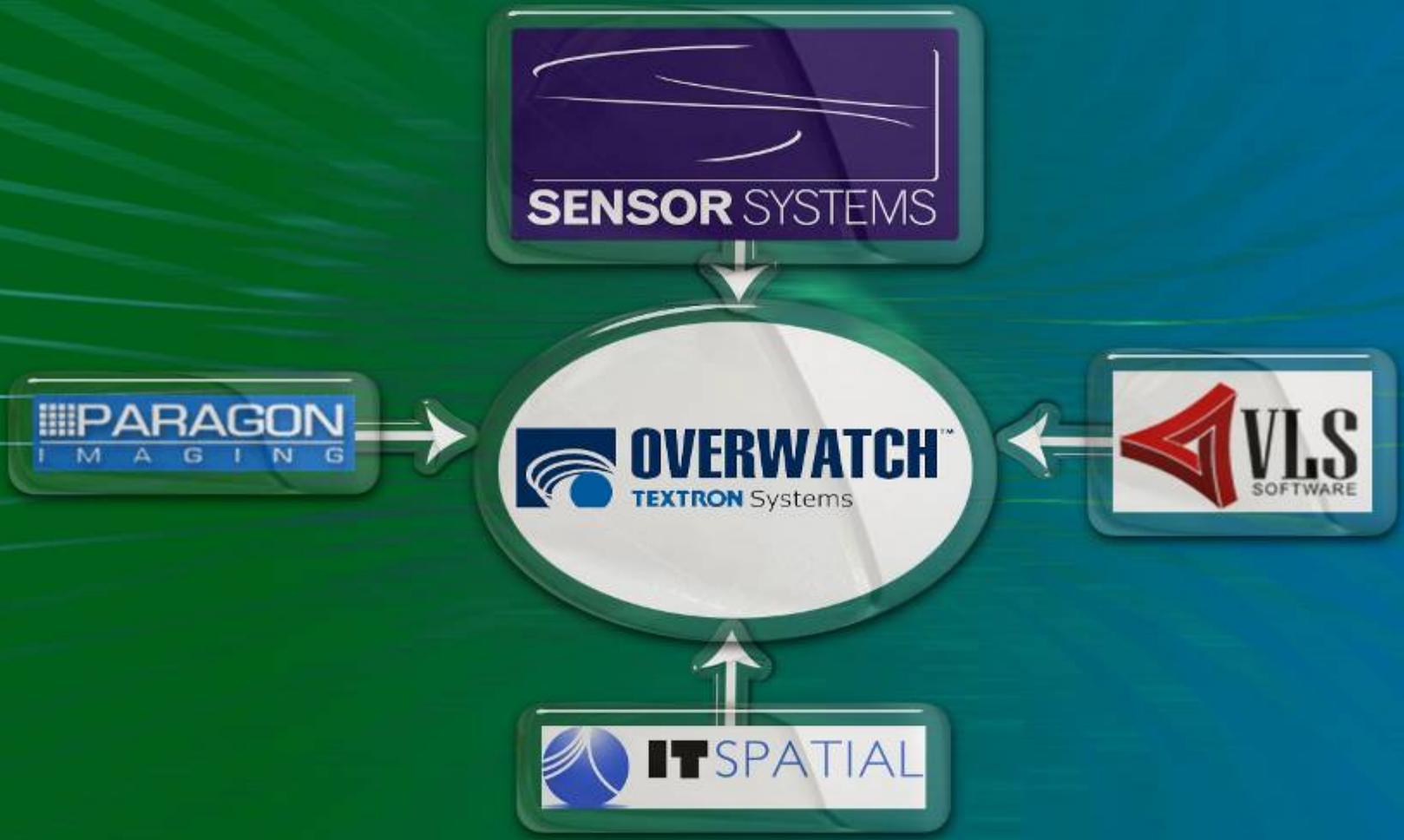




**2008 Geospatial Conference**  
Innovative Image Processing  
Solutions from **OVERWATCH**  
GeoOps

March, 2008

# Overwatch Geospatial Operations - Heritage



# Textron Corporation at a Glance



Cessna



Bell



Finance



Industrial



Bell  
Helicopter

Textron  
Systems

Defense  
Systems

HR Textron

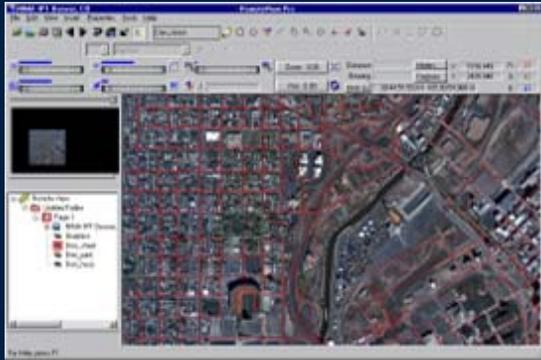
Marine and Land

Overwatch  
Geospatial

Overwatch  
Tactical

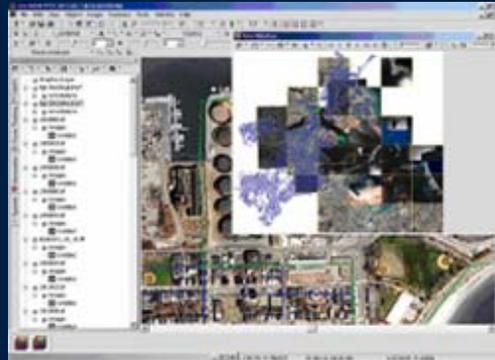
Lycoming  
Engines

# Industry Leading COTS Products



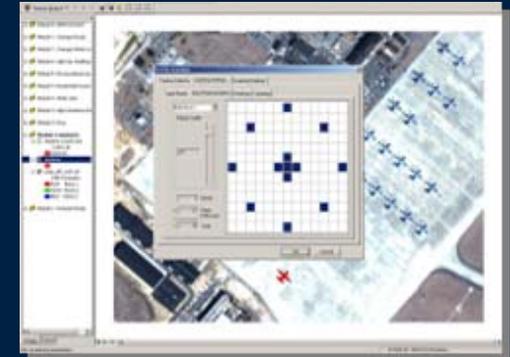
*Image Processing, Exploitation, and Analysis*

**RemoteView**



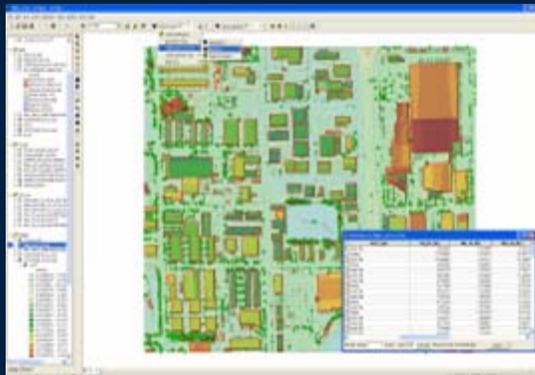
*Image Exploitation and Analysis*

**ELT 5500/3500**



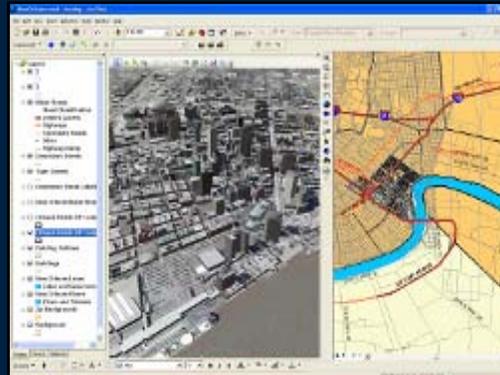
*Extraction of 2D/3D features from Raster*

**Feature Analyst**



*Extraction of 3D features from LIDAR data*

**LIDAR Analyst**



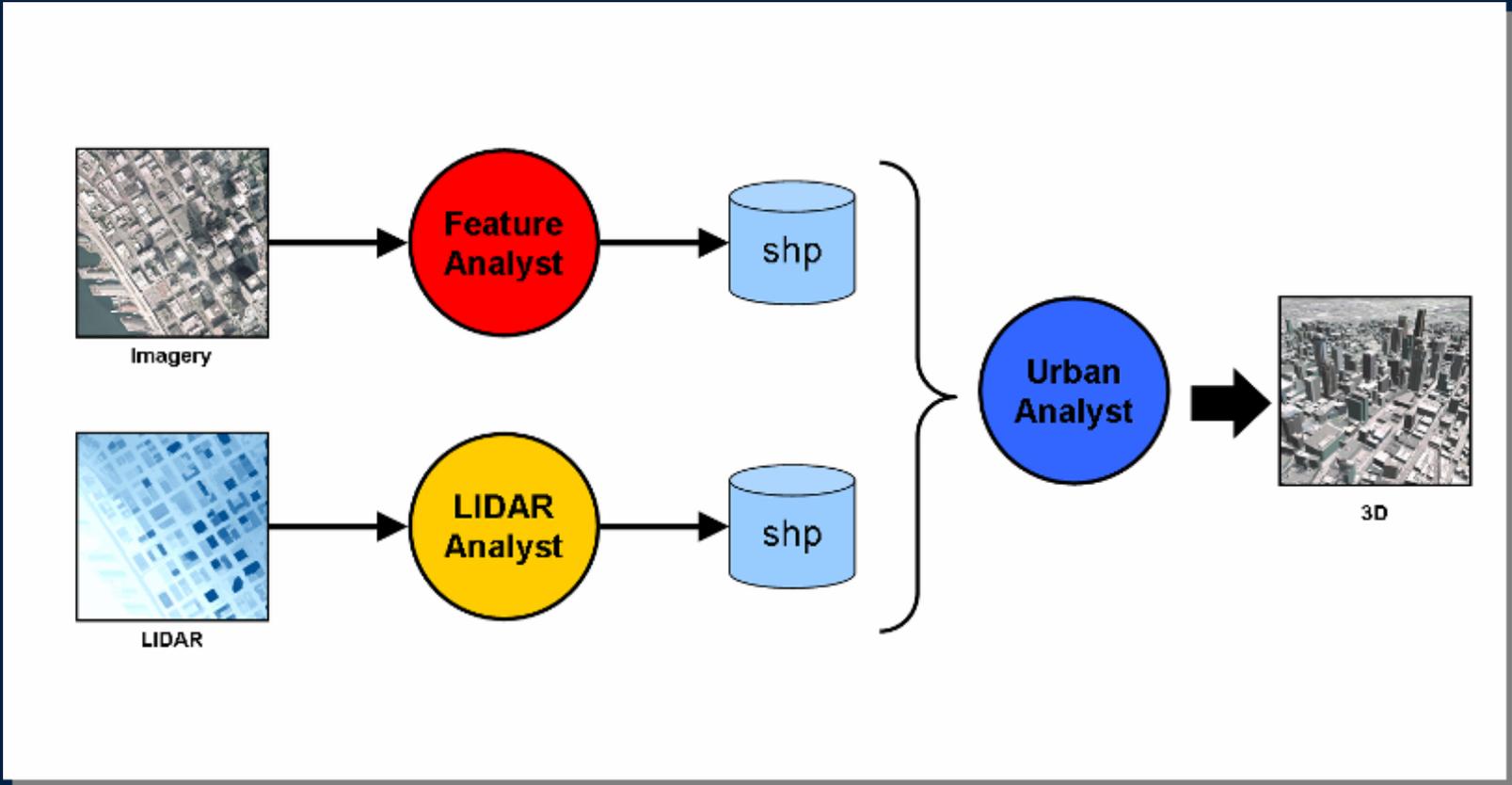
*Advanced 3D Exploitation and Analysis*

**Urban Analyst**



*Geospatial Decision Support Platform*

**InterSCOPE**

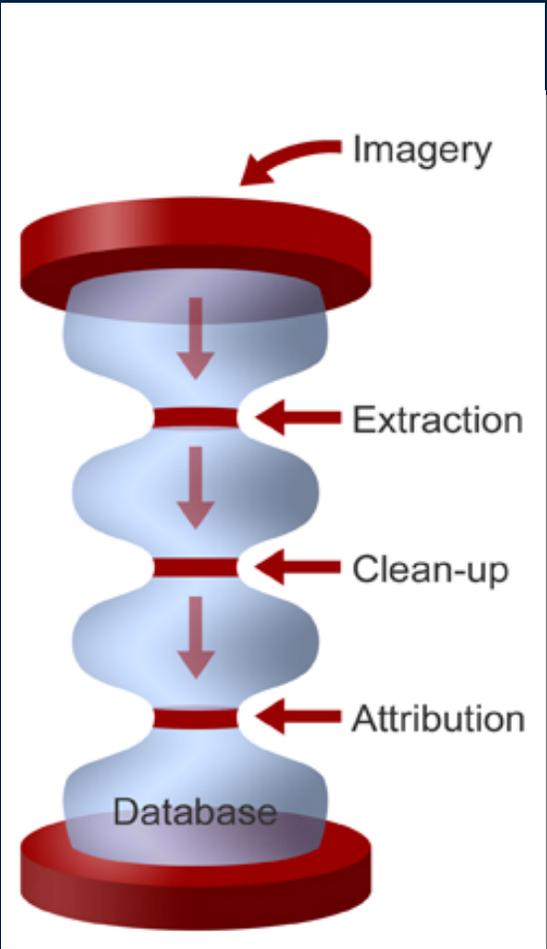




## Quickly and Easily Extracts Feature Data from Imagery



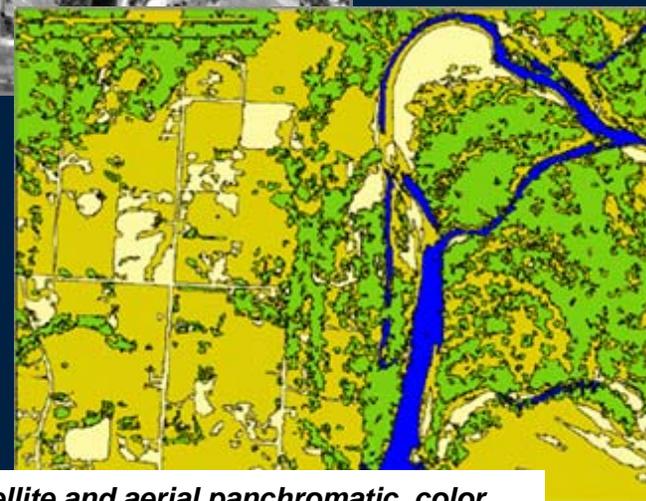
# Feature Analyst® cont.





# Feature Analyst® Saves Time!

- Save time and money from manually digitizing information from satellite image data.
- Save by leveraging high-resolution image data and gather more detailed information compared to traditional methods used in the past.



*The Feature Analyst works with satellite and aerial panchromatic, color composite, multi-band, and radar imagery... And can perform land cover classifications fast and accurately.*

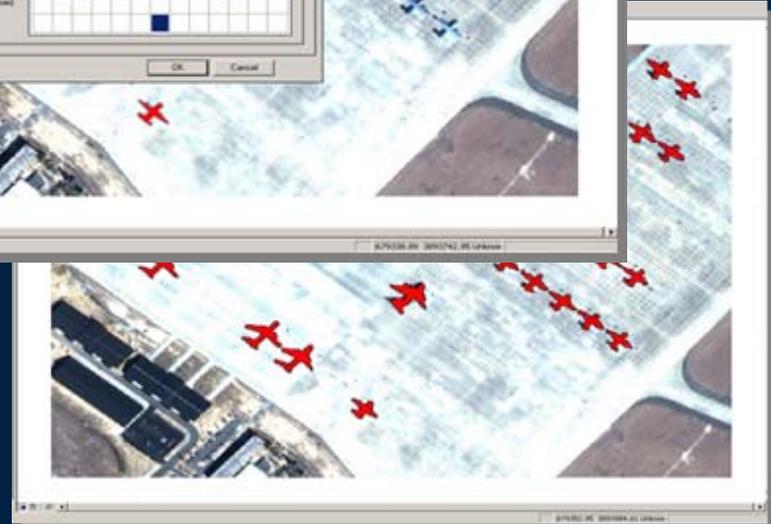
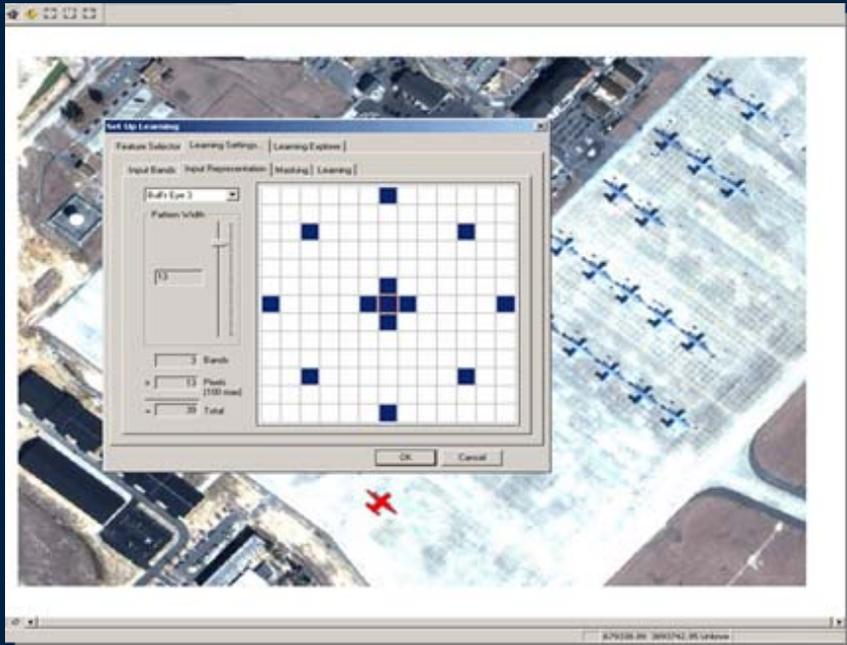


# Feature Analyst® cont.

## Why Does *Feature Analyst* Excel at Extraction?

During extraction,  
Feature Analyst uses:

- Color
- Size
- Shape
- Texture
- Pattern
- Shadow
- Spatial Association

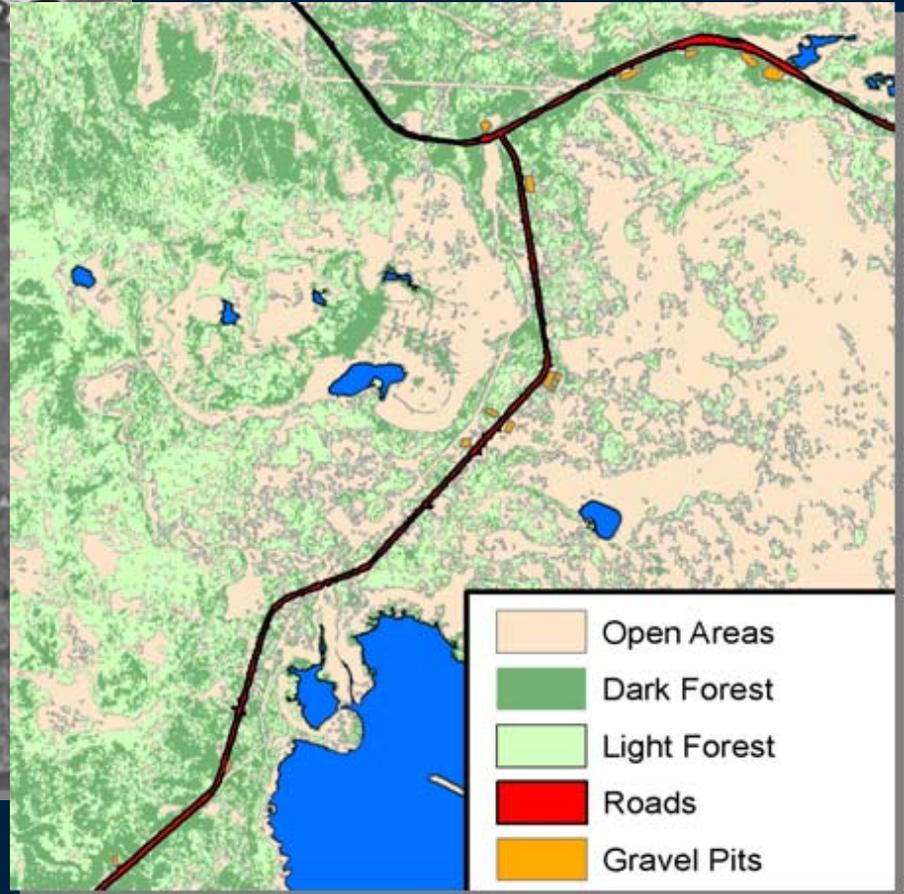
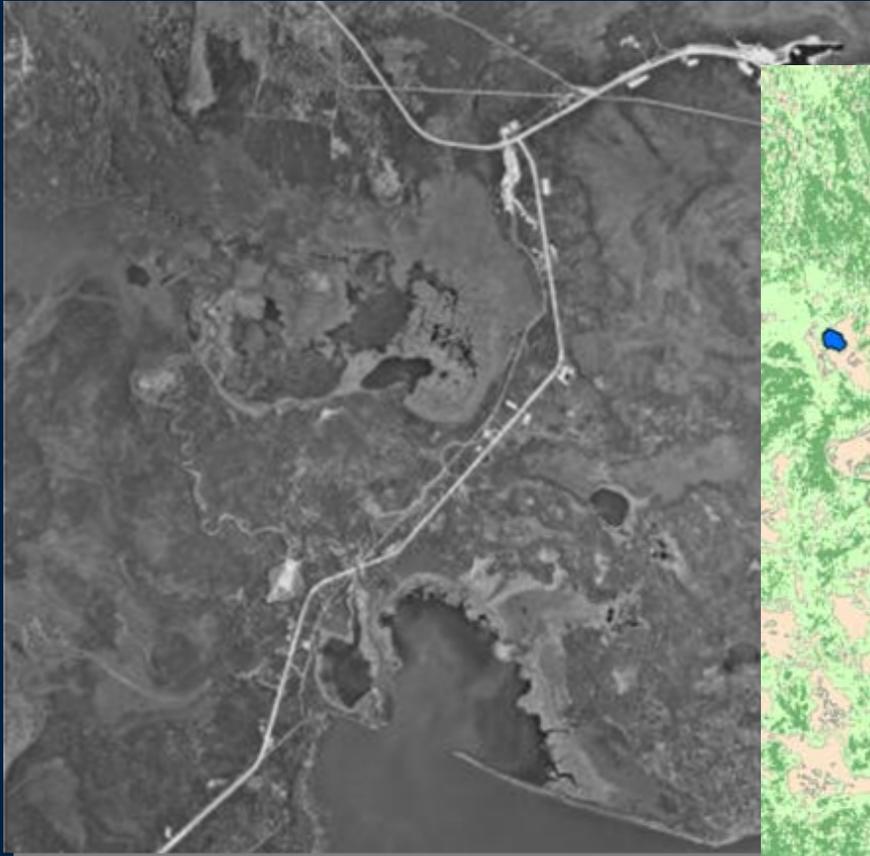


# Land Cover Change Detection



**Before and after images captured after tsunamis hit Banda Ache allow for immediate assessment of damage to shorelines, vegetation and houses**  
*Images provided by DigitalGlobe*

# Multi-Class or Single Class Extraction Capabilities





# Examples From the USDA FS RSAC

## Kenai Peninsula – estimation of insect damage in White Spruce, Jan Johnson - RSAC

Ikonos Imagery Bands 4,3,1

Damaged White Spruce Feature Extraction



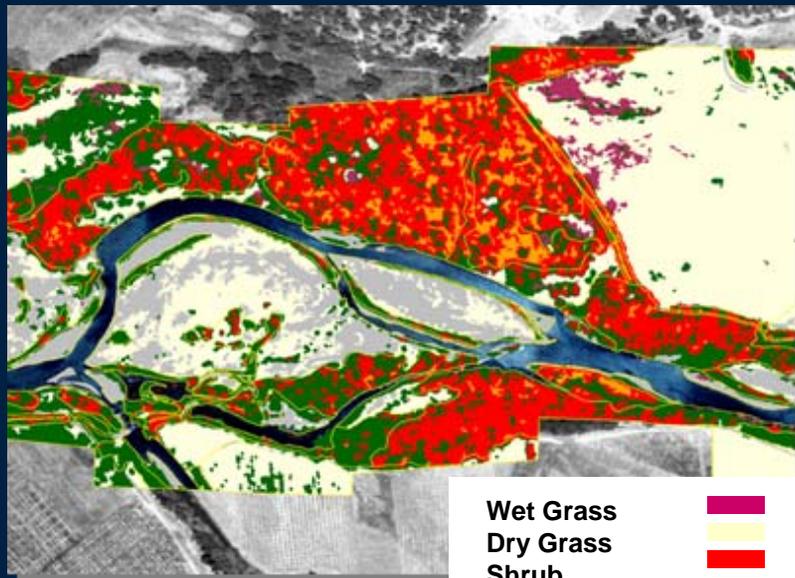


## Riparian Stream Mapping Rogue River National Forest Mike Williamson - RSAC

1999 Mosaic Digital Camera Imagery



Feature Analyst Classification

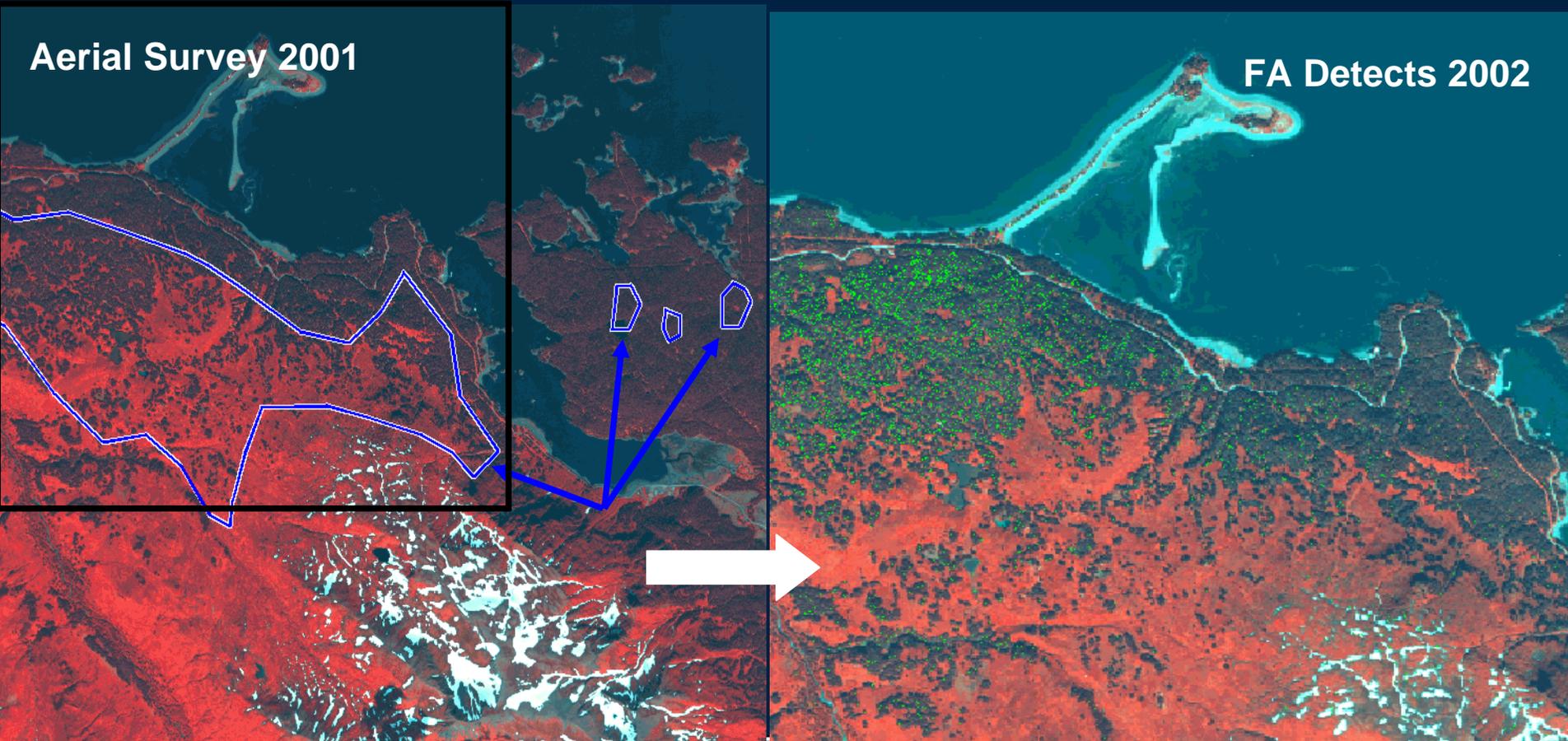


Wet Grass	
Dry Grass	
Shrub	
Deciduous Tree	
Conifer Tree	
Bare Ground	

# Examples From the USDA FS RSAC

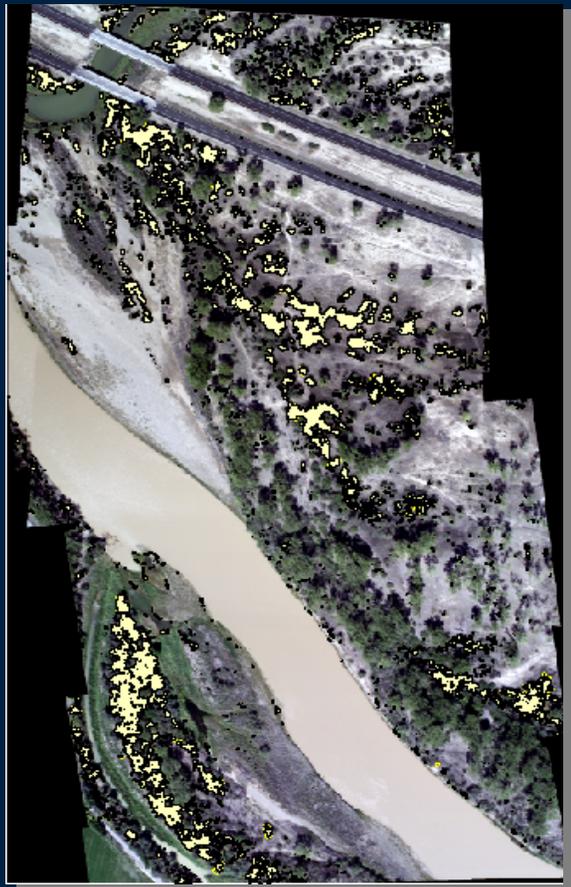


## Beetle Damage Assessment using Feature Analyst Jan Johnson and Paul Greenfield - RSAC



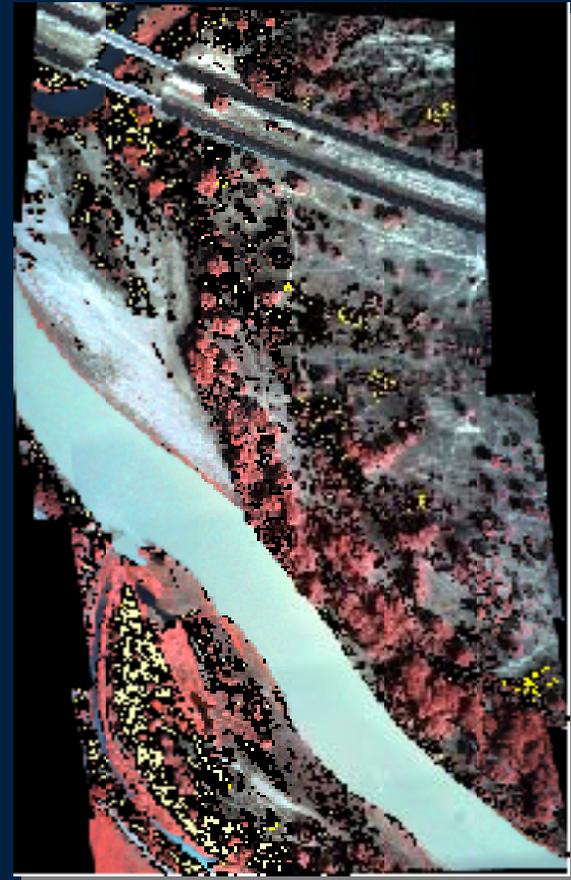


## Tamarisk Inventory Assessment using Feature Analyst Denise Laes – RSAC



Natural Color

MACK  
Area



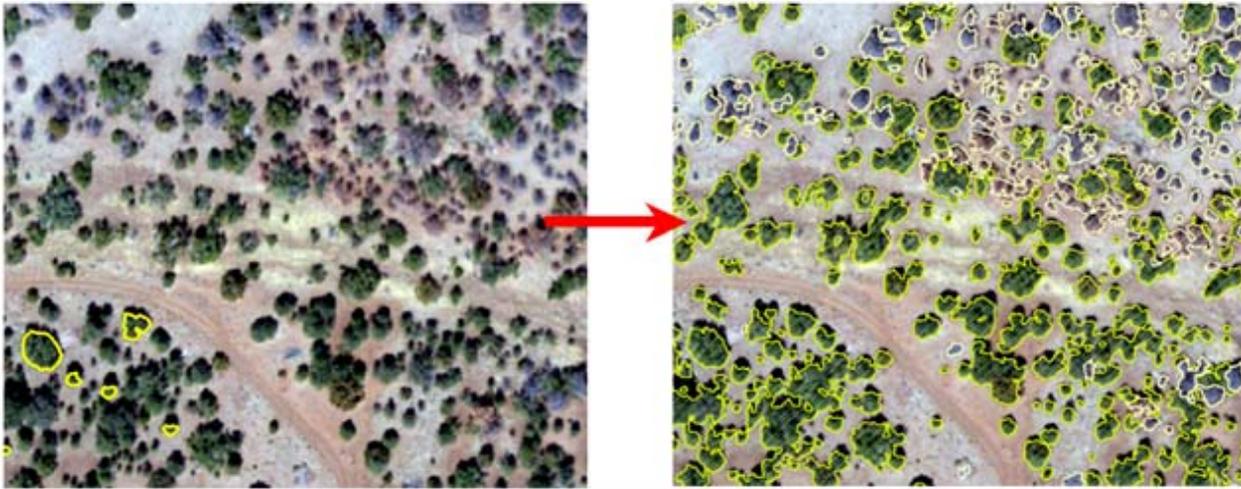
Color Infrared



# Examples From the USDA FS RSAC

## Tree Crown Delineation of Pinion Pine Randy Hamilton - RSAC

Classification of Pinion Pine tree crowns from high-resolution digital aerial photography (6-inch resolution) using Feature Analyst.



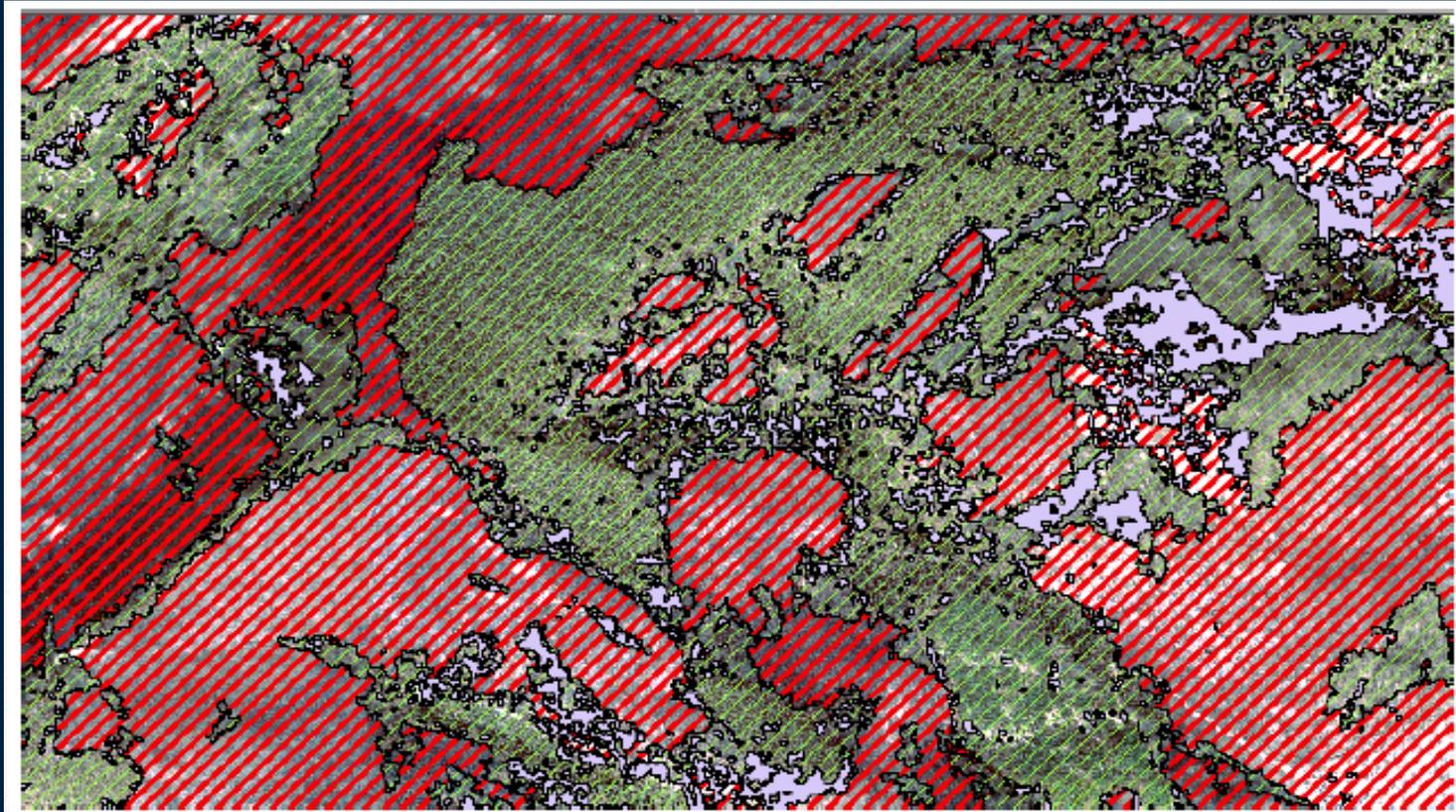
- Live tree, dead tree (needles on and needles off in separate classes), and shadow were classified.
- The classification was nearly 100% accurate.
- Even dead trees with brown needles still on were accurately distinguished from areas of bare ground that were spectrally very similar.

# Examples From the USDA FS RSAC



## Fire Severity Assessment

Geno Bassette – Region 1 Missoula, MT





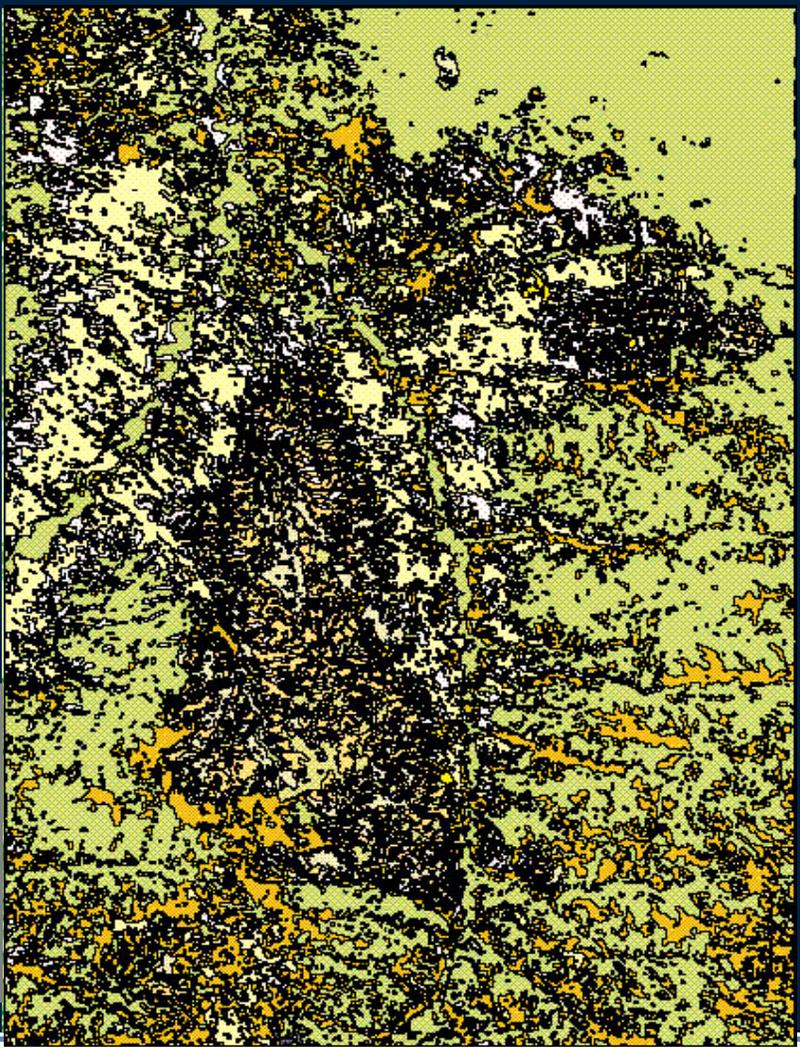
# More Client Examples

## CLASSIFYING & MAPPING WILDFIRE SEVERITY

Roland L. Redmond and J. Chris Winne-  
Wildlife Spatial Analysis Lab

-  **Barren**
-  **Burned\_Grass**
-  **Burned\_Shrub**
-  **Burned\_Tree**
-  **Mixed\_Lethal**
-  **Unburned\_Grass**
-  **Unburned\_Shrub**
-  **Unburned\_Tree**

Feature Analyst used 180 “examples” to classify a post-fire Landsat TM scene more accurately and faster than state-of-the-art image processing



# Client Application I



## Case Study: GIS Campinas



- **Location:**
  - County of Campinas, SP, Brazil
- **Purpose:**
  - Support Mayoral taxation initiative by providing updated map of parcel edifications (impervious area)
- **Project Area:**
  - 800 sq km
  - 400,000 parcels



# Client Application I cont.



## Case Study: GIS Campinas Cost Savings Assessment

### AFE vs. Manual

- **Cost**
  - Manual: \$750,000
  - AFE: \$150,000
  - **80% SAVINGS**
- **Time**
  - Manual: 9 months
    - 10 Technicians
  - AFE: 2 months
    - 5 Technicians
  - **80% SAVINGS**

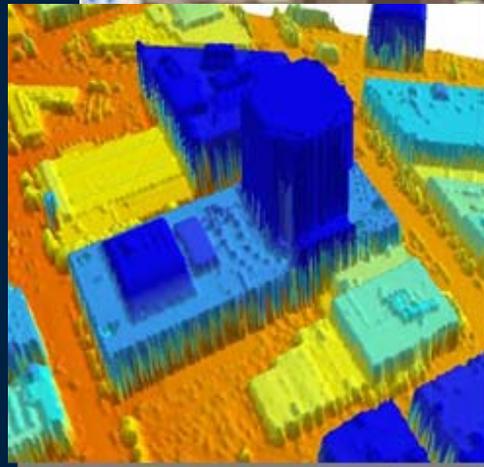
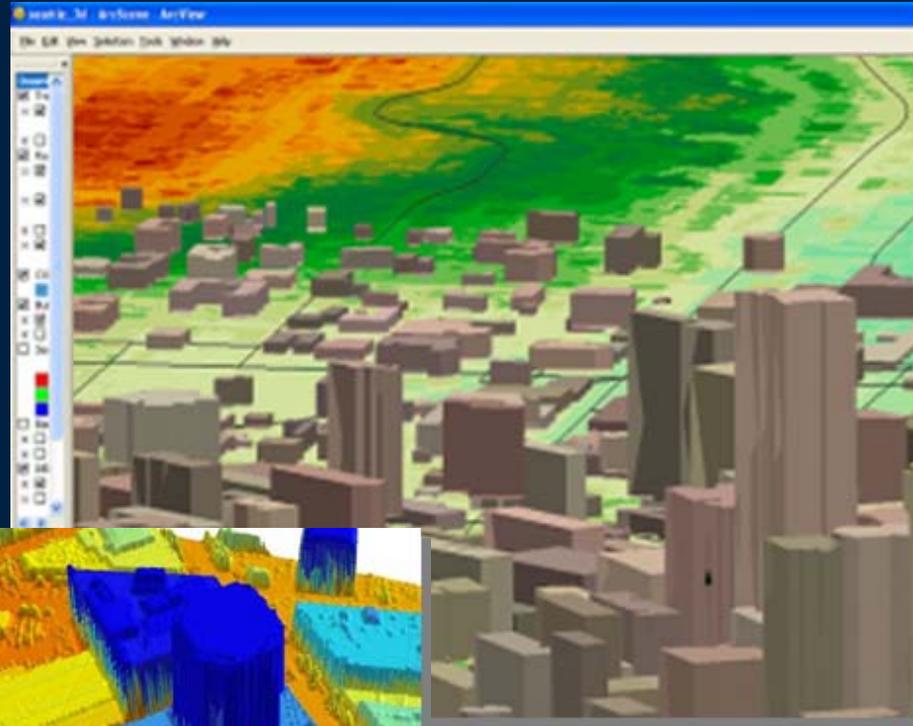
Because of these massive savings, this project was sole-sourced to NCDC



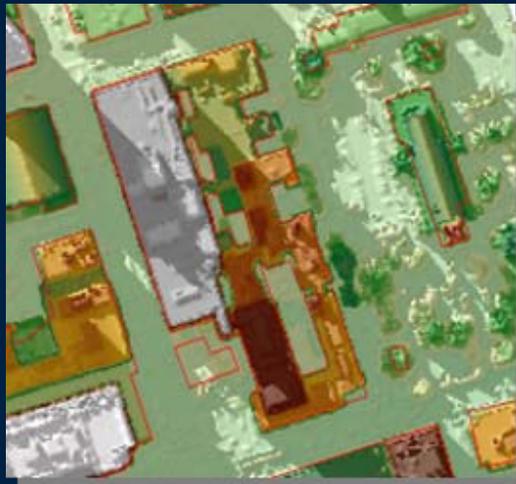
# LIDAR Analyst®



- LIDAR Analyst is a 3D extraction solution for collecting features and generating raster data from airborne LIDAR.
- Simplifies the process of extracting bare earth, buildings, and trees/forests features.
- Provides tools for advanced modification and analysis



# LIDAR Analyst® cont.



## Accuracy\*

- Bare – earth:
  - RMSE as low as 0.12 meters under leaf off conditions
- Buildings:
  - An overall accuracy as high as 97.4 percent

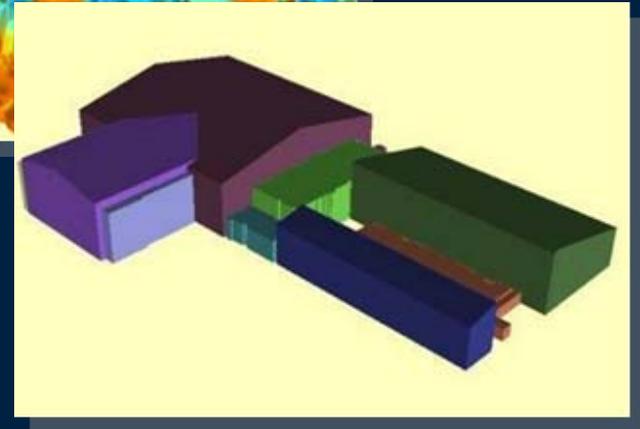
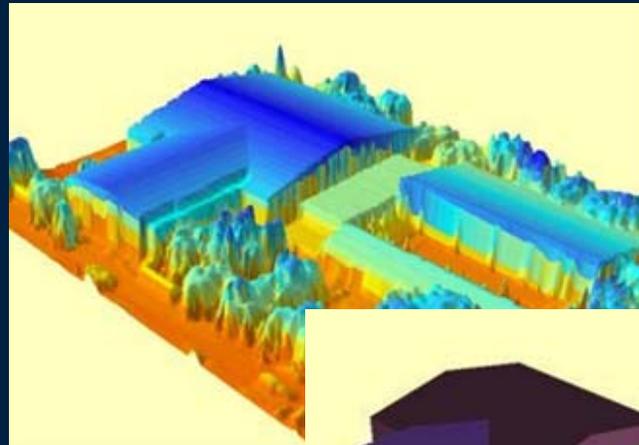
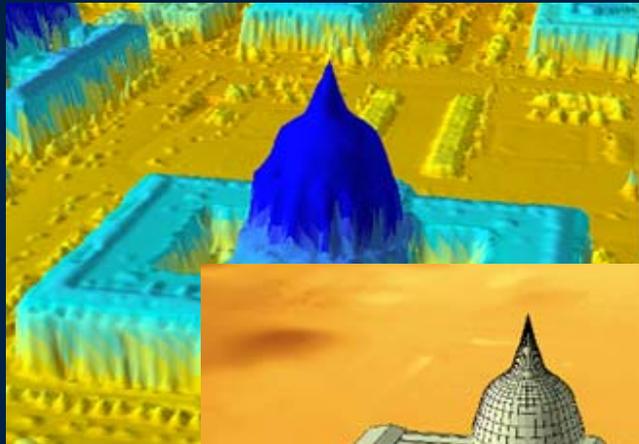
## Speed\*

- Bare – earth:
  - Average processing speed of 86 seconds per km<sup>2</sup>
- Buildings:
  - 11,000 buildings in 9 minutes over an Urban High Density Area of 33 sq km (Los Angeles East)
- Trees:
  - 100,000 trees were extracted from a Forested Semi-Rural Area in 6 minutes over a 50 sq km extent (Stafford, CT )

*\* Done with the U.S Army's Engineering and Research Development Center (ERDC) Topographic Engineering Center (TEC)*

*\* Ground control data provided by ERDC-TEC*

# LIDAR Analyst® cont.



## Complex Building Extraction



## Accuracy Assessment of Bare Earth Extraction

Accuracy Assessment of VLS Bare Earth Extraction vs. 3,400 Surveyed Ground Control Points					
Leaf Off	Method 1	Method 1	Method 1	Method 2	Method 2
	No LPF	LPF	LPF no Post Process	No LPF	LPF
R Square	0.999235282	0.999373483	0.999373501	0.999235192	0.999373375
RMSE (m)	0.139403907	0.127533192	<b>0.127531231</b>	0.139422922	0.127557336
Leaf On	Method 1	Method 1	Method 1	Method 2	Method 2
	No LPF	LPF	No LPF	LPF no Post Process	No LPF
R Square	0.998291117	0.998368004	0.998586971	0.998648238	0.998726325
RMSE (m)	0.210665637	0.206072097	0.191551753	<b>0.187282513</b>	0.18279457

**RMSE of z-value collected by LIDAR sensor is 0.12 meters!**

# LIDAR Analyst® cont.



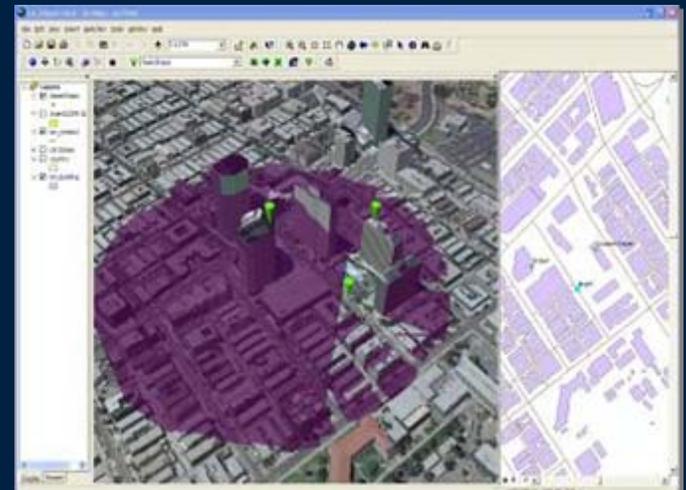
## Automated 3D Building Extraction Results from LIDAR

Dataset Name	Extents (Sq. Km.)	Landcover Type	Processing Time (min:sec)	Number of Buildings	Sq km / sec	Secs /sq km
Boise Airport	26.698269	Urban-High Density	6:58	5463	0.721575	1.385858
LAX West	33.075	Urban-High Density	17:02	3999	0.032363	30.89947
LAX East	33.075	Urban-High Density	09:30	11130	0.058026	17.23356
Seattle -King	22.993476	Urban-High Density	09:54	5976	0.03871	25.83341
Seattle - Int	23.038376	Urban-High Density	08:16	5618	0.046448	21.5293
Las Vegas	23.8075	Urban-High Density	06:58	2389	0.056956	17.55749
Stafford	50.2071	Forested-semi rural	13:12	563	0.063393	15.77466
Boise	0.411879	Suburban	00:08	319	0.051485	19.42318
Florida Suburb	0.305406	Suburban	00:04	61	0.076352	13.09732
Los Angeles	0.262668	Suburban	00:05	157	0.052534	19.03544
National Mall	6.287689	Urban Parkway	01:27	302	0.072272	13.83656
Mckenna	1.471594	Rural partial forest	00:14	20	0.105114	9.513494
Miami	1.324015	Urban	00:16	127	0.082751	12.08446
Salt Lake City	28.210132	Urban	11:14	6188	0.041855	23.89212
Sample 1	0.219912	Suburban	00:03	105	0.073304	13.64182
Sample 2	0.487602	Suburban	00:06	36	0.081267	12.30512
Sample 2a	1.47149	Suburban	00:22	342	0.066886	14.95083
Sample 6	0.17574	Suburban	00:03	47	0.05858	17.07067
Sample 7	1.045044	Suburban	00:12	84	0.087087	11.48277
Sample 8	0.573534	Semi-rural	00:06	72	0.095589	10.46145
San Francisco	0.323164	High Density Urban	00:07	151	0.046166	21.66083
Santa Domingo_a	0.716405556	Suburban	00:04	15	0.179101	5.58343
Santa Domingo_b	1.931377778	Suburban	00:08	29	0.241422	4.142121
Seattle Downtown	1.296479	Urban	00:29	189	0.044706	22.36828
<b>Average Processing Speed</b>					<b>0.07619</b>	<b>16.23382</b>



## What is Urban Analyst ?

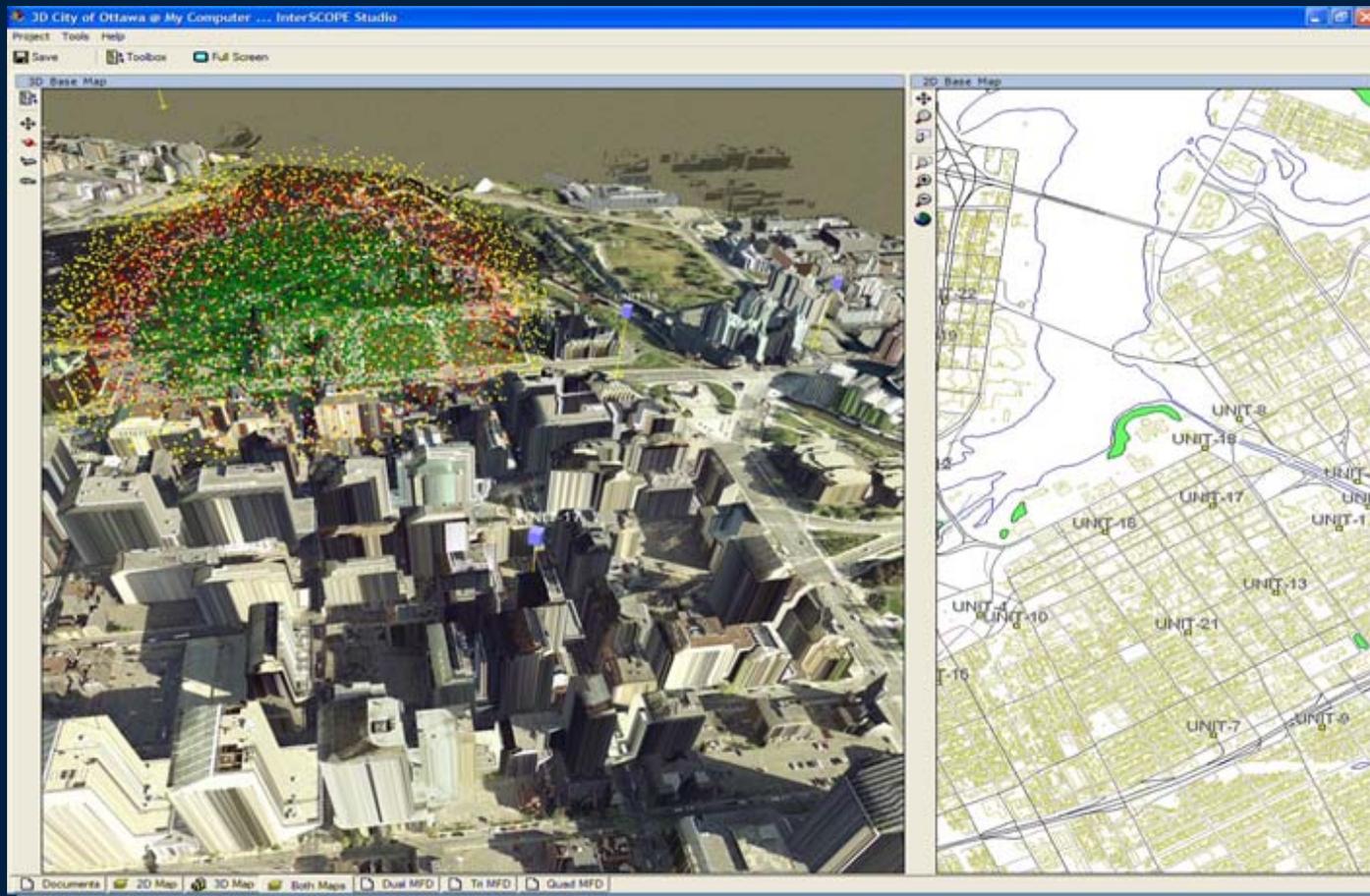
- UA is an ESRI ArcMap extension that allows users to Visualize, Analyze and Publish 3D geospatial data.
- Seamless integration with Feature Analyst and LIDAR Analyst to provide an end-to-end solution for extracting, visualizing and analyzing geospatial content
- Urban Analyst automates what was once a completely manual production process. What used to take weeks and days now takes hours and minutes.



# Urban Analyst™ cont.



Visualize – Analyze - Publish



# Urban Analyst™ cont.



## *Visualize*

- Real-time (on-the-fly) 3D content generation
- Supports data sources such as LIDAR
- Supports 3D model substitution
- SDE feature class support
- Real-time, Interactive Navigation
- Capture of spatial bookmarks
- Asset and Resource Management



# Urban Analyst™ cont.



## Analyze

- Measurement tool suite
- Line-of-Sight Tool Suite
- Blast Radius Tool
- GIS Query Integration
- Basic Routing/Path Tools
- Sensor Placement
- Manage Assets and Resources
- Interfaces to existing analytical models such as:
  - HAZUS MH (multi-hazard)
  - HPAC (Dispersion)
  - CPST (RF Propagation)
  - AXIS (HUMINT)

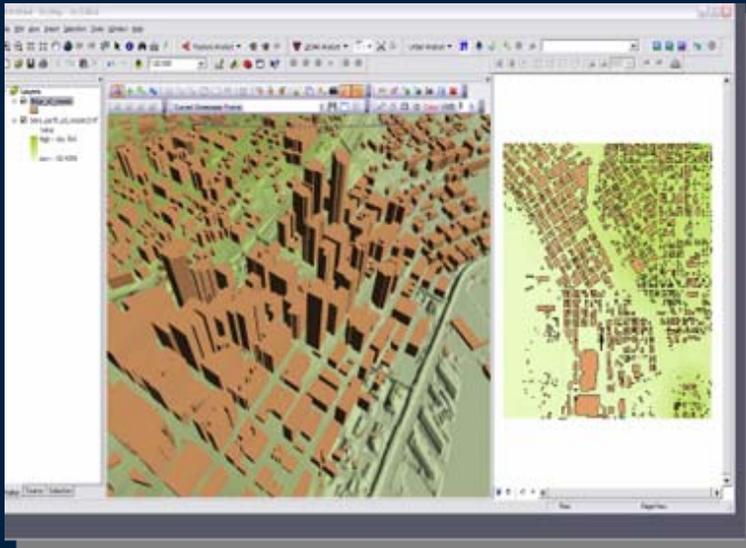


# Urban Analyst™ cont.

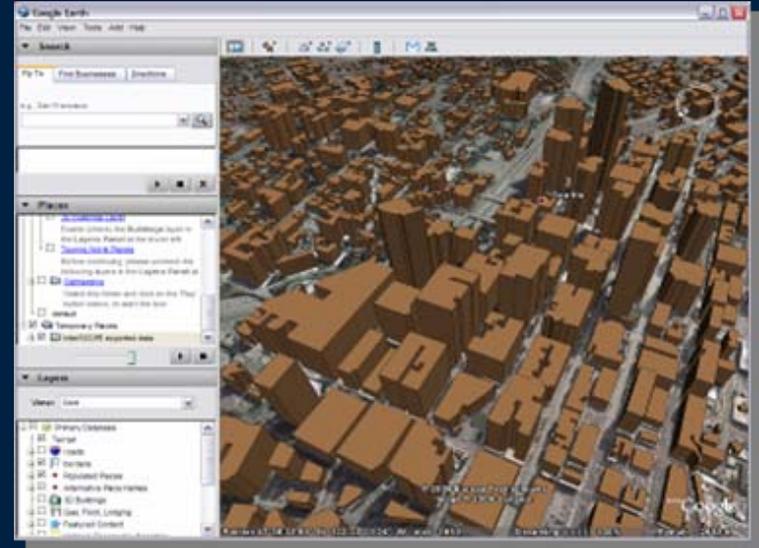


## *Publish*

- Annotation Tools for scene mark up
- Image Capture for presentations and reports
- Movie Capture for presentations and reports
- Export to KML
- Export high resolution Raster DEMs



ArcMap

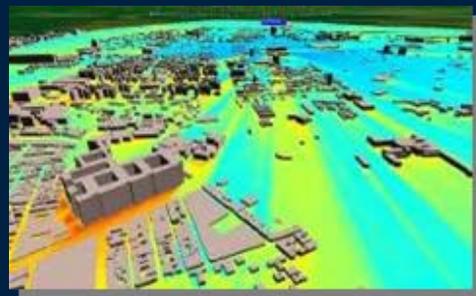


Google Earth

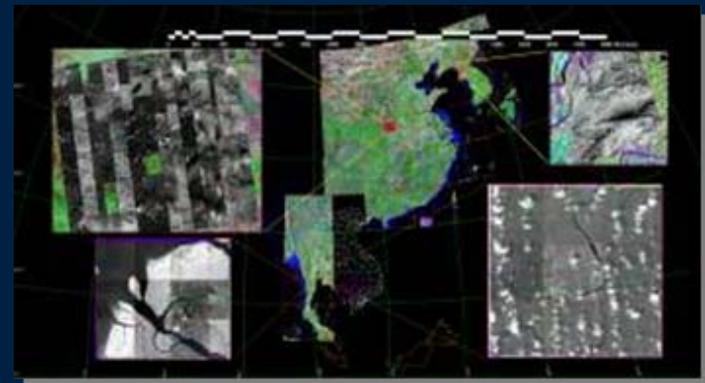
# Advanced Technology Initiatives



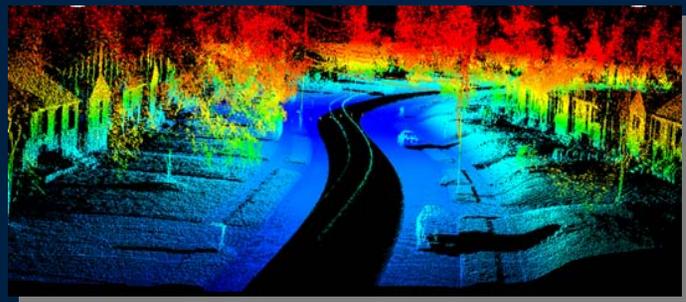
3D Exploitation



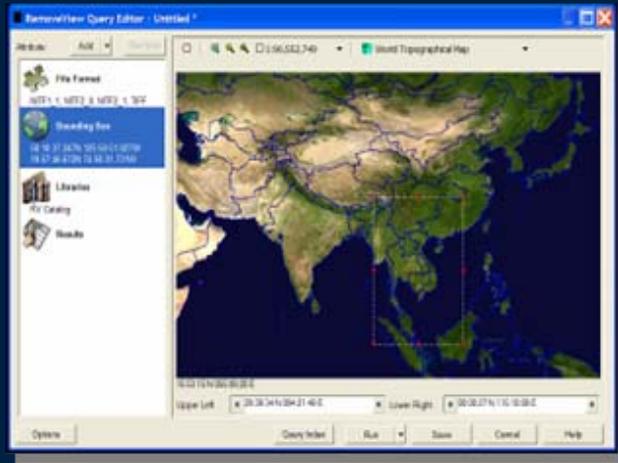
Multi-INT Exploitation



Large Scale Image and Raster Management



3D Feature Extraction



Enterprise Automation, Accessibility, and Collaboration



# Overwatch Solutions Are Client Tested

**Overwatch software resides on over **30,000+** workstations world wide.**

- **Federal**
- **State**
- **Local**
- **University**
- **Non-profits.**

## Sample of Government Clients:

- NGA
- OSM
- All US Armed Forces Branches
- NOAA
- USGS
- US Forest Service
- Dept. of Homeland Security
- BLM
- Nat'l Parks Service
- Environment Canada
- Parks Canada

## Sample of Commercial Clients:

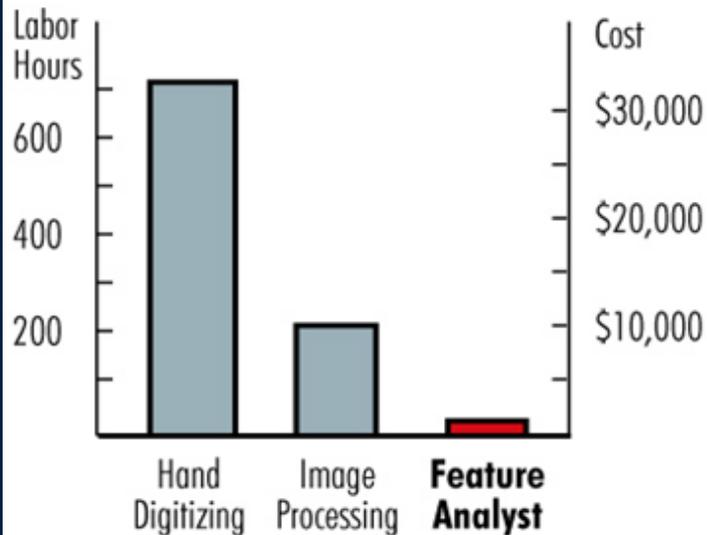
- Adams, Rehmann, Heggan, & Associates Inc.
- Aramco Services Co
- Digital Globe
- Bechtel
- GeoSyntec Consultants
- Greenhorne and O'Mara
- Lockheed Martin
- NavTech
- Raytheon
- Sanborn

# Overwatch Solutions Offer



## Example of Cost Savings of a Feature Extraction Project

Using 0.5 meter multispectral Imagery  
Collected over San Francisco, 1999



### Interoperability:

- Works right within ArcGIS, IMAGINE, GeoMedia and SOCET SET

### Accuracy:

- More accurate than manual
- More consistent than manual

### Automation:

- Reduce the labor costs by orders of magnitude
- Studies show 80-99% reduction in costs

### Tested:

- User-friendly, for any GIS technician
- Powerful, for any remote sensing expert

***Presenting An End to End Solution for  
Extraction, Editing, Attribution and  
Exploitation***



# QUESTIONS?



# **Contact Overwatch for more info**

For more information please contact:

Rebecca Holman  
rholman@vls-inc.com  
406-829-1384x225

**Overwatch Geospatial –  
Montana Operations  
P.O. Box 5012  
Missoula, MT 59806**

Free trial software is available at  
[www.FeatureAnalyst.com](http://www.FeatureAnalyst.com)