

# What's in an Image?

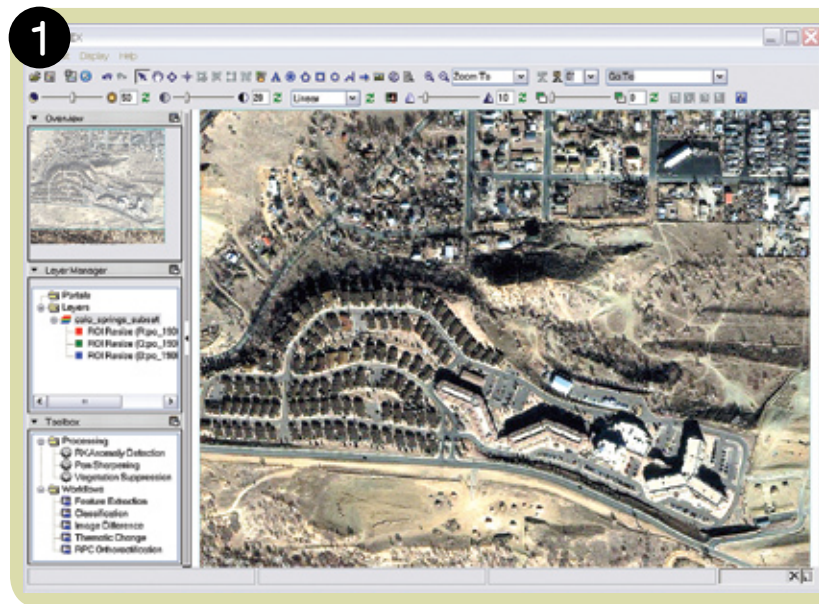
## Imagery Value and Perspectives

» **IMAGERY—PHOTOS TAKEN FROM SATELLITES AND** airplanes—is now ubiquitously available through a number of Internet, desktop, and mobile applications. As a result, imagery is becoming a defacto communication tool as it finds its way into all sorts of applications and reports, from navigation to title insurance to site selection to market research. Even for those who have not made a career of analyzing imagery to detect missile silos or national security threats, or of scientific research on planetary changes, there are purposes for integrating imagery into workflow.

According to Antoine de Chassy, President of Spot Image Corporation, the single most important reason satellite and aerial imagery are becoming relevant to businesses is that almost overnight, imagery has moved from an analog technology to digital media. Imagery as digital media changes everything. It is no longer just a static picture, but is now a digital platform for integration of data from real-time data sources such as sensors, social networks, business intelligence systems, and newsfeeds. Digital imagery creates a new dynamic information platform for improved decision making.

In the past, many people viewed imagery as a very expensive picture that required sophisticated software to process, was difficult to transfer, and was not relevant to traditional business thinking about sales, management, and operations, nor to traditional business communications about key performance indicators. (See related story on KPIs on page 24.) In addition, the government subsidization of satellites distorted the business model and value proposition of imagery outside of government agencies. Today imagery is an expected component of any product or service associated with location: Where am I? Where is something or someplace located? How do I get from A to B, and what is around or related to a particular location?

Easy transfer of imagery, easy integration and manipulation of imagery, and the mashup (overlying information



▲ **FIGURE 1.** These examples use IKONOS imagery of Colorado Springs for building extraction. The ENVI EX Feature Extraction technology was used to identify buildings in green overlaying the raw satellite image (left). Image courtesy of ITT VIS and IKONOS image courtesy of GeoEye.

from multiple sources onto an image, which renders it more intelligent) change the perception and value of what was once viewed as a static picture. With all this interactivity, imagery is now a productivity and communication platform and a social network platform where sensor information and user-generated content can be exchanged. Imagery is now the visual platform upon which people can exchange information.

Commercially financed satellites such as Spot-6 and -7 (planned for 2012 and 2013 respectively) and MDA's RapidEye (launched in fall 2008) will also force change in the way imagery is sold and packaged in the marketplace. A much richer range of ways in which businesses can consume imagery, including subscription services, will evolve. The value of imagery is no longer in the data; it is in the services, communications, and productivity that create a smart set of information for businesses.

By **Natasha Léger**

Editor, LBx Journal

# What are the most important things to know about imagery?

- ▶ Deriving value from an image requires the right image at the right time and the right resolution to meet business objectives. For example, a multi-billion-dollar green commercial real estate investment requires the most current high- and mid-resolution imagery to identify and model the impacts of the development.
- ▶ An image can appear either overwhelming or underwhelming, presenting either a very high level view of land use, or through image analysis a very granular view that

rendering 3D elevation models. Such applications include land development, transportation and corridor projects, flood plain mapping, utility and pipeline mapping projects, utility maintenance and compliance purposes, natural resource planning, and smart city planning. The use of Lidar for facilities monitoring and management, including security event planning, both internal and external imagery, is growing. Lidar is still an emerging technology, and its ability to do 3D

modeling is being explored in all sorts of applications, including entertainment, when the band Radiohead recorded their song, "House of Cards" as a music video only in Lidar. (You can find it on [www.youtube.com](http://www.youtube.com).) Companies offering Lidar include Merrick, 3001 (now Northrop Grumman), Sanborn, Woolpert, and others.

## 2. HIGH-RESOLUTION satellite and

aerial imagery includes sub-meter to 10-meter resolution. Aerial imagery can achieve 3-5 centimeter resolution. For example, insurance, real estate, location-based services, and engineering applications all require sub-meter resolution. High-resolution satellite imagery, such as that provided by GeoEye, DigitalGlobe and Spot Image (with Spot-5 and in early 2010, with Pleiades-1), is playing an increasing role in climate change analysis and carbon trading systems.

3. **MID-RESOLUTION** satellite imagery includes 20- to 30-meter resolution and is used for land use planning, geological mapping and vegetative analysis. Satellites

include Spot2, Spot-4, and the U.S. Government's Landsat.

4. Imagery can be acquired directly from these providers, through resellers, or bundled in software applications.
- ▶ Total cost of ownership should focus on the service, not on the data.

1. An imagery solution involves not only the data purchase but also the imagery analysis.

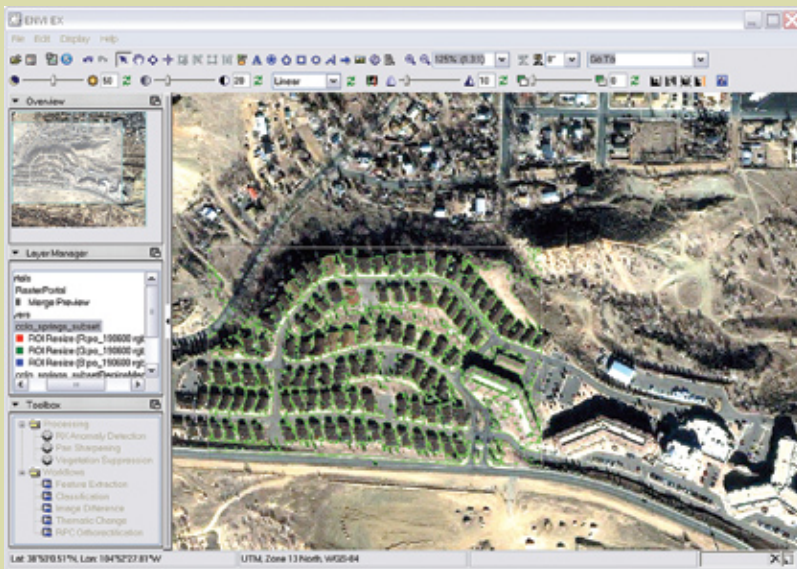
A. Data costs can be anywhere from 0-\$1 million, depending on what the needs are, while less than \$10,000 can start an imagery processing solution.

B. There is a difference between visualization of imagery and processing of imagery.

2. Visualization platforms, like the data costs, can range from 0-\$1 million depending on the needs of the enterprise. There are a number of visualization platforms from NASA WorldWind to Microsoft Bing and Google Earth to MapQuest and ESRI's ArcGIS Explorer. Plug-ins are available to extend the functionality of these various platforms.

A. Google Earth, with over 600 million downloads, has in many cases become the default visualization platform for many organizations, but Google Earth doesn't allow extraction of the imagery. Since Google Earth is not authorized to redistribute the imagery, it is possible to work only with what's available in the Google Earth window. However, there are plug-ins to extend Google Earth's functionality whereby Google Earth is being used to visualize imagery that has been separately purchased from imagery providers or authorized resellers.

3. Total cost of ownership may also include hardware, maintenance, and service personnel. These will all vary depending on how imagery is used and integrated within the organization.

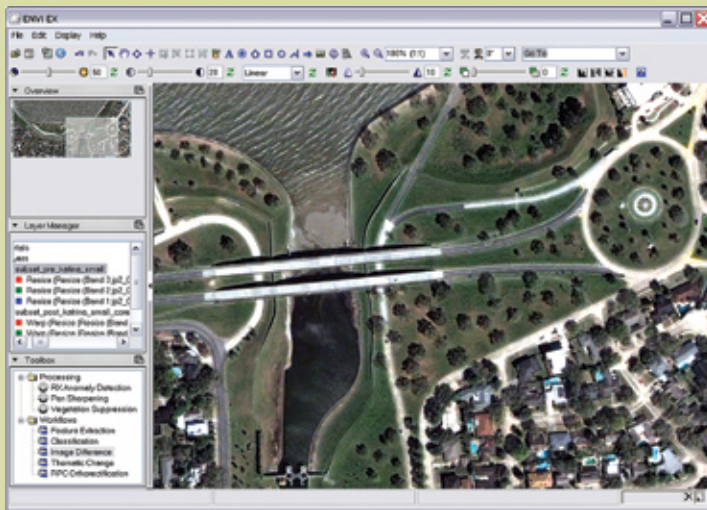


focuses on critical features – the pixels can be deconstructed or extracted to focus on those individual elements that are relevant to a particular issue.

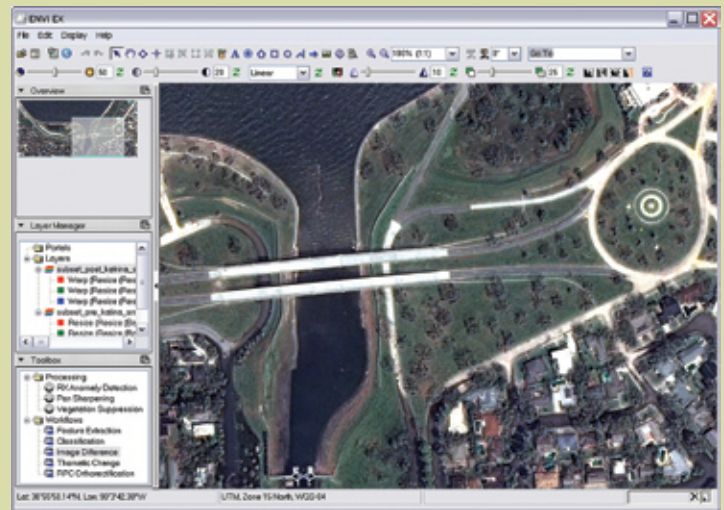
- ▶ Limitations on satellite imagery, such as cloud cover and tree canopy, may block views.
- ▶ Types of imagery include high-definition, high-resolution, and mid-resolution.

1. **HIGH DEFINITION:** Lidar is very high-resolution 3D imagery that collects over a million points of data, rendering an extremely rich and intelligent image that can allow for 360 views of a particular feature within an image. Lidar is traditionally used for landcover analysis required for mapping projects and





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We spoke with Antoine de Chassy, President of Spot Image Corporation; Pete McIntosh, Imagery Specialist and Technical Marketing Manager, ITT Visual Information Solutions; Mindy Brown, VP of Commercial Strategies; and Christian Dwyer, GM for MapQuest for some perspective on the role of imagery. With intelligent pixels, a range of applications from identification to extraction to photo imagination becomes possible; the real question on the type of business value that can be extracted from an image is a function of the business question one is trying to answer, or business problem one is trying to solve.

## Collective Views on the Value of Imagery

**TYPES OF INTELLIGENCE, INFORMATION, OR FEATURES THAT CAN BE EXTRACTED FROM AN IMAGE:** In general terms, anything that is two meters or more in size can be recognized, extracted and analyzed from imagery that is currently commercially available, according to McIntosh of ITT. The easiest types of objects to extract are roads, coastlines, large vehicles, homes, buildings, bodies of water, groups of people, structures, and natural features, such as trees and open space boundaries. Traditionally these extractions have been useful in military applications, such as identifying tanks, aircraft, and landing strips to determine military threats. However, imagery is being used increasingly for commercial purposes such as site selection, car navigation, digital advertising, health and safety, risk mitigation, or detection of building materials to determine risk of fire loss. (See our Risk Management article on page 20 for discussion of integration of GIS and imagery into catastrophic risk modeling.)

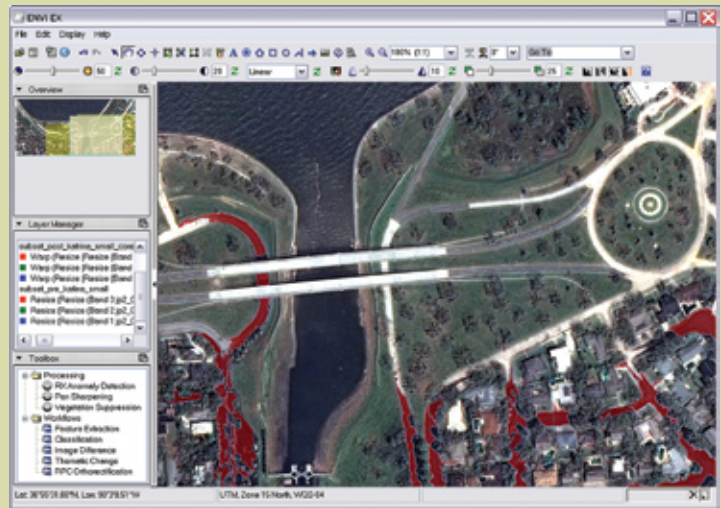
**CHANGE DETECTION:** Imagery is a great way to identify changes over time and implications for the surrounding area that are not readily apparent in tabular, graphic, and text reports such as commercial building development as illustrated in *Figure 1*. Changes to the landscape such as soil erosion, effects of pollution, and new construction, can provide important information for researchers, government agencies, and commercial businesses. See *Figure 2-4* for road damage detection after the Katrina hurricane in New Orleans. Imagery analysis goes beyond the merely visual difference between two images. It reveals what the eye alone cannot see and can extract measurements and metrics—this is the real difference between a static image and an intelligent image. An intelligent image has data and metrics attached to it that can then be mined.

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Antoine de Chassy

◀ **FIGURES 2-3.** Multispectral QuickBird imagery is used for change detection analysis in New Orleans pre (left)- and post-Katrina (middle). Courtesy of ITT VIS; Quickbird imagery courtesy of DigitalGlobe.

▶ **FIGURE 4.** Using ENVI EX, road damage can be identified in red (right). Image courtesy of ITT VIS.



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**RETAILERS:** Large retailers are constantly researching and tracking new site strategies. The density of residential housing around a potential new site is critical information. However, traditional data on residential housing, gathered by surveying and census data, are generally expensive and can be outdated very quickly in areas with rapid housing development. With the availability of high-resolution, high-quality satellite and aerial imagery, retailers can now easily update housing data. With new technology such as Feature Extraction from the ENVI product line of image analysis software from ITT, virtually any business professional with access to a geospatial image can identify and extract individual homes from an overall image of a geographic area. The software can identify objects or features in an image based on their shape, texture, and spectral attributes. By identifying buildings in an area, the number of residential dwellings in an area can easily be counted, comparison between two images taken years apart can calculate how many homes have been built over time, or a GIS or other location intelligence application can be updated automatically.

**AGRICULTURE:** Sensors reveal detailed information about the health of crops. For many years, farmers and agriculturists have used satellite, aerial, or terrestrial based imagery (data from space, a plane, or a sensor on the ground) to reveal detailed information about their crops. The resulting image can provide a wealth of information that could otherwise be obtained only by extensive field work. For example, multi-spectral imagery, which uses visible and infrared light, can be analyzed with software technology to indicate that a crop has low nitrogen levels and would need more fertilizer. Precision agriculture like this can save money and help guide a budgeting process for fertilizer expenditures and water usage.

**MARKETING AND SALES:** As location-based services evolve, imagery is playing a larger role in attracting customers. According to MapQuest GM Christian Dwyer, imagery acts as "ground truthing." It provides verification for what we believe to be true based on such things as road maps, directories, blueprints and engineering records. It therefore becomes a critical component of local search for retail establishments, and directions and navigation.

The ability to see where an establishment is located within context of other establishments and amenities within a neighborhood factors into attracting customers and driving revenues. Communications providers are increasingly relying on imagery to identify new market opportunities, which include identifying underserved areas, opportunity to offer competitive services, and identification of the need to upgrade network capacity based on new residential and commercial growth. ☒

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