Imaging NOTES

EARTH REMOTE SENSING FOR SECURITY ENERGY AND THE ENVIRONMENT

Summer 2008
Vol. 23 >> No. 2

The Politics of EO

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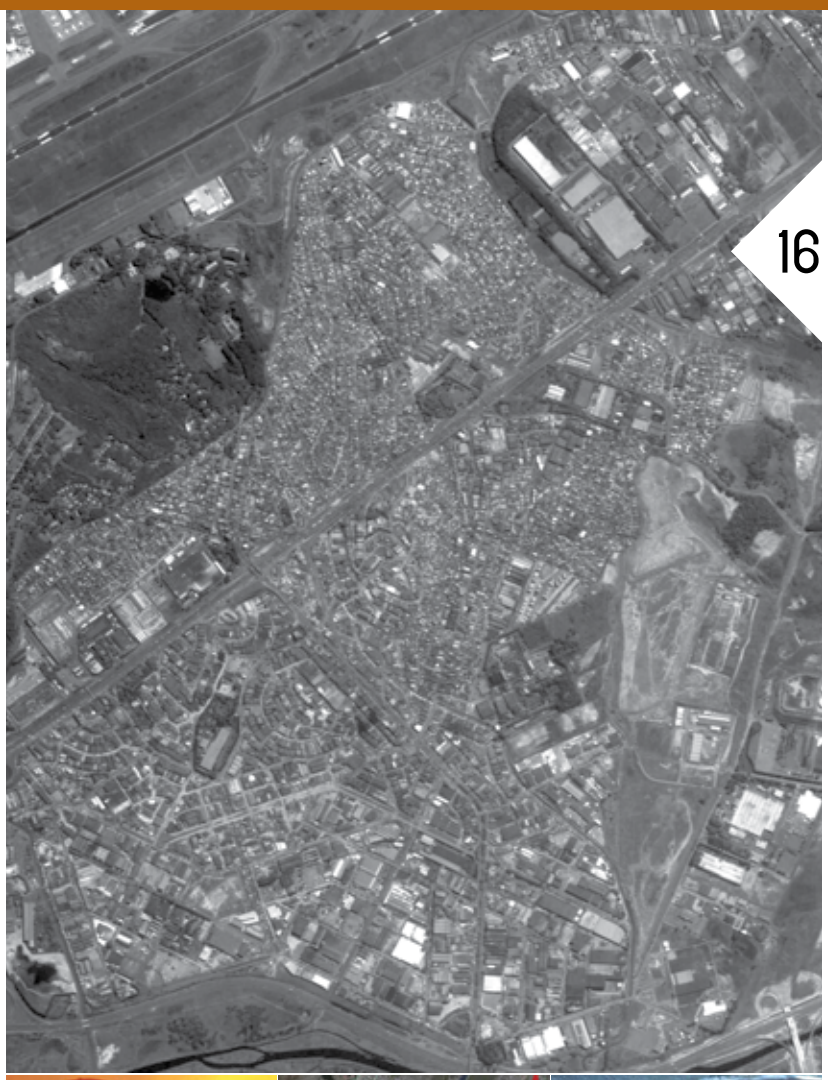
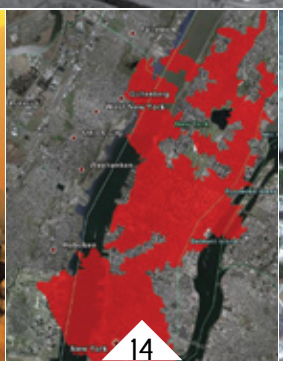
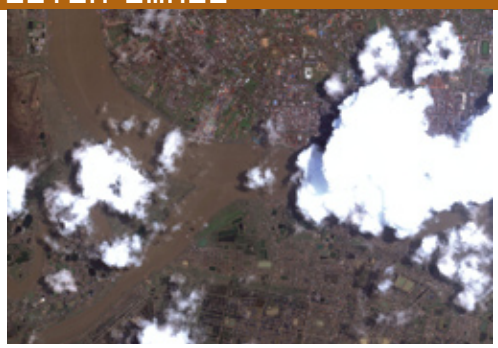




Rangoon, Myanmar

COVER IMAGE



The front cover of Imaging Notes features the 'before' image of the city of Rangoon (or Yangon), Myanmar (formerly Burma), prior to Cyclone Nargis, which hit the area on May 2, 2008. This 'before' image was captured by IKONOS on Nov. 27, 2007.

The back cover shows an extension of the same area, taken on May 7, 2008, where extensive damage and flooding occurred after Cyclone Nargis ravaged the area. Standing water has engulfed trees and made small tributaries into swollen rivers.

The images also appear on page 23, illustrating "Observing Earth in a Changing Political Climate," an article about the need to continue to fund Earth observations for disaster relief and many other applications.

This image was collected as part of the International Charter on Space and Major Disasters. The International Charter works to provide emergency response satellite data free of charge to those affected by disasters anywhere in the world; it is an operational initiative based on the use of satellite data for emergency response. The objectives of the charter are to strengthen international cooperation by opening membership to all governmental satellite operators around the world and to foster the development of a coordinated, global response to requests for assistance from rescue and relief organizations (www.disasterscharter.org).

This image was provided by GeoEye/CRISP-Singapore. ≪

Imaging NOTES

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OUR MISSION

Imaging Notes is the premier publication for commercial, government and academic remote sensing professionals around the world. It provides objective exclusive in-depth reporting that demonstrates how remote sensing technologies and spatial information illuminate the urgent interrelated issues of the environment, energy and security.

Imaging Notes is affiliated with the Alliance for Earth Observations, a program of The Institute for Global Environmental Strategies (www.strategies.org).

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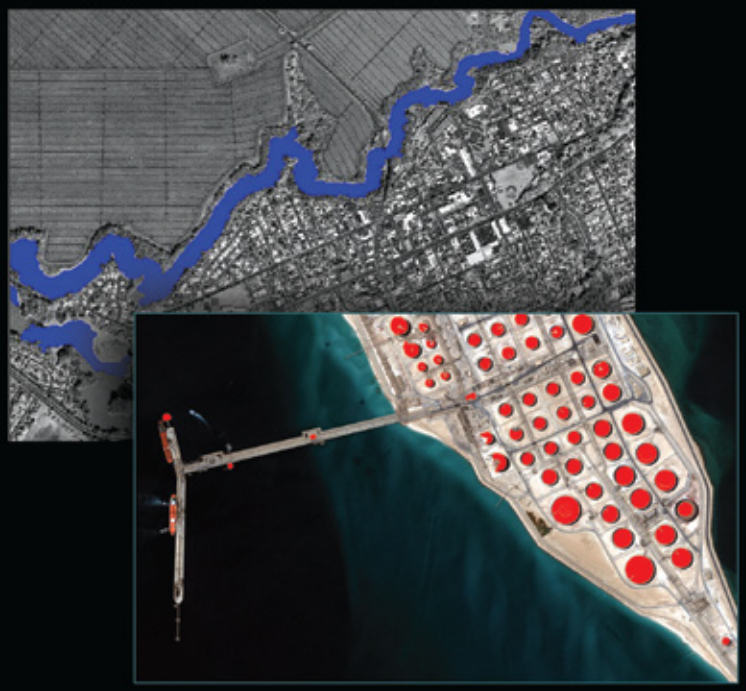

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Climate is a Security Threat

Dear Reader,

Geospatial technologies have been acknowledged in the past few years as instrumental in assessing climate change and environmental issues. Now, based on the release this spring of several major reports, we find that a strong and important link exists between climate and national security. As we reported in our April eNewsletter from the National Space Symposium, there is consensus that many of the effects of the changing climate–such as climate refugees, lack of fresh water and other resources, and disease–will destabilize not only the way of life for those in developing countries, but in the U.S. and other developed countries as well.

Ray Clark's Guest Editorial, "The Security Threat Requiring Rapid Response," points out that the U.S. Department of Defense has an opportunity to take the lead on addressing climate change, and the responsibility to do so as well. Rapid response is usually a term reserved for what is required after a disaster. Ray argues that the federal government must respond rapidly to the changing climate, as a matter of national security.

Dan Stillman from the Institute for Global Environmental Strategies brings us an update on NASA budgets and renewed support of Earth observations in this time of great need for continuity in data gathering.

Also in this issue, we report on the expanding partnership between China and Brazil with their CBERS satellite constellation, and on software innovations as companies expand and consolidate, offering better solutions in data integration for their customers.

"Many of the effects of the changing climate—such as climate refugees, lack of fresh water and other resources, and disease—will destabilize not only the way of life for those in developing countries, but in the U.S. and other developed countries as well."

In *Next-Gen Mapping*, columnists Natasha Léger and Craig Bachmann discuss a new offering of geospatial companies to their customers: a return on their investment! This key issue of how to "monetize the data" will be addressed in upcoming issues as well.

In fact, moving forward, we will be more focused on the business side of geospatial technologies and location-based services. You'll see more articles like those found in *Next-Gen Mapping* throughout the publication. It is the responsibility of media to change with the times and the industries that they cover, so we'll be making some changes to the publication.

In addition to becoming more focused editorially on what readers need to know, we will be doing many things the same. We have always been committed to editorial integrity, which means that we publish articles based on what's most important for our readers, not for the benefit of advertisers. This way, our readers know that they can trust what they read; it's not "sponsored."

This integrity combined with our in-depth reporting style and the timeliness of our articles has won us several media coups. *Imaging Notes* was credited on the front page of *The Washington Post* when we published the first images of China's only nuclear submarine. We scooped *The New York Times* last fall when we published a preview of a report written for the U.S. Air Force about the 2006 war between Israel and Hizbollah that took place in Lebanon. We will continue to bring you timely articles that are relevant to your work.

Please glance through the names of those industry leaders serving on our Editorial Advisory Board on page 4. Let them know, when you see them, that you appreciate their involvement in the geospatial industry's media. You deserve the best information that we can provide, so their service to you and to us is important. ≪

– Myrna James Yoo
Publisher/Managing Editor

A Pirate's Point of View

LOCATION-BASED DATA: COST, REVENUE DRIVER OR TABLE STAKES?

Treasure maps were the prized strategic assets of pirates, who fought fiercely over crudely drawn maps with directions to where the treasure was buried. Although the X was clearly marked, rarely did the map provide precise directions to the gold. It took luck, timing, perseverance, and the occasional skullduggery.

Mapping has become quite sophisticated since the days of high seas piracy. Computerized mapping in particular has enabled an unprecedented documentation of the world. When it comes to searching for new fortunes in the world of modern capitalism, a "treasure map" may offer more clues than charts, excel spreadsheets, business intelligence reports, and intricate layers of geographical data.

CRAIG BACHMANN & NATASHA LÉGER
are partners in ITF Advisors, LLC, an independent consulting firm with a focus on next-generation strategy and on translating the increasingly complex new media business environment's impact on business models, markets and users.

THE DATA QUEST

Many organizations have become paralyzed by bureaucratic inertia. Rigid processes, procedures, financial metrics and IT structures dictate decision making. As storage costs have declined, data warehouses have become more affordable. Managers now find themselves increasingly overwhelmed by tsunamis of data—both internal and external data.

In the information age, market research companies, the media, and data companies feel compelled to push more and more data to people. With the ability to crunch massive volumes of data and to splice and dice consumer behavior and transactions, companies feel compelled to acquire more and more data in their quest for competitive advantage. As data-driven management strategies infiltrate the executive suite, managers are trying to balance information overload with the opportunity finally, after twenty years of pouring millions of dollars into expensive IT systems, to monetize the data that has been so costly to acquire, store, and manage.

AS DATA-DRIVEN MANAGEMENT STRATEGIES INFILTRATE THE EXECUTIVE SUITE, MANAGERS ARE TRYING TO BALANCE INFORMATION OVERLOAD WITH THE OPPORTUNITY FINALLY, AFTER TWENTY YEARS OF POURING MILLIONS OF DOLLARS INTO EXPENSIVE IT SYSTEMS, TO MONETIZE THE DATA THAT HAS BEEN SO COSTLY TO ACQUIRE, STORE, AND MANAGE.

Maps that tell stories of the past, present, and future are the most effective filters for understanding complex information. It's one thing to know (from columns and tables) that you have 7.5 million customers across the U.S., but another thing to drive that point by seeing it on a map. Companies like Netflix, with geographically dispersed customers operating in a hypercompetitive landscape, recognize that location data projected on a map increases the speed of insight and reduces the time required for action.

WHERE'S THE ROI?

"Most maps [are] created for an intended purpose and an intended audience. They include the details that are, or were, deemed significant and omit the ones that are, or were, not. No map has ever, nor can ever show 'everything'," states Lez Smart in *Maps that Made History*. This is where IT may have taken the mapping business astray—as it relates to the enterprise market. Indexing geographic information (lat/long data) has been traditionally costly due to data acquisition, maintenance, and integration.

In particular, it has been presumed that with more data catalogued, virtually any business question could be answered as it relates to location. The costs of doing so are passed on to the customer. This

PHOTOGRAPH BY ANDREW STERNARD

is an important and noble exercise when funding is not an issue and when the goal is research, health, safety, and security-related analysis. Infrastructure companies such as utilities and telecommunications providers with regulatory mandates have justified the costs in the past. However, in today's cost-cutting environment, passing these costs to the customer is no longer acceptable.

Although most companies recognize that 80% of their business intelligence data is location oriented, they have yet to find a way to leverage that data in a systematic way. ERDAS CEO Bob Morris acknowledges, "The business world is driven by ROI, and traditional geospatial technologies have been limited to departmental deployments within an organization." Instead of dealing with IT and all the costs associated with acquiring, maintaining, and integrating the location data, many analysts and managers are experimenting with data and services that are freely available on the Internet.

Right now, "free" seems to offer a pretty good ROI. Morris believes, "By deploying geospatial technologies within a Service Oriented Architecture (SOA), the utilization of geospatial business systems will increase and will also drive a higher ROI for our customers." This ROI dilemma constantly reminds us that enterprises do not necessarily understand how to approach mapping, spatial imagery and location data as a systemic strategic asset. For business to leverage location, a new approach to cost, revenue or the perception of value is needed.

For business to leverage location, a new approach to cost, revenue or the perception of value is needed.

X MARKS THE SPOT

Maps have served many different purposes over the years, from exploration to navigation to documentation to

visualization, with varying levels of detail and sophistication. However, pirate treasure maps, with their crude sophistication and simple objective, are exactly what businesses need to provide context to an increasingly complicated business environment. Where's the gold? How do we find it? In the days of high seas piracy, a big "X" on a map meant gold. In today's modern economy, the quest for new fortunes may take several forms as companies and financiers implement various performance scorecards. Nonetheless, if "X marked the spot" for the location of guaranteed revenue, customers, or other ROI, all organizations and individuals would be in the mapping business—or at least would be loyal mapping customers.

FIGURE 1
A Microsoft Virtual Earth aerial image of a development Vibrant Solar is evaluating for optimum solar access. X marks the southern facing rooftops.

IF LOCATION DATA ARE TABLE STAKES—NO DIFFERENT THAN, FOR EXAMPLE, ACCOUNTING SOFTWARE OR A POINT OF SALE SYSTEM—THEN THEY'RE NO LONGER A DISCRETIONARY EXPENSE THAT MERITS THE SAME ROI ANALYSIS.

DATA: COST, REVENUE, OR TABLE STAKES?

Two key trends are changing the perceived value and cost of location data. First, companies like Netflix, Amazon, Ebay, Harrah's Casino, and Disney recognize that data are now part of a basic business infrastructure that needs to be thought of as core and centric to doing business. They claim data are the table stakes of doing business today. If 80% of data is location-oriented, then are location data also now "table stakes"? Is it just another part of the tool set that is needed to play the game? If they're table stakes—no different than, for example, accounting software or a point of sale system—then they're no longer a discretionary expense that merits the same ROI analysis.

Second, the perception of the "cost" of spatial imagery and location data is changing, but not because it appears "free" on the Internet. (What's available for free on the Internet are map viewers, imagery and geocoding services. These consumer tools are not designed to handle, in a secure fashion, large volumes of enterprise data, and they most certainly do not address the costly issue of data acquisition, maintenance and integration. In addition, the timeliness, source, and accuracy of the data are not always clear.) Instead, the value and cost of location data are changing because the data can be monetized.

Data are generally monetized when companies derive revenue streams from sale of the data. The sale of customer lists has been a longstanding practice in profiting from data. However, when a "long tail" of fragmented customers are nested in what seems like a "find Waldo with $" exercise, location data can create new value for the company. (See "Monetizing the Spatial Mashup," Summer 2007.) Imagery and location data on their own are costs. When combined with other business intelligence information such as internal sales activity, market dynamics, and demographics, companies can suddenly see new opportunities for revenue (otherwise called data mining, revenue mining or revenue mapping).

The objective of a business is to create a customer. Once a customer is created, value is created and investments are monetized. In the past, direct mail, blanket advertising, nationwide marketing and direct sales provided brand recognition, but not a verifiable customer. Adding a mapping component to the sales and marketing budget appeared to be simply adding cost. Where was the treasure?

Robert Quist, solar consultant for Vibrant Solar, a solar engineering and consulting company, and Xcel Energy's implementation contractor for their

Google Maps, MyLoki, TomTom, Magellan, and other location-based services are demonstrating that individuals are also finding that treasure maps are now part of contemporary lifestyle:
- **Where's the party?**
- **Where's the poisonous shrub?**
- **Where are the kids?**

Solar Rewards program, uses imagery from Microsoft Live Search and Google Earth to speed up the qualifying process when customers call inquiring about solar options. "What I'm looking for in the imagery is an idea of roof slopes, which is key to determining solar access. The image resolution isn't perfect and it doesn't give me the ability to measure the slope, but it's enough to give me a rough idea of the opportunity, which maximizes the efficiency of sales calls and eliminates the need for unnecessary trips—which is particularly important with gas prices soaring," said Quist. (See ***Figure 1***.)

To better maximize the inbound sales qualification process, what Quist would like to have is the ability to measure the slope and better resolution. However, what Quist would find to be particularly valuable is an image-based, aerial map that points him to a qualified customer lead by showing rooftop slopes that would work for solar power. "That would be worth shifting marketing dollars from direct mail to a subscription and data mining service," said Quist. Location-based business intelligence is the next-gen treasure map!

NEXT-GENERATION TREASURE MAP

Location data is the bridge between top-line revenue development and bottom-line cost management. Small companies are most adept at the balance of costs and revenue. Large companies, in contrast, have a number of business units, and product and service lines with their own P&L, which makes it increasingly difficult to balance. (Internal turf wars don't help, either.)

Information technology has been used over the last twenty years to manage costs—ERP systems and cost accounting look for the cost of inventory, supply chain management, and human resources, for example—whereas topline revenue growth is generally a function of marketing and sales, with marketing relying on market research and demographics to target customers, and sales being incentive driven. Location-based business intelligence combines top-line revenue issues with bottom-line cost issues to deliver a context-aware business map—a next-generation treasure map for creating customers, growing businesses, and developing value.

There are exciting new ways to put location data into operation, but first it has to be seen as a search question, not a bottom-up mapping exercise. One needs to demand, with the pirates of old, "ARGGG…I need a map where X marks the spot!" «

PHOTOGRAPH BY ANDREW STERNARD

Remote Sensing & Natural Disasters

SOME IMPORTANT NEEDS REMAIN

POLICY WATCH

Images from satellites and the software used to analyze them have added an important set of tools to responders' ability to provide help and succor to victims of natural disasters. The earthquake that rocked Sichuan Province in China this May and the earlier tropical cyclone Nargis, which struck Burma's coastal regions, illustrated once again the power of this imagery to reveal the extent of damage. Nevertheless, much work still needs to be done to use the imagery effectively.

Immediately following the 7.9 Sichuan primary shock in May, Chinese officials activated the International Charter on Space and Major Disasters, requesting earthquake data from other members of the Charter to assist them in assessing the geographical extent of damage and to guide them toward areas of greatest concern. China's National Space Administration joined the Charter in 2007, after being the recipient of satellite-derived information during an earlier flooding disaster and seeing how useful it was.

In an ironic twist, the island of Taiwan, which the Peoples Republic of China claims as its own, even provided some of the first satellite data to the mainland. Taiwan operates FORMOSAT, a very capable multispectral satellite, which senses details as small as two meters in black and white and eight meters in color. These data were used to monitor possible flooding from lakes formed when massive landslides blocked some of the rivers in the Sichuan region following the earthquake.

Yet according to many who have assisted in the process of placing imagery into the hands of the disaster responders, the process of moving from raw satellite data to usable information in the hands of first responders is slow and cumbersome, despite the ready availability of satellite imagery from a number of sources. Countries generally lack the necessary institutional arrangements, interpretive capacity, and distribution mechanisms making it possible for the needed information to reach responders quickly and in a form that they can use effectively.

RAY A. WILLIAMSON, PHD,
is editor of *Imaging Notes* and Executive Director of the Secure World Foundation, an organization devoted to the promotion of cooperative approaches to space security (http://www.SecureWorldFoundation.org).

Even in the United States, with its robust commercial and governmental capacity for collecting and distributing imagery from satellite and aircraft platforms, the government is not fully prepared to distribute data or processed imagery to affected communities. Hurricanes Katrina and Rita proved that.

Shortly after the storms had struck, television and print media were full of overhead pictures of the disaster, some acquired by satellite, many more by aircraft. However, people in the local community charged with responding in times of natural disasters had a hard time getting what they needed to save lives and assess the extent of damage. Power lines were down, cell phones did not work, and in most cases, the only way to receive the necessary digital imagery was by hand delivery.

Yet, even if the data were delivered to offices that had the necessary digital tools to process them, they were seldom in a useable format, and they might also lack the necessary geo-registration to link them to the areas they imaged. As a result, the utility of the imagery was severely blunted.

In remote areas with few of the modern computer tools prevalent in the United States, the problem is even more serious, because first responders there generally need very simple paper maps with captions in the local language. Besides, computers are difficult to use in the field where adequate sources of electricity or protection from the elements seldom exist.

The International Charter—which was started in 1999 to provide satellite-derived information to States affected by severe natural disasters—has done a commendable job in tasking partner countries to provide satellite data to countries in need. However, the Charter still lacks the means and mechanisms to assure timely delivery of useful information to the affected areas. The supply chain is generally long and complex, and because disasters often strike with limited warning, delivering needed information quickly enough to disaster sites or even to crews heading into them is a huge logistical problem.

The international community needs to spend the money and time to develop ways to collect and deliver the needed information to first responders. This part of the job is not as sexy as collecting data from space, but is just as important in making sure that the many operating Earth observing satel-

lites in the world can be used effectively to reduce the loss of human life.

Despite the growing pains we suffer in using satellite data to improve human security, we have become more aware than ever before of the direct human impacts of natural disasters. Increasingly, the media seek satellite imagery to illustrate the scope of these calamitous events and their effects on the local populations. High-resolution images, especially, have provided details that add important depth to the coverage.

In 1984, I led a study for the Congressional Office of Technology Assessment entitled "Newsgathering from Space," in which we explored the utility of satellite imagery to illustrate and lend greater depth to news coverage. As it turned out we were a few years ahead of our time. Imagery then was expensive and lacked sufficient resolution for the sort of visual appeal needed for most readers or TV viewers. Nevertheless, proponents of using satellite imagery in the media pressed on, using those images wherever possible. As satellite images became sharper and the media learned to be more effective in using them, they became important components of news coverage.

Since 1984, I have observed a steady increase in the use of satellite imagery in the media where details of the geographical context of the event can enhance understanding. I would argue that the public's appreciation of the power of imagery from satellites to inform understanding derives first from the heartbreaking coverage of hurricanes Katrina and Rita, and of course from the aftermath when property owners, friends and relatives began searching the Internet for details on the conditions of their loved ones, homes and businesses from their refuges far away from the damaged areas. Many of these pictures, collected either by satellite or by various aircraft, were only a few hours or days old.

Private industry has made significant contributions to vastly expanded awareness of satellite imagery including Google Earth, Microsoft Virtual Earth, and others. These powerful platforms for information about the Earth's surface have made it possible for millions of people around the world to get in touch with their surroundings better than ever before. A nonprofit organization called InSTEDD (www.instedd.org) has been bridging the gap between raw data and useful data following the Myanmar cyclone and China earthquake in May. They are currently developing a free, open source software and services platform for early detection and more effective response to human-itarian crises and emerging infectious diseases. These companies have made the world much more transparent than ever before and created expectations that we will use even better the information that satellite imagery can provide to meet the enormous challenges posed by the effects of natural disasters. ≪

JIANGJIANG RIVER, CHINA
FLOODING AFTER EARTHQUAKE

Following the May 12, 2008 earthquake in China, landslides blocked the Jiangjiang River, creating swollen reservoirs that threatened to break and flood catastrophically. The largest of these lakes, Tangjiashan Lake, threatened roughly 1.3 million people.

On June 10, 2008, Chinese authorities announced that the landslide that created Tangjiashan Lake had been successfully breached, and the lake had safely drained. These natural-color images show changes in the Jiangjiang River—downstream from the lake.

The 'before' image from June 8, 2008, shows the apparently slow-moving river, hampered by landslides both up- and downstream (river direction is from left to right).

The image on the right, from June 10, 2008, shows a swollen, faster-flowing river after the massive landslide upstream was breached. Compared to the image taken two days earlier, the river is wider, and it has submerged some land features along its banks. Its tan hue indicates that it carries a considerable amount of sediment.

Draining the lake sent floodwaters coursing into the city of Beichuan, which had been home to some 22,000 people before the earthquake struck. Having already experienced massive damages from the quake, the city was evacuated before authorities drained the lake on June 10.

As of June 10, 2008, more than 69,000 people had died in the Sichuan earthquake, and more than 17,000 remained missing.

Credit: Taiwan's Formosat-2 image, Dr. Cheng-Chien Liu, National Cheng-Kung University, and Dr. An-Ming Wu, National Space Organization, Taiwan. Caption by Michon Scott.

Appalachian Voices and Satellite Eyes:

WINNING TOOLS FOR SOCIAL-ENVIRONMENTAL JUSTICE IN THE ENERGY WAR

EARTH SCOPE

If you aren't tuned in to the spectacular mass decapitation of 470 summits along the Appalachian Mountains in West Virginia, Virginia, Tennessee, and Kentucky, you are really missing out on one of the most dramatic changes in the American landscape ***(See Figure 1)***. The coal industry has determined that this action is necessary to access the underlying coal.

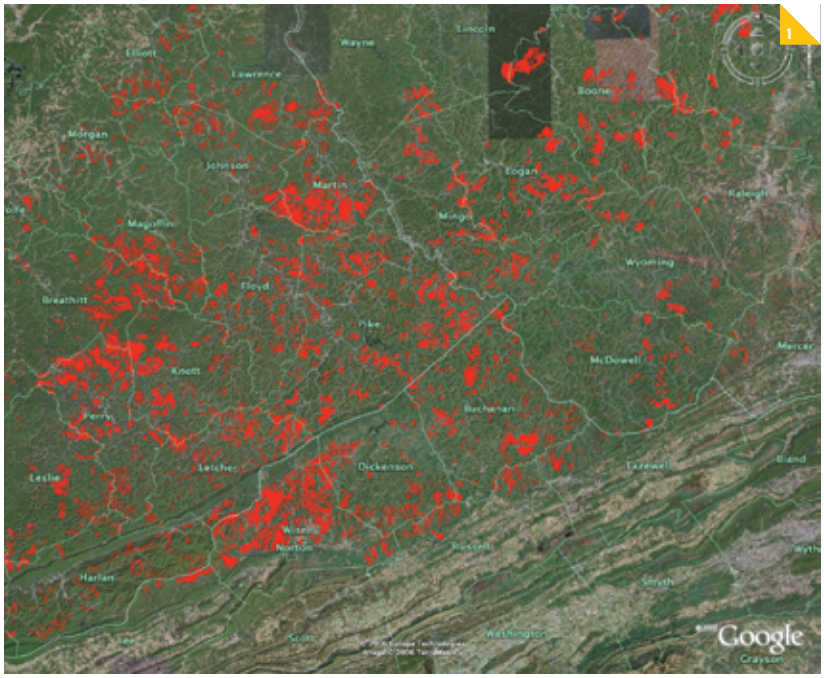
Unfortunately, accompanying this shearing off of the rough mountainous topography are the fantastic losses of endemic and remnant ecosystems that have survived along these rugged terrains since long before the arrival of European settlers. And to add further injury to insult and injury, the mountain top mass is shoveled into the mountain drainage ravines and stream beds. Since 1985, according to scientists investigating this social-ecological blitzkrieg, 1200 miles of streams have been irreparably harmed, inflicting excessive pollution from waterborne toxins impacting both human and environmental health (EPA, 2003).

Not since Manhattan was paved over to create New York City has an American landscape shifted so radically, but this devastation has occurred in a much shorter period of time. The image of a single mountain top removal area at the West Virginia Hobet Mine Complex transposed as a red overlay over N.Y.C. provides a hint at the aerial magnitude of the coal industries' ecological footprint ***(See Figure 2)***.

A CRY IN THE WILDERNESS

Appalachian Voices (www.appvoices.org) is an organization whose members are crying in the wilderness – real Americans with real concerns about the rampant destruction by the coal industry of their treasured natural resources and their impacted communities. This David-versus-Goliath challenge has been blessed with the advent of remote sensing and its prowess on the Internet with Google Earth visualization platforms, where it is a layer within Global Awareness on all versions of Google Earth. The sling that is rocking the coal industry is the audacity of the puny locals to use satellite imagery of the landscape desecration to stir up the affected population.

"In the beginning, we used to take people up in airplanes to show them what is going on just over the next ridge," says Mary Anne Hitt, Appalachian Voices founder. "People were shocked at the magnitude. But now, we simply use satellites, remote sensing, and virtual globes to get the message out and let our neighbors view these ravaged mountains. The proof is in the image. A 3-D view has really transformed this issue and that wakes people right up. This is one of the most powerful tools ever for our effort." This visualized villainy of the Appalachian landscape has raised a clarion call to action as area residents see one mountain top after another sliced off to quench the country's insatiable appetite for coal in the genera-



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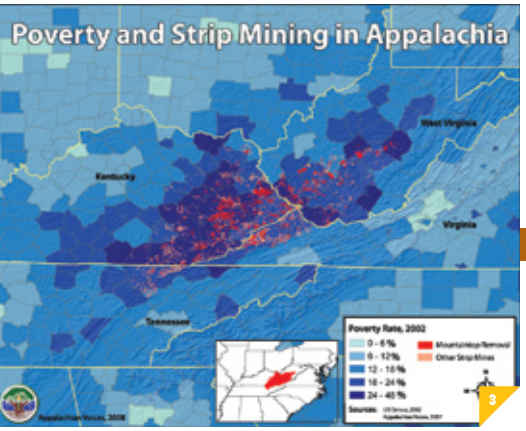
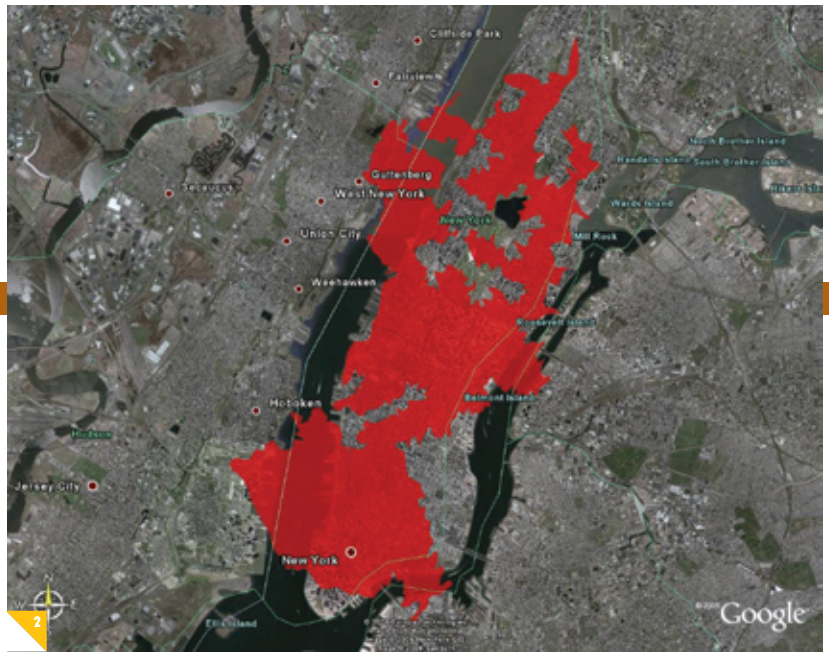
is President of the International Centre for Remote Sensing Education. He has been director of United Nations Environment Programme's Division of Early Warning and Assessment (Nairobi, Kenya) and national program manager for NASA's Digital Earth (Washington, D.C.). He is editor of *The History of Geographic Information Systems*, 1998, Prentice Hall. Dr. Foresman was the Director-General for the 5th International Symposium on Digital Earth (www.isde5.org) and is author of the children's book, *The Last Little Polar Bear: A Global Change Adventure Story.*





tion of electricity. Appalachian Voices and increasing numbers of collaborating groups and individuals have banded together to find solace and strength in their common cause for sanity while working to define a sustainable path for the future.

MAKING THE CONNECTIONS

Environmental justice and a host of social-economic-environmental issues are intertwined with the Mountain-Top Removal (MTR) saga. When we turn on the lights in McLean, Virginia, we are supporting the coal industry pipeline and providing the finances for MTR. "We show people how they are connected to MTR," explains Mary Anne Hitt. "Using the virtual globe technologies, we can show the connection of mining operations to the delivery of electricity into people's homes." And assessing the links to social-economics for these areas being bulldozed over is another requirement to ensure environmental justice to the poorest of our citizens ***(See Figure 3)***.

The energy deciders held secret meetings in the White House from 2001 and launched a new set of liberal policies for MTR. Whether they will ever have to explain their actions to the citizens of ravaged landscapes is a political question (Union of Concerned Scientists, 2008). But it is increasingly important that all citizens become educated as to the direct and indirect impacts that MTR is having throughout the Appalachians. It is everyone's business to become concerned with the connections we all have to the policies and lifestyles that result in the horrific desecration of our precious natural resources.

REMOTE SENSING CONTRIBUTIONS

Appalachian Voices does not have a staff of scientists with expertise in remote sensing, landscape ecology, or other critical disciplines that are needed in the MTR drama. What better class project or Master's thesis could there be than to focus on one of the many areas that have been destroyed, or better yet, to pre-position the imagery and environmental analysis to head off further losses? Hitt points out, "We are going to be doing a lot of looking at mountains that are standing but threatened. We need modelers to help us look at the spread of MTR and modelers to study the extent of pollution along rivers and communities. We are working with Sky Truth and would certainly welcome help from the remote sensing community."

John Amos' team at Sky Truth (www.skytruth.org), led by Dr. David J. Campagna (Adjunct Professor in West Virginia University's Remote Sensing Lab in the Department of Geology and Geography), has been a pioneering partner in helping Hitt and her colleagues assess and communicate the disturbing images of mountain destruction. "We are working to determine and map the areas most likely to be mined in the near future," explains Amos. "We are launching the Web-based Adopt-A-Mountain tool to enable average citizens to help us with ground-truth and field verification prior to the destruction," he adds, "and are looking for talented GIS and remote sensing professionals."

It would appear that these true heroes of America's landscape could use a lot of help. It seems patently unfair to place the continued battle against MTR on their shoulders alone. I wonder what our talented and capable remote sensing community can do to help this chorus of Appalachian Voices. ⁂

FIGURE 1
Visualization from Google Earth showing mountain tops that have been removed for mining in the Appalachian Mountains.

FIGURE 2
This red area is the actual size of the Hobet Mine Complex, overlaid on a satellite image of New York City to show the magnitude.

FIGURE 3
This diagram shows the clear link between poverty and strip mining in the area.

REFERENCES

EPA. 2003. **Draft Programmatic Environmental Impact Statement on Mountaintop Mining.** *III.K-47. May 2003.*

Union of Concerned Scientists. 2008. **Mining Agency Buries Streams and Science.** *http://www.ucsusa.org/scientific_integrity/interference/mountaintop-mining.html*

CBERS

REMOTE SENSING COOPERATION BETWEEN BRAZIL AND CHINA

Remote sensing is a continuously evolving process. Technology has made the satellite images available to everyone, not only to specialized people. Thus, we are beginning a real transformation of remote sensing all over the world. Many new applications and uses of satellite images are expected to appear as remote sensing becomes more and more popular.

In the beginning, satellite availability was restricted to a few countries. The capabilities and characteristics of the payloads were not very large. Currently, spatial resolutions are very diverse, from a few centimeters to hundreds or thousands of meters; swaths are as narrow as a few kilometers to as wide as two thousand kilometers. There are missions with only one instrument, and missions with various instruments. This diversity of resolutions is important for users, as

« FIGURE 1

This image of Brasilia, the capital of Brazil, with its airplane shape surrounded by Paranoa Lake, was taken with the High Resolution Camera (2.7 meters) onboard CBERS-2B, which was launched in September, 2007. The image was taken on October 15, 2007.

» FIGURE 2

Field campaign for CCD/CBERS calibration.

they can choose the best combination of sensors, satellites, and data policies to fit their needs. At the same time, more and more countries are becoming part of the club of satellite owners.

Brazil was one of the first countries to build and operate a ground station to receive Landsat-1 data back in 1973. Since then, remote sensing has become strong there, counting on the support of educational programs at various levels, including graduate courses at masters and doctoral levels. Based on these foundations, a number of remote sensing research and application programs were developed.

As Brazil is large geographically—more than 8.5 million km^2—and has high biodiversity, special ecosystems such as the Amazonian and Pantanal regions, an ever-growing agriculture, a fast-changing land use and land cover, and a long coastline, it is especially suited for space-based remote sensing developments. Thus, it was natural that Brazil would envisage its own remote sensing satellite development.

CBERS: CHINA-BRAZIL EARTH RESOURCES SATELLITE

At the end of the 1980's, Brazil began the development of a civilian remote sensing satellite program with China. This cooperation is now 20 years old and has launched three satellites successfully. It was one of the first programs in the world involving two countries under development striving to build and launch a satellite – an effort that brings difficult technological challenges. To be successful, the cooperative effort had to overcome many obstacles. The first one was the language; since the two countries have languages that are very different, a third one had to be chosen to work as a common language. The cultures are very different also, and adaptations from both sides had to be done so that both teams could work together. Many other obstacles had to be overcome as the project evolved.

The initial signed agreement was for the development and launch of two remote sensing satellites. In October 1999, the first satellite, CBERS-1, was launched from Xi'An (a Chinese launching base), and was carried by Long March-IV launch vehicle. The second CBERS was launched four years later, in October 2003. In 2002,

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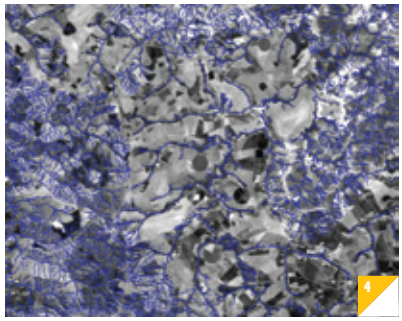


FIGURE 3
Number of CCD/CBERS-2 images requested in just one month. Each star indicates one path/row requested at least one time.

FIGURE 4
CCD/CBERS stereoscopic data for feature extraction.

FIGURE 5
CCD/CBERS image helps Brazilian fiscal agency to apply tax enforcement law.

before the launching of CBERS-2, a new agreement was signed for the continuity of the CBERS mission, which included two new remote sensing satellites, with new characteristics and payloads. However, as CBERS-3 would be launched only around a 2010 time frame, after the de-commissioning of CBERS-2, both countries decided to sign a third agreement in 2004, for the development of CBERS2B, very similar to CBERS-1 and -2, using as much as possible engineering parts from the first two satellites. CBERS-2B was successfully launched in a very short time, in September 2007.

The cooperation between Brazil and China for development of remote sensing satellites has been so successful and useful for both countries that a new CBERS family is under way, with CBERS-5 and -6. The continuity of the CBERS Program is viewed as strategic for the environmental monitoring of both countries.

CBERS CONSTELLATIONS

The orbit of CBERS satellites is a sun-synchronous, quasi-polar, 26 days phased and circular orbit, at 744-km altitude, and 10:30 Equator crossing time. The main payload of the first three CBERS satellites is a CCD camera with 20-m GIFOV (ground instantaneous field of view), five bands (blue, green, red, NIR, pan), 8 bits, 113-km swath, and ±32° across-track viewing capability. The second important payload present in these three satellites is a Wide Field Imager (WFI), with two bands (red and NIR), 260-m GIFOV at nadir, 890-km swath. As part of CBERS-1 and -2, there was an Infrared Scanner (IRMS) with four bands (pan, TIR, and two in SWIR), 80-m (160-m TIR) spatial resolution, 120-km swath. For CBERS-2B, this scanner was replaced with a High Resolution Camera (panchromatic, 2.7-m spatial resolution, 27-km swath). ***Figure 1*** depicts an HRC image. CBERS-2 is still operational, but only the CCD camera is working; CBERS-2B is fully operational. All CBERS satellites have onboard recording capability. ***Figure 2*** shows a field campaign to calibrate CCD/CBERS-2.

The CBERS second generation is composed of two new satellites: CBERS-3 and -4. The orbital characteristics are the same as for CBERS-1, -2 and -2B. The multi-payload is composed of a Multispectral Camera similar to the CCD from previous CBERS. A second camera is a Panchromatic-Multispectral Camera (10-m XS-ñ blue, green, red, NIR, 5-m Pan), with 60-km swath and across-track viewing capability. The WFI was improved: four bands (blue, green, red, NIR), 70-m spatial resolution at nadir, 860-km swath. The scanner was also improved: four bands (pan, two SWIR, one TIR), with 40-m (80-m TIR) spatial resolution. The onboard recording capability is 15 minutes for all instruments altogether.

DATA POLICY AND APPLICATIONS

One of the main aspects of the CBERS Program is the data policy adopted after the CBERS-2 launch. Brazil adopted the free-of-charge CBERS data distribution policy when data are requested in electronic format. Initially adopted for Brazilian users, it was extended for neighboring countries, and then to the world. Currently, all CBERS data gathered at Cuiaba, the Brazilian ground station, is distributed free of charge to everyone (www.dgi.inpe.br/CDSR).

Each year, more than 100,000 CCD scenes have been distributed inside the country to thousand of users and institutions. The processing system is very fast and it takes only a few minutes for the user to have his request for a full-resolution scene fulfilled. This kind of data policy and easy distribution system promoted a strong increase in the number of users and applications.

Today, there is no organization related to agriculture, environment, geology, or hydrology in the country that is not a CBERS user. Hundreds of businesses in remote sensing were opened after the adoption of the current data policy. The environmental control by the society was also increased. ***Figure 3*** shows the CCD/CBERS images requested in just one month. Almost all of Brazil and parts of other countries covered by the Cuiaba ground receiving station have requested data at least one time in that particular month.

In general, governmental institutions have difficulty in acquiring up-to-date remote sensing data. This problem is worse in developing countries. For instance, the deforestation in the Amazon region is a main environmental issue in Brazil. Actions from the governmental environmental protection agency depend on monitoring, based on remote sensing

data. The fast and free access to CBERS data allows the agency to use up-to-date satellite data to map and measure deforested areas. The map and figures of deforested areas in the Amazon region on an annual basis used to be based on Landsat data, and now the map has the help of CCD/CBERS data (www.obt.inpe.br/prodes/index.html).

Another important activity in Amazonia is the project called DETER (Detection of Deforestation in Near Real Time; www.obt.inpe.br/deter/metodologia.pdf), which is aimed at detecting early signs of deforestation and at alerting the environmental agency in time to take action. This is a permanent monitoring system based on MODIS and WFI/CBERS data.

Brazilian legislation requires that each farmer identify and notify the environmental agency about areas to be protected on each farm. This procedure is called environmental licensing and has been adopted in many states around the country. Currently, most of this procedure is done based on CBERS images and has opened hundreds of small businesses specializing in this kind of service. As CCD/CBERS has stereo-viewing capability, its data can be used for feature extraction ***(Figure 4)***.

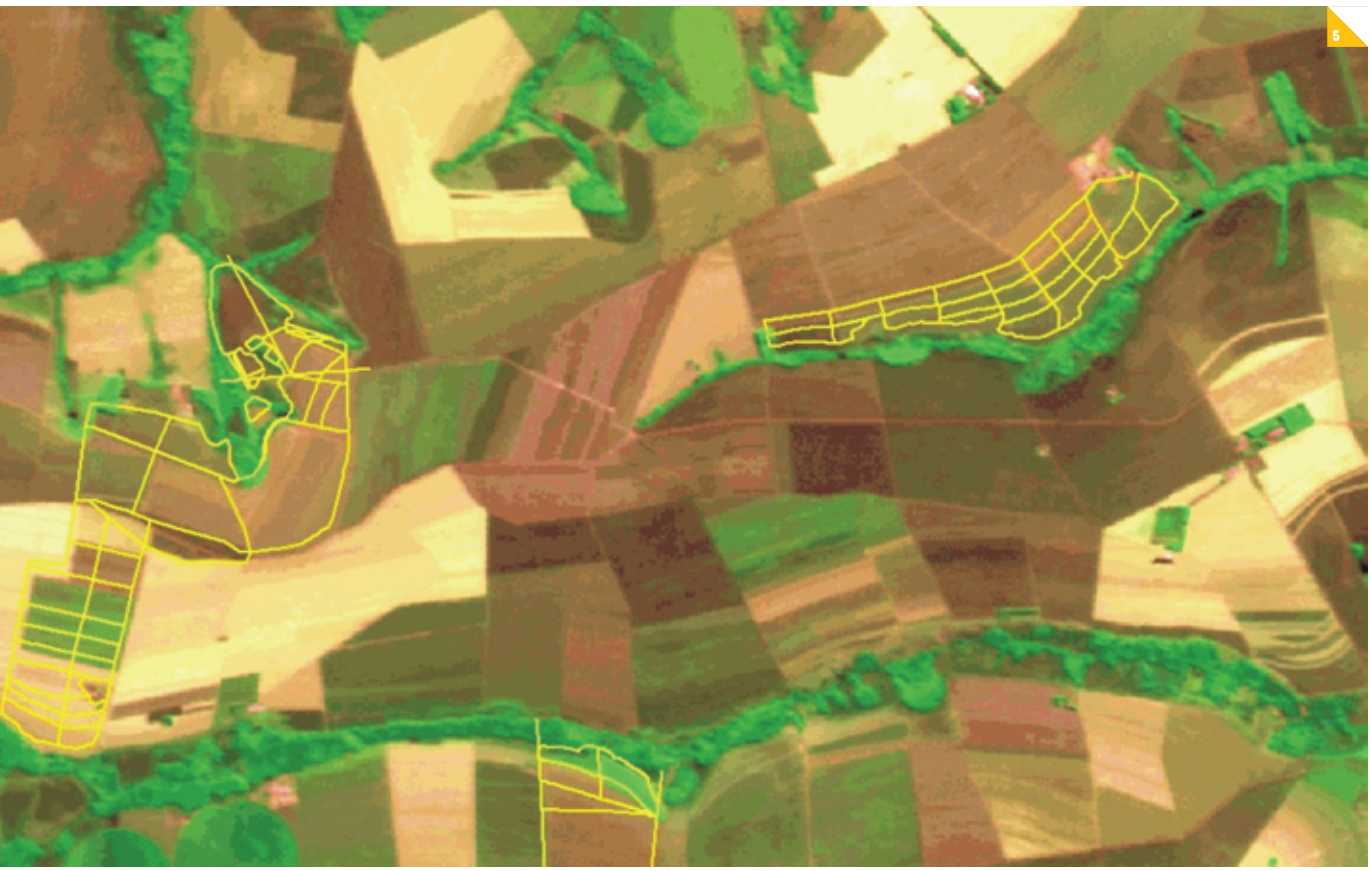
An interesting application of CBERS images is in tax enforcement ***(Figure 5)***. Some states use CBERS to help them to monitor farms to assure that all declarations made by farmers are in accordance with the tax law. More examples of applications of CBERS data in Brazil can be found at www.dsr.inpe.br/seminariocbers/.

As part of the objective of making the CBERS Program as useful as possible to mankind, Brazil and China decided to launch the project CBERS for Africa, which will distribute CBERS images for African countries to help them control deforestation and protect the environment. This project is part of the contribution of both countries to the GEO (Group on Earth Observation). At least two ground receiving stations in Africa will be able to have direct downlink of CBERS remote sensing data beginning later this year.

The CBERS Program, developed under a Chinese and Brazilian cooperation, is an important and very useful data provider to both countries and their neighbors – and now to Africa. The data policy that assures free access to CBERS images brought new remote sensing users, applications and business. Applications related to environmental protection were improved with CBERS data availability and free access. «

EDITOR'S NOTE

See Fall 2007* Policy Watch *column for related article about CBERS and China's emerging Earth observations program.



5


Observing E

arth

IN A CHANGING POLITICAL CLIMATE

THE YEAR 2008—WITH a devastating cyclone in Myanmar, a catastrophic earthquake in China, and a tornado season off to a record-setting pace and massive flooding in the United States—has demonstrated like never before the importance of environmental information to protecting life, property and economic well being ***(See Figures 1-4)***.

This being a presidential election year, interest is building within the U.S. Earth-observations sector, and in sectors that depend on observational data, as to how high a priority the next administration will assign to observing the planet, especially as many of the nation's Earth-observing instruments approach the end of their operational lifetimes.

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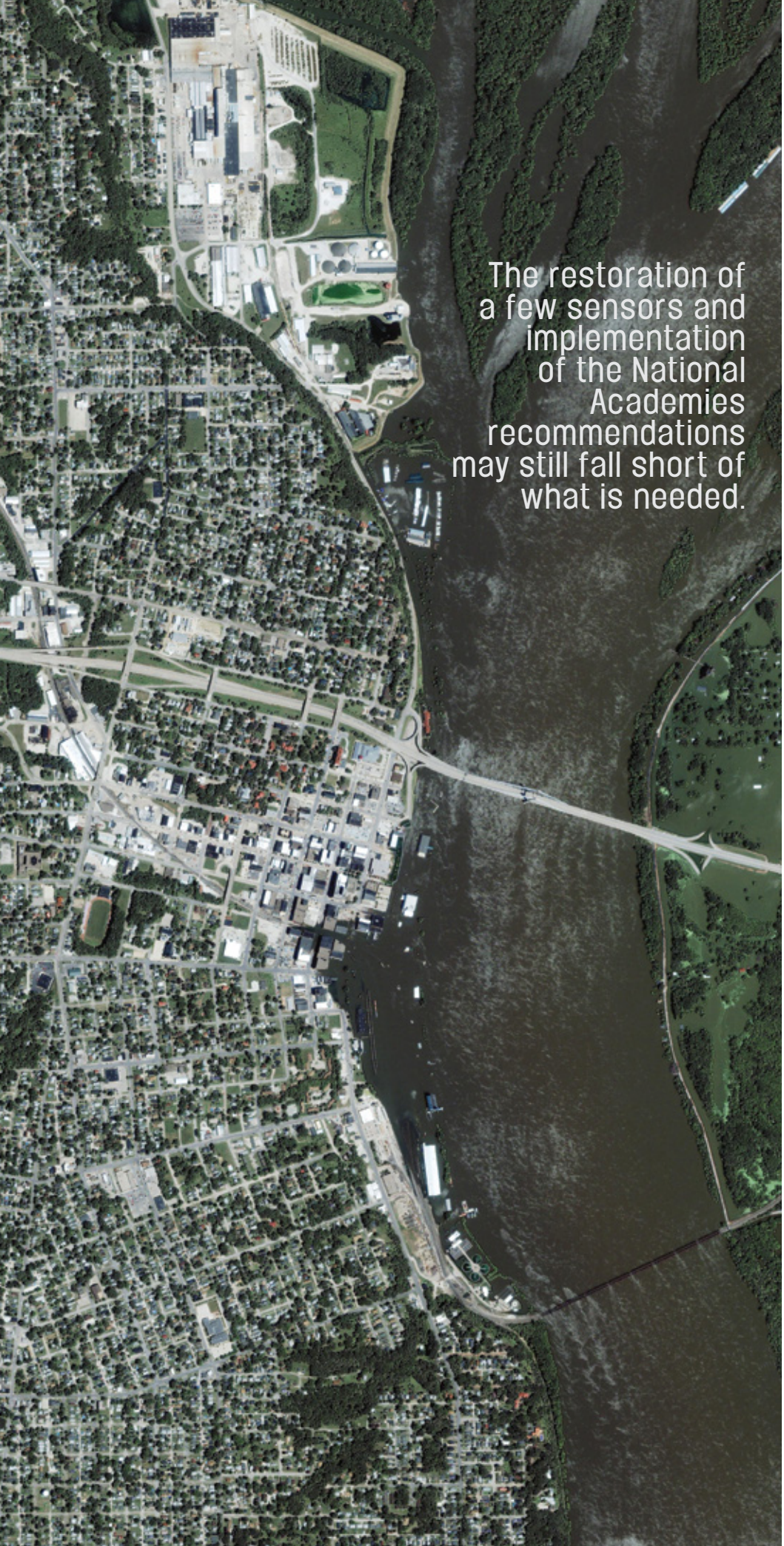
FIGURE 1
Miansizhen, China after the May 12, 2008 earthquake, taken by IKONOS on May 23, 2008. Credit: GeoEye.



"The playing field for Earth observations has changed. Not only are U.S. observing systems in decline, but the demand for climate and environmental information is greater than it's ever been," said Nancy Colleton, executive director of the Alliance for Earth Observations, a group of industry, academic and nongovernmental organizations that promotes the use of Earth observations for societal and economic benefit. "You can't have sound climate or environmental policy, mitigate risk or develop adaptation strategies without credible and timely Earth observations. This has to be a priority for the next administration."

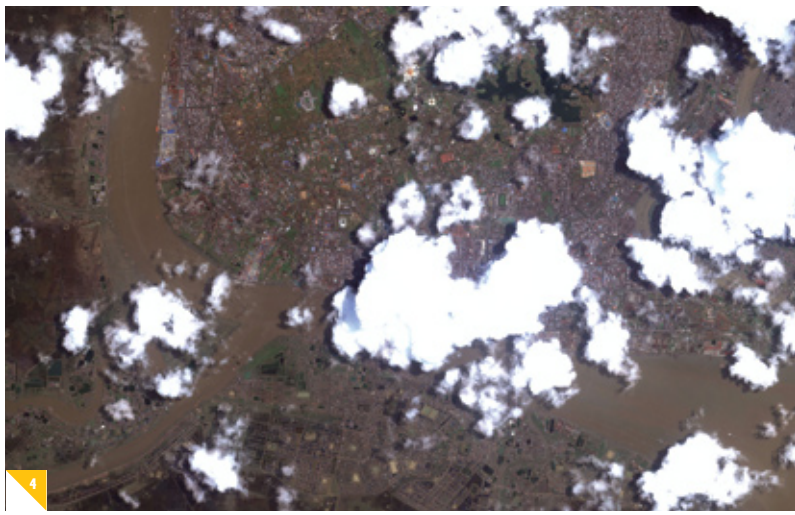
Earlier this year, a group of organizations led by the University Corporation for Atmospheric Research (UCAR) urged the next administration and Congress to "take actions to make our nation resilient to severe weather and climate change." Its recommendations included increasing funding for satellites and land-based instruments, increasing the computer power available for Earth science research and weather and climate forecasts, and supporting education and training to use observations, models and related tools.

Anything less will put both individuals and the country as a whole at risk, says UCAR president Rick Anthes. "Earth and its life support systems—and its ability to provide people with the rapidly increasing demand of clean fresh water, food, energy and other vital needs—are under severe and increasing stress, which threatens national security on many fronts," Anthes said. "We must move Earth observations and related information systems to a much higher priority."

There's been plenty of talk in recent years about the need for U.S. investment in sustained observations of the Earth system, and about the potential social and economic consequences of failing to do so.

FIGURE 2
Floods from high volumes of rainfall and breached levees created major problems along rivers throughout the Midwestern region of the U.S. for several weeks. This IKONOS image of Gulfport, Illinois was taken on June 20, 2008. Credit: GeoEye.

FIGURE 3-4
Rangoon (or Yangon), Myanmar after Cyclone Nargis. These 1-m satellite images were collected by GeoEye's IKONOS satellite as part of the International Charter on Space and Major Disasters. The "before" (left) image was taken on Nov. 27, 2007 and "after" was post-cyclone on May 7, 2008. Extensive damage and flooding occurred in the city of Rangoon. Standing water has engulfed trees and made small tributaries into swollen rivers. These images also appear on the cover. Credit: GeoEye/CRISP-Singapore.



A 2007 report by the National Academies went so far as to outline a strategy for Earth observations over the next decade, including specific steps necessary to ensure continuity of existing observations in the face of a deteriorating fleet of Earth-observing satellites. See ***Figures 5-6***.

But talk is cheap compared to action. Development, launch and operation of the NASA and NOAA missions recommended by the National Academies would cost an estimated $7.5 billion.

Rep. Mark Udall argues that it's a small price to pay for a potentially big return. "The knowledge gained carrying out the missions recommended by the National Academies Decadal Survey will return benefits to society far in excess of the cost of our investment in those missions," said the Colorado Democrat.

In May, Udall introduced a NASA authorization bill (H.R. 6063, which passed the full House on June 18, and the Senate Committee on Commerce, Science and Transportation on June 24) that compels NASA to submit a plan to Congress describing how the agency intends to implement the missions recommended by the National Academies. The bill allocates just over $1.5 billion for Earth science in fiscal year 2009, out of a total NASA budget of $20.2 billion.

"NASA has an important role to play in advancing the nation's Earth-observations research and applications capabilities, and H.R. 6063 will help to ensure that NASA is able to meet its responsibilities in that regard," Udall said.

H.R. 6063 also requires NASA to provide a plan that ensures continuity of Landsat thermal infrared data, used to calculate evapotranspiration and water use on a field-by-field basis. Landsat is a series of satellites, managed jointly by NASA and the U.S. Geological Survey, that have imaged the Earth's landscape since 1972.

Scientists and policymakers have expressed concern that funding for a thermal sensor has not been included in the budget for the Landsat Data Continuity Mission scheduled to launch in 2011 as a replacement for the aging Landsat 7 spacecraft, and that a gap in this data could mean a loss of information critical to monitoring drought conditions and managing water resources.

While adequate funding is always a concern for the Earth-observations community, so too is a lack of organization and leadership. The question of who should take the lead when it comes to planning and managing U.S. Earth observations has long been a complicated issue, with Earth-observing activities and budgets scattered among several different agencies, including NASA, NOAA, and USGS.

> "Earth and its life support systems—and its ability to provide people with the rapidly increasing demand of clean fresh water, food, energy and other vital needs—are under severe and increasing stress, which threatens national security on many fronts."
>
> – RICK ANTHES, UCAR

To address the issues of organization and leadership, H.R.

6063 will instruct the White House Office of Science and Technology Policy (OSTP) to "enter into an arrangement with the National Academies for a study to determine the most appropriate governance structure for United States Earth Observations programs," and to provide a plan for implementing the study's recommendations within two years of the bill's passage.

OSTP and other White House offices are the subjects of a report that was released in June by the Woodrow Wilson International Center for Scholars, a research center in Washington, D.C. The report's findings—based in part on interviews with science and technology leaders from the public and private sectors, including former White House science advisors—were expected to present a set of best practices designed to enhance the effectiveness of the next administration's science and technology policymaking.

"Looking ahead, the United States must position itself to be a global leader in advancing Earth-observation systems and the decision support tools that will integrate the data generated by these systems into a wide range of value-added products," said Mark Schaefer, coauthor of the Wilson Center report. "This is one of several important areas where OSTP must have the capacity to shape the next administration's policies and ensure an efficient, well-coordinated, multi-agency effort to implement them."

Efforts to increase the impact of Earth observations have been hampered not only by a void in leadership, but also by a failure to transition new technology from research to operations efficiently. While NASA's role is traditionally one of mainly research, the agency often launches and manages satellites that provide data used by NOAA for operational purposes, such as weather and climate forecasts. On this front, H.R. 6063 will direct OSTP to work together with NOAA to develop a process for federal agencies to transition appropriate NASA missions or sensors to operational status.

Both NASA and NOAA have been targets of congressional scrutiny in recent years. Attention on NASA has focused on whether its emphasis on returning humans to the moon and eventually reaching Mars and beyond, as outlined in President Bush's Vision for Space Exploration announced in 2004, has shortchanged agency activities in Earth science and disciplines.

Interest in NOAA, meanwhile, has centered on its management of the National Polar-orbiting Operational Environmental Satellite System (NPOESS), discussed in multiple congressional hearings and documented by the Government Accounting Office. NPOESS, the first satellite of which is scheduled to launch around 2013, has fallen victim to cost overruns, delays, and the stripping of some sensors from the mission during the past several years.

However, at the pleading of scientists and the recommendation of the National Academies, some sensors that had been removed have been restored, either to NPOESS or to the NPOESS Preparatory Project, scheduled for a 2010 launch and meant to bridge the gap between NASA's dying suite of Earth Observing System (EOS) satellites and NPOESS. These include the Total Solar Irradiance Sensor (TSIS), which measures the total amount of solar energy coming into the Earth's atmosphere, and the Ozone Mapping and Profiler Suite Limb, an instrument for measuring the vertical distribution of ozone.

Also of note is the addition of the Clouds and Earth Radiant Energy System (CERES) on the NPOESS Preparatory Project. CERES will complement TSIS

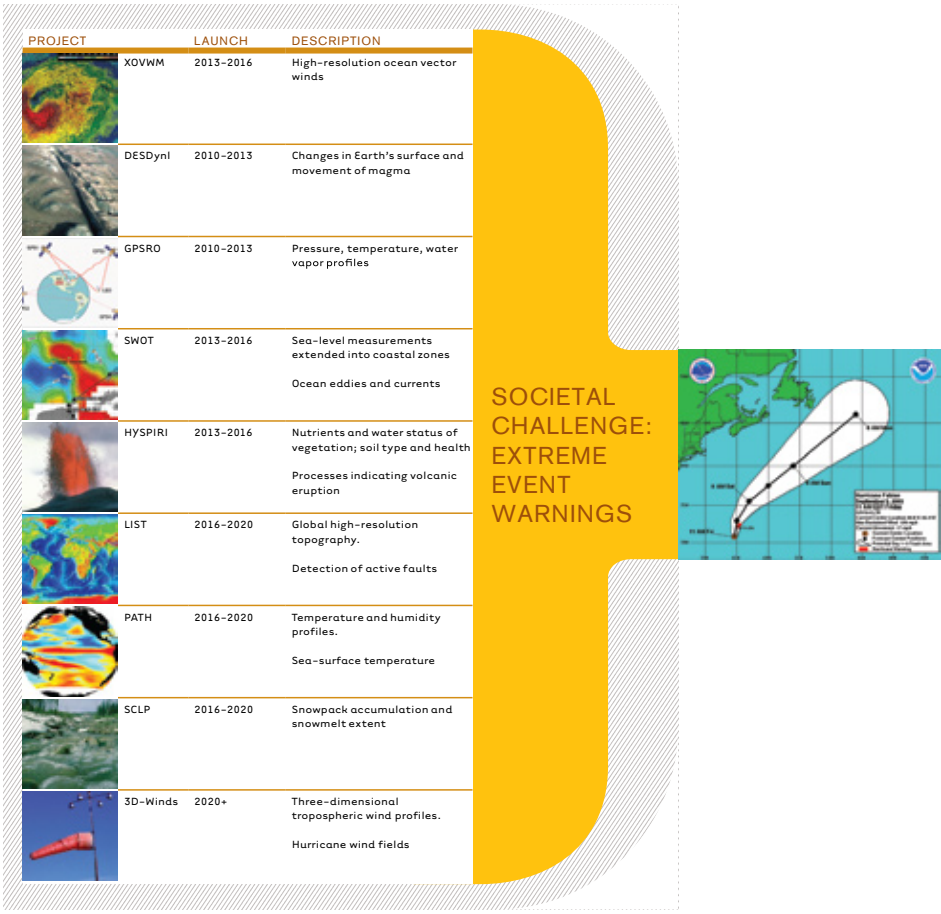
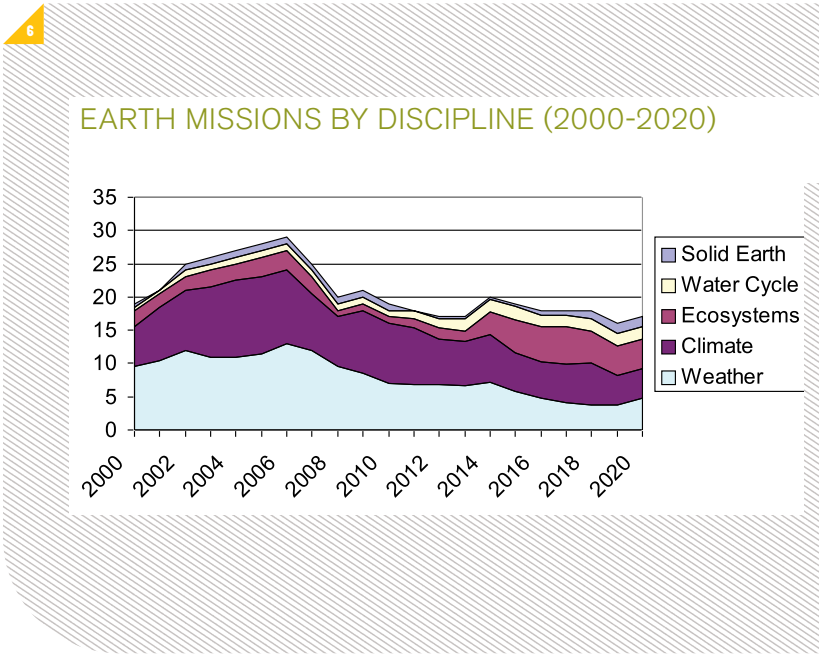


FIGURE 5

Recommended missions supporting extreme-event warnings would enable effective evacuation planning and preparation. These missions would provide for longer-term, more reliable storm track forecasts, storm intensification predictions, and volcanic eruption and landslide warnings. Credit: Reprinted with permission from the National Academies Press, Copyright 2007, National Academy of Sciences.

FIGURE 6

Space-based missions from 2000-2020. All the recommended missions are assumed to operate for 7 years, including 4 years of extended mission. Human health is not a separate category as a theme because the committee determined that most missions contribute to human health. Credit: Reprinted with permission from the National Academies Press, Copyright 2007, National Academy of Sciences.



measurements by providing information on how clouds influence the Earth's energy balance and the role they play in regulating climate.

Charles Kennel, formerly the director of Scripps Institution of Oceanography and associate administrator for NASA, warns that the restoration of a few sensors and implementation of the National Academies recommendations may still fall short of what is needed.

NASA and NOAA Earth-observing satellites "are aging and the replacement plans are fragmentary, inadequate and were started much too late," said Kennel, who heads the Environment and Sustainability Initiative at the University of California, San Diego. "On the NASA side, there is no plan to explicitly replace EOS, and what the decadal survey has recommended is only a down payment on what will be needed."

The Center for Strategic and International Studies (CSIS), a policy research institute in Washington, D.C., is due to release in mid-July a report assessing the current state of Earth observations. The report was to identify the gap between user requirements and the current and planned Earth-observation capabilities, and to recommend long-term strategies for acquiring the data needed to understand and respond to global environmental change.

"In order for the U.S. to derive full benefits from its past investments in Earth observations and deliver on their potential for its citizens and people around the world, it is critically important that the U.S. set a long-term strategy for Earth observations," said Lyn Wigbels, senior associate for CSIS's Space Initiatives Program and primary author of the report.

Many of the deficiencies expected to be highlighted in the CSIS report were supposed to be addressed by the U.S. Integrated Earth Observation System (IEOS), the U.S. component of the Global Earth Observation System of Systems (GEOSS), an international initiative of more than 70 countries and the European Commission to link observing instruments around the world. A strategic plan for IEOS released in 2005 set goals and requirements for U.S. observing systems organized around nine societal benefit areas, ranging from improved weather forecasting to the monitoring and managing of water and energy resources.

But some Earth-observation advocates say privately that IEOS and GEOSS have not lived up to their billing, in part because the Bush administration has not made either a high enough priority, even as it acknowledged in a scientific assessment released in May that a changing climate "is very likely … to have significant effects on" U.S. water resources, agriculture, land resources, biodiversity, and human health and other resources over the next few decades and beyond.

Kennel still sees a bright upside for GEOSS, albeit slow in the making. "All international voluntary efforts are necessarily slow, and GEOSS is only now beginning to show results that affect actual observations," he said. "It is important that these efforts continue, as there is nothing better on the horizon. GEOSS has not failed, but it has not yet succeeded."

The slow pace of efforts to improve Earth observations and to enable more informed decision-making poses an increasing risk to lives, livelihoods and economies in the United States and around the world as weather becomes more extreme in some places, natural disasters pile up, and evidence for climate change mounts. The refrain is much the same every time nature strikes, says Michael Keebaugh, president of Raytheon Intelligence and Information Systems, which is working on ground segments of NPOESS.

"We hear almost daily about the devastating and deadly impacts of floods, droughts, forest fires, tornadoes, hurricanes, tsunamis, earthquakes or volcanoes around the world," Keebaugh said. "A recurring theme in each of these natural disasters is the need for better and more timely information, both pre- and post-disaster, greater accessibility to that information, better integrated and more accurate forecast models, and improved decision support tools." «

Unlocking the Wealth of Imagery

ARIZONA DOT AND SANBORN USING ArcGIS IMAGE SERVER

Both public and private organizations are finding that the volume of imagery available to them is growing at a rapid rate. At the same time, however, the importance of updated and current imagery, including aerial and satellite, is also growing. Decision makers in many organizations need the latest high-quality images to visualize and analyze activities such as land use, forest quality, military operations, and emergency situations.

Geographic information system (GIS) users are especially interested in the increasing availability of imagery. Whether serving as a natural background for GIS applications, as a vehicle for direct interpretation of data, as a basis for statistics and analysis, or as the source for many vector maps, imagery has many demands placed upon it. While huge volumes of imagery from many sources exist today, accessibility to this data is a challenge, and as a result only a fraction of what is available is actually accessed. Increasing access to the imagery increases its value, and since images are a snapshot in time, the faster they are made available, the more useful they are to those who need them.

Arizona's Multimodal Planning Division (MPD) of the Arizona Department of Transportation (ADOT) provides high quality transportation research, plans and programs to the public. "GIS is a necessary tool for Arizona to plan, analyze, model and manage our information," says James Meyer, Senior GIS Analyst, ADOT. "It has really helped us provide a visual array of information that allows our users to understand easily the complex environmental, economic and social issues. GIS is also useful as an effective tool for bringing people together on the same page when discussing programs and policies in the state."

The central objectives of MPD are to help identify current significant transportation issues in Arizona and to improve existing systems. MPD is also committed to cost effectively maintain-

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ing and expanding the state's transportation infrastructure. An ESRI GIS user for many years, the ADOT geographic information system and transportation section maintains the statewide street centerline GIS database and coordinates GIS issues for ADOT. Primarily focused on the more than 6200-mile state highway system, the section maintains the GIS database, also known as the Arizona Transportation Information System (ATIS Roads), and is the foundation for many planning studies and programs, including supporting the Federal Highway Performance Monitoring System (HPMS) for the state of Arizona.

ATIS Roads originated from the Accident Location Information Surveillance System (ALISS) map base that was maintained using photogrammetry and mapping until its conversion to GIS in the early 1990s. What began as a simple drawing tool has now grown into a full GIS.

One of the ongoing projects of ADOT is the ATIS Roads Update, which is the most important work of the group, since it is the basis for all the GIS data at the organization. This street centerline file for the state of Arizona is used to reference routes and mileposts that are geocoded to the Linear Referencing System and displayed on the maps. All data in ADOT uses the standard ATIS nomenclature for referencing location. See ***Figure 1***.

To assist in this update, ADOT adopted ArcGIS Image Server. "Using imagery, it is easy for us to identify areas where the streets in our database don't match up with real-world information," says Meyer.

Four terabytes of imagery are used to verify ground data. Once an ominous task for the department, today using this much raster data is an efficient means of viewing and analyzing its information. "Before ArcGIS Image Server, looking at images of the road network meant hooking up an extra hard drive and sifting through 8,000 tiles," says Meyer. "Using Image Server, we are able to view one continuous image quickly throughout the department on our network."

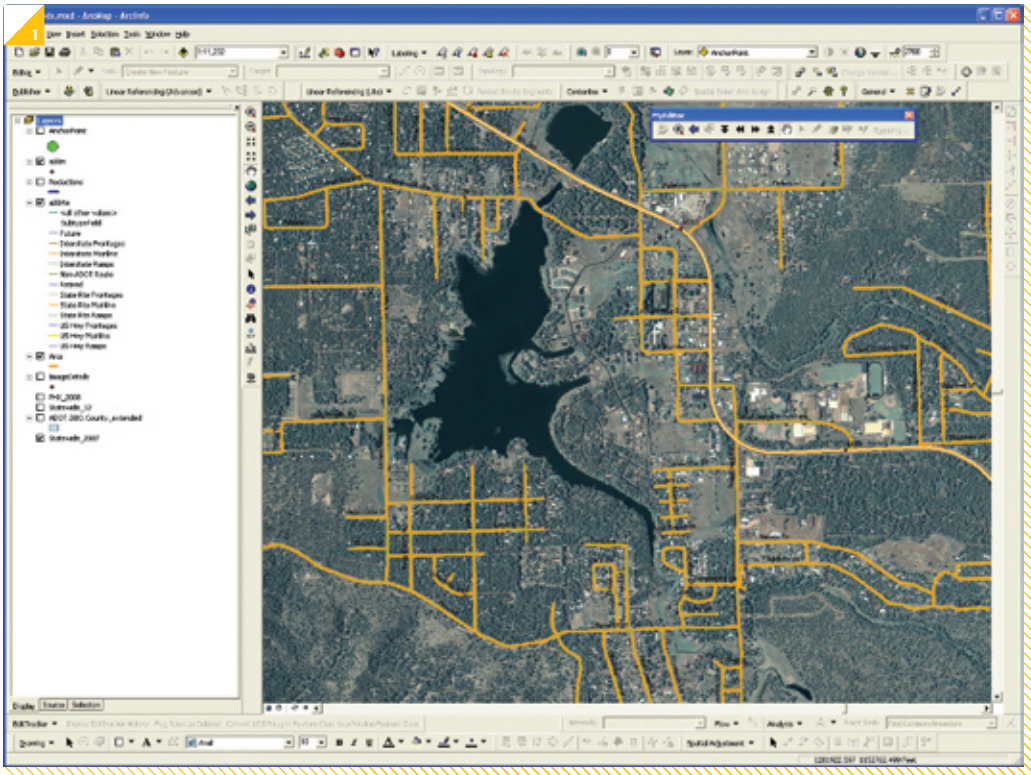


FIGURE 1
Arizona's street centerline file is used against imagery in order to do a quick quality control on the entire Arizona Transportation Information System (ATIS), checking to ensure streets that exist in the real world are also captured in the system.

FIGURE 2.
Image Server allows Arizona DOT to view 620 miles worth of state highway system and background imagery quickly and seamlessly.

This usage is possible because of ArcGIS Image Server mosaics and because it processes imagery on the fly, providing users with the seamless image products they need without having to save multiple copies of the same image or perform time-consuming image pre-processing. ADOT is able to let users throughout the planning department access the most current imagery available. "This has taken out any reason to have data redundancy throughout the agency," says Meyer. "It also means we save money by not having to deal with extra storage requirements."

Many users at ADOT are new to GIS, so they are unfamiliar with the traditional means of loading and looking at images. "ArcGIS Image Server makes it easy for non-GIS users to view data in the way they are used to—quickly and intuitively. They don't think twice about the amount of data they are viewing or how quickly they can access it. This has helped us to support many more users than previously and to expand the use of GIS data throughout the whole organization," says Meyer.

MPD's goal is that ArcGIS Image Server will be adopted by other non-GIS departments such as the CAD Department. Potentially, CAD users will be able to perform quality assurance/quality control (QA/QC) on their survey data and measure the ground truth with the images. "We are hoping that ArcGIS Image Server will support all of ADOT's aerial image needs," says Meyer.

ArcGIS Image Server is also important in supporting the continuing efforts of the Highway Performance Monitoring System (HPMS) submittals. A requirement

of each state, the HPMS is America's national database of highway information. Roadway extent, use, condition, and performance data are collected by and for the states and submitted to the Federal Highway Administration (FHWA) each year. See ***Figure 2***. From a national perspective, the FHWA's primary intent with this program is to provide Congress with a policy tool for major highway legislation and funding decisions.

ArcGIS Image Server is an integral tool that allows ADOT to continue to provide the best administrative, financial, and clerical support possible. The software has proven valuable for planning, traffic, and feature inventory, and the agency plans to continue expanding its use to more departments.

"The value of imagery is highest when a large number of users have access to the data quickly," says Clark Coffey, ArcGIS Image Server Product Marketing Manager. "With conventional solutions, image processing and distribution are difficult and time-consuming, and end users have difficulty accessing and using the imagery in their standard applications. ArcGIS Image Server is one component to the image solution, providing a new approach to storing, managing, processing, and distributing geo-imagery."

A company whose staff understand this well is Sanborn (Colorado Springs, Colo.). Sanborn first became known back in 1866 through its finely detailed fire insurance maps—maps so well created that they are actually still used today. Now part of the DMG Information Group of companies, which is owned by the United Kingdom-based Daily Mail and General Trust, Sanborn continues to provide geospatial solutions to its clients. Government agencies and companies in environmental management, national mapping, utility, and energy markets rely on them for their mapping needs.

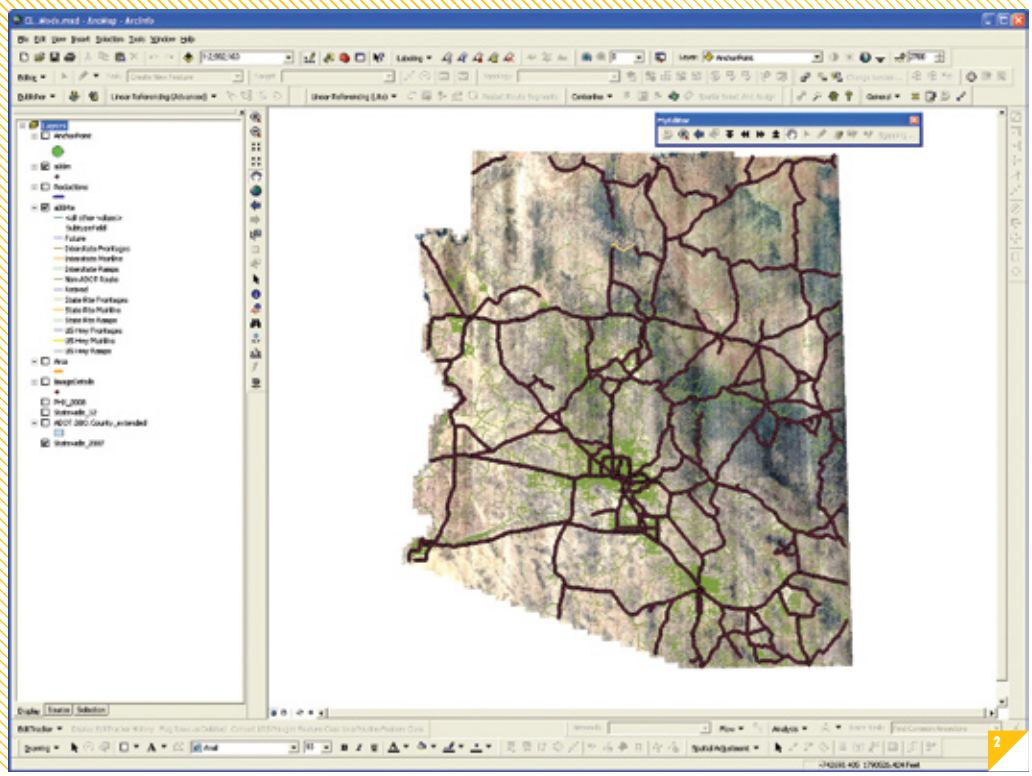
Sanborn was the first commercial mapping firm to develop and implement a system for producing digital orthophoto imagery without distortion. Sanborn's images include surrounding streets and other cultural features that are not ordinarily visible in standard orthophotos, using a method they developed called Method for the Elimination of Terrain and Relief Displacement in Orthophotography (METRO).

This type of imagery is being used by a significant number of GIS users as a useful database layer for topographic, planimetric or cadastral mapping, utility data capture and accurate project analysis and design implementations. These images are created as both second-generation imagery for clients requiring geo-referencing to their original GIS data, and as first-generation orthophotos of the highest accuracy.

Many of Sanborn's imagery projects cover large areas with many customer stakeholders. Customers include large counties such as Maricopa County, Arizona, as well as councils of government and statewide initiatives. The average delivery range of imagery projects' size is 144 Gigabytes for one area to 4.4 Terabytes for up to 30 delivery areas, based on an average tile size of 2000' x 3000' for a delivery area size of 2000 tiles—the equivalent of 400 square miles. Sanborn's delivery format is RGB with a six-inch pixel size. Processing hundreds of terabytes of orthophotos per month for customers like these required Sanborn to find an innovative solution for clients who need massive amounts of imagery for their applications without extensive preprocessing or alteration of source data.

Sanborn chose ArcGIS Image Server because it provides rapid access to large quantities of file-based imagery, and the ability to process on the fly and on demand. The specialties of the two companies led Sanborn to become an ESRI implementation partner. "Image Server allows Sanborn to offer our clients a solution that gives them the images they require immediately and with consistency," says John Copple, chief executive officer of Sanborn.

Sanborn uses ArcGIS Image Server



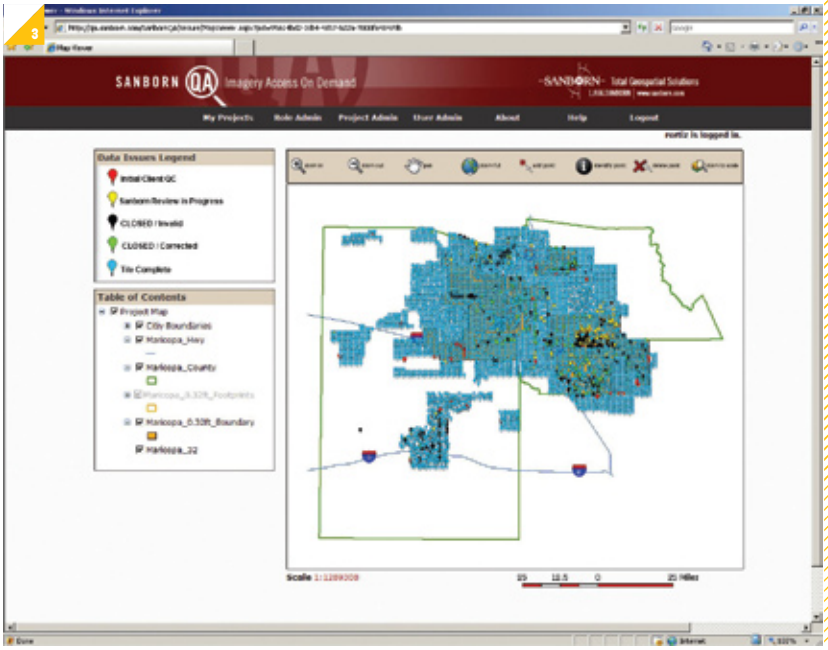
to diminish the interval between the collection of an image and its availability to users. Traditionally, image processing and distribution have been considered two separate stages in image utilization. Imagery was first processed and mosaicked into a large dataset, then put on servers for dissemination.

This separation has caused many problems: long preprocessing and loading times and data redundancy that exacerbates data storage issues and hinders efficient data management. With ArcGIS Image Server, these two stages are combined into one. The data received from an imagery supplier can be directly served. This ability enables administrators to maintain the primary imagery, while creating multiple specialized products on the fly when required. This is a significant and unique paradigm shift in how imagery is managed, processed, and distributed.

Using ArcGIS Image Server, Sanborn created Sanborn Quality Assurance (QA), a client imagery interface that facilitates Web-based quality checking of Sanborn-created orthophoto imagery products. Clients can view imagery through a standard Web browser as the image is being processed and add digital 'issue points' to areas within the imagery that they feel may require attention. This real-time error reporting while Sanborn is processing the imagery makes data management much more simplified and reduces data redundancy and the delay in making the imagery accessible.

Clients can review orthoimagery as soon as they are available on Sanborn computer systems. Users are granted entry to the image Web application via secure login privileges to access a particular project. Clients may add QA flags to the project to indicate items requiring additional review, and these become immediately available inside the main GIS for viewing by Sanborn's production staff. There they are immediately available for technicians to review and resolve. These digital issue points give clients the ability to describe errors efficiently, and in turn, users are able to make fast, responsive changes such as color balancing and edgematching to the imagery. There is also a reporting tool to give up to the minute quality control status of the project. This tool makes the problem resolution process more streamlined and problem-free.

All imagery is served from a central image server to the client-side computer within a mapping interface in a standard Web browser format. ArcGIS Server 9.2 authors map documents that contain the image server data and QA/QC features classes. ArcSDE technology provides access to the data. Using this solution, the QA/QC points are immediately ready for status and resolution, and updates to the points by the QA team are immediately available online.



Built on fully scalable enterprise client/server architecture, ArcGIS Image Server offers multiplatform GIS/CAD/Web client access and direct access to many file formats and compression. Using the software, multiple imagery projects can be created from a single source.

Client visibility is granted into project management with macro-level access using a log-in access control with granular security role assignment. A custom ASP.Net application adds robust security. Resource assignments are now very easy and flexible. Users of the system log in online using a standard Web-based browser to access their projects.

Once logged in, the QA users are shown a list of projects they are able to access. By clicking a link from a pull-down menu called 'Map,' the users open the QA environment for their projects. The initial map that is displayed shows the individual project status through colored pixels, green specifying tiles available for review, red for areas not yet available. The user of that project can then add and view the current issue points for the project.

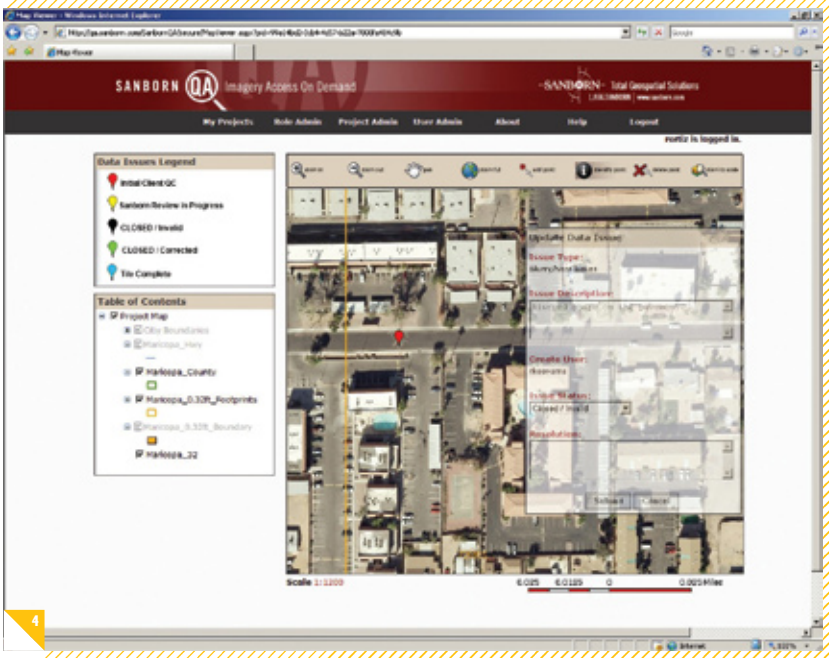
Sanborn prototyped the system with customers from Colorado and Texas. Based on their positive prototype experience and customer feedback, the company is releasing a next-generation system for use by Maricopa County, Arizona. This county is approximately 9200 square miles, with an expected data delivery size of around 4.4 terabytes. See ***Figures 3-5***.

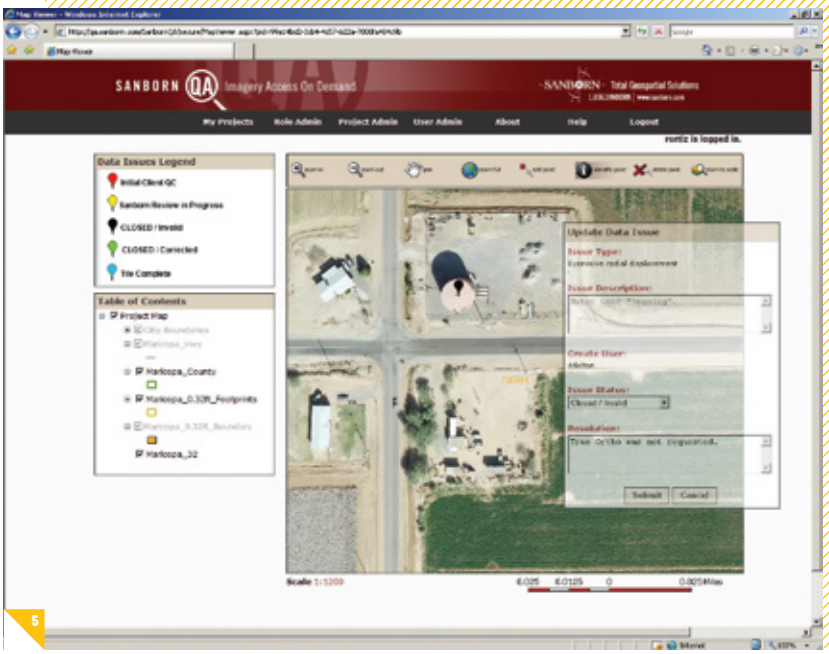
Implementing the system took approximately 150 man hours from the

initial design, including determining requirements, purchasing and implementing the software, customizing, testing and, finally, releasing the system. Sanborn QA requires nothing more than a standard Web browser and high-speed Internet connection. After clients utilize the system and are satisfied with the quality of the imagery, the project is delivered through either turnkey ESRI Image Server delivery, on demand data staging for after flight review, traditional hard drive or DVD delivery.

Says Copple: "The instant online imagery review accelerates our quality assurance and quality control review. We have given our customers the option to completely eliminate physical shipping requirements for QC purposes." Sanborn has also found they have successfully reduced their clients' IT involvement and provided for a secure solution for project management. Using this solution, Sanborn clients get fast image access optimized to their requirements with improved image quality and image metadata. By serving data to their clients directly, Sanborn has realized an overall production–to-delivery time decrease of approximately 66% in some cases.

Due to the schedule savings and the increased QC accuracy, Sanborn is able to improve its responsiveness while saving the customer costly edit and deliverable delays. "It's now easier for us as a company to assign our resources and offer flexible, efficient delivery options to our clients," explains Melinda Brown, Vice President of Corporate Marketing at Sanborn.





FIGURES 3-5
Based on ESRI's ArcGIS Image Server, Sanborn Quality Assurance client imagery interface allows their clients to view large amounts of imagery through a standard Web browser as the image is being processed, adding 'issue points' to areas within the imagery that may require additional attention. These examples are from Mariposa County, Florida.

Both MPD and Sanborn are looking forward to the upcoming release of ArcGIS Server 9.3 that will add new functionality, including a new Representational State Transfer (REST) API. Organizations like these will be able to bring together quickly the detailed road information and imagery into additional web applications such as Google Maps and Microsoft Virtual Earth using the appropriate ArcGIS JavaScript Extensions for each application. The JavaScript APIs are powered by backend REST services that can be hosted on any Java or .NET installation of ArcGIS Server. These new Image Services will enable clients to utilize the imagery services not only as background in their GIS applications, but to access the pixel values, enabling the image and elevation models to be used in different analysis applications. «

Data Integration

4

SOFTWARE COMPANIES EXPAND AND CONSOLIDATE

//BY ROD FRANKLIN, REPORTER, *IMAGING NOTES*, DENVER, COLO.//

EDITOR'S NOTE

ESRI's impressive end-to-end solutions are not addressed specifically in this article; a full article on ESRI's ArcGIS Image Server begins on page 26.

THE CONTINUING EMBRACE OF OPEN GIS DATA STANDARDS IN 2007 HELPED mark the graduation of location-based technology into the consumer and business mainstream. Standards-based geospatial distribution represents a technological watershed for the industry, and an acknowledgement of the need for reliable data integration at a time when conflicting file formats threaten to guarantee anything but a civil handshake between GIS solutions and existing IT repositories.

During recent years, however, the functional virtues of interoperability have been coded into some of the industry's best known products. As a result, the era of GIS as a "back room" engine with a limited mandate in day-to-day operations is ending, and

FIGURE 4

In the field, a LizardTech customer is holding a hand-held device viewing a map in MrSID file format, the image for which has been compressed using GeoExpress.

standardized specifications are pushing geographic data deeper into the enterprise-wide business management systems now commonly used by large private and public organizations.

This trend has resulted in a greater number of internal and customer-facing GIS applications across a variety of business lines. That result lends drama to the coming-of-age phase that geospatial providers are now experiencing, and motivates leaders like ESRI and Intergraph Corp. to make sure their flagship data editing products suit the needs of customers at the enterprise level. As the industry consolidates, upstart players seek to compete with the better established vendors of end-to-end solutions, while other firms jockey to fill specialty niches within the unfolding geospatial enterprise paradigm. High throughput requirements typical of geospatial data storage and delivery networks, along with existing technological gaps, signal opportunities for companies like Seattle-based LizardTech and Definiens Inc., a German firm with offices in Morristown, New Jersey.

The long-standing clarion call for interoperability has leveraged use of open data exchange interfaces in recent years enough so that spatially-enabled business processes now rarely operate in isolation. Sam Bacharach, executive director of outreach for the Open Geospatial Consortium (OGC), has noted that the benefits of standards-based integration extend not only to data, but also to the way applications speak to one another and to the simplified way they can be presented to users. More and more, these advantages are manifest in the reduced need for point-to-point adaptors or interfaces between programs, and in the features of service-oriented architecture, which permit whole clusters of applications in an enterprise to be "front-ended" to users in the form of a common interface.

Intergraph Corp. (Huntsville, Ala.) has acknowledged the need for integrated systems and data as a function of both product penetration and OGC advocacies. Its family of GeoMedia geospatial data editing products is tailored to be compatible with formats as varied as ESRI Shapefiles, Autodesk files, Bentley Systems files and Oracle Spatial files. With GeoMedia Professional, an employee using Microsoft Access or SQL Server in a corporate facilities department can just as easily retrieve data from a centralized spatial database as an employee who works with Oracle's relational database from within the firm's sales division. Data accessibility is enhanced by features that allow administrators to set up special enterprise libraries, and the application is capable of integrating multiple spatial data formats into a one-user view of the information with no translation required.

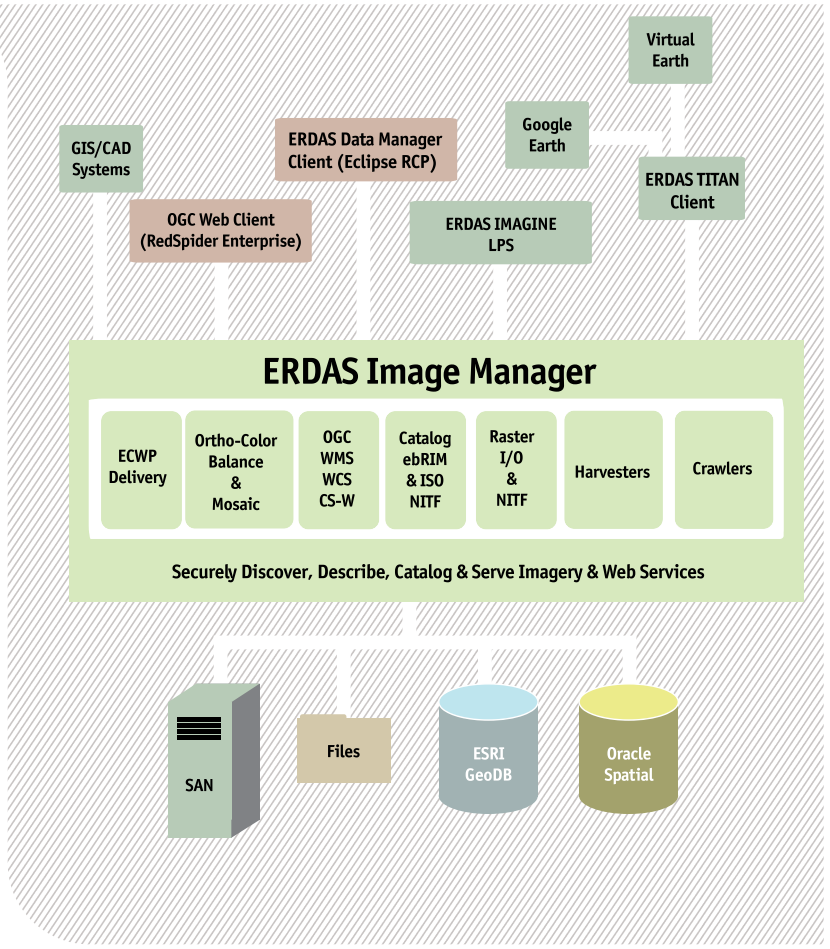


FIGURE 1
ERDAS Image Manager chart shows compatibility with Oracle Spatial files, ESRI and others.

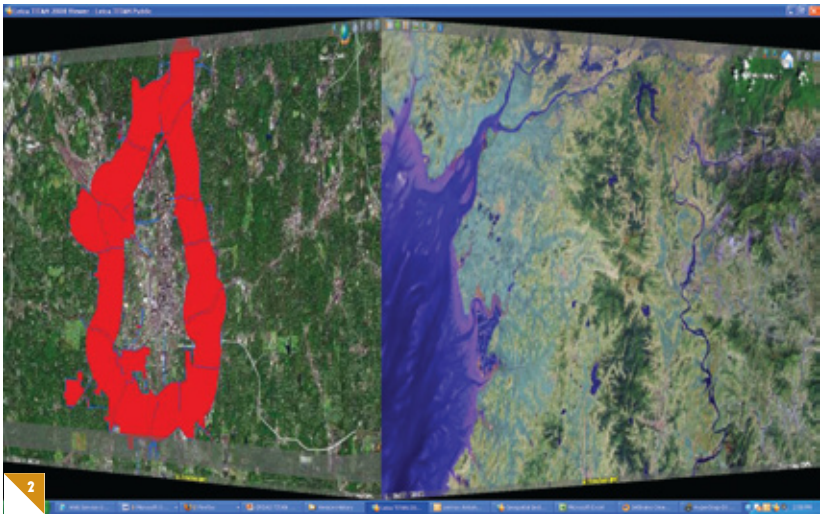
Interoperability gets another boost as a result of support for major vector and raster formats and OGC standards like Web Feature Service, the open interface that permits web users at disparate locations to make platform-independent data calls. GeoMedia is not unlike some other major enterprise products in that its recognition of OGC's Web Map Service allows for the use of standard web browsers to submit requests in the form of uniform resource locators, and its support for Geography Markup Language (GML) provides the XML grammar, as defined by the OGC, to express geographic features.

Technical accommodations like these don't guarantee that all data integration chores will be easy. The National Geographic Institute of Belgium and the Alabama Department of Revenue both use

FME Desktop, a translator and converter marketed by Safe Software, to ensure that any of more than 200 GIS, CAD and raster formats can be accurately read into their GeoMedia-powered business enterprises. In Alabama, FME enabled the transfer of MicroStation and AutoCAD files into GeoMedia and the sharing of GeoMedia data in various formats, while performing quality checks during the translation process.

But the occasional need for a third party assist doesn't seem to be slowing Intergraph's momentum in the enterprise market. Case studies presented at its recent Users Conference in Las Vegas illustrated the use of the company's technology in the day-to-day operation of two utility systems. Spectra Energy, a Houston-based natural gas distributor operating in the Eastern United States and Western Canada, uses GeoMedia WebMap for enhanced decision support, geo-referenced ad hoc reporting, Department of Transportation compliance, and maintenance of data integrity. And in Marietta, Georgia, Cobb Electric Membership Corp. has folded Intergraph solutions together with its work management, materials, financials and customer information enterprise modules. Enhanced asset tracking, increased data accuracy and reduced risk of mapping workload backlog are among the benefits that Cobb administrators are reporting.

With larger customers like these jumping on the geospatial enterprise bandwagon, it's clear that one of the OGC's five strategic goals—"adoption of open, spatially enabled reference architecture in enterprise environments worldwide"—is being seen to fruition. The benefit of well-placed GIS at the enterprise level presumes the information can be exploited contextually and is able to cohabitate with business applications and input data on the same networked floor plan. The service oriented architecture model builds on the advantages of open standards by making



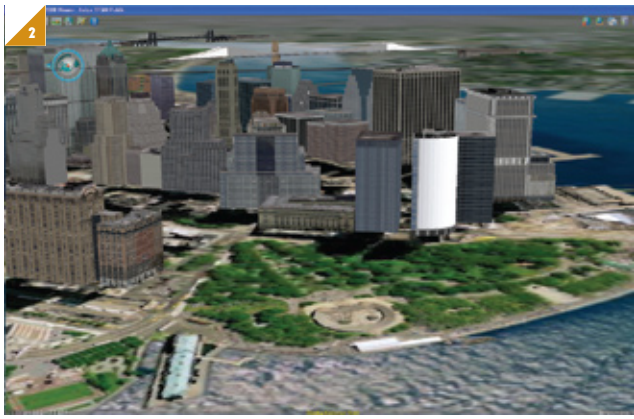


FIGURE 2
ERDAS' digital earth called TITAN, showing a portion of New York City (right) as a customized "My World," which is compatible with Google Earth and Microsoft Virtual Earth. Top image shows switching to another user's "My World."

way for configurations in which the various functions of an enterprise are chopped into distinct "service units" that can be mixed, matched, distributed and reused to create any number of business applications. Large organizations that structure their processes this way and use standards such as GML are in a position to benefit from the abstraction of rules and policies in ways that promote independence from specific vendors. Just as importantly, open standards can help extend the lifespan of expensive legacy system investments made in previous years.

ERDAS Inc. (Norcross, Ga., formerly Leica Geosystems Geospatial Imaging) is another player working to posture itself as a champion of newer data exchange paradigms. Although its reputation as a photogrammetric and optical systems vendor under the earlier Leica name was well grounded, managers in recent years have come to view the migration of GIS data into cross-departmental business environments as an opportunity to rebrand the firm as a provider of end-to-end functionality across the entire geospatial workflow conundrum, leveraging the power of the flagship ERDAS brand.

According to President Bob Morris, simple market realities inspired the change in direction. "In our changing marketplace, companies able to effectively incorporate geospatial information to help solve their business problems will be the most successful," he says. "Geospatial Business Systems will deliver stronger sales, replacing a customer's traditional method of purchasing and attempting to integrate separate products from multiple software vendors."

With its purchase of IONIC Software last year, ERDAS gained a scaleable geospatial platform in the RedSpider suite of products (including RedSpider Enterprise), as well as internal ties to OGC's support for interoperable GeoWeb guidelines and the International Organization for Standardization's (ISO) support for metadata standards. ERDAS now has representatives sitting on a number of

OGC/ISO committees, and on the OGC Board of Directors.

The IONIC deal was just one of three that the company negotiated to diversify its product portfolio. The purchase of Acquis Inc. gave it a foothold in multi-user topological editing, with support for mobile, web and rich client desktop environments. The acquisition of a third firm, ER Mapper, drew Image Web Server into the ERDAS product line. The latter deal also brought ownership of ER Mapper Professional to ERDAS, strengthening its presence in the remote sensing image processing arena. ER Mapper Professional is now co-marketed along with the existing three-tier suite of ERDAS IMAGINE tools.

Senior Vice President of Product Management and Marketing, Mladen Stojic explained that the company will adhere to a multi-phased development plan aimed at solidifying its presence in the enterprise market. Phase One commenced earlier this year with the release of ERDAS Image Manager, a tool that addresses the challenge of discovering, describing, cataloging and serving image data. See ***Figure 1***.

Phase Two will extend this same functionality into a more fully consolidated package consisting of three elements: the OGC/ISO-compliant enterprise application ERDAS Apollo, a geo-portal toolkit customers can use to develop custom Web applications, and an integrated Web client that will permit the completion of geospatial workflows in a browser format. Full integration of vector topology in the company's core products, and improvements in the automation of support for on-demand geoprocessing, are among the goals targeted in Phase Three. Finally, ERDAS hopes to refine its geospatial platform by developing market-focused solutions that address specific needs identified by members of its partner network. Particular focus will be directed toward the resolution of issues in the utilities, natural resources, defense and oil/gas sectors.

ERDAS emphasizes how geospatial information can increase in value as it evolves through the progressive stages of authoring, management, sharing and delivery. Last year's ERDAS TITAN network debut was something of a functional glamorization of the data sharing phase. TITAN is an online solution that permits the discovery, visualization and retrieval of geospatial data within a secure environment. Desktop and Internet applications, as well as three-dimensional virtual globes, may be used to display content interactively and collaboratively, and users are encouraged to create personal, permissions-controlled "MyWorld" spaces into which they can upload geospatial data for others to view. With this controlled structure, ERDAS is offering a data sharing environment that ensures the protection of digital ownership rights. See ***Figure 2*** on page 33.

> The long-standing clarion call for interoperability has leveraged use of open data exchange interfaces in recent years enough so that spatially-enabled business processes now rarely operate in isolation.

ITT's ENVI updates bring new automated workflows and data integration options for ESRI's ArcGIS. ENVI 4.4 delivers new functionality that streamlines image analysis workflow (such as working with vector layers, pan sharpening images and performing change detection) and provides advanced spectral processing and analysis capabilities.

ENVI 4.5 delivers seamless integration of ENVI and ArcGIS, for file exchange between the ENVI and ArcGIS geodatabases. It delivers direct access to the full suite of map composition tools available with ESRI's ArcMap, providing a complete image processing workflow from data access and analysis, to a completed map product. Image processing and analysis done in ENVI can then be launched in ArcMap from within ENVI to generate reports and map compositions.

In Seattle, LizardTech engineers have dedicated themselves to slimming the cumbersome heft of geospatial files in the interests of optimized workflow, reduced storage requirements and speedier image delivery to internal and online users. Early this year the firm released GeoExpress 7, its newest version of the application customers use to shrink giant raster files by as much as 95 percent using LizardTech's patented mrSID compression format. See ***Figures 3-4***.

"Not only can you compress those images, but you can take existing images and you can combine them together into larger datasets," explained Senior Product Manager Jon Skiffington. "So a typical workflow for one of our customers might be that they have a thousand GeoTiff files and they want to combine those over to one large image and maybe project it to a coordinate system, or maybe do some color balancing and then compress. They can do all that in GeoExpress very easily."

In a fully implemented LizardTech storage and server network, two additional products would be installed—Spatial Express for storage and Express Server for image delivery—and GeoExpress would act as a command center to

FIGURE 3

Paul Christin, ESRI Homeland Security Specialist, is cropping a .sid image using GeoExpress in an office environment.

configure both of them. Customers who prefer archiving their data in an Oracle Spatial database, thereby eliminating time-consuming image pyramiding, can run the Spatial Express extension. The product allows gigabyte-sized images to be stored in Oracle as native mrSID or JPEG 2000 files. Both of these file formats support selective decompression.

"Rather than having to decompress the entire image, you can just request the region of interest that you want." Skiffington said. "Spatial Express will return that area, so it saves a lot of space, and it's a lot faster."

For most customers, easier storage and image access is likely to comprise just a portion of the workflow optimization plan. So LizardTech rounds out its product offering with Express Server, a distribution solution which links to GeoExpress and allows for the cataloging of geospatial images without using command line prompts or manipulating complex XML files. Imagery delivered by Express Server can be viewed simultaneously in Web Map Service clients, ESRI's ArcIMS (Internet Mapping Server), Oracle MapViewer, or with any number of lower-bandwidth mobile applications.

However, enterprise-level data exchange isn't always about open interfaces and brokering peace between file extensions. Strategic alliances that accelerate the assimilation of next-generation technologies by linking them to familiar products are additional factors to consider in the subjective judgment of the fully "tricked-out" geospatial enterprise. A case in point is Definiens Inc. of München, Germany. When this company joined the ArcGIS Integration Partner program last year it exposed its products to ESRI's installed base, and a considerably larger market, in one fell swoop.

Definiens specializes in automated image analysis for feature extraction and change detection at any scale—a capability of interest for organizations that manage natural resources, plan infrastructure or specialize in security and emergency response. Its eCognition Network Technology goes beyond the mere assessment of color and intensity in an image and looks at pixels in a wider contextual sense. By recognizing groups of pixels as objects and analyzing shape, texture, size and pixel group relationships, the Enterprise Image Intelligence suite of products seeks to emulate the skills of a trained image analyst.

This automation of feature extraction in a nuanced fashion allows users to distinguish, for example, between trees that make up a park and trees in a forest. The German Remote Sensing Data Center has used platform technology by Definiens to classify automatically bog habitats using an object-based approach that extracts features according to their actual shape, rather than as parcels. Another project funded by the European Space Agency resulted in a prototype application that fuses multiple input data to examine the suitability of land use for pipeline construction.

Distribution collaborations are pushing advanced capabilities like these deeper into the enterprise environment. PCI Geomatics, a Canadian vendor of geospatial decision support technology for the earth sciences market, agreed recently to market and provide technical support for Definiens' solutions in North America. PCI's Geomatica platform works with remote sensor data, GIS, digital photogrammetry, cartography and data visualization to provide image preprocessing technology that "complements our product suite for earth sciences," said Gregg Westerbeck, vice president of sales and general manager for Definiens' Americas operations.

Another partnership announced on July 9 is between Autodesk and Bentley Systems. They will expand interoperability between their portfolios of architectural, engineering, and construction software. The companies will exchange software libraries, including Autodesk RealDWG, to improve the ability to read and write the companies' respective DWG and DGN formats in mixed environments. They will facilitate work process interoperability to improve AEC workflows by enabling broader reuse of information generated during the design, construction, and operation of buildings and infrastructure.

These trends and developments point to some of the ways that open standards, industry consolidation and marketing alliances are helping to fill the data integration and image processing needs of enterprise-level GIS experts. More and more, customers want to abandon the fragmented outsourcing model of earlier years and work with turnkey solutions that ease the methods by which spatially relevant information is commingled with existing business data and operational or decision support intelligence. «

FIGURE 1
Kwajalein Island, where a significant amount of money has been spent, particularly on the Strategic Defense Initiative.

(continued from page 38)
year for a period of six to 10 years," (Guam's representative in Congress, Madeleine Z. Bordallo) said."

Consider having to repeat that major move because of the effects of rising sea level in Guam. As the "National Security and the Threat of Climate Change" report by the CNA points out, "Lack of planning for (critical defense installations) can compromise them or cause them to be inundated, compromising military readiness and capability." See ***Figure 2***.

In fact, Pacific Island lawmakers who attended a three-day general assembly of the Pacific Island legislature on Guam in early May are very concerned for their own sustainability in light of global warming, and plan to meet again in November to discuss the effects of global warming on Pacific Islanders. General assembly delegate Alik J. Alik, vice speaker of the Marshall Islands' Nitijela (Parliament), said concerns about rising sea levels have prompted some people in the island republic to relocate, or to consider relocating.

The Army alone has more than 14 million acres and over 2000 Installations, 12,000 historical structures, a multi-billion dollar military construction program, and a base operations program. Not only should the Army be preparing for the effects of global climate change, but also it should examine how its institutional processes are creating greenhouse gases, what the installations can do to be a part of local, regional and national solutions, and how the Army is going to adapt the 21st century base structure to the new realities of climate change.

The defense authorization committees are well aware of the need to engage the military in the new realities of climate change, and they are hard at work with authorizing the services. However, the services themselves must embrace new ways of thinking about this issue and about tackling those reforms to change the way the bureaucracy works.

I offer the following six suggestions only as a starting point:

Fund the New Energy Technologies
The Logistics Management Institute said in their review of "Winning the Oil Endgame" that "Aggressively developing and applying energy-saving technologies to military applications would potentially do more to solve the most pressing long-term challenges facing the Department of Defense (DOD) and our national security than any other single investment area. Recently, the Secretary of Defense called upon the services to be more innovative as they look at the technology, and many have said the services have fallen woefully behind in innovation. Yet, their very engagement can improve the entire marketplace for technology. The Energy Independence and Security Act of 2007 sets a standard for cutting greenhouse gases, and both DOD and the private sector have stated that the technology is available to meet these greenhouse gas requirements." Specialized programs in each of the military services have shown impressive results that need to be more broadly implemented throughout DOD.

Fix the Installation Organization Structure
While the Department of Defense is in the process of developing a comprehensive energy strategy, there remains a lack of integration of environmental and energy policy. Currently, the Army Installations and Environment organization separates environmental policy and practice from the energy organization into two stovepipe organizations. While both of them are under the same Assistant Secretary, they have almost no lines of communication, and the energy organization sees their mission as getting the best price of electricity for the installations. If that price is dependent on coal, so be it. If it is delivered on a vulnerable antiquated grid, that is the problem of the energy provider.

The environmental and energy team must see their mission as a national security mission, and it must be integrated. Ongoing information and training programs like those started at the National Defense University need to be expanded to all service academies and offered throughout the training infrastructure in the services.

Deploy more versatile fuels
During my tenure with the Army, there was great resistance to looking at renewable energy or distributed systems. While the installations planners have developed

a program called Enhanced Leases to better utilize land capacity, still the idea of leasing for solar or wind was resisted because of the long-term power agreements the Army entered into. Perhaps this is inherent in the process of change.

The Senate Armed Services Committee has recommended that the services enter into multiyear contracts, for a period of up to 10 years, for the purchase of alternative or synthetic fuels. The services ought to be buying at least 25 percent of their electricity from wind, solar, biomass, geothermal or other renewable energy sources by 2025. No place is better suited for plug-and-drive vehicles than military installations. As military facilities expand and are upgraded and realigned, greater use of high performance buildings, on-site distributed generation, and the most advanced energy-saving technologies need to be aggressively deployed.

Assess the Vulnerability of Installations

Insurance companies have already performed risk assessments on coastal housing and may have decided to pull out of that market. The military too should assess the risks and begin planning for the next round of base closures and begin to build a base structure that takes into account a warming planet and a rising sea level.

Fresh water will become scarcer in more places due to warming. Just recently, the Senate Armed Services Committee, concerned with vulnerability of the grid, found that, "despite numerous vulnerability studies, the extent of technical and operational risks to specific critical missions is not adequately assessed, or plans for its mitigation programmed." This incomplete assessment, coupled with the trend over the last several years to place more defense installations onto the commercial power grid, suggests that department infrastructure energy plans may not be synchronized with an up-to-date technical and operational risk evaluation. Efforts by DOD to back up critical base functions with on-site renewable generation need to be expanded.

Change the way the services do business at the installation

The department should require a full accounting of the cost of energy at the installations. This should include the cost to the environment from exploration to transportation to clean up of the residue. There should be a department-wide energy efficiency target and authorization for the installations to modify existing contracts to take account of the full cost of energy to the installation and to create energy independence at the installation level.

Work with local communities, including tribes, to develop a smart grid

The military installations should move aggressively toward a web-enabled, digitally controlled power delivery system that efficiently distributes electricity and protects from blackouts and excess energy consumption.

No group of Americans has a larger stake in managing the effects of climate change, and perhaps no government body has a more significant responsibility, than DOD. The department also has the structure, the discipline, and the resources to play one of the most valuable leadership roles in one of the greatest challenges facing the next three generations. The incoming Administration will have an opportunity to appoint a defense leadership who understands the national security implications of climate change and should ask each potential appointee what he or she would do to ensure that the DOD trains, equips and deploys the department to lead on this national security issue. ≪

FIGURE 2

The island of Guam, future home of U.S. Marines moving from Japan by 2014. Is this the wisest move considering the likelihood of sea level rise? Top image is QuickBird image of west side of Guam taken May 21, 2005. Credit: DigitalGlobe.

The Security Threat Requiring Rapid Response

CLIMATE CHANGE IS OPPORTUNITY FOR DOD LEADERSHIP

RAY CLARK

Ray Clark is Senior Partner at The Clark Group, a Washington D.C. environmental and energy consulting firm. In 1999 he was appointed Principal Deputy Assistant Secretary of the Army and served as the Acting Assistant Secretary for Installations and Environment during the transition between administrations. From 1992 to 1999 he was the Associate Director in the White House Council on Environmental Quality. He has a Masters Degree from Duke University where he continues to serve as adjunct faculty. Recently he formed the Conservationists for National Security to provide a forum to address the impacts of climate change on national security. He is editor of two books on environmental policy.

EDITOR'S NOTE

The relevance of climate change to national security was also the subject of our April eNewsletter, which is archived at www.imagingnotes.com.

By now, there are only a handful of people who doubt that global warming is occurring, and most agree that it is happening at such a pace that adapting and managing it could outstrip our institutional skills and abilities. The most charitable description of the Bush Administration leadership on this issue is lackluster. Not only are citizens not prepared – neither is the federal government.

Increasing concerns about the national security implications of climate change have been well documented with numerous studies, including the Center for Naval Analyses (CNA) report led by 11 retired flag officers, and others by The U.S. Army War College, the Defense Science Board, and the Pentagon. The security threats include increased tensions over competition for resources like fresh water and food, as well as large-scale migration of refugees, and disease. It is the U.S. military that is often called upon to bring stability to regions in turmoil and conflict.

While instability is a major national security concern, the full scope of climate change impacts on national security could go beyond instability to include the loss or diminishment of U.S. military installations, and even the inability to deploy weapons because of dramatic changes in ocean temperatures and intensity of local climate conditions.

These senior flag officers of the CNA report have not gone daffy; they have looked at serious data and they are suggesting the deployment of the institutional planning associated with the complex system of the biggest and most sophisticated planning system in the United States government. They are suggesting that the Quadrennial Defense Review assess the capabilities of the U.S. military to respond to the almost certain events that will be caused by climate change. Thus, climate change will become a threat addressed in both the National Security Strategy and the National Defense Strategy. The officers are asking the intelligence community to integrate the consequences of climate change into the National Intelligence Estimate.

The traditional tools of the military, like war games and scenario planning, are overdue in the matter of climate change and would certainly help the next Administration begin the institutional reforms needed to deal with this threat, if they were put into place.

A particularly vulnerable aspect of the military structure that often is overlooked is the fact that installations are not often seen as the "tip of the spear." But climate change will bring major effects to defense installations, particularly the ones in low-lying areas near shorelines and in the Indian Ocean and the Pacific Islands. See ***Figure 1***.

The 2006 agreement between the United States and Japan to move 8,000 U.S. Marines from bases in Japan to the island of Guam by 2014 is clearly about more than just relocating Marines. Guam is about to become once again an important forward position in the U.S. Defense posture.

The FY 2007 National Defense Authorization Act includes a $193 million Military Construction authorization fund for Guam, a $31 million increase over 2006 funding. "Guam is likely to see between $400 million and $1 billion in military construction each

(continued on page 36)

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MYANMAR CYCLONE FLOODING

Rangoon, Myanmar, is shown here after massive flooding following Cyclone Nargis, which occurred on May 2, 2008. The front cover shows an extension of the same area, before flooding. Images are also published on page 23 in "Observing Earth in a Changing Political Climate," an article about the politics of Earth observations. See full details and image description on page 4. Images courtesy of GeoEye.

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