

Interoperable Geospatial Solutions Strengthen Homeland Security

Private-public partnerships are preserving resources and safeguarding our nation.



By Patrick Collins, manager, Technical Marketing, Exelis Visual Information Solutions (www.exelisvis.com), Boulder, Colo.

In an age of unlimited data and ever-increasing data types, it has become more challenging than ever for the U.S. Department of Homeland Security (DHS) to safeguard our nation effectively. The agency's ability to synthesize data and extract meaningful information from so many disparate data sources is critical to its success (see "DHS Embraces Remote Sensing," page 16).

Numerous geographic information system (GIS) software and data providers have teamed with members of the DHS community to develop and deploy technologies that assist with this mission. The power of cloud-based computing and a plethora of new imaging sensors (see "Leveraging New and Emerging Sensors," page 21) are making it easier for DHS to prepare for and respond to homeland security threats.

Cloud-Based Data Fusion

The geospatial industry's adoption of cloud computing has increased

the ability to quickly analyze data and receive timely information, especially on remote devices such as smart phones and tablets. This is increasingly important to field responders, who often find it necessary to make decisions in rapidly changing situations.

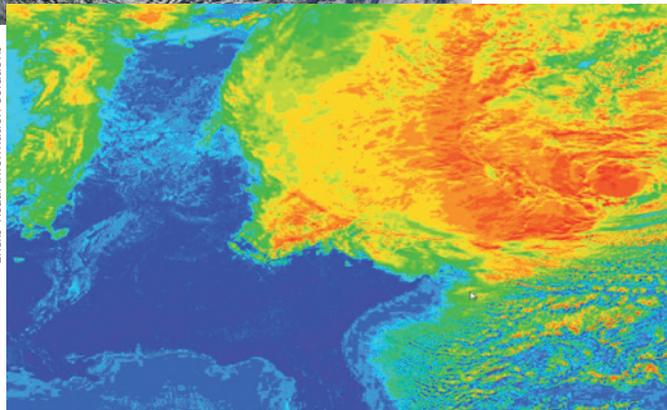
Making decisions based on up-to-date information reduces mistakes and allows responders to address the most critical

situations in real time. A centralized data server is a powerful tool for DHS members to leverage when planning for, responding to and running post-event threat analysis. Products such as the ENVI Services Engine from Exelis Visual Information Solutions (www.exelisvis.com), ArcGIS for Server and ArcGIS Online from Esri (www.esri.com) and FirstLook from DigitalGlobe (www.digitalglobe.com) are prime examples of interoperable cloud-based solutions that can be leveraged by DHS to successfully execute its mission.

DigitalGlobe's FirstLook service focuses on collecting pre- and post-event imagery for disasters and other events that occur around the world. The data are disseminated via Web services that can be leveraged by any system that supports Open Geospatial Consortium (OGC) specifications. High-resolution data are delivered within hours after collection for emergency planning, risk assessment, emergency response, damage assessment and recovery. The imagery is invaluable when trying to rapidly respond to a new disaster.

Esri has several tools that can leverage imagery and related geospatial data to provide on-the-ground situational awareness. ArcGIS contains native support for OGC's Web Map Service (WMS), Web Map Tile Service (WMTS), Web Feature Service (WFS), and Web Coverage Service (WCS) specs, which DigitalGlobe uses to deliver its data online.

DigitalGlobe also has a plugin for ArcGIS for Desktop called ImageConnect, which contains numerous point-and-click tools for accessing, displaying, comparing, and downloading imagery directly to the ArcGIS interface. The toolbar facilitates consumption of DigitalGlobe data for assessing pre- and post-event disaster conditions, allowing users to



Geospatial imagery and advanced image analysis tools such as ENVI (inset) were used to provide timely, critical information to decision makers following Hurricane Sandy.

Leveraging New and Emerging Sensors

quickly overlay the imagery on top of other critical information such as staging areas, resource locations, population centers and more. The interoperability between ArcGIS and DigitalGlobe's FirstLook program is just one example of how companies are collaborating to provide solutions for DHS employees.

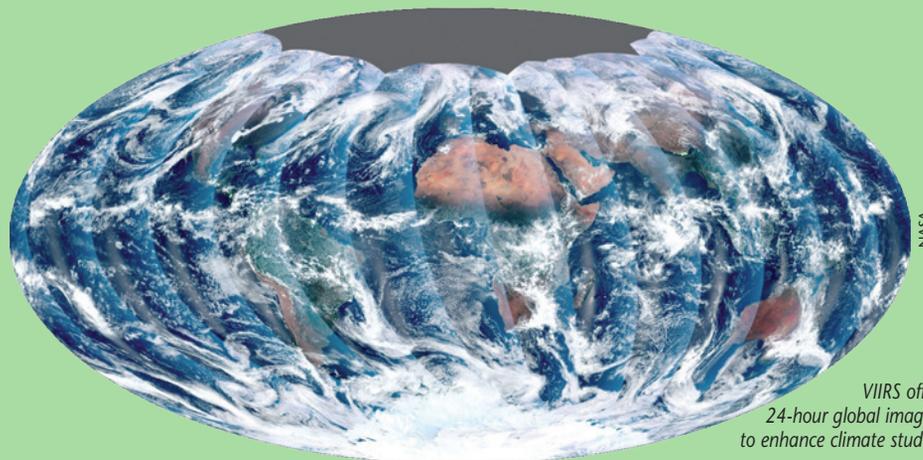
Another solution, the ENVI Services Engine, is a scalable, server-based resource that allows users to run advanced image analytics from thin clients or mobile devices. When used in conjunction with ArcGIS for Server in the form of ENVI for ArcGIS for Server, the software allows users to embed ENVI desktop's analytic capabilities into the Esri ecosystem. Once a user has identified helpful scenes from a service such as

Cooperation between the U.S. government and the commercial geospatial industry is crucial to address future homeland security threats and create a safer tomorrow.

FirstLook, he or she can retrieve the raw data for those pixels for further analysis. Also, the data can be staged in the ArcGIS for Server environment and served to the greater community as an Image Service, a soon-to-be adopted OGC specification created by Esri to expose raw imagery to software over the Internet.

To further promote real-time decision making, many of these functionalities can be automated to reduce hands-on analysis of disaster conditions and provide relevant information to responders more quickly. Data can be ingested and analyzed, and derived products can be pushed out via the cloud to decision makers, responders and civilians affected by events without the need for time-consuming, manual data retrieval, analysis and dissemination. By leveraging RESTful architecture and standards such as GeoRSS, information hubs can push data to relevant parties without the need for requests from those parties to the server. This

Along with using cloud technologies and interoperable geographic information system components to achieve success, the U.S. Department of Homeland Security (DHS) has the unique opportunity to gain threat insights by leveraging analysis software designed to consume data from a slew of new sensors. As part of the U.S. government's commitment to tracking and addressing issues affecting homeland security, new sensors such as the Landsat Data Continuity Mission (Landsat 8) and the National Polar-Orbiting Operational Environmental Satellite System Preparatory Project (NPP) have been developed and launched.



VIIRS offers 24-hour global imaging to enhance climate studies.

The Landsat mission is aimed at ensuring the continued acquisition and availability of Landsat data, which continues a 40-year history of Earth observation (see "Imagery in the News," page 46). Recently, Esri created the Landsat Image Service, a free data feed of all of the Landsat data to date. The imagery has great potential to serve as baseline data for monitoring changes to the U.S. landscape over time.

The NPP satellite contains a sensor called the Visible Infrared Imager Radiometer Suite (VIIRS). According to NASA's website, "VIIRS will collect radiometric imagery in visible and infrared wavelengths of Earth's land, atmosphere and oceans ... Its data, collected from 22 channels across the electromagnetic spectrum, will be used to observe Earth's surface, including fires, ice, ocean color, vegetation, clouds, and land and sea surface temperatures."

The sensor will be critical for climate studies during the next few years, especially considering the astonishing fact that it has the potential to capture a full image of Earth every 24 hours. Another notable attribute is the ability for VIIRS to take images at night, further expanding the temporal aspect of disaster response and threat assessment.

Recently, Exelis Visual Information Solutions has created new support for the VIIRS sensor, including the ability to quickly rectify and extract reflectance values from the data without having to run through multiple steps for geo-rectification and atmospheric correction. This illustrates how commercial companies are working in sync with U.S. government programs to create solutions for end users.

DigitalGlobe plans to launch WorldView-3 in 2014 to complement its existing five Earth imaging satellites already in orbit, ushering in a new age of high-resolution imagery. According to a press release from DigitalGlobe in February 2013 "(WorldView-3) will offer the most spectral diversity available commercially and be the first to offer multiple Short-Wave Infrared bands that allow for accurate imaging through haze, fog, dust, smoke and other air-borne particulates."

Furthermore, "WorldView-3 will provide 31-cm panchromatic resolution, 1.24-meter multispectral resolution in eight spectral bands, and 3.7-meter Short-Wave Infrared resolution in an additional eight spectral bands. WorldView-3 will be capable of collecting up to 680,000 km² per day, bringing the collection capacity of the DigitalGlobe constellation to more than 4.2 million km² per day."

The inclusion of new spectral bands that aim to solve new and emerging problems faced by agencies such as DHS show the initiative that commercial companies provide to further the resources and information available to responders addressing issues of national concern.

— Patrick Collins, Exelis Visual Information Solutions



Scheduled to launch in mid-2014, WorldView-3 will offer 31-cm panchromatic resolution and eight-band multispectral imagery.

creates smart enterprise systems that give people the information they need, when they need it.

Optimizing Private- and Public-Sector Cooperation

Cooperation between the U.S. government and the commercial geospatial industry is crucial to address future homeland security threats and create a safer tomorrow. As DHS takes on ever-greater challenges, the ability to take advantage of interoperable geospatial technologies provides new ways to solve unique problems.

The companies profiled here work closely with their government counterparts to ensure they provide the software and data solutions that will drive smart decision making in the future. Along with these efforts, sensors developed and launched by the U.S. government are providing new data types that can be leveraged by commercial software packages to provide advanced, automated analysis for dissemination to responders, decision makers and civilians. Such collaborative efforts will help ensure the security of our country, saving time, resources and lives. 



ImageConnect was used to bring a FirstLook image of the recent Texas fertilizer plant explosion site into ArcGIS.

DigitalGlobe

30cm Precision Aerial, 50cm Pléiades, 50cm GeoEye, 50cm WorldView, 60cm QuickBird, 80cm IKONOS, 1.5m SPOT 6, 5m RapidEye, 15m ASTER & Landsat, 22m DEIMOS

LANDinfo
WORLDWIDE MAPPING LLC

SATELLITE & AERIAL IMAGERY

IMAGE PROCESSING

DIGITAL ELEVATION MODELS

VECTOR FEATURE EXTRACTION

OBJECT-BASED CLASSIFICATION

TOPOGRAPHIC MAPS & NAUTICAL CHARTS

GeoEye Authorized Reseller • DigitalGlobe Distribution Partner
RapidEye Direct Distributor • Authorized Intermap Data Distributor
Astrium GEO-Information Services Image Partner
USGS Business Partner • Esri® Business Partner



Pagosa Springs, Colorado, U.S.A.

Semi-automated object based classification of one meter resolution 4-band NAIP. Classes include trees, lower vegetation, impervious type surfaces and hydrological features.

tel +1.303.790.9730 • fax +1.303.790.9734

sales@landinfo.com • www.landinfo.com