



Rich Basket of Tool Kits

INDUSTRY PLAYERS ARE CONTINUALLY UPDATING THEIR GEOSPATIAL EXPLOITATION TOOL KITS TO MEET ONGOING CHALLENGES.

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The non-stop forward march of technology has created new horizons for the collection, analysis and exploitation of geospatial intelligence. The availability of full motion video, persistent surveillance data, satellite imagery, LiDAR and other new data types is providing analysts with the potential for unparalleled richness and accuracy to the images and information they are dissecting.

But perhaps the most important drivers to the innovations being fostered in geospatial exploitation are the needs of warfighters in current U.S. military areas of operation. More than ever, geospatial intelligence is being brought to bear in support of tactical operations, and this has challenged providers of geospatial exploitation tool kits to catch up.

From these facts flow the other major trends to be found in the development of geospatial exploitation technology. New types of data to be exploited lead to the desire to fuse that information by layering one set of data on top of another accurately and robustly. This in turn has accelerated the drive toward the development and adoption of data standards to make that happen, as well as the move toward taking an enterprise, as opposed to a desktop, approach to geospatial data and applications.

"I see increasingly that geospatial exploitation is providing a foundation for tactical intelligence," said Stuart Blundell, vice president for geospatial products and solutions at Overwatch Systems, a



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unit of Textron. "Users want terrain imagery, features in two- and three-dimensional quality, with full motion video data and other data layered on top of that to support tactical exploitation."

The exploitation of more and complex data types has become a major challenge of providers of geospatial tool kits. Besides video, which multiplies geometrically the number of images that need to be processed, energy-sensing hyperspectral and multispectral data are also making their way to analysts' desktops.

"These can provide richer and more detailed analysis," said Beau Legeer, director of product marketing for ITT Visual Information Solutions. "One trend in the industry has been to introduce a work flow approach that guides the user one step at a time, from bringing the data in, to processing, analyzing, extracting and sharing the data with other applications."

In addition, LiDAR data is becoming increasingly important to analysts as a result of the aerial surveillance being conducted over Afghanistan and Iraq. LiDAR, or light detection and ranging, is a system that uses laser beams to map terrain elevation. LiDAR reports elevation of scanned areas in the form of point clouds.

"LiDAR involves large volumes of data," noted Tom Lobonc, product line director for defense at ERDAS. "You need different kinds of tools to work with LiDAR data. There are also different ways to visualize LiDAR point clouds."

Old-school geospatial exploitation had analysts accessing panchromatic images and performing measurements and visual analyses. The availability of greater numbers of data sets, together with higher levels of horsepower provided by computers, has spawned the desire to fuse that data into rich, robust and accurate visualizations, complete with features like roads, rooftops and bodies of water.

"Analysts want to be able to handle any number of sources and data sets of any size," said Legeer. "That is what geospatial tool kits have to address."

The information overload engendered by the explosion of data requires the application of automation to the analysis process. More robust algorithms and increases in computing power allow geospatial exploitation tool kits to bring half a dozen types of data to the analyst's desktop. The ability to fuse multiple sources of data into a single visualization provides greater assurance that the end product is accurate.

"In earlier days, analysts worked with 50 percent probabilities of accuracies," said Lobonc. "Applying automation to data fusion can give them 90 percent confidence that their analysis is accurate."



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ESSENTIAL STANDARDS

For industry to keep up with the demand for new sensor data, the broad adoption of standards across all data types is essential. Standards define in detail how systems interpret data, and provide industry with a roadmap for incorporating the processing and analysis of new data such as video into their exploitation tool kits.

Standards such as those promulgated by the Open Geospatial Consortium are increasingly being accepted and adopted by industry players as well as by the defense and intelligence communities. Some standards, such as those for full motion video data, are still being developed.

"Standards set the framework for industry to more rapidly build capabilities," said Rob Mott, vice president for military and intelligence solutions at Intergraph. "One challenge for industry is to build support into tool kits for those new sensor formats while standards are still in flux."

One model for the adoption of standards occurs when a proprietary system, such as ESRI's ArcGIS, gains widespread support, noted Sean Love, a business development manager at Northrop Grumman. "If the developer is willing to publish its standards, as ESRI did, the other vendors are able to create applications for that environment," he said.

Lobonc sees broader collaboration among commercial vendors, government agencies and the standards community. The next step will be mandated adherence to given standards.

"We are not at the point where anyone is saying you must use this standard," said Lobonc. "But we should be getting to the point where standards are enforced. Lack of adherence to standards in some cases leads to the inability to solve certain problems."

Geospatial exploitation tool kits traditionally have been delivered as desktop applications. Increasingly, however, they are evolving into enterprise applications accessed over servers. In some cases, hybrid architectures seeking the best of both worlds have been developed.

Desktop applications provide analysts with robust computing power. Enterprise applications better allow for the storage of massive amounts of data, and by some accounts reduce costs.

The functionality of tool kit applications does not necessarily differ depending on the computing environment. "It is the same application. It's just being presented and managed in a different sort of way," said Lobonc.

"In our world, analysts have traditionally used the desktop," said Mark Sarojak, BAE Systems' director of sales and marketing for SOcET GXP. "It was the best and only environment to do heavy number crunching. Now we see more enterprise applications where operations can be handled on a centralized server while the analyst sits at a desktop."

"Now that networks are getting more bandwidth, it is more possible to do this at the enterprise level," added Love.

Legger believes that the enterprise model will be key to the future of ITT-VIS tools. "The applications will be hosted on servers right alongside of the data," he said. "We see that as a very important trend and one that is very real."

But others, such as Sarojak and Blundell, don't foresee ever getting away completely from desktop applications. Blundell noted that it is important to provide customers with cost-effective options, especially in today's budget-cutting environment.

Lobonc doesn't see the desktop-enterprise dichotomy in quite the same way as his colleagues. ERDAS' approach, he said, is to regard all sources of computing, applications, and data, whether local or network-accessible, as the "enterprise."

Given the multifaceted and dynamic environment in the GEOINT field, it is no surprise that industry players are continually updating their exploitation tool kits to meet ongoing challenges.

BAE SYSTEMS

BAE Systems recently introduced GXP Xplorer, which addresses the first step in analyzing geospatial intelligence—finding the data.

"If they can't find data, analysts can't do their jobs," said Sarojak. "Once they find it

they want to fuse it. Each data type has its strengths and weaknesses."

GXP Xplorer enables analysts to search not only their local catalogs but also other sources of available data, such as those stored on enterprise applications or on network-accessible libraries, by enabling federated queries across multiple sources.

"Another new feature of BAE System's offering is spatially enabled exploitation. This feature essentially digitizes and stores analysts' markups of imagery by geolocation, data and time so that they can be retrieved and exploited at some future date.

"Spatially enabled exploitation is new in the analysts' world," said Sarojak. "It takes analysis to next level. That is real knowledge and content management."

Video exploitation is now available in SOcET GXP, but will receive greater emphasis,

together with fusion of multiple data types, in SOcET GXP's upcoming v3.2 release.

"Analysts are faced with more and more data every year," said Sarojak. "We are working hard to produce tools that enable them to find data locally and on other sources to help them accomplish their jobs."

ERDAS

ERDAS redesigned its Imagine geospatial package in its most recent release. The completely redesigned interface, based on Microsoft's Ribbon-style Office 2007 and Windows Vista applications, allows users to accomplish tasks more efficiently. The location of tools has been reorganized and made more intuitive and work flows have been streamlined. Some tools have been consolidated so that there are fewer tools to contend with. Very large files are easier and quicker to open.

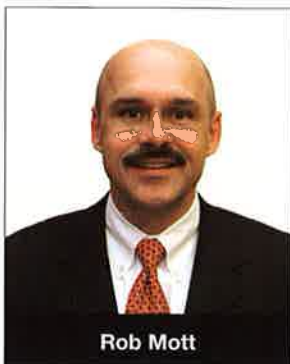
An upcoming release scheduled for this fall will endeavor to improve performance and provide enhanced analysis and work flows for newer data sets such as photogrammetry and remote sensing. It will also feature a new and improved viewer, which will be handy in exploiting larger files.

ERDAS introduced its Apollo server around three years ago in recognition of the growing interest in a client-server, as opposed to desktop, architecture for the access and operation of geospatial exploitation tools. "It is really coming into its own



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now," said Lobonc. "We continue to work on that as well as desktop exploitation tools."

ERDAS is in the process of developing a tool that will manage both desktop and enterprise catalogs as one. Under this scheme, an analyst's catalog located on the desktop will act as a subset of the enterprise catalog, which will be accessed remotely. Data and documents located in a desktop catalog will be easily pushed to the enterprise catalog.

"We didn't want to go with a server-only or desktop-only architecture," said Lobonc. "An integrated approach latter is the best and most versatile way to go."

INTERGRAPH

Intergraph's recent enhancements to its geospatial exploitation tool kit include capabilities to fuse full motion video, geospatial elevation data and satellite imagery into a single view.

"We regard full motion video as another geospatial data type," said product manager Elaine Woodling. "We can connect to multiple kinds of data sources and Web services."

As part of this enhancement, Intergraph has incorporated its patented video enhancement and stabilization algorithm to produce a fully and fused integrated geospatial view that includes full motion video. The tool also catalogs and indexes the data and captures its telemetry so users can find the data they need, and "importantly," Woodling added, "exclude data they don't need, so they that they can perform pattern of life analyses, for example."

Since full motion video is evolving at a rapid pace and its emerging standards are only loosely adhered to, Intergraph sees itself challenged to keep pace with this rapidly developing market technology. "We have a road map for the next few years," said Woodling, "but we want to be agile enough to react if new situations develop in the marketplace."

ITT-VIS

ITT-VIS is continuing to develop and market its tool, which uses automation to extract features from images. The company has experienced success with the adoption and acceptance of the tool by users. The soft-

ware saves time over the hand digitization still practiced by many analysts.

"The technology is getting faster and more accurate with every release," said Legeer. ITT-VIS's soon-to-be-released ENVI 4.8 puts the company's product into the ESRI ArcGIS ecosystem. "We already have a strong partnership with ESRI," said Legeer. "This takes it to the next level."

The move will integrate the ENVI desktop solution with both the ArcGIS desktop solution and the Arc Server enterprise solution. This catapults ITT-VIS's product to the enterprise realm.

"Many of our customers already work in an ESRI environment for functions like mapmaking and productization," said Legeer. "This integration will streamline work flows and allow users to access our tools and work in a single environment."

At the same time, Intergraph will also be releasing tools to exploit LiDAR data. "This is one step in a multi-year process towards true multi-sensor fusion," said Legeer. "We already had tools for multispectral and hyperspectral sensors, now we can check off LiDAR."

Next year, ITT-VIS will be introducing ENVI 5.0, which will feature auto registration. "We see that as the first key component in a fusion strategy," said Legeer. "All modalities will be able to register themselves. This will take us one step further toward a vision of multi-sensor fusion."

ENVI 5.0 will also include a powerful display engine that will enable a view into all of

the types of data that will be brought to bear in fusion. Modalities such as video and synthetic aperture radar data will be more tightly integrated.

NORTHROP GRUMMAN

Northrop Grumman has expanded its existing geospatial portfolio to include geospatial data acquisition, collection and processing of LiDAR, full motion video and persistent surveillance data, photogrammetric services, geographic information systems and analysis.

The company's offerings support functions such as intelligence gathering and mission planning, routing and logistics, execution monitoring, physical asset tracking, exploration of what-if scenarios, data exploita-

tion and analysis, highly integrated databases and sensor networks, and secure command and control systems.

Northrop Grumman sees itself responding to customer demands when it focuses less on geospatial intelligence in isolation and more on multi-INT, said Love.

"The real focus going forward is on taking geospatial data and pushing it to other intelligence types and ingesting other intelligence into geospatial," he added.

The company facilitates the fusion different data types through translators supported by a service oriented architecture. "All this is transparent to the user," said Love. "The user doesn't care what the application looks like. He just wants to be getting the right kinds of information. That is why we focus on getting actionable intelligence to analysts and warfighters."

TEXTRON

Textron's latest iteration of its ELT/Series Geospatial Intelligence software includes the ability to receive and analyze full motion video collections and incorporate video analysis with other tools.

The ELT/Series software also provides imagery and geospatial exploitation tools for a range of applications, including tactical imagery and national geospatial analysis. The latest release, version 20.1, leverages a flexible architecture and provides users with advanced products, such as GeoCatalog, which enables analysts to create searchable databases for the management of geospatial data, and SpotLite, which enables analysts to produce and analyze 3-D visualizations from imagery.

New graphic drawing tools have been provided to improve visualization of blast assessment and geo-referenced bearing indication. Grid capabilities have been extended to support improved definition and specification.

Textron has also "invested in making its code base more modular," said Stuart Blundell, vice president for geospatial products and solutions. "This allows customers to choose between a full-scale solution or to pick and choose the tools and applications they need for their particular purposes." ★



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