Government Business Council
Industry Insights

A Briefing
from GBC:
Industry Insights
January 2012

Data Surge and Automated Analysis: The Latest ISR Challenge

Over the past decade, the United States government has spent hundreds of billions of dollars to improve its ability to collect intelligence. The sheer amount and ever-increasing sophistication of information have overwhelmed analysis systems and processes.

Data from sources as varied as unmanned aerial vehicles, surveillance video and online chat result in a flood of information so vast that only a fraction of it can be analyzed. The Intelligence, Surveillance and Reconnaissance (ISR) community must develop capabilities to analyze intelligence at unprecedented speed and capacity.

Thousands of unmanned aerial vehicles now collect intelligence, up from fewer than 50 a decade ago. Airborne sensors now track dozens of targets simultaneously. UAVs feed full-motion video directly to front-line troops. Automated systems suction emails, chats and Twitter feeds continuously from the ether, forming constellations of sensors and sensor networks.

> "We simply haven't had the scalable storage capacity or the Big Data analytic tools to fuse petabytes of data into actionable intelligence, in real-time."
>
> - MG(R) John M. Custer
> CENTCOM J2 2003-08

U.S. technology has conquered the problem of collection, but has created massive problems related to storing and analyzing data, and to disseminating useful intelligence, according to MG(R) John M. Custer, former commander of the Army Intelligence Center, current director of federal strategic missions and programs at EMC Corporation.

"How do you harvest chat, or Twitter, or Facebook, or full motion video?" Custer asked in an interview. Though Google and the age of the search engine solved the problem of navigating the infinite universe of the text Internet, there still remains to be a similar mechanism for rich media—audio, video and images. How can such vast data troves be stored, transmitted and analyzed?

"We don't have the analytic tools or the storage capability" needed to turn all of the data into actionable intelligence, warns Custer. Fixing that—in a cost-efficient manner—is the next step in the intelligence, surveillance and reconnaissance revolution.

A Big Data Dilemma

The enormous volume of data flooding into intelligence databases has a name: Big Data.

"The real problem is Big Data," Custer said. It's easy to collect, but traditional storage and database management cannot handle the flow. "Storage has to scale to infinity," Custer said. And to yield useful intelligence, data must be ingested by databases and examined by algorithms in real time, he said. Anything less results in stale data, which defeats the purpose.

Pulling crucial bits of intelligence from the data deluge has produced a new analogy: "It's no longer about looking for a needle in a haystack, now it's looking for the silver needle

EMC²

in a stack of silver needles," says Custer. The value of a single event—a video clip or a chat keyword—has increased. In response, the intelligence community must collect more data of increased quality and sophistication.

Sophisticated Sensors in Air, Space and Undersea

Collecting terabytes of data has become routine for military and civilian intelligence services, propelled by recent wars and technological advances.

The wars in Iraq and Afghanistan made unmanned aerial vehicles the kings of ISR collection. UAVs have flown more than 1 million combat hours since 2001. Spending on UAVs exploded from less than $300 million in 2002 to more than $4 billion in 2011, and the military plans to keep buying, according to a long-range aircraft procurement plan the Pentagon published in March 2011. Meanwhile, military technologies are advancing.

UAV maker AeroVironment demonstrated its Nano Hummingbird In February 2011, which flies by flapping 3.25-inch wings, and spies with a miniature video camera. The whole thing weighs two-thirds of an ounce–battery and camera included. The Air Force Research Lab is working on an even smaller dragonfly-size UAV.

A 302-foot-long, unmanned Long Endurance Multi-intelligence Vehicle–LEMV–is scheduled for delivery to the Army in Afghanistan in 2012. It is designed to loiter at 10,000 feet for 21 days at a time, keeping watch with 2,750 pounds of radars, full-motion video and signals interception gear.

The Air Force plans an even larger airship. Its 450-foot-long Integrated Sensor Is Structure craft–ISIS–is to have one giant radar for tracking vehicles and dismounted troops, and a second radar for spotting cruise missiles and other airborne threats. Helium-filled and solar-powered, ISIS is intended to fly at 65,000 feet and remain aloft for a year or more at a time.

At $1 billion or more apiece, satellites remain the most costly of U.S. ISR platforms, the Congressional Research Service reports. So work continues on a class of simpler, cheaper, "Operationally Responsive Space," satellites that can be warehoused and kept ready for launch on short notice.

The first ORS satellite, launched June 29 and declared operational Sept. 28, 2011, uses a multispectral SYERS-2 reconnaissance sensor to provide "battlespace awareness" to the U.S. Central Command, according to sensor manufacturer Goodrich Corp.

As UAVs multiply in the skies, UUVs–unmanned undersea vehicles–take on ISR missions underwater. The Navy's ISR roadmap calls for building a fleet of UUVs by the end of the decade. They could be used to monitor the movements of drug smugglers in the Caribbean and track adversary warships around the world. Three were deployed in the Gulf of Mexico in 2010 and transmitted back volumes of data on the plume of oil gushing from BP's blown-out well.

The military intelligence community has devised sophisticated methods for data collection, while technologies available to civilian users has expanded, also.

Civilian and Social Sensors

The proliferation of social media has opened another vast realm in which the intelligence community must focus attention. Chats, blogs, Twitter, YouTube and social networking sites often are sprinkled with important intelligence. The problem is finding actionable points in the tsunami of data.

In July 2011, DARPA launched its Social Media in Strategic Communication program, offering $42 million for "automated and semi-automated operator support tools and techniques for the systematic and methodical use of social media" to detect and track the spread of ideological movements, misinformation and persuasion campaigns to identify participants, and to launch counter operations.

A DARPA-issued broad area announcement described these social media tools as "heavily dependent on chance," and urged the ISR community to no longer rely on "a combination of luck and unsophisticated manual methods."

The Intelligence Advanced Research Project Agency (IARPA) has a similar effort underway. In August 2011, IARPA announced its Open Source Indicators program to develop technology that will continuously and automatically analyze "publicly available data, such as web search queries, blogs, micro-blogs, internet traffic, financial markets, traffic webcams, Wikipedia edits, and many others." With automated analysis, IARPA hopes to detect developing political and humanitarian crises, riots, mass migrations, disease outbreaks and economic instability.

A similar push for automation is underway for the closed-circuit television systems (CCTV) used increasingly for homeland security. CCTV is being fused with biometrics and human behavioral signature recognition technology to create automated systems for spotting threats, the Homeland Security Research Corporation reported earlier this year. In the United Kingdom, already 1.85 million CCTV cameras monitor civilian movements—or one for every 32 UK citizens.

> "We are swimming in sensors and drowning in data."
>
> - Regina Dugan
> Director, DARPA

The Homeland Security Research Corp. predicts a $3.2 billion global market for smart CCTV systems by 2016. But CCTV systems without automated analysis cannot provide reliable real-time warnings, the research and consulting firm said.

The massive increase in military intelligence collection is mirrored in federal civilian agencies. The Department of Homeland Security (DHS), the FBI and state and local agencies have established 72 fusion centers that receive, analyze and share intelligence. And like the military, the civilian sector is awash in data that pours in from law enforcement, public safety and emergency response agencies, plus the private sector.

The Automation Ambition

"We are swimming in sensors and drowning in data," said Regina Dugan, director of the Defense Advanced Research Projects Agency. For many intelligence experts, better automated analysis technology is the top ISR priority. According to a report by the Defense Science Board earlier this year, algorithms that can discover useful intelligence in the surfeit of collected data would allow analysts "to perform real analysis rather than exhausting themselves culling raw data." Science and technology created the problem and now must solve it.

DARPA director Regina Dugan spelled out the case for automated analysis this way to Congress during a March hearing: to detect dismounted fighters in Afghanistan requires collecting and processing about 100,000 times more data than it takes to detect a strategic bomber.

"One of two things must happen," she said. "Either we must give up the target set [of dismounted fighters], or we must deal with the data volume. Obviously, we do not want to give up the target set. The only choice before us, therefore, is to develop capabilities that dramatically improve our ability to manage and use the data."

In part, it's a problem that's solving itself, she said. "Empirical results suggest that better sensors give us better data. More and better data leads to better automation. Better automation enables better analysis." The millions of hours of video and the endless stream of tweets and email are unstructured data that must be quickly analyzed and transformed into usable intelligence.

> "Collaboration across state, local, and federal partners to 'connect the dots' to prevent and deter threats remains a challenge."
>
> - Dept. of Homeland Security

Piecemeal in Approach

Project by project, the ISR community is working to develop automated techniques.

The Army is tackling a facet of the problem with a Federated Universal Synchronization Engine – FUSE. The system pulls together intelligence from multiple sources–video, synthetic aperture radar and a moving target indicator, for example–and presents it together on one viewing screen.

FUSE is intended to quickly integrate perishable intelligence such as the locations of moving targets, the Army said during tests last spring. It was developed after the Army discovered that UAV operators did not have the technology needed to fuse intelligence from multiple sources into a single operational picture. The system is expected to be ready for deployment in 2012.

The Navy Research Lab has already demonstrated how automation can tackle one part of the information overload problem. An airborne, wide-area surveillance sensor and a high-resolution narrow field-of-view sensor, worked together in 2010 without human intervention, to spot, track and identify vehicle-size and some human-size targets on the ground in real-time.

DARPA has launched an ambitious program, Insight, to build an ISR "exploitation and resource management system" that integrates human reasoning and machine analysis of intelligence. The system must be able to sort through all types of ISR data in real-time, according to DARPA–video shot by drones, signals collected by ground-based sensors, information reported by soldiers, even intercepted text messages.

Insight would use automated techniques such as behavior modeling, threat network analysis and anomaly detection to comb through raw data and discover useful intelligence.

"Little 'True Fusion'"

The proliferation of military and civilian sensors creates complex, structured and unstructured data, all of which the ISR community must store, transport and analyze to turn data into intelligence.

Years after the September 11, 2001 terrorist attacks, "little 'true fusion,' or analysis of disparate data sources, identification of intelligence gaps and pro-active collection of intelligence" is occurring, the Congressional Research Service reported. The fusion centers are swamped, and DHS is aware of the problem.

"Collaboration across state, local, and federal partners to 'connect the dots' to prevent and deter threats remains a challenge," the DHS inspector general wrote last year. The fusion centers need more effective information sharing IT systems, he said.

Enterprise Solutions for Cost-Savings

"You have to be smarter about how you manage your infrastructure," said Dawn Meyerriecks, Deputy Director of National Intelligence Acquisition and Technology in an interview with the Geospatial Intelligence Forum.

> Technologies can address conundrums like Big Data, storage and analytics, but as you decrease boots on the ground and the intelligence that connotes, you need more systems that provide indications and warning.
>
> -MG(R) John M. Custer

In the Defense Department, combining ISR data is the job of the Defense Intelligence Information Enterprise, or DI2E, and other virtualization efforts. Envisioned as a common military-wide framework, DI2E would rely heavily on cloud computing to provide intelligence analysts with access to hundreds of scattered databases and exploitation tools to make storing, finding, retrieving, analyzing and disseminating ISR data faster and easier.

Parts of DI2E already exist, said Custer, the former Army Intelligence Center commander. The Army "already has a cloud – they're using it today in Afghanistan," he said. "DI2E will bring the Air Force and Navy" and military intelligence entities such as the National Geospatial-Intelligence Agency into the same cloud, he said. The military and intelligence community can "save huge money" by moving to the cloud, as DI2E proposes, relying more on virtualization and data center consolidation.

For the Office of the Director of National Intelligence, "cloud computing and all the technologies that come with that are big players," said Meyerriecks. "Network and content staging innovations, peer to peer, and proxy caching are among the things that are happening."

Risks in Reductions

U.S. annual spending on intelligence now tops $80 billion a year, more than double the amount spent in 2001, according to the Pentagon. But budgets cuts are expected.

"We've had ten years of steady increases. Now we're going to have to tighten our belts," U.S. Army General (R) David Petraeus told a joint hearing of the House and Senate intelligence committees Sept. 13, 2011. As the senior commander in the Iraq and Afghanistan wars, Petraeus was the beneficiary of extraordinary ISR improvements. Now, as the director of the Central Intelligence Agency, Mr. Petraeus may have to decide which ISR technologies he can do without.

The coming budget cuts are likely to impose discipline of their own. Not all ISR programs that exist today will survive the spending downturn, Director of National Intelligence James Clapper told the Intelligence Committees. Nor should they. "I think we have to be rather cold-hearted and objective about the real contribution the various systems make," he said. But at the same time, "we must try to sustain healthy R&D for the future."

Even as the government decides which programs and force structures to cut, agencies must be judicious with ISR capabilities, Custer cautioned. Indications and warnings that offer situational awareness are essential, particularly as cost-reduction efforts reduce the volume of ground troops.

According to Custer, "technologies can address conundrums like Big Data, storage and analytics, but as you decrease boots on the ground and the intelligence that connotes, you need more systems that that provide indications and warning."

William Matthews is the author of this report.

About EMC®

EMC Corporation is a global leader in enabling the Federal Government to transform its operations and deliver IT as a service. Fundamental to this transformation is cloud computing. Through innovative products and services, delivered in partnership with leading Government Contractors and Federal Systems Integrators, EMC accelerates the journey to cloud computing, helping Federal IT departments to store, manage, protect, and analyze their most valuable asset–information–in a more agile, trusted, and cost-efficient way. Additional information about EMC can be found at www.emc.com/federal

About the Government Business Council: Industry Insights

GBC: INDUSTRY INSIGHTS, a division of the Government Business Council and Government Executive Media Group, is dedicated to advancing the business of government through analysis and insight. GBC: INDUSTRY INSIGHTS partners with industry to share best practices with top government decision-makers, understanding the deep value inherent in industry's experience engaging and supporting federal agencies. Contact Bryan Klopack, Director, at bklopack@govexec.com.