Airbus Defence and Space is introducing Data Management Solutions, an integrated suite of products and services that enable users to access, manage and disseminate various types of geospatial data.

— Jessi Dick, Sr. Marketing Manager in the Geo-Intelligence Programme Line of Airbus Defence and Space

"(It is good to see everyone) working together to harness our geospatial data and analytic efforts that will address the President’s message that climate is a National Security threat." p. 26

— Robert Cardillo, Director of NGA
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Dublin, Ireland

THIS IMAGE OF DUBLIN, IRELAND shows the coastline, harbor, and rivers running through the city.

The image was taken on May 27, 2012, by RapidEye, one of the early smallsat constellations. RapidEye was acquired by BlackBridge in 2011.

BlackBridge owns and operates an end-to-end commercial earth observation system, comprised of the RapidEye constellation of 5 spacecraft, a dedicated spacecraft control center (SCC), reception facilities for enabling uplink/downlink services, and a ground segment designed to plan, acquire, and process over 5 million km² of imagery every day.

Satellite image courtesy of BlackBridge.
Companies Are Merging, Evolving, Transforming...

WHEN I ATTENDED THE GEOINT Symposium in June, the Director of the National Geospatial-Intelligence Agency (NGA), Robert Cardillo stated that the NGA wants to be as successful in the unclassified world as in the classified world. “Open is the secret sauce,” he said. “90% of the NGA Foundational Data is commercial.” This is a new viewpoint for the highly classified NGA, and one that should be applauded.

I also spoke with Matt O’Connell, consultant and former CEO of GeoEye. He thinks that the imagery market is in a very exciting phase. “Lower costs – for components, telecommunications, launches, etc. – have made it possible for a new generation of smaller satellite companies to emerge. Although not all of them will thrive, many of them will. The market is eager to benefit from the lower cost and increased revisit time that many of the smaller companies offer. The larger companies – like DigitalGlobe – will continue to take the lion’s share of the revenue, especially from government clients in the U.S., because those clients want the very high resolution and accuracy that can be achieved only by big, expensive satellites. But commercial customers and some of the smaller governments will gladly take lower resolution and accuracy if they can reduce their costs and increase their revisit rate.” He also noted, “As imagery becomes more plentiful, that will facilitate the development of analytics and products, which is what most customers really want anyway. Customers are increasingly looking for subscription-based delivery of information and information products rather than raw pixels.”

That is exactly what the companies are doing, which is detailed in our feature story on page 18. Turning pixels into usable, relevant information has been the focus of the imagery companies for several years now, and we are seeing new developments making this a reality. The cover story is about how the imagery companies are evolving, and partnering to offer new services that ultimately serve their customers better. They are offering image processing in the cloud, so that customers don’t have to download the huge imagery files in order to work with them. In addition, most companies offer some sort of analytics capability, in addition to image processing, to varying degrees and with various technologies and levels of expertise. Of course, they must evolve to stay competitive, as Dennis Jones, President of the Earth Observation Industry Alliance, points out in the story.

The companies are not just changing; they are transforming the way that they do business. There are mergers and acquisitions, strategic partnerships, and more. Let’s keep an eye on the early smallsat companies like Surrey Satellite and BlackBridge (with the RapidEye constellation), newer players like Skybox (now owned by Google) and Planet Labs, as well as OmniEarth, UrtheCast, Aquila Space, and satellites for weather, PlanetIQ, Tempus Global Data, and Spire… and let’s watch the UAVs with consumer cameras!

In this issue, we report on a few different workshops that bring together stakeholders who are using the geospatial data for important work in all corners of the globe. The Secure World Foundation Forum on page 6 is about the importance of the newly released SRTM-2 DEM dataset, and how the NGO communities are training users in developing countries, in particular for flood modeling. The workshops are small, but important, in that they are training people how to use the data, and those people will train others. This is all towards the goal of being prepared for disasters or mitigating them, rather than focusing mostly on response.

We also report on the Climate and Human Security – Geospatial Data and Mapping Symposium, organized by several stakeholders, including the Department of State, NGA and NCAR. This event focused on how climate change is a risk to human security. Read more on page 26.

Please email me your thoughts, ideas, and feedback! We are here for you.
Flood Modeling

BUILDING CAPACITY WITH SRTM 30-METER DATASET

THE INTERNATIONAL DISASTER MANAGEMENT COMMUNITY IS PAYING increasing attention to the role of space-derived information in the full cycle of disaster management, from beyond the immediate response phase to long-term recovery and even to preparedness by informing actions before disasters occur, as noted in a prior column (“Beyond Disaster Response,” Spring 2014). High-resolution imagery and derived models from satellites and other remote sensing systems contribute greatly to hazard or risk mapping as communities are able to identify vulnerabilities, informing analyses of the timing, force, and potential impact of future natural disasters. The geospatial community recently celebrated the announcement to release the highest resolution digital elevation model (DEM) available, a dataset uniquely positioned to enable modeling of floods, a top concern of developing countries all over the world.

In September 2014, the White House announced the phased release of the global DEM derived from the Shuttle Radar Topography Mission-2 (SRTM-2). At 30-meter resolution, the dataset offers a marked improvement to the already ubiquitous SRTM 90-meter dataset, and is a promising addition to a growing suite of tools for disaster management and prevention. This dataset is important because it is publicly available. Commercial options are available at higher resolution.

Soon after the announcement, U.S. agencies and non-governmental organizations involved in the release effort convened to discuss initiatives to best enable the widespread utilization of this dataset. One such initiative, organized by the Working Group on Capacity Building and Data Democracy (WGCapD) of the Committee on Earth Observation Satellites (CEOS), is a series of regional capacity-building workshops to share the recently released dataset and demonstrate its use. This article highlights two WGCapD-organized workshops that were implemented in 2015. The summary reports for both workshops, which include background details and participant feedback referenced in this article, are available on the Secure World Foundation website at swfound.org/events.

The workshops, titled Higher Resolution SRTM Data & Flood Modeling Workshops, took place in Hartebeesthoek, Gauteng, South Africa, in April 2015, and in Tonantzintla and Puebla, Mexico, in May 2015. The workshops were hosted by the South African Space Agency (SANSA) and the Centre for Space Science Education for Latin America (CREACTEALC), both members of the WGCapD. Both were enabled by the collaboration of a diverse group of local, regional, and international partners that provided financial resources, programmatic support, training and other materials, and in-kind contributions to support the lodging, transportation, and other needs of the workshop participants. The workshops reached over 50 practitioners from seven countries in the Southern Africa region, and 11 countries in the Latin America and Caribbean region. Over half of the participants received travel support from the funding partners to participate in the workshop.

The main goal of the program was to build capacity in understanding and using the 30-m DEM data in two open-source flood models: TerraHidro, developed by the Instituto Nacional de Pesquisas Espaciais...
INPE) of Brazil, and CREST, developed by the University of Oklahoma, and the Sistema Regional de Visualización y Monitoreo de Mesomérica (SERVIR), a program of the National Aeronautics and Space Administration (NASA) and the U.S. Agency for International Development (USAID). The emphasis on floods was chosen as the application focus after consultations with the hosts and others knowledgeable of key issues of concern in the target regions. The hands-on training elements were combined with presentations on freely available data sources, tools, and software, and supplemented with virtual presentations.

In both instances, participants’ feedback highlighted the practical value of the training; a participant in the South Africa workshop praised the flood models as a “new tool for saving life.” Some participants expressed confidence in their ability to train others in their organizations in the use of the models, adding value to the train-the-trainer model to help expand the reach of what are by nature targeted and small-group opportunities. To aid in this, as well as to ensure that workshop participants had the opportunity to use their newly-acquired skills upon returning to their home countries, NASA and the United States Geological Survey (USGS) distributed portable drives loaded with the SRTM-derived DEMs for the relevant regions.

Discussions following completion of the workshops indicated growing momentum in regional efforts to continue capacity building with partner organizations, as well as regular exchanges of information and lessons learned among practitioners. This is particularly important given a growing awareness that making valuable datasets discoverable is only one step in ensuring that they are utilized in decision making. The result of these and other ongoing efforts to raise awareness and build capacity in the use of the newly released DEM should help ensure that this valuable dataset is added to the suite of tools of decision makers and disaster management practitioners as they work to understand and manage risk before disasters occur. Ad
During approximately the last 100 years, humanity has gone through a transition unparalleled in Earth’s history. In fact, this transition deserves to be called an anthropogenic cataclysm. In physical geography, a cataclysm is a sudden and violent physical action producing changes in the earth’s surface. This is what humanity accomplished and is continuing to accomplish. Let me develop this thought in more detail.

Up to the beginning of the 20th century, the Holocene, the last geological epoch that started 11,700 years ago, was characterized by exceptional stability of the environment, including climate and sea level. Humanity was also stable and changes generally took place slowly. If we compare the changes during the Holocene before 1900 to those during the last 100 years, we find extreme differences (Figure 1).

Most remarkably, energy usage increased in

Finding the Message in the Facts

HAS HUMANITY EVOLVED INTO THE MOST EXTREME HAZARD, AN ANTHROPOGENIC CATACLYSM?

ARE WE HUMANS OUR OWN WORST ENEMY? Could our unconscious addiction to growth and need to increase our population be driving us towards our own demise?

In my last column, focus was on extreme geohazards. A community science paper identified large volcanic eruptions as an underrated threat for our increasingly complex, interconnected and fragile global society. Extreme volcanic eruptions have typical recurrence times from 1,000 to 100,000 years or more, and at these time scales they are the largest geohazards in terms of energy release. The energy associated with these eruptions is on the order of 1020 to 1021 Joules, exceeding the energy associated with large impactors with similar recurrence times. But the eruptions may not be the largest hazards and we may have to rethink disaster risk management and reduction to account for a potentially more important extreme hazard: humanity.

Even if we would have the energy resources to produce the subsistence for a further growth of the population and avoid a control of the numbers “by misery and vice,” these side effects of our cataclysmic lifestyle indicate a trajectory leading to global disasters.”
the last 100 years about 1,600 times faster than on average during the pre-cataclysm Holocene. This rapid increase in energy usage caused an increase in atmospheric carbon dioxide, 600 times larger in the last 100 years. This energy usage supported a rapid growth of human population. It allowed for industrialized agriculture which based on fossil fuels produced enough food to sustain a population growth 350 times larger in the last 100 years than before.

Stimulated by the question of a 20 year old student, I discussed in a previous column what to tell my 20 year old self. Now, the fact that the Holocene was extremely stable and provided a “safe operating space for humanity” must be considered against the fact that during the last century humanity has caused cataclysmic changes in the earth’s life support system making the future extremely uncertain. This might be the most important message to tell our 20 year old selves. In fact, we have started to put these facts as simple messages on T-shirts and cups to make it available to the young people, who need to know where their world is heading.

It surprises me that many argued against the thoughts T.R. Malthus developed more than 200 years ago when he pointed out, “yet in all societies, even those that are most vicious, the tendency to a virtuous attachment is so strong that there is a constant effort towards an increase of population” and that this addiction to growth could lead to problems. He wrote, “That the increase of population is necessarily limited by the means of subsistence, That population does invariably increase when the means of subsistence increase, and, That the superior power of population is repressed, and the actual population kept equal to the means of subsistence, by...
Humanity seems to be the most important extreme hazard that needs to be accounted for in any effort of disaster risk reduction.\[4^{4}\]

What Malthus may not have anticipated was that humanity would gain easy access to seemingly unlimited energy by basically drilling holes in the Earth to let oil run out. We use a huge amount of this fossil energy to produce the food and subsistence for a seemingly unlimited growth of the population. Malthus also found that “this constant effort as constantly tends to subject the lower classes of the society to distress and to prevent any great permanent amelioration of their condition.”\[3\]

Consistent with this, the abundance of energy and subsistence did not lead to more equality across humanity, rather the opposite. The Gini coefficient is a simple measure of equality of income in a community.\[5\] It is zero if all community members have equal income and 1 if basically all are without any income and one person has all the income. During the cataclysm, the Gini coefficient increased 100 times faster than before, and today we are close to a world where most of us have very little income while very few of us collect almost all the global income. All of this was enabled by access to abundant energy.

In total, we are now using more primary energy per year than the energy of the volcanic eruption of Tambora in 1815, one of the seven large volcanic eruptions that are known during the Holocene. See Figure 2. Within a decade we use almost as much energy as the Toba eruption 75,000 years ago, a cataclysmic event that eliminated 60% of the global population. Even the kinetic energy of a 2 km impactor, an event with a typical recurrence time of 100,000 years or more, only slightly exceeds the energy that we are using within a decade.

This comparison of humanity’s energy usage
with extreme geohazards leads me to call the process taking place during the last 100 years the anthropogenic cataclysm that is reshaping the planet’s surface, redesigning the geo-biological processes, and degrading the earth’s life support system on which we and all future generations depend. With this, humanity seems to be the most important extreme hazard that needs to be accounted for in any effort of disaster risk reduction. Since Malthus developed his thoughts about the negative consequences of our addiction to growth, there has been an argument between what Ross Douthat in his recent opinion piece\(^6\) calls dynamists and catastrophists. While dynamists see our modern society as a basically successful civilization that will be able to solve the existing problems through innovations, catastrophists believe that the trajectory we are on will end in crisis and disaster – similar to Malthus’ view that “the actual population kept equal to the means of subsistence, by misery and vice.”

Realizing the magnitude of the anthropogenic cataclysm, it is difficult for me to share the optimism of the dynamists. The cataclysmic “life style” of our modern society is propelled by a wasteful and inefficient usage of fossil fuels not only depleting Earth’s resources rapidly but also producing many severe “side effects.” One of them is the extremely rapid change in climate.

Using 800,000 years of paleo data, we can develop a baseline for the “normal” range of variability in the climate system. See Figure 3. The changes during the last 100 years have already moved a number of key variables in the climate system outside of this normal range. The projected changes in the 21st century will move the system even further away from the normal range, and very far away from the range experienced during the Holocene. Even if we would have the energy resources to produce the subsistence for a further growth of the population and avoid a control of the numbers “by misery and vice,” these side effects of our cataclysmic lifestyle indicate a trajectory leading to global disasters. More innovation along the same lines will not help to bend the trajectory towards more promising futures.

What seems necessary is to overcome the addiction to growth leading to more inequality among humanity for the price of a degraded life support system of our planet. If this addiction is as much a part of our nature as Malthus saw it, we are in dire trouble. We must ask ourselves what this planet will look like in the Post-Holocene when finally “misery and vise” will kick in to control our growth. \(^{ac}\)

Endnotes:
The Price of Progress in ALASKA
Measuring the Impact of Development on the State’s Natives

BY MICHAEL GUNDLING / VP PRODUCT MANAGEMENT / TERRAGO TECHNOLOGIES / WWW.TERRAGOTECH.COM
Their work is done in Nuiqsut and Kaktovik, in Kivalina and Point Hope, along the shores of the Beaufort and Chukchi Seas and the Arctic Ocean – places where the Arctic Circle is hundreds of miles to the south, where the summer sun offers 24-hour days and winter means 24-hour nights.

Little is routine about collecting data for anthropological, geographical, biological, environmental and cultural studies in those forbidding places in Alaska, where natives subsist on game, fish and the few indigenous plants. These are places where they cope with fires on the tundra, where ever-warming summers mean more and bigger bugs, where rivers are changing their courses, prompted by changing environmental conditions. They are places under assault from global warming that has caused lakes to disappear into ground that was once permafrost, places where animals the natives hunt for food are on the move racing to stay ahead of threatening change and sometimes losing the race, places where cell phone and Internet connectivity is intermittent at best.

They also are places that yield oil and gas, and that have potential for greater yields in mineral development, but at what cost?

MEASURING PROGRESS

Stephen R. Braund & Associates (SRB&A), an Anchorage firm, has been employed by government and industry since 1978 to help chart change and determine its cost by mapping ethnicity, archeological sites and cultural landscapes, and by tracking migrations of Alaska’s natives and the resources that allow them to subsist and to retain their way of life. Challenges in these specialty surveys lead field crews off the grid and beyond the map to conduct interviews, gather scientific data and research available literature. Information from detailed reports that use a combination of spatial data and structured and unstructured sources of information presents as complete a picture as possible of existing conditions in some of the most remote regions of Alaska.

At stake are the health of Alaska’s natives and the survival of a way of life that is often at odds with industrial development. The pictures that SRB&A paints with the data it collects establish baselines, from which crews can measure change, often in areas in which moving herds of caribou – that have diminished at a rate of 4 to 6 percent per year over the past decade – and other game, and also altered cycles of spawning fish threaten the existence of natives who inhabited the land hundreds of years before “progress” arrived. They are areas where maps often are incomplete because they are not up to date in a time in which people and the resources they need to live are on the move.

Development in the name of progress can be a threat to those communities, but SRB&A now uses new technology to help collect the data needed to better determine the extent of that threat in ways never before imagined – by the natives, and by those who measure the elements that make up native life in some of the harshest regions in the world.

LIGHTENING THE LOAD

Where once SRB&A operated with pencil, paper and plastic map overlays, with questionnaires and forms to facilitate data collection and make it uniform, now their backpacks of all-weather gear include digital cameras, handheld GPS devices and various software packages that have changed with the times. The opportunity to do its work more easily and economically, while lightening the load in those backpacks and keep up with advancing software, led the firm to investigate location-based,
mobile technology breakthroughs. The investigation included these challenges to would-be vendors:

- Date collection would be made in disconnected environments with offline U.S. Geological Survey quad maps of the entire state of Alaska.
- Customizable forms would be integrated with the map surface.
- Seamless data export would not require manual data entry.

This last was extremely important. The SRB&A workforce is largely comprised of trained and educated archeologists and geologists whose skills and time should not be spent on clerical chores, such as transferring data. The workers analyze data and provide customers with expansive and detailed reports from that analysis.

Also, they are people who are passionate about their work in the beautiful but often harsh Alaskan wilderness and its remote communities, and while in the field they can benefit from two-way communication: data collected offline could be sent to the Anchorage office when connectivity can be established, and map updates can be received to help them direct or even re-direct their work.

**NOT JUST A MAP**

Field teams needed flexibility to meet diverse study and survey objectives that combined geographic mapping, data collection, land surveys and research interviews. While seeking to combine as many operations as possible, SRB&A looked to deploy field-data collection applications that were flexible enough to accommodate disparate workflows and meet the needs of anthropologists, surveyors and researchers.

Training time was a factor. Ease of use was critical. The company sought the ability to map areas in all parts of the state with a program that was not intimidating or difficult to use for a staff unfamiliar with GIS applications.

After its investigation, SRB&A field crews now use iPads with TerraGo Edge software to help them do their work. With data collection apps downloaded from the Apple App Store and onboard GPS capability, their backpacks are lighter. A customizable interface meant workers were up and running in minutes without a user manual. They could access offline maps without a network connection by bundling those maps with project notebooks ahead of time. Data could be collected and sent back to a server when connectivity was available. Steps in the process are fewer, and money and time are saved.

A cloud-based solution meant SRB&A could view job progress in real time from a web dashboard and extract data for processing and analysis and for determining if more data was needed to provide a more complete report.

"TerraGo Edge helped to dramatically simplify our data collection process," said Paul Lawrence, a research assistant at SRB&A. "In the past, we were forced to use multiple approaches and manually combine the data later. Because this software has both custom forms and maps, our field users could collect data all in one place. This saves us both time and money in the field and back in the office, where we have to clean up the data. We also found it’s one of the best apps available in handling offline maps. In Alaska, we are often disconnected, and this was of utmost importance to us."

**THE IRONY OF PROGRESS**

The cost of progress, even its definition, is not an issue confined to Alaska. Around the world, indigenous people are being disturbed and displaced by headlong rushes to exploit resources under the name of development. Government and industry are increasingly being required to become more responsible in assessing the impact of progress, both financial and anthropological, on people who have been comfortable in their environment for centuries.
Money to fund government studies can be scarce, and industry is ever attuned to the bottom line, so its investment in determining the impact of its action can be measured. Firms charged with making those determinations are turning toward new technology that meets their needs for combining the efforts of field crews and headquarters.

Those firms are learning from technology companies and from each other, and they are benefiting from a time when location-based capabilities of smartphones and iPads, plus evolving use of the cloud and web-based solutions, are making data collection easier and more economical. The solution was one increasingly used by the field crews of disaster relief agencies, utilities and other industries around the world who are taking advantage of advancing capability of location-based technology.

An even longer-term reward can accrue to people whose way of life is being disturbed by development because now its cause and effect, cost and benefit can be measured more accurately, in greater detail, and more economically than ever before. Decisions can be made with greater confidence because the impact of those decisions can be known ahead of time.

Everybody can win when everybody knows the price of what can be lost, and companies like SRB&A are showing new ways to determine that price, make smarter policies and achieve real progress.

“...We also found it’s one of the best apps available in handling offline maps. In Alaska, we are often disconnected, and this was of utmost importance to us.”
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Wind Power in Texas

These two images of the Texas Panhandle of the U.S., known for fossil fuel production, show a rapid surge in wind energy development. This is the Longhorn North Wind Project, which was initiated in late 2013 and is expected to be fully operational in 2015. The top image was taken Dec. 26, 2013, and the bottom on Dec. 29, 2014.

When completed, the installation will provide approximately 200 megawatts of power from 100 wind turbines. The area covers almost 57 square kilometers (22 square miles), and is only one of many new wind farms that are being developed in this region of Texas. The irregular white lines in the bottom image are access roadways that support construction of the new wind turbines and connection to major transmission networks in the area. The small bright areas on those roadways show individual turbine locations. In the bottom image is an increased number of green fields and small lakes. In September 2014, heavy rain from a tropical storm poured into this part of Texas, which had been in a drought since 2011. Images taken by Landsat 8, and courtesy of USGS.
Imagery Companies Become Information

LEGEND
WV3 – Vegetation Health Value
- Healthy Vegetation
- Impervious / Non-Vegetation
New analytics and the cloud benefit customers using the ultimate big data: imagery

BY MATTEO LUCCIO
CONTRIBUTOR
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In the past few years, the number of space-based Earth observation sensors, their resolution, the number of bands they have, and their refresh rate have exploded, especially with the launch of swarms of smallsats, cubesats, and nanosats. The latest Earth observation satellite is China’s Gaofen 8 (“gao fen” means “high resolution”), launched on June 26. It is optimized to provide country surveying, disaster response, agriculture mapping, city planning, land ownership marking, and road network planning.

The vast amounts of Earth-observation data now available provide new opportunities to solve challenging environmental, natural resource, and global security problems. However, efficiently extracting meaningful information from imagery and sensor data requires automating much of the image analysis and feature extraction and providing access to the data and the analysis on the cloud. Most providers of satellite imagery are now offering their customers end-to-end solutions, so that they are not just selling pixels, but information. “As new imagery companies...
come into the market, they and the traditional providers must diversify their product and service offerings to compete for market share,” says Dennis Jones, President of the Earth Observation Industry Alliance.

**DIGITALGLOBE BRINGS ENVI EARTH SCIENCE ANALYTICS INTO GEOSPATIAL BIG DATA PLATFORM**

In December 2010, GeoEye acquired SPADAC, a geospatial predictive analytics company, turning it into a wholly owned subsidiary named GeoEye Analytics. It provided geospatial predictive analytic solutions to more than 40 customers in the defense, intelligence, and homeland security markets by combining satellite imagery with intelligence data to anticipate the future locations of adverse events and opposing forces based on their pattern of prior locations. After DigitalGlobe acquired GeoEye in 2013, GeoEye Analytics became DigitalGlobe Analytic Services [www.digitalglobe.com/products/analytic-services], which brings together the company’s massive image archive with a cross-disciplinary team.

Now, DigitalGlobe has launched a cloud-based image analysis service jointly with Exelis. It offers ENVI Earth science analytics software for the DigitalGlobe Geospatial Big Data (GBD) platform,

“Airbus Defence and Space is introducing Data Management Solutions, an integrated suite of products and services that enable users to access, manage, and disseminate various types of geospatial data.”
creating a single platform that enables imagery users to combine ENVI geospatial analytics with DigitalGlobe’s image library. ENVI image analysis software, designed and built by Exelis (now Harris), has been in use for more than 25 years to extract information from geospatial data, especially in the fields of mineral exploration, precision agriculture, environmental protection, and national defense. The offering promises to greatly reduce hardware costs and requirements for processing power and data storage, lowering the barriers to entry into the Earth observation market.

DigitalGlobe’s new service is a Platform-as-a-Service (PaaS) offering under GBD. “The platform enables a variety of operations to be performed at scale against imagery such as exploring, extracting, and exploiting information associated with imagery,” says Kevin Lausten, Sr. Manager, Geospatial Big Data. “This model gives users access to imagery data, tools, infrastructure, and expertise.”

GBD combines DigitalGlobe’s imagery and the ENVI software via two Web application programming interfaces (APIs). The first API performs a search and discovery operation against DigitalGlobe’s imagery catalog; for example, one might use it to find all the images related to Boulder, Colorado. Images, of course, are datasets that can be processed. “That is where ENVI comes into play,” Lausten explains. The second API enables users to run a set of tasks against that set of images very quickly using scaleable cloud computing approaches. For example, having discovered all the images relating to Boulder, a user could use ENVI’s vegetation analysis tool to show changes in vegetation over time. In other words, the ENVI tasks are now an integral part of this workflow API.

By combining the ENVI software and its imagery archive this way, DigitalGlobe, Lausten points out, has brought about a technological advancement and a business innovation. The former consists of bringing together infrastructure, data, and software tools so as to enable users to ask broad questions in time and space. The latter consists of a business model that lowers the barriers to entry into Earth imaging analysis by offering developer-friendly pricing to access this bundled solution. End users obtain the analyses they require, while the raw images remain in the cloud, where DigitalGlobe retains ownership and control of them. See Figure 1.

FIGURE 2. Illustration courtesy of Airbus Defence and Space.
DigitalGlobe provides commercial high-resolution Earth observation data and geospatial solutions sourced from its constellation of six satellites. Last August, it launched its most advanced satellite, WorldView-3, which has a panchromatic resolution of 31 cm, as well as eight SWIR bands to penetrate haze, fog, smog, dust, and smoke, and 12 CAVIS bands to map clouds, ice and snow, correcting for aerosol and water vapor.

“We are thrilled to have the opportunity to expose our 15-year catalog of high-resolution satellite imagery to ENVI’s technologically sophisticated user base,” said Hyune Hand, DigitalGlobe’s Senior Vice President of Product Marketing and Management.

**AIRBUS DEFENCE AND SPACE Launches Data Management Solutions**

In July, at the 2015 Esri User Conference in San Diego, Airbus Defence and Space, a division of Airbus Group, is introducing Data Management Solutions (DMS), an integrated suite of products and services that enable users to access, manage, and disseminate various types of geospatial data. The product, which can be hosted in the cloud or on premises, includes fully managed solutions that eliminate the problems traditionally associated with managing large volumes of different types of geospatial data archived and accessed in multiple locations. DMS is designed to handle raster imagery, GIS vector layers, digital elevation models, LiDAR point clouds, contour maps and asset-monitoring information in virtually any format. See Figure 2.

Airbus Defence and Space has been tailoring solutions for each client’s specific data management needs for more than two decades, says Jessi Dick, Sr. Marketing Manager of Online Partnerships and DMS, Geo-Intelligence Programme Line. “Because of the customization we are able to provide, these solutions quickly become core components of our clients’ businesses,” she says. “They are invaluable tools for increasing overall efficiency, and in most cases, decreasing operational costs. Our offerings range from simple, cloud-based geospatial data archive management portals to fully customized location intelligence systems, so organizations large and small can benefit from the expertise and capabilities included in Airbus Defence and Space Data Management Solutions.”

“We developed the DMS suite to enable our clients to profit from almost three decades of Airbus Defence and Space experience in archiving, processing and delivering geospatial data,” said Bernhard Brenner, head of the company’s Geo-Intelligence Programme Line.
The Data Management Solutions suite includes four offerings:

- **Data Management Portals** that provide single-point access to all of a customer’s geospatial data and that integrate into existing workflows. Customers can choose the DataDoors Portal, a software-as-a-service (SaaS) option, or the GetGeo Portal, offered as part of a customized solution for secure data storage, analysis, monitoring, and collaboration.

- **Fully Customized Solutions**, which combines the company’s geo-intelligence portfolio with open source modules to provide location intelligence solutions.

- **Streaming Services**, which give clients instant access to their own data and/or the full line of the company’s geospatial products via an Internet connection using multiple streaming delivery protocols.

- **Data Management Systems**, which include three hardware/software packages that can be installed behind the client’s firewall onsite or on mobile devices.

**THE BLACKBRIDGE GEOCLOUD**

BlackBridge – a provider of satellite operations, ground station services, and worldwide satellite imagery distribution, as well as value-added products and geo-service solutions – also recently formed a marketing agreement with Exelis VIS to provide ENVI software inside of its cloud for processing and analytics. BlackBridge’s philosophy is “bring your algorithms to the data, rather than the data to your algorithms.” In addition to providing the ENVI analytics, the company’s GeoCloud allows customers to host their own proprietary algorithms and workflows next to the imagery. By obviating the need to download high-resolution imagery, the system reduces processing time by orders of magnitude. Additionally, the derived information product typically has a smaller file size than the raw data, making it much faster and cheaper to download.

Most of BlackBridge’s cloud-based imagery is for its Monitoring Programs for Agriculture, which is a subscription service that gives users access to all the imagery acquired several times throughout the growing season across specific areas, as well as archive imagery dating back from 2009, via a cloud platform. See Figure 3.

“BlackBridge’s philosophy is ‘bring your algorithms to the data, rather than the data to your algorithms.’”

**A CUSTOMER’S VIEWPOINT: BECHTEL**

Bechtel, the largest construction and civil engineering company in the United States, has used imagery from DigitalGlobe – and, before the companies merged, from GeoEye – on projects ranging from the Dallas Metro Rail to transmission lines in Chile to infrastructure development in West Africa. “We have used it for traditional background information but also for remote sensing analytics and other work that we’re doing,” says Tracy McLane, Bechtel’s GIS Corporate Manager and GIS technical discipline lead. “Bechtel was the first commercial entity to sign a master services agreement with GeoEye, before it merged with DigitalGlobe. I helped negotiate that. We are in the midst of updating our arrangement with the company.”

“The merger of GeoEye and DigitalGlobe has considerably improved the satellite constellations available to us,” McLane says. “[It has improved] the turnaround time and the number of analytics that are part of the services. We may end up expanding and actually having them do part of that work, depending on the
needs of a project. Certainly a lot of topography that is developed from geostereo-type data is of interest as well. [For engineering,] we do need very detailed data, but a lot of their products are getting down to the centimeter accuracy. So, when something from a satellite can be turned into a topo with 20-cm accuracies, then it is something that we can really talk about.”

“We’ve had vendors provide [image analytics] for us in the past,” says McLane. “Some of it has also included development of feature-coded lidar, so that we can look at things from a 3D aspect. That can be important in terms of clearances for equipment that we may need to get in and out of a job site. It is also important in terms of what other types of utilities and infrastructures are intersecting our project locations.” Bechtel, McLane explains, does some image analytics in-house, using such software as ArcGIS desktop and ERDAS Imagine. “I’ve used it since the days when it was a DOS program. It’s come a long way since then.”

Bechtel’s enterprise GIS is built on both ArcGIS Server and Oracle Spatial, which has some internal database analytics capabilities. “I just arranged for a training of a good number of our GIS specialists for using Oracle Spatial for georaster analysis,” says McLane. “From a big data standpoint, it gives us a lot more capability to do what we have been doing on a more manual basis.”

Bechtel is not new to cloud services, but it is still worried about having data beyond its firewall. “Our use of [cloud services] is currently limited due to security concerns. Not all of that has been fully flushed out by our IS&T organization, particularly as it pertains to some kinds of work and clients. We haven’t yet taken advantage of [DigitalGlobe’s new offering of ENVI on its cloud platform] but I’m sure that we’ll be looking at it, figuring out how that fits with our project work going forward. Again, the only things that we have to look at very carefully are the data security issues.”

Hosting and processing immense volumes of high resolution imagery in the cloud is the new normal for imagery providers. It makes their services scalable, protects users from data loss, and saves them time and money. Increasingly, users can ask questions such as, “How have land use patterns changed in a certain area over a certain period of time?” or “Which parts of which fields require more water or fertilizer?” and get the answers, without having to set up their own image analysis shop with hardware, software, and expertise. However, adoption may be slow, due to security concerns.

DigitalGlobe has launched a cloud-based image analysis service jointly with Exelis. It offers ENVI Earth science analytics software for the DigitalGlobe Geospatial Big Data (GBD) platform, creating a single platform that enables imagery users to combine ENVI geospatial analytics with DigitalGlobe’s image library.”

Harris Acquires Exelis

Harris Corporation, a vendor of advanced, technology-based solutions for government and commercial customers, recently acquired Exelis. Harris shareholders now own 85 percent of the combined company and Exelis shareholders own 15 percent. The company now has a combined pro forma revenue of about $8 billion, about 23,000 employees, including 9,000 engineers and scientists, and customers in more than 125 countries. “Together, the two companies’ complementary technologies and capabilities strengthen the core franchises and provide new opportunities for innovation to solve our customers’ most complex challenges,” said William M. Brown, Harris’ Chairman, President and Chief Executive Officer.
Great speakers and industry-leading technical content is already lined up for 2015 and we anticipate the test flights, on-site data processing, and live demos will be even better than last year!

**Highlights of the symposium**
- Demonstrations (in-flight) of UAS technologies
- Test flights and on-site data processing
- Data processing training workshops
- Exhibitor floor including attendee breaks and lunch
- Speakers and presentations on relevant UAS topics
- Collaboration opportunities among users, mapping professionals, government, academia, developers, and UAS product and service providers

**Suggested attendees**
- Users & potential users of UAS products & services
- UAS product & service providers
- Aerial mapping, survey, & geospatial firms
- Companies with UAS interests & business plans
- Government agencies involved in UAS technology
- Government agencies driving the implementation of UAS policy
- UAS companies- software, hardware, system developers and integrators
- Academia, research institutions, UAS training institutions
- Students in geospatial, survey, robotics, UAS
- The geospatial community
- Geospatial media

Stay up-to-date with new sessions and speakers at our website [http://uasreno.org](http://uasreno.org)

**About ASPRS** Founded in 1934, ASPRS is an international professional organization of geospatial information professionals. ASPRS is devoted to advancing knowledge and improving understanding of the mapping sciences to promote responsible application of photogrammetry, remote sensing, geographic information systems and supporting technologies. More information is available at [www.asprs.org](http://www.asprs.org) and [http://uasreno.org](http://uasreno.org).
Climate and Human Security

Geospatial Data and Mapping Symposium Report

BY DR. ODEAN SERRANO / NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY / WWW.NGA.MIL
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MISSIONS ENABLE HUMAN SECURITY AND ALL REQUIRE FOUNDATION HUMAN GEOGRAPHY DATA
The National Geospatial-Intelligence Agency (NGA), Department of State, and the National Center for Atmospheric Research (NCAR), in collaboration with the World Wide Human Geography Data (WWHGD) Working Group and the Homeland Infrastructure Foundation Level Data (HIFLD) Sub-Committee leadership hosted the Climate and Human Security – Geospatial Data and Mapping Symposium on June 3-4, 2015. The symposium, hosted at the University of Colorado, Boulder, focused on developing collaborative networks, bridging expertise from policymakers to scientists, in order to leverage data and the latest research on climate impacts to human security.

This collaborative meeting brought together over 300 total attendees (138 In-Person and 165 gathering via Webinar) from 157 different organizations across the Department of Defense, Civil Agencies, Academia, Non-Governmental Organizations, the Volunteer Technical Community, and Private Corporations, with international representation from Nigeria, Mexico, Canada and Sweden.

Throughout the symposium, participants discussed climate and human geography data, modeling, collaborative partnerships, data requirements and tradecraft capabilities as well as climate impacts to human security. Climate has only been acknowledged as a human security risk for less than 10 years. Human security requires the attention of many missions, many of which overlap. See Figures 1-2. Specific objectives of this meeting included:

- Attaining a better understanding of the working and research dimensions of climate and human security;
- Increasing knowledge of the challenges of climate prediction and impacts to human security;
- Increasing awareness of climate data, models and mapping tools;
- Learning the global extent of current research in key areas;
- Escalating collaboration, networking, and partnerships.

During the symposium, experts in the field of climate and human security participated in panels and facilitated discussions on Climate Risk, Challenges, and Decisions; Global Climate Change – Adaptation and Mitigation Efforts for Human Security; Climate Change and Global Human Security; Climate and Human Security Industry Initiatives; Climate Modeling: Global Human Security Indicators; Anticipating Near-term Climate Disruptions on the Human Geography Scales; Climate Change Demographics; and Health Impacts and Global Climate Change Impacts Research.

Keynote speakers for the event included: Judge Alice Hill (Ret), of the White House, National Security Council; Robert Cardillo, Director of the NGA; Dr. Lee Schwartz, Geographer of the U.S., Department of State (DoS); John Englander, Oceanographer and author of *High Tides on Main Street*; and Dr. Ian Noble, Advisor, Notre Dame Global Adaptation Index.

Director Cardillo’s opening remarks welcomed the audience to the first Climate and Human Security Assessments

- 2011: National Intelligence Estimate on Global Water Security
- 2012: Global Trends 2030 - references to impacts of climate change on future national security issues
- 2014: National Climate Assessment issued by the U.S. Global Change Research Program
- 2014: Executive Order on Climate-Resilient International Development
- 2015: Quadrennial Diplomacy and Development Review (DoS) identifies climate change as one of the four key pillars of international engagement
- 2015: Intelligence Community Assessment on Global Food Security.
- 2016: Updated Climate Change Intelligence Community Assessment.

![Figure 1](image1.png)

**FIGURE 1.** Supporting human security involves foundational human geography data and many missions.

![Figure 2](image2.png)

**FIGURE 2.** Assessments are integral components, and are required by law. The National Climate Assessment is done every four years, the most recent of which was released in May 2014.
Security Symposium comprised of the many stakeholders from policymakers and human geographers to climate scientists, human security practitioners and analysts. Director Cardillo stated that the unique perspective offered by these different groups and collaboration afforded by the symposium will help identify fundamental geospatial data critical to enhancing our understanding of climate change and its implications for society within a Human Geography framework. He emphasized how NGA has made a concerted effort to share Ebola products with the world at large using NGA’s ArcGIS online site as well as through the WWHGD Community on GeoPlatform. See Figure 3. Director Cardillo was pleased that the panelists and attendees are all interacting together to harness our geospatial data and analytic efforts that will address the President’s message that climate is a National Security threat. He closed by stating that this work will help the community to adapt, mitigate and keep the world an environmentally safe place for everyone.

Judge Alice Hill (Ret) of the White House National Security Council provided the keynote address to commence the symposium. She first noted that her task on the Security Council is specifically related to climate change, and agreed with President Obama’s message that climate change is a fundamental and immediate threat to U.S. national security, and a serious threat to global security. Judge Hill noted that water supply and reliability are at risk as drought becomes more frequent and severe, and that those shortfalls will affect every country on Earth. Judge Hill urged the attendees to continue working collaboratively to develop climate change mitigation solutions.

In addition to the keynote speakers, the symposium included over 30 speakers and panelists who shared their expertise and knowledge on Climate and Human Security. They were passionate about ensuring that the data was at the scale appropriate for decision making. The presenters and audience agreed that there was a need for a bridge of collaboration between the scientists and analysts to the key stakeholders and decision makers.

Dr. Odean Serrano of NGA presented the Environmental Geography Community framework that bridges the gap of science and policy by bringing together a variety of environmental security topics, by theme, to include Water, Climate, Food, and Ecosystems. Of great interest to the audience were the climate data sources shared by Dr. Olga Wilhelmi, NCAR GIS Program and Climate Inspector. Dr. Wilhelmi described the Climate Change Scenarios GIS Portal, located online at http://gisclimatechange.ucar.edu. The portal features a new application called the Climate Inspector (http://gisclimatechange.ucar.edu/inspector), in which a user can explore climate change anomalies interactively (source code available on GitHub). See Figures 4-5.

At the closing of the symposium, Mr. Ted Cope, Director of the Office of Basic and Applied Research at NGA; Dr. Lawrence Buja, Director of the Climate Science and Applications Program at NCAR; Dr.
Lee Schwartz, Geographer of the U.S., DoS; and Mr. Brian Hagan, National GEOINT Officer for Geography and Cartography at NGA, provided a discussion on the way forward.

Dr. Schwartz highlighted the need to discuss Climate and Human Security topics with policymakers within a short-term and long-term context so that timely decisions regarding climate and humans can be made. Dr. Buja conveyed the climate and human security community needs a mechanism to collaborate with key stakeholders. Mr. Cope discussed how complex the problem is and how integrating location data will help to visualize the magnitude of climate change. He also talked about the need for human security to support national security. Mr. Hagan discussed the need to get data and assimilate data in one place to share and thanked the planning team and all the attendees.

This symposium was the second combined event facilitated for NGA by the World Wide Human Geography Data Working Group and the Homeland Infrastructure Foundation-Level Data Sub-Committee.

In 2011, the World Wide Human Geography Data Working Group (WWHGD WG) was created to focus on the need for human geography global foundation data in order to provide a basis for a deeper understanding of cultures, activities, and attitudes for analytics. Well-organized and comprehensive human geography data can be applied to analysis that allows us to better anticipate the behavior of people over space and time and to inform decision-making that supports human security, including crisis mitigation and humanitarian response. The WWHGD WG is designed to build voluntary partnerships around human geography data and mapping focused on the general principle of making appropriate information available at the appropriate scales to promote human security. This involves a voluntary “whole-of-governments” national and international approach to create a human geography data framework that can leverage ongoing efforts around the world to identify, capture, build, share, and disseminate the best available structured and unstructured foundation data. The WWHGD Working Group has over 2600 members from throughout the Department of Defense, Civil Agencies, International Organizations, Non-Governmental Organizations, Academia and Private Industry. Join the WWHGD WG at https://wwhgd.org.

The Homeland Infrastructure Foundation-Level Data (HIFLD) Sub-Committee was established in February 2002 to identify, share, and protect geospatial infrastructure data/information used for visualization and analysis. The HIFLD Sub-Committee is a chartered multi-agency organization of Federal partners. HIFLD partners include: the Defense (DoD) Office of the Assistant Secretary of Defense for Homeland Defense and Americas’ Security Affairs – OASD (HD&RASA); the Department of Homeland Security (DHS); the NGA; and the Department of Interior (DOI).
United States Geological Survey (USGS) National Geospatial Program (NGP). The sub-committee brings together individuals across the Federal, State and Local Governments and the private sector involved in promoting information sharing, enhancing partnerships, collaboration, sharing best practices and providing an enterprise approach to identifying and developing common authoritative infrastructure data, common processes, and leveraging technology. The group enhances outreach and awareness of the Homeland Security Infrastructure Program (HSIP) datasets (Gold and Freedom) to the HLS, HD and National Preparedness – Prevention, Protection, Mitigation, Response and Recovery (NP-PPMR&R) communities. In recognition of the value that the HIFLD whole of government partnerships have brought to the Homeland Security, Homeland Defense and National Preparedness communities, the Federal Geographic Data Committee (FGDC) has adopted the HIFLD as a sub-committee. Join the HIFLD Sub-Committee at https://www.hifldwg.org.

Both the WWHGD Working Group and HIFLD Sub-Committees facilitate open sharing using both foundational and mission-specific data, advanced geospatial analytical capabilities, and best practices to meet mission objectives and to promote a better understanding of the world around us.

For more information, please visit https://WWHGD.org or www.HIFLDWG.org to attain copies of the briefs provided during the symposium and the attendee list.
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GEOGRAPHY 2050
EXPLORING OUR FUTURE IN AN URBANIZED WORLD

In 2014, we mounted an “Expedition to the Future”, and a topic that prominently recurred through much of the dialog was “urbanization” since an ever increasing proportion of the world’s population will dwell in urban areas by 2050, and the world’s population will swell by billions. The geographies of our urban habitats are poised to change radically by 2050, and the implications of this for local, regional, and global decision makers are significant and paramount to our well-being. The spatial-temporal processes and patterns that will reshape our urban habitats are many and interrelated, and will manifest differently in different places over time. In short, there is no single “urban habitat,” and it is imperative that we, as a global society, understand the variety and interconnectedness of the world’s cities, as they are likely to evolve by 2050.

The AGS Fall Symposium brings together leaders in business, government, science, and education that might not otherwise have the opportunity to interact, and provides opportunities for discussion, debate, and collaboration to further the understanding of the future of our cities.

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