OGC NEW SPACE **WORKSHOP** EVENT REPORT

MAY 13—14, 2020

OGC®

Making location count.

EVENT SPONSOR

GRSS

TABLE OF CONTENTS

03 • EXECUTIVE SUMMARY

- 03 • Welcome & Instructions
- 03 • Workshop Overview and Objectives

04 • SESSION SUMMARIES

- 04 • Session 1: Technologies
- 05 • Session 2: Data Preparation, Curation and Processing
- 06 • Session 3: Analytics

08 • SESSION 1: TECHNOLOGIES

- 08 • Keynote - Trends in Space
- 09 • Session 1 Panel #1 New Sensor Phenomenologies
- 11 • Session 1 Panel #2 Data Curation and Analytics

14 • SESSION 2: Data Preparation, Curation and Processing

- 14 • Keynote - Creating Trustworthy Data for Actionable Intelligence
- 15 • Session 2 Panel #1 Big Data from Space
- 16 • Session 2 Panel #2 Analytics

19 • SESSION 3: Analytics

- 19 • Welcome & Introductions
- 19 • Keynote —Monitoring the Pulse of our Planet: Towards the 100 Trillion Pixel Challenge
- 20 • Session 3 Panel #1 Technology for Handling Big Data
- 22 • Session 3 Panel #2 Analytics & Visualization

24 • NEXT STEPS

EXECUTIVE SUMMARY

WELCOME & INTRODUCTIONS

Nadine Alameh, OGC

Welcome to the OGC New Space Workshop. We envision this workshop to be a kickoff of a series of conversations at a global level, discussing events around new space, impacts, and standards. The Open Geospatial Consortium (OGC) is a worldwide consortium with academic, industry, government, and research organizations as members. We focus on making location information Findable, Accessible, Interoperable and Reusable (FAIR). We achieve this mission by being a hub for thought leadership and innovation, as well as a trusted neutral forum for tackling interoperability issues. OGC is the authority on open consensus-based standards for geospatial locational information.

This is an exciting time for us. Location is everywhere and is creating value in many domains. OGC embarked on a disciplined approach to continuously monitor technology trends that are impacting location or being impacted by location. We use those trends to modernize our standards.
We are at a critical point in new space. New rockets, smallsats, expanded access to space, increasing frequency. There are 500-1000 remote sensing satellites are planned to launch over the next 5 years.

Multiple constellations, new orbits, new sensors, new modalities and phenomenology. The new ground infrastructure and business models, uptake of agile thinking. More than 40 commercial companies launched imaging satellites in the past ten years and 21 startups founded between 2014 and 2019. These satellites are creating large volumes of data – terabytes per day every day. Major advancements in analytics and AI are creating new opportunities to add value by bringing various data together to go beyond these specialists and open up new opportunities.

We have an amazing lineup in this workshop split into three sessions: Technology, Data Curation and Processing, and Analytics. We'll hear about the latest tech trends and market trends, and go beyond that to cover multi-source data integration and how we make the data actionable? What are the pain points upstream, midstream and downstream? What standards do we have? What should we anticipate in the future? There are two panel discussions in each session.

WORKSHOP OVERVIEW AND OBJECTIVES

The space market is changing and a New Space paradigm is emerging driven by a combination of technology and market advances from (1) rocket launches, small satellites, orbital planes, (2) evolving sensor modalities and new ground infrastructures and (3) the uptake of agile thinking and new business models.

While the data captured by these space sensors can leverage some of the current data standards, updated and new standards and frameworks are needed to meet the increasing demand for timely and actionable information/intelligence.

The objective of this workshop is to bring experts and users from the various aspects of new Space 2.0 to:

- Document trends in the industry
- Share pain points, challenges, and best practices
- Map the state of current standards to meet the new requirements
- Identify areas that require the development of new frameworks and standards for interoperability

I. SESSION SUMMARIES

SESSION 1: TECHNOLOGIES

New launch service providers are introducing new economics that enable space constellations and a proliferation of smallsats. The diversity of sensor phenomenologies continues to increase based on years of research, e.g., SAR, RF reconnaissance, radio occultation, hyperspectral. These new launch capabilities and observation technologies are driving changes in downstream data curation and analytics.

KEYNOTE : TRENDS IN SPACE

Richard French, Rocket Lab

In the Keynote address, Richard French of Rocket Lab set the tone for the entire session touching on a common technological theme of doing more with less. Specifically, Rocket Lab is helping the developers of small satellites focus on building advanced platforms and sensors while letting a third-party – like Rocket Lab – take care of the launch. Not only can these small satellites accomplish more, they are getting into space faster with launch services specifically designed for multiple satellite deployments.

PANEL 1: NEW SENSOR PHENOMENOLOGIES

‘

- Alex Fox, Executive VP of ISR Solutions at HawkEye 360 Global Radio Frequency Geospatial Intelligence (RF GEOINT)
- Adina Gillespie, Business Development Europe for GHGSat Inc.Global Emissions Monitoring
- Jeff Rex, VP Sales and Marketing at Spire Spire: A Satellite Data Driven Company

Panel 1, focusing on New Sensor Phenomenologies, featured speakers from three remote sensing companies discussing how their organizations are making the ‘art of the possible’ with smaller platforms and sensors. HawkEye 360 detects radio frequency signals. GHGSat Inc. measures greenhouse gas emissions from point sources on the Earth’s surface, and Spire extracts atmospheric data from radio signal refraction for use in weather forecasting.

All three companies discussed the challenges of converting extremely complex remotely sensed data sets into usable information products for diverse end users. Asked what new technologies we can expect in the future, presenters agreed that coming platforms will have great pointing capabilities. On the ground segment side, there will be increasingly more applications of Machine Learning techniques as operators strive to enhance information products for customers.

PANEL 2: DATA CURATION AND ANALYTICS

- Mark Abrams, Principal, Xtreme GEO
  Provenance, Curation and Security
- Fabio Pacifici, MAXAR, Principal Scientist, Dir at GRSS
  Data Curation and Analytics
- Shayn Hawthorne, Amazon Web Services
  We Are Living in a Different Era

The three speakers in Panel 2 presented different perspectives on the curation and processing of new types of data along with old data. Xtreme GEO suggests a curation framework that could merge data from multiple sources without introducing errors. IEEE/GRSS is working to standardize data even though there is not a "one size fits all" answer. Amazon Web Services provides a method of managing the increasing volume of geospatial data in an organized manner to allow for efficient analysis and rapid sharing of information.

Without interoperability between data sources, the full power of geospatial data cannot be realized. New opportunities will arise when fusion of ground, ocean and aerial data with satellite imagery is achieved. Improved technology that downlinks data from space, rapidly processes the data and makes information available very quickly will enable machine learning and expand applications. Each user's unique problem determines "Quality – Purpose – Intent," which drives the selection of an appropriate curation and processing methodology.

Detailed summaries of Session 1 presentations begin on Page X of this document.

SESSION 2: DATA PREPARATION, CURATION AND PROCESSING

Petabytes of data volume present challenges for getting the most value from space observations. The emergence of cloud computing on big data has brought revolutionary capabilities to the preparation and processing of data from space. Big data platforms and cloud-scale computing allow curation and processing to work with entire data collections rather than individual scenes.

Petabytes of data volume present challenges for getting the most value from space observations. The emergence of cloud computing on big data has brought revolutionary capabilities to the preparation and processing of data from space. Big data platforms and cloud-scale computing allow curation and processing to work with entire data collections rather than individual scenes.

KEYNOTE: CREATING TRUSTWORTHY DATA FOR ACTIONABLE INTELLIGENCE

Frank Avila, Director for Commercial GEOINT Discovery and Assessments Office

The Session 2 Keynote delivered by NGA's Frank Avila should be mandatory viewing for any geospatial company that provides, or wants to provide, data, algorithms and derived GEOINT products to the agency. The crucial concern is that all GEOINT deliverables are accurate and reliable so that analysts can have confidence in them when deriving actionable intelligence. Analysis Ready Data (ARD) is crucial to NGA. Standards will play a large role here. NGA pledged to work with industry and academia toward this goal of creating trustworthy products and encouraged webinar participants to view the NGA 2020 Focus Areas document.

PANEL 1: BIG DATA FROM SPACE

- Adam Astrada, MAXAR
  Computer Vision of Satellite Imagery
- Daniel Barcay, VP of Product at Planet
  Big Data from Space
- Scott Soenen, VP Product Engineering at Capella
  Small Satellite SAR

In the Big Data from Space panel, three satellite remote sensing operators described the challenges of dealing with the enormous volumes of data now being captured. MAXAR discussed its use of the ONNX format as it moves deeper into using Artificial Intelligence. Planet is investigating new ways for end users to query image stacks without downloading enormous archives of data. For Capella, the challenge is building a new customer interface for its clients to work with complex SAR data sets that are so different from traditional EO images.

The common theme among the presenters was the desire to make big image data sets easier for their clients to task, query, order and access. APIs and the cloud will play important roles in making this possible moving forward. Standards will also be needed as various data sets are fused to create entirely new image products.

PANEL 2: ANALYTICS

- Frederic Houbie, Senior Product Manager, Hexagon Geospatial Analytics
- Scott Herman, BlackSky, CTO
  BlackSky Overview
- June McAlarey, CEO, PCI Geomatics
  Earth Observation for Climate Change Analysis

The three speakers in Session 2, Panel 2, discussed emerging trends in analytics and the value of combining information to support critical decision making. Hexagon Geospatial develops a smart digital reality by taking static data and applying dynamic analytics to create the five dimensions of location intelligence. BlackSky blends high-frequency EO imagery with other data sources to establish patterns of life and detect anomalies. PCI Geomatics emphasizes collaboration and interoperability to solve problems such as climate change.

Adopting cloud technology and setting standards for data processing and analytics are necessary steps for providing consistent analysis-ready data. By applying artificial intelligence, location information and patterns of life analytics can answer many questions that today are beyond our capabilities.

Detailed summaries of Session 2 presentations begin on Page X of this document.

SESSION 3: ANALYTICS

Moderator: George Percivall, OGC

New Space observations can benefit many fields of study and business. Extracting knowledge from the observations requires analytics. Data science methods are transforming analytics and applications. Machine learning at scale is effective in analysis, but needs to be confirmed as effective, accurate and robust across applications. Visualization continues to be an effective method to convey understanding of geospatial information. This session addressed the analytics and visualization that make the New Space Observations applicable to many fields and focused on technology needed to handle big data, fuse multiple sources, and conduct machine learning

KEYNOTE: MONITORING THE PULSE OF OUR PLANET: TOWARDS THE 100 TRILLION PIXEL CHALLENGE

Budhu Bhaduri, Oak Ridge National Laboratory

In the Session Keynote, Budhu Bhaduri from the Oak Ridge National Laboratory described the challenge arising as the volume of data collected and stored rapidly increases. For daily refresh of global imagery at 5m resolution, the industry would need the capability to process 100 trillion pixels every day. This can only be accomplished with a federated cyber infrastructure, which doesn't exist today, to move data from sensors in space to large scale computing to interactive visualization.

PANEL 1: TECHNOLOGY FOR HANDLING BIG DATA

- Manil Maskey, NASA
  NASA Earth Science Data Systems (ESDS)
- Peter Becker, Group Product Manager-Imagery, ESRI
  Technology for Handling Big Data
- Ashley Antonides, Lead Data Science, Anno.ai
  Operationalizing AI/ML for Mission

The three speakers in Session 2, Panel 1, discussed the importance of analysis-ready data (ARD), machine learning (ML), visualization and data fusion. NASA is working on standards for earth science data in the cloud, as its database is the largest repository in the world and supports the work of many researchers and scientists. ESRI seeks to improve the storage and management of data through an open platform that facilitates access to ARD. Anno.ai is helping developers create applications that meet their specific needs.

For machine learning to produce reliable and accurate results, users need access to the source data and increased transparency as to how algorithms are trained, what kind of data was used in the training, what is the geographic distribution of the dataset, etc. Model results are only as good as the data input and training.

PANEL 1: ANALYTICS & VISUALIZATION

- Patrick Cozzi, CEO of Cesium
  3D Geospatial Visualization Born in Aerospace
- Ash Richter, Archaeologist/Anthropologist/Engineer at In-Q-Tel Spatial Computing: Mapping at Different Physical Scales
- Perry Peterson, OGC and University of Calgary
  The Future: Better Decisions, Better World

In Session 3, Panel 2, Cesium provided an overview of the fusion of geospatial and 3D graphics technologies, discussing how it created the 3DTile OGC community standard as an efficient way to stream and represent data for visualization and analysis. In-Q-Tel described how 3D Mapping will lead us to the Augmented Reality Cloud in five years and then result in a Replayable Digital Twin of the Physical Landscape and Historical Archive of Human Activity in 25 years. Perry Peterson wrapped up the session relating how OGC has adopted a new earth reference model called the Discrete Global Grid System (DGGS), a major Earth reference innovation for information storage to allow for data fusion and integration on demand.
Each speaker offered insights into where these technological advancements are taking the geospatial industry. With 3DTiles now an open standard for visualization, the next logical step is a temporal version – perhaps 4DTiles. As often occurs when so many different remote sensing technologies are discussed, the conversation turned to ideas for fusing diverse data sets into a coherent geographic context for decision support. This will require continued standards development already underway at OGC and IEEE GRSS.

Detailed summaries of Session 3 presentations begin on Page X of this document.

II. SESSION 1 TECHNOLOGIES

New launch service providers are introducing new economics that enable space constellations and a proliferation of smallsats. The diversity of sensor phenomenologies continues to increase based on years of research, e.g., SAR, RF reconnaissance, radio occultation, hyperspectral. These new launch capabilities and observation technologies are driving changes in downstream data curation and analytics.

KEYNOTE – TRENDS IN SPACE

Richard French, Rocket Lab

Rocket Lab is contributing to the new trends in space with dedicated small launch capabilities. The company was founded in 2006 by Peter Beck with headquarters in Long Beach, Calif. Rocket Lab has raised over $288 million in venture capital, and has had 11 successful launches with 48 satellites, 100% mission success. Rocket Lab owns the only private launch site in the world, located in New Zealand, and one in Wallops Island, Va.

Rocket Lab designed the first 3D printed rocket engine, the first electric pump cycle rocket engine, the first fully carbon composite vehicle, and built the first NASA Cat 1 certified small launch vehicle. The company recently acquired Sinclair Interplanetary in Toronto, thus securing a key set of components for its satellite program. Rocket Lab serves a broad range of government groups – NASA, DARPA, NRO. Production is scaling up to meet the goal of launching a rocket every week.

Small launch is a “solved problem” but Rocket Labs continues to innovate to improve reliability so that customers can focus on payloads rather than worry about the launch vehicle. The PHOTON satellite is a collection of components configurable to meet requirements for different applications. Rocket Lab wants to produce a satellite that also shares some commonality with its launch system. This eliminates excess mass because rocket and satellite are integrated.

The company is moving toward offering a complete solution by offering a bundled package of launch + satellite + ground operations and a streamlined path to orbit. PHOTON leverages Rocket Lab’s heritage kick-stage and adds additional components for power generation, attitude control, radiation protection, etc. The bus is configurable for each mission. Development plans go beyond LEO capabilities. PHOTON is a versatile platform for earth observation, with new subsystems produced in-house, such as star trackers, motor controllers, propulsion, reaction wheels, etc.

Rocket Lab was selected to provide launch services for the next NASA Capstone mission to the moon, which will demonstrate CISLUNAR communications and navigation principles. The PHOTON Lunar platform has a number of modifications for this beyond LEO mission, such as expanded tanks and upgraded engines. The lunar mission and other planned launches will support research for further CISLUNAR applications, and trips to the Moon and other planets, such as Mars and Venus.

SESSION 1 : PANEL #1
NEW SENSOR PHENOMENOLOGIES

Moderator: Nadine Alameh, OGC

Alex Fox, Executive VP of ISR Solutions at HawkEye 360 Global Radio Frequency Geospatial Intelligence (RF GEOINT)

Founded in 2015, HawkEye 360 (HE360) provides global radio frequency (RF) data and analytics. The Virginia firm operates a cluster of microsatellites that detect and geolocate RF signals from sources in the air, on land, at sea and in space. Initial focus of the company has been on maritime activities, but HE360 is expanding into land operations. The satellites have nearly continuous RF signal coverage in the 144 megahertz to 15 gigahertz range with a target geolocation accuracy of 1 km.

With a total investment of $100 million, HE360 launched its first cluster of microsatellites in late 2018, and they became fully operational in early 2019. To date, the satellites have already detected 18 million RF signals. The company plans to have six constellations in orbit by late 2021, providing a global revisit of 20 to 55 minutes. Satellites are arranged in phased polar orbits.

As a vivid example of the information that can be gleaned from RF signal data, Fox showed the dramatic decrease in maritime RF signals emitted from the Italian coastline before and after the COVID-10 lockdown. Other common use cases for HE360 data and analytics include the following:

- Regional Pattern of Life Changes – RF signals change with the seasons due to varying activities.
- Maritime Domain Awareness – Vessels reporting inaccurate AIS locations (spoofing) can be accurately geolocated via RF signal detection.
- Dark Ship Location – Vessels emitting no AIS location signals can also be located and tracked for possible rendezvous with other ships at sea.
- Tactical Mapping – Geolocation and monitoring of RF signal emitters to identify anomalous activities or changes in normal operations.

Adina Gillespie, Business Development Europe for GHGSat Inc. Global Emissions Monitoring

GHGSat Inc. is a New Space company based in Montreal with offices in Calgary, Ottawa, Houston and soon in Europe. The company launched its first small satellite in 2016 with the commercial objective of measuring greenhouse gas emissions from industrial facilities on the ground. Already there has been tremendous response from for this monitoring in the commercial market as well as for government agencies.

Greenhouse gas monitoring from space has been accomplished in the past but at very coarse resolution. GHGSat is currently pinpointing emissions at 50-meter pixel size and will soon improve that to 25 meters with the launch of its next satellite in June 2020. Roughly the size of a microwave oven, the GHGSat satellites carry sensors that detect and differentiate gases, such as methane, by their absorption frequencies. The company aligns these detections with points on the ground, processes the signals, and delivers meaningful reports to customers and/or facility operators, which then remediate the leak or emission.

Gillespie stressed that GHGSat often uses coarse-resolution data from Copernicus and NASA satellites in a tip and cue configuration for its own satellites. For instance, the Sentinel 5P satellite can use its SWIR sensor to detect hot spot gas emissions at 7 km resolution, and GHGSat takes this information to point its satellite and pinpoint the actual source location of the release. This process has successfully detected large methane leaks.

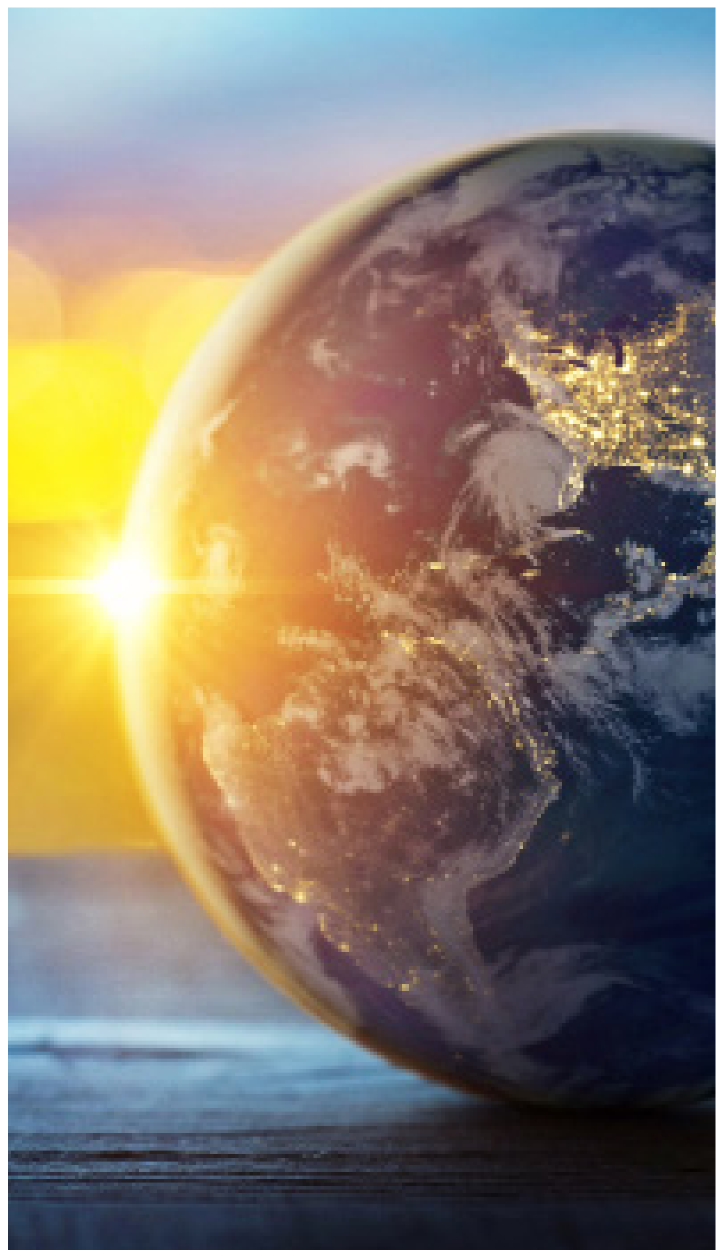
Gillespie closed by noting that GHGSat has committed to making 5% of the data collected by its newest satellite available at no charge for research purposes through the European Space Agency and Canadian Space Agency. She encouraged webinar attendees to take advantage and try the data sets.

Jeff Rex, VP Sales and Marketing at Spire
Spire: A Satellite Data Driven Company

Spire is a global analytics company that uses nanosatellites to provide advanced maritime, aviation and weather tracking. With 88 nanosatellites in orbit and more nearing the launch pad, Spire provides coverage for nearly every spot on the Earth's surface. The company is fully integrated, handling the development and manufacture of its satellites as well as the data processing, modeling and production creation for multiple vertical markets. Spire has offices in San Francisco, Boulder, Washington DC, Scotland, Singapore and Luxembourg.

For his presentation, Rex discussed the weather data collected and processed by Spire. The company uses a technique called radio occultation (RO) whereby its nanosatellites collect signals from GNSS satellites in orbit. The refraction of these signals as they pass through the Earth's atmosphere between the GNSS satellite and Spire nanosatellite is measured to determine the air pressure, water vapor and temperature in the atmosphere. This global atmospheric information is used by Spire and provided to weather agencies worldwide to augment high-resolution weather forecasts.

Rex explained that Spire RO data, which is measured 7000 times per day evenly spread around the globe, complements atmospheric readings captured by weather balloons and commercial aircraft. The Spire RO data has several advantages over both. Compared to weather balloons, the satellites capture data evenly across the globe throughout the day without the bias of measurement sensors. The value of satellite-based RO measurements, compared to aircraft data collection, has been highlighted during the COVID-19 lockdown when only 20 percent of the commercial aircraft fleet has been flying.



QUESTIONS:

Question 1:
What are the challenges and pain points, especially related to customers, that your business experiences?

Several panelists mentioned that launch delays due to COVID-19 are ongoing pain points.

For Spire, the biggest challenge is setting customer expectations for the products the end user will get. This is challenging because different users have different product requirements. Jeff Rex explained that accommodating the product needs of many end user markets may require help from key business partners.

Adina Gillespie agreed that GHGSat faces a similar challenge of creating products that meet the various needs of different end user groups. One related issue is that GHGSat is trying to develop products that are open so customers can perform additional exploitation if they desire.

At HE360 the challenge has been educating the marketplace on the value of information products that have not been offered before. Alex Fox noted that educating end users has been made more difficult in the COVID-19 era because education can't be done in face-to-face settings, which has compelled the company to develop new online methods of meeting with and working with its customer base.

Rocket Lab experiences challenges from the perspective of a launch services provider. Richard French replied that a constant pain point for Rocket Lab is spacecraft that do not arrive at the launch site when expected. The other problem is perceived value – too many customers are assuming the term ride share should mean inexpensive.

Question 2
What is the status of sensor data fusion? Is it happening?

Adina Gillespie, referring to her earlier comments about Sentinel 5P, responded that data fusion is happening now at GHGSat with the integration of SAR, EO, SWIR and other data sets. She expects more fusion in the future as customers ask more complex questions.

Jeff Rex of Spire commented that weather forecasting is getting more complex – and better – thanks to data fusion, which is increasingly being done not just with satellite data but also with ground-based observations.

Question 3
What technological advancements should be expected in next five years?

Rocket Lab expects small satellites will become more agile, have greater on-orbit maneuverability, and achieve better pointing capabilities. In addition, spacecraft will be designed for easier integration of sensors from multiple companies.

GHGSat plans to enhance the spatial resolution of its sensors to detect greenhouse gas emissions from smaller sources. The new sensors will also detect a larger variety of gases.

HE360 anticipates putting its sensors on other platforms and expanding into using Machine Learning for its analysis.

SESSION 1 : PANEL #2
DATA CURATION AND ANALYTICS

Moderator: Nadine Alameh, OGC

Mark Abrams, Principal, Xtreme GEO
Provenance, Curation and Security

The first panel discussed three phenomenal new sensing capabilities – radio frequency signals, chemistry, and atmospheric occultation measurement. The next challenge is how to align all that data simultaneously at an appropriate scale, and at human scales. The issue is provenance – accumulating the necessary metadata to register, fuse and extract and to identify the feature content needed for location-based services. It is necessary to understand the error sources in data capture and understand the processing of the metadata and the extraction process.

Knowledge of these factors leads to a curation framework for spatial, spectral and temporal sampling and associated errors. As a reminder, geomatics has been around for 400 years; photogrammetry has been used for hundreds of years for image exploitation; GNSS 30–40 years. Over time there has been significant diversity (and divergence) of methods for error propagation. The ultimate goal is to bring all this data together in one place.

It is very important for data to be aligned to prevent errors that create security issues and cause catastrophic results. In the near future, there will be 7 billion GNSS devices, each producing numerous geolocation events every year with increasing accuracy. Each will localize a human or a network into a 4D trajectory. That becomes the unique opportunity we have over the next decade to expand new data capabilities and take it down to the human scale in four dimensions. 4D is the new space concept.

Fabio Pacifici,
MAXAR, Principal Scientist,
Dir at GRSS
Data Curation and Analytics

IEEE Geoscience and Remote Sensing Society (GRSS) is a professional society from academia and space agencies around the globe, many members from academia and government space agencies. Partner SpaceNet focuses on accelerating open source AI research for geospatial applications.

Analysis-ready data (ARD) meets different needs in different markets. Old markets are familiar with data (agriculture, maritime). New markets (insurance, finance) may not be familiar with calibration, accuracy and uncertainty and just want concise actionable information. In addition, civil government vs. Industry vs. intelligence have different missions, timelines and requirements and skill levels.

“There is no one-size-fits-all data curation solution,” says Fabio.

Availability, accessibility (common APIs and formats), and interpretability are important considerations that impact how data are used. Appropriate collection is a function of the intended use. Objects are illuminated differently from different angles, and the effectiveness of AI is dependent on the data specifications.

Shayn Hawthorne,
Amazon Web Services
We Are Living in a Different Era

One of the big things changing in the space community is the movement from a product-focused approach in the 1970’s to products and analysis in the 1990s, then to customer-centric in the 2000’s and a service-centric (cloud) approach today. Cloud connectivity and cloud services are driving what the space industry is able to do for customers. As a broadband internet system consisting of many small low-earth orbit satellites, Starlink is a great example of where the industry is moving in the future.

Between 2000–2019, 310 new space companies have been founded, compared to 1955 when there were only five defense contractors and zero AWS customers. Today 160+ space companies and 20+ government agencies are 100% AWS-based. AWS helps companies do what they do best by removing the lag time between data collection in space and information delivery to the customer.
AWS focuses on the problem of how to downlink data from space, rapidly process the data and make information available very quickly, in seconds. This enables all the new collection platforms to deliver data in real time and feed into analytics engines. With the technology that automates the orchestration of various services’ APIs at the antenna, within seconds the provider can share fused products with the type of new customers that are entering the market. New users don’t really care about the mechanics – they just want information in a cost-effective way. For example, from space it is possible to detect an oil leak from a ship in the middle of the ocean and send the customer an alert, or create digital twins of cities and entire enterprises on a global scale in the cloud. AWS is helping move and deliver this data in the time frame that customers need.

QUESTIONS:

Question 1
What are the main pain points in the new environment?

Marc Abrams feels the challenge of going from 2D to 3D is a key pain point. In 2D everything is fixed to a point on the earth with an undefined z value. To perform change detection, mis-registration produced from different viewing geometries must be resolved to a single voxel level in three dimensions so the user can attribute an identity associated with those items that are changing.

Fabio Pacifici agrees that moving from 2D to 3D is a problem and to standardize an approach between many different communities is very difficult. One trend over the past few years is a push into deep learning/machine learning, but many of those models are based on 3-band imagery. There are many more bands that should be exploited for a full understanding.

AWS has six ground stations around the world, each with two redundant antennas directly connected to the AWS cloud so customers can get data off the antenna and into a private cloud within seconds.

Question 2
What are your plans for the future?

Shayn Hawthorne explained that AWS is planning to operate a minimum of 12 ground stations. The first round of ground stations is built identically. Now with input from customers, improvements are being made to subsequent ground stations, such as different frequencies and locations.

Question 3
What activities are addressing data provenance problems?

Mark Abrams is seeing huge progress in integrating data across the community in every discipline. Work is being done on how to register different types of data, how to represent a chemical signature, and what is the basic accuracy of a smart device. A lot of research is being done to achieve consistent reproducible data over time and to recognize the difference between precision and accuracy. Another issue centers on whether your location should be encrypted so that the government can control it but you cannot.

Question 4
Are you seeing customers fusing satellite imagery with drone data?

Shayn Hawthorn says several AWS customers are combining data from drones, ground sensors, and aerial platforms with satellite imagery. The applications range from military to oil and mineral extraction activities. The main pain point is bandwidth, which restricts the ability to get the data into the network, analyze quickly, fuse results into one feed and deliver to customers.

Fabio Pacifici pointed out the need to identify the goal of fusion before trying it. What do you want to do? Drones can be used to extract 3D data or fused with SAR data from space – to do what? What is the spectral and spatial quality? What are the viewing angles? These are the questions.

Mark Abrams explained a unique application for data fusion. Police are using differential GPS and a drone to quickly capture a 3D scene of an accident to show the exact positioning of everything involved. This completely redefines forensic reconstruction. Fusion provides an accurate multi-dimensional representation of a problem that needs to be solved.

Shayn added that AWS has seen customers use LiDAR drones to fly around refineries to capture 3D data to maintain their asset model several times a day.

Nadine Alameh concluded by thanking the Session 1 speakers and reiterating the OGC theme of collaboration and cooperation. New data, sensors and modalities are great, but we still need to answer to our customers and identify the specific problems.

III. SESSION 2 DATA PREPARATION, CURATION AND PROCESSING

Petabytes of data volume had presented challenges for getting the most value from space observations. The emergence of cloud computing on big data has brought revolutionary capabilities to the preparation and processing of data from space. Big data platforms and cloud-scale computing allow curation and processing to work with entire data collections of rather than individual scenes.

KEYNOTE – CREATING TRUSTWORTHY DATA FOR ACTIONABLE INTELLIGENCE

Frank Avila, Director for Commercial GEOINT Discovery and Assessments Office

As NGA expands into the use of commercial geospatial solutions, it must establish trust, confidence and reliability in the solutions that are procured by assessing the accuracy, quality and fitness to mission. This gives NGA analysts the trust to include these solutions in foundation products to provide decision advantage to policy makers, warfighters, intelligence professionals, and first responders.

In combining these different data sources with ML algorithms for actionable intelligence, NGA needs calibrated imagery and complete metadata to achieve better results for predictive analytics. NGA wants industry, academia, and research organizations to assist in verification of commercial GEOINT analytics, algorithms and services. NGA analysts must have full view of error, accuracy, and sources to make reliable judgments. Commercial data can be verified with open standards, structured data sets, and technical evaluations.

This will involve many activities – Error sources must be captured during data collection at the sensor level; Time and place components of geospatial services must be fused; A common framework for spatial, temporal and spectral measurements must be developed. Excellent progress is being made on these objectives. Improved confidence in data becomes more critical as NGA moves into automated processes.

Avila closed his keynote by encouraging attendees to examine the recently released NGA 2020 Focus Areas. He pledged that NGA will strengthen its partnerships with industry, academia, and the entire GEOINT community while verifying GEOINT accuracy and reliability.

SESSION 2: PANEL #1
BIG DATA FROM SPACE

Moderator: Kumar Navulur, MAXAR

Adam Astrada, MAXAR
Computer Vision of Satellite Imagery

MAXAR, which operates the DigitalGlobe remote sensing satellites, has a sophisticated cloud infrastructure in place. The company has stored the entire DigitalGlobe archive in the Amazon cloud and uses AWS for nearly all of its workflows, including automated object detection. MAXAR workflows cover major NGA technical focus areas, including Machine Learning Model Fitness for Use, Object Detection, Feature Extraction, Object Classification, Feature Characterization, and Activity Characterization.

For ML Model Fitness for Use, MAXAR has developed the Artificial Intelligence Interpretability Rating Scale (AIIRS), which matched the ML model to satellite imagery and rates it like the NIRRS rating scale. This improves detection to image quality and enables the machine-to-satellite tasking. With a new constellation of satellites coming online, MAXAR needs to match convolutional neural network with appropriate image as a means of getting data from the cloud into the right place for processing. AIIRS will make that happen.

Another important development for matching imagery to neural networks is the Open Neural Network Exchange (ONNX) format, which was created by a community of companies to interchange neural networks. ONNX provides an easy and automated way for MAXAR to export out of popular neural network frameworks into a single file for deployment anywhere.

Computer Vision and ML currently are used to extract features from images, detect objects, classify features and objects, characterize what specific objects are, and contextualize what is occurring in the scene.

Daniel Barcay, VP of Product at Planet Labs
Big Data from Space

Planet's constellation of 363 Dove satellites is delivering a firehose of medium-resolution (3-5 meter) imagery to the tune of 3 million images per day. This torrent of data has put Planet in a new regime when it comes to dealing with huge volumes, cadence and density of data. The company itself is divided into three layers –
Imaging, Insight Generation, and Delivery.

As the industry moves from data scarcity to huge data volumes, we are asking what is the best image, what is in the image, and what is in the stack of images. There are new software layers and scaling challenges related to search and analytics.

Barcay addressed four areas that Planet and the industry need to work on to enable planetary-scale monitoring:

- Streaming APIs – We need streaming tile services and analytics tiles services so people don't need to suck down entire database to perform search.

- Search Standards – We need industry standards related to search – not just filtering images, but actually looking through images to find specific things. Standards need to be modular and small.

- Data Slicing and Aggregation – We need to generate summaries across space, so that instead of analyzing all images we can ask specific questions and see trends across the images.

- Machine Learning – As ML becomes standard, we need to thing about inputs and outputs – how we ask questions of the database without downloading the whole thing.

Scott Soenen, VP Product Engineering at Capella
Small Satellite SAR

Capella plans to begin launching its constellation of small synthetic aperture radar (SAR) satellites this year, COVID-19 permitting, with the objective of providing information about what's happening on the ground regardless of darkness or weather. Capella's commercial SAR imagery will have 0.5-meter spatial resolution with revisit every few hours. Major focus for the company is to develop a web console where users can task the satellites, search for imagery, and integrate data into their own geospatial platforms and workflows.

With the limited budget of a start-up, Capella is facing many challenges. Some are related to the enormous size and complexity of SAR data sets, while others relate to the customers themselves. Capella will serve a broad base of end users, each with their own preferences for interoperability, standards, file formats, metadata formats, and even definition of ARD. The company is using industry standards where applicable but is developing its own tasking standards for SAR data. Customer requirements are driving Capella's product development.

SESSION 2: PANEL #2
BIG DATA FROM SPACE

Moderator: Kumar Navulur, MAXAR

Frederic Houbie, Senior Product Manager, Hexagon Geospatial
Analytics

The focus of Hexagon Geospatial is visualizing and analyzing dynamic information to solve real-world and mission critical problems. The five dimensions of location intelligence are What was, What is, What could be, What should be, and What will be. Hexagon encourages users to create a smart digital reality created by taking static data and applying dynamic analytics.

The Geo-Ops Challenge in every domain is to shorten the time needed to deliver high fidelity and actionable 5D time location intelligence to enterprise operations. Data acquired daily becomes obsolete quickly, so management of the data is crucial. It is important to optimize the acquisition turnaround time and use metadata to help decide whether the data suit the use case.

Scott Herman, BlackSky, CTO
BlackSky Overview

The evolution of standards and how they apply to geospatial data analytics is relevant as BlackSky monitors the globe by accessing the world's satellites. The company studies the patterns of life through data and has built its own swarm of point target satellites to provide a high revisit rate. BlackSky blends EO imagery with other data sources – EO, SAR and terrestrial sensors. Multiple shots of the same target throughout the day are ingested for analysis. This provides a different way of thinking about satellite imagery analysis with varying light angles and time of day.

Imagery-derived analytics supports object identification and when combined with contextual information, anomalies can be identified. Monitoring applications range from refugees, natural disasters, Saudi oil prices, military aircraft, and construction of a nuclear facility. Imagery combined with context such as cellphone traffic supports better conclusions.

Studying the patterns of life for a particular facility provides unique dynamism. OGC standards for interoperability are very important as data becomes higher volume and higher velocity and data from multiple sources are combined.

June McAlarey, CEO, PCI Geomatics
Earth Observation for Climate Change Analysis

As we look to address the 21st century geoscience challenges it is clear that no single organization has an end-to-end workflow to serve all users. Regardless of where each organization resides, everyone relies on collaboration and interoperability to expand industry value chains, improve workflows and diversify the user base.

PCI was a legacy desktop solution but has reorganized its cloud product development methodology and expanded its distribution channels and business model to sell with and through partners. There is an ARD focus for data in the cloud and open data cubes are democratizing data across an expanding user base. SANSA is a highly automated solution to produce ARD for the SPOT archive.

The industry needs high quality/accurate ARD for multi-temporal, standardization so that pre-processing will allow users to handle the data, whether it is CARD4L, OGC, etc., to produce real time actionable intelligence. ARD is needed to save time and money and support a focus on satisfying EO information needs and produce better outcomes.

QUESTIONS:

Question 1
How does industry feel about existing standards supporting interoperability?

June McAlarey feels that current efforts are not sufficient and needs to improve so that the time to process data is reduced and it is easier to share results with other solutions. Continued investment to solve this issue takes everyone's commitment.

For BlackSky, the metadata being included with the data provides additional information necessary for thorough analysis. For ML/AI based analysis and supervised learning, the company takes an expansive approach to what to include when building and labeling a training set. Images might look very different depending on the time of day in inter-day images. Sufficient calibration and alignment also necessary for inter-day analysis. Deep stacks of imagery have to be lined up in a way that consistent analytics can be applied. There can't be one standard to rule them all due to competitive differentiation, but must have some standardization in order to leverage all the data together as we move away from traditional image processing and image exploitation and into ML and computer vision techniques.

As more satellites are launched, how is Hexagon thinking about satellite models and combining data? From Hexagon's perspective, it is difficult to combine different sources because each satellite has its own model. There is room for improvement to help users in this area.

Question 2
What is 5D?

Hexagon's concept is about temporal datasets, 1. What was, 2. What is now, 3. What could be (simulated data), 4. What is optimized model, 5. What will be?

Question 3
What are the big changes regarding management of new space data?

Scott Herman says that one of the big changes is instead of looking at data as very structured, now it is thrown all together with a minimum of tagging to create elastic databases. Of course, users still have to be able to find the data so some tagging is necessary. The ability to more easily pull in data from multiple sources is a new technology. Data collection is increasing in volume with more frequent collects, but the observation data point can still be small, just more of them in a day.

Question 4
How is PCI approaching on-demand data by processing into data cubes?

From PCI Geomatics' perspective, ingesting data into a data cube in the cloud is valuable for real-time analytics to provide on-demand data. PCI's architecture allows us to process real-time data along with old data.

Question 5
What is Hexagon doing in the area of analytics-ready data cubes?

Hexagon isn't being asked to manage that type of concept. Customers usually process their own data using HxGN software and maintain their own data cube.

Question 6
Tell us about BlackSky's constellation.

BlackSky is currently operating four satellites with two more scheduled in the next 4-6 weeks. In the next few months the company plans to launch a successive series of 1m and 50cm satellites.

Question 7
How does 5D correlate with the four modules of an analytic mechanism (heuristic)?

At BlackSky, moving from descriptive analytics to prescriptive is really about analyzing the patterns of life. As the number of observations increase, the analyst determines anomalies, which is descriptive, then determines what action to take, which is prescriptive. It is a forensic to real-time to predictive approach. Other considerations include asking if another type of sensor can provide additional information to change the results. There is an evolutionary loop of how to move through 5D.

Question 8
How are your organizations making actionable intelligence more trustworthy?

PCI Geomatics adopts standards that are accepted throughout the industry for processing analytics-ready data so end users can trust the output.

Hexagon believes that shortening the time between acquisition and analysis improves its trustworthiness, as well as avoiding transforming information which can result in losing information or introducing errors. Extracting information is fine, but not transforming.

Scott Herman says there are two parts to trusting the data. First, to ensure data has not been purposely changed, an organization needs effective cyber security and a chain of custody. Also, the customer must trust the source, i.e., a closed loop system has a higher veracity score than data pulled from the internet. BlackSky's analytics products are referenced to the data sources and the veracity of those sources is disclosed. Inadvertently mangling the data through transformation is also an interesting problem.

IV. SESSION 3 ANALYTICS

Space observations can benefit many fields of study and business. Extracting knowledge from the observations requires analytics. Data science methods are transforming analytics and applications. Machine learning at scale is effective in analysis, but needs to be confirmed as effective, accurate and robust across applications. Knowledge based models bring robust understanding and predictability, but also need to be confirmed as accurate. Visualization continues to be an effective method to convey understanding of geospatial information.

WELCOME & INSTRUCTIONS

George Percivall, OGC

Welcome to the New Space Workshop. OGC represents around 500 companies of industry, government and research organizations. We focus on interoperability across communities and consensus-based standards to encourage information sharing. We investigate trends in geospatial information, currently about 50 topics. New Space is about increased availability of getting to space and the democratization of space, diversity of phenomenologies and new processing and analytics, such as big data, cloud computing, statistical computing, etc. More sensor types are giving us more information in space, which is leveraged through data fusion.

Today is about the technology needed to handle big data, fuse multiple sources, and conduct machine learning.

KEYNOTE – MONITORING THE PULSE OF OUR PLANET: TOWARDS THE 100 TRILLION PIXEL CHALLENGE

Budhu Bhaduri, Oak Ridge National Laboratory

A major “claim to fame” of Oak Ridge Labs is the ability to conduct high performance geocomputation with the fastest smartest machine in the world called Summit. But 20 years ago the Intel Paragon 150 represented the technology of the day for large geocomputing. 150 gigaflops was impressive at that time.

The Titan processed 45.5 TB of data in less than two hours using about 5,000 cores of the supercomputer to map every building in Yemen in the mid-90’s. This progress is not just from bigger machines but from parallel stream of research that allows experimentation with approaches to machine learning and artificial intelligence. Maturing those approaches supports more efficiency.

Large scale time series visualizations with MODIS imagery created many new analysis opportunities, such as detecting change (spread of Walmart stores used as an example). This raised the question of how to move from MODIS imagery to .5m resolution imagery which has many more pixels. To cover Nigeria, 90TB of imagery has 32 trillion pixels. An analysis of Nigeria showed only 2% (62 billion pixels) of land covered with buildings.

Key challenges with large-scale data analysis include spatial-temporal generalization, multi-scale generalization, training data experience, and maximizing utilization of HPC resources while minimizing end to end execution time of workloads. A comparison between NVIDIA and Titan shows the progress made in countrywide processing with NVIDIA DGX taking 19 days vs. Titan taking 60 hours to process an entire US database.

The automation scaling challenge involves ML models being trained for a particular object in a specific context to achieve an accuracy. If new context is introduced, accuracy deteriorates. To solve this issue, RESFLOW partitions images into buckets with persistent context over multiple conditions, e.g., sensor, geography, angle, haze, etc., which means one can look for buildings everywhere that displays the same context. Early studies are showing promising results.

For daily refresh of global imagery at 5m resolution, the industry would need the capability to process 100 trillion pixels every day. To accomplish this would require a federated cyber infrastructure, which doesn't exist today, to move data from sensors in space to large scale computing to interactive visualization. This would help move processing from a few large machines to edge computing. These topics were introduced at Global Scale AI workshop, September 26-27, 2019 (Click here to view presentations). A second workshop is planned for spring 2021.

SESSION 3: PANEL #1
TECHNOLOGY FOR HANDLING BIG DATA

Moderator: George Percivall

Manil Maskey, NASA
NASA Earth Science Data Systems (ESDS)

NASA maintains the single largest repository of Earth Science Data in the world. The free and open data policy since 1994 allows access to anyone for any use. The archive is a critical resource for scientists and researchers. By 2022, 48PB of data will be added to the archive each year with a total archive volume reaching 250 PB by 2025. This growth poses a series of challenges for storage and data management.

NASA is pursuing two major initiatives: 1) Earthdata Cloud to prepare for high-date-rate missions and provide faster access/processing for researchers and commercial users without the need for data mgt and 2) AI/ML to support data-driven science with training datasets and tools for operational efficiency. NASA is conducting workshops to seek community input to establish standards.

Peter Becker, Group Product Manager-Imagery, ESRI
Technology for Handling Big Data

ArcGIS is an open platform for all forms of geospatial data that enables users to create sustainable solutions at scale. By combining content with visualization and mapping tools and applying analysis and modeling techniques, information is generated to support decision making and ultimately action.

The foundation of ArcGIS is data management/storage of data. The process has to be efficient and make data rapidly accessible. Old formats might not be best choice to store metadata and source imagery. Dynamic imagery is a combination of source imagery and metadata, used to produce ARD products and data cubes, but not everyone wants the same kind of end product.

L1 is source data stored in cloud. Some organizations need secure environment outside the cloud, such as a military environment. ArcGIS Online manages data in the cloud and on in-house servers. As more data providers provide data in the cloud, the infrastructure must support interoperability of many data sources.

Ashley Antonides, Lead Data Science, Anno.ai
Operationalizing AI/ML for Mission

Anno.AI is based in the DC area and focuses on applied ML, software and custom solutions, and scalable model development and deployment for government, nonprofit and commercial customers. The company supports the broader use of ML for domain experts and provides service when there is a need to rapidly deploy a model, such as for emergency responders. Anno.AI's core application allows user to describe what they are trying to detect and then run pre-trained models that are appropriate for their context. Anno.AI helps solve collaboration problems for interdisciplinary teams and is working to improve the development of training models by incorporating cognitive science disciplines. The company's goals include making workflows accessible to a range of end users, making training annotation more efficient and improving interoperability between different AI/ML dataset and framework formats. OGC's GeoAI Domain Working Group is a focus of activities for advancing the application of AI and machine learning for geospatial information.

QUESTIONS:

Question 1
What is ARD (Analysis Ready Data) and what is it good for?

Ashley Antonides thinks that in terms of typical use cases, users want to be able to quickly develop new applications, so accessing derivative products already in a GeoTIFF format helps. Also, being able to quickly label data and be more efficient creating training models is important. The ability to run pre-trained models helps make the decision about which model is appropriate for each use case.

Peter Becker says the data gets processed to create different products. ARD is the pre-processing to prepare the data for quick analysis. For example, for multi-temporal datasets, apply surface reflectance and other things to make it ready to use. But ARD doesn't solve the problem for all users because some will need the source data. ARD is an important data source for access to a visualization or applying ML.

NASA did a study as part of a cloud analytics workshop which found several definitions for ARD based on user or application perspective. From NASA's perspective, to enable big data analytics the community has to move toward analytical optimized data score (AODS) which makes data more scalable. AODS minimizes the need for data wrangling and further processing for a large share of NASA users. Oak Ridge National Laboratory thinks of ARD from a slightly different perspective by re-thinking how data is captured in space, and how could sensors be redesigned to more easily produce ML-ready data. A new generation of sensors that are flexible and adaptable to support ARD would be more useful, instead of trying to make existing sensors produce ML-ready data.

Question 2
What advances are needed to make ML more accessible and reliable?

Budhu Bhuduri feels that all analysis usually comes with some level of assessment by calculating error bounds and confidence levels. But the user must ask what is the sensitivity and tolerance of the application to the kinds of uncertainty bounds being generated? For example, the weather app has been refined over many years. People make decisions based on numbers updated every 15 minutes and it is fairly accurate. If there is a 50% chance of rain it might rain only in one area and not nearby, so there is always a risk.

NASA has reviewed the adoption of ML for earth science. Open science, community building and benchmark datasets contribute to progress in this area. Advances in algorithm development is plateauing because low hanging fruit has been picked. NASA is focusing on improving the data side and training data are the key. The model and data go hand in hand and both have to be good to get good results.

Peter Becker says there is a difference between the data science perspective and data user perspective. From the data science perspective, models can only be as good as the training data being used. Every user needs specific information about training data used for each model to be sure it is appropriate for a use case, and the end user needs access to source data to increase confidence. A feedback loop must be built into the system.

Ashley Antonides likes the distinction between the data science and the end user requirements. The end user needs transparency to know where data came from, what ontologies were used, what is the geographic distribution of the dataset, etc. Anno.AI has end users involved in training to add their expertise to ensure correct labeling and reducing bias on how data are sampled.

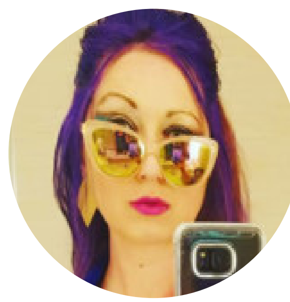
George Percivall added the comment that today's younger generation is growing up as "AI/ML natives." They will be involved in the ongoing development process.

SESSION 3 PANEL #2 ANALYTICS & VISUALIZATION

Patrick Cozzi, CEO of Cesium
3D Geospatial Visualization Born in Aerospace

By way of introduction, Patrick Cozzi explained two core beliefs when it comes to realizing the potential of the data we are acquiring today. First, the intersection of geospatial and computer graphics is the sweet spot for advancing our field, whether accelerating classification algorithms with parallel computing, using spatial data structures for rate tracing, or streaming massive geospatial content. Second, the huge volume of data coming from new sensors and systems represents an opportunity, but we need open standards and we need interoperability. Contributing to open standards is the core of what Cesium does.

Cesium started in the aerospace industry focused on high-precision, high-performance visualization but saw potential outside of aerospace. With data acquisition on the rise with satellites, drones, etc., it seemed hard to fuse the data together, visualize it, understand it and share it. So Cesium broadened its mission to become a fundamental platform for 3D geospatial visualization. Cesium created the 3DTile OGC community standard as an efficient way to stream and represent data for visualization and analysis.
Current advancements in the 3DTile standard is to enhance the metadata to include additional information such as per-pixel accuracy and surface material types, which better supports computer vision and ML. In the near future, there will be dynamic 3DTiles that contain information related to temporal changes in the stack of images or data.



Ash Richter, Archaeologist/ Anthropologist/Engineer at In-Q-Tel
Spatial Computing: Mapping at Different Physical Scales

In-Q-Tel was founded 20 years ago by the Central Intelligence Agency as a venture capital firm to invest in new technology on behalf of the Intelligence Community. In-Q-Tel exists to look at what's coming and figure out how government can help push it along.

In-Q-Tel is examining how to bring together multimodal data sets from different times and space at various scales so they can be analyzed. Spatial Mapping has progressed from Mapping in 2D to Basic Augmented Reality Mapping, where we are now. We are moving into 3D Mapping which will lead us to the AR Cloud in five years. Ultimately, mapping will result in a Replayable Digital Twin of the Physical Landscape and Historical Archive of Human Activity in 25 years.

To achieve this end result of AR mapping, we will all engage in labeling of features, which is already beginning to occur with what Ash Richter calls 'ubiquitous sensing' such as Alexa and the other 'smart' devices we interact with every day in our homes and offices. Even in the world of COVID-19, people have increased their embrace of digital devices, accelerating this AR mapping trend. New Space is also helping to push this trend along by capturing and providing new data sets as training data and validation.

Perry Peterson, University of Calgary
The Future: Better Decisions, Better World

vHow can we build a better world? That's the question Perry Peterson used to begin his presentation. From his perspective, our efforts to build better sensors, systems, processing capabilities are wasted if they don't result in our ability to make better decisions. Spatial analysis is really asking two questions – What is here? Where is it?

These are the key two questions of spatial analysis, but why are the answers so hard? The problem is data fusion; it is the bottleneck in geospatial decision making. Most questions we ask are complex and require multiple sources of data. We should be able to produce universal answers to unanticipated questions.
To allow for data fusion and integration on demand, OGC has adopted a new earth reference model called the Discrete Global Grid System (DGGS). It is undergoing ISO now. DGGS represents a major Earth reference innovation for information storage. DGGS is cell based and meant to store information in equal area cells at finer and finer resolution over the Earth's surface. When data is prepared in DGGS, spatial analysis is as simple as set theory. Data fusion is a free operation because all data is aligned in its own level of resolution to that data model.

As a final thought, Perry Peterson observed that traditional GIS is great at slicing the world into layers of information, DGGS is design for bringing that information back together again so it is usable.

Figure from Perry Peterson: OGC Discrete Global Grid System

QUESTIONS:

Question 1
What are the challenges to achieving information fusion beyond the pixel level and what will be result of getting to information fusion?

Perry Peterson responded that the answer to the question, “What is here?” can be answered with Virtual Reality. However, the question “Where is it?” is more difficult to translate into natural language processing, which will require geospatial Artificial Intelligence.
Ash Richter said that co-registration of multi-modal data sets is the biggest challenge to data fusion, specifically preparing the data and updating them. A later challenge will be who owns and controls the data.

At Cesium, Patrick Cozzi says that data must be brought together, correlated, presented and analyzed to provide value to end users. This becomes difficult when correlation and analysis involve combining the natural and built environments. Performing line of sight analysis for cell signal propagation is an example. Georeferencing the natural and built worlds is a challenge.

V. NEXT STEPS

Based on the outcome of this New Space webinar, OGC sees the following calls to action for the entire geospatial industry:

- Collaborate as a community to ensure interoperability of resources and meet the requirements of customers
- Engage in standards activities to overcome current or potential data integration challenges
- Continue raising awareness about the potentials and impacts of New Space

OGC expects this webinar will be the first of several addressing the new issues that are arising as geospatial technologies advance, sensors evolve, and end user applications change.

The OGC New Space Workshop Report is sponsored by IEEE-GRSS, a leading world organization dedicated to advancing the scientific and technical theory and application of remote sensing for the geosciences.

Learn more at: http://www.grss-ieee.org/

If you wish to keep informed of future OGC webinars and events, contact info@ogc.org

OGC®
Making location count.