



NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

Office of Corporate Communications

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**Remarks as prepared for delivery by
Robert Cardillo
Director, National Geospatial-Intelligence Agency
Small Satellites – Big Data
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Utah State University
Logan, Utah**

Thank you, Noelle [Dr. Noelle Cockett, President, Utah State University], for that kind introduction. And thanks to the Aggies for hosting us here at Utah State.

It's a personal and professional privilege for me to be here representing the women and men of the National Geospatial-Intelligence Agency at the 31st annual Small Sats conference, and what an exciting three decades it has been for this industry.

Although NGA itself has only recently celebrated our 20th anniversary, our pioneering predecessors trace their history all the way back to the earliest days of satellite technology – The days of Corona, and moon flights, and satellites the size of buses.

Today, we all find ourselves facing a very different landscape.

With your vision – and your persistence -- we have a new and expansive view of the world – a view that comes from space, air, sea, and ground – and one that, in the next five years, has the potential to see us receiving a million times more geospatial data.

We are moving from a world of data scarcity to a world of data abundance.

So just how big is this rising tide? If we attempted to manually exploit the imagery we will receive over the next 20 years, we would need eight million imagery analysts. As a former IA, let me relish that thought for a moment.

Back to reality -- that's clearly not a viable solution, so we have to think about the problem differently.

All this data – combined with dramatic improvements in computing power – represent a phenomenal opportunity to do, to know, to understand and to achieve even more.

We have more access to, and information about, our planet and the activity upon it, than at any time in history.



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We know that this building wave of data is not something to be afraid of – the data is not the threat.

Managed smartly and efficiently, this wave will help us do our job better and more effectively meet our mission needs: anticipating threats, reducing decision time, confirming intelligence – but we also know it's going to require us to change.

First and foremost, we know we cannot deal with this wave on our own. We need partners. We need you.

As the Director of NGA, I also serve as the functional manager of the ever-growing GEOINT community.

This community connects us with our Commonwealth allies, as well as with other international partners, with academia and UARC's such as Utah State, and of course, with industry.

With these partnerships, we can and do literally circumnavigate the globe.

And each one of them, each one of you, matters.

Because together, we can, and we must, build a far more unified, professional, and interoperable GEOINT Enterprise.

So if we first think how best we can partner, we're far more likely to achieve success for ourselves and our enterprise.

It's no secret that NGA relies on a variety of platforms to support our customers' mission needs, and more and more often, those platforms are commercial in nature. We are agnostic as to the source of the data we need to answer the demands of those who rely upon us.

And we have always relied on the latest and greatest technology to meet our mission needs. We must however build in a new agility in our thinking, in our contract processes, and our architecture.

So, if you will come with me for a moment to early days of our early move to space, I'd like to explore the cutting edge overhead imaging system of that time and look at how it revolutionized our tradecraft in ways similar to what we're experiencing today with advances such as small sats.

During the height of the Cold War, the U.S. moved from very high flying jets to satellites for imagery -- and then as now -- the focus was on getting imagery to the ground, and to the analysts and, most importantly, to the decision maker as quickly as possible.



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The successful launch of Corona in 1960 revolutionized not only the business of satellites but the business of intelligence as well. Those pioneers literally revolutionized our understanding of the planet.

For example, the first Corona mission delivered more photographic coverage of the Soviet Union than all of the U-2 flights together ever had. One and a half million square miles of Soviet territory, which was equal to 17 percent of their territory.

It wasn't easy, and it wasn't cheap. There were dozens of failures, large and small.

In fact, of the first 30 missions from 1960 through 1962, only 12 were considered successful.

For all of the world's sanctions, and the country's primitive economic base, North Korea has joined the space-faring club more quickly than any of the other eight members.

Back to our story. Our limited success is not surprising when your transmission system involved ejecting an 84-pound canister of film from a satellite moving at 17,500 mph, and then having a C-119 – what they used to call a “flying boxcar” – hook the canister's parachute before it plunged into the ocean.

And then the film canister had to be shipped from Hawaii to Rochester to be processed, and then moved to Washington DC, and then from there to the customer who needed the analysis.

On that first mission, six days elapsed between Capt. Harold Mitchell's successful capture of the film capsule to when President Eisenhower was able to inspect the mission's photographs, and of course, the data in those images was even older.

Corona was about 60 feet long and weighed about 30,000 pounds. Initially, it delivered imagery with 20-30 foot resolution, although that improved to 5-6 feet by the end of the program.

Today's commercial satellites include a number on orbit right now that are about the size of a refrigerator, and with Planet's successful July launch of 48, they have a constellation of 190 satellites, each one smaller than the carry-on suitcase you brought to this conference.

And they are rapidly approaching the ability to sense the entire surface of the earth, every single day.

Moore's Law – it seems – is proving to apply to satellites as well as CPUs.



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The total cost of the CORONA program from 1960 to 1972 amounted to \$850 million, or \$4.9 billion in today's dollars.

During its twelve year operational life, CORONA collected over 800,000 images in response to the national security requirements of the time.

While no costing method is perfect, that averages out to slightly more than \$6000 to acquire each image.

Here's what is remarkable about that breakthrough mission. The resolution was substantially worse than that collected from U-2 flights, but the first Corona mission covered more of the Soviet Union than all of the U-2 flights before it ever had. Even though resolution was not as good, volume was dramatically better, and it proved to be a seismic shift in the way we used imagery, and how it provided strategic advantage.

Sound familiar? We are no longer on the cusp of – we are now in the mindset of – a similar revolution today. CORONA marked the beginning of an explosion of intelligence data – and the associated technologies that launched, collected, retrieved and exploited that data from space.

Overnight we went from famine to feast in terms of intelligence information.

The most important lesson from the Corona program? At the right time, taking advantage of an advance in technology can revolutionize the business of intelligence in unexpected ways.

Corona failed, a lot, particularly in the early days. But the mindset was, "We are willing to fail so long as we fail forward," and the results were well worth all the risk.

Today, NGA is similarly determined to boldly step out from traditional government and intelligence norms and mindsets, and find innovative solutions to our greatest challenges.

We fully understand the need to grasp the opportunities that new technology present.

One last footnote to this Corona story. When President Clinton declassified Corona imagery in February 1995, it highlighted the value of consolidating the scattered imagery operations across the DoD and US government into a single organization.

It also led to a number of unexpected uses for that historic imagery, from climate studies to human geography.

In fact, when Director of Central Intelligence John Deutch spoke at the CORONA Symposium in May 1995, he said:



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“One of the things I intend to do, to ensure that we get the most out of our imagery capabilities, is to establish a National Imagery Agency that will pull together all aspects of collection, analysis, and distribution of imagery. We need to go beyond the technical magic of space photos, to develop better ways to present this information to the people who need it, from the President, to the military commander on the battlefield...”

My agency was created shortly after that, with a mandate that requires us to go beyond “the technical magic of space photos” to provide decision advantage to our mission partners and customers, from the President to the warfighter. We must steal time and space from those that would harm our country and our allies to ensure we can defeat those threats.

Our motto, “Know the Earth – Show the Way – Understand the World” defines the scope of our vision and the import of our mission.

Today, Team NGA includes one of those couriers and one of those “star-catcher” pilots, although they’ve both moved on to other responsibilities at NGA, ones that don’t involve giant film canisters from space.

Per presidential direction, NGA is currently conducting a review of historic satellite imagery from the KH-8 system. In the next 12 months, NGA will transfer more than 300,000 declassified images collected between 1966 and 1976 to the National Archives and Records Administration (NARA).

This will add to the current collection of KH-7 and KH-9 images that were transferred to NARA in 2002, and the imagery declassified in 1995, all with the goal of sharing knowledge and documenting history.

NGA as a whole has moved from the world of pictures to pixels to today’s big data environment. Along the way, we’ve adapted to continue to meet customer needs.

When I started my career, a light table was state of the art. Today it is a curiosity that we share with our high-tech interns.

In my analytic days, I spent a lot of time hunting, counting and identifying individual objects on blurry photographs. That’s simply not good enough for today’s mission needs.

Now I’m learning Python, so I can at least follow along as my agency evolves from imagery analysts to geospatial analysts, from staring at pictures and reporting, to programming algorithms and automation to drive production.

In other words, we must move from seeing to sensing – from exploiting to understanding – and from reporting to anticipating.



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We're already using technology to change the way we do GEOINT. Let me give you some examples.

We are proud of our partnership with a crown jewel our country's scientific expertise – the Oak Ridge National Lab in Tennessee.

With help from the Gates Foundation and NGA, Oak Ridge used big data and world class computational power to create a unique map, and unique insight, of Nigeria.

It's based on satellite imagery and more than 2,000 neighborhood surveys. This project identified settlements that didn't exist just a few years ago.

So when Nigeria distributes the measles vaccine next year, the country will save a billion dollars, and countless lives, because they won't use flawed, 10-year-old census data. All thanks to combination of imagery, automation, human geography and mapping technologies, underpinned by strong partnerships.

Closer to home, we're partnering with the U.S. Census Bureau to assist them with their 2020 address canvassing operation.

We are sharing NGA imagery with Census Bureau personnel verifying housing units in 11 million census blocks nationwide.

Census needs to verify how many housing units are in each census block, so they can ensure an accurate count in 2020.

Using NGA imagery, and applying innovative algorithmic solutions, they estimate they can verify 75 percent of housing changes without having to actually walk the streets involved.

This will save the Census Bureau as much as \$1 billion, accelerate their counting efforts, and improving their count. Win-win-win.

Another good example of partnership is the TanDEM-X High Resolution Elevation Data Exchange program.

The T-REx Alliance, under Germany's leadership, consists of nearly 30 nations. This program is leading to the most comprehensive pole-to-pole global Digital Elevation Model, or DEM, in history.



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Germany's investment and innovation, and the team's coordinated efforts, will literally redefine the ground. It illustrates how the value of these kinds of partnerships often exceeds the technology available without them.

We've reached out to other nations to share post-processing of data in a way that is mutually beneficial to all that participate.

Through sharing agreements, the T-REx member nations are provided access to the unclassified raw elevation data collected by the T-REx constellation for free, in exchange for edited data to share among members.

Along the same lines, on the 2nd of June, in conjunction with the University of Minnesota's Polar Geospatial Center, we released the latest update of our Arctic Digital Elevation Model on the World Wide Web. It covers 65 percent of the Arctic region, and we'll reach 100 percent in one more month.

We launched the website in September of 2015, and it's the first high-resolution, publicly available DEM of the Arctic.

Since its first release less than one year ago, our academic, commercial and government partners have downloaded more than 1.5 terabytes of elevation data.

With two meter spacing and full coverage, the world has a much greater understanding of the geography, and the potential for economic development, as well as associated military tension in this evolving and important frontier.

The DEM supports informed land management, sustainable development, safe recreation and scientific studies, as well as domain-specific challenges inherent to the aviation, transportation and defense industries. And it also serves as a benchmark against which future landscape changes, due to, for instance, erosion, extreme events or climate change can be measured.

NGA has also developed and made available in both hard-copy and explorable digital formats the most comprehensive pan-Arctic map ever published by the U.S. government.

It includes layers such as Arctic routes, Arctic currents, oil production sites, gas production sites, oil drilling areas, oil and gas reserves, airfields and ports, bathymetric data, digital terrain elevation data and other layers – including rivers, railroads and populated places.

Another great example is NOME, an acronym for our NSG Open Mapping Enclave, which allows us to crowd-source and share foundation data in areas with sparse or no existing coverage.



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Right now, there are more than 600 members from 15 nations on our World Wide Web presence.

And more than a thousand teammates on our top-secret domain.

By the end of this month, we expect to be able to deploy NOME to our secret domain, so many more military users can access it.

Here's a recent example from the city of Yei, in South Sudan.

In just seven weeks, Team NOME added more than 700 kilometers of new roads and more than 70,000 new features.

Another tool, called Beachfront, automatically creates new coastline data using commercial satellite imagery, and more importantly for this audience, collected by Planet's constellation of 3U small sats.

You're looking at the immense river delta system on the border of India and Bangladesh.

It would have taken one analyst five hours to produce these vectors manually. It took Beachfront less than six minutes, using Planet imagery. That's a lot of time freed up by computers, to perform analytic work that today only humans can do.

This is a perfect example of the future we hope you'll help us define and deliver create, using commercial small sat data combined with automation and analytics to improve the way we do business.

That's why, on June 19th, NGA purchased a \$14 million subscription, via our joint venture with GSA called CIBORG, to explore and leverage Planet's small satellite capabilities for another year.

The global scope of coverage and high-temporal frequency of collection from Planet provides us with an important new data source to support our many missions, to include foundation GEOINT, intelligence and humanitarian assistance.

Part of our job as an intelligence agency is to assess regional stability and Planet imagery has been valuable to help us determine activity trends in ports, airfields, military garrisons and road networks.

And on the humanitarian side, it assists the global community to track refugee density and events that threaten food security.



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So, the lessons learned from our pilot contract with Planet are reflected in the structure of this new contract, which enables the Department of Defense and the Intelligence Community to access Planet's imagery of over 25 regions of interest, ranging from portions of the Middle-East, Asia, and Africa to Central and South America.

This has been a learning experience for us and for Planet.

As Planet has continued to mature its capability to offer weekly global coverage, NGA and our customers have learned how to use this coverage across our varied mission sets so we truly understand where we get the bang, that is mission impact, for our buck.

NGA analysts and mission partners will continue to capitalize on the operational success experienced during the Planet Feed Pilot contract period, as well as explore new ways to utilize Planet imagery and data.

And, in addition to Planet's current imagery, NGA will also have access to Planet's archive. This will help our analysts produce change-detection services and reference imagery for historical context. Our coders will develop tipping and queuing services and automation initiatives which will rebalance the mix of pixels and services.

So, as you can see, NGA is determined to embrace commercial GEOINT where it has demonstrated mission utility. As I've said before, we will go wherever the data exist, and apply the same wherever the mission demands.

For each of the examples I just mentioned, the data layers being created are going to create new insights, insights that will be developed by academia and industry, as well as the Intelligence Community, to meet our mission needs.

This leads me to my next point: Public-Private partnerships.

That term has been used in different ways over the years, but in this case, I'm talking about an innovative and interdependent relationship between NGA, academia and industry that supports and advances all our respective capabilities.

NGA sits on an amazing, and broadly untapped, resource. We have labeled imagery, GIS data, and GEOINT expertise going back decades.

In a world of deep learning, historic data and ground truth are immensely valuable.

The Economist recently called this "Big" data "the new oil."



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At the same time, we know that industry has valuable data, as well as the talent, creativity, and ability to develop insights from the deluge.

We must tap into that.

So we propose to create an exchange, a data brokerage.

NGA will compete our data, our analysis, and maybe even our digital exhaust, the byproducts among promising startups, long-standing industry partners, schools and think-tanks.

The goal is to obtain a return on that invested data in the form of new algorithms – new trained machine vision approaches, or new applications.

Our approach to this initiative is now in formation, and we look forward to developing this type of data-centric synergy with any and all interested partners.

It's a bold idea with many challenges, from authorities to declassification to licensing.

And it definitely falls into the category of taking a risk. Our idea is to invest this data into the US economy and into US companies and universities and inventor – that's the capital we'd bring to the deal.

Once we have our capital – the data – in a usable format, we can form our investment fund to invest this capital.

We might also open up the investment to other 'co-investors' who can chip in their own data.

So imagine NGA and the Air Force, or NGA and a company, say a large tech company or prime contractor, getting together to co-invest. Then we must find companies and inventors who have the skill and talent and experience to take that data and turn it into something even more valuable.

For example, a company that is looking to build change detection capabilities. We can provide huge amounts of back data for them to train and test their algorithms.

We can provide this data or baseline technology or expertise, as appropriate, as an investment in future innovation.

We'd find the right team with the right ideas and we'd make that investment and try to help grow that investment.



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The finding the right company at the right time, with the right team will be everything. Then that company can go take our investment and turn it into something.

If data is the new oil, we want these companies to go make petrochemical services. In fact, to take this one step further, let me quote that classic film, *The Graduate*. In the scene, Mr. Robinson provides advice to an aimless new graduate Benjamin Braddock.

“I have one word for you – Plastics... There's a great future in plastics. Think about it...”

So, we need your help to turn those data petrochemicals into plastics, and then build something, something new, something better.

Turn it into a change detection algorithm or into a new innovative way to use hyperspectral imagery or a new automated way of labeling objects in images or something that we never even considered.

Like any good business strategy, in exchange for our data, we'd like a return on our investment.

In this case, that return looks like better data, better technology, better solutions.

Some 'value add' to what we started with. That's the return on investment.

For example, if that company comes up with a great change detection algorithm, then they sell it commercially and become the next unicorn.

We just want to be able to use the new invention ourselves. And combine it with our classified sources and apply it across our mission spectrum.

Another example could be all that Corona imagery I mentioned earlier.

Imagine what could be done from a change detection perspective with decades of declassified satellite imagery.

The analytics developed could lead to a host of new applications, for both government and industry.

So, as you can see, there are a lot of ways that we see Public Private Partnerships as a win-win-win, the last win being those that we serve.

NGA gets new and innovative technology to give us a competitive advantage and companies and inventors get a competitive edge of their own.



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Importantly, this is not a cash investment or transaction. This is a data investment. And it is a data transaction. We give data and we get data and technology back.

We know that the reality is that the best AI and tech companies out there don't even need our money. There is plenty to be had in venture capital and capital markets in general.

We think of the public private partnership as a GEOINT data investment fund.

And our Public Private Partnership includes the flexibility to consider partnership rights, licenses and copyright.

This will allow the PPP to meet NGA's mission needs while also continuing to provide the right incentives to partners to innovate and develop new and necessary inventions.

Certainly, we will see these intellectual property approaches evolve over time, just as we are seeing data licensing evolve in front of our eyes as it becomes one of the foundations of the U.S. economy.

It's part of our larger efforts to drive innovation for GEOINT community.

In addition, we are standing up a new Office of Ventures and Innovation.

That office is going to combine our innovation activities as they relate to our internal processes and external relationships.

This is an admission that we cannot get to our future by internal innovation alone. We need to tap into innovation across academia and industry.

As we become a more technology and data centric organization, we must move faster and be more innovative to carry out our mission.

We seek to unlock the power of the resources that we are sitting on.

If data really is the new oil, then NGA and the US government in general is the Saudi Arabia of that new data economy.

In a sense, this is about even more than just innovation for NGA and GEOINT.

I think that this is also a way to start a whole new type of conversation between the intelligence community and the technology industry.



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As always, we're close partners with NRO in these efforts as well, in fact, Betty Sapp and I recently stood up what we call the CGA [Commercial GEOINT Activity], to evaluate commercial GEOINT capabilities and services for the community.

Today at 3:00 PM, Kevin Ayers will provide a CGA overview with a heavy focus on the CGA Leaderboard. This effort articulates GEOINT needs and enables industry to submit capabilities with instant feedback. If you haven't had the chance yet, I recommend you visit the CGA Leader Board.

This includes fitness for use, design parameters, and insights into how to improve your products, all in real time.

This is one more example of how we are working to be more responsive to our customers and our providers, so they can better address our mission needs.

During the classified session, Mike Foster will discuss how small sat data is being integrated into operations today and opportunities for the future.

And, as new commercial data capabilities and services become available, we intend to make it easier for the government to acquire them through the CIBORG [Commercial Initiative to Buy Operationally Responsive GEOINT] initiative.

It's about the rapid and easy acquisition of commercial imagery, data, analytic capabilities, and services.

And CIBORG is off to a great start. GSA has added 10 vendors to CIBORG, with another 20 pending final approval.

And so far in this Fiscal Year, NGA has committed more than \$40 million via CIBORG.

This initiative supports our commitment to become the GEOINT broker of choice. Along with other activities like JANUS, which will take our data partners into the realm of content services, CIBORG provides a gateway for our GEOINT suppliers.

We will broker user needs to suppliers, and convey the content and services to our customers. This brings me to my final point, regulatory reform.

As everyone here knows, the volume, variety and complexity of Commercial Remote Sensing (CRS) license requests continue to grow dramatically.



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In 2012, there were four new license applications for individual satellites, we've already received three times that many applications this year, and it's only August, and the vast majority of those applications are for constellations, not single satellites.

The type of organizations applying for a license is expanding as well.

For example, this Middle School: Saint Thomas Moore Catholic Academy in Washington, DC.

And this Elementary School: North Idaho STEM Charter Academy in Rathdrum, Idaho. Both of these schools applied for a CRS license this year, along with an ever-growing number of high schools and universities.

Their application process is exactly the same as everyone's in this room, regardless of the size of your company, the size of your payload or the number of satellites you are launching.

And, to date, no application for a CRS license has ever been denied by the US Government.

That "one size fits all strategy" won't work in the smallsat boom days ahead of us.

The Administration is looking at the issue and Congress is engaged as well.

In addition, the Department of State, Department of Defense, Commerce, Interior and the Intelligence Community have updated their five-party MOU concerning the licensing of Private Remote Sensing Satellite Systems.

The goal is to establish the interagency consultation process for handling these licenses... along with a common consultation process for the interruption of normal commercial operations.

Our hope is that this will clarify and expedite the licensing process.

The point of regulatory reform is to get remote sensing concepts reviewed efficiently and quickly with an initial presumption of "yes," or a clear explanation of USG concerns and how they can be mitigated.

This is an evolving process, for example, the President recently signed an executive order reviving the National Space Council to advise and assist him on national space policy and strategy.

As the Functional Manager for GEOINT, I intend to work closely with the Council to streamline and simplify the licensing process so the USG can spend our scarce resources on applications for cutting edge technology rather than elementary school cubesats.



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And industry can count on a greatly simplified regulatory process when you are asking to license a very well understood capability.

It's time to bring common sense to government regulation of the small sats gold rush.

In closing, let me re-emphasize the importance our partners place in our ability to produce timely, relevant and accurate GEOINT for their many mission needs.

Those mission needs drive our innovation efforts and our evolving business strategy.

As I mentioned earlier, NGA's motto defines our mission and our vision: "Know the Earth, Show the Way, Understand the World..."

That third piece, advancing our understanding of this ever more complex world – is where you've already been making a difference, and where we hope you'll help us take the next steps as well.

I too am proud of our past, and grateful to those in this room who made it successful. And I am anxiously hopeful about our future.

I hope you'll join us as we define our future and tell our story. Thank you.