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Opening Remarks as delivered by
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GEOGRAPHY 2050
"POWERING OUR FUTURE PLANET"
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Thank you, Al [Di Leonardo, AGS Councilor], for that kind introduction. And thanks as well to the American Geographical Society for inviting me to this year's event.

Looking at a map of Europe, Napoleon proclaimed, "Geography is Destiny."

While I might not agree with the destiny Napoleon saw in that map, I think everyone in this room can agree that, at the very least, a firm understanding of geography is necessary to sketch the destiny of our future planet… whether it's defining a nation-state, a mega-city, oil fields, uranium deposits or even a water source.

By understanding all the variables that bear on a particular point on the globe, and how they are changing, you can gather significant insight into the future, and yes, how to craft and re-craft that future.

As the Director of the National Geospatial-Intelligence Agency, that's a part of my job – and probably each of yours as well. For those of you who aren't familiar with us, NGA is the premier provider of geospatial intelligence, or GEOINT, to the US government.

GEOINT is a discipline focused on the exploitation and analysis of geospatial data and information to describe, assess, and visually depict physical features – both natural and constructed – and geographically referenced activities on the Earth.

Although our agency is relatively new by our current name, our mission set reflects a basic human desire to understand the physical space in which we live…

NGA's motto is Know the Earth… Show the Way… Understand the World. In that context, NGA recognizes the unique role that geospatial data plays in assessing resources and monitoring changes in our global environment. We're actively involved in dealing with safety of navigation, environmental hazards, food management, and water security, as well as natural resources and land use.

For example, NGA has led symposiums on Water, Climate, Food, and Combating Wildlife Trafficking – all to harness the advanced data collection and analytic methods of non-governmental organizations and academia to enhance what the federal government – including the Intelligence Community – can provide.

As I speak, the Department of Interior's National Interagency Fire Center in Boise, Idaho, is working with our analysts in Springfield, Virginia and St. Louis, Missouri to track the spread of wildfires and their destructive aftermath in California.

We need to provide decision makers with the best data possible so that they can make better informed choices to enhance the sustainability and security of our world. And by sharing it on the World Wide Web, that information helps our first responders, our military responders, and our policy makers understand the scope of an event much closer to real time.

For us, and probably for most of you, foundational data is the key to these efforts. It provides the baseline for increasing our predictive ability, for automating the process to the maximum extent, and for recognizing indicators far enough in advance of a potential crisis so our customers can act before events dictate.

NGA creates, maintains, shares and refines a variety of environmental data sets. For example, through predictive modeling we can use snow cover to predict floods, fire risks or famine, which in turn affects the ecosystem and human geography.

But we also know that we must improve our ability to anticipate and take action to prevent – or respond in advance of – potential disruptions to natural systems – like fire risks for next year. That's why NGA so is proud to join the State Department in sponsoring the World-Wide Human Geography Data Working Group.

In June, I know many of you attended the symposium the Working Group hosted with Georgetown University and the Urban Dynamics Institute at Oak Ridge National Laboratory. The symposium brought together participants from 51 different organizations across the Department of Defense, civil agencies, academia, international partners, NGOs and private corporations. Participants were able to identify a variety of Human Geography datasets that are instrumental to deepen our understanding of access to energy.

At NGA, we know well the role Human Geography data plays in strengthening resilience and informing responses during and after energy disruptions and shocks – in other words, crowds are good and there is real safety in numbers. We have been at the forefront of supporting first responders and decision makers with current imagery and data after disasters strike – from Katrina in New Orleans to the fires in California.

As a result, we've grappled with the continued need for standardization in data collection, reporting, and analysis across the field. We've created apps and tools for first responders to share data quickly and broadly, even in environments without significant wireless access.

Those efforts are not enough. We need more creative approaches for data collection in data-poor or signal-poor environments. I'm hoping the people in this room can help us with that – no, even more than hoping, I'm counting on you.

Now, I'd like to share a couple of examples of what we're accomplishing today to show where GEOINT and NGA is heading and how we can help meet some of the challenges we face. I'm going to start not at the top of the planet, but at the bottom – the South Pole. Our agency provided the imagery and the expertise – and the experience – for the recent release of this map.

It's the first Reference Elevation Model – or REM – of Antarctica. It's a terrain map of about 98 percent of the contiguous continental landmass. It's actually a mosaic that was constructed from hundreds of thousands of individual stereoscopic Digital elevation models – or DEMs. Those models were extracted from satellite images from our partner, DigitalGlobe.

And because the data set was so large, we had to generate the model using the Blue Waters supercomputer at the University of Illinois at Urbana-Champaign… one of the few computers powerful enough to run the algorithm.

Compared to the Arctic DEM project we completed last year, this was more straightforward:

- No border disputes – because nobody owns Antarctica.
- The elevation is quite flat.
- And unlike the Arctic, it's not split up between an ocean, several seas, a number of large land masses, and many islands – all divided among different countries.

So, speaking of the Arctic, let's move from the bottom of the planet to the top. Here's a DEM – high-resolution, high-quality – and analysts can use it to understand changes in topography over time.

This is another great example of public-private partnership, as it was also made by many of the same people – a team of scientists, geographers, cartographers and analysts from:

- NGA,
- The National Science Foundation,
- The University of Minnesota's Polar Geospatial Center,
- And Esri.

Arctic DEMs have been used by the government, academia and commercial industry:

- For analysis and production,
- To detect and quantify vegetation change and deforestation in Siberia,
- To study ice cap collapse and loss,
- To study river systems and drivable roads in the Siberian forest, many of which were otherwise inaccessible.
- And to measure the tsunami water height after an earthquake and landslide hit a village in Greenland.

When the world has open, high-resolution, satellite-based elevation data of Alaska and the entire Arctic available, to inform policy and decisions in an increasingly critical part of the world, that's a good thing. You can find them both at NGA.mil.

These are just two examples of how we are exploiting the explosion of geospatial data we're seeing today.

In addition to polar elevation maps, we produce a number of other worldwide data sets like the World Magnetic Model, the Earth Gravity Model, and World Geodetic System 84.

Taken together, these data sets can be used to enable exploration, transportation and monitoring of our energy resources – present and future. These data sets and the maps generated from them are particularly important for those who travel our oceans.

Maritime transport remains the backbone of international trade and the global economy, particularly from an energy perspective. More than 70 percent of global trade is transported by sea and handled by ports around the world.

Why would a gravity map make a difference to a sailor? Similar to the effect the moon and sun have on our tides, the gravitational force of uneven mass distribution across the entire Earth's surface – mountains, valleys and heavier or lighter rock strata in the crust – all of these things cause "permanent tides."

These tides force water to pile up where gravity is higher and recede where gravity is lower, actually giving the oceans an irregular, bumpy surface.

Measuring gravity everywhere allows us to model ocean levels in all locations and establish a mean sea level. The EGM helps us develop GEOINT for a variety of programs, including safety of navigation, ballistic missile guidance and GPS, as well as other mission areas within NGA and the National Geodetic Survey.

This worldwide gravity compensation data supports navigation for U.S. military operations, mission planning, and safety, with collection platforms in the air, over the land and on – and under – the sea.

The Earth Gravitational Model is not the only model that supports worldwide navigation accuracy. It is part of the World Geodetic System 1984, the governing reference system. WGS 84 is an inclusive and complex model that defines our latitude, longitude and ellipsoid height system. It reflects our dynamic physical earth and takes into account geodynamic motions such as plate tectonics and the daily movement of the Earth's axial spin.

The Earth Gravity Model, World Magnetic Model and World Geodetic System 1984 form the framework for those tasks that ensures our land-based vehicles, ships and aircraft can safely and accurately navigate the world.

The inability of the worlds' tankers and other fuel shipments to stay on track, even temporarily, could lead to substantial supply delays and higher shipping costs, resulting in higher world energy prices.

Inaccuracies in mapping ports and unexpected obstacles at critical chokepoints – like the Straits of Hormuz – could also expose these tankers to greater risk of theft from pirates, terrorist attacks, political unrest, and shipping accidents. So, in a very real way, these maps help keep the engine of global commerce running, on track and on time.

Our International Hydrographic Office, along the same lines, is currently crowdsourcing to update the World Port Index – giving sailors around the world a more complete and robust source of information about global ports right there on the World Wide Web.

We are also a leading agency in another ocean crowdsourcing effort – the SEABED 2030 bathymetric initiative, which will reach out to commercial industry, academia, and government organizations to create a more complete database of worldwide bathymetry. The result is more data, better data, and hopefully safer navigation with fewer disruptions to energy transporters.

In today's environment, data are instantly available and NGA is working to be equally nimble in our response to it – to access, to assess, to condition, and to leverage it. For example, we created what we call the Rapid Feedback Team (RFT) to look at cases where we can quickly and agilely respond to customer needs using AI, automation and augmentation technologies, what we call AAA, particularly in an unclassified environment.

As you all know, we're seeing more data from more sources than ever before. The globalization and democratization of GEOINT provides us an unprecedented amount of geospatially relevant information to answer our intelligence questions. But the sheer volume and persistence of the data collected by all these new sources, and the diversity and openness of this data demands that we adapt.

Our challenge is to discover the valuable information hidden within all that big, messy data – to create new insights that advance our understanding of the world and provide actionable intelligence for our customers; to create coherence from chaos.

To do this, we're embracing augmentation, automation, and Artificial Intelligence — to enable the GEOINT enterprise to find value and meaning in this new data-rich environment.

For example, the RFT has conducted a number of case studies to monitor and understand the ecological impacts of the evolving energy sector.

In Nigeria, we explored the repercussions of an oil monoculture, unabated development and neglectful or nonexistent oversight that causes pollution and damage to the Niger River Delta.

Additionally, the team has used nighttime light measurement imagery[i] to monitor the changing landscape of the energy sector, both in countries that have emerging or existing energy infrastructure.

So, as you can see, we at NGA are expanding our unclassified geography community in a variety of ways – and I invite you all to join in.

To further improve our ability to anticipate and predict, NGA is engaged with innovation centers like Silicon Valley, New York City and Boston to work with industry, using exploratory technology to identify, explore and – when appropriate – adopt the latest GIS technology and predictive analytics.

The availability of data and the advance of technology and tools are enabling a new breed of contributors who aren't necessarily GIS professionals. Non-traditional partnerships through activities like open collaboration and crowdsourcing create new opportunities and can add new value, including the contributions of non-GIS professionals.

The future of this increasingly interconnected world depends in large part on our ability to collect and share information – real information, accurate information, timely information – so leaders and citizens at all levels can make informed decisions. Geography still can shape the boundaries of destiny. Geographic data, geospatial technologies, and geographic understanding will be essential to navigating our collective future.

Put another way, your passion and your profession will lead to a brighter, better future for us all.

With that, I'd like to thank the American Geographical Society for the invitation to speak, and in particular, thank you all for your willingness to participate in this important long-term dialogue. We're proud of our role and our contributions. We're equally aware of our need for partners. So, if we're already teamed up with you, thank you. If we're not, let's get going!

Thank you!

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[i] VIIRS is one of five instruments aboard the NASA/NOAA Suomi National Polar-orbiting Partnership satellite, which was launched in October 2011. VIIRS is a scanning radiometer that collects visible and infrared imagery

and radiometric measurements of the land, atmosphere, cryosphere, and oceans. VIIRS data is used to measure surface lights, cloud and aerosol properties, ocean color, sea and land surface temperature, ice motion and temperature, fires, and Earth's albedo.