The American Geographical Society, an organization with a 163 year history of geographic exploration, recently mounted a new expedition: An “Expedition to the Future.” The Geography2050 conference, held on November 19, 2014, by the AGS and the Earth Institute of Columbia University, provided a unique glimpse forward at the Earth and its inhabitants in the year 2050. Many “geo” conferences stress that “geography matters,” but Geography2050 offered details on why and how for a prestigious group of industry, government and academic geographers, and interested citizens.

Like any good expedition, Geography2050 included a broad range of expertise, with demographers, remote sensing technologists, energy analysts, climate scientists, global health experts, government leaders, investment specialists and others. Each addressed: What is happening on the Earth? and, Who is being affected by it? The interdisciplinary aspect of the expedition was exemplified in remarks by two senior US government officials: Dr. Lee Schwartz, The Geographer of the United States at the State Department, and Robert Cardillo, Director of the National Geospatial-Intelligence Agency. Dr. Schwartz advocated for increased emphasis on gathering human geography knowledge and data, noting the inherent difficulty in mapping human data accurately (“You can’t [map human data] from satellites”). In an era when creating maps is easier than ever, Dr. Schwartz emphasized, “The map starts at the beginning, it’s not the end result.”

Director Cardillo, who leads the nation’s largest technical mapping entity (NGA), amplified these points in the conference’s keynote, describing how “our national security depends on our ability to maneuver wisely through complex, interdependent, yet widely contrasting, fast evolving circumstances.” He noted NGA’s increased interest beyond remotely sensed data and into information on government services and health care, food and water supplies, and the transportation infrastructure. Cardillo stressed that NGA values the perspective geographers bring: “[Geographers] are increasingly valuable in a world where everything is connected,” and stated that NGA plans to assist academic institutions with providing geographic training for the future.

Geography2050 was organized around 5 expert panels, interspersed with keynote addresses, awards and focused presentations. Proceedings were kicked-off by Dr. Jerome Dobson, President of the AGS, who provided the audience with context for the conference: “Geography is foremost among professions” and we neglect it at our peril. He was followed by the event’s host, Prof. Jeffrey D. Sachs, Director, Earth Institute, Columbia University, appearing on video. Columbia’s contribution to the conference was immense, most clearly in contributing the use of the Low Library, an historic and magnificent setting for the expedition. Dr. Christopher Tucker, founder of the MapStory Foundation, introduced the conference and posed insightful questions throughout the day for attendees to ponder. More than any other single person, Dr. Tucker was the driving force behind Geography2050 and its sweeping coverage of physical and human geography factors on our future.
Population, Identity, and Well Being
The initial conference panel on Population, Identity and Well Being focused the proceedings on the changing human geography of 2050. Professor Deborah Balk, Associate Director, CUNY Institute for Demographic Research described an increasingly urban world population with a growing set of gigantic mega-cities and even faster growing smaller cities. Dr. Balk portrayed the population of 2050 as increasingly in Asia, and located in low-lying seaboard areas (Low Elevation Coastal Zones) setting the scene for increased seaboard hazards.

Next on the agenda, Prof. Alexander Murphy of the University of Oregon challenged the assumption that “the world is flat” as he explained the link between identity and territory – and how it is changing. Dr. Murphy noted globalization “is transformative in terms of intensity of connections,” but argued that territories will continue to matter in defining identity over the next 35 years. Looking forward, Dr. Murphy concluded that: “Careful analysis of geospatial relationships can identify potential sources of future conflict.”

Dr. Margaret E. Kruk, Associate Professor of Health Policy and Management at Columbia University described global health and medical issues facing the world of 2050, portraying the world’s unfinished health agenda – avertable deaths due to disease – illustrated by world maps with countries weighted by public health spending and by preventable deaths. Advocating for changes in current world patterns, Dr. Kruk posited that the "world spends health dollars where they are least needed," and “needs to promote global health through long term investment.” Dr. Kruk contrasted the lack of spending on preventable deaths with the increased “confluence of diseases of affluence” (diabetes and other non-communicable diseases), as she argued that much can be done before 2050 to change the geography of avoidable deaths and bring all countries to the same level in terms of health.

Climate, Risk, and Opportunity
The conference shifted from depicting the population in 2050, to projecting the climate of that time. Dr. D. James Baker, Director of the Global Carbon Measurement Program at the Clinton Foundation shaped the issue past "What will the climate be like in 2050?" to: “What can/will we do about it and how do we prepare?” Dr. Baker meticulously detailed the drivers of climate change: greenhouse gases, aerosols and landscape changes with the intent of better climate change forecasts.

Mr. Francis Ghesquiere, Head of Global Facility for Disaster Reduction & Recovery at The World Bank then followed, discussing populations at risk with the changing climate, and focussing the expedition on the future geography of natural hazards. Mr. Ghesquiere noted historical disaster statistics: $3 trillion USD in economic losses from 1980-2013, and then described how sea
level rise, population growth, and rising urban populations increase risk while new infrastructure and better construction standards resulting from economic development and population growth offer the opportunity for a better, more risk-tolerant and sustainable future.

Putting the 2050 future in vivid images, Professor Lawson Brigham, Distinguished Professor of Geography at the University of Alaska, starkly described how climate change will lead to ice free shipping lanes and open water in an area where the AGS once sponsored over-ice expeditions to the North Pole. Professor Brigham outlined how five key geographic issues – climate change, globalization, natural resources, regional geopolitics, and indigenous populations – will combine to make the region the setting for profound changes, and he portrayed a region of new fishing areas, navigational routes, natural resource projects and political boundary disputes.

The AGS Bowman Expeditions
Professor Jerry Dobson spoke between panels on the work of the AGS through its “Bowman Expeditions.” Highlighting a theme of the day – Geographic ignorance is a key reason for failures in international and regional conflicts – Professor Dobson described how the Bowman Expeditions Program combats such ignorance, gathering human geography data through fieldwork in foreign areas and enabling an improved understanding of foreign people and places through university-based, scholar-student research. Noting the recent expedition to Central America (CA INDÍGENA), Dr. Bowman described the open-source information collected and the mapping, analysis, and GIS functionality contributed to host countries and communities by AGS scholars.

Future Energy Landscape
The next panel of the expedition took a more focused approach, discussing the Future Energy Landscape. Mr. Niel Golightly, Vice President of Shell Oil offered a lively kickoff to this panel, describing energy’s fundamental roots in physical, political and economic geography. Offering Shell’s take on energy resilience: preserving room to maneuver, where early action is encouraged versus remaining trapped in transition, with inadequate capacity, Mr. Golightly noted, “What we might be able to do tomorrow shouldn't condemn what we can do today.” The presentation included Shell’s predictions for the energy future of 2050 (solar and non liquid energy sources will only take over when implications of climate change become impossible to ignore – projected at 2040), as well as its view on necessary transition steps (allowing coal and gas now as we make our way to alternatives for the future).

Mr. James Scrivener, President and CEO of National Solar next presented his take on the energy future, describing a scenario where solar technology disrupts the energy paradigm, and predicting that an end of centralized energy control will democratize the energy landscape. Noting that “Energy is a Geographic Enterprise,” Mr. Scrivener pointed out that our current energy infrastructure is poorly collocated with population, contributing to a 60% annual energy loss. Predicting “Advances in energy storage will enable technological leaps,” “Solar will lead the way,” and “Renewable energy will dominate the global energy landscape by 2035,” Mr. Scrivener outlined a shift to virtual power plants intelligently integrated and managed by computer, and stated the
economic case for solar, detailing land and resources needed, and health and pollution savings generated in the process.

Professor Michael Bradshaw, Professor of Global Energy at the University of Warwick completed the panel, presenting the trilemma of energy, economy and environment, and asked, "Can we have secure, affordable, and equitable energy services that are environmentally benign, despite the origins of the energy or the source?" While outlining the need for understanding the geographic consequences of globalization and for redefining energy security, Professor Bradshaw illustrated the energy paradox of 2050 as: “The best case scenario is the same as the worst case scenario with respect to energy". Professor Bradshaw offered that we need to balance affordability with sustainability (including respecting the environment), while linking increased energy access in poorer nations with positive outcomes like increased female educational attainment (with a subsequent lowering of population growth and energy use). Providing a humorous break to the proceedings, Professor Bradshaw offered “I’ve seen more maps per minute at this conference...,” bringing a laugh from the cartographically oriented geo crowd.

**Geography2050 Keynote**

Robert Cardillo of NGA offered the Keynote of the expedition, noting that “Every global challenge has a geographical component,” and outlining the many ways NGA relies upon geographers and geographic knowledge. "Geographers are natural integrators,” Cardillo stated, as he pointed out the focus of the intelligence community on integration operations. Director Cardillo described NGA’s work on online spatial and temporal systems to enable insights and understanding for its customers and meet its missions, offering specifics on its recent response to the Ebola crisis. Setting up the next theme of the day, Director Cardillo pointed out today’s reality: "Every person a sensor," and, "History is made in messages of 140 characters” as he talked about how Twitter and social media content have changed the Intelligence paradigm.

**The Future Geography of the Internet of Things**

The afternoon panels of the expedition focused particularly on technologies that will change the way we work as geographers in 2050. The first session – The Future Geography of the Internet of Things – began with noted sensor scientist Dr. Michael Botts echoing Director Cardillo: “People are a collection of sensors.” Dr. Botts outlined how "in the last few years, 'The Internet of Things' [has begun] to buzz loudly." Describing how machine-to-machine interfaces are as important as machine-to-human interfaces, Dr. Botts linked geography and technology as he reviewed ways that “It's not the thing, but what it can do for us when connected,” as he projected Internet of Things developments to 2050. Building on the topic, Mr. Jared Novick, CEO of GeoMakers postulated that we're in a time of three revolutions: spatial, open source, makers, creating infinite possibilities! Mr. Novick drew the expedition’s attention to the convergence of mapping, open source, hardware, education, and how technology advances as we approach 2050 will enable new sensors and wider applications for geographic understanding.
Interlude: The AGS Medal Award Ceremony
The expedition paused from scientific panels to present two AGS awards to leading geographers. The 2014 Van Cleef Memorial Medal for outstanding original work in the field of urban geography, presented to Professor Edward Malecki of Ohio State University based on his outstanding career achievements, was announced ahead of the conference and presented at the event. The second award was a surprise to the audience and the awardee, as Lee Schwartz, The Geographer of the United States was awarded the AGS Cullum Geographical Medal. The Cullum medal, for persons who distinguish themselves by geographical discoveries, or in the advancement of geographical science was the first medal to be awarded by AGS, dating back to 1896. It’s recipients include geography luminaries such as Robert Peary, Rachel Carson, Sir Ernest Shackleton, and the crew members of Apollo 11.

The God’s Eye View
The expedition turned its attention back to future technology and geographic issues to 2050 with a panel on “The God’s Eye View.” Mr. Jeffrey Harris, Chairman of the Board of both the Open Geospatial Consortium and the United States Geospatial Intelligence Foundation introduced the panel’s diverse set of remote sensing technology experts by urging the audience to consider how we “align the data into a solution space.” Mr. Brian McClendon, Vice President at Google kicked things off with a detailed and very practical overview of geographic challenges Google faces in building its global points of interest and address data. Noting that “Human Geography is going to a Big Data problem,” Mr. McClendon offered a peek inside Google’s processes for using imagery and optical interpretation to decipher street numbers, maintain accurate geocoding, detect business names, speed limits, street signs and more. Mr. McClendon described the company’s initiatives to use machine learning, 3D models, and other techniques, and its challenges in big data extraction and management of data.

Next, Mr. Robbie Schingler, Co-Founder of Planet Labs posed humanity’s greatest challenge to be "How we live resiliently on the Earth,” as he talked about the company’s goal to make satellite data visibly accessible and actionable. Mr. Schingler said Planet Labs is “creating a line scanner for the planet” with daily imaging by 100 spacecraft at 3 meter resolution, and is aiming to use this knowledge to help reverse the degradation of earth from human intervention. A veteran of NASA, Mr. Schingler described the accelerating “Space Renaissance,” its strong commercial component, and growing efforts to collect data from space to democratize access to daily images of the entire earth.

Mr. Anthony Quartararo, President and CEO of Spatial Networks followed and picked up on the earlier theme of humans as sensors. Noting that there are 1300 new mobile device users every minute, Mr. Quartararo postulated that “Smartphones with geographic information will provide a "digital record of routines, customs, traditions and their evolution," and “the concept of privacy will be understood very differently in 2050,” given where our ability to collect data is going. Projecting that by 2050 the Earth will be inhabited by 9.5 billion people with 18 billion “smart” devices tracking record routines, customs, traditions, and more, Mr. Quartararo opined that true predictive analysis of human activity is within reach.
Next on the panel, Mr. Abe Usher, Chief Technology Officer of HumanGeo expanded on Mr. Quartararo’s themes, pointing how the dramatic increases in population, Internet users and geo-tagged social media observations will create a flood of human geography data by 2050. Mr. Usher noted how analytic techniques need to expand to manage this data surge, and contrasted the unscalable current “expert model” for assessing information with the need for systems that enable “a persistent awareness of human activities as an algorithm of geospatial data,” by aggregating huge numbers of small value observations into analyses.

Mr. Josh Campbell, Vice President of Boundless, completed the panel with remarks on technologies that capitalize on decentralized control of and increased access to data. Noting the free and open data “avalanche” of “pixels, point clouds and people,” coming from space-based LIDAR, drones, and handheld devices, Mr. Campbell described how “Spatial IT” is replacing “GIS” as enterprises seek to break down data silos and solve the geographic issues of the future. Overviewing “tools for building smarter data buckets,” Mr. Campbell described software Boundless is developing to edit and maintain version control on rapidly-changing geographic databases, in order to manage the flood of geo information.

Creating an Investment Roadmap

In the day’s final session, Barbara Ryan, Secretariat Director of the international Group on Earth Observations (GEO), and Matthew O’Connell, former CEO of GeoEye and a Director of the US Geospatial Intelligence Foundation wrapped up an information-packed day as they reflected on a roadmap for investment to solve geo challenges to 2050. Noting the “data centric business is too dependent on government,” Mr. O’Connell and Ms. Ryan covered ways private investment can fund initiatives from robotic to human in the pursuit of the geographic knowledge and solutions needed for the future. Both acknowledged the democratization of data creation and use as an important trend. Dr. Tucker closed the day by noting that the “Expedition to the Future” is not over. Ideas and suggestions gathered during the day on note cards or submitted after the conference will inform the American Geographical Society’s work plan. Plans are underway to hold a follow-up meeting in 2015 to continue the expedition.