Written Testimony of Kevin Pomfret
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The Centre for Spatial Law and Policy (the "Centre") appreciates this opportunity to provide written comments to the Committee on Science, Space and Technology, Subcommittee on Space, of the U.S. House of Representatives in connection with its hearing titled, "Commercial Remote Sensing: Facilitating Innovation and Leadership." The Centre is a not-for-profit organization with a purpose to educate stakeholders on the legal and policy issues associated with the collection, analysis, visualization, storage and distribution of geospatial information ("geoinformation"). These issues include intellectual property rights, privacy, national security, licensing and liability. As discussed in further detail below, these issues are global and cut across a number of technology platforms, including commercial remote sensing satellites.

Background on Geoinformation

Geoinformation can be defined very generally as information about a person, place or thing that can be tied to a particular place on the earth. Geoinformation can be collected in a variety of ways, using a number of different technologies. For example, geoinformation can be collected from sensors mounted on satellites, manned aircraft, drones, automobiles, ships, and smart phones or other mobile devices. Alternatively, it can be collected from fixed ground-based sensors or by individuals walking around a neighborhood with a notebook collecting information for a census. Geoinformation includes the location, size and shape of a lake, the median income of a particular zip code, a street address, hours of operation of the closest Starbucks or the coordinates of a suspected terrorist. In the future, the internet of things (IoT) will also collect vast amounts of geoinformation that will be mapped, visualized and analyzed.

Versatility of Geoinformation

One of the unique attributes of geoinformation is that it can be used in various ways by different actors, which is why it is recognized as an important aspect of the national, regional and global information infrastructure. For example, a satellite image can be used by a business to help decide where to open a new store, by a consumer using his or her satellite navigation ("sat-nav") device to find the store once it has opened, and a city's department of transportation to decide where to install new traffic lights in order to address traffic issues associated with the store's opening. It also could be used by a criminal in planning a robbery of the store.

As a result, geoinformation is much more versatile than other types of data. While this versatility increases its value, it also can be a challenge from a policy and legal standpoint. For example, efforts by law enforcement to control the collection and use of imagery to reduce store robberies will also limit the ability of businesses, consumers and government agencies to use the same information in ways that save time, money and lives. This challenge to regulators, lawmakers and policymakers is magnified by a number of other attributes of geoinformation, many of which are also unique.

Power of Geoinformation

Another important attribute of geoinformation is that it is extremely powerful. For example, when a disaster occurs, it is critical to know exactly where it took place, how large of an area has been impacted, what is the best route for first responders to take to get there, and where are the nearest available resources for medicine, food and water. Geoinformation is vital in each of these roles and this power increases as the accuracy, timeliness and precision of the geoinformation improves. The impact of satellite navigation is another example of the power of geoinformation. Turn-by-turn satellite navigation is a direct result of the U.S. government's decision to allow for commercial use of high quality GPS data. The convergence of satellite navigation with other types of geoinformation, such as remote sensing data from commercial satellites, contribute to the development and growth of ride sharing services such as Uber and Lyft. In the not too distant future satellite navigation and satellite remote sensing data will work with sensors embedded in automobiles collecting other types of geoinformation to permit broad consumer use of autonomous vehicles.

Geospatial Technology is Evolving Quickly

Any discussion regarding geoinformation should also take into account the rapid advancements in geospatial technology that are currently taking place. For example, over the past decade there has been a dramatic increase in the number of platforms that collect geoinformation. As a result of technology innovations such as the miniaturization of sensors and significant decreases in cost associated with transmitting and storing data of all types, small satellites ("small sats"), drones and mobile devices are viable platforms to collect timely and, for many applications, accurate geoinformation. Much of this geoinformation is still electro-optical imagery; however, there is an increase in other data types of geoinformation being collected, such as LiDAR, radar and infrared. In fact, increasingly "smart" technology has come to mean geolocation-enabled.

This increase in the availability of geoinformation has had a significant impact on the broader technology community. It has contributed to the development of a number of software solutions that allow for visualization and analysis of geoinformation. These software solutions vary from simple software that can be downloaded from the web for free and used without any training, to more sophisticated enterprise solutions that can be used throughout large businesses and government agencies. They are offered by commercial vendors under proprietary licenses and as open source solutions.

The vast amounts of geoinformation being collected and the powerful new visualization and analytical software tools have resulted in a number of innovative applications for geoinformation. For example, entrepreneurs are using geoinformation to create exciting new business models, such as AirBnB. Similarly, new mobile apps developed using geoinformation vary from warning scientists about earthquakes to location-based games such as PokØmon GO.

Global Impact of Geoinformation

Historically, the United States has been recognized as the global leader in many geospatial technologies. However, today the geospatial community is international, consisting of governments, businesses, non-governmental organizations (NGOs) and individuals from around the world. Many of these diverse set of actors are collecting and using geoinformation in varied and innovative ways. Some have already become leaders in their respective fields. For example, Singapore is on the cutting edge of using geoinformation for transportation and smart cities while Japan leads many aspects of applying geoinformation to disasters and the associated reduction of human vulnerability and risk.

Recognizing the global value of geoinformation, the United Nations formed the UN Global Geospatial Information Management (UN-GGIM) Initiative in 2011. Its goal is to assist in the global development of geospatial information and to promote its use to address key global challenges. These challenges include disaster response, food security, migration and the sustainable development goals (SDGs). The UN-GGIM works closely with other international organizations that support the collection, use and sharing of geoinformation for transnational issues, such as the Group on Earth Observations (GEO), the World Bank, the Open Geospatial Consortium (OGC) and the International Hydrographic Organization (IHO). These partnerships highlight the diverse use and the increased importance of geoinformation to address critical transnational issues.

These unique attributes have contributed to the development of a geospatial ecosystem consisting of government agencies, businesses, NGOs and citizens from around the world that are both collectors and users of geoinformation, often simultaneously. This ecosystem is creating products and services by analyzing and visualizing geoinformation from business and governmental geoinformation databases placed on an image, or a map created from imagery, and aggregated with geoinformation collected and shared by individuals through tools such as OpenStreetMap.

The economic value of this ecosystem is substantial. For example, according to one report published in 2012, the geospatial technology industry produced $75 billion in annual revenue in the U.S. alone and employed an estimated 500,000 people.[1] The impact on the broader U.S. economy was even more significant, driving $1.6 trillion in annual revenue and $1.4 trillion in cost savings.[2] While such figures require assumptions that can be quite subjective, it is clear that the value of geoinformation to the global economy is significant. For example, according to two recent studies $1.6 billion was spent on the acquisition of satellite earth

[1] Geospatial Services: A $1.6 Trillion Growth Engine for U.S. Economy (Boston Consulting Group, 2012) [accessed online at https://www.bcg.com/documents/file109372.pdf
[2] Id.

observation data in 2015[3] and the aerial imagery market is projected to reach $3.3 billion in 2023.[4]

Regulation of Commercial Remote Sensing Satellites

Some were concerned in the 1990s that the commercialization of satellite remote sensing would weaken U.S. national security. Since the genesis of the technology came from the defense and intelligence communities, and this was in the aftermath of the Cold War, they questioned why the U.S. should allow others access to high resolution satellite images. It was often difficult to refute these concerns, particularly since the commercial and civil applications for high resolution satellite imagery were mostly speculative. However, as noted above, the commercial remote sensing industry is now part of a larger, global geoinformation community. There are a growing number of ways that bad actors can obtain geoinformation that the U.S. prefer they not have. As a result, many of these national security concerns are less applicable, and those concerns that remain are often outweighed by the tremendous economic and societal value of the geoinformation satellites provide.

Satellite Remote Sensing Is Now Global

In today's global geospatial ecosystem, governments from around the world will increasingly have access to vast amounts of remote sensing data from a number of non-U.S. sources. For example, according to a 2016 study, 400 earth observation satellites will be launched from 50 countries in the next decade.[5] Governments that do not operate their own satellites can acquire satellite imagery from other nations' satellites or by acquiring it from commercial actors in countries such as Canada, Russia, Israel, France and India. This capability will only increase as small sat technology makes it increasingly affordable for non-traditional actors to launch and operate an imaging satellite.

While the geoinformation collected from these satellites may not be as accurate or precise as those currently available from U.S. commercial systems, the quality is improving. In addition, the shortfalls in quality, coverage, repeat rate, precision, accuracy or even data type can often be supplemented with geoinformation from other sources. U.S. commercial remote sensing companies, as with all other businesses in today's global economy, have competitors around the world, and any restrictions on what they can collect or distribute affects their economic competitiveness.

[3] Satnews (on-line) "Newly Published Report By Euroconsult Focuses In On The Global EO Market" (September 16, 2015) [accessed at http://www.satnews.com/story.php?number=919906682]
[4] "Global Aerial Imaging Market Is Expected to Expand at a CAGR of 13.5% from 2015 to 2023" (press release) [accessed at http://www.digitaljournal.com/pr/3038264]
[5] Satnews (on-line) "Newly Published Report By Euroconsult Focuses In On The Global EO Market" (September 16, 2015) [accessed at http://www.satnews.com/story.php?number=919906682]

Increasing Competition from Other Platforms

The typical consumer of geoinformation does not consider how the data is collected but rather is only interested in the final geoinformation product or service that addresses their particular need. In the early days of the commercial satellite remote sensing industry, manned aircraft were the primary platform that competed with satellites for remote sensing data. Today, customers are able to acquire geoinformation from a number of sources that did not exist at the birth of the commercial remote sensing industry. For example, drones will increasingly become a source of high quality geoinformation, particularly once beyond visual line of sight restrictions are reduced. Ground-based mobile platforms are also being used to collect geoinformation in ways that were not possible or practical several years ago. In addition, manned aircraft are also offering better services due to higher quality sensors. The geoinformation collected from these platforms may not have all the same attributes as satellite-collected geoinformation, but will prove sufficient for a number of commercial and civil applications. As a result, commercial remote sensing companies now find themselves in a multi-platform geoinformation industry in which they will have to distinguish themselves in terms of capabilities and products.

Critical Role of Geoinformation in Addressing Global Challenges

The global community's awareness of geoinformation has increased greatly since the launch of the first commercial remote sensing satellite. Due in large part to the efforts of U.S. companies, geoinformation is now considered a vital asset to address today's transnational challenges. Commercial remote sensing satellites continue to play a key role. For example, commercial remote sensing satellites are being used in disaster response, to monitor the development of nuclear testing in denied areas and to verify the accuracy of cease fire claims in regions wracked by war. In the future, they will be used to track the UN's sustainable development goals, particularly in the most vulnerable countries and regions where capacities to do so are considerably limited.

Developing technology policy inherently requires balancing perceived risks versus potential benefits. Any perceived national security concerns associated with commercial remote sensing needs to be put into the context of a complex and interconnected world in which geoinformation has tremendous economic, societal, environmental and governmental value. Therefore, such a cost-benefit analysis must include the potential consequences of not collecting and realizing the full value of such an asset.

Conclusion

In a report on future trends in geoinformation management published several years ago, the UN-GGIM stated:

> "Technological developments, as opposed to legal and policy frameworks, are, relatively speaking, without boundary. Technological developments may be leading us towards a

> spatially-enabled society and a society that feels confident in using and creating, both actively and passively, geospatial information and location-enabled services. *However, the legal and policy frameworks required to facilitate the development of such a society are not developing in a consistent way and are tending to lag behind technological developments*." [Emphasis added][6]

Remote sensing satellites are one technology in which the laws and regulations tend to lag behind technological developments. Ideally, such laws and regulations would recognize the growing importance of geoinformation in a wide range of applications. They also would reflect the global competitive environment in which commercial entities must operate, including the challenges of new stakeholders with disruptive technologies. Such laws and regulations would be narrowly tailored and regularly reviewed and updated. They would be transparent and fully weigh the trade-offs between perceived risks and potential benefits. Most importantly, these laws and regulations would reflect that satellite remote sensing technology is now part of a global ecosystem that has tremendous economic, societal and governmental value.

[6] Future trends in geospatial information management: the five to ten year vision; July 2013 (Ordnance Survey on behalf of UN-GGIM) p. 21 [accessed online at http://ggim.un.org/docs/Future-trends.pdf]