COMMERCIAL REMOTE SENSING: FACILITATING INNOVATION AND LEADERSHIP

HEARING

BEFORE THE

SUBCOMMITTEE ON SPACE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

SECOND SESSION

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COMMERCIAL REMOTE SENSING: FACILITATING INNOVATION AND LEADERSHIP

WEDNESDAY, SEPTEMBER 7, 2016

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON SPACE
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to call, at 2:10 p.m., in Room 2318 of the Rayburn House Office Building, Hon. Brian Babin [Chairman of the Subcommittee] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Commercial Remote Sensing: Facilitating Innovation and Leadership

Wednesday, September 8, 2016
2:00 p.m.
2318 Rayburn House Office Building

Witnesses

Mr. Kevin O'Connell, President and CEO, Innovative Analytics and Training LLC; Former Chair, Federal Advisory Committee on Commercial Remote Sensing (ACCRES)

Mr. Kevin Pomfret, Executive Director, Centre for Spatial Law and Policy

Ms. Michele R. Weslander Quaid, President, Sunesis Nexus LLC

Mr. Michael Dodge, Assistant Professor, Department of Space Studies, University of North Dakota

Ms. Joanne Gabrynowicz, Professor Emerita, University of Mississippi School of Law

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Charter

TO:	Members, Committee on Science, Space, and Technology
FROM:	Majority Staff, Committee on Science, Space, and Technology
SUBJECT:	Subcommittee on Space Hearing: "Commercial Remote Sensing: Facilitating Innovation and Leadership"
DATE:	September 2, 2016

On Wednesday, September 7th, 2016 at 2:00 p.m. in Room 2318 of the Rayburn House Office Building, the Committee on Science, Space, and Technology, Subcommittee on Space will hold a hearing titled, "Commercial Remote Sensing: Facilitating Innovation and Leadership."

Hearing Purpose

The hearing will examine the current state of the space-based remote sensing industry, including scientific and technical advances in the fields of space-to-earth and space-to-space remote sensing. Examples of remote sensing applications include mapping technologies, crop monitoring, natural resource exploration, and national security. This hearing will also assess existing United States law and regulation governing private remote sensing space systems, including whether there is a need to reform existing law and regulation.

Witnesses

- **Mr. Kevin O'Connell,** President and CEO, Innovative Analytics and Training LLC; Former Chair, Federal Advisory Committee on Commercial Remote Sensing (ACCRES)
- **Mr. Kevin Pomfret,** Executive Director, Centre for Spatial Law and Policy
- **Ms. Michele R. Weslander Quaid,** President, Sunesis Nexus LLC
- **Mr. Michael Dodge,** Assistant Professor, Department of Space Studies, University of North Dakota
- **Ms. Joanne Gabrynowicz,** Professor Emerita, University of Mississippi School of Law

Staff Contact

For questions related to the hearing, please contact Mr. Tom Hammond, Staff Director, Space Subcommittee, Dr. Michael Mineiro, Counsel, Space Subcommittee, or Mr. Jonathan Charlton, Policy Assistant, Space Subcommittee, at 202-225-6371.

Chairman BABIN. The Subcommittee on Space will come to order. Without objection, the Chair is authorized to declare recesses of the Subcommittee at any time. Welcome to today's hearing entitled "Commercial Remote Sensing: Facilitating Innovation and Leadership."

For over two decades, the United States has led the world in space-based commercial imagery, supporting our civil, commercial, and national security communities. In just the past few years, American innovation in space-based remote sensing has enjoyed a period of immense growth. American companies are investing in and developing a host of new and innovative technologies, services, applications, including space-based full motion video, hyper and multi-spectral imaging, space to space remote sensing and commercial signals intelligence.

As these technologies grow, we must ask why, what, and how should we regulate space-based remote sensing activities? The last time Congress passed legislation on this subject was the 1992 Land Remote Sensing Act. Back then, cube sats had not yet been invented or standardized. Computers, sensors, and other key technologies were orders of magnitudes more expensive, and far less capable. Today we depend on these technologies, and the geospatial data that they produce. Satellites, UAVs, and many other data collection systems provide the public with unprecedented information. After 24 years, it's time to take a hard look at these changes, and see where the laws, regulations, and policies governing this industry need reform.

Section 202 of the Commercial Space Launch Competitiveness Act directed the Secretary of Commerce, in consultation with the National Oceanic and Atmospheric Administration's Advisory Committee on Commercial Remote Sensing, also known as ACCRES, to report on statutory updates necessary to license private remote sensing space stations no later than November the 25th of this year. For this report to be worthwhile, the Secretary should ensure the Advisory Committee has sufficient time to contribute to and inform the report. Let me say again that Congress directed consultation with ACCRES.

Yet, as we near the due date for the report, I have some concerns. The last time the Department of Commerce held an ACCRES meeting was in June 2015, over a year ago. This is unacceptable, in light of the law passed by Congress, and signed by the President, directing the Department of Commerce to seek guidance from ACCRES. Slow rolling and obstructing this law is not only an affront to Congress and the President, but also to the American people. The Department has had ample time to draft the report, call an ACCRES meeting, and solicit their input. In addition, since the passage of the Commercial Space Launch Competitiveness Act, the Department has changed the composition of ACCRES by including representatives from federal agencies. And while the inclusion of federal representatives on ACCRES is within the authority of the Secretary, it is completely unnecessary. The Department already has a multitude of ways to engage with other federal agencies.

In a response to the recent oversight letter, the Department argues that including federal representatives in ACCRES's member-

ship facilitates meaningful interaction among government experts, knowledgeable industry representatives, and other critical stakeholders to provide advice to the Department. While this may be true, it's also true that such interaction does not necessarily require inclusion of federal representatives on the Advisory Committee. One thing is certain, if ACCRES operates on a consensus basis, the inclusion of federal representatives gives the Executive Branch a means to influence and control of the advice provided, including advice directed by Section 202 of the Commercial Space Launch Competitiveness Act.

We, as Congress, and as a Nation, must adhere to certain principles as we reform that which governs private space-based remote sensing. First we must ensure U.S. industrial leadership, and this requires regulatory certainty, and a permissive environment that promotes innovation. In addition, we must, to the greatest extent possible, have both friend and foe justifiably rely on U.S. private sector services and applications. Finally, we must address broader national interests, particularly our national security interests.

Few would contest these principles. The challenge lies in achieving the right balance. And right now the balance is all out of whack. This is partially a result of the policy Congress established in the 1992 Land Remote Sensing Act, and partially due to Executive Branch policies and regulatory processes. Congress and the administration can, and must, work together on reforms that encourage U.S. industrial innovation in a way that aligns with national security interests. We cannot have the private sector compete with national security.

Make no mistake, we need reform. Over the past several years, NOAA's commercial remote sensing license applications have increased exponentially. Many of these applications are precedent setting, and challenge the legal construct of the 1992 Land Remote Sensing Act. Some of NOAA's licensing actions are months, if not years, over the 120-day determination timeline which is required by law. Companies are applying and waiting, without understanding as to why NOAA takes so long to get back to them. Stakeholders report significant uncertainty with licensing actions, including modifications to operational license conditions without notice or due process.

American remote sensing startups want to stay in the United States, but must plan for overseas operations due to uncertainty in the regulatory approval process. Without reform, we risk losing American leadership in commercial remote sensing. Such a loss hurts our national security and our economic competitiveness. We saw this happen before when, in the 1990s, a number of U.S. companies sought to establish commercial space-based synthetic aperture radar, or SAR, remote sensing satellite service. But due to regulatory uncertainty and dysfunction in the Executive Branch license determination processes, U.S. investment went overseas, unfortunately. Instead, Germany and Canada benefitted. Each established for-profit commercial synthetic aperture radar remote sensing satellite services, which to this day dominate the international commercial market.

We can't make the same mistake again. I am dedicated to continuing vigorous oversight on this subject, and working with my

colleagues on both sides of the aisle to achieve constructive reform. I want to thank today's witnesses for joining us as we discuss these very important issues, and I look forward to hearing your testimony.

[The prepared statement of Chairman Babin follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
September 07, 2016

Media Contacts: Kristina Baum
(202) 225-6371

Statement of Space Subcommittee Chairman Brian Babin (R-Texas)
Commercial Remote Sensing: Facilitating Innovation and Leadership

Chairman Babin: For over two decades, the United States has led the world in space-based commercial imagery, supporting our civil, commercial, and national security communities. In just the past few years, American innovation in space-based remote sensing has enjoyed a period of immense growth. American companies are investing in, and developing, a host of new and innovative technologies, services and applications, including space-based full-motion video, hyper and multi-spectral imaging, space-to-space remote sensing, and commercial signals intelligence.

As these technologies grow, we must ask: Why, what, and how should we regulate space-based remote sensing activities? The last time Congress passed legislation on this subject was the *1992 Land Remote Sensing Act*. Back then, CubeSats had not yet been invented or standardized. Computers, sensors, and other key technologies were orders of magnitudes more expensive and far less capable. Today we depend on these technologies and the geospatial data they produce. Satellites, UAVs, and many other data collection systems provide the public with unprecedented information. After 24 years, it is time to take a hard look at these changes and see where the laws, regulations, and policies governing this industry need reform.

Section 202 of the *Commercial Space Launch Competitiveness Act* directed the Secretary of Commerce, in consultation with the National Oceanic and Atmospheric Administration's (NOAA) Advisory Committee on Commercial Remote Sensing, also known as ACCRES, to report on statutory updates necessary to license private remote sensing space systems no later than November 25th of this year. For this report to be worthwhile, the Secretary should ensure the advisory committee has sufficient time to contribute to and inform the report.

Let me say again that Congress directed **consultation** with ACCRES. Yet as we near the due date for the report, I have some concerns. The last time the Department of Commerce held an ACCRES meeting was in June, 2015, over a year ago. This is unacceptable in light of the law passed by Congress and signed by the President directing the Department of Commerce to seek guidance from ACCRES. Slow-rolling and obstructing this law is not only an affront to Congress and the President, but also to the American people. The Department has had ample time to draft the report, call an ACCRES meeting, and solicit their input. In addition, since the passage of the *Commercial Space Launch Competitiveness Act*, the Department has changed the

composition of ACCRES by including representatives from Federal agencies. While the inclusion of Federal representatives on ACCRES is within the authority of the Secretary, it is completely unnecessary. The Department already has a multitude of ways to engage with other federal agencies. In a response to a recent oversight letter, the Department argues that "including Federal representatives in ACCRES' membership facilitates meaningful interaction among government experts, knowledgeable industry representatives, and other critical stakeholders to provide advice to the Department...." While this may be true, it's also true that such interaction does not necessarily require inclusion of Federal representatives on the advisory committee. One thing is certain: If ACCRES operates on a consensus basis, the inclusion of Federal representatives gives the Executive Branch a means to influence and control the advice provided - - including advice directed by Section 202 of the *Commercial Space Launch Competitiveness Act*.

We, as a Congress, and as a Nation, must adhere to certain principles as we reform that which governs private space-based remote sensing. First, we must ensure U.S. industrial leadership. This requires regulatory certainty and a permissive environment that promotes innovation. In addition, we must, to the greatest extent possible, have both friend and foe justifiably rely on U.S. private sector services and applications. Finally, we must address broader national interests, particularly our national security interests.

Few would contest these principles. The challenge lies in achieving the right balance. And right now, the balance is all out of whack. This is partially a result of the policy Congress established in the *1992 Land Remote Sensing Act* and partially due to Executive Branch policies and regulatory processes. Congress and the Administration can and must work together on reforms that encourage U.S. industrial innovation in a way that aligns with national security interests. We cannot have the private sector compete with national security.

Make no mistake; we need reform. Over the past several years, NOAA's commercial remote sensing license applications have increased exponentially. Many of these applications are precedent-setting and challenge the legal construct of the *1992 Land Remote Sensing Act.* Some of NOAA's licensing actions are months, if not *years*, over the 120-day determination timeline required by law. Companies are applying and waiting without any understating as to why NOAA takes so long to get back. Stakeholders report significant uncertainty with licensing actions, including modifications to operational license conditions without notice or due process. American remote sensing startups want to stay in United States, but must plan for overseas operations due to uncertainty in the regulatory approval process. Without reform, we risk losing American leadership in commercial remote sensing. Such a loss hurts our national security and our economic competitiveness.

We saw this happen before when, in the 1990s, a number of U.S. companies sought to establish commercial space-based synthetic aperture radar (SAR) remote sensing satellite services. But due to regulatory uncertainty and dysfunction in Executive Branch license determination processes, U.S. investment went overseas. Instead, Germany and Canada benefited. Each established for-profit commercial synthetic aperture radar remote sensing satellite services, which to this day dominate the international commercial market. We can't make the same mistake again.

I am dedicated to continuing vigorous oversight on this subject and working with my colleagues, on both sides of the aisle, to achieve constructive reform.

I thank today's witnesses for joining us as we discuss these important issues and I look forward to hearing your testimony.

###

Chairman BABIN. And I now recognize the Ranking Member, the gentlewoman from Maryland, for an opening statement.

Ms. EDWARDS. Thank you very much, Mr. Chairman, for holding this hearing today on Commercial Remote Sensing: Facilitating Innovation and Leadership. And I'd like to welcome our distinguished panel of witnesses today.

Since the 1980s, Congress, across Democratic and Republican Presidents and Congresses, has set policy to encourage the development of commercial remote sensing industry, as well as the government's purchase of commercial remote sensing data, as appropriate. The Land Remote Sensing Policy Act of 1992, as the Chairman mentioned, established the framework for licensing and regulation of commercial remote sensing satellites under the Department of Commerce. Establishing a licensing regime was needed to fulfill our obligations under the Outer Space Treaty for supervision of non-governmental activities in space, and for providing U.S. private entities with a legal mechanism for carrying out commercial space-based remote sensing operations.

Subsequently, since 1996, the Department of Commerce has issued about 100 licenses for commercial remote sensing systems. Over the past few years, the explosion of cubesats and advances in sensing capabilities have led companies to propose novel approaches to collecting space-based remote sensing data. Indeed, commercial remote sensing is now a dynamic and growing industry. In addition, the societal benefits these data provide for such global issues as natural disasters are evident with the appearance of commercial remote sensing imagines in televised news and headline newspaper articles. These exciting developments, however, mean that the days of relatively straightforward license applications are indeed over. As part of the licensing process, novel architectures, orbital mechanics, and new sensing capabilities must undergo careful consideration across the government to assess any impacts to national security and foreign policy, and to ensure the safety of existing orbital operations.

Several stakeholders, including NOAA's Advisory Committee on Commercial Remote Sensing, have indicated that delays in approving licenses and operational constraints imposed by the licensing process may be impeding the current growth and evolution of the industry. And, in fact, Title II of the Commercial Space Launch Competitiveness Act was enacted last fall—just last fall—last year, requires a report on potential statutory updates that might be needed for licensing commercial space-based remote sensing systems. That report is due in the coming months. In fact, a year from enactment, the report is due in November. I certainly hope, Mr. Chairman, that the Subcommittee will have an opportunity to examine that report with NOAA before considering any potential updates to law, policy, or regulations. And, indeed, it would've been helpful to have invited NOAA to appear here today. They are not the enemy. They're our partners in trying to figure this out for the future.

But before closing, Mr. Chairman, I want to highlight the enabling role that federal research and development continues to have in enabling the success of this industry. It is federal investment in remote sensing research and development, the free and open dis-

semination of federally provided remote sensing imagery, and the Federal Government purchase of commercial remote sensing data, that makes this vibrant industry, and its supporting value-added enterprises, possible. And I hope that we can have a partnership as we move forward both with the industry and with our federal executive partners to make sure that we're setting policy in the right direction. And I thank you, Mr. Chairman, and yield back the balance of my time.

[The prepared statement of Ms. Edwards follows:]

OPENING STATEMENT
Ranking Member Donna F. Edwards (D-MD)
of the Subcommittee on Space

House Committee on Science, Space, and Technology
Subcommittee on Space
"Commercial Remote Sensing: Facilitating Innovation and Leadership"
September 7, 2016

Thank you, Mr. Chairman, for holding this hearing on "Commercial Remote Sensing: Facilitating Innovation and Leadership" and welcome to our distinguished panel of witnesses.

Since the 1980s, Congress has set policy to encourage the development of a commercial remote sensing industry as well as the government's purchase of commercial remote sensing data, as appropriate.

The Land Remote Sensing Policy Act of 1992 established the framework for licensing and regulation of commercial remote sensing satellites under the Department of Commerce. Establishing a licensing regime was needed to fulfill our obligations under the Outer Space Treaty for supervision of non-governmental activities in space and for providing U.S. private entities with a legal mechanism for carrying out commercial space-based remote sensing operations. Subsequently, since 1996 the Department of Commerce has issued about 100 licenses for commercial remote sensing systems.

Over the past few years, the explosion in cubesats and advances in sensing capabilities have led companies to propose novel approaches to collecting space-based remote sensing data. Commercial remote sensing is now a dynamic and growing industry.

In addition, the societal benefits these data provide for such global issues as natural disasters are evident with the appearance of commercial remote sensing images in televised news and headline newspaper articles. These exciting developments, however, mean that the days of relatively straightforward license applications are over.

As part of the licensing process, novel architectures, orbital mechanics, and new sensing capabilities must undergo careful consideration across the government to assess any impacts to national security and foreign policy, and to ensure the safety of existing orbital operations. Several stakeholders, including NOAA's Advisory Committee on Commercial Remote Sensing, have indicated that delays in approving licenses and operational constraints imposed by the licensing process may be impeding the current growth and evolution of the industry.

In fact, Title II of the Commercial Space Launch Competitiveness Act (CSLCA) that was enacted last Fall year requires a report on potential statutory updates that might be needed for licensing commercial space-based remote sensing systems. That report is due in the coming months.

I certainly hope, Mr. Chairman, that the Subcommittee will have an opportunity to examine that report with NOAA before considering any potential updates to law, policy, or regulations.

Before closing, Mr. Chairman, I want to highlight the enabling role that Federal R&D continues to have in enabling the success of this industry. It is Federal investments in remote sensing research and development, the free and open dissemination of Federally-provided remote sensing imagery, and the Federal government purchase of commercial remote sensing data that makes this vibrant industry, and its supporting value-added enterprises, possible.

Thank you, Mr. Chairman, and I yield back.

Chairman BABIN. Thank you, Ms. Edwards. I now recognize the Chairman of our Full Committee, Mr. Smith.

Chairman SMITH. Thank you, Mr. Chairman. The commercial remote sensing space sector continues to experience unprecedented innovation and growth. Investments are being made in new technologies and applications with the potential to significantly improve the world we live in.

According to the Satellite Industry Association, in 2015 Earth observation services revenues grew by ten percent over the previous year. This growth is attributed to the development of smaller satellites, lower manufacturing costs, lower launch costs, and a growing customer base for remote sensing data. In other words, innovation. The Institute for Defense Analysis, Science, and Technology Policy Institute reached similar findings in its 2015 report, Global Trends in Space. The report stated that "Expectations are especially high in the space remote sensing and space"—"Earth observation sectors, where high resolution, frequently updated geospatial imagery can provide information on the location and movement of people and objects."

Fortunately, the United States leads the world in these promising entrepreneurial endeavors. U.S. satellite remote sensing companies continue to push ahead and make the headlines. But the laws, regulations, and policies that govern private remote sensing space systems have not been updated for decades, are outdated and cumbersome. It's time for Congress to take a hard look at how we can streamline and reduce regulatory burdens. The private sector's innovation and leadership continue to outpace the government's ability to keep up with the industry, with very serious consequences. In fact, the United States may lose its innovators, its investors, and its leadership due to outdated and improper regulation and policy.

Last year the Federal Advisory Committee on Commercial Remote Sensing stated the U.S. government needed to fundamentally re-think its approach to commercial remote sensing and policy. The committee found that traditional conceptions of remote sensing as in aerospace technology are outdated. It stated, "Agencies continue to think about remote sensing as a traditional aerospace technology when, in fact, it is increasingly an information technology, requiring a different regulatory philosophy, and regulatory actions. U.S. Government stakeholders must tailor policy and regulations to reflect the fact that remote sensing is no longer a U.S. only, exclusively satellite based effort, but is instead a global information technology that relies on a wide range of platforms."

One of the complex challenges with reform stems from the fact that there are not only legal or regulatory challenges, but also process and oversight challenges. For oversight, Congress needs certain types of information in order to ensure that the administration follows the law. Unfortunately, Secretary of Commerce and the National Oceanic Atmospheric Administration have not been timely in producing such information. The Commercial Space Launch Competitiveness Act, signed into law last November, directs the Secretary to report, every year, basic information about how many license applications were received, how they were adjudicated, and how long it took. This information would let Congress know wheth-

er or not NOAA is satisfying their statutory responsibilities under existing law. But even this basic information hasn't yet been provided to Congress.

The United States can continue to lead the world in commercial remote sensing, but we must ensure the law, regulations, policies, and processes governing this industry are well suited for the realities of our time. I do thank our witnesses for being with us today, and look forward to hearing their testimony. I yield back, Mr. Chairman.

[The prepared statement of Mr. Smith follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
September 07, 2016

Media Contacts: Kristina Baum
(202) 225-6371

Statement of Chairman Lamar Smith (R-Texas)
Commercial Remote Sensing: Facilitating Innovation and Leadership

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The Institute for Defense Analyses' Science and Technology Policy Institute reached similar findings in its 2015 report, *Global Trends in Space*. The report stated that, "expectations are especially high in the [space] remote sensing and [space] Earth observation sectors, where high-resolution, frequently updated geospatial imagery can provide information on the location and movement of people and objects."

Fortunately, the United States leads the world in these promising entrepreneurial endeavors. U.S. satellite remote sensing companies continue to push ahead and make the headlines.

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The *Commercial Space Launch Competitiveness Act*, signed into law last November, directs the Secretary to report every year basic information about how many license applications were received, how they were adjudicated, and how long it took.

This information would let Congress know whether or not NOAA is satisfying their statutory responsibilities under existing law. But even this basic information hasn't yet been provided to Congress.

The United States can continue to lead the world in commercial remote sensing. But we must ensure the law, regulations, policies, and processes governing this industry are well-suited for the realities of our time.

I thank today's witnesses for joining us and I look forward to hearing their testimony.

###

Chairman BABIN. And thank you, Mr. Chairman. I now recognize the Ranking Member of the Full Committee, Ms. Johnson.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and I appreciate you holding this hearing, and thank the panel of witnesses that are here today.

Enabled by years of federal investment, the commercial remote sensing industry has made significant progress. In addition to selling high resolution imagery to government and commercial customers, a number of companies are proposing new approaches to remote sensing, including using constellations of smaller satellites to provide imagery more frequently.

As many of the Members of this Subcommittee know, the licensing operations of private space-based remote sensing systems fall within the jurisdiction of the Department of Commerce, namely NOAA's Assistant Administrator for Satellite and Information Services Commercial Remote Sensing Regulatory Affairs Unit. Industry growth has impacted the licensing workload of that unit. For example, while 26 licenses were issued from fiscal year 1996 to fiscal year 2010, 75 licenses were issued from fiscal year 2010 to fiscal year 2015. And just within fiscal year 2015, 33 applications for licenses were filed with the unit.

With this backdrop, I look forward to hearing from our panel of witnesses on ways in which NOAA's regulatory function can be improved in the face of evolving technology and projected operational advancements. In particular, I'd like to know whether there is a need to update NOAA's licensing regulations, and whether NOAA operations can be streamlined, for example, in dealing with the increasing number of cubesats requesting a license. I would also be interested in hearing whether new regulations can be developed without unduly limiting the promise of innovative commercial remote sensing technologies, while at the same time addressing any legitimate concerns of the intelligence and national security communities.

Chairman Babin, today's hearing is important, and I appreciate you having it. In addition to today's testimony, I would urge you to invite NOAA representatives to a future hearing to lay out the challenges they face and actions they plan to take to address them. I thank you, and yield back.

[The prepared statement of Ms. Johnson follows:]

OPENING STATEMENT
Ranking Member Eddie Bernice Johnson (D-TX)

House Committee on Science, Space, and Technology
Subcommittee on Space
"Commercial Remote Sensing: Facilitating Innovation and Leadership"
September 7, 2016

Thank you Chairman Babin for holding this hearing, and thank you to our panel of witnesses for being here this afternoon.

Enabled by years of federal investment, the commercial remote sensing industry has made significant progress. In addition to selling high-resolution imagery to government and commercial customers, a number of companies are proposing new approaches to remote sensing, including using constellations of smaller satellites to provide imagery more frequently.

As many of the Members of this Subcommittee know, the licensing of operations of private space-based remote sensing systems falls within the jurisdiction of the Department of Commerce, namely NOAA's Assistant Administrator for Satellite and Information Services' Commercial Remote Sensing Regulatory Affairs unit.

Industry growth has impacted the licensing workload of that unit. For example, while 26 licenses were issued from Fiscal Year 1996 to Fiscal Year 2010, 75 licenses were issued from Fiscal Year 2010 to Fiscal Year 2015. And just within Fiscal Year 2015, 33 applications for licenses were filed with the unit.

With this backdrop, I look forward to hearing from our panel of witnesses on ways in which NOAA's regulatory function can be improved in the face of evolving technology and projected operational advancements. In particular, I would like to know whether there is a need to update NOAA's licensing regulations and whether NOAA operations can be streamlined, for example, in dealing with the increasing number of cubesats requesting a license.

I would also be interested in hearing whether new regulations can be developed without unduly limiting the promise of innovative commercial remote sensing technologies while at the same time addressing any legitimate concerns of the intelligence and national security communities.

Chairman Babin, today's hearing addresses an important topic.

In addition to today's testimony, I urge you to invite NOAA representatives to a future hearing to lay out the challenges they face and actions they plan to take to address them.

I yield back.

Chairman BABIN. Thank you, Ms. Johnson. I would add that, we will invite them after the report is delivered, okay?

Now I'd like to introduce our witnesses. Our first witness today is Mr. Kevin O'Connell, President and CEO of Innovative Analytics and Training. Mr. O'Connell is a leading analyst, scholar, and writer on national security and intelligence issues. For over three decades he has been deeply involved in identifying, analyzing, and helping manage emerging threats to the Nation's interest, whether governmental or commercial. His prior U.S. Government experience has included assignments with the Department of Defense, the Department of State, the National Security Council, Office of the Vice President, and the Office of the Director of Central Intelligence. He serves today as a senior consultant to the Office of the Director of National Intelligence. He was a longstanding member, and later chairman, of NOAA's Federal Advisory Committee on Commercial Remote Sensing, or ACCRES, between 2002 and mid-2016. He received his B.A., his Bachelor of Arts, in International Studies from The Ohio State University, and his Master's in Public Policy from the University of Maryland.

We'll recognize you for five minutes, Mr. O'Connell.

Mr. O'CONNELL. Thank you, Mr. Chairman.

Chairman BABIN. Yes, sir.

TESTIMONY OF MR. KEVIN O'CONNELL,
PRESIDENT AND CEO,
INNOVATIVE ANALYTICS AND TRAINING LLC;
FORMER CHAIR, FEDERAL ADVISORY COMMITTEE
ON COMMERCIAL REMOTE SENSING (ACCRES)

Mr. O'CONNELL. Good afternoon Chairman Babin, Ranking Member Edwards, Chairman Smith, Ranking Member Johnson. Thank you so much for inviting me to testify today on how we can sustain U.S. leadership and innovation in commercial remote sensing. Today I'll be speaking from my own personal vantage point, having looked through all of the assignments that the Chairman has mentioned over the years, at the issue of commercial remote sensing. And I'm proud to have served on NOAA's Federal Advisory Committee since inception in 2002 until recently, both as a member, and then, in more recent years, as the chairman.

Remote sensing technologies, processing, and analysis, as has been already said, are changing dynamically. American companies, like Black Sky Global, Digital Globe, Harris Systems, Omni Earth, Planet, Terrabella, and others are at the cutting edge of the global commercial remote sensing market. They feature a remarkable diversity of technical approach, business models, and operational concepts, world class technology that's supported by fast breaking parallel developments in areas like cloud computing, advanced analytics, and others, and they're able to leverage new funding sources in the private sector and venture capital markets, and the ability to leverage a broad geospatial ecosystem that is global.

In my written testimony I identified six big trends that I think influence the global market. I'll only mention them here, and we can talk about them later. One, a growing demand for new applications, both in the government and in the commercial sector, the

rise of analysis, increased access by a wider range of participants, increased globalization, changing business models, and, last but not least, the growing importance of non-technical factors, such as national prestige and workforce development.

U.S. policy has been consistently forward-looking and bipartisan over the past 20 years, but our future rests atop a more uncertain foundation created by traditional bureaucratic mindsets, an outdated regulatory system, and deep concerns concerning the tradeoffs between innovation and national security. The U.S. Government needs to benefit from leveraging by solely creating the kinds of capabilities, information, and analysis that are increasingly available in the market.

The U.S. Government, including Commerce and NOAA, play five roles in the market; customer, patron, a regulator, a competitor, and an advocate. And, by the way, these are not purely theoretical roles: they are active policy roles, every one of the five. They sometimes conflict with one another. But the speed of technology and innovation is rapidly changing and outpacing the ability to keep up with policy regulatory developments. As is the case with many other information technologies, the U.S. Government must re-formulate its approach and practice if it wants to remain on the cutting edge of these technologies.

Let's talk for a moment about the regulatory regime. The regulatory regime needs to be modernized both substantively, and from a process perspective, to objectively reflect the current market and technology trends. Speed is an important market, and even national security, discriminator. Other than consolidation of existing statutory authority in 2010, there have not been modifications, as has been said, to the Commerce Department's authorities, in this area for over a decade, during which time novel technologies, operational concepts, and business models have emerged.

Current regulations, for example, don't extend beyond the electro-optical realm. They're out of date, in terms of control and leverage mechanisms, and they don't reflect modern ideas about how to shape global markets, and thereby enhance U.S. national security. I understand that proposed NOAA resources in the President's budget for fiscal year 2017 are welcome, but that does not necessarily guarantee that the regulatory regime will be modernized in such a way that is both limited and efficient. Policy and regulation should be anticipating future opportunities and challenges, not looking backwards, as is sometime the case.

Let's talk for a minute about security issues. Remote sensing has a very rich history in the security of our Nation. That security history sometimes clouds our thinking about how to advance security and leadership through successful commercial remote sensing. Four key points. We need to attract top talent and investment to the United States under a functioning regulatory structure. The U.S. maintains leverage, and shapes global developments. Failure to adapt our mindset will push innovation offshore.

Secondly, we need to re-frame our thinking about imagery within the national security toolkit, especially as it helps with shaping the national security environment in areas like humanitarian relief, and others. I would note, for example, some of the work being done

at NGA by Mr. Cardillo in thinking in a different way about how to apply imagery and information sharing.

Third, given concerns about space security, the U.S. benefits from the resilience created by a robust commercial market. Diffuse global reliance on commercial satellite systems redefines the strategic environment for space. And fourth, very important, something I've written about for almost 20 years, we need to learn how to live in a much more transparent world. We need to update our thinking about how to protect U.S. troops, U.S. facilities, U.S. public at large for this world, but not fixate on information control. Obviously the United States Government will retain the option for dire national emergencies, but we need to think about security differently.

I'll close in saying that the Nation still holds a leadership position and a strategic advantage in commercial remote sensing, and we have a bipartisan policy to encourage it. U.S. policy and regulatory mechanisms need to be updated for the current technology and market factors, and must anticipate newer developments, with an eye toward efficient and practical regulation, and incentive creation for U.S. industry. The Nation as a whole benefits from this. Inaction and indecision will result in strategic failure, and being defensive only cedes advantage to foreign competitors. Given longstanding U.S. policy aims, and an American innovation culture, in my view, the only long term strategy is offense. And on that note, I'll look forward to the other testimony, and certainly your questions. Thank you, Mr. Chairman.

[The prepared statement of Mr. O'Connell follows:]

Prepared Statement of Kevin M. O'Connell, President and CEO, Innovative Analytics and Training, LLC and Outgoing Chair of NOAA's Federal Advisory Committee on Commercial Remote Sensing (ACCRES)

Committee on Science, Space, and Technology,
Subcommittee on Space
U.S. House of Representatives

"Commercial Remote Sensing: Facilitating Innovation and Leadership"

September 7, 2016

Thank you, Mr. Chairman and Members of the Subcommittee, for providing an opportunity to discuss the important topic of U.S. commercial remote sensing, especially how we can sustain U.S. leadership and facilitate innovation through our policy and decision-making processes. This topic cuts across vital American commercial, economic, and national security interests in many different ways.

Personal Perspective and Experience

The views that I will present today are my own based on more than 20 years of experience with U.S. commercial remote sensing. Briefly, I began to look at this issue back in 1993 for the Director of Central Intelligence to understand the national security equities associated with commercialization, as input to Presidential Decision Directive 23 (March 1994), and again later as the Staff Director of the Independent Commission on the National Imagery and Mapping Agency (1999-2000). During a decade at RAND, I conducted research on the nature of global geospatial markets and international activities. This culminated in a number of reports, such as "Commercial Observation Satellites: at the Leading Edge of Global Transparency" (ASPRS/RAND: 2001) with Mr. John Baker and Dr. Ray Williamson.

In 2011, I co-authored a report for the Department of Commerce that summarized U.S. policy and regulatory history, and postulated alternative futures for the U.S. commercial remote sensing satellite industry. We are in the process of updating that report right now, given the speed of change in the industry and global markets. Finally, I am proud to have been a member and most recently Chairman of the Advisory Committee on Commercial Remote Sensing (ACCRES) which was created by the Secretary of Commerce to advise NOAA on matters related to the U.S. commercial remote sensing industry, including their regulatory responsibilities.

The Current Context

The technology of remote sensing, and related processing, and analysis are changing dynamically. As a direct result, companies like Black Sky Global, DigitalGlobe, Hera Systems, OmniEarth, Terra Bella and others now stand to leverage the cutting edge of the U.S. commercial remote sensing market. Even within a small but growing slate of U.S. licensees, there is remarkable diversity of technical approach, operational concepts, and business models. While U.S. firms have world-class satellite technology, they also benefit from fast-breaking developments in areas like cloud computing, communications, launch, machine learning, advanced analytics and others. Increasingly, they benefit from the interest and participation of venture and private equity capital in the market. And they can also leverage the emergence of a broad, global geospatial ecosystem that includes other capabilities like navigation and geographic information systems. These allow us to understand remote sensing data in the context of readily available and interoperable information sources.

There are some broad trends underway in the market that are important to understand. These are not uniquely American trends, although several U.S. firms are leading the way. For potential vendors, investors, users, and regulators of commercial remote sensing data and information, these trends are occurring across the entire remote sensing value chain. Among the most important are the following:

- *Growing demand for new specialized applications:* The geospatial industry is expanding, with new applications spurring demand for highly precise, unique and timely imagery data, such as radar and additional electro-optical bands (such as hyperspectral). Applications are becoming more and more diverse: they range from consumer-driven, location-based services to companies that are exploiting these unique data sources with advanced analytics of sensed data (e.g. commodities, finance, and insurance). New applications are emerging that leverage both geospatial and temporal precision. Similarly, applications are emerging in support of both government and commercial needs.
- *The rise of analysis*: As with other information sources, the real value lies in the insights we can gain from remotely sensed data, not just the data themselves. This includes not only satellite data, but, increasingly, data from aircraft, drones, and other sources. Almost every U.S. firm has made the leap from being a data collector to becoming an analysis provider. Further, as data users, new firms such as Orbital Insight are creating analytic insights based on any data sources that they can acquire without specifically possessing the satellite infrastructure. It seems that we've gone in a few short years from a worry about data overload to a worry that we don't have enough data to feed models as the basis for sophisticated understanding and decision-making.

- *Increased access by a broader range of participants*: Expanding access to small satellite technology, including constellations of "cubesats," is lowering barriers to entry and enabling experimentation and open system learning with innovative imagery architectures. At the same time, remote sensing industry participants are becoming more diverse. They increasingly include university researchers as well as large, commercial data interests (e.g., Google). Foreign remote sensing systems (e.g., TanDEM-X, ASNARO) continue to be developed and ambitious privately funded systems (e.g., Planet, Terra Bella) are in various stages of development, testing, operations, and flight. The data from these emerging private remote sensing systems are more likely to be integrated into large-scale data mining, analysis and geospatial data operations rather than being standalone entities, as was the case with early U.S. commercial remote sensing firms. Increasingly, the ready availability of open standards from the Open Geospatial Consortium, for example, help to make these data *plug and play*, thereby lowering both cost and time to market.
- *Increased globalization of the space remote sensing market*: There are an increasing number of cooperative partnerships beyond the space programs of the United States, Europe, Russia and China. For example, the United Arab Emirates acquired remote sensing technologies from South Korean companies, Algeria launched its first remote sensing satellite on an Indian space booster, and Vietnam is seeking to acquire a radar satellite and launch from Japan. Similar efforts in other regions are being discussed. This is a global marketplace with many aspects of the remote sensing value chain now available from multiple sources.
- *Changing business models*: The days of selling imagery pixels alone are long gone. The traditional model of selling the single image at high value with only limited regard for the rest has given way to completely different valuations of current, near-real-time, archival, fused and other kinds of information. Satellite providers and other commercial vendors today demonstrate a wide range of products and services. For many commercial providers, the image itself is purely an artifact, just as the phone service user thinks little about a satellite as the means of transmission. Look for rapidly changing business models and investment opportunities in this area. Venture capital is growing in space and geospatial markets as opportunities arise: this is likely to bolster innovation as investors seek improved risk/reward opportunities.[1]
- *Growing importance of non-technical factors.* Ownership of a remote sensing capability – even a small one –is increasingly seen as a matter of national prestige, particularly for emerging space states. This is true even if the bulk government imagery needs are met by commercial or foreign sources. Some states seek to have individual systems with

[1] See, for example, *Space Review*, Jeff Foust, "The Commercial Remote Sensing Boom", published June 16, 2014. Also see Peggy Hollinger, "UK Space Start-ups to Get Boost from Venture Capital Fund" published in *Financial Times*, July 15, 2015.

some local content (e.g., Bolivia, Turkey), while other countries seek to acquire turn-key systems for immediate national needs (e.g., Vietnam, UAE). Some countries are willing to participate in a regional system (e.g., European *Pleiades*) where they share other transnational political ties. Even as we discuss the U.S. regulatory environment, other countries are beginning to promulgate their own, both as a source of cooperation and competition. A number of countries are recognizing the importance of aligning their workforce with these technologies.

At first glance, an observer might think that the situation is optimized for the innovation and leadership that this Committee wishes to discuss today. Some U.S. licensees flying satellites, others in advanced state of development, all of them leveraging a broad slate of new technologies and pursuing unique market segments. However, the exciting developments that I have highlighted here lie atop a more uncertain foundation created, generally, by traditional bureaucratic mindsets, by an outdated statutory and regulatory system, and by deep concerns controlling the tradeoffs between innovation and national security. As in other areas, the speed of technology and innovation is rapidly outpacing the ability to keep up with policy and regulatory developments.

This uncertainty is paradoxical, of course: U.S. policy has been consistently forward looking and bipartisan over the past twenty years – and arguably longer -- and clear on the nation's intent: U.S. policy statements declare that our fundamental goal is "to advance and protect U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and by sustaining and enhancing the U.S. remote sensing industry."[2] Further, the U.S. government needs to benefit from leveraging, vice solely creating, the kinds of capabilities, information and analysis increasingly available in the market. This is already reflected, for example, in the National Geospatial-Intelligence Agency's Commercial GEOINT Strategy (October 2015) and even NOAA's commercial weather data policy as spotlighted by this committee. Commercial remote sensing developments represent an additional source of experimentation and learning from the space segment to the analytic tradecraft, and should drive new approaches to the government's approach to investment in unique remote sensing capabilities. For many years I have argued that, rather than see government and commercial interests in competition, that they are highly complementary, especially as commercial ventures propose more and more innovative ideas. As in the case of many other information technologies, the government must reformulate its approach and practices if it wants to stay remain on the cutting-edge of these technologies.

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[2] The White House, Fact Sheet, "U.S. Commercial Remote Sensing Policy," (April 25, 2003), http://www.nesdis.noaa.gov/CRSRA/files/Commercial%20Remote%20Sensing%20Policy%202003.pdf

On the U.S. Government's Many Role(s) in the Marketplace

The U.S. government plays many different roles in how our nation's commercial remote sensing satellite industry develops. Implementing policy and regulatory functions in a coherent manner is challenging because of these different roles, partly because they sometimes can conflict with each other, and partly because the weight and relevance of them has shifted over time.

In principle, government organizations play multiple roles in any market: customer, patron, regulator, competitor, and advocate[3]. Importantly, the policy framework and government bureaucracy has a critical role in how these are coordinated and implemented. The following is a brief discussion of these distinctive roles within the context of how the U.S. government interacts with the American commercial remote sensing industry.

- *Customer*. The U.S. government is an important customer in the commercial imagery market and can exert a substantial influence on business prospects. For example, through its EnhancedView contract and other activities, the National Geospatial-Intelligence Agency has played a major role in shaping the commercial imaging satellite market for the past several years. As new international capabilities and business models emerge, U.S. government agencies are likely to remain a major customer for any commercial remote sensing satellite data as long as it satisfies identified requirements.

- *Patron*. While U.S. government agencies are naturally a customer, they often cannot only be a casual consumer of the commercial market and hope to fulfill their particular needs. There are times when government agencies need to take a proactive role in understanding, shaping, and adapting market capabilities for their own purposes. This role involves formal business relationships and small investments in order to shape the market, whether based on the need to encourage experimentation, unique capability development, or an analytic process that helps government agencies satisfy mission requirements or anticipate future developments.

- *Regulator*. Given the complex array of U.S. government organizations that have or perceive equities in commercial remote sensing, each has an important role in informing policy and regulatory processes about the impact of any proposed U.S. or foreign satellite capability. The lead responsibility for licensing the operation of U.S. commercial remote sensing satellites belongs to the Secretary of the Commerce and is managed by personnel in the National Environmental Satellite, Data and Information

[3] As adapted from Charles V. Wolf, *Markets or Governments: Choosing Between Imperfect Alternatives*, RAND Corporation, 1993.

Service (NESDIS) of the National Oceanic and Atmospheric Administration (NOAA).[4] In comparison, government decisions concerning exports of U.S. commercial remote sensing satellite systems or technologies are the purview of the U.S. State Department. In either case, the review of licensing or export applications involves a broad interagency process involving relevant experts in the Department of Defense, the intelligence community, and several other government agencies. But the large number of participants in the regulatory process demands efficiency and speed where possible, as well as transparency of process to all.

- *Competitor.* In some less obvious ways, the federal government is involved in activities that compete with the efforts of the commercial remote sensing satellite industry. For example, the U.S. Geological Survey (USGS) has traditionally played a major role in collecting, processing, and disseminating lower-resolution, multispectral imagery data produced by Landsat imaging satellites, which was initially viewed a competing with potential commercial provider of comparable data. Along with ensuring continuity in this important source of Earth observation data for civil purposes, the government viewed the availability of lower-resolution Landsat data to have broader public benefits while helping to develop the satellite remote sensing market.[5] Similarly, at times NGA may compete with the commercial market, consistent with its national security responsibilities to collaborate with allied and friendly government on overhead imagery data and analysis.

- *Advocate.* Finally, in some instances, government agencies have formal responsibilities to serve as an advocate for the commercial remote sensing industry. For example, by congressional statue, the Office of Space Commerce, another NOAA office within the Department of Commerce, is responsible for fostering the conditions for the economic growth and technological advancement of the United States space commerce industry, including the export of space-related goods and services.[6] Similarly, NGA has been assigned the primary responsibility for acquiring and disseminating commercial remote sensing space products and services for meeting the U.S. government's national security or foreign policy requirements.[7]

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[4] The licensing process for U.S. private remote sensing satellites is specifically managed by Commercial Remote Sensing Regulatory Affairs (CRSRA) office within NOAA/NESDIS. http://www.nesdis.noaa.gov/CRSRA/licenseHome.html

[5] John C. Baker, Kevin M. O'Connell, Ray A. Williamson, *Commercial Observation Satellites: At the Leading Edge of Global Transparency*, (RAND Corporation and the American Society for Photogrammetry and Remote Sensing, 2001), pp. 37-51, and 139-146.

[6] U.S. Department of Commerce, "Legal and Departmental Authorities of the Office of Space Commerce," http://www.space.commerce.gov/law/office-of-space-commercialization/

[7] The White House, Fact Sheet, "U.S. Commercial Remote Sensing Policy," (April 25, 2003), p. 5; http://www.nesdis.noaa.gov/CRSRA/files/Commercial%20Remote%20Sensing%20Policy%202003.pdf.

These multiple roles are legitimate, but sometimes conflict, both in fact and appearance. And the number and variation in these roles sometimes creates an unnecessary burden in the process of regulation. Well-cited regulatory delays – such as Planet's delay in orbital slot allocation and Digital Globe's request to use short-wave infrared (SWIR) capabilities in the market – are examples that should be avoided, in order to minimize unnecessary uncertainty for all involved. The pace and process of review highlights and exacerbates the innovator's dilemma: it remains too easy for different elements of the bureaucracy just to say no.

Toward a More Effective Regulatory Environment

Given the focus of this hearing, it is important to address some key aspects of the regulatory environment for U.S. firms. How the regulatory system evolves will weigh heavily on the future of the entire U.S. industry, with attendant positive and negative benefits.

First of all, it has been my impression that NOAA does not apply sufficient resources to this problem. As the number of license requests has grown rapidly over the years, NOAA has been unable to devote additional resources to its regulatory and enforcement responsibilities. For example, based on data NOAA provided in 2015, they have reviewed about 50 license requests and stimulated the need for 22 others over the past six years, compared with approving 26 licenses between fiscal year 1996 through 2010. (That number is probably outdated and on the low side today). This problem is further exacerbated by NOAA's additional responsibilities to shepherd the views of the rest of government within the licensing process. Beyond that, the treatment of space and space commerce issues within the Department of Commerce is fractured across a number of agencies and organizations.

I understand that the President's budget for FY2017 includes a substantial increase in budgetary authority for both NOAA/NESDIS and the Office of Space Commerce. While at least some increase is welcome, there is no guarantee that more resources will be directed at the needed modernization of the regulations with more limited and efficient regulation of U.S. industry. The regulatory regime needs to be modernized to objectively reflect the current market and technology trends from both a substance and a process perspective. Technology often outpaces policy, but in this area our inability to modernize the regulations is triply harmful: it limits the advantage that we can collectively take from innovation, it reinforces conservative thinking, and it drives innovation overseas. Even in traditional slow areas like policy and regulation, we need to recognize that speed is an important market and even national security discriminator.

Why update the regulatory mechanism? Sadly, the current regulations are no more meaningful than the operator's manual for an old car or mobile phone: they don't extend beyond the electro-optical realm, they're out of date in terms of control and leverage mechanisms, and they don't reflect modern ideas about how to shape global markets and thereby enhance U.S. national security. Other than the consolidation of existing statutory authority in 2010, there have not been substantial modifications to the Department of Commerce's authorities in this area for over a decade, during which time novel technologies, operating concepts and unique business models have emerged.

Beyond the substance, any new approaches must include ways to remain agile and responsive in the regulatory process. Any new regulation needs to be objective about what can and should be regulated, not areas that we would like to be able to control but cannot, given the global diffusion of technology. Commercial space products are increasingly embedded in information products, so the practical effects of regulation are muted if not eliminated entirely. Clearly, equities like orbital slots, spectrum and debris mitigation require public scrutiny, but other regulatory mechanisms will not be meaningful in a world of foreign satellites, drones, and other proliferated sensors.

As stated, the U.S. national security establishment now relies more heavily on commercial satellite imagery, expanding the many ways that it is used. That is a very good thing, but only one dimension in an expanding global market. In spending scarce taxpayer dollars in the market, it is natural for government managers to assess risk, although they must do so in the context of fast-paced technology and marketplace nuances.

One of the natural questions that always arises is whether the commercial business models make any sense. Do they close? Will the companies survive? Will they be profitable? This is a legitimate question for anyone in government who is trying to evaluate a business relationship with a commercial remote sensing firm. But government evaluators rarely have the experience and perspective to make that kind of decision. The government should avail itself of an *independent* sense of business risk from organizations more familiar with the business world, like space insurance or the growing number of space finance companies.

Most importantly, as we think about future regulation, the government needs to reorient its thinking around future challenges, and objective realities, instead of looking backwards and fighting old battles. During a panel I moderated at this year's USGIF GEOINT Conference, Deputy Secretary of Defense Douglas Loverro talked about the primacy of U.S. government thinking and writing about commercial remote sensing as a source of risk,

with the need to balance incentive for commercial success against national security risk[8]. Twenty years of history have not borne out that risk, especially given the unprecedented cooperation of industry when the U.S. government provides clear details about national security concerns in in both space and time, for as limited a time as possible.

Rethinking Security Issues

Remote sensing has a rich and storied history with the security of our nation. The extraordinary legacy of remote sensing in U.S. national security history sometimes clouds our thinking about how to advance U.S. leadership through successful commercial remote sensing, in part by re-thinking its security basis. Let me illustrate a few key areas.

First, and most important, we need to continue to attract top talent and investment to U.S. firms and the U.S. government. Under a reasonable, functioning regulatory structure, the United States can continue to shape global developments through technical innovation, new business processes and by encouraging new applications. In the process, industry is incentivized to pursue new concepts, which serve both as a source of leverage and experimentation in a cutting edge area. Failure to adapt our mindset, especially given the global nature of commercial remote sensing, will push U.S. offshore to more welcome environments. That will be a tactical victory for the bureaucracy, and, ultimately, a strategic failure for U.S. policy aims and the nation.

Second, we tend to look at enhancing security through the traditional lens, value and practice of imagery analysis, not the diverse slate of capabilities, operating concepts and business models that characterize remote sensing today. We have to think about information as a broader shaping mechanism within our national security toolkit, not only as individual inputs to national security decision-making. This happens through the increasing understanding of developments on our planet – including humanitarian relief, technical assessment, and other areas – as well as the sharing of that information in both government and commercial contexts. There is a unique value to transparency that these data and analysis can provide to frame, or even resolve, complex national security issues. While the canonical "killer app" for commercial imagery has not yet emerged, perhaps that app is more broadly defined as the need to understand a wide range of economic, environmental and security developments on the earth.

Third, at a time when we are increasingly concerned about space security, the national security establishment benefits from the resilience created by a robust and global

[8] Warren Ferster, "Regulation: A Double-Edged Sword – Panel Concludes Restrictions on Remote Sensing Activities Are Not Without Risk." Trajectory Magazine (United States Geospatial Foundation, May 17, 2016). http://trajectorymagazine.com/got-geoint/item/2185-regulation-a-double-edged-sword.

commercial market. U.S. and Allied firms become a complementary source to government systems, and global reliance on the information provided from commercial systems genuinely redefines the strategic environment for space. The recently released National Academy of Sciences study "National Security Space Defense and Protection"[9] (Summer 2016) highlights the many human activities that are dependent on space systems, including the need for updated policies to strengthen mission assurance in a space environment that is increasingly congested, contested, and competitive, and in a world where foreign counter space activities are growing.

Finally, even within our U.S. national security domain, we need to learn to live in a much more transparent world. When we wrote "Commercial Observation Satellites," over 15 years ago, we highlighted the new and unprecedented insights that many different actors – not just military and intelligence organizations -- would have from emerging information capabilities like commercial remote sensing and other advanced information sources, like location-based services and cloud computing, and thereby challenging traditional approaches to creating decision advantage.

This is a very big issue. We need to update our thinking about how to protect U.S. troops, facilities and operations in this increasingly transparent world, not fixate on information control as a source of security. In fact, unless commercial remote sensing or other types of information uniquely contribute to an adversary understanding, the risk that of limiting U.S. industry's participation in the market both harms industry and potentially creates greater danger by creating a false sense of security in a world with a multitude of complementary and substitute information sources. Of course, the U.S. government should and will always retain that option for circumstances of dire national security emergency.

Closing Remarks

In spite of the challenges mentioned here, the nation still holds a leadership position and a strategic advantage in commercial remote sensing, and a bipartisan policy to encourage it. Activity is taking place at an accelerated pace, given technology and market developments, including the leveraging of other fast-breaking technologies in an expanding geospatial ecosystem.

The 20-year modern history of U.S. commercial remote sensing tells us how and how not to proceed going forward. (As an aside, they are also illustrative to a whole variety of other

[9] National Academy of Sciences, Engineering, and Medicine, *National Security Space Defense and Protection: Public Report* (Washington, D.C.: The National Academies Press, 2016). Access at https://www.nap.edu/catalog/23594/national-security-space-defense-and-protection-public-report.

emerging commercial space areas, like space situational awareness (SSA), debris mitigation, weather, and others). U.S. policy and regulatory mechanisms need to be updated for the current technology and market factors, and even anticipate newer developments with an eye toward efficient and objective regulation and incentive creation for U.S. industry. The nation as a whole benefits from this.

As I see it, especially given our lead role in the idea of commercialization over the past twenty years, and beyond, the only long-term strategy is offense. Being defensive and apprehensive about the bold developments cited here only cedes advantage to U.S. competitors. A renewed U.S. vision is required that is then reflected in agile policy and regulation. To fail at this, including by inaction and indecision, will result in strategic failure. We can and must do better.

Thank you for your attention. I am prepared to answer any questions that you might have.

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Kevin M. O'Connell is President and CEO of Innovative Analytics and Training, LLC, a small professional services firm designed to improve analysis and decision-making for U.S. government and commercial clients. He is the former director of the Center for Intelligence Research and Analysis (CIRA) at Defense Group, Incorporated (2004-2007) and was the founder and first Director of RAND's Intelligence Policy Center (2001-2004) during almost a decade at RAND.

Mr. O'Connell is a leading analyst, scholar, and writer on national security and intelligence issues. For over three decades he has been deeply involved in identifying, analyzing, and helping manage emerging threats to the nation's interests, whether governmental or commercial. His prior U.S. government experience has included assignments with the Department of Defense, the Department of State, the National Security Council, Office of the Vice President, and the Office of the Director of Central Intelligence. He serves today as a senior consultant to the Office of the Director of National Intelligence.

Mr. O'Connell is a recognized expert on the policy, security, and commercial aspects of satellite remote sensing technologies and markets. For over 20 years, Mr. O'Connell has been involved with commercial remote sensing, focusing on related policy, market, and security issues. He analyzed these issues while on the staff of the Director of Central Intelligence, as Executive Secretary and Staff Director of the Independent Commission on the National Imagery and Mapping Agency (NIMA), while at RAND, and as an advisor to the National Geospatial-Intelligence Agency. He was a long-standing member and, later, Chairman, of NOAA's federal advisory committee on commercial remote sensing, or ACCRES, between 2002 and mid-2016.

Mr. O'Connell is an author and co-editor of *Commercial Observation Satellites: at the Leading Edge of Global Transparency* (with John Baker and Ray Williamson, ASPRS/RAND, 2000). This book introduced the complex motives behind government and non-government pursuit of remote sensing capabilities, as well as the early insights on the security and intelligence implications of transparency. He has authored or co-authored a number of other articles, reports and monographs on commercial remote sensing activities. Mr. O'Connell is currently updating a 2011 study on "Alternative Futures: U.S. Commercial Remote Sensing Industry in 2020."

Finally, Mr. O'Connell is a long-standing member of the adjunct faculty at Georgetown University, where he teaches a graduate course on comparing intelligence services.

Chairman BABIN. Thank you, Mr. O'Connell, appreciate that.

And our second witness today is Mr. Kevin Pomfret. He's the founder and Executive Director for the Centre for Spatial Law and Policy. He's also a partner at the Williams Mullin law firm, and co-chair of both the firm's Unmanned Systems and the Cyber Security and Data Protection practice groups. His career began as a satellite imagery analyst, where he helped to develop imagery collection strategies to monitor arms control treaties and identify requirements for future collection systems. In addition, he is a member of the National Geospatial Advisory Committee. He earned his J.D. from the Washington Lee University School of Law, and his B.A. from Bates College. So I will recognize you for five minutes, Mr. Pomfret.

TESTIMONY OF MR. KEVIN POMFRET,
EXECUTIVE DIRECTOR,
CENTRE FOR SPATIAL LAW AND POLICY

Mr. POMFRET. Thank you, Mr. Chairman. Good afternoon to you, and Members of the Subcommittee. I appreciate this opportunity to speak on behalf of the Centre for Spatial Law and Policy in connection with the hearing on commercial remote sensing.

Geospatial information can be generally defined as information about a person, place, or thing that can be tied to a particular place on Earth. It can be collected in a variety of ways, using a number of different technologies. For example, geo-information can be collected from sensors mounted on satellites, manned aircraft, drones, automobiles, ships, and mobile devices, such as smartphones. 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.

Geo-information 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. There are a number of legal and policy issues associated with the collection, analysis, storage, and distribution of remote sensing data, and other types of geo-information. These issues include intellectual property rights, privacy, licensing, liability, and national security. These issues are global, and cut across a number of technology platforms, including commercial remote sensing satellites.

The commercial remote sensing industry is an integral part of a global ecosystem of businesses, government agencies, NGOs, research organizations, and citizens that collect, analyze, and distribute to you information. Each stakeholder in this ecosystem can serve as both a data collector and a data user, often simultaneously. This ecosystem creates products and services that allow analysis and visualization of information from business and government databases overlaid on an image, or a map created from imagery, and aggregated with geo-information collected and shared by individuals through tools such as Open Street Map.

Geo-information is a versatile and powerful asset that is being used in a growing number of important business, governmental, and environmental applications that have tremendous economic and societal value. For example, a satellite image can be used by

a business in deciding where to open a new store, by a consumer using his or her satellite navigation device to find the store once it is opened, by the city's Department of Transportation to decide where to put lights in order to address the traffic issues associated with the store's opening. Unfortunately, like other technologies, it can also be used by a criminal in planning to rob that store.

This power of information to assist in decision making is based upon a number of factors, including data type, timeliness, accuracy, precision, and completeness. In general, decision making improves with a greater availability of higher quality geo information. This versatility and power enhances the value of geo-information, however, it could also be a significant challenge from a policy and regulatory 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, governments, and consumers to use the same information in ways that save time, money, and lives.

Historically the United States has been a global leader in most geospatial technology. However, today the geo-information marketplace is truly global. For example, Singapore is on the cutting edge of using geo-information for transportation and smart cities. In 2011 the United Nations formed the UN Global Geospatial Information Management Initiative to assist in the global development of geospatial information, and to promote its use to address challenges such as disaster response, food security, migration, and the sustainable development goals.

The geo-information marketplace is extremely competitive. Technology advancements have contributed to a dramatic increase in the number of platforms that collect new information, including, as discussed today, small sats, drones, and mobile devices, as well as improved software tools to analyze and visualize this information. Despite these changes in the market, consumers of geo-information still are more interested in whether the product or service will help them in their decision making, rather than the platform or sensor in which the geo-information is collected. As a result, overly restrictive regulations on one technology or one platform will make that sector less competitive.

Technology policy inherently involves balancing perceived risks with potential benefits. Concerns associated with commercial remote sensing satellites need to be weighed against the growing role that geo-information is playing in our daily lives. Policies should also consider the opportunity costs associated with not collecting the information or realizing its full value. Laws and regulations that pertain to geo-information should be narrowly tailored and transparent, and such laws and regulations should be continuously reviewed and updated to reflect this changing technology landscape. Thank you, Mr. Chairman.

[The prepared statement of Mr. Pomfret follows:]

Written Testimony of Kevin Pomfret
House Subcommittee on Space
September 7, 2016

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.

Written Testimony of Kevin Pomfret
House Subcommittee on Space
September 7, 2016

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.

Written Testimony of Kevin Pomfret
House Subcommittee on Space
September 7, 2016

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.

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[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]

Written Testimony of Kevin Pomfret
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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]

Testimony of Kevin Pomfret
House Subcommittee on Space
September 7, 2016

Bio

Mr. Pomfret is the founder and Executive Director of the Centre for Spatial Law and Policy, a non-profit organization with a mission to educate the geospatial community on the policy and legal issues that impact the collection, use, storage and distribution of location and other types of geospatial information. Mr. Pomfret has given talks around the world on matters of spatial law and policy and writes regularly on issues of privacy, licensing, national security and liability issues and the use of geospatial technology in the courtroom. He is also a Partner at the Williams Mullen law firm and co-chair of both the firm's Unmanned Systems and the Cybersecurity & Data Protection practice groups. He advises businesses and governments on regulatory matters, licensing, privacy and data protection, information security and corporate transactions.
Mr. Pomfret is the principal author of the chapter on location privacy in the United States in Geographic Data and the Law: Defining New Challenges. Mr. Pomfret has been involved in geospatial technology for over 25 years, beginning his career as a satellite imagery analyst where he helped to develop imagery collection strategies to monitor arms control treaties and identify requirements for future collection systems. He is a member of the National Geospatial Advisory Committee (NGAC).

Chairman BABIN. Thank you, Mr. Pomfret, we appreciate that.

And our third witness today is Ms. Michele Weslander Quaid, who is founder and President of Sunesis Nexus LLC. Prior to founding her own company, she served as Google's Chief Technology Officer for the public sector, and Chief Innovation Evangelist. Before joining Google in 2011, Michele served in both industry and government. Her government service includes Deputy Technical Executive for the National Geospatial Intelligence Agency, Intelligence Community Deputy Chief Information Officer for the Director of National Intelligence, and Chief Technology Officer for the National Reconnaissance Office. She is also an ACCRES member. She earned a Bachelor of Science from Seattle Pacific University, a Master's Degree in Optics from the University of Rochester, and she is a graduate of Harvard University's Kennedy School of Government Program for Senior Managers in Government.

So we will give you five minutes, Ms. Quaid.

TESTIMONY OF MS. MICHELE R. WESLANDER QUAID, PRESIDENT, SUNESIS NEXUS LLC

Ms. WESLANDER QUAID. Thank you, Mr. Chairman, and Members of the Subcommittee. It's an honor to be here to speak with you today on this important topic of commercial remote sensing, and keeping America's leadership position in this area. Please refer to my written testimony for further details on my experience, but I want to highlight some specifics here.

In my last assignment in government, I served as the DNI, Director of National Intelligence, representative to the Secretary of Defense Intelligence, Surveillance, and Reconnaissance Task Force. We were focused on stability operations in Afghanistan, and around the globe, and something that really was driven home by that experience is the importance of information sharing—not only with the Commonwealth, not only with the Coalition, but with nontraditional partners, and those can include local citizens, private volunteers, and humanitarian organizations. Those people don't have clearances, and they need access to information in a geospatial context. So this geospatial information we're talking about form commercial satellites is critical to those type of operations.

So, as was mentioned, after my government service, I joined one of the most innovative companies in the world, Google. And one of the things I want to highlight on that environment is defaulting to trust, and empowering people to innovate, and make decisions, and affect positive change. Also highlight something, a default to share model, while also employing a security team that is second to none. And in that environment, how innovation could flourish, and the national security community would benefit from that type of model.

These experiences that I've had throughout my career have really shaped my perspective, and, again, more details are highlighted in my written testimony, and more details on several national security issues, but I want to highlight some themes. The only constant is change. Heraclitus said that in 500 B.C., and it's even more important today. The speed of change in the remote sensing industry is unprecedented. The U.S. Government must strive to make itself

a veritable Delaware for commercial remote sensing, attracting the top talent, and creating an environment in which they can innovate and flourish, and thereby enable U.S. to maintain a leadership role.

If we don't share together, we risk dying together. Commercial imagery, being open, can be freely shared. National technical means imagery, being from a classified source, and therefore classified, cannot be easily shared. It's rare these days that we are in a U.S. only operation. More often than not we find ourselves working with partners we have not previously worked with before, and embark on an endeavor with these partners where shared situational awareness is not only key to the success of the mission, but also critical to the safety of all involved. For example, counterterrorism operations and humanitarian assistance and disaster response operations, or HADR, require the ability to share information with the coalition of the day, which often includes those nontraditional partners I mentioned before. By sharing this information in a geospatial context, we can enable what I call unity of effort, without unity of command.

Imagery from commercial remote sensing is critical to these operations, whether in Afghanistan, or Haiti, or the United States. It's not just about pixels, it's about information services derived from the data. If you talk to most any of the big names in Silicon Valley, they cared so much about the imagery and the pixels. They care about the information services they can derive from that data, and constantly updating the services they provide, many of which become very critical, and we depend on in our lives today.

In addition, geo-referenced social media and news sources can provide valuable insight and additional context to an HADR scenario, as we saw following the 2010 earthquake in Haiti. Once again, commercial imagery provides critical, shareable context. Utilizing commercial remote sensing assets and automatic processing can be a huge competitive advantage. Commercial companies, like Google, have cybersecurity expertise, and can provide an ability to share data securely, and the government could benefit by harnessing commercial data and the automated processing to provide secure access to data information and expertise around the world. We collect massive amounts of data every day. But just because we collected it doesn't mean we're any smarter, because you can't do intelligence by osmosis. Someone has to look at the data, and we don't have enough human resources to do it, so we need to get the machines to do it, and tip the humans what to look at any given day, in any given hour.

If we don't take intelligent risks, we risk becoming irrelevant. In my experience, the biggest barriers to innovation are culture, policy, and technology, and most often culture is the biggest challenge. In the case of remote sensing, the government used to be the only game in town, and now others have entered the field. There is no way for the government to predict what could come next, or to keep pace, or to accurately judge the viability of commercial business model. Creating an overly burdensome regulatory environment and oversight policy that holds commercial innovation back until such time that the government can catch up or get comfortable with it is not reasonable or responsible use of authorities, and can have devastating consequences for the industrial base. The burden

should not be put on industry to justify why. The burden should be put on the government to justify why not. What has made this country great is our industrial base and intelligent risk taking.

There are completely new fields being invented, and we do not tend to see the same level of government regulation and oversight in those arenas as we have observed in the commercial remote sensing arena, yet some of these capabilities have become just as critical to our national security and our way of life. Government should empower, not compete, with industry. We're dealing with limited resources, so we must focus the resources government does have on things unique to its mission, and uniquely governmental, and leave the rest to industry.

The potential loss of our industrial base is a national security issue. U.S. policy articulates a very supportive environment for commercial satellite industry, and artificially constraining what U.S. commercial industry can build or sell handicaps them in the international marketplace, which is quickly being flooded with others who do not face the same restrictions. And the over-regulation, as is highlighted before, has led to the demise of commercial U.S. satellite ventures in the past. So leadership has set the vision in NSPD 27, PPD 4, and the 2011 National Security Space Policy. Now we must implement that vision.

So, in conclusion, we cannot lose sight of the characteristics that have made the U.S. a global leader, and that includes courage, intelligent risk taking, and innovation. Our world is changing at an unprecedented pace, and we must allow our industry to keep pace and be agile and adaptive, so our regulatory environment must enable them to do so, and not thwart the very characteristics that have enabled the U.S. to enjoy a leadership position. Thank you for your time and attention, and I'm happy to answer questions.

[The prepared statement of Ms. Weslander Quaid follows:]

Prepared Statement of Michele R. Weslander Quaid,

Founder & President, Sunesis Nexus LLC, and

Member of NOAA's Federal Advisory Committee on Commercial Remote Sensing (ACCRES)

for the U.S. House of Representatives,

Committee on Science, Space, and Technology,

Subcommittee on Space,

"Commercial Remote Sensing: Facilitating Innovation and Leadership"

7 September 2016

Mr. Chairman and Members of the Subcommittee, thank you for providing an opportunity to discuss the strategically important topic of US commercial remote sensing, and how we can facilitate innovation and US leadership in this sector through our policy and decision-making processes.

Professional Experience and Context

The views that I express here are my own, and based on nearly 25 years of experience in the remote sensing industry. My Bachelor's degree is in Physics and Engineering Science (double major) from Seattle Pacific University, and my Masters Degree is in Optics from the University of Rochester. Since the start of my career in 1992, I have been involved in remote sensing.

While still in graduate school, I was recruited to work in industry on a government program initializing satellite payloads, working anomaly resolution, and optimizing image processing and image products. Throughout the next decade, I worked with multiple sensor types and helped to create new products for use by analysts, decision makers, and warfighters. In addition, I focused on providing analysts and engineers better access to data, information, and expertise, by creating a distributed architecture and utilizing the Internet and World Wide Web. Pre-9/11/2001, I collaborated with colleagues across the national security community to promote information sharing across intelligence disciplines to better enable situational awareness. Furthermore, I participated in various military exercises focused on how to provide critical information in a timely manner to enable decision making -- what those in the national security business would call "actionable intelligence." What is foundational to all of this intelligence is geospatial information, for it provides critical context.

Post-9/11/2001, I was recruited from industry into government to lead innovation and organizational transformation, and served as a senior executive in both Defense and Intelligence. Initially, I served as the Deputy Technical Executive of the National-Geospatial Intelligence Agency (NGA), focused on multi-INT integration, to include better collaboration between NGA and the National Security Agency (NSA) -- America's Eyes and Ears -- from tasking and collection all the way to analysis and production. This required significant cultural changes and a paradigm shift in order to combine these resources to provide a more holistic view of what was occurring at any given time in any area of the world, in order to aid in policy development and decision making. In every case, geospatial information served as the foundation layer, and provided critical context to enhance situational awareness. During my visits "down range" to the combat zones in Iraq and Afghanistan, I saw first hand the value of providing integrated products in a timely manner to better inform combatant commanders and special operations forces, and the importance of having that data at a level that could be shared with Commonwealth (5-eyes) and

Coalition partners. While in Afghanistan, I worked with one of the commercial imagery providers, Digital Globe, to provide commercial imagery data directly from their archive within minutes of time over target, which proved to be invaluable for both mission planning and operations. National Technical Means (NTM) imagery can provide great insight to the analysts in the intelligence cell, but the operators cannot take NTM imagery with them on a mission because it is classified. Upon my return to the Washington DC Metro area, I used this insight and those mission imperatives to affect necessary change.

When the new Director of National Intelligence was established, I was asked to serve the first Deputy Chief Information Officer for the Intelligence Community. There I applied my technical expertise and operational experience to affect changes in policy to better enable modern operations, as much of the policy we were dealing with was over 50 years old, written for a different era, and crafted long before the advent of modern technology and the Internet. In addition, I served on the Special Access Program (SAP) review board, where we assessed all programs that were SAP or wished to be SAP, and either granted or denied approval. Following that assignment, I went "back to my roots" and served as the Chief Technology Officer of the National Reconnaissance Office (NRO), helping to lead one of the biggest transformations the agency had seen in over 15 years, with a focus on creating an integrated ground architecture that enabled the processing of data from various sources (classified and unclassified) and afforded timely access to that information to intelligence analysts around the world. In my last government assignment, I served as the DNI's senior representative to the Secretary of Defense's Intelligence Surveillance and Reconnaissance (ISR) Task Force, focused on stability operations in Afghanistan and around the globe. One of the most critical aspects of successful stability operations is information sharing for shared situational awareness -- not only with traditional partners, but also with "non-traditional" partners. For the US government, non-traditional partners are those who are not in established coalitions (e.g. NATO), but those who comprise "the coalition of the day." Members of such coalitions can include local citizens, private volunteers, and humanitarian organizations.

This experience compelled me to make a move to one of the most innovative companies on the planet -- one whose founders' mantra is to have a "healthy disregard for the impossible." It is an amazing experience to be surrounded by fellow innovators in an environment that liberates and empowers people to create, innovate, and affect positive change. After spending nearly two decades in the national security community, I was impressed with Google's "default to share" model, while employing a security team that is second to none. It reinforced an intrinsic belief I have had that there is a difference between classified and secure, and most people do not really want classifed information -- they want secure information sharing. Commercial industry can provide a high level of security for sensitive data, and liberate non-classified data from the increasingly complex national security apparatus. This means that the government too can harness the power of

commercial data combined with the commercial cloud to take its business to a whole new level, be more efficient and effective, and provide secure access to data, information, and expertise in a timely manner around the world.

Last year, I founded Sunesis Nexus LLC, and am consulting with a broad range of both US and International customers on various topics to include remote sensing. In addition, I co-founded Global Nexus Alliance, a nonprofit organization that seeks to apply open source technologies such as commercial remote sensing in the humanitarian sector to support their operations.

Since 2012, I have been a member of the Advisory Committee on Commercial Remote Sensing (ACCRES), which was created by the Secretary of Commerce to advise NOAA on matters related to the US commercial remote sensing industry, including regulatory responsibilities.

Personal Perspective

"The only constant is change." - Heraclitus
That statement was true in 500 B.C. and is even more true today. The speed of change in the remote sensing industry is unprecedented. To use an analogy, the US Government must strive to make itself the "Deleware" of the international remote sensing industry, by attracting the top innovators and creating an environment in which they can flourish and be competitive in the global markets, and thereby enable the US to maintain a leadership role in this sector.

We must be careful what we label as "intelligence," because once something is labeled "intelligence," we limit the users and the uses.
In the 20th century, the primary source of remote sensing information was government or military assets. That is not the case today. In the 21st century, we have companies building a wide range of remote sensing assets, from the traditional large satellite "bus in the sky" to microsat "box in the sky." Because the national security community was first in this arena, their default posture often seems to be to view commercial remote sensing innovation as a threat, and to consider any new capability as classified, or at least the aggregate of capabilities as classified. At this point, we must remember that unclassified or non-classified information in the aggregate, while it may be sensitive, is still unclassified. The national security community has a tendency to classify any open source information of interest and to label it as intelligence, when in fact, it is not. This has huge ramifications for people with boots on the ground conducting operations. In too many instances, information that comes from a Commonwealth (5-eyes) source, when brought into the national security apparatus gets labeled NOFORN, and then cannot not be shared with the very Commonwealth partner that provided the information. In other instances, information that

is gathered in an open environment is loaded on JWICS, because that is the default system for the analysts, and immediately gets labeled TS/SCI, even though the source is not classified and the data is not classified. This mindset and procedural issue is affecting the perspective of the national security community with regard to commercial assets. It also limits the data and information that can be used in operations around the world. This is the reason why Central Command (CENTCOM), during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), sought to change policy and analyst practices and get them to default to writing reports at the lowest level possible, and only then move to higher systems to provide additional context from classified sources. This paradigm and procedural shift was necessary to enable reporting to get into the hands of people who needed it, most of whom did not have access to classified systems.

If we don't share together, we risk dying together.
Commercial imagery, being open and free of classification, can be freely shared. National Technical Means (NTM) data, having come from a classified source, is labeled as classified and, as such, cannot be freely shared. It is rare these days that we would do a U.S.-only operation. More often than not, we find we must work with partners that we have not previously worked with before. We do not have classified data sharing arrangements with these partners, and we do not necessarily have the level of trust we would require in order to share classified data. Yet, we are embarking on an endeavor with these partners where shared situational awareness is not only key to the success of the mission, but critical to the safety of all involved.

For example, Counter-Terrorism operations, and Humanitarian Assistance and Disaster Response (HADR) operations, require the ability to share timely information with the "coalition of the day," which often includes "non-traditional" partners. By sharing this information in a geospatial context, we enable what I call "Unity of Effort without Unity of Command." Imagery from commercial remote sensing assets is critical to these operations, whether in Afghanistan or Haiti or the United States. Furthermore, commercial remote sensing assets can tip and cue NTM assets.

It's not just about pixels; it's about information services derived from the data.
If you talk to most any of the big names in Silicon Valley to include Google, Amazon, and Facebook, they are not as interested in the pixels from the imagery as they are with the data that can be derived from it and the information services that it enables. They use the data to constantly refresh base maps, update roads, enable more precise geolocation and navigation services (e.g., GPS, Google Maps), etc. They understand the need to continually improve in order to stay on the leading edge. Given the volume of data collected from commercial sources each day, the government could be perpetually updating their base maps and digital terrain maps, rather than scheduling the updates every so many years. Furthermore, with the underlying base imagery and elevation data being constantly

updated, a customer could create a tailored map product at any time from the commercially sourced data, and share it as needed -- whether they are engaged in a battle against enemy forces, or are in a race for time to find and aid survivors following a natural disaster. A combatant commander should never again have to fight a war "at the intersection of 4 different map points." In addition, georeferenced social media and news sources can provide valuable insight and additional context in a HADR scenario, as we saw following the 2010 Haiti earthquake. Once again, commercial imagery provides critical, sharable context.

Utilizing commercial remote sensing assets and automated processing can be a huge competitive advantage. We collect mass amounts of data every day, but just because we collected it, does not mean we are any smarter. You cannot do intelligence by osmosis. Someone has to look at the data, and there are not enough humans to do it, so we need machines to do it and then tip the humans as to what to look at on any given day at any given time. Once again, data derived from commercial remote sensing sources, continually processed and analyzed, can provide critical insight not otherwise seen if you are only imaging at 10am and 2pm every day.

If we don't take intelligent risks, we risk becoming irrelevant.

In my experience, the biggest barriers to innovation are culture, policy, and technology. By far, the biggest challenge is most always cultural. In case of remote sensing, the government used to be the only game in town. Over time, others have entered the field. Some have chosen to essentially replicate the government business model. Others have entered with radically new and innovative business models. There is no way for the government to predict what could come next or to keep pace, or to accurately judge the validity of a commercial business model. Creating an overly burdensome regulatory environment and oversight policy that holds commercial innovation back until such time that the government can catch up or get comfortable with it is not a reasonable or responsible use of authorities, and can have devastating consequences for the industrial base. The burden of proof should always be on the government to make the case for "why not." The burden should not be put on industry to make the case for "why." What has made this country great is our industrial base, and intelligent risk taking -- not being limited by how things are today, but imagining how they could be and making it so. There are so many things that someone outside of government dreamed up and made a reality that we now consider indispensable parts of our lives today. There are completely new fields being invented, and we do not tend to see the same level of government regulation and oversight in those arenas as we have observed in the commercial remote sensing arena, yet some of the capabilities have become just as critical to our national security and our way of life. Is it perhaps because the government was not there first, and therefore is not clinging to its perceived leadership role, using its authorities to keep all of the other "new comers" to the field in check?

Government should empower, not compete with, industry.
As was the case when I was in government, we are dealing with limited resources. Our national debt is a tremendous risk to our national security and we cannot increase spending, so we must focus the resources the government does have on things that are unique to its mission and are uniquely governmental, and leave the rest to industry. In the case of remote sensing satellites, there was a time when the government was the only source, but that is far from the case today. If commercial industry or academia can do it, let them, and then focus limited government resources on capabilities that the government needs that are not already found elsewhere. Before embarking on a new program, the government should first look at what is available in commercial industry, and then determine what complementary capabilities it needs that are presently lacking in the commercial space. By doing so, they can save the taxpayers money, while also enjoying a more robust capability by utilizing what others have already built. A great example of this is In-Q-Tel, which funded a technology called Keyhole that became Google Earth.

The government should explore alternatives to the government owned / government operated (GOGO) model. For example, the government could establish service level agreements (SLAs) with other providers, and give some thought to using its funding for other missions and not replicate what is already available by other means.

Take for example LANDSAT and the European Space Agency (ESA) Copernicus Program Sentinel Satellites. The ESA Sentinel constellation over satisfies the majority of the Landsat Data Continuity Requirements. The US government could work a data exchange agreement between the EU and US to provide Sentinel-2 capabilities to the LANDSAT Community. By utilizing the ESA capabilities, such as Sentinel-2, NASA could focus its limited resources on capabilities it needs that are presently not a part of the ESA's constellation, e.g., Thermal IR.

Consider high resolution electro-optical imagery. Two producers of high resolution imagery are DigitalGlobe and Airbus Defense and Space. Together, they have more than 2 billion square kilometers (sqkm) of coverage capacity per year, with 0.5m GSD panchromatic and up to 8 bands of 2.0m GSD visible and near-infrared. That is a vast amount of data that the US government can utilize to fulfill its mission and provide resiliency.

The potential loss of our industrial base is a national security issue.
US policy articulates a very supportive environment for commercial satellite industry. In reality, historical regulations and oversight have not supported the intent of that policy. Artificially constraining what US commercial industry can build and/or sell handicaps them in the international marketplace, which is quickly being flooded with others who want to play in this space and face less restriction to do so.

Over-regulation has led to the demise of US commercial satellite ventures in the past. For example, prior to October 2015, US licensing policy applied more stringent controls on operation and dissemination of synthetic aperture radar (SAR) systems and data than on optical systems. US Policy is particularly stringent on the handling of "phase history data," which is the raw data collected by the satellite and is most valuable for the advanced interpretation of image data. These restrictive data dissemination policies are a major reason why no US firm has been able to effectively enter the global SAR market to date.

One of the key goals articulated in the 2006 National Space Policy is to, "Enable a dynamic, globally competitive domestic commercial space sector in order to promote innovation, strengthen US leadership, and protect national, homeland and economic security." Sadly, the US is not leading with regard to space-based commercial radar imaging systems, due to over-regulation. Although the US government granted a 1 meter resolution radar-imaging license in 1998, the licensee was not authorized to sell better than 5 meter resolution imagery. Then in 2000, the US government granted another 1 meter resolution radar-imaging license, but the licensee was not authorized to sell better than 3 meter resolution imagery. The reality both faced is that the utility of 5m and 3m SAR imagery is limited, which restricts the commercial viability of this arrangement. Meanwhile, non-US commercial SAR providers significantly improved their capabilities and, in 2007, both Germany and Italy launched SAR satellites with better than 1 meter capability. It is safe to assume that other, less transparent, governments may do the same in the future.

History of US Commercial SAR Policy (timeline)

- 1997: Former Sen. Dennis DeConcini noted, "No U.S. Company has been licensed to sell high resolution radar imagery." Noting that 12 U.S. companies had been granted licenses since 1992, but none for radar, he argued, "if Commerce does not license a radar satellite system, then a foreign owned radar system, with a one meter or less capability, will enter the market leaving the U.S. government with no effective control in this area."
- 1997: DoD opposes commercial sale of radar satellite imagery better than 5-meter resolution, due to national security.
- May 1998: Former Sen. Tom Daschle wrote to the Pentagon noting, "If currently proposed restrictions on U.S. commercial remote sensing satellites are not revised, the capabilities of foreign SAR systems will quickly exceed those of the United States."
- June-November 1998: A U.S. company (Space Radar Corporation) obtains a license to operate a 1-meter resolution commercial radar satellite, but data sold could not be better than 5-meters.

- November 2000: A second U.S. company (Ball Aerospace and Technologies) obtains a license to operate a commercial radar satellite, but resolution restrictions apply. Three-meter resolution imagery eventually is allowed for sale.
- 2004-2005: The Government considers, but does not issue a 1-meter commercial radar satellite license.
- June-December 2007: Germany's TerraSAR-X and Italy's COSMO-Skymed 1 are launched with better than 1-meter capability.
- October 2009: Department of Commerce authorizes commercial sale of 1-meter resolution radar imagery to Northrop Grumman.
- October 2015: XpressSAR, Inc. receives the only license for sub-meter resolution to date.

[reference: http://apogeospatial.com/commercial-sar-comes-to-the-u-s-finally/]

Leadership has set the vision. Now we must implement it.
National Security Presidential Directive (NSPD) 27 [dated 2003] states that it is the policy of the United States to advance and protect national security interests by maintaining leadership in remote sensing and sustaining the US remote sensing industry.

Presidential Policy Directive (PDD) 4 [dated 2010] states that the United States is committed to growth of a US commercial space sector.

The 2011 National Security Space Strategy states that the United States should rely upon proven commercial capabilities to the maximum extent practicable.

These documents create the framework for a less restrictive regulatory environment that would better support US innovation and leadership in the remote sensing sector.

Conclusion

In summary, we cannot lose sight of the characteristics that have made the US a global leader in so many aspects, and those include courage, intelligent risk taking, and innovation. We see things not as they are, but as they could be, and make them so. We dare to try things no one else has tried, and go places that no one else has gone before. To quote President Kennedy in the race to the Moon, "We choose to... do [these and] other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone." Our world is changing at an unprecedented pace. Our industries must keep pace, and remain agile and adaptive. Our regulatory environment must enable them to do so, and not thwart the very characteristics that have made us great and enabled the US to enjoy a global leadership position.

Michele R. Weslander Quaid

Michele is the Founder and President of Sunesis Nexus LLC, an independent consulting company, and the Co-Founder, President and Chief Executive Officer of Global Nexus Alliance, a nonprofit humanitarian organization. Her career has been at the nexus of National Security, Domestic and Foreign Policy, and Technology. Michele is a gifted communicator and consults globally with both the public and private sectors, utilizing her experience and expertise in executive leadership, strategic planning, coalition building, technology, innovation, leading change, organizational transformation and operations.

Most recently, Michele served as Google's Chief Technology Officer for the Public Sector and Chief Innovation Evangelist. Prior to joining Google in 2011, she served in both industry and government, collaborating with talented people of diverse backgrounds and cultures, from corporate boardrooms to combat zones. She started her career as an image scientist and systems engineer, where her innovative technology applications proved to be prescient solutions for operational needs, and she soon became the youngest chief engineer in the history of her company. Post-9/11/2001, Michele was recruited into public service to lead change, innovation, and organizational transformation, and became one of the youngest people ever sworn in as a senior executive in the US Government. As a government official, she led the cultural and technical integration of the national security community, establishing and serving in senior leadership positions to include: Deputy Technical Executive for the National Geospatial-Intelligence Agency; Intelligence Community Deputy Chief Information Officer for the Director of National Intelligence; Chief Technology Officer for the National Reconnaissance Office; and, the DNI's senior representative to the Secretary of Defense's Intelligence - Surveillance - Reconnaissance (ISR) Task Force leading information sharing and collaboration initiatives in support of global coalition stability operations. Michele's perspicacious leadership -- both in industry and government -- has had a lasting positive impact on the US and it's Allies, and her support of the troops both at home and abroad earned her the call sign "Warrior Goddess."

Honors and awards Michele has received include:

- National Intelligence Meritorious Unit Citation (2001)
- National Geospatial-Intelligence Agency Meritorious Civilian Service Medal (2005)
- Seattle Pacific University Medallion Award (2014)
- "DC's Top 50 Women in Tech" (*FedScoop*, 2014)
- "Power 100" list of influencers (*Washington Life*, 2014)
- "The 7 Most Powerful Women to Watch" (*Entrepreneur Magazine*, 2014)

Michele earned a B.S. in Physics and Engineering Science with honors from Seattle Pacific University, and a M.S. in Optics from the University of Rochester. She is a graduate of Harvard University's Kennedy School of Government program for Senior Managers in Government, and a Chairman of the Joint Chiefs of Staff CAPSTONE Fellow.

In addition to advising high level leaders in both the public and private sectors, Michele serves on various commercial and non-profit Board of Directors and Strategic Advisory Boards. Her non-profit roles include: DigitalGlobe Foundation Board of Directors; National Oceanic and Atmospheric Administration's Advisory Committee for Commercial Remote Sensing; DHS Blue Ribbon Panel (cyber security); AFCEA Intelligence Committee; University of Rochester Hajim School of Engineering and Applied Science Dean's Visiting Committee; Naval Aviation Museum Foundation and National Flight Academy Board of Trustees; Mid-Atlantic Girls Collaborative (MAGiC) Project Champion's Board. She is active in Science, Technology, Engineering, and Math (STEM) and leadership outreach for students in K-12 and at universities.

Chairman BABIN. Thank you, Ms. Quaid. We appreciate that very much.

Our fourth witness is Mr. Michael Dodge, Assistant Professor and Graduate Program Director in the Department of Space Studies at the University of North Dakota. At the University of North Dakota he teaches courses that include Space Law, History of the Space Age, Space Politics and Policy, and Remote Sensing Law and Regulation. He's also an editor of the Journal of Space Law. He received his J.D. from the University of Mississippi School of Law, and his LLM in Air and Space Law at McGill Faculty of Law in Montreal, Canada.

So we give you five minutes, Mr. Dodge. Thank you.

TESTIMONY OF MR. MICHAEL DODGE,
ASSISTANT PROFESSOR,
DEPARTMENT OF SPACE STUDIES,
UNIVERSITY OF NORTH DAKOTA

Mr. DODGE. Thank you, Mr. Chairman, and Members of the Committee. I'd like to thank you for inviting me to participate in the hearing today, and it's a privilege to be invited, so I'm happy some thoughts on this timely topic.

For the most part, extent commercial remote sensing law and regulation has served the United States and its commercial interests quite well. However, the current system is no longer ideal for either the federal government or industry, and changes to the nature of technology and business over the years, since the Land Remote Sensing Policy Act of 1992, have generated new opportunities that can be successfully exploited with regulation that more fully conforms to the spirit of the national space policy, as well as NSPD 27, more commonly known as the U.S. Commercial Remote Sensing Policy.

Indeed, the laws and regulations respecting space-based private remote sensing systems stand ready for change. Because, although generally effective in supporting the needs of both the Federal Government and the industry, they nevertheless often cause unintended negative consequences for industry participants. In particular, complaints have been lodged that the system, in its current instantiation, has caused unnecessary obstruction in the licensing of certain data, and even substantial delays in action on applications for the sale of data that can exceed statutory and regulatory limits.

If Congress chooses to act with respect to this issue, there are a few mechanisms that can be utilized to ameliorate the current situation. Congress can, for instance, change the policy behind the law in an effort to better align the system. It can also choose to change the regulatory structure by modifying the statute governing private remote sensing systems. And, as has been called for by some in the industry, better enforcement of extent standards could help relieve some of the pressure facing private entities seeking licensure and governmental permission to sell data and imagery.

Possible changes could be done either by replacing the 1992 act with a modern incarnation that better reflects the needs and interests of all the interested parties, or it could be done with clarifying amendments. If replacing the law wholesale proves too far for cur-

rent Congressional interest, the current system can still be improved with surgical statutory modifications that lead to refined regulations, renovating where necessary to assist with concerns such as more rapid response to license applications, as well as reforming, and, when possible, speeding the process of inter-agency review of matters that require input from the Departments of Defense or State.

Recent legislative efforts have reinforced the notion that the role of government should adapt to benefit the needs of the private remote sensing industry. As an example, Title III of the U.S. Commercial Space Launch Competitiveness Act requires the Office of Space Commerce to foster the conditions for the economic advancement of the United States Space Commerce industry. Indeed, this provision helps to demonstrate the need for legal and regulatory clarity vis-a-vis commercial remote sensing. Moreover, this provision lends credence to utilizing clearer, consistently applied regulatory work for commercial interests.

This philosophy is supported by United States policy, including the National Space Policy as espoused by the Executive Branch, and the U.S. Commercial Remote Sensing Policy, which note that the success of the commercial remote sensing industry is not only desirable, but closely linked with increased national needs, including strengthening United States national security. It should be emphasized that, in most instances, there need not be friction between promoting commercial success and protecting national security and that the two can and often do complement one another.

Finally, clarity, be it in regulatory reform or by modification of the 1992 Act, helps the United States to fulfill its longstanding public international law obligations under certain key provisions of the Outer Space Treaty. In particular, Article VI requires authorization and supervision of the State Party to the treaty for all of its non-governmental entities acting in space. In the current system, licensing can serve as the requisite authorization. Knowing when to license and, in colloquial terms, changing the presumption of licensing new technologies and available data resolutions to yes, rather than we will see, will both promote the success of an industry struggling to keep up or, in some cases, catch up, with international competitors, as well as provide a clear statement to the international community that the United States intends to continue following its Article VI obligations through a more consistent and transparent process.

I thank the Committee for allowing me to speak at this hearing, and I am happy to answer questions as needed. Thank you.

[The prepared statement of Mr. Dodge follows:]

Written Testimony of

Michael Steven Dodge, before the

Committee on Science, Space, and Technology, Subcommittee on Space, of the United States House of Representatives

September 7, 2016

Chairman Smith, Subcommittee Chairman Babin, Ranking Member Edwards, and Members of the Subcommittee: I'd like to thank you for inviting me to participate in the hearing on "Commercial Remote Sensing: Facilitating Innovation and Leadership". It is an honor to be invited, and I offer some thoughts on this timely topic in my testimony below.

On the state of remote sensing law & policy:

The purpose of this hearing is to examine the space-based remote sensing industry in the United States, including scientific and technological developments, as well as current remote sensing applications. The hearing is to examine these issues with a view towards the current law and regulation governing private remote sensing systems, and will investigate whether changes to law or regulation are warranted. To this discussion, I am pleased to comment on the role of policy, regulation, and law in enhancing the success of the United States remote sensing industry.

Extant commercial remote sensing law and regulation has served the United States, and its commercial interests, quite well. However, the current system is no longer ideal for either the Federal Government or industry, and changes to the nature of technology and business over the years since the Land Remote Sensing Policy Act of 1992 have generated new opportunities that can be successfully exploited with regulation that more fully conforms to the spirit of the

National Space Policy, as well as NSPD-27—more commonly known as the U.S. Commercial Remote Sensing Policy.[1] Indeed, the laws or regulations respecting space-based private remote sensing systems stand ready for change, because, although generally effective in supporting the needs of both the Federal Government and the industry, they nevertheless often cause unintended negative consequences for industry participants. In particular, complaints have been lodged that the system, in its current instantiation, has caused unnecessary obstruction in licensing of certain data, such as sub-meter resolution imagery, and even substantial delays in action on applications for the sale of data.[2]

Possible change to the current legal status is no cause for consternation. Indeed, there is a strong, thoughtful, and growing history of law, regulation, and policy governing private remote sensing in the United States. To that end, if changes to the law or regulations are deemed necessary, they will likely respect the extant system, evolving in ways beneficial to both the United States Government, as well as the private entities engaged in the remote sensing industry. The current policy and legal structures provide ample room for changes to be made that reflect the realities of the modern remote sensing industry, and I believe that should modifications to the current system be crafted—in law or regulation—they can emerge from current structures.

The Land Remote Sensing Act of 1992 is itself a reflection of congressional efforts at identifying the appropriate roles for government and industry alike, with its ancestry including the 1984 Land Remote Sensing Commercialization Act.[3] Congress demonstrated sensitivity to the realities of the commercial market in replacing the 1984 Act with the 1992 law, and,

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[1] U.S. Commercial Remote Sensing Policy, *available at* http://www.nesdis.noaa.gov/CRSRA/files/Commercial%20Remote%20Sensing%20Policy%202003.pdf

[2] Letter from Brian Babin, Chairman, Subcommittee on Space, Committee on Science, Space, and Technology to Penny Pritzker, Secretary, U.S. Department of Commerce (June 6, 2016) (on file with author); *e.g.*, the multi-year delay in according a decision to DigitalGlobe on their desire to sell high definition infrared imagery data from the shortwave infrared sensor (SWIR) on its Worldview-3 satellite.

[3] Land Remote Sensing Act of 1992, Pub. Law No. 98-365, 98 Stat. 451 (1984).

arguably, the time may have come to revise current statutes once again. This could be done either by replacing the 1992 Act with a modern incarnation that better reflects the needs and interests of all the interested parties, or it could be done with clarifying amendments. If this solution proves too far for current congressional interest, the current system can still be improved with attention to the regulations in 15 CFR Part 960, renovating, where necessary, to assist with concerns such as more rapid response to license applications[4], as well as reforming and, when possible, speeding the process of inter-agency review of matters that require input from the Department of Defense or the Department of State under 51 USC § 60147(a) & (b-1). No matter what changes are proposed, the Departments of Defense and State should maintain their consultative role with the Department of Commerce, in no small part because of the reliance by the United States Government on privately acquired remote sensing data, as well as the continued truism that the United States is one State among many—and thereby bound by its international obligations. The role of these agencies remains clear, although the process can potentially slow down industry efforts.

Another welcome change to current regulation would be in more effective enforcement of standards already in place. For instance, one recent example of regulatory disappointment is NOAA's substantial delay in deciding on whether DigitalGlobe should be allowed to sell high-resolution infrared data obtained from the WorldView-3 satellite. This application has been outstanding for more than three years, despite both statutory[5] and regulatory[6] requirements that, at the very least, require a decision by the Secretary within 120 days—or at least an explanation to the applicant of any issues surrounding the application that require addressing. While an

[4] 15 C.F.R. § 960.6.
[5] 51 U.S.C. § 60121(c).
[6] 15 C.F.R. § 960.6(a).

exceptional example, this nevertheless demonstrates that the current regulatory scheme can result in lengthy (and, for the private entity, potentially costly) delays that surely do not align with the intent of law or policy[7].

Recent legislative efforts have reinforced the notion that the role of government should adapt to benefit the needs of the private remote sensing industry. As an example, Title III of the U.S. Commercial Space Launch Competitiveness Act requires the Office of Space Commerce foster the "conditions for the economic advancement of the United States space commerce industry"[8]; indeed, this provision helps to demonstrate the need for legal and regulatory clarity vis-à-vis commercial remote sensing. Moreover, the provision lends credence to utilizing clearer, consistently applied regulatory work for commercial interests. This philosophy is supported by United States policy, including the National Space Policy[9] as espoused by the Executive Branch and the U.S. Commercial Remote Sensing Policy, which note that the success of the commercial remote sensing industry is not only desirable, but closely linked with increased national needs—including strengthening United States national security. It should be emphasized that, in most instances, there need not be friction between promoting commercial success and protecting national security, and that the two can and often do complement one another.

Yet another concern that could be mitigated by congressional action is in maintaining a technological and economic edge over foreign competitors. United States policy is to maintain the most advanced and effective commercially produced remote sensing systems available, and

[7] The U.S. Commercial Remote Sensing Policy states, as a policy goal, that the United States Government will "provide a timely and responsive regulatory environment for licensing the operations and exports of commercial remote sensing systems."
[8] U.S. Commercial Space Launch Competitiveness Act, Pub. L. 114-90, 129 Stat. 704 (2015).
[9] National Space Policy, *available at* https://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf (Principles: "A robust and competitive commercial space sector is vital to continued progress in space."

yet much has been made of foreign systems absorbing a sizeable share of the market in recent years.[10] Increasing the responsiveness of the regulatory machinery may provide partial redress to this limitation, which in turn could provide greater opportunity for U.S. private remote sensing entities to compete more effectively with foreign companies.

Finally, clarity, be it in regulatory reform, or by modification of the 1992 Act, helps the United States to fulfil its longstanding public international law obligations under certain key provisions of the Outer Space Treaty. In particular, Art. VI requires authorization and supervision of the State Party to the treaty for all its non-governmental entities acting in space. In the current system, licensing can serve as the requisite authorization. Knowing when to license, and, in colloquial terms, changing the presumption of licensing new technologies and available data resolutions to "yes", rather than "we will see", will both promote the success of an industry struggling to keep up or, in some cases, catch up, with international competitors, as well as provide a clear statement to the international community that the United States intends to continue following its Article VI obligations through a more consistent and transparent process. This does not mean that the Departments of Defense and State should no longer be involved, but rather that the presumption should be in favor of allowing industry to develop and utilize novel and increasingly useful technologies that have, at times, been stymied by current regulation.

In conclusion, Congress has often acted early and efficiently to maintain United States leadership in private remote sensing, whether by codification or regulatory effort. Both domestically and internationally, developments in technology and the global economy have continued to morph since the passage of the Land Remote Sensing Act of 1992. If Congress chooses to act on updating or clarifying the law or regulations, it should do so with an eye

[10] Mike Gruss, *House Panel wants answers on DigitalGlobe Licensure Delay*, http://spacenews.com/house-panel-wants-answers-on-digitalglobe-licensure-delay/.

towards maintaining its close relationship with the private remote sensing industry, as proposed by the U.S. Commercial Remote Sensing Policy.[11] Certitude with respect to requirements for licensing and operation should be the benefit of any changes to come, and would serve to assist both the private industry and the Federal Government. Further, continued attention to and revision of the current regulatory regime will serve to reinforce international perception that the United States is maintaining its obligations under international law—most especially the Outer Space Treaty's Article VI.

[11] U.S. Commercial Remote Sensing Policy Sec. II "In support of this goal, the United States Government will...Develop long-term, sustainable relationship between the United States Government and the U.S. commercial remote sensing space industry."

Michael S. Dodge currently serves as an Assistant Professor & Graduate Program Director in the Department of Space Studies at the University of North Dakota. Prof. Dodge obtained his J.D. from the University of Mississippi School of Law (2008), and his LL.M. in Air & Space Law at McGill Faculty of Law in Montreal, Canada, where he wrote a thesis on "Global Navigation Satellite Systems (GNSS) and the GPS-Galileo Agreement". Prof. Dodge is formerly Research Counsel & Instructor in the LL.M. in Air & Space Law Program at the University of Mississippi School of Law, where he taught courses in aviation law, remote sensing law and regulation, as well as domestic and international space law. At the University of North Dakota, he teaches courses that include space law, history of the space age, space politics & policy, and remote sensing law & regulation. He is also an Editor of the Journal of Space Law. His research interests include the environmental management of outer space, global navigation satellite systems, the concept of sovereignty and ownership rights in space, and the law and regulation of remote sensing technologies.

Chairman BABIN. Thank you very much, Mr. Dodge. And our final witness today is Ms. Joanne Gabrynowicz, Professor Emerita at the University of Mississippi, School of Law. Mrs. Gabrynowicz is the Director Emerita of the National Center for Remote Sensing Air and Space Law at the University of Mississippi's Law Center and Editor-in-Chief Emerita of the Journal of Space Law. Mrs. Gabrynowicz has taught space law for 28 years and lectures at various universities including the University of Vienna and the Beijing Institute of Technology. She received her BA from Hunter College and a JD from Yeshiva University, Cardozo School of Law. I now recognize Mrs. Gabrynowicz for five minutes.

TESTIMONY OF MS. JOANNE GABRYNOWICZ,
PROFESSOR EMERITA,
UNIVERSITY OF MISSISSIPPI SCHOOL OF LAW

Ms. GABRYNOWICZ. Thank you, Mr. Chairman, and Committee Members for this opportunity to be here today. The entire text of my testimony has been submitted for the record. I will address four points. The first, a key question to be considered is whether federal grants, contracts, or subsidies will be used to facilitate new national remote sensing legislation. And if so, what is the policy the funds are intended to enable?

In approximately one decade as military and intelligence space imaging requirements changed, the commercial remote sensing satellite industry decreased from three companies to one. The remaining company continues to operate due to its continuing NGA contract. After years of exchanging funds, contracts, products, and services, there is not a sustained long-term U.S. commercial satellite space-based industry. A single entity exists because of military funding, not because of an independent market.

The NGA has announced a new commercial strategy that plans to use emerging technologies. Therefore, the question going forward is, will the previous cycle be repeated but with newer technologies? That is, an infusion of military funds into a few companies whose overwhelming focus must be to meet mission needs, followed by industry reorganization catalyzed by change in requirements, followed by a winnowing of companies that will be likely rendered technologically less relevant in the face of the next new technology.

Going forward, it ought to be clear whether Congressional intention is to facilitate a true commercial information industry with a vibrant market or a dedicated capability dependent on military funds. The possibility of repeating the cycle requires consideration of two concepts: first, what constitutes commercial, and second, what should be done by the public sector and what should be done by the private sector. And I refer you to my written testimony for a full discussion.

The second point is the global commercial remote sensing legal landscape. U.S. remote sensing law is the apparent standard for remote sensing law around the world. Changes in U.S. law will be closely observed by other remote sensing nations. It should be expected that in some cases changes made in U.S. law will be adopted by other nations. In addition to the U.S., there are currently 22 nations that have remote sensing laws and policies. The prolifera-

tion of remote sensing legislation was in response to the commercialization of high-resolution data.

Some laws are more restrictive than U.S. law. In Canada, government satellites require licenses. That would be analogous to NASA or the Defense Department having to get a license for their satellites. In Germany, a satellite operator can be subject to criminal sanctions if it finds out that data distributed got in the hands of entitles that were adverse to Germany's national interests. The U.S. only has civil sanctions.

Third, two important policies. The first one is the non-discriminatory access policy created by the United States and adopted twice by this Congress. The second time it was adopted by this Congress, the committee said, "The Committee refrained from making any changes in the policy. Specifically the Committee is reluctant to take any action which might revive the debate in the United Nations about the legitimacy of remote sensing without prior consent. It is in the U.S. national interest to ensure that the non-discriminatory access policy is continued."

Another important policy is the National Satellite Land Remote Sensing Data Archive. The scientific value of data grows over time, and in the era of big data, it now also grows in economic value over time. It is crucial to both public and private interests that the United States has data archiving policies in place for the very long term.

And the fourth and final point I will address is the onerous licensing process that currently exits. Current regulations embody a worldview that reflect the closing days of the Cold War more than the globalization era technology development. This is most clear in the method of dispute resolution in an interagency disagreement. The Secretary of Commerce is required to personally consult with the Secretaries of State or Defense, and this function "shall not be delegated below the acting Secretary." This dispute resolution structure gives substance to an often-voiced criticism of the licensing process, namely that the government is overly protective of remote sensing capabilities and technologies. The regulations were promulgated in 2000 and revised in 2006. The interagency process was not revised. It may not be necessary to change the Land Remote Sensing Policy Act. However, after a full 16 years, revisiting the interagency process is appropriate. Among the potential changes that ought to be considered are mechanisms to determine if and when an individual agency policy is bringing more influence to bear than a national policy; the failure to reach a decision is based on disparity of political power more than anything else; and the establishment of an authoritative dispute resolution mechanism that can be accessed below the Cabinet level.

I thank the Committee for giving me this opportunity and thank you for your work in developing the law of space.

[The prepared statement of Ms. Gabrynowicz follows:]

Written Testimony of

Joanne Irene Gabrynowicz

Before the

Committee on Science, Space and Technology Subcommittee on Space
United States House of Representatives

Wednesday, September 7, 2016 – 2:00PM 2318 RHOB

Chairman Smith, Ranking Member Johnson, Members of the Committee: Thank you for giving me the opportunity to address the subject of *Commercial Remote Sensing: Facilitating Innovation and Leadership.*

When invited to testify regarding the state of U.S. remote sensing law and regulation governing commercial space-based remote sensing, I was asked to raise what I consider to be some of the key issues for Congress to include in its consideration. They are, the purpose of the Federal government's investments in enabling commercial remote sensing activities; the global commercial remote sensing legal landscape; U.S. leadership in two crucial policies; and the existing onerous licensing process.

I. The Purpose of the Federal Government's Investments In Enabling Commercial Remote Sensing Activities

A key question to be considered is whether federal funds—either as grants, contracts, or subsidies—will be used to facilitate new national remote sensing legislation and the activities it will address. And, if so, what is the policy the funds are intended to execute?

In approximately one decade as government space-imaging requirements—specifically military and intelligence requirements—changed, the commercial remote sensing satellite industry decreased from three companies to

one.[1] The remaining company continues to operate only due to its continuing National Geospatial-Intelligence Agency (NGA) contract.

Is this situation the result of the government harming industry development by attempting to commercialize satellite remote sensing with public funds and exercising control over companies to meet mission needs? Or is the situation the result of the private sector being dependent on government funding rather than risking its own capital and executing bona fide business plans? Or is it both? This is an analysis for an economist and should be pursued. Nonetheless, what is evident is that after years of providing funds, contracts, products, and services, the fact remains that there is no sustained long-term commercial remote sensing satellite industry in the U.S. What does exist—a single entity—exists because of military funding, not because of an independent market.[2]

New technologies are emerging that can now be applied to commercial satellite remote sensing. These include smallsats and smallsat constellations. Unpiloted aerial vehicles ("drones") are also in competition with emerging space-

[1] EOSAT began in the 1980s. SpaceImaging began circa 1994. It acquired EOSAT in 1996. WorldView Imaging began in 1992. WorldView Imaging changed its name to Earthwatch in 1995. Earthwatch changed its name to DigitalGlobe in 2001. In the early 2000s, there were three operators: DigitalGlobe, SpaceImaging and Orbimage (former subsidiary of Orbital Imaging). The government (NIMA/NGA) tendered two contracts. SpaceImaging was not awarded one of the contracts and failed. SpaceImaging was acquired by Orbimage in 2005. Orbimage changed its name to GeoEye in 2006. GeoEye and DigitalGlobe merged in 2012 when the government changed its requirements for imaging services. In sum, the industry went from three operators to one in approximately one decade.

[2] This was also the case with the civil *Landsat* system in the 1980s. The attempt at first privatizing, then commercializing *Landsat* resulted in a single federally funded monopoly which led to returning *Landsat* to the public sector. *See* Joanne Irene Gabrynowicz, *The Perils of Landsat from Grassroots to Globalization: A Comprehensive Review of U.S. Remote Sensing Law with a Few Thoughts for the Future*, 6 CHI. J. Intl'l. 45 (2005).

based platforms. The NGA has announced a new Commercial GEOINT Strategy that plans to use smallsats and other new emerging technologies.[3]

The question going forward is, will the previous cycle be repeated but with newer technologies? That is, an infusion of military funds into a few companies whose overwhelming focus must be to make the new technologies meet mission needs; followed by industry reorganization catalyzed by change in mission requirements; followed by a winnowing of companies to a single provider that will likely be rendered technologically less relevant in the face of the next new technology.

The possibility of repeating this cycle requires consideration of two concepts. The first is, what constitutes "commercial". The second is what remote sensing activities ought to be in the private sector and what remote sensing activities ought to be in the public sector.

"The definition of the term 'commercial' has a long and dynamic history in the aerospace industry."[4] In Congress' consideration of the state of U.S. remote sensing law careful attention needs to be paid to the definition of "commercial". This consideration needs to include the fact that the remote sensing industry has become less an aerospace industry and more of an information industry. Careful attention needs to be paid to the related concepts and definitions of "commercialization" and "privatization".[5] Congress has indicated it also strives to

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[3] Doug Messier, *NGA Announces New Commercial GEOINT Strategy*, Parabolic Arc (Nov. 7, 2015), http://www.parabolicarc.com/2015/11/07/geoint-strategy/#more-56695

[4] *See* Joanne Irene Gabrynowicz, *One Half Century and Counting: the Evolution of U.S. National Law and Three Long-Term Emerging Issues*, 4 Harv. L. & Pol'y Rev., 405, 423 (2010).

[5] "Privatization is when industry provides goods and services previously provided by governments. Commercialization is a more difficult task in that industry has to serve private demand in addition to government demand." Dr. Scott Pace, Hearing of the House Committee on Science, Space, and Technology Subcommittee on Environment

seek clarification of these terms.[6] Going forward, it ought to be clear whether Congressional intent is to facilitate a true commercial information industry with a vibrant market or a dedicated capability dependent on military funds.

Remote sensing is more than satellites. Congress' consideration of the state of U.S. remote sensing law should also include what remote sensing activities ought to be in the private sector and what activities ought to be in the public sector. This includes considering the need for a publically disseminated remotely sensed data set with characteristics determined by science and industry

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"NOAA Utilization of Commercial Remote Sensing Data", May 20, 2015,*available at* https://elliott.gwu.edu/sites/elliott.gwu.edu/files/downloads/news/pace-noaa-commercial-remote-sensing-data-May20-2015.pdf.

[6] An Act To Authorize Appropriations for the National Aeronautics and Space Administration for Fiscal Years 2000, 2001, an 2002, and for Other Purposes, P.L. 106-391, § 309. "DEFINITIONS OF COMMERCIAL SPACE POLICY TERMS. It is the sense of the Congress that...the usage of terminology in [NASA] policies [be]...consistent with the following definitions:

> (1) The term ``commercialization'' means actions or policies which promote or facilitate the private creation or expansion of commercial markets for privately developed and privately provided space goods and services, including privatized space activities.
>
> (2) The term ``commercial purchase'' means a purchase by the Federal Government of space goods and services at a market price from a private entity which has invested private resources to meet commercial requirements.
>
> (3) The term ``commercial use of Federal assets'' means the use of Federal assets by a private entity to deliver services to commercial customers, with or without putting private capital at risk.
>
> (4) The term ``contract consolidation'' means the combining of two or more Government service contracts for related space activities into one larger Government service contract.
>
> (5) The term ``privatization'' means the process of transferring--
>
> > (A) control and ownership of Federal space-related assets, along with the responsibility for operating, maintaining, and upgrading those assets, to the private sector; or
> >
> > (B) control and responsibility for space-related functions from the Federal Government to the private sector."

needs as a baseline to support value-added activities by both the public and private sector.[7]

II. The Global Commercial Remote Sensing Legal Landscape

U.S. remote sensing law, like most U.S. space law, is the apparent standard for remote sensing law around the world. Some of the legal principles established in U.S. remote sensing law have been adopted by other nations. The best example of this is the principle of nondiscriminatory access to data. Any changes in U.S. national remote sensing law will be closely observed by other remote sensing nations. It should be expected that in some cases changes made in U.S. law will be adapted or adopted by other nations.

Remote sensing has catalyzed more recent national space law, regulations, and policies than any other space activity.[8] Even nations that had been major spacefaring nations for decades only found it in their national interest to promulgate a national space law with the advent of commercial remote sensing. These nations include Canada, Germany, France, and Japan. In addition to the United States, there are currently approximately 22 nations that have national commercial remote sensing laws, regulations and/or data policies.[9]

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[7] The author would like acknowledge Dr. Gerald C. Nelson Professor Emeritus, University of Illinois at Urbana-Champaign for his assistance in discussing economic aspects of remote sensing. See, Google Scholar, *Gerald C. Nelson*, https://scholar.google.com/citations?user=g5W2z5EAAAAJ (last visited, Sept. 5, 2016).

[8] Here, "national space law" encompasses statutes analogous the 1958 *National Aeronautics and Space Act* in the U.S. That is, a statute specifically dedicated to general national space interests. It does not include bodies of law specifically dedicated to stand-alone activities like telecommunications.

[9] Gabrynowicz, J.I. *The Land Remote Sensing Laws and Policies of National Governments: A Global Survey*, NCRSASL/DOC-NOAA (2007), *available at http://www.spacelaw.olemiss.edu/resources/pdfs/noaa.pdf*. (There are more policies than law but the trend has been to establish more formal law.).

The proliferation of remote sensing legislation was a specific response to the commercialization of high-resolution data.[10] High-resolution data has a long heritage of intelligence gathering and military applications that prompted nations to protect their national security interests and to meet international treaty obligations by passing national laws.

Each national law has been crafted to meet the specific interests of the nation in question. Some are more restrictive than U.S. law. Two examples of this are the remote sensing laws of Canada and Germany.

In Canada, government departments and agencies at all levels, as well as individuals and corporations, are subject to the legislation and require a license.[11] This is analogous to requiring NASA or the Defense Department to obtain a remote sensing license for their satellites.

In Germany, satellite operators and data distributors must use a decision-tree supplied by the Federal Government to determine if the entity to whom they want to provide data is an acceptable recipient. Despite the use of the decision-tree, if the recipient later proves to be anathema to Germany's national interests the distributor is subject to criminal sanctions.[12] U.S. law provides only civil, not criminal sanctions.[13]

[10] There is no one uniform definition of "high resolution". For purposes of this testimony, the term "high definition" refers to spatial resolution used in national laws and policies by the major remote sensing nations.
[11] *See* Remote Sensing Space Systems Act, 2005 S.C., ch. 45 (Can.), and Remote Sensing Space Systems Regulations, SOR/2007-66 (Can.).
[12] *Act to give Protection against the Security Risk to the Federal Republic of Germany by the Dissemination of High-Grade Earth Remote Sensing Data (Satellite Data Security Act — SatDSiG)* (2007). Unofficial English translation available at 34 J. Space. Law 115 (2008).
[13] 15 C.F.R. §§ 960.14 – 15 (2006).

III. U.S. Leadership in Two Crucial Policies

A. The Nondiscriminatory Access Policy

The U.S. was the leader in establishing, defining, and applying the nondiscriminatory access policy. The U.S. instituted the policy to counter the position taken by some nations that the consent of a sensed state was necessary before remotely sensed images could be collected or distributed. The international community accepted the nondiscriminatory policy and the legitimacy of remote sensing was established at international law. At the national level, the U.S. Congress formally adopted the policy and incorporated it into U.S. law twice. The second time Congress enacted the policy, "the Committee refrained from making any changes in the nondiscriminatory access provision as it applies to private systems. Specifically, the Committee is reluctant to take any action which...might revive debate in the United Nations about the legitimacy of remote-sensing without prior consent."[14]

It is in the U.S. national interest to ensure that the nondiscriminatory access policy is continued. Currently, it applies to both public and, to a more limited extent, private systems. In the U.S., satellites paid for entirely by tax funds are required to make data available to all who request it. Satellites paid for entirely by private funds must make data available to a sensed state on commercial terms. A case-by-case determination is to be made regarding satellites paid for partly by tax funds and partly by private funds.[15]

B. The National Satellite Land Remote Sensing Data Archive (NSLRSDA)

The scientific value of data grows over time. In the era of big data, it now also grows in economic value over time. It is crucial to both public and private interests that the U.S. has data archiving policies in place for the very long-term.

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[14] H.R. Rep. 102-539 at 51-53.
[15] 15 C.F.R. §§ 960.9 and 12 (2006).

Recognizing the growing importance of global change research, Congress transferred responsibility for maintaining and expanding the National Satellite Land Remote Sensing Data Archive from a private sector operator and the Department of Commerce to the Department of the Interior. The result was to align responsibility with what was already being carried out in practice.[16] As part of this realignment, a regulation was promulgated to require licensed commercial remote sensing satellite operators to "(1) [p]rovide data to the National Satellite Land Remote Sensing Data Archive for the basic data set; (2) [m]ake data available to the National Satellite Land Remote Sensing Data Archive that the licensee intends to purge from its holdings..." so that the NSLRSDA has the opportunity to acquire the data at the cost of reproduction and delivery. Annual operational audit and record keeping must include imagery purges and purge alerts provided to NSLRSDA.[17] Operators are not required to purge data. If an operator chooses to conduct a data purge it will use its own internal criteria based upon what it deems best for its business. However, the operator must give the NSLRSDA a right of first refusal if the decision to purge is made. These are important regulations that must be retained.

IV. The License Application Process, as Currently Administered, is Onerous and Dysfunctional

A license certifies to the world the legality of the licensee's actions. A license is also the mechanism whereby the U.S. meets its obligation[18] to

[16] H.R. Rep. 102-539 at 50.
[17] 15 C.F.R. § 960.0 (2006).
[18] "In particular, it is important to note that ***the license requirement*** imposed on the licensee that it maintain 'operational control,' as the term is defined in Section 960.3, ***is an implementation of U.S. obligations under the United Nations Outer Space Treaty of 1967***. That treaty provides that the U.S. Government, as a State party, will be held strictly liable for any U.S. private or governmental entity's actions in outer-space. Consequently, NOAA requires that licensees under this part to maintain ultimate control of their systems, in order to minimize the risk of such liability and assure that the national security concerns, foreign policy and international obligations of the United States are protected." 15 C.F.R. § 960 at 24477 (2006). Emphasis added.

"authorize[e] and continua[lly] supervis[e]" the space activities of nongovernmental organizations.[19]

An effective and efficient licensing process is in the best interests of both the Nation and industry. However, an effective and efficient licensing process is not the current reality. On paper, the interagency licensing process is a maximum 120-day process in which "the Secretary of Commerce shall review...and make a determination."[20] In reality, license applications are mired in interagency turf battles, ideological differences, disparity of political strength among agencies, as well as genuine differences in worldview and what is in the national interest.

The private satellite remote sensing licensing regulations embody a worldview that reflects the closing days of the Cold War more than Globalization Era technology development. This is most clear in the method of dispute resolution in the event of an interagency disagreement at the staff level during a license review. "Consultations shall be constructed so that, in the event an agreement cannot be reached at the staff level, sufficient time will remain to allow the Secretary of Commerce to consult ***personally*** with the Secretary of State or the Secretary of Defense, as appropriate, prior to the issuance of a determination by the Secretary of State or the Secretary of Defense [...] That function ***shall not be delegated*** below the acting Secretary [...failing to reach consensus, the Principals will] refer the matter to the President for decision."[21] (See Appendix 1) This dispute resolution structure gives substance to an often-voiced criticism of the licensing process namely, that the Government is overly protective of remote sensing capabilities and technologies.

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[19] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, art. VI.

[20] 15 C.F.R. Part 960, Appendix 2, Fact Sheet Regarding the Memorandum of Understanding Concerning the Licensing of Private Remote Sensing Satellite Systems Dated February 2, 2000.

[21] 15 C.F.R. 960, Fact Sheet Regarding the Memorandum of Understanding Concerning The Licensing of Private Remote Sensing Satellite Systems, Feb. 2, 2000. Emphasis added.

The regulations for licensing private land remote sensing systems were first promulgated in 2000, and revised in 2006.[22] The revision was prompted by the "experience gained since August 2000 with respect to the licensing of commercial remote sensing space systems, and include improvements that take into account public comments received on the regulations."[23] The interagency process was not reconsidered at that time.[24] It is unnecessary to change the Land Remote Sensing Policy Act of 1992.[25] However, after a full 16 years of experience, revisiting the interagency process would be appropriate. Among the potential changes that ought to be considered are mechanisms to determine if and when: an individual agency policy is bringing more influence to bear than a national policy; the failure to reach a decision is based on disparity of political power more than anything else; and, the establishment of an authoritative dispute resolution mechanism that can be accessed below the Cabinet level.

Finally, when considering the interagency process the use of durable general principles ought to be encouraged as guidelines for the process. General principles can be applied to a myriad of situations that require decisions to be made. If the guidelines are articulated primarily in technological specifics, the guidelines can change with each inevitable technological change, creating an unpredictable regulatory process.

I thank the committee for giving me this opportunity and thank you for your work to develop the law of space.

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[22] 15 C.F.R. Part 960 (2006).
[23] Id. at 24474.
[24] Id. Subpart B, at 24476. "NOAA, in consultation with the other signatory agencies to the MOU, has determined not to amend the MOU at this time."
[25] 51 U.S.C. § 60101 et seq.

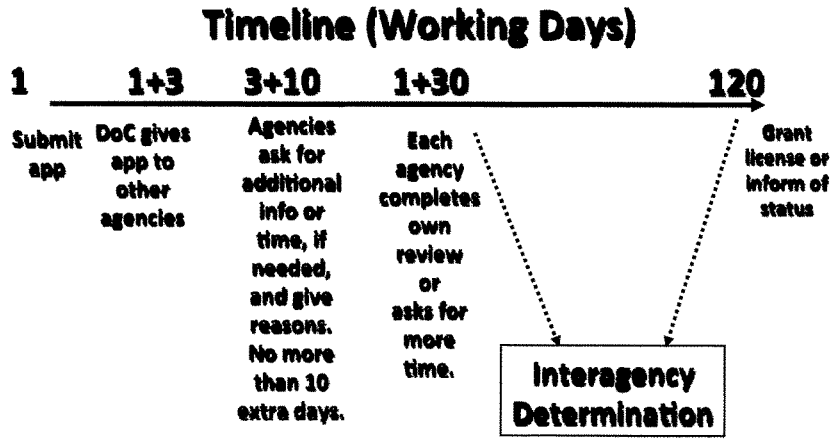
* The author wants acknowledge Mr. Ian Burke Perry for his assistance in editing.

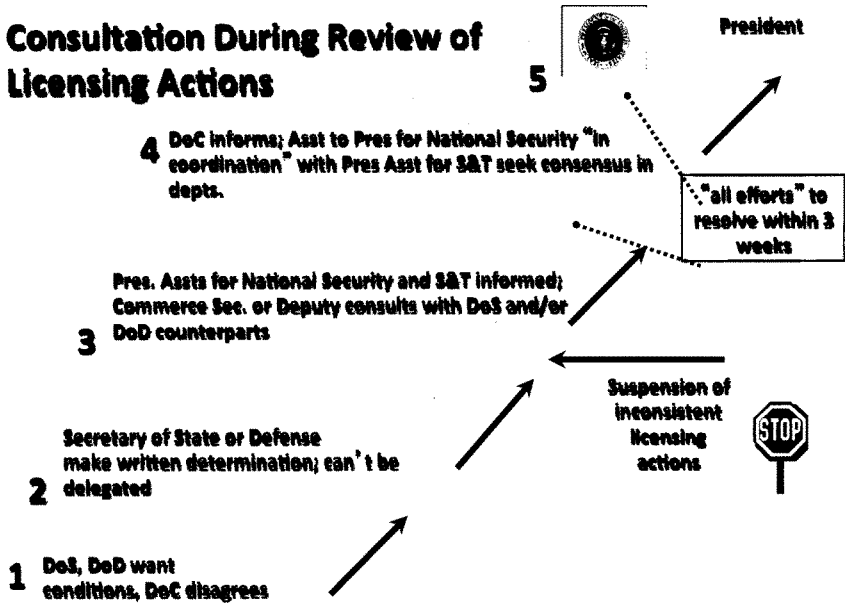
Memorandum of Understanding Concerning the Licensing of Private Remote Sensing Satellite Systems Dated February 2, 2000

Written Testimony of
Joanne Irene Gabrynowicz
Before the
Subcommittee on Space of the Committee on Science, Space and Technology United States House of Representatives

APPENDIX 1

Commercial High-Resolution Systems
Consultation During Review of Licensing Actions





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C.V. Summary

Prof. Gabrynowicz is Professor Emerita of space law, Director Emerita of the National Center for Remote Sensing, Air, and Space Law, Univ. of the Mississippi Law Center and the Editor-in-Chief Emerita, Journal of Space Law. She managed a faculty and staff off 6 - 8 people, 10 - 15 student workers, and a multi-million dollar budget.

Prof. Gabrynowicz has taught space law for 28 years and currently lectures at various universities including the University of Vienna and the Beijing Institute of Technology School of Law. She has lectured at the Harbin Institute of Technology School of Law, the China University of Political Science and Law, and the Beihang University (Beijing University of Aeronautics and Astronautics). In September 2014, she was invited by the Subcommittee on Space of the U.S. House Committee on Science, Space, and Technology to testify regarding the legality of asteroid mining. She is currently a member of three U.S. Federal Advisory Committees (Dept. of Commerce, NASA, Dept. of Interior).

Prof. Gabrynowicz briefed former U.S. Secretary of the Interior Gayle Norton as part of the Secretary's preparation for the Earth Observation Summit. Prof. Gabrynowicz briefed Frank A. Rose, Deputy Assistant Secretary for Space and Defense Policy, U.S. Department of State on legal aspects of orbital debris. She was the organizer and chair of the U.S. Federal Advisory Committee for the National Satellite Land Remote Sensing Data Archive.

Prof. Gabrynowicz was a founding faculty member of the Space Studies Department at the University of North Dakota, where she also served as its Director of Graduate Studies. From 1992-94, Prof. Gabrynowicz was a member of The Congress of the United States Office of Technology Assessment Earth Observations Advisory Panel. From 1994-96, she was a member of the National Research Council Committee that produced Bits of Power: Issues in Global Access to Scientific Data. In 1994-95, Prof. Gabrynowicz was awarded a NASA/American Society of Engineering Education Summer Faculty Fellowship from Goddard Space Flight Center where she also served as the 1997 Dean of the NASA Space Academy. Prof. Gabrynowicz has been invited by the U.S. Dept. of Commerce/NOAA, the U.S. National Research Council, the NASA Public Health Applications Program on Confidentiality and Geospatial Data, the Univ. of Cologne Institute of Air and Space Law to participate in a number of studies. Prof. Gabrynowicz was the managing attorney of a NYC law firm. She is a member of the American Bar Association Forum on Aviation and Space Law.

Prof. Gabrynowicz is a Director of the International Institute of Space Law (IISL) and is an official observer for the IISL to the UNCOPUOS Legal Subcommittee and has made a number of presentations to that group on space law issues. She was a member of the Advisory Board for the Permanent Court of Arbitration for the Draft Arbitration Rules on Disputes Relating to Outer Space Activities and has presented to the UN Institute for Disarmament Research. The UN Office of Outer Space Affairs (UNOOSA) invited Prof. Gabrynowicz to lecture on space law at all of its space law capacity building workshops for government officials and policymakers and she is the lead author for UNOOSA's remote sensing law curriculum. In 1999, the IISL invited Prof. Gabrynowicz to write and present the remote sensing law position paper at UNISPACE III. In 2001 she was awarded the Women in Aerospace Outstanding International Award. In 2011 she was awarded the IISL Distinguished Service Award. In 2014, Prof. Gabrynowicz received the China Institute of Space Law 1st International Service Award.

Chairman BABIN. Thank you, Ms. Gabrynowicz. I'd like to thank the witnesses for their testimony, and the Chair now recognizes himself for five minutes.

Mr. O'Connell, in the 1990s, a number of U.S. companies sought to sell synthetic aperture radar images. Prohibition and dysfunction in the Executive Branch licensed the termination processes, pushed these companies overseas. Today, a number of U.S. companies are developing new and innovative space-based remote sensing systems such as space-to-space remote sensing.

Are we in a similar situation that we were in in the 1990s with the possibility that American innovation and investment will go overseas to foreign competitors because of these regulatory challenges?

Mr. O'CONNELL. Thank you, Mr. Chairman, for the question. Absolutely we're in that same position, and as a side comment, I'd make this comment as well. When we look at the 20-year modern history of commercial remote sensing, it's highly illustrative in both a good and a bad way for other areas of space commercialization: space debris, asteroid mining, others. And so we should learn our lessons from this particular area. But we're absolutely in that same case again. And we used to talk about this mostly in theoretical terms. Could companies go overseas? The reality is that the globalization of this technology and the information that's coming from it now creates incentives for other countries to offer deals, opportunities, for people to move overseas.

And so I would greatly worry about that. I do see that NOAA has recently licensed a commercial radar capability, which is a bright note. But the commercial radar capability issue is a history to avoid.

Chairman BABIN. Yes. Thank you very much. Ms. Quaid, I don't think anyone would disagree that protecting U.S. national security interests is paramount. However, from a policy perspective, it seems that there's a question of what these interests should be, particularly in light of increasing international competition and wide availability of commercial remote sensing and geospatial data.

Current policy places the obligation to mitigate national security risks on licensees, not necessarily on the government. As a result, foreign commercial operators are catching up with, and in some cases, passing the United States. It doesn't make sense to have policies that hold American innovation back and yet assists foreign competitors.

Isn't it better to stay in the lead and dictate terms from a position of strength? And how should we as a Nation be evolving our understanding of national security interests within this domain to ensure that America remains the leader?

Ms. WESLANDER QUAID. Thank you for the question, and I wholeheartedly agree with the statements that you made. I absolutely think, as I highlighted in my testimony, that taking the shackles off commercial industry, allowing them to innovate, allowing them to do their best is absolutely what we must do because we want to maintain a leadership position. If we continue to handicap them, we will lose our industrial base, which is a national security concern.

Furthermore, if we have the U.S. in the lead, those are friendly parties. And should we need to, in a crisis, there are ways to do regulation, such as delay of release of information or, just like we do with overseas military sales, restricting who we could sell to. So those are things that we can enact, as needed, if there is a crisis without overly burdening the commercial industry.

Chairman BABIN. Absolutely. Thank you very much. And Mr. O'Connell, in your testimony you identified that there's a need to reform the law, regulations, and processes governing commercial remote sensing. What are the policy outcomes reform should achieve? And what, if any, specific recommendations do you have to effectuate such outcomes?

Mr. O'CONNELL. Thank you, Mr. Chairman. I think ironically that the intent of the current policy, as has been mentioned at the table already this afternoon is exactly right. It's to advance American foreign policy, national security interests. I would argue, in addition, scientific interests through the creation of a robust commercial remote sensing industry. And so that's the broad dimension. Not much has to change there, quite frankly, in terms of intent.

What does that allow us to do? It allows us to make investments on the government side of scarce budgetary dollars and stretching the limits of science, safety, and security on the one hand while taking advantage of a whole new area of a commercial market in remote sensing and the knowledge that it creates.

You know, in the industry there's been sort of a question over the years, what's the killer application in commercial remote sensing? And maybe for now we just have to be comfortable with the idea that the killer application is a much more detailed understanding of lots of different developments that are on our planet.

And so in addition to that, the knowledge base, the encouragement of young children and others to get involved, be excited by this whole set of issues that's coming forward, I think that's a starting point of some of the outcomes that we should achieve.

To your former question about the national security interests, I'd just add one other thing. We do recognize there are consequences to our national security from a robust commercial imagery market. We have to deliberately understand those and take an objective view of how to deal with them.

Ms. WESLANDER QUAID. Mr. Chairman, if I could add to that?

Chairman BABIN. Sure. Go ahead.

Ms. WESLANDER QUAID. That is to say that having a robust commercial marketplace provides resiliency for our national security architecture.

Chairman BABIN. Well said. Thank you, Ms. Quaid. Thank you, Mr. O'Connell. Now I'll recognize Ms. Edwards.

Ms. EDWARDS. Thank you, Mr. Chairman, and thank you to the witnesses. It feels like we're having this same discussion in the commercial space flight arena as well, sort of how to balance government and regulation and government participation with the interests of facilitating a robust industry. And that is true here. It does occur to me, of course, that the 1992 Act that established the licensing framework for commercial remote sensing was enacted before the evolution of the commercial remote sensing industry.

And while the industry has grown over time as has been noted by Mrs. Gabrynowicz, that it's still pretty heavily dependent on government contracts and grants and resources. So it is not truly a commercial sector as yet. Over the last few years a number of entrants and advances in the capabilities and operations has also been quite dramatic.

And so I'm trying to understand, and I heard some of this in Mr. Dodge's testimony, whether the proposal is that there needs to be a foundational statute that has to change or whether it's the implementation of the current law and regulations that need to be updated. And I wonder, if starting with Mrs. Gabrynowicz, if we could begin with you?

Ms. GABRYNOWICZ. Thank you. There's no doubt that the interagency process needs a lot of work. There's no doubt. And that can be done through the MOU of 2000 which is appended to the regulations in the CFR, the Code of Federal Regulations. I would be very careful about wholesale changing the '92 statute because there are a lot of things in there that, in addition to commercial remote sensing, that might come in play under a political process. For example, there is a National Archive which is something we absolutely need, and that could be put back on the table. There is the balance between the public sector and the private sector regarding Landsat that has a tortured 25-year history being pulled back and forth between the public and the private sector.

So I think there's no doubt that the licensing has to change, that there has to be mechanisms put in place. But that can all be done through revising and renegotiating the MOU of 2000 without necessarily touching the statute.

Ms. EDWARDS. And you could also then touch all the underlying regulations as well?

Ms. GABRYNOWICZ. Yes, absolutely, because it's part of the CFR. I mean, if you go to the statute first, you'll have to figure out what's going to go into that, and then you're back to square one with the regulations, whereas I agree with Mr. Dodge's statement about a surgical approach, and the surgery starts with the 2000 MOU.

Ms. EDWARDS. And so Mr. Dodge, could you comment on the areas where we could have changes to regulation or maybe there need to be amendments to the '92 Act? But could you elaborate on your testimony?

Mr. DODGE. Whether a number of areas that could use some change, but I guess off the top of my head one of the areas could be the fact that there's a 120-day period of time for the interagency process for reviewing whether or not there can be approval of a license. That is a long time. And for a business, for example, that can be onerous to their needs and interests.

So you could make a, as I said earlier, a surgical modification to modify that, for example, going down from 120 days to maybe 90 days or 60 days or whatever would be sufficient to both serve the needs of the industry whilst maintaining the interests of the government and those sorts of data.

Ms. EDWARDS. Thank you. Mr. O'Connell, I wonder if you could tell me, I mean there has been reference to the 120-day period. How much of that is impacted by the relatively static budget that

the regulators face in terms of them being able to move forward the process?

Mr. O'CONNELL. Thank you, Congresswoman. I think it's very much affected by that as well as the extensive set of stakeholders in the U.S. Government that have equities in remote sensing. And so you see I think NOAA sometimes struggles with shepherding all of those entities and their viewpoints as we think about the licensing piece.

I think one of the things that troubles me is that there are—I'll say it this way: there are too many people who can say no and too many people who can stop the clock without direct accountability in the regulatory process. And as has already been mentioned, sometimes those 120-day delays are really onerous on businesses that are trying to get off the ground.

And so how do you make sure that there's a transparent process? And again, there are way too many examples of companies saying that on day 119, they've gone through a faithful discussion with NOAA about what they intend to put in the license. The clock runs on the day 119. They get a letter that says, oops. We're not ready to do this yet. We've got to think about it a little bit more. And beyond that, there is opacity in the process. And lots of people, like I said, can stop the clock, and lots of people can say no in the process.

Ms. EDWARDS. Thank you.

Mr. O'CONNELL. So I think that's partly a resource issue as you've suggested. But there also needs to be more transparency in the whole process.

Ms. EDWARDS. And thank you. Mr. Chairman, can we let Ms. Gabrynowicz finish her comment?

Chairman BABIN. Yes.

Ms. EDWARDS. Thank you.

Ms. GABRYNOWICZ. Thank you, and the only other thing I wanted to state is that the clock can be stopped at the level of the cabinet and special assistants to the President. When you're up in that stratosphere, there's no control anymore by the rank and file and the licensees. To have to reach Cabinet level where the clock can be stopped for reasons you won't know is a serious problem.

Chairman BABIN. Thank you. I now recognize the gentleman from Alabama, Mr. Brooks.

Mr. BROOKS. Thank you, Mr. Chairman. My question is directed first at Mr. O'Connell, and so if you'd give your response? And then following that, Ms. Quaid, if you would add your insight. And then should any of the other three panelists wish to add their insights thereafter, please feel free to do so.

National security is a major application for remote sensing capabilities. It constitutes an important market for the industry. At the same time, national security concerns may constrain the commercial market through means such as licensing requirements that limit image resolution.

Considering the international development of increasingly advanced remote sensing capabilities, how effective are current United States requirements such as resolution limits, shutter control, and export control regimes at addressing national security concerns? And if we fail to achieve meaningful reform, how will

United States national security interests be impacted? Mr. O'Connell?

Mr. O'CONNELL. Thank you, Congressman, for the question. On the one hand, we have a national policy that says we're going to lead in the international world, not follow, not harmonize, et cetera. And I'd like to make that point first. National security is enhanced by us taking maximum advantage of these capabilities consistent with what we're doing on the government side.

And so some of the mechanisms that you've referred to, we really have to be proactive in thinking about innovation that comes from them for the government's purposes in addition to what may go on in the commercial market.

And so we have to be sensitive to the national security implications of allowing things at say better spatial resolution, some of the other things that you're talking about.

It's a complex regulatory landscape, and some alignment has to be done to look across those to see what the effect is on the actual industry and its effect on national security in accordance with that.

Mr. BROOKS. Ms. Quaid?

Ms. WESLANDER QUAID. I think the resolution limits—the example we have with SAR where we had a license granted, and they were not allowed to sell better than five meter, which is not very useful—and we had another license granted where they were not allowed to sell better than three meter, which is also not very useful and viable in a commercial marketplace.

And so we are looking at a reality where the U.S. is not a leader in synthetic aperture radar right now as a result of that.

And then if we look at something like shutter control, if you step back, and a lot of times the people writing the policy don't realize the practical implications of this, but saying I'm going to black out certain regions of the globe and having to implement that on the commercial side can be extremely burdensome and complex and very costly, versus saying, as I suggested before, where they might say a delay in release of imagery or you know, sells not to certain areas. But we must recognize there are other vendors that are not U.S. that may sell that data to someone that we don't want to have that data. So I think there are definitely better ways to provide this. Have a collaborative nature to say, let industry lead. Let them innovate. That is in our national security interest. Those assets provide resiliency. And then we have a cooperative partnership with them in the national security community. And when the need arises, we can invoke something that will help protect national security interests.

And, for those of us with intelligence backgrounds, there are always ways to potentially spend money and ask them to task someplace else on that pass so they are not looking at the area that you are concerned with, so there are ways to get around this. Thank you.

Mr. BROOKS. Thank you, Ms. Quaid. Does anyone else wish to add any insight?

Mr. O'CONNELL. Could I have one follow-up, please?

Mr. BROOKS. Yes, Mr. O'Connell.

Mr. O'CONNELL. There's an important 20-year history to recognize here on issues related to shutter control and national security

and it's that there has never been an example where government and industry have not cooperated, especially when the government is clear in both space and time on its concerns about national security, okay? So that's a very positive history that we need to leverage going forward as we think about this.

Ms. WESLANDER QUAID. And if I can add, we're all American citizens, whether industry or government, and we all care very deeply about the national security. So I agree with what Kevin said. Absolutely there's been cooperation when we needed it for the country.

Mr. BROOKS. Thank you, Mr. Chairman. I yield back the balance of my time.

Chairman BABIN. I now recognize the gentleman from Virginia, Mr. Beyer.

Mr. BEYER. Thank you, Mr. Chairman. Thank you all for being here. Mr. O'Connell, you wrote, "We need to update our thinking about how to protect U.S. troops, facilities, and operations in this increasingly transparent world, not fixated on information control as a source of security." Ms. Weslander Quaid, you said again and again, because expanding the sensing capabilities gives us the resiliency, makes us more secure.

How much pushback do you get from the Department of Defense and from flag officers on this perspective? It seems to me easier to be in the industry that is growing and doing so well to argue this than perhaps it is from someone who has the responsibility to protect troops and protect the Nation.

Ms. WESLANDER QUAID. Thank you for the question. In my time down range with those combatant commanders in Iraq and Afghanistan, the need to share was paramount. And you had them taking essentially their authorities and saying we may be violating policy, but we'll ask forgiveness later because lives are on the line. And I think that's important, that we have data from assets that is freely sharable that can be provided in the context where we're going to, you know, go after a terrorist and they're doing an operation at night. And that intel picture is great in the intel cell, but then they can't take it with them when they're going on the mission. And often the resiliency that we talk about with commercial assets, maybe the intel asset has not been over most recently but a commercial asset has been. And that is the timely intelligence they need as they're doing their mission planning.

So that's what I've seen. When lives are on the line, they will take it from any source. And the most important thing is that they can share that and they can share it with the commonwealth, the coalition, and the coalition of the day.

Mr. BEYER. But in listening for the last hour it seems to me the great conflict here, the source of all this burdensome regulation, the need for new philosophy, is the conflict on national security. So isn't it possible also to have the national security leaders sitting at the same table to argue this? Would they be willing to do that? Or are they going to resist this?

Ms. WESLANDER QUAID. There are those of us on ACCRES for example who have held TS/SCI clearances—for me for my entire career, and we would welcome that discussion to understand specific national security concerns that cause them to raise the national security flag. In my experience, I don't know what they could be.

Mr. BEYER. Okay, because that does seem to be the existential crises here driving all this.

Mr. Pomfret, you lead the Center for Spatial Law and Policy. You know, our Chairman, Mr. Smith, at the beginning talked about, quote, the outdated and improper federal regulations and policy and that we need a different regulatory philosophy. There's been lots and lots of general comment about how outdated the process is. How do we go about fixing this? What process do we create to get something that is actually forward-looking, 21st century?

Mr. POMFRET. I think the first step is to recognize, one, that the remote sensing industry is a global one and some of the national security threats that people were concerned about back in 1992 and in 2000 and in 2004 from U.S. commercial systems are now not the U.S. commercial systems. There are a number of other actors that have sensors that are collecting this information, not just from satellites. So any balancing—I talk about the inherence of balancing between the perceived risks and the benefits. Any balancing needs to take that into effect.

I also think that we need to start thinking about—and you'll know in my comments I talked a lot about geo-information and not about just remote sensing because I think we tend to have on blinders and to think about regulating a certain sector, whether it be the commercial remote sensing sector or whether it be drones or whether it be issues associated with mobile devices and to start thinking about it more broadly in terms of all this information that's being collected and how it's going to be used because that's what the consumers care about. And that's what industry cares about. And even if we talked about here before about doing sort of just a surgical change to a particular law or regulation to me is a short-term fix and doesn't address the long-term implications of where this technology is going in what, if you want to have a location-enabled society, what that's going to look like and where the commercial remote sensing industry fits into that.

Mr. BEYER. Okay. Thank you. Mr. O'Connell, is NOAA's enforcement requirement on visiting all ground stations reasonable? Is this a place to start?

Mr. O'CONNELL. This is certainly one place to start, Congressman. And this is a topic that we did take up in the committee probably about a year ago. It is an old-fashioned way of doing it. The need to visit every single ground station, I would argue perhaps the technical limits, that we're living in a world where I might be able to control a satellite with an iPad or some sort of a mobile device. And so it's probably impractical, certainly within the resources that NOAA has to visit every single ground station at least once a year. And that's certainly one place.

On the committee in public session we recommended a number of things for NOAA to consider in that regard. One of them was for example deputizing another federal official overseas. Give them a checklist, ask them to go out and do the inspection themselves, someone closer to where the ground station would be, and that was not agreed to, as best as I understand.

Mr. BEYER. All right. Thank you. Mr. Chair, I yield back.

Chairman BABIN. Thank you. I now recognize the gentleman from Oklahoma, Mr. Bridenstine.

Mr. BRIDENSTINE. Thank you, Mr. Chairman. Thank you all for being here and testifying today. I wanted to ask you, Mr. O'Connell. Earlier you said current regulations don't address capabilities outside the electro-optical spectrum. Is that correct?

Mr. O'CONNELL. That's correct.

Mr. BRIDENSTINE. And I think just a few minutes ago you said that there was recently a license given for radar, space-based radar?

Mr. O'CONNELL. That's correct.

Mr. BRIDENSTINE. So how do you reconcile those two?

Mr. O'CONNELL. Well, I think there was a large discussion that went on, a large and lengthy discussion, about applying what they could out of the regulations and nonetheless going ahead and issuing the license.

Mr. BRIDENSTINE. So they are regulating and they are licensing. Do they have statutory authority to do that? Is that something we should give?

Mr. O'CONNELL. I think you should take a look at it.

Mr. BRIDENSTINE. Okay. That's important. When you think about transparency, we've heard from a lot of folks, I've heard, our office has heard from a lot of folks that at the end of the day, they don't get a yes or a no but they don't get a why, either.

Mr. O'CONNELL. Right.

Mr. BRIDENSTINE. And sometimes they get a no but they don't get a why. If you have a company that's cleared, do we have an obligation or should we have an obligation to make sure they understand why? Because ultimately we have an interest in making sure this industry is successful so that we want them to go and get more capital investments. We want them to build more satellites. We want them to get more geospatial intelligence resources for us. But then we're not giving them an explanation of why they're not getting a license which prohibits them from doing all those great things we need them to do.

Mr. O'CONNELL. Congressman, that's a great question, and it calls for a better conversation between the government on its precise national security concerns and the industry. There's clearances involved. There's all the other artifacts associated with doing that. We have to have a better way to convey those national security concerns clearly and crisply to companies that are in the market.

One of my best examples of this is when I hear government colleagues say, gee, do the business models close on these companies? You know, are these companies going to be profitable? It is proper for anyone in the government that expects to spend money with a commercial enterprise to have some sense of that. But as you might imagine, government officials are uniquely not positioned to make that kind of evaluation. One of the things that I've been pursuing is some surrogate that could come from an organization closer to the business model world—space insurance, space finance—just as examples that we thought about. But you're absolutely on the right track which is we need a much better conversation, a clearer conversation.

Mr. BRIDENSTINE. Can you do space insurance for a risk that nobody can possibly measure? We're talking about political risk I guess in this case?

Mr. O'CONNELL. Or business model risk.

Mr. BRIDENSTINE. Okay. Sure. I had another thought that I read recently which is that the law requires that the Secretary of Commerce consult with, but not concur with, necessarily the Department of Defense or the Department of State. Is that correct?

Mr. O'CONNELL. Correct.

Mr. BRIDENSTINE. So ultimately, the Secretary of Commerce, unless told a very explicit reason why not to do it, could just say let's go forward with this, according to the law?

Mr. O'CONNELL. That's correct.

Mr. BRIDENSTINE. Anybody here disagree with that? So if we had maybe an aggressive Secretary of Commerce that was willing to push on that, could we get better results for the intelligence community and for the industry in general?

Mr. O'CONNELL. I think that conversation would be improved, Congressman.

Mr. BRIDENSTINE. I'm not saying we need a new Secretary of Commerce.

Mr. O'CONNELL. No, no.

Mr. BRIDENSTINE. I'm just saying that maybe that's one area that the Secretary of Commerce could look at. The one area, another area, that I've heard and I have concerns on is this retroactive changing of licenses where people, you know, get their license maybe not revoked but changed in a way that is not as beneficial to them in the future and they can't sell their products as much. What do we do to compensate them as a government? If they make investments based on a contract with the U.S. Government, and that contract might be just a regulatory deal, maybe not a monetary deal but a regulatory arrangement, and they go out and they start selling products and then they have their license maybe altered and they can't close that business model as you suggested earlier, what do we do to compensate when government makes that decision? And are we at risk of putting people out of business or maybe not quantifiable but are we at risk of having people not enter a business that they otherwise would have entered?

Mr. O'CONNELL. Absolutely, Congressman. I can't comment on what we would pay them and how we'd make that calculation. And to my knowledge—

Mr. BRIDENSTINE. Do we? Does that ever happen? Anyone? It does happen?

Ms. GABRYNOWICZ. A license can be an asset, and if it gets modified or changed, its economic value changes. And there are other contract regulations. You need to talk to a good contract officer here——

Mr. BRIDENSTINE. Okay.

Ms. GABRYNOWICZ. —about for the needs of the government, when something needs to be modified or ended that wasn't planned, how that's paid for.

Mr. BRIDENSTINE. Okay. Last question, Mr. Chairman, if you'll give me just a few more seconds here.

Chairman BABIN. Certainly.

Mr. BRIDENSTINE. When you think about hyperspectral and synthetic aperture radar, we're always talking about space-based, look-down capabilities. What about space-based look-up capabilities,

maybe for better space-based, space-situation awareness? Do we regulate that at all? Is there anybody trying to get a commercial license to do that kind of activity? And maybe anybody that you guys either represent or have represented that is involved in that activity? And would NOAA or the Department of Commerce be involved in issuing such a license?

Mr. O'CONNELL. I've talked to a couple of people who say they're going to start companies in that arena. I do not believe that the regulatory process, or at least a reasonable one, exists to license that kind of capability.

That's the point I was making before. I think we ought to look at this 20-year history as something to consider when we think about other areas of space commerce that people, that companies, are starting to enter: space weather, SSA (space situational awareness), space debris, other things like that.

Mr. BRIDENSTINE. Okay. Mrs. Gabrynowicz, I would like to thank you for your testimony explicitly because it said—you were talking in there about the Secretary of Commerce and the Secretary of State and the Secretary of Defense, and that if they don't agree—remember, this is after it's gotten through the staffers, it goes to them. If they don't agree, then it goes to the President.

Ms. GABRYNOWICZ. Well, the assistants to the President and then the President.

Mr. BRIDENSTINE. And then the President.

Ms. GABRYNOWICZ. Um-hum.

Mr. BRIDENSTINE. Do we know that that's ever happened?

Ms. GABRYNOWICZ. I personally have no knowledge, yeah.

Mr. BRIDENSTINE. That seems like a bit much. I think the President has other things to do. If that's the process and if that's the process that's written down, there's no wonder it takes such a long time.

So I thank you. And Mr. Chairman, I yield back what time I don't have anymore.

Chairman BABIN. Yeah, I gave you an inch. You took a mile there, Mr. Bridenstine. No problem. I now recognize the gentleman from Colorado, Mr. Perlmutter.

Mr. PERLMUTTER. Thanks, Mr. Chair. I'll start with where Mr. Bridenstine just left off. I mean, two words, obviously jump front and center: transparency and opacity. And the other two words that come to mind are pecking order because everybody at the table, all you panelists, probably have much higher clearances than anybody up here. And obviously, I've run into this. I've actually had a conversation with the Secretary of Commerce about a particular issue dealing with Digital Globe and something that's been hanging out there for two or three years now. And my sense is that whether there is some specificity in the law or not, there is a real or perceived pecking order in how decisions involving something that might be used by the intelligence community or might be used by the military or might be moved over to the civil side, how that all is developed.

And so I want to start with you, Ms. Quaid, and then go to you, Ms. Gabrynowicz, just to talk about reality here. Theory is great. I'm a lawyer, okay? That's what I do. I try to deal with the law. But in these kinds of things—and Ms. Quaid you talked about

when life is on the line, when somebody's life is on the line, whatever these rules may be seem to go out of the window. If somebody at a Cabinet level or some lower level or the Special Assistant to the President says, wait a second, this could get a bunch of our soldiers hurt, you don't think that's going to stop NOAA from issuing a license? I mean, that's what I'm sensing here.

So talk to us about reality. You had a chance to be on the geospatial, you were with that department, so how does it work? How does it really work?

Ms. WESLANDER QUAID. Well, I'll tell you, the biggest question—and it goes to this Congressman's question as well as when they got a no or they got the license revoked, were they given a why? And we have heard time and time again, especially in ACCRES about the national security concern. And as I mentioned before to say let's have the meeting, let's have the discussion, because we have to advise the Secretary of Commerce. And frankly, in the discussion we finally had, which I think was a whopping 30 minutes, none of us who were in that session could agree that there was really a valid reason to say there's a national security concern and further thwart the requests that were coming forward.

Mr. PERLMUTTER. Were you dealing with one of the intelligence agencies or was this with NOAA?

Ms. WESLANDER QUAID. No, it was with quite a few of the intelligence agencies in the room in a skiff, as we'd say, where they have——

Mr. PERLMUTTER. Okay.

Ms. WESLANDER QUAID. —secure discussions. And so what I think as I mentioned in my testimony, the burden of proof being on the government to say why not and articulate that. And where there's those of us in the advisory roles who are kind of mediating between those in the national security community, because we have the clearances, and with the Secretary of Commerce that we can be informed, and therefore we all want the best interests of America here. But when there is—we're fighting ghosts, it's hard. You know, give me some tangible reason and then I can go explain to the Secretary of Commerce why she shouldn't do this.

Mr. PERLMUTTER. Okay.

Ms. WESLANDER QUAID. And so without that data, you know, it's hard to justify why we would say no.

Mr. PERLMUTTER. Okay. Let me go to Ms. Gabrynowicz and then to you, Mr. Pomfret. Okay.

Ms. GABRYNOWICZ. I have not had the kind of in-the-trenches experience that Ms. Quaid has had. But my observation has been that sometimes what happens is there's an agency policy that participants hang onto and promote which may be different than a national policy. And it will stop there.

Mr. PERLMUTTER. Okay. Mr. Pomfret?

Mr. POMFRET. Thank you. I guess the perspective that I want to bring is that this isn't just unique to the United States and it's not just unique to remote sensing satellites. Most geospatial technology has come out of the defense and intelligence communities over the years. And in many countries around the world they have the first or last say, if you will, as to whether something can and can't be used for a commercial or civilian use. And they will play the na-

tional security card quite a bit. And I think it's natural given where they're sitting and their perspective and their background. So I don't necessarily fault them. But in countries around the world, in India they're trying to deal with mapping legislation that would make it illegal for people who weren't government authorities to create maps. And there are similar situations in a lot of different countries around the world, evolving geospatial technology and geospatial information.

And so when we have this discussion, I think part of it is to recognize that yes, the technology started in these communities but the environment has changed. And maybe some of the deference that was paid before isn't necessarily as critical as it was. I'm not saying that, no, that they shouldn't have any say but the balancing has changed.

Mr. PERLMUTTER. All right. Last question if I could, Mr. Chairman. The last question would be so to go back to placing the burden on the government or the intelligence community or the military to say, okay, in a SCIF or in a secured environment, say here's why we don't want this to be available to the public. Is it going to be written down and then published? Is it just available in a confidential way? I mean, what are you thinking about here? Because there may be a middle ground for us so that the Secretary of NOAA actually can say, you know, this is why I'm not issuing this license. But right now, she can't. Do you see what I'm saying?

Ms. WESLANDER QUAID. And some of the discussion can be can we go ahead and let them build it and launch it and operate it? And then when there is truly a national security concern, say a high res collection over a certain area, that's when we say you can't disseminate it—24 hours, 48 hours, ever—or you can't give it to these parties. And so we're not tying the hands of American innovation. What I worry about is going back to that SAR example where they said, no, you can't sell the one meter, and then—boom— two international competitors pop up while we've held them back. We could have been the leader there. And we don't want to repeat that.

Mr. PERLMUTTER. Okay. Thanks, Mr. Chair.

Chairman BABIN. You bet. Thank you. They've called votes, so we're going to get our last question in here. And Mr. Davidson, I'll give you five minutes.

Mr. DAVIDSON. Thank you, Mr. Chairman. And I'll keep it brief so I know we all have places we have to get to. So I'll just ask one general question that may take a little bit for you all to answer. What areas are we behind? And if I just think about this from the perspective of an entrepreneur, I get this great idea, want to launch it. How do I know that, well, you can't sell that? How do I then, if I'm sitting behind the desk at Wright-Patterson Air Force Base looking for the greatest geospatial resources, how do I know that it even exists? You know, it's not like all this stuff is going to wind up on eBay. So how does our Intelligence Committee know that there's an entrepreneur working in a garage to come up with this radar? How does the guy that's working on this, you know, latest/greatest, you know, geo thing, whatever the void in technology is, how do these people come to be aware that they're working on something that could be helpful to one another?

Mr. O'CONNELL. Thank you, Congressman. I guess that's the place that the licensing process should be the enabler, not the blocking mechanism. In essence, that's the basis for someone to understand in the government that a new kind of capability is being considered under commercial considerations. So that's the entry point where we know what people are thinking about, and at least in my time looking at this, there've been a lot of people coming for with interesting capabilities. Not all of them will necessarily succeed for lots of different reasons. But that licensing process is the starting point at which somebody comes and says, "I'm so serious about this." I'm going to create a business for it. And that should be the basis. That should be the enabler, ultimately, for doing that, for creating that capability.

Mr. DAVIDSON. Okay. So what are some examples where that didn't go correctly? So you look at it and say, hey, oops. Now this is out there. We really wish that didn't. The downside of a total security environment is you don't get all the innovation, you know. An upside of it is you don't compromise stuff. It preserves the status quo. And since we're in the lead on a lot of things, we might like that. It doesn't do good things for the market, but I guess that's the thing. How does there become this market? Simply licensing, just the fact that the people that know this space know, gee, if I know enough to create this contraption, I know that I have to license it. How do they find that they've committed a violation of the law? Surely they wouldn't be prosecuted without an intent.

Mr. POMFRET. My experience is, and I'm not sure if this directly answers your point, but that entrepreneurs, they operate very well in a vacuum. And so the uncertainty, because of the business, the technology, the legal and regulatory uncertainty isn't a problem for them. They will fill that void. It gets to be a problem when you have a business that's actually up and running and operating, and you have products to sell and you hire lawyers. And lawyers look at it and say I have no idea what you can and can't do. And so it's easier for me to say no and yes. So I think you see—and we've heard that there are a number of companies that have applied for licenses because they just—their business risk is so great that just filling out this regulatory paperwork is not that big of a deal for them. But when you do start running a business and you're trying to figure out when you can sell to NGA and when you can sell to a foreign entity and what you can sell to someone else, that's where it gets really complicated. And that's where a lot of companies are hitting the wall because they see who their customers are or they think they know where they can get investments. But the challenge is that the uncertainty is such that they don't want to spend the money or they don't want to spend the 300 days waiting to get approval.

Mr. DAVIDSON. Thank you. I yield back my time.

Chairman BABIN. Thank you so much. That was my second warning that votes have been called. But I would like to thank the witnesses for your valuable testimony and the Members for your questions. The record will remain open for two weeks for additional comments and written questions from the Members. And so this hearing is adjourned.

[Whereupon, at 3:45 p.m., the Subcommittee was adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Mr. Kevin O'Connell

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Questions submitted by Rep. Brian Babin, Chairman, Subcommittee on Space

1. Question: Does the inclusion of government officials as advisory committee members impact the ability of ACCRES to provide an independent perspective to the government?.

   I do not believe that the inclusion of Executive Branch officials on ACCRES necessarily limits the ability of ACCRES to provide an independent perspective to the government. In fact, Executive Branch officials from the National Imagery and Mapping Agency (NIMA) and the State Department participated in the early meetings of ACCRES. There is ample precedent for Executive Branch officials to sit on other federal advisory committees, to good effect.

   The key issue, unresolved as I understand it, is whether the Executive Branch participants are there in an official, representational capacity, or simply as experts on departmental perspectives or commercial remote sensing issues overall. There are both legal and perception issues associated with this. In my view, ensuring that those officials do have formal, representational roles could, in fact, accelerate the process of regulatory input and reform.

   NOAA should be tasked with noting any specific conflicts that impede an independent view to the Administrator, NOAA and/or the Secretary of Commerce.

2. Question: What would you recommend that the Executive Branch do with regard to commercial space remote sensing policy during the first one hundred days?

   Recognizing that the new President will have many competing issues and the new administration will need some time to put in place senior political appointees and formulate its initial policy guidance, I would recommend the following:

   - First, publicly acknowledge the importance of a robust U.S. commercial remote sensing industry to our economic vitality and national security, with primary and secondary innovation benefits. This should be stated within the broader affirmation of the importance of space to the United States.
   - Second, direct that an updated U.S. commercial remote sensing policy be developed that continues to promote U.S. leadership in this field, including associated safety, security, and scientific benefits. The updated policy should recognize the full range of earth-observation and non-earth observation activities that are underway today and that are anticipated in the future.
   - Third, the White House also should acknowledge the need to consider carefully and act on ways to improve the existing licensing and compliance processes, which may require streamlining of regulatory processes and additional updated policy guidance. Such an update should explicitly recognize the shift of commercial remote sensing from a traditional aerospace technology to a modern information capability, which should drive any new regulatory frameworks.
   - Fourth, the White House should mandate a full rationalization of U.S. government activities in space, including how the role of a robust U.S. commercial space industry

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can advance our overall national goals in space. In parallel, the National Security Council should undertake a full review of U.S. national space policy, including the roles of commercial space and international cooperation.

- Finally, the White House should mandate an immediate review of the Department of Commerce's many roles and functions on commercial space – including the roles of agencies like BIS, NOAA, NTIA and others – in order to create greater efficiency and effectiveness. The Office of Space Commerce should be filled with a credible, recognized, and proactive leader who will advocate on behalf of the industry.

3. Question: What aspects of the 1992 Land Remote Sensing Act Should Be Reformed?

I would defer to the legal experts to speak to the particulars of how to reform and modernize provisions under Title II of the Land Remote Sensing Policy Act of 1992, and the relevant subsequent modifications to the legislation. I would speak to the policy and regulatory issues.

While it was necessary and useful to include the licensing of private or commercial land remote-sensing space systems as part of the Land Remote Sensing Policy Act legislative provisions in 1992, it has been nearly 25 years since the original legislation that has mainly focused on U.S. civil remote sensing issues involving the Landsat program. Discussions about Landsat and commercial remote sensing are mainly separate conversations, and the legacy references to "national security" in the LRSPA often form the foundation of outmoded counterarguments to commercial licensing

It is time to shift the discussion toward legislation pertaining to commercial space activities, including commercial remote sensing. That shift would be more forward looking, and more anticipatory of an expanding set of innovative remote sensing and other space capabilities (e.g., satellite servicing, commercial space weather data, others).

Along with my specific recommendations on reforming existing U.S. government licensing processes for commercial remote sensing satellites, as discussed below, it is important for any new legislation to have a forward focus on considering the types space-based remote sensing sensors and platforms that it concerns, and potentially novel issues, such as the implications of small satellite systems and introduction of new satellite phenomena. It is well recognized that constellations consisting of substantial numbers of small satellites may present new technical and operational issues, such as safely deorbiting large numbers of defunct satellites. However, any new legislative provisions should also acknowledge future non-technical contingencies, such as having one or more U.S. commercial satellite operators encounter financial difficulties, which may present novel policy choices for the U.S. government.

4. Question: Is it time that the 2003 executive order (NSPD-27) should be updated, and what should the new policy achieve?

It is definitely time to update NSPD-27. Almost a decade and a half later, satellite remote sensing technologies, enabling space technologies (e.g., space launch), and related analytic and communications technologies (e.g., cloud computing, machine learning) have advanced

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far beyond what was conceived at the turn of the century. And they have proliferated internationally as well, with many more sources of expertise and open learning.

What should the new policy achieve? For sure, it should rstrongly reaffirm the same overarching goal that has existed for over two decades in U.S. policy, namely that the United States must strive for global leadership in commercial remote sensing. It should further acknowledge the dynamic nature of commercial remote sensing and other potential commercial space capabilities with a view toward encouraging proactive thinking on how the nation can benefit from an robust commercial space sector.

The policy should acknowledge the important downstream benefits in science, safety, and security, with an explicit recognition that we have to rethink what can be effectively achieved or controlled through regulation. Moreover, the policy should recognize a very different conceptualization of security that is created, both in space and on the ground, by a robust commercial sector, including fusion with other information sources: topics ranging from space control to emerging global transparency to the value chain and impact of satellite imagery need to be rethought for the future world we are facing. The opportunities and challenges for U.S. government future investments should also be addressed.

At core is the question of what can and should be regulated. Commercial remote sensing impacts U.S. international obligations and does involve scarce public goods, and those need to be carefully considered. U.S. national security creates a requirement for regulatory-driven options in crisis situations, and should, but the impact to U.S. industry should be limited in both space and time as much as possible. But a forward-leaning policy means that the U.S. government should be thinking explicitly about the future and how global remote sensing affects U.S. equities (e.g., facilities, and people, and military operations), including any needed adaptations. Emerging remote sensing and other commercial space capabilities are likely to have analytic insights and information as their output, which fall under a far different3 regulatory regime.

5. Question: What are the greatest challenges associated with the interagency regulatory process? What reforms do you recommend?

NOAA often takes the blame for the challenges in the licensing process, and certainly bears some responsibility for delays. NOAA is continuously under-resourced for the regulatory and compliance missions that it has responsibility for managing in a dynamically changing area. However, NOAA is just the most public face of an inadequately designed regulatory process. The interagency process is too complex, too slow, too cumbersome, and lacks transparency to both potential licensees and, at times, even current licensees. As I stated in my testimony, too many government officials have the ability to say no or stop the clock without accountability.

Sadly, the bold policy vision of PDD-23(1994) and NSPD-27 (2003) has not resulted in proactive implementation. Some of this stems from outdated thinking based on space-based imagery's exceptional Cold War legacy, some of it from concern about the proliferation of unique geospatial information. While these concerns are understandable, they fail to recognize the truly global nature of remote sensing and the rapid leveling of knowledge associated with using it. For the United States, still the global leader in remote

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sensing, there is no strategy but offense: placing appropriate long-term, moderate-to-high risk investments in government remote sensing while leveraging the experimentation and innovation arising in the commercial sector in order to retain its primacy in global markets.

There are potentially many adjustments to the interagency process. But I would focus on two key areas: a shift in policy presumption, and improved review and decision timelines. First of all, given a U.S. policy that strives for leadership, there should be a presumption of approval in the licensing process. Automatic approval should be granted for capabilities already in the market, either at home or abroad. For truly innovative capabilities, due diligence should be conducted in a timely manner by the interagency, but with a presumption that a license will be approved (e.g., not if?, but how?).

The burden of proof to reject or overly restrict the license should lie specifically within Executive Branch agencies, including clarity on the basis for concern. Any restrictions imposed within the license should recognize the value of experimentation and innovation, and therefore be limited in time and scope. Policy conflicts should be elevated to the Secretary of Commerce, the Secretary of State, and the Secretary of Defense, as necessary, to ensure that parochial bureaucratic concerns do not undercut the broader aims of U.S. commercial remote sensing policy.

Second, all relevant parties should be involved in the deliberative process – including the Office of the Director of National Intelligence and the Office of Space Commerce – with specific timely deadlines and escalation approaches if there is no agreement. Further, while NOAA has done an excellent job in the pre-license meetings, there needs to be a separate, more regular, forum between U.S. government stakeholders and industry to discuss emerging technical approaches and business models approaches as well as potential conflicts with U.S. international obligations and national security, including prospective workarounds and mitigation measures. Licensees and prospective licensees should be involved in an inclusive process, not one which generates regulatory surprise or surprises U.S. licensees with retrospective action.

6. Question: Given the convergence of smallsat technology revolution and the "big data" revolution, how are these technology developments impacting the commercial space remote sensing industry? What are the legal and policy implications of these technological developments?

Again, I would defer legal commentary to my fellow witnesses with legal background and experience.

As I mentioned in my testimony, the convergence of smallsat technology and associated "big data" analytics creates both the incentive and the opportunity for many other countries to be involved in satellite remote sensing. We presently see a major shift in the United States from the collection and dissemination of imagery data to one where U.S. firms are increasingly delivering analytic insights, often through unique uses of machine learning, advanced analytics and big data. While data sales will always be important, this transition will be crucial for the future of U.S. firms.

These developments are not lost on other members of the international community. The forecasting firm Euroconsult reports over 50 countries are involved in or planning remote

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sensing activities in addition to countries that benefit by virtue of international cooperation or industrial participation. Many different organizations – environmental, educational scientific, national security, civil and commercial – have unique interests in satellite remote sensing data, while other countries see the benefit from being involved in the satellite and space dimensions of it.

Countries have a wide range of motives for their involvement in commercial space activities, ranging from national pride to internal monitoring and economic and industrial development. Some countries have themselves moved to export both satellites and data consistent with foreign policy and trade imperatives, thereby proliferating capabilities and the knowledge gained from them.

The question about the policy implications of these developments returns to the point about what should and can be regulated. As space-based information becomes fused with other kinds of geospatial information, to produce answers and insights, the space regulatory regime that governs it weakens relative to the final product and has less relevance.

7. Question: What are the challenges of having the regulatory authority vested to a NOAA line office? Would you recommend elevating the regulatory authority back to the Office of the Secretary of Commerce?

I do not believe that there is an inherent conflict having the regulatory authority vested to a NOAA line office. NOAA has the same set of complex relationships in the commercial remote sensing market as would other agencies. NOAA's National Satellite, Data, and Information Service (NESDIS) office is as logical a place as any to house the regulatory and compliance responsibilities. However, I have the sense that the resources applied to this issue within NOAA is insufficient to the task, requiring some emphasis on the tactical over the strategic (such as tending to badly needed regulatory reforms). Other priorities within NOAA, and NESDIS, seem to crowd out the attention needed to prioritize this mission. With regard to elevating the authority, the Secretary of Commerce should be aware of lines of inquiry and debate on this issue within the interagency, especially to the extent that it impedes licensing of innovative U.S. satellite systems. An equally strong and active Office of Space Commerce should support the Secretary in the advocacy role for the U.S. commercial remote sensing industry, including an assessment of any restrictions in light of their U.S. industrial and international impact.

Given the increasing importance of space to U.S. interests, the next Administration should conduct a review of all space functions within the Department of Commerce with a view toward improving efficiency, effectiveness, and coherence of licensing, export control and other functions.

Finally, NOAA should make more use of its advisory committee, ACCRES, to flesh out key themes and opportunities for both the U.S. government and industry. A number of still useful ideas lie in the ACCRES archives and work done previously; ACCRES' outstanding membership brings a practical view toward modernizing U.S. commercial remote sensing policy and recommending ways to reform the regulatory process. ACCRES members also have both tacit and explicit knowledge of international developments beyond government-to-government discussions.

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8. Question: Is the U.S. better served by placing the burden of proof on the USG to demonstrate a harm in order to prohibit an activity? Should the USG also be required to first attempt to mitigate those risks to the greatest extent before limiting the liberty of US entities?

Yes. The current U.S. approach to regulating commercial remote sensing is shaped by a historical context that is less relevant in an age of rapidly diffusing satellite imaging capabilities and an even faster level of learning by others on how to use remote sensing data in combination with other geospatial sources. Automatic licensing should take place for any capability that is already available in the international marketplace.

The U.S. government has had 20 years to consider this moment, and should be actively thinking about the world of global transparency, created in part by commercial remote sensing capabilities. They, in combination with modern communications, computing, and analytic capabities, transforms the landscape for governance, economy and security in ways not previously envisioned. A wholesale rethinking of how security is achieved in this world is needed, ranging from a different understanding of the value chain for satellite imagery to the shaping that can and must be done in the international environment. For example, a robust U.S. commercial space industry that satisfies global markets actually serves as a stabilizing factor in outer space by improving space resilience and changing the strategic landscape for space.

All of this presupposes a more routine conversation between the U.S. government and industry, especially as fast-breaking technology encourages experimentation and innovation. Improved and more routine interaction will allow U.S. government agencies to anticipate future developments for purposes of risk mitigation and their own investment of scarce budgetary resources. It would also create more cooperative solutions in response to perceived national security concerns.

Questions submitted by Rep. Jim Brindenstine:

1. Question: Does uncertainty in the CRS licensing process put efforts at risk other USG effort to disaggregate and distribute architectures, including NGA's commercial GEOINT strategy and NOAA's commercial weather data pilot?

Absolutely. The NGA commercial GEOINT strategy, for example, represents exactly the kind of updated strategy that U.S. government agencies should have, given U.S. commercial remote sensing policy and associated commercial developments. Rather than keep a historical mindset about space – where the U.S. government created the capabilities – we need to shift to a mindset of using scarce government dollars to satisfy unique government requirements and stretching the imagination on unique capabilities in science, safety and security, while highly leveraging the experimentation and innovation taking place in the commercial market. This is not a blindly optimistic view: the U.S. government must maintain sufficient expertise and collect external inputs in order to maintain an objective assessment of risk, and an updated view of capability, both foreign and domestic, especially where public equities and taxpayer dollars are at stake.

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2. Question: Given that the CRS licensing process has involved other issues, such as space traffic management, does this highlight the need for a separate, clear space traffic management regulatory regime?

The 20-year modern history of U.S. commercial remote sensing regulation has important lessons for other areas of commercial space, such as for those involved in commercial weather, radio frequency (RF) measurement, or space situational awareness (SSA). Space traffic management will be an underlying issue for those and other phemonena. A preferred approach would be to manage the overall projected growth in space systems using a dedicated space traffic management regulatory system that can be comprehensive in accounting for all types of space systems, including U.S. and foreign space systems. Obviously, this regulatory system should be integrated with NOAA's regulatory and compliance oversight to the degree possible, in order to avoid unnecessary deconfliction and additional delays in licensing.

3. Question: With regard to the introduction of the American Space Renaissance Act, which directs NOAA to create different categories of remote sensing licenses, do you see benefits in taking a more segmented approach to the application process?

The American Space Rennaissance Act includes many ideas which would improve the regulatory process, including the shortening of timelines, improved communication between the U.S. government and industry on licensing concerns, prohibition on retroactive licensing restrictions and others. Special attention is called to the provision that requires automatic licensing of any capability already in the international marketplace. When addressing that issue, U.S. licenses can be challenged based on the fact that no such capability is operational overseas, yet which disregards substantial foreign investment in areas like very high resolution, radar, and other phenomena.

As a practical matter, NOAA should segment license requests into different categories, depending on whether capability is already in the market, or represents an entirely new capability. Distinction might be made between earth-imaging and non-earth imaging systems, for example, that would require different expertise and different criteria for evaluation.

As I stated in my testimony, speed is both an economic and a national security discriminator in this market. The key is to make the regulatory processes be faster and more efficient in trying to encourage U.S. industry and thereby maintain our national leadership in remote sensing.

4. Does the Office of Space Commerce have an official role in the CRS licensing process and should it?

The Office of Space Commerce should have an official input into the licensing process in addition to serving a role as counsel to the Secretary. This office should aggressively seek to understand international remote sensing developments, at least partly by serving as a repository of information collected by U.S. industry about emerging business models, fair and unfair economic competition, emerging foreign regulatory issues, and the net effects of U.S. regulation on our industry's ability to compete in global markets.

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The Office of Space Commerce should also have a formal role in advising the Secretary on the financial health of the industry, including capital flows and financing, expected and unanticipated challenges within licensed firms, and overall industrial competitiveness. These issues will become more complex as commercial remote sensing providers shift their own value proposition toward analytic insights, and partnerships within a much broader geospatial ecosystem. In particular, the Department of Commerce should help evolve traditional macroeconomic accounting mechanisms to include a sophisticated understanding of the digital economy, including commercial remote sensing's role in it.

These and other ideas recommended in testimony underpin the Office of Space Commerce's advocacy role on behalf of U.S. industry.

Questions submitted by Rep. Donna F. Edwards:

1. Question: What is the Federal role in enabling the commercial remote sensing industry? Does this role need to change, and if so, how? Can the Federal govt. reduce its level of investment? Why or why not?

As discussed in my testimony, the U.S. government plays five different roles in interacting with and enabling the U.S. commercial remote sensing industry: customer, patron, regulator, competitor, and advocate. These roles are real – vice purely theoretical – complex, and sometimes conflict with one another, whether in fact or perception only. Especially as a robust and dynamic U.S. industry emerges, the balance among these roles may shift, but these roles will all continue to exist within the market.

Let highlight a couple of these: the customer role is obvious, and agencies like NOAA and NGA are starting to take advantage of developments in the market, whether for operational need or sources of innovation. Within the patron role, the government places smaller bets in order to shape a technical dimension for purposes of experimentation, and perhaps market creation. The regulator role should emerge with the assumption that the U.S. government can take some advantage of new-found capabilities as they emerge, with direct impact on their own future investments.

Can the Federal government reduce its level of investment? Perhaps, but it may want to take advantage of new capabilities, enhance its own programs, and experiment for the future. Your question may relate to *initial* funding and anchor tenant commitment to U.S. firms, which should now shift in light of a number of market-based finance mechanisms, overall commercial market growth and other related developments. Planet's discussion of the role of the U.S. government as a "second customer" is an interesting marker here, and reflects important shifts between government and industry in the market. them that the aim is for the CRS firms to be viable commercially while providing desired products and services to various USG agencies, as well as more broadly being a source of remote sensing innovation and best practices for both government and the CRS industry

2. Question: How does the free and open availability of federally funded data sources, such as medium resolution and multispectral Landsat data, affect the use of CRS imagery in developing information products?

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The U.S. government legitimately undertakes a wide range of activities in remote sensing: capability development for both space systems and downstream analytic capabilities; international cooperation for weather, environmental, and national security programs; investment in experimentation and future capabilities. Our rich Landsat experience was initially seen to compete in the market, but could also be viewed through the lens of having helped develop a marketplace through encouragement of innovative applications for both academic and commercial uses.

The diversity and complexity of U.S. government roles in the market might be likened to a 3D chessboard, where legitimate execution of one function potentially competes with another. An easy to understand example is in the national security arena, where the U.S. government does and will continue to share imagery and imagery intelligence information with our closest allies. In examples like these, it will be important for U.S. government executives to deliberately and explicitly think about the consequences of action for the market, and, where possible, limit competition with industry. Because of the emergence of U.S. industry, government faces a more complex "make or buy" decision, including a deeper understanding of its own role(s) in the market. Where possible, U.S. government managers should consider roles where it can separate requirements, some of which relate to core government missions and others which can allow for unique commercial contribution and value. NOAA's commercial weather program is experiencing the need to rethink this in light of our international obligations (e.g., WMO-40) and the remaining requirements that can be offered for commercial value and benefit in the market.

3. Question: The CRS industry is changing not only re advanced sensing capabilities and new approaches to operations, but also the means by which data can be delivered to the customers. Could you discuss the changes in data delivery mechanisms and what, if any, regulatory, and security issues they raise?

Data delivery mechanisms are changing dynamically in light of developments in advanced analytics, cloud computing, and communications, to name a few. Our digital world rapidly shifts toward direct-to-business or direct-to consumer activities, with considerable economic value placed on that kind of immediate and direct access.

The U.S. commercial remote sensing industry has acknowledged and is quickly taking advantage of these shifts: firms are moving from pure data sales to the creation of analytic insights for customers, although a myriad of traditional and new products will continue to drive commercial value in the market. Ironically, the blending of remote sensing products with geospatial and other information sources generally weakens the relevance of the regulatory regime to the overall product.

In other words, this shift creates a number of questions about what can and should be regulated. New delivery mechanisms will be essential to both government and commercial innovations on how to use remote sensing data and associated downstream products, so our thinking about how to consider them within the licensing and compliance process must change from a traditional aerospace model to one associated with modern information capabilities. Finally, as discussed, our thinking about how to create and maintain security in a world of global transparency – one fueled by *global* commercial remote sensing developments and their role in a much larger geospatial ecosystem – must take place as

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quickly as possible, with appropriate adaptation for U.S. military operations, facilities, and organizations. Information control is less likely to be effective in such a dynamic world, except under very, very specific time and space conditions. Maximizing its use for overall U.S. economic, scientific and national security benefit will be.

This is why, under our current national policy of leadership, I believe that offense is the only appropriate strategy, not attempts to limit innovation on the basis of traditional thinking.

Responses by Mr. Kevin Pomfret

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON SPACE

Commercial Remote Sensing: Facilitating Innovation and Leadership

Mr. Kevin Pomfret, Executive Director, Centre for Spatial Law and Policy

Questions submitted by Rep. Brian Babin, Chairman, Subcommittee on Space

1. What do you expect the legal and regulatory framework around geoinformation will look like in the future?

   In the near-term (next five years) I expect that there will be a patchwork of federal and state laws and regulations pertaining to geospatial information (geoinformation). Many of these laws and regulations will pertain to privacy concerns. However, there also will be industry specific regulations related to the wide range of technologies that use sensors to collect, use, store and distribute geoinformation, such as autonomous vehicles, unmanned aircraft systems and the internet of things. However, in the long term, I expect that we will see a consistent and transparent legal and regulatory framework that cuts across technology platforms and legal and disciplines.

2. In your opinion, what are the greatest strengths and weaknesses of America's commercial remote sensing industry?

   In my opinion, the greatest strength of the commercial remote sensing industry is its ability to collect and distribute high resolution, electro-optical imagery in near real-time. Its greatest weakness is its inability to compete in other types of sensor data (infra-red, radar, multi-spectral) for commercial purposes.

3. In a recent op-ed, Digital Globe founder, Walter Scott, said that two common sense changes are needed to existing law and regulation. "First, we need to stop the practice whereby any official within the U.S. government can block a license from being issued for an innovative technical capability....License approval should be automatic and on a firm timeline unless a cabinet-level decision blocks it." And second, "eliminate the need for approvals of foreign imagery sales agreements," as "the law doesn't require approval, merely notification." Do you agree with these recommendations?

   Yes, I agree with both of those recommendations.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON SPACE

Commercial Remote Sensing: Facilitating Innovation and Leadership

Mr. Kevin Pomfret, Executive Director, Centre for Spatial Law and Policy

4. There have been a number of reports in the press and from stakeholders that the current commercial space remote sensing license adjudication interagency process has significant issues. The process is administered by NOAA, but under existing statutory authority the authority to decide license conditions for national security and foreign policy are with the Secretary of Defense and Secretary of State, respectively. In your opinion, what are the greatest challenges with existing interagency regulatory processes? What reforms do you recommend to address these challenges?

   In my opinion, the greatest challenge with the existing interagency regulatory process is the lack of transparency. Too often, the commercial industry is not given sufficient information as to the concerns of the defense and intelligence communities. Without such information they are unable to make the changes necessary to receive the necessary approval. One way to address this issue is to create a presumption an activity is permitted unless the defense and intelligence agencies can show an independent panel that the activity is a direct threat to national security.

5. The *1992 Land Remote Sensing Act* vested authority for the licensing of private space remote sensing systems to the Secretary of Commerce. The Secretary has delegated this authority down to the NOAA Administrator. The NOAA Administrator has in turn delegated this authority to a NOAA line-office, the National Environmental Satellite Data and Information Service. In your opinion, what are the challenges with having the regulatory authority vested to a NOAA line office? Would you recommend elevating the regulatory authority back to the Office of the Secretary?

   I am not sure how much elevating the regulatory authority to the Office of Secretary will help without a fundamental change in the understanding of the value of geoinformation. My sense is that it will solve some issues but will cause others.

6. The current regulatory regime governing space remote sensing systems places the burden of demonstrating activities won't cause harm to U.S. interests with the license applicant. In your opinion, would the US be better served by placing the burden of proof on the government to demonstrate a harm in order to prohibit an activity? Should the government also be required to first attempt to mitigate those risks to the greatest extent practicable before limiting the liberty of US entities?

   As stated above, I think the U.S. would be better served by placing the burden of proof on the government to demonstrate a direct harm in order to prohibit an activity. I also agree that there should be an attempt made to mitigate those risks before limiting the commercial activity. In my opinion such mitigation should be a joint government-industry effort.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
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Commercial Remote Sensing: Facilitating Innovation and Leadership

Mr. Kevin Pomfret, Executive Director, Centre for Spatial Law and Policy

Questions submitted by Rep. Jim Bridenstine

1. It is my understanding that the remote sensing licensing process has been used to examine issues not directly related to remote sensing, such as space traffic management. Does this conflation of issues highlight the need for a separate, clear space traffic management regulatory regime?

   Unfortunately, I am not familiar with space traffic management and do not have an opinion on the necessary regulatory regime.

2. Does the Office of Space Commerce, which by Congressional mandate is tasked with facilitating and promoting economic growth and innovation in the commercial space industry, have an official role in the remote sensing licensing process? Should it?

   The Office of Space Commerce participates in the process; however in my opinion it has limited ability to address concerns raised by the defense and intelligence communities.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON SPACE

Commercial Remote Sensing: Facilitating Innovation and Leadership

Mr. Kevin Pomfret, Executive Director, Centre for Spatial Law and Policy

Questions submitted by Rep. Donna P. Edwards, Ranking Member, Subcommittee on Space

1. What is the Federal role in enabling the commercial remote sensing industry?
   - Does this role need to change as the industry grows and matures? If so, how? Can the Federal government reduce its level of investment? Why or why not?

   As I mentioned in my testimony, I see the geospatial community as an interdependent ecosystem consisting of government, industry and the "crowd." The government's role with respect to the commercial remote sensing industry should be as a participant in this ecosystem by encouraging the collection and use of geoinformation that supports a variety of economic, governmental and environmental activities. This role can be as an investor, as a customer and by creating a consistent, transparent and rational legal and regulatory framework that recognizes the value of geoinformation collected from commercial remote sensing satellites.

2. Commercial remote sensing data has largely been focused on providing high resolution imagery. That said, many sources of data are often used in creating geospatial information products. How does the free and open availability of federally funded data sources, such as Landsat, which provides low to medium resolution imagery and multispectral data, affect the use of commercial remote sensing imagery in developing information products?

   Free and open data sources of satellite remote sensing data complement but cannot replace high resolution remote sensing data. The quality and type of data that is required depends upon the problem being addressed. Landsat data has proven to be very successful in addressing a variety of issues across the globe. This has helped fuel the market for higher quality data, as is the case with many technologies.

3. The commercial remote sensing industry is changing not only in terms of advanced sensing capabilities and new approaches to operations but also in the means by which data can be delivered to the customer. Could you discuss the changes in data delivery mechanisms and what, if any, policy, regulatory, and security issues they raise?

   I am not an expert in data delivery mechanisms, but it is my understanding that industry has the capability to allow for shorter delivery times of data to the customer and/or end user. As with any technological advancement, there are benefits and risks associated with such capabilities. I am not aware that this technology raises any new policy, regulatory or security issues, other than perhaps cybersecurity concerns, if for example the customer was a US government agency.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON SPACE

Commercial Remote Sensing: Facilitating Innovation and Leadership

Mr. Kevin Pomfret, Executive Director, Centre for Spatial Law and Policy

4. You stated in your written testimony that "*U.S. commercial remote sensing companies ... have competitors around the world, and any restrictions on what they can collect or distribute affects their economic competitiveness*". Can you describe in greater detail the quantitative data you used for establishing the impacts to economic competitiveness resulting from remote sensing restrictions? Are you suggesting that companies be free to sell any and all data without restriction, even if it has national security implications?

I am not suggesting that companies be free to sell any and all data even if there are national security implications. I am suggesting that there are far fewer such implications than certain groups within the defense and intelligence communities believe. I am also suggesting that if there were greater transparency on the true nature of such concerns, these issues could be addressed through technology, information governance, business policies and security measures, rather than through blanket prohibitions.

While, admittedly, there are a number of complex reasons that contribute to the economic competitiveness of any US industry, in my opinion restrictions in the U.S. regulatory regime are having a significant impact. I base this on several metrics. One such metric is the lack of U.S. companies in the radar sector of the industry. Another metric is the growing number of countries that have decided to build and/or operate their own remote sensing systems rather than purchase imagery from a U.S. company. A third metric is anecdotal and based upon my research and my conversations with customers of remote sensing companies from around the world.

Responses by Ms. Michele R. Weslander Quaid
Response to questions from Rep. Brian Babin, Chairman

1. Given the Advisory Committee on Commercial Remote Sensing (ACCRES) charter -- to provide information, advice, and recommendations to the Secretary of Commerce on matters related to the U.S. commercial remote sensing space industry and on NOAA's regulation of the industry -- it is important that the members have the appropriate credentials and expertise, as well as a commitment to provide their independent perspective based on their personal experience. In order to achieve the objective of receiving an independent perspective, the most important factor is the careful selection of members, for the right person will have the courage of their convictions and speak their mind regardless of where they are employed at the present time, for they recognize the higher calling of doing what is right for America.

2. In the beginning, and for some time, the government led technical innovation in remote sensing with industry partnership. In the 21st century, however, the commercial sector is leading technology innovation in remote sensing, and will continue to lead as long as the government does not hold industry back. Perhaps with the exception of some highly classified special access programs (in which the defense industrial base is undoubtedly a part) that only benefit a select few (due to the nature of such a program), the most creative and innovative remote sensing technologies and derivative products that are having the broadest impact around the world are coming from industry.

3. The greatest threats to U.S. competitiveness in commercial remote sensing are an overly burdensome and bureaucratic regulation process, and a mindset of risk aversion on the part of the government. This approach has resulted in lost opportunities for U.S. leadership in this sector in the past, specifically with regard to Synthetic Aperture RADAR (SAR). The reality is that international competition will only increase and continued loss of our industrial base due to an inability to compete at the international level is a risk to our national security. U.S. interests would be better served if the government had a mindset of intelligent risk taking -- embracing innovation and the benefits it brings, and developing mitigation strategies to lessen any potential risk. The government must take a more holistic view of its regulatory role in the context of facilitating U.S. innovation and leadership, and proactively work to reform the licensing process. For example, there should be a construct to enable expedited approval of a license for any technology that already exists in the international marketplace. In regard to new technology that does not already exist, it is important to keep in mind that even though the U.S. commercial sector may be the first to develop a technology, there may be others who fall outside U.S. jurisdiction who are working on a similar technology, as was the case with SAR. We must recognize that it is in

the best interest of the U.S. -- both with regard to commerce and national security -- to have the U.S. industrial base in a leadership role in the commercial remote sensing sector and be the first to market with new technologies. Therefore, the U.S. government should have a strategy to proactively do whatever it can to grant a license. This includes engaging in discussions with a license applicant to determine mitigation strategies, if there is truly a potential threat to national security that the government cannot mitigate on its own, in an earnest attempt to arrive at a solution that enables the license to be approved.

4. One of greatest challenges with regard to the current interagency regulatory process is the ability for the government to "stop the clock" indefinitely, which has resulted in license applications not being adjudicated until well beyond the currently mandated 120 day response time. The volume of license applications will only continue to increase, and the existing regulatory process does not enable us to keep pace with the current demand, so changes are needed. There must be a shift in mindset on the part of the government from "do not approve until we better understand the technology and its implications" to "approve unless there is a grave threat to national security that cannot be mitigated." There must be a construct to enable rapid approval of any license that represents technology already available in the international marketplace, and such license applications should not require in-depth interagency review. In regard to a new technology, if there is a national security concern, the national security community should first do everything it can to modify its operations to mitigate the perceived security risk. If the government ultimately determines that the existence of the technology in the commercial marketplace poses a grave threat to national security and there is no way for it to mitigate the risk, the burden of proof must be put on the national security community to clearly articulate the national security risk and to make a compelling case for why the license should not be approved "as is." There should then be a dialog between the government and the license applicant in the proper channels to facilitate understanding of the concern in order to determine if there are changes that can be made that would mitigate or eliminate the national security risk. Historically, such dialog has resulted in acceptable solutions that satisfy both parties. Presently, there is not enough transparency in the process (e.g., a license applicant can be told "no" but not given a "why") and no formal mechanism to facilitate discussion on potential mitigation strategies if there is a perceived national security risk. Yet transparency and timely communication are critical in order to facilitate mutual understanding and trust on both sides and to ensure that the decisions being made are in the best interest of the U.S. with regard to both commerce and national security. Some of our greatest achievements have come when both government and industry worked together as "one team" focused on doing what was in the best interest of America.

5. Technological innovation and intelligent risk taking are long-standing strengths of the U.S. private sector, and the resultant capabilities the U.S. private sector has developed have benefited not only the U.S. but people around the world. In regard to the remote sensing sector, we have long been in the data gathering business, but the greatest innovation is in the utilization of that data. To paraphrase what I stated in both my written and oral testimony, the mere collection of data does not provide value. We only derive value from the review and application of that data. People with expertise in this area are developing algorithms to analyze and exploit data from any source, combined with any other source, to deliver insight. The most exciting developments are in regard to information we can derive from this data, the associated applications, and the value-added services that enable us to better understand our world, enhance people's lives, preserve individual freedom and support national security. Many traditional remote sensing companies recognize this and are transforming their business accordingly, and most of the new entrants to the market are basing their business on this model.

6. There is an increasing demand for licenses of private space remote sensing systems and the supply of government officials to adjudicate those licenses in the current regulatory construct is not sufficient to meet the demand. Merely hiring more staff at whatever level the authority might reside -- whether at the NOAA National Environmental Satellite Data and Information Service office or at the Office of the Secretary of Commerce -- will not address the problem. What is required is a fundamental shift in mindset, a recognition that demands for licenses will only continue to increase, and a realization that it is in the best interest of the U.S. for our private sector to be the first to market with any new technology. The licensing authority must have the objective to approve licenses by default, and to only delay by exception while proactively working between the government and industry to arrive at a solution to enable approval of the license. The innovation in this sector is unprecedented and these fundamental changes are required if we are to keep pace and empower our industrial base to thrive and stay competitive in the international market.

7. The U.S. would be best served by placing the burden of proof on the government to demonstrate harm to national security before delaying or prohibiting an activity. Furthermore, the government should first attempt to mitigate those risks to the greatest extent practicable before limiting the liberty of U.S. entities. If the government is unable to mitigate those risks on its own, it should engage in timely dialog with the license applicant via the proper channels to determine if there is a mitigation solution that would enable approval of the license. Please refer to my responses to questions number 4 and number 6, as well as my oral and written testimony, for additional details.

Response to questions from Rep. Jim Bridenstine

1. It is in the best interests of the U.S. -- both in regard to commerce and national security -- to enable the U.S. private sector to be first to market and have a leadership role in remote sensing. Uncertainty and delays in the remote sensing licensing process negatively impact the license applicant, and also have the potential to negatively impact other programs, whether they be from industry, academia, or government. Given the current reality and future projection of increased demand for remote sensing licenses, we need to reform the licensing process. There must be a shift in mindset on the part of the government from "do not approve until we better understand the technology and its implications" to "approve unless there is a grave threat to national security that cannot be mitigated." This approach will enable government agencies and others to use capabilities in the commercial marketplace to benefit their missions.

2. Commercial remote sensing and space traffic management are separate but related issues. Any remote sensing asset launched into space affects space traffic management. However, space traffic management goes beyond commercial remote sensing to encompass everything in space, and we should view space activities as a comprehensive traffic regime and regulate them accordingly. Space traffic management should consist of a set of regulatory rules to ensure safe access to outer space, safe operations in outer space, and safe return from outer space. It would be beneficial to have a clearly defined space traffic management regulatory entity that is separate from, but works in collaboration with, the remote sensing licensing entity, particularly in regard to launch and proposed orbitology. In this construct, the space traffic management regulatory entity would participate in the stakeholder review of any remote sensing license application to provide input with regard to the proposed orbitology impact and any necessary changes required to ensure safe operations in outer space.

3. The current remote sensing licensing process needs to be reformed with the intent to fast track licenses for systems whose capabilities already exist in the international marketplace. A proposal to create different categories of licenses with this objective in mind is certainly setting us in the right direction. The stated purpose of the American Space Renaissance Act to "permanently secure the United States of America as the preeminent spacefaring nation" is in line with the leadership objectives articulated in NSPD 27, PPD 4, and the 2011 National Security Space Strategy. Please refer to my response to question number 1 for additional details.

4. Given the Office of Space Commerce's Congressional mandate to facilitate and promote economic growth and innovation in the commercial space industry, it should have an

official role in the remote sensing licensing process. The Office of Space Commerce has the stated objective of "helping U.S. businesses use the unique medium of space to benefit our economy," and as such is a government stakeholder that can assist in helping to identify the benefits of a proposed technology, which can be balanced against any perceived risk identified by the national security community. As with any key role, it is important that this leadership post be filled and with the right person who has the necessary qualifications, believes in the mission, and has the personal conviction to affect positive change.

Response to questions from Rep. Donna Edwards, Ranking Member

1. The primary role of the Federal government in enabling the commercial remote sensing industry should be to create a policy construct that places a high value on U.S. leadership and embraces public sector innovation. The regulatory construct should have the strategic objective of getting to "yes," rather than finding reasons to say "no" to license applicants. The demand for commercial remote sensing licenses will only continue to increase, and the current demand is already more than the existing government staff can support. So the Federal government should fast track licenses for technologies that already exist in the international marketplace, which would not only benefit U.S. commerce but also reduce the oversight burden currently placed on the government. The Federal government's objective should be to create a regulatory framework to enable industry to thrive while also providing a check to ensure that there are not unintended consequences of any technologies that could cause grave damage to our national security.

2. Any program that is funded by the American taxpayer is effectively "owned" by the American citizens. So it is appropriate and beneficial for the Federal government to make sources of data, which do not pose a national security risk, free and openly available to the citizenry. Americans are known for their innovation, and the most innovative applications of technology are derived from a diversity of thought and approaches, and those closest to a problem most often have the insight and motivation to address it. We certainly want to continue to provide Federally funded (taxpayer resourced) data to the citizenry to provide the maximum benefit possible (per the taxpayer's investment) and to facilitate innovation particularly with regard to derivative information products and value-added services.

3. Data is being delivered in real time to mobile devices around the world. In fact, mobile devices are used to command and control some of those data collection systems. The role of government should be to facilitate international standards for data and interoperability (e.g., metadata tags, product formats, etc.), because with universal international standards everyone benefits. There was a time when we had a variety complicated cables for computers and every vendor had a different cable for its mobile device. Standards like USB and micro USB have had a huge positive impact on interoperability and usability of devices, not to mention cutting down costs with regard to hardware accessories. It is very important that the international experts in these fields be a part of developing the standards, which are then voluntarily adopted. The government can then develop policy to encourage the use of these standards. Big data is both promising and challenging, and these standards can include compression algorithms that enable transmission of large data files. Furthermore, commercial cloud computing can be used not only to process this data, but also to enable real-time tailored access to the data with high security around the globe. In

regard to security, one of the greatest challenges we currently face and will continue to face is the ability to preserve data integrity, and to ensure that data is not tampered with in transit, and to confirm the validity of that data on the receiving end. This is an area that warrants investment, and it is in the best interest of the U.S. government to ensure such data integrity capabilities exist.

Responses by Mr. Michael Dodge

Responses to Questions from Members of the Committee on Science, Space, and Technology

October 12, 2016

Mr. Michael S. Dodge, Assistant Professor, Department of Space Studies, University of North Dakota

Commercial Remote Sensing: Facilitating Innovation and Leadership

Questions submitted by Rep. Brian Babin, Chairman, Subcommittee on Space

1. In your opinion, what are the greatest challenges with existing law, regulation, and policy when it comes to commercial remote sensing?

Perhaps the greatest challenge is in maintaining a balance between national security interests and the promotion and development of the commercial remote sensing industry. It would be a false dichotomy to argue that commercial remote sensing is in a constant battle between national security and economic development. The two can and do co-exist, but one of the greatest challenges is in the process utilized to ensure both subjects receive the regard owed them with respect to law and policy. In particular, the somewhat opaque interagency review process between NOAA and the Departments of State and Defense regarding issues in which such agencies have a substantial interest[1] has caused occasional difficulties in acquiring licenses in a timely and useful manner for some applicants. While the Secretary of Commerce, or his or her designee, is the ultimate deciding entity insofar as license issuance is concerned, the Secretaries of the Departments of State and Defense determine the conditions necessary to achieve national security needs and international obligations.[2]

While I would not argue that such decisions should be taken away from those agencies—for they remain the most germane entities in determining such national needs—it would behoove the current system to develop regulatory mechanisms that encourage faster and more consistently applied efforts in determining whether a license application has sufficiently addressed any relevant concerns. As it stands, the 120-day limitation in informing the license applicant of its status is not always followed, which stands in opposition to extant law and policy. Some possibilities for improvement in the Code could include streamlining the current review process,

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[1] 15 CFR Part 960.6(a).
[2] Id. at 960.1(b).

or providing for new and dedicated federal employees to ensure compliance with the time limitations, which might alleviate some of these concerns, and simultaneously maintain both national security and commercial needs.

2. The United States is not the only country to regulate commercial remote sensing. How does our current regulatory regime compare to others? Are other countries more permissive? Are they more restrictive?

It is challenging to answer this question in a definitive, black and white way; indeed, the United States possesses the most extensively written and operable space law in the world, and this extends to the commercial remote sensing field. By contrast, many other States, even those participating in space activities, have little, if any, operable domestic space legislation. That said, there are some States that have begun to regulate remote sensing, and commercial aspects thereof, in more recent years. The two best known examples are those of Canada and Germany, which both have legal regimes established to govern how remote sensing activities may take place in those countries.

In Canada, for instance, the licensing system reflects that of the United States in many ways. As an example, a condition for obtaining a license includes having the licensee maintain control of the system, and that raw data taken of a State be provided to the government of that State in a reasonable timeframe[3]—both of which have similar analogues in United States regulation.[4] However, the Canadian scheme is in some ways more restrictive, since it also applies to government agencies[5], whereas the U.S. scheme being considered here impacts private providers. That said, the "more restrictive" effect of the Canadian regulations is in its application to more than just the private entities or corporations intending to operate a remote sensing system.

Germany has an even more restrictive system, in that violations for failing to keep up with the law can result in criminal penalties.[6] In this sense, Germany's rules seem just as preoccupied with national security concerns as does the United States. On the other hand, with the hard laws (or, in many instances, lack thereof) cropping up in space-based remote sensing

[3] Remote Sensing Space Systems Act (S.C. 2005, c. 45), at 8(4).
[4] See generally, 15 CFR Part 960.11.
[5] Remote Sensing Space Systems Regulations (SOR/2007-66), at 1(1).
[6] See the Satellite Data Security Act (2007) (Act to give Protection against the Security Risk to the Federal Republic of Germany by the Dissemination of High-Grade Earth Remote Sensing Data).

States around the world, it seems that many States are enjoying the fruits of remote sensing activities without having to wade through the extensive regulatory networks of States like the United States and Germany. In fact, it is currently more common to find White Papers and policies on the subject, or on the general use of space (without emphasis on remote sensing), than it is to find the hard law, statutory and regulatory regime common to the United States. In some ways, this can conceptually make operating systems in some foreign States less onerous than doing so in the United States, and it is known that several companies have risen around the world to take a swipe at portions of the market that the U.S. has seemingly either abdicated, or over which it has delayed authorization. If the United States intends to remain the premier space power globally, it should consider the effect that regulation has on the possibility of delay that could, eventually, cede some business to other, non-U.S. parties.

3. From an academic perspective, what were the policy presumptions of the 1992 Land Remote Sensing Policy Act? Do they still make sense today?

The predominant policy presumptions of the 1992 Land Remote Sensing Act are twofold: firstly, that the Landsat system needed to be maintained by the Federal Government; and secondly, that the United States would benefit from encouraging the development and success of a commercial remote sensing industry.[7] In terms of the former policy rationale, it has long been understood that there is significant scientific value in the generation, provision, and consistent archiving of Earth systems data as created by federally funded systems like Landsat. Having such a broad and growing database has numerous beneficial applications for government, academia, and private individuals. One of the basic policies behind the 1992 Act was to ensure that this valued service remains consistent through time.

As for the second policy presumption—that the United States would benefit from commercializing other aspects of remote sensing, and that this should remain the province of the private sector—this remains consistent with extant commercial remote sensing policy[8], as well as with the overall impression on commercial applications as espoused under the currently operable

[7] Pub. L. 102-555 § 2(1, 4, 6), 106 Stat. 4163 (1992); see also Id., at § 2(15): "Development of the remote sensing market and the provision of commercial value-added services based on remote sensing data should remain exclusively the function of the private sector."
[8] See generally NSPD-27, U.S. Commercial Remote Sensing Policy (2003).

National Space Policy.[9] If Congress acts to modify or update the 1992 Act, it should do so with the knowledge that current space policy retains the emphasis on the value of commercialization of space activities, and that new law, while written with modern technological and political realities in mind, should reflect the same policy that noted that the private sector was best equipped to develop and implement commercial remote sensing applications. In short, the original policy presumption of the value of and need to develop private sector investment in remote sensing activities, though technologies have evolved and resolutions since sharpened, remains valid in today's world.

Finally, while these presumptions remain valid, their enforcement via the current regulatory system could stand to be revised in light of the experience of both the Federal Government and private industry in both licensing and commercial activities surrounding the provision of private remote sensing. Regulations could be made more efficient by modifying relevant provisions of the 1992 Act to change segments that have caused the most confusion or difficulty to license applicants, whilst retaining sections that have worked effectively to date.

4. In your study of comparative jurisprudence, do you have any insight as to the policy challenges of other commercial remote sensing domains—for example, remote sensing from unmanned aerial systems—and to what extent there are lessons we can learn from those domains?

The recent proliferation of unmanned aerial systems (UASs) in the United States has caused the Federal Government to struggle with the integration of new technologies in an area of highly regulated space—in this case, the national air space (NAS). The controversies and legal challenges associated with introducing drones/UASs into the NAS are myriad; however, I do believe some of the lessons learned from this realm could be applied to commercial remote sensing in outer space. There is much that aerial remote sensing, and specifically UAS remote sensing, could learn from the space based system effectuated by the regulations contained in 15 CFR Part 960. However, this question asks what the lessons learned from systems like UAS can teach us about space based remote sensing. Accordingly, one lesson that can be gleaned immediately is that regulation, despite its importance in maintaining rational use of technologies, can also be potently onerous to the operations of commercial providers.

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[9] National Space Policy of the United States of America, June 28, 2010, Principles: "a robust and competitive commercial space sector is vital to continued progress in space."

In the United States, the road to integrating UAS into the NAS has been a long, and often painful, one. However, recent regulation was released purporting to fulfill the Congressional mandate given to the FAA of merging drones into the airspace[10]. Far from helping to encourage the growth and proliferation of commercial remote sensing UAS providers, the new rules set forth severe restrictions that make many kinds of commercial remote sensing difficult or even impossible.[11] For instance, companies may operate their UAS, but they must do so with devices (and any payloads, including for remote sensing) weighing no more than 55 pounds[12]. Additionally, the device must stay within the sight of the operators[13], and has to be flown only in daylight[14]—and there are more restrictions beyond these. As a consequence of such regulatory burdens, some commercial operators may choose to operate outside of the bounds of the United States.[15]

The point to be taken for the purposes of space-based commercial remote sensing is that sometimes regulations can be passed—even for sensible reasons—that have the unintended consequence of impeding the development of a technology or the industry that exists to use such technology. If the Federal Government is to continue to follow the guidance of the Commercial Remote Sensing Policy, and the National Space Policy, and encourage the growth of the commercial use of outer space, it should be wary of any regulations—current or future—that could reflect the negative consequences of regulation we have seen in other realms like UAS. Thus, any potential changes to the Land Remote Sensing Policy Act of 1992, or to the regulations that guide its implementation, should be done to minimize the negative impact such regulation could have on the growth of the industry—so long as an appropriate balance between industry needs and national security is maintained. Indeed, if the belief persists that "enhancing the U.S. remote sensing industry…will also foster economic growth…"[16] and otherwise

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[10] See, e.g., H.R. 658 §332(a)(1) (2012).
[11] See generally, 14 CFR Part 107.
[12] 14 CFR Part 107.3.
[13] Id at 107.31.
[14] Id. at 107.29.
[15] As an example, though not directly related to commercial remote sensing, the Amazon corporation, which has long argued for allowing the use of UAS to deliver packages as part of the commercial services it provides. Since the U.S. rules do not permit the practical use of this method, they have taken this business to other States. See, e.g., Nick Woolf & Samuel Gibbs, "Amazon to Test Drone Delivery in Partnership with UK Government", 7/25/16, https://www.theguardian.com/technology/2016/jul/25/amazon-to-test-drone-delivery-uk-government.
[16] NSPD-27, United States Commercial Remote Sensing Policy, Sec. II, Policy Goal (2003).

"advance and protect U.S. national security and foreign policy interests"[17], changes made to extant law and policy should act to remove barriers to industry success, since, by extension, that success benefits the United States as well.

5. The 1992 Land Remote Sensing Act vested authority for the licensing of private space remote sensing systems to the Secretary of Commerce. The Secretary has delegated this authority down to the NOAA Administrator. The NOAA Administrator has in turn delegated this authority to a NOAA line-office, the National Environmental Satellite Data and Information Service. In your opinion, what are the challenges with having the regulatory authority vested to a NOAA line-office? Would you recommend elevating the regulatory authority back to the Office of the Secretary?

The challenges of placing regulatory authority with a line-office primarily stem from the distance this places between the licensing entity and other relevant federal agencies that also need to place input into the parameters of permitting a license to be offered. The further from the central authority of the agencies involved, the more likely delay there can be in the licensing process. While this is not necessarily true in every instance, it poses enough of a potential issue to suggest that moving the seat of authority could have positive benefits for the commercial remote sensing industry. In particular, utilizing the line-office system arguably lengthens (or enables delay) the time needed to authorize a new license, since the decision may have to be filtered through layers of agency. This could be changed by constructing the system such that the presumption is that new licensing requests will be approved, unless a high-level governmental official, such as (ideally) the Secretary of Commerce, or even directly the Administrator of NOAA, decides that in fact the license would be contrary to U.S. interests.

In part, this change should be made because of the simple fact that high-level administrators like the Secretary of Commerce will have more direct contact with the heads of other relevant federal agencies—those that have a stake in licensing commercial remote sensing systems—like those of the Departments of Defense and State[18]. The current licensing regime could potentially operate more rapidly or efficiently if the regulatory authority is transferred to the Office of the Secretary, rather than operating from a line-office. While an improved outcome is not certain, if any changes are sought with respect to the current regulatory system, they

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[17] Id.

[18] 15 CFR Part 960.1(b). The Secretaries of State and Defense must determine what constitutes the conditions needed to meet international obligations, national security, and other matters relevant to their purview.

should bear in mind the role that government is meant to play, according to statute and policy alike, in enhancing the ability of commercial operators to successfully partake in outer space activities.

6. The current regulatory regime governing space remote sensing platforms places the burden of demonstrating activities won't cause harm to U.S. interests with the license applicant. In your opinion, would the US be better served by placing the burden of proof on the government to demonstrate a harm in order to prohibit an activity? Should the government also be required to first attempt to mitigate those risks to the greatest extent practicable before limiting the liberty of US entities?

The burden for proving national security interests or some other international harm would result from the use of space-based commercial remote sensing would be best placed on the Federal Government. It would be fair to say that the government is better situated, and possesses much more comprehensive knowledge about the status of national security needs and international obligations, than does any given commercial remote sensing provider. This is not to say, however, that a license applicant should not be required to think rationally, and demonstrate that deliberative effort, about the possible consequences to national security or to international concerns. However, because the applicant cannot possibly be equipped with the real-time data, security concerns, and intelligence estimates in the possession of the government, it is more sensible for the burden of demonstrating compliance with these matters to rest with the government.

In a sense, this is already the operating procedure under the federal regulations, since the Secretary (or his or her designee) will only grant the requested license if he has determined that the license applicant will operate in a manner "consistent with the national security interest, foreign policy and international obligations of the United States".[19] Additionally, the Secretary is capable of invalidating the license of the private entity if he or she determines its operations are endangering national security.[20] Finally, there is regulatory authority for placing the burden of proving a harm on the shoulders of the government, since the Secretaries of Defense and State must determine the eventualities or conditions that impact international obligations and national security, which means that the burden for preventing harm could be ascribed to their ambit.

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[19] 15 CFR Part 960.6(f).
[20] 15 CFR Part. 960.9(a).

On the other hand, currently some burden can be placed directly on the shoulders of the commercial entity, since a condition for operation is that the licensee "operate its system in a manner that preserves the national security and observes the foreign policy...obligations...of the United States"[21], as well as when it wishes to transfer their license, or change operational control; indeed, in such a circumstance, the licensee has to provide a "plan...[to] prevent technology transfer that would adversely impact national security...or international obligations..." of the United States. [22] For the aforementioned reasons, it would be better from a logistical and intelligence perspective to place the burden of showing a harm on the Federal Government itself, rather than the licensee. This should, in turn, alleviate some of the more difficult burdens imposed upon commercial remote sensing providers, and free their time up to address other aspects of their obligations under the federal regulations.

Finally, the Federal Government should indeed work to mitigate the risk of placing such a burden on the commercial providers, not only because they are in the best position to ascertain national security or international obligations and the concomitant risks associated with their endangerment, but also because such mitigation comports to the spirit of the U.S. Commercial Remote Sensing Policy and the National Space Policy, both of which encourage the use of governmental resources and authority to enhance the success of commercial actors in space. By reducing obligations hoisted onto license applicants or commercial remote sensing providers, the government would be helping to effectuate these longstanding policies.

Questions submitted by Rep. Jim Bridenstine

1. It is my understanding that the remote sensing licensing process has been used to examine issues not directly related to remote sensing, such as space traffic management. Does this conflation of issues highlight the need for a separate, clear space traffic management regulatory regime?

Using the regulatory licensing process associated with commercial remote sensing as an analogue for what could eventually exist to manage space traffic is an understandable technique that could provide some utility to the U.S. Government. However, such a conflation of issues does have drawbacks as well. In particular, the licensing process for commercial remote sensing was designed to accomplish a very particular statutory mandate, spurred on by years of

[21] 15 CFR Part. 960.11(b)(1).
[22] 15 CFR Part. 960.7(f)(1)(ii).

consistent national space policy efforts involving commercializing space activities. That process has worked, albeit in a flawed manner, for both the government and industry. It is therefore understandable that these methods could be viewed as a guide for future space traffic management; however, because the needs of both the Federal Government and the private industry in relation to space traffic management will strongly differ from the needs that law and regulation have sought to address with commercial remote sensing, the licensing process used is not a perfect tool for mapping one process to the needs of the other.

The ultimate goal of the commercial remote sensing licensing process is to facilitate the successful implementation of private efforts at remote sensing activities, which should simultaneously benefit private actors and the national needs of the United States.[23] The economic and national security goals of current remote sensing policy, and by extension the licensing process, may fit within the greater ambit of future space traffic management, but it cannot, in and of itself, completely account for all currently known space traffic management needs. Accordingly, I would argue that the United States does need to develop a separate and clear space traffic management regime to account for the needs of industry and the Federal Government alike—current and future—in their space activities. However, how such a system should look is a debatable subject. Indeed, more research and studies need to be undertaken by the Federal Government and academic institutions alike in order to ascertain the likely needs of industry and government in future space activities. Until such data are returned that would provide reliable parameters for future space activities, it is difficult to do more than speculate on the exact nature of a new and separate legal or regulatory scheme for a space traffic management system. The commercial remote sensing licensing process has taught both industry and the Federal Government some valuable lessons, and those could assist in the generation of a reasoned and effective future space traffic management regime. My academic suspicion on this subject is that while the current U.S. system has operated satisfactorily vis-à-vis space activities to date, the future will see more and greater numbers of space activities that will necessitate a clear governance structure that is currently lacking for subjects like STM and other issues—such as on-orbit authority.

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[23] See, e.g., NSPD-27, United States Commercial Remote Sensing Policy, Sec. II, Policy Goal (2003): "The fundamental goal of this policy is to advance and protect U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and by sustaining and enhancing the U.S. remote sensing industry. Doing so will also foster economic growth...."

2. Does the Office of Space Commerce, which by Congressional Mandate is tasked with facilitating and promoting economic growth and innovation in the commercial space industry, have an official role in the remote sensing licensing process? Should it?

Neither chapter 603 of Title 51 to the U.S. Code, nor the regulations contained within 15 CFR Part 960, directly involve the Office of Space Commerce in the process of remote sensing licensing. However, the Office of Space Commerce does have a statutory mandate to be involved with and promote the existence and success of private or commercialized activities in space. Thus, the Office of Space Commerce should arguably have some impact on the decision to approve or deny a license for commercial remote sensing activities. The primary responsibility should still rest with the Administrator of NOAA, but consultation with the Office of Space Commerce could give the Administrator the information needed to make an informed decision during the (up to) 120-day process for deciding on a license.

The challenge to integrating the Office of Space Commerce more directly in the licensing process should be in ensuring that its inclusion, whether by direct advice to the Secretary or other administrative means, should not be designed to cause any further delay in the licensing process, since the time-delay in obtaining a response to applications seems to be one of the most serious points of consternation for commercial remote sensing providers. Indirectly, the Office does have a responsibility to "foster the conditions for the economic growth...of the United States space commerce industry", as noted in the recent revisions to chapter 507 of Title 51.[24] In this sense, there is a legal obligation to support commercial remote sensing activities, which could be extended to more direct involvement in the licensing process.

Questions submitted by Rep. Donna F. Edwards, Ranking Member, Subcommittee on Space

1. Commercial remote sensing data has largely been focused on providing high resolution imagery. That said, many sources of data are often used in creating geospatial information products. How does the free and open availability of federally funded data sources, such as Landsat, which provides low to medium resolution imagery and multispectral data, affect the use of commercial remote sensing imagery in developing information products?

[24] Originally this was accomplished in Sec. 302 of the US Commercial Space Launch Competitiveness Act, Pub. L. 114-90, H.R. 2262-17. It can now be found in 51 USC § 50702(c)(1).

Firstly, I would note that the free and open data provided by federally funded systems like Landsat has long been, and is still clearly exceptionally important to the generation of global scientific knowledge of Earth systems. The 1992 Land Remote Sensing Policy Act recognized this importance, noting in its Findings that the Federal Government acknowledges the utility and need for a continuously acquired and stored source of information from Landsat, and that, to ensure the system's reliability, the Federal Government needs to continue its maintenance and stewardship of that process.[25] This same law recognized the need to commercialize other aspects of remote sensing, and served as the genesis of the modern commercial remote sensing regulatory system.[26] As a result, our current state sees both federally funded systems and private systems coexisting. Ascertaining the exact way in which the freely acquired (i.e., taxpayer supported) data from systems like Landsat impact the information products being produced by private providers is more the province of economists and geospatial information scientists than that of law.

What can be noted is that regardless of the exact impact of Landsat data on the geospatial information product sales of commercial remote sensing providers, the target audience of both systems—the low to medium resolution imagery of Landsat, and the medium to high resolution imagery of private systems—remains intact and in continuous need of new information from these sources. This necessitates the continued application of remote sensing laws and regulations to maintain the reliability and usefulness of data produced from both types of sources, and any future changes to the statutory basis of commercial remote sensing licensing should be mindful of meeting the needs of private industry, whilst not upsetting the continuity and utility of federally funded sources of information used by governments and scientists alike.

2. The commercial remote sensing industry is changing not only in terms of advanced sensing capabilities and new approaches to operations but also in the means by which data can be delivered to the customer. What do the existing law and regulations require regarding the transmittal of commercial data to ground stations? What, if any, policy or regulatory changes need to be considered regarding data transmittal and delivery?

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[25] Pub. L. 102-555 § 2(1, 4, 6), 106 Stat. 4163 (1992).

[26] Id., at § 2(15): "Development of the remote sensing market and the provision of commercial value-added services based on remote sensing data should remain exclusively the function of the private sector."

Current regulation requires that a commercial remote sensing licensee create a Data Protection Plan to be provided to the Assistant Administrator of NOAA.[27] This plan must contain information on the "process to protect data and information throughout the entire cycle of tasking, operations, processing, archiving and dissemination"[28]—this includes data transmission and physical delivery, and could include situations where certain kinds of data are restricted to use for the U.S. government or government approved customers.[29] Additionally, an applicant for a commercial remote sensing license needs to provide sufficient information to the Secretary such that he or she can be certain that the applicant will uphold and conform to the provisions of the 1992 Land Remote Sensing Policy Act.[30] This includes information on the command, mission data, and transmission frequencies, system transmissions, and any planned communications crosslinks.[31] The applicant must also have a plan in place to deny unauthorized access to data transmission "to or from the remote sensing space system".[32] Providing this information should enable the Secretary to ensure that the planned activities of the licensee comport with the national security strictures contained in the commercial remote sensing regulations.

Finally, an inter-agency MOU has determined that in instances in which national security or international obligations require data collection by the licensee to be minimized or otherwise limited, the possibility of delaying data transmission to the ground station may be employed, rather than the stricter methodology of preventing data collection and transmission altogether.[33]

Reevaluation of current policies regarding data transmission should take into account national security needs, and provide for better security against modern cyber-attacks or potential infiltration efforts. Additionally, given the increasing integration of traditional remote sensing data into comprehensive commercially provided geospatial data products, potential changes to law or regulation ought to be mindful of current usages, and see such data as one component in a larger commercial tapestry.

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[27] 15 CFR Part 960.11(b)(13).
[28] Id.
[29] Id. at 960.11(13)(i-ii).
[30] Appendix 1 to Part 960(d).
[31] Id. at § IV(2).
[32] Id. at § IV(4).
[33] Appendix 2 to Part 960--Fact Sheet Regarding the Memorandum of Understanding Concerning the Licensing of Private Remote Sensing Satellite Systems Dated February 2, 2000, at B(2).

Responses by Ms. Joanne Gabrynowicz

Replies to Questions For the Record*

By

Prof. Joanne Irene Gabrynowicz*

Replies to Questions submitted by Rep. Brian Babin, Chairman, Subcommittee on Space

1. In my opinion, there are two major challenges with existing law, regulation, and policy when it comes to commercial remote sensing. The first is the extreme difficulty of completing the licensing process due to the national security measures and politics involved with the licensing process. A number of license applications have failed to complete the licensing process when this stage is reached.

The second challenge is the speed of technological development. Remote sensing law needs to include general principles that licensing officials can apply to new and emerging technologies without having to have a specific rule to apply to a specific technology.

2. Unpiloted aerial systems (UAS) are governed by aviation law, not space law. Therefore, the principle of sovereignty is the basis of regulation for UASs. It is necessary to acquire permission to fly UASs over sovereign territory. In the U.S., UAS regulation is the responsibility of the Department of Transportation/Federal Aviation Administration. The principle of sovereignty is inapplicable in space and permission to remotely sense terrestrial territory is not required. However, in exchange for sensing and distributing collected data without permission, data must be made available on a nondiscriminatory basis.[1]

Regarding commercial remote sensing, I have observed that U.S. law is the *de facto* basis of remote sensing laws in other nations.[2] National remote

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* Submitted 13 October 2016

* Professor Emerita, Director Emerita, Editor-in-Chief, Emerita, JOURNAL OF SPACE LAW

[1] H.R. Rep. 102-539 at 51-53.

[2] Gabrynowicz, J.I. *The Land Remote Sensing Laws and Policies of National*

sensing laws address the national interests of the nation promulgating the law with necessary adaptations of U.S. law and principles. It should be expected that any changes in U.S. remote sensing law will be watched carefully by other remote sensing nations.

3. Thank you for the opportunity to clarify the answer to this question. I received payment from the Beijing Institute of Technology School of Law (BIT) as a visiting professor in 2013 and 2014. The payments are documented in my 2014 and 2015 tax return forms under "Other Income". I received payment in 2015 and it will be documented in my 2016 tax return. I did not, and do not, represent BIT. I was there, and am here, as an independent scholar. I received no payment from the China Institute of Space Law.

Replies to Questions submitted by Rep. Jim Bridenstine

1. Whether or not a "separate, clear space traffic management regulatory regime" is needed now requires more of a technical assessment than a legal one. This is a question that requires the consideration of the current and projected amounts of space traffic as well as the consequences of traffic on meaningful access to space. Systems engineers, orbital mechanics scientists, aerospace engineers, and computer scientists more appropriately answer these questions. The results of a technical assessment can then be used to determine the right time to establish a regulatory regime.

However, as space technologies and their applications mature and grow, they often do become subject to additional bodies of law.[3] Therefore as space traffic increases it should be expected that additional bodies of law will be applicable and consideration of what ought to be part of a space traffic management regime is timely. At the national level, a space traffic management

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Governments: A Global Survey, NCRSASL/DOC-NOAA (2007), available at http://www.spacelaw.olemiss.edu/resources/pdfs/noaa.pdf. (There are more policies than law but the trend has been to establish more formal law.).

[3] United States v. Jones, 132 S. Ct. 945 (2012). For example, the Court unanimously held that the use of a GPS tracking device on a vehicle as a "search" under the law of the 4th Amendment.

regime will involve multiple bodies of law including tort liability, contracts, administrative, and insurance, among others. Additionally, as some elements of space traffic management occur both in national territory and in international space a regulatory regime will necessarily involve both U.S. national law and international space law. It would be prudent to consider how they interact and where the interfaces exist.

2. Currently, the commercial remote sensing licensing process involves the Departments of Commerce, State, Defense, Interior and the Intelligence Community.[4] Two of the purposes of the hearing, "*Commercial Remote Sensing: Facilitating Innovation and Leadership*"[5] were to 1.) consider the current malfunctioning of the existing licensing process and; 2.) if, and how, U.S. commercial remote sensing law ought to be revised.

The addition of an another entity—any entity—to the commercial remote sensing licensing process at this time is likely to add further to the disorder created by the already substantial number of federal entities involved in the licensing process. If it is decided that the licensing process has to be restructured then the participation of any federal entity in the restructured process ought to be based on, among other things: the national interest it is charged with serving; the existence and degree of internal remote sensing expertise; and, the uniqueness of its potential contribution without creating unnecessary redundancy.

Replies to Questions submitted by Rep. Donna F. Edwards, Ranking Member, Subcommittee on Space

1. The free and open availability of *Landsat* has been documented to be "recognized as indispensable to science, natural resource management, commerce, security, foreign policy, agriculture, and education." "Free data fuels

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[4] 15 CFR 960 Appendix 2 (2006).

[5] *Commercial Remote Sensing: Facilitating Innovation and Leadership*, Wednesday, September 7, 2016, 2:00pm, 2318 Rayburn House Office Building, Subcommittee on Space (114th Congress). https://science.house.gov/legislation/hearings/space-subcommittee-hearing-commercial-remote-sensing-facilitating-innovation

significant business activity that creates jobs, generates tax revenue, protects property, protects the environment, and saves lives." Since *Landsat* data was made available free of cost, its uses, in all categories, increased from 1 million scenes to 8 million scenes. Information products were developed for telecommunications, insurance, and agriculture among many others. [6]

The *Landsat* free and open data policy has resulted in the increased use of *Landsat* data by U.S. companies[7] and has increased overall commercial economic benefit.[8] The policy has also caused an increase in the number of published *Landsat*-related scientific articles[9].

Other federally funded data from the U.S. weather and satellites have also created vibrant commercial value-added sectors that produce an extremely wide array of information products. "GPS is an engine of economic growth and jobs, and has generated billions of dollars of economic activity. [The] GPS application market is diversified into a large number of segments."[10]

2. Under existing remote sensing regulations, the transmittal of commercial data to the ground is a complex, time-consuming process that begins in the license application process, through all operations from the sensor to delivery at a location.

The regulations require that 6 months prior to launch a license applicant must submit a graphically detailed data flow diagram that represents the data flow from the sensor to the final product delivery locations. They also require a

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[6] National Geospatial Advisory Committee – Landsat Advisory Group Statement on Landsat Data Use and Charges, available at https://www.fgdc.gov/ngac/meetings/september-2012/ngac-landsat-cost-recovery-paper-FINAL.pdf, pg. 1, 4.

[7] See Appendix 1.
[8] See Appendix 1.
[9] See Appendix 1.
[10] Markets and Markets. Available at http://www.marketsandmarkets.com/PressReleases/gps.asp

detailed data protection plan for terrestrial data delivery methods, including electronic and physical package delivery to the licensee's own central data storage facilities, ground stations, and relay stations. A protection plan is required for the delivery of restricted data and imagery to the U.S. Government and approved customers. The protection plan must be developed to protect both data and information through the entire cycle of tasking, operations, processing, archiving and dissemination. Finally, before delivery can be made to a non-U.S. Government user the regulations also require a 24-hour waiting period.[11]

Industry has stated that the temporal issues are the most problematic. They include the 120-day license approval period and the 24-hour waiting period for data distribution.[12]

It has been 10 years since the commercial remote sensing regulations have been revised. There have been important changes in remote sensing markets, relevant sciences, and sensor and computer technologies. It is recommended that the Space Studies Board[13] (SSB) of the National Academies conduct a study to address what is needed in a contemporary, efficient U.S. remote sensing licensing regime based on current technologies and markets. The SSB is an interdisciplinary body whose members come from industry, government, and academia. It is well suited to address the technical and commercial aspects of commercial remote sensing including emerging developments like smallsats, cubesats, and constellations.

[11] 15 C.F.R. §§ 960.1 – 12 (2006).
[12] 15 C.F.R. Part 960
[13] Space Studies Board, 500 Fifth Street NW, Washington, DC, Phone: (202) 334-3477, Fax: (202) 334-3701, E-mail: ssb@nas.edu

APPENDIX 1[14]

U.S. Companies Use Landsat

For example:

- Google: downloads the entire Landsat archive for non-profit science supp Earth Engine and for a Google Map global image layer
- Esri: geographic information systems image-data layers
- MDA Federal: land-change detection for Federal and private customers
- E&J Gallo Winery: irrigation water monitoring and management
- SilviaTerra: forest inventory services
- Mapbox: custom map products, reference for data calibration
- Amazon Web Services: Landsat 8 data provided in its cloud service
- Blackbridge Networks and Cybera offer thousands of Landsat 8 images to Canadian nonprofits
- Landsat.org, an affiliate of the Tropical Rain Forest Information Center, offers multi-faceted access to images from Landsats 4, 5, 7, and 8

Plus

- Insurance Companies: wildfire fuels assessment
- Agricultural Commodity Companies: global crop estimates
- Communications Companies: tower siting
- Many other commercial applications, including timber management, mineral and petroleum exploration, pipeline siting, real estate, etc.

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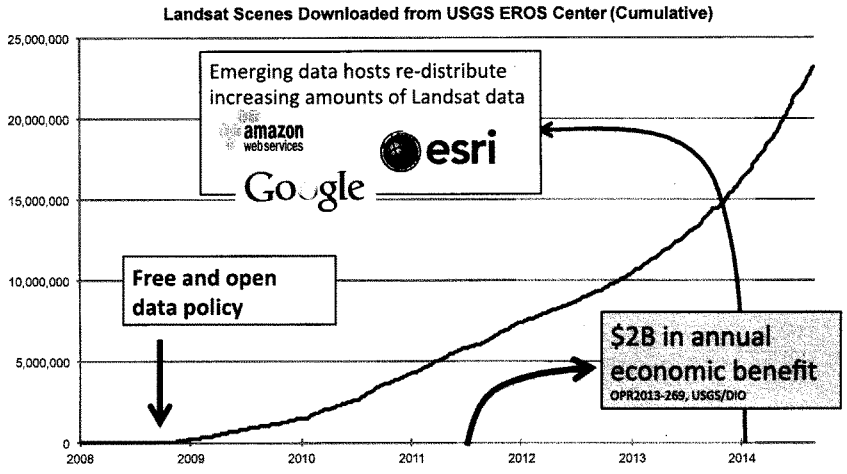
[14] Public Briefing Department of the Interior, US Geological Survey. Point of contact: Timothy R. Newman, Program Coordinator, Land Remote Sensing U.S. Geological Survey, tnewman@usgs.gov, (703) 648-4405, (Office) (703) 386-0115 (Cell).

Landsat Economic Benefit

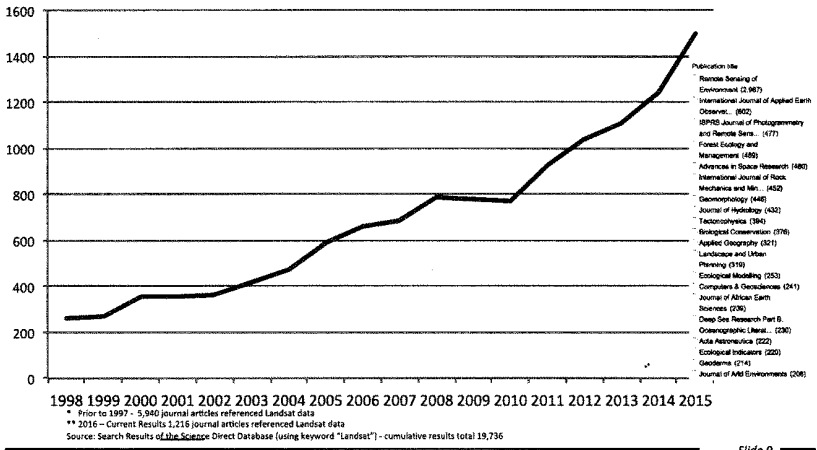


USGS

Slide 3

Landsat Science Publication

Number of Published Science Journal Articles Referencing Landsat Data *(per year)*



* Prior to 1997 - 5,940 journal articles referenced Landsat data
** 2016 – Current Results 1,216 journal articles referenced Landsat data
Source: Search Results of the Science Direct Database (using keyword "Landsat") - cumulative results total 19,736

USGS

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