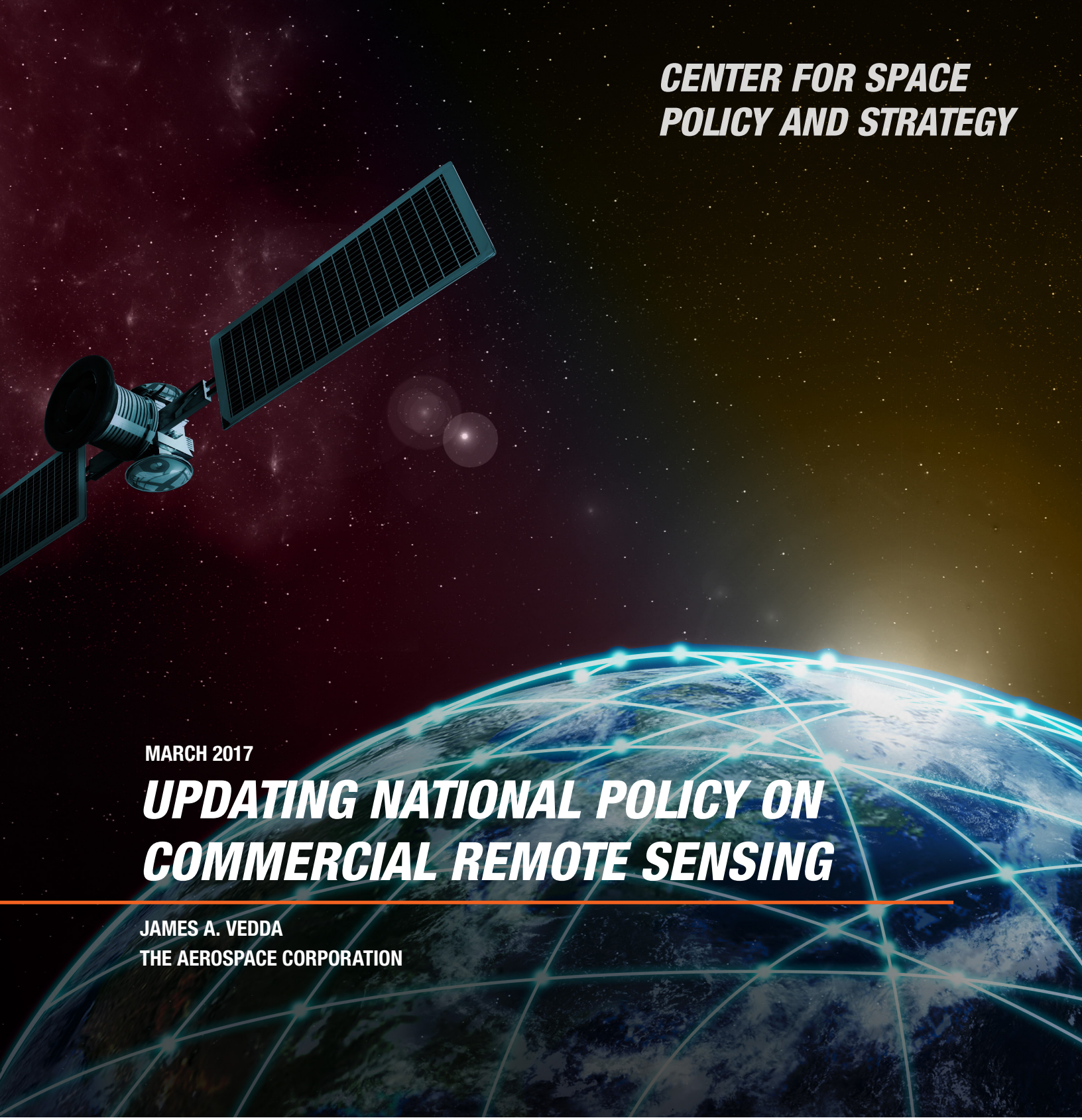

CENTER FOR SPACE POLICY AND STRATEGY

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UPDATING NATIONAL POLICY ON COMMERCIAL REMOTE SENSING

JAMES A. VEDDA
THE AEROSPACE CORPORATION

JAMES A. VEDDA

Jim Vedda is a senior policy analyst with The Aerospace Corporation's Center for Space Policy and Strategy. He is the author of *Becoming Spacefarers: Rescuing America's Space Program* and *Choice, Not Fate: Shaping a Sustainable Future in the Space Age*. He holds a Ph.D. in political science from the University of Florida and an M.A. in science, technology, and public policy from George Washington University.

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Foreword

The current U.S. commercial remote sensing policy (NSPD-27) is 14 years old, and in that time, much has transpired domestically and internationally (see Appendix for a brief policy history). NSPD-27 was not designed to accommodate the number, the increasing capabilities, the diverse applications, and the expanding array of global operators of today's and tomorrow's remote sensing satellite systems. In anticipation of possible actions by the U.S. administration to update national policy, this paper examines the evolution of existing commercial remote sensing policy and discusses revisions that may be necessary or desirable as U.S. industry faces an increasingly competitive global market. A revised presidential directive could provide needed guidance on the U.S. government's treatment of satellite imagery and related hardware, software, and value-added services marketed to commercial and foreign entities.

What Has Changed that Merits a New Policy?

National policy on privately owned and operated remote sensing space systems is embodied in a presidential directive (NSPD-27) issued by the George W. Bush administration in April 2003.[1] In the years since NSPD-27 appeared, international satellite imaging capabilities have evolved and expanded dramatically. Skill sets have improved and become more widely distributed, and the expectations of the various user communities have grown. Commercial remote sensing has moved into the social and economic mainstream as internet mapping sites and smartphone apps featuring satellite imagery have become common tools.

The U.S. National Space Policy (PPD-4)[2] issued by the Obama administration in June 2010 acknowledges the importance of the domestic commercial space sector and encourages the use of its services to satisfy U.S. government needs. The policy speaks in general terms regarding the collection, integration, analysis, and dissemination of intelligence information. Also, it assigns responsibilities to NASA, NOAA, and the U.S. Geological Survey related to space-based Earth observation that address:

- Transition of mature R&D Earth observation satellites to long-term operations.
- Use of international partnerships to help sustain and enhance observation from space.
- Operational requirements for collection, processing, archiving, and distribution of land surface data to the U.S. government and other users.
- Providing remote sensing information related to the environment and disasters that is acquired from national security space systems to other civil government agencies. This responsibility is assigned to the U.S. Geological Survey, but disaster monitoring and relief efforts have become common activities for the National Geospatial-Intelligence Agency (NGA) as well, especially in the aftermath of the 9/11 terrorist attacks and Hurricane Katrina.

The theme of sharing and collaboration in Earth observation has been building for many years. It is reflected in NSPD-27 and was embraced by the Obama administration. It is evident in the National Space Policy on three levels: interaction among federal agencies and

across levels of government, public-private partnerships, and international cooperation. As a major theme of the current space policy and well-established policy trends, collaboration should figure prominently in any revision of remote sensing policy.

Another National Space Policy theme is ensuring the health of the industrial base, including the development and retention of space professionals. Combined with the collaboration theme, this confirms a consistent pattern that transcends administrations, including government reliance on commercial capabilities and the cultivation of an enduring, productive relationship between the public and private sectors.

There is a new kind of data provider in the commercial remote sensing market that didn't exist when NSPD-27 was written…

Two related circumstances have changed significantly in recent years: the state of play in export control reform, and the number and sophistication of new remote sensing systems, many from outside the U.S., targeting the global imagery market.

When the statute that treated essentially all satellite exports as munitions went into effect in 1999, marking a dramatic change in policy and practice, there was an apparent assumption that the U.S. held the lead in the relevant technologies, and would continue to do so if export control was sufficiently strict. By the time NSPD-27 was being written a couple of years later, it was already clear to many that this was not true, but in the case of remote sensing, the evidence of competing foreign commercial systems did not yet exist. The only commercial imaging satellites flying at the time with spatial resolution around 1 meter were U.S.-based. The Obama administration reviewed the 1999 export control regime and made recommendations to the Congress for revising it.[3] That round of revisions was finalized in November 2014, but industry would like to see more attention on this matter.

Today, imaging systems originating in Europe and Asia with spatial resolution of 1 meter or better are operational, and more are on the way. In part, this is because of (not in spite of) strict U.S. export controls, which prompted many countries to invest in technologies that would make them independent of U.S. suppliers. As foreign competitors reach and possibly surpass the resolution level that U.S. operators can sell without restriction, policymakers must reconsider whether government-imposed restrictions on the availability of the highest quality U.S. products still make sense.

Table 1 shows a sample of non-U.S. systems with 1-meter-or-better resolution that have been launched in the past several years or are planned for the next few years, and which are expected to make imagery available beyond the operating country's national security sector. (U.S.-based companies are not participants in the competition for commercial radar imagery due to domestic regulatory limitations that so far have been an insurmountable barrier to entry.)

The table clearly demonstrates that the U.S. commercial sector is not alone in the world market for high-resolution imagery. (If the table were expanded to include resolutions down to three meters, it would list at least five more radar satellites and more than 20 additional optical satellites.) As foreign providers approach the best that U.S. companies have to offer, U.S. agencies lose their remaining leverage to restrict what imagery is available, and to whom. Shutter control – the government's ability to limit or halt imagery services for national security or foreign policy reasons – will be ineffective if applied only to U.S. systems.

There is a new kind of data provider in the commercial remote sensing market that didn't exist when NSPD-27 was written. Based on smallsat technologies and different business models, these companies think of themselves as information and service companies, not satellite companies. In general, their business plans feature large constellations of relatively inexpensive satellites, allowing more frequent revisit of imaging targets and technology refresh rates that could see new generations of capabilities appear multiple times in a single year. Some of these companies are looking outward from Earth as well as inward, raising concerns about sensitive assets making an unintentional appearance in

Table 1: Foreign Satellite Imaging Systems Recent and Planned with Spatial Resolution of 1 Meter or Better

Country	System	Optical (O) Radar (R)	Launch date	Resolution (m)
China	DMC-3	O	7/10/2015	1.0
France	Pleiades 1A	O	12/17/2011	0.7
	Pleiades 1B	O	12/2/2012	0.7
Germany	SAR Lupe 1	R	12/1/2006	1.0
	SAR Lupe 2	R	7/1/2007	1.0
	SAR Lupe 3	R	11/1/2007	1.0
	SAR Lupe 4	R	3/27/2008	1.0
	SAR Lupe 5	R	7/22/2008	1.0
	SAR Lupe 5	R	6/15/2007	1.0
	T anDEM-X	R	6/21/2010	1.0
	TerraSAR-X NextGen	R	2018	0.25
India	Cartosat-2	O	1/10/2007	1.0
	Cartosat-2A	O	4/28/2008	1.0
	Cartosat-2B	O	7/12/2010	0.8
	Cartosat-2C	O	6/22/2016	0.65
	Cartosat-2D	O	2/15/2017	0.65
	Cartosat -2E	O	2017	0.65
	Cartosat 3	O	2018	0.3
	RISAT-2	R	4/20/2009	1.0
Israel	EROS B	O	4/25/2006	0.7
	TECSAR	R	1/21/2008	1.0
Italy	COSMO/SkyMed 1	R	6/7/2007	1.0
	COSMO/SkyMed 2	R	12/9/2007	1.0
	COSMO/SkyMed 3	R	10/23/2008	1.0
	COSMO/SkyMed 4	R	11/5/2010	1.0
Japan	ASNARO	O	11/6/2014	0.5
	ALOS-2	R	5/24/2014	1.0
	ALOS-3	O	2019	1.0
Kazakhstan	DZZ-HR	O	4/29/2014	1.0
Russia	Resurs-DK1	O	6/15/2006	1.0
	Resurs-P1	O	6/25/2013	0.9
	Resurs-P2	O	12/26/2014	0.9
	Resurs-P3	O	3/13/2016	0.9
South Korea	Kompsat-2	O	7/28/2006	1.0
	Kompsat-3	O	5/18/2012	0.7
	Kompsat-3A	O	3/25/2015	0.55
	Kompsat-5	R	8/22/2013	1.0
	Kompsat-6	R	2020	0.5
Turkey	Gokturk-1	O	12/5/2016	0.8
United Arab Emirates	DubaiSat-2	O	11/21/2013	1.0

Derived from numerous media sources and announcements by industry and governments.

non-Earth imaging (i.e., capturing full or partial views of space rather than images restricted to Earth's surface).

Reconsidering Specific Language in NSPD-27

One of the policy goals of NSPD-27 is to "Enable U.S. industry to compete successfully as a provider of remote sensing space capabilities for foreign governments and foreign commercial users, while ensuring appropriate measures are implemented to protect national security and foreign policy." This refers to U.S. global competitiveness in hardware and services as well as imagery. There is obvious tension between commercial success in the global marketplace and protection of other national interests. The strategy for achieving these goals must strike the right balance, but that balance cannot remain static as technologies and the geopolitical environment change. A new directive may use words identical to those above as a stated goal, but that doesn't mean the actions taken to implement the policy should be identical to those used in the past.

This is how NSPD-27's **licensing and operation guidelines** balance the sometimes competing goals:

> To support the goals of this policy, U.S. companies are encouraged to build and operate commercial remote sensing space systems whose operational capabilities, products, and services are superior to any current or planned foreign commercial systems. However, because of the potential value of its products to an adversary, the operation of a U.S. commercial remote sensing space system requires appropriate security measures to address U.S. national security and foreign policy concerns. In such cases, the United States Government may restrict operations of the commercial systems in order to limit collection and/or dissemination of certain data and products, e.g., best resolution, most timely delivery, to the United States Government, or United States Government approved recipients.
>
> On a case-by-case basis, the United States Government may require additional controls and safeguards for U.S. commercial remote sensing space systems potentially including them as conditions for United States Government use of those capabilities. These controls and safeguards shall include, but not be limited to: (1) the unique conditions associated with United States Government use of commercial remote sensing space systems; and (2) satellite, ground station, and communications link protection measures to allow the United States Government to rely on these systems. The United States Government also may condition the operation of U.S. commercial remote sensing space systems to ensure appropriate measures are implemented to protect U.S. national security and foreign policy interests.

During the lifetime of the new directive, U.S. companies will be facing multiple competitors with equal or nearly equal capabilities. Their ability to attract and retain customers will depend on factors beyond the price of imagery. Spatial and spectral resolution, frequency of revisit, timeliness of delivery, and the customer's ability to download directly from a satellite—precisely the elements that the government may seek to limit—are likely to be key selling points. No customer will expect a satellite imagery company to conduct business that undermines the interests of its home country, which grants its license and is probably one of its best customers. However, customers may look elsewhere if they perceive degraded product quality, higher costs, or service delays that they attribute to chronic and unjustified policy restrictions.

Included in NSPD-27's language on foreign access to U.S. commercial remote sensing hardware and capabilities is the following:

> Exports of sensitive or advanced information, systems, technologies, and components, however, will be approved only rarely, on a case-by-case basis. These items include systems engineering and systems integration capabilities and techniques, or enabling components or technologies, i.e., items with capabilities significantly better than those achievable by current or near-term foreign systems. The Secretary of State, in consultation with the Secretary of Defense and the Director of Central Intelligence, shall maintain a Sensitive Technology List that includes these items.

The form that this language takes in an updated directive should reflect the status of ongoing export control efforts and the goal of the policy to "Enable U.S. industry to compete successfully as a provider of remote sensing space capabilities for foreign governments and foreign commercial users." Continued use of language such as "will be approved only rarely" may send a signal to potential foreign customers that they should

look elsewhere if they want access to the best available technology.

Regarding **U.S. government use of commercial remote sensing**, NSPD-27 calls for the following:

> Establish the National Imagery and Mapping Agency (NIMA) [now NGA] as the agency of primary responsibility for acquiring and disseminating commercial remote sensing space products and services for: (1) all national security requirements; and (2) in consultation with the Secretary of State, all foreign policy requirements.
>
> [Civil agencies shall]... Coordinate with [NGA] procurement of all U.S. commercial remote sensing data and products that are restricted to United States Government or United States Government-approved users pursuant to NOAA license conditions due to U.S. national security or foreign policy concerns.
>
> Civil agencies may acquire commercial remote sensing space products and services directly, through cooperative arrangements with other civil agencies, or through [NGA].

In addition to the name change from NIMA to NGA, the directive needs updated consideration of homeland security requirements. There is no specific mention of expedited procedures for disaster relief, which became more prominent at NGA after Hurricane Katrina. The relationship with state and local governments and first responders is not discussed. Should NGA have a direct relationship with (for example) domestic law enforcement agencies (within the limits of statutes governing domestic surveillance)?

These omissions may stem from the fact that commercial remote sensing policy seems to have been developed in isolation from U.S. policy on the organization and management of national activities in geographic information systems (GIS), which has been evolving concurrently and also involves private-sector participation.

GIS policy guidance is embodied in Office of Management and Budget Circular A-16, which originated in 1953 to coordinate national surveying and mapping efforts and was updated in 1990 to incorporate digital data and modern geospatial information concepts. The 1990 revision established the Federal Geographic Data Committee (FGDC), which includes representation from 10 Cabinet departments and nine other federal agencies, and is chaired by the Secretary of the Interior.[4] Circular A-16 was reinforced by Executive Order (EO) 12906 in 1994, which put the FGDC in charge of developing the National Spatial Data Infrastructure (NSDI) and establishing a National Geospatial Data Clearinghouse (NGDC) to address standardization and redundancy issues and make geospatial data publicly available.[5] The circular was updated again in 2002 to make organizational adjustments and to incorporate EO 12906.[6] The Obama administration issued a supplement to the circular in November 2010 to recast national GIS coordination in terms of a portfolio management concept.[7] At least in part, this was an indication that even after two decades of top-level attention, management of the national GIS enterprise was still not keeping up with evolving technology and practice.

New policy should encourage interaction among federal agencies and across all levels of government, and the establishment of public-private partnerships…

Neither NSPD-27 nor its predecessor directive included a tie-in to the FGDC or its NSDI and NGDC activities even though the remote sensing stakeholder agencies are FGDC members. (NGA participates in the FGDC Steering Committee and the Coordination Group.) It is unclear whether satellite imagery (including commercial) is adequately represented in FGDC functions, or if NGA's clearinghouse duties constitute a separate stovepipe. The relationship of commercial satellite remote sensing to the NSDI and its representation in the NGDC should be addressed in the process of drafting the revision to NSPD-27.

The language included in the next commercial remote sensing policy directive should take a long view and

build in some flexibility for decisionmakers. The new directive should be drafted with the realization that it could be around for several years in a continuously shifting environment.

Key Observations

The following points should be considered if the administration chooses to update the 14-year-old national policy on commercial remote sensing:

- In keeping with existing policy, and in recognition of the potential benefits to U.S. national interests, the new policy should encourage interaction among federal agencies and across all levels of government, and the establishment of public-private partnerships.
- Spatial and spectral resolution, frequency of revisit, timeliness of delivery, and the customer's ability to download directly from a satellite are likely to be key selling points for U.S. commercial remote sensing service providers. The drafters of the new policy should consider the implications for U.S. industry and the practices of global competitors before seeking to limit any of these parameters.
- Regarding the export of hardware and services, continued use of language such as "will be approved only rarely" may send a signal to potential foreign customers that they should look elsewhere if they want access to the best available technology.
- The new policy should provide guidance for addressing homeland security needs. This may include expedited procedures for disaster relief, as well as establishment of closer relationships with state and local governments and first responders. For example, NGA could have a direct relationship with domestic law enforcement agencies (within the limits of statutes governing domestic surveillance).
- The relationship of commercial satellite remote sensing to national activities in geographic information systems should be addressed to harmonize policy across the broader national efforts at managing standardization, redundancy, and public availability of geospatial data.

References

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[3] U.S. Departments of Defense & State, "Risk Assessment of United States Space Export Control Policy," Report to Congress, Section 1248 of the National Defense Authorization Act for Fiscal Year 2010 (Public Law 111-84), March 15, 2012.

[4] Peter Folger, "Issues and Challenges for Federal Geospatial Information," Congressional Research Service, April 27, 2012 (http://www.fas.org/sgp/crs/misc/R41826.pdf).

[5] William J. Clinton, " Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure," Executive Order 12906, April 11, 1994 (http://www.archives.gov/federal-register/executive-orders/pdf/12906.pdf).

[6] OMB Circular A-16, "Coordination of Geographic Information and Related Spatial Data Activities," August 19, 2002 (http://www.whitehouse.gov/omb/circulars_a016_rev).

[7] OMB Circular A-16 Supplemental Guidance, "Geospatial Line of Business," November 10, 2010 (http://www.whitehouse.gov/sites/default/files/omb/memoranda/2011/m11-03.pdf).

Appendix

A Brief History of U.S. Commercial Remote Sensing Policy

Commercial remote sensing emerged in the U.S. in the 1980s, but it had to await the Land Remote Sensing Policy Act of 1992[1] before the environment was right for developing a new industry. (Earlier legislation,[2] passed in 1984, had been too restrictive and was primarily focused on an ultimately unsuccessful attempt to privatize the government's Landsat system.) Applications for operating licenses quickly followed the October 1992 passage of the new statute, compelling the Clinton administration to take a serious look at the implications. In contrast to Landsat (30-meter resolution), the image quality offered on the commercial market within a few years was expected to reach 1-meter resolution, providing militarily useful information. Additionally, foreign entities were likely to seek to purchase copies of these high-performance U.S. systems.

Lockheed was an early applicant for a license, which was granted in April 1994 for its proposed Ikonos satellite. Six months later, Lockheed created a subsidiary called Space Imaging to take over the remote sensing business. Space Imaging grew in 1996 by acquiring EOSAT, the commercial holder of the license to operate Landsats 4 and 5 and market their data.[3] This gave the company a presence on the imagery market well in advance of the launch of its first satellite. After the first Ikonos was lost in a launch failure in April 1999, the backup spacecraft was successfully orbited that September, becoming the first high-resolution commercial satellite. It featured spatial resolution of 1 meter for panchromatic imagery and four meters for multispectral. About two years later, Space Imaging returned operational responsibility for Landsats 4 and 5 back to the U.S. government and relinquished its right to commercially market Landsat data in order to focus on developing the high-resolution imagery market.

The Clinton administration anticipated and addressed the security concerns with Presidential Decision Directive (PDD) 23 in 1994.[4] PDD-23 wisely did not impose a specific resolution limit on commercial sensors. The interagency team that drafted the directive recognized that the technology, both domestic and foreign, would always be a moving target. Instead, PDD-23 specified case-by-case review of remote sensing license applications, with favorable consideration of systems "whose performance capabilities and imagery quality characteristics are available or are planned for availability in the world marketplace."

At first glance, this language would seem to force U.S. businesses to always be followers, never leaders on the world market. In practice, licenses have been issued that keep U.S. operators ahead of their foreign competition, at least for optical imaging systems. Today, DigitalGlobe holds licenses allowing operation of imaging satellites in the sub-meter range.

The conditions attached to the licenses were developed in the regulatory process in the years after PDD-23, which assigned the regulatory duties to the Department of Commerce (with advice from the interagency process). The Secretary of Commerce, in consultation with the Secretaries of State and Defense, was given the authority to "require the licensee to limit data collection and/or distribution by the system to the extent necessitated by the given situation." This authority is known as shutter control, and it caused controversy due to its implications for operators' business plans and product marketability as well as the questions it raised on freedom of speech issues.

Government officials said at the time that they would prefer never to use shutter control, but such statements provided no guarantees and left some outside observers doubtful. To date, shutter control authority has never been exercised, although in the months following the 2001 invasion of Afghanistan a contractual arrangement was implemented that was labeled "checkbook" shutter control. The U.S. government simply purchased exclusive rights to all high-resolution (1-meter) commercial satellite imagery of Afghanistan that was on the market at the time. This was easy to do because all such imagery came from one satellite (Ikonos) licensed by the U.S. government. This incident was soon followed by the launches of two more U.S. commercial high-resolution satellites: Quickbird-2 (October 2001) and Orbview-3 (June 2003). Checkbook shutter control can no longer be considered a viable option. High-resolution satellite systems have proliferated and will continue to do so. It is unlikely that the U.S. government would be able to buy exclusive rights to all imagery over a particular area for an extended period of time, especially since not all systems are licensed in the U.S.

Since April 2003, national policy on commercial remote sensing has been derived from NSPD-27, which superseded PDD-23 after it had been in force for nine years. In the time that transpired between the two directives, the expected high-resolution capability had arrived and it was clear that the capability and the appetite for better imagery was spreading to many other nations.

The guidance in NSPD-27 has many similarities to its predecessor, PDD-23:

- Encourage and enable a new industry in the national interest. The stated 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."
- Assign responsibility to the Commerce Department for timely and responsive licensing and regulation.
- "Rely to the maximum practical extent on U.S. commercial remote sensing space capabilities." This is exemplified by a series of programs that followed at NGA: ClearView, NextView, and EnhancedView. These programs have supported commercial imagery providers by contracting for large data purchases and helping to fund new commercial satellites. Routine government needs, such as updating maps, can be well-served by commercial imagery, freeing government assets to perform more specialized or sensitive duties. Ideally, this could ease tasking bottlenecks and workloads of expensive government systems, possibly reducing the number of satellites needed. As commercial systems improve in product quality and service, some new functionality is gained as the government receives a steady stream of unclassified imagery that can be shared with uncleared personnel such as domestic first-responders or foreign allies.
- Keep the focus of government systems on "needs that cannot be effectively, affordably, and reliably satisfied by commercial providers because of economic factors, civil mission needs, national security concerns, or foreign policy concerns."
- "As a general guideline, remote sensing exports that are currently available or are planned to be available in the global marketplace also will be considered favorably; Exports of sensitive or advanced information, systems, technologies, and components, however, will be approved only rarely, on a case-by-case basis."
- Provide for government use of "controls and safeguards" to protect national security and foreign policy interests (e.g., shutter control). The Commerce Department is the decision authority, in consultation with the Departments of Defense and State. The government has shown some flexibility in this regard. Since the policy went into effect, some licensing restrictions have been adjusted, allowing greater spatial resolution and removing the requirement for a 24-hour hold on the distribution of imagery with resolution as precise as 0.5 meter.
- Define the character of government-to-government relationships involving satellite remote sensing. NSPD-27 also contains significant guidance that goes beyond PDD-23:
- "Develop a long-term, sustainable relationship between the United States Government and the U.S. commercial remote sensing space industry." There has been substantial progress in government-industry interaction as a result.[5]
- Assign national security and civil agency heads the responsibility for determining which of their needs can be fulfilled using commercial imagery.
- Assign NGA (then called NIMA) the responsibility for being the clearinghouse for national security, foreign policy, and civil requirements for the government-restricted output of commercial imagery providers. (Civil agencies may obtain nonrestricted commercial imagery through alternative means.) This clarifies interagency relationships and procedures to facilitate U.S. government purchase and use of commercial imagery.

Initial implementation of NSPD-27 required that entrenched practices and cultural perspectives be addressed, such as:

- Reluctance of agency personnel to change habits or procedures;
- Agency accounting practices that made government imagery appear "free" while commercial imagery drained the budget[6];
- Persistent belief among government users that inferior quality and slow delivery will always plague commercial imagery as compared to government sources;
- Inadequate budgets to cover the routine tasks that are most appropriate for use of commercial products; and
- Complications caused by the handling and distribution of an external, unclassified information source.

Substantial progress has been made on all these fronts since NSPD-27 was issued.

References

[1] Public Law 102-555, "Land Remote Sensing Policy Act of 1992," October 28, 1992.

[2] Public Law 98-365, "Land Remote Sensing Commercialization Act of 1984," July 17, 1984.

[3] Space Imaging press release, "Space Imaging and EOSAT Agree on Acquisition," November 5, 1996.

[4] William J. Clinton, Presidential Decision Directive 23, "Foreign Access to Remote Sensing Space Capabilities," March 10, 1994.

[5] For example, see Industrial College of the Armed Forces, "Spring 2007 Industry Study Final Report: The Space Industry," National Defense University, 2007, p. 9.

[6] The same situation has affected DoD use of commercial satellite communications: military satellites have been perceived as "free" while commercial bandwidth costs money. Richard DalBello, "Required Summer Reading," *Space News*, June 16, 2008, p. 19.