

# **High-Resolution Earth Observations From Space: What are Today's Issues?**

## **CO-HOSTS:**

**The Space Policy Institute, George Washington University  
&  
The National Remote Sensing and Space Law Center  
University of Mississippi School of Law  
18 December 2001**

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The Space Policy Institute at George Washington University and the National Remote Sensing and Space Law Center at the University of Mississippi School of Law, co-hosted this one-day symposium to discuss some of the major issues surrounding the use of High-Resolution Earth Observations from space. As commercial and de-classified government satellite imagery becomes increasingly available to the public, many issues relating to the legal framework and policies that are affected by this EO data will continue to surface.

This symposium sought to bring to light some of the most recent applications of EO data as well as discuss the legal and policy issues surrounding its usage for intelligence gathering and environmental regulation. It also provided a forum for participants representing the commercial remote sensing industry, various federal agencies, and the scientific community who utilize EO data on a daily basis, to share their major thoughts and concerns regarding the current and future usage of high resolution EO data. The following paragraphs provide a summary of the presentations and discussions that occurred during the symposium.

### ***Welcome, Opening Remarks***

*JOANNE GABYRNOWICZ, DIRECTOR OF THE NATIONAL REMOTE SENSING AND SPACE LAW CENTER, UNIVERSITY OF MISSISSIPPI SCHOOL OF LAW*

Professor Gabyrnowicz opened the symposium by discussing the importance of understanding the legal issues surrounding GIS, remote sensing, and Earth Observation satellites. Many new developments have taken place in this field just within the six weeks prior to December 18, which will affect the development of the market for high resolution satellite data. Further information regarding the legal framework of remote sensing and space policies can be accessed at <http://www.spacelaw.olemiss.edu/>

*RAY A. WILLIAMSON, RESEARCH PROFESSOR OF INTERNATIONAL AFFAIRS AND SPACE POLICY, SPACE POLICY INSTITUTE, ELIOT SCHOOL OF INTERNATIONAL AFFAIRS, GEORGE WASHINGTON UNIVERSITY*

In his opening remarks, Ray Williamson provided an overview of the major topics of discussion included in the symposium. The first half of the forum focused on examples of the uses of high resolution and remotely sensed data, and the major limitations and drawbacks in their use. The second half turned attention to some of the current legal and policy in commercial remote sensing. The Space Policy Institute often hosts technical, legal, & policy issues in Earth observations. Reports of other events can be found on the SPI website: <http://www.gwu.edu/~spi/> .

### **MORNING SESSION: USING THE DATA EFFECTIVELY**

***Regulatory Enforcement of SMCRA using High Resolution Satellite Imagery***  
*KYLE BOHNENSTIEHL, REMOTE SENSING SCIENTIST, DEPARTMENT OF INTERIOR, OFFICE OF SURFACE MINING, DENVER, COLORADO.*

Kyle Bohnenstiehl demonstrated the value of utilizing high resolution EO data, such as 1-meter IKONOS imagery or LiDAR data for the regulation and enforcement of SMCRA (Surface Mining Control and Reclamation Act). The office uses these data to identify areas in surface coal mines where major violations might have been committed by a particular mining company. The DOI inspectors then take maps made from the data and a GPS receiver into the field in order to inspect and verify potential violations directly. Thus, the main focus of Bohnenstiehl's effort is on the *discovery of potential areas subject to violation*. Any violation that is discovered by the OSMRE (Office of Surface Mining, Reclamation and Enforcement) is subject to a series of fines, the proceeds of go into the Federal treasury. Data costs are relatively low compared to the value of the safety and environmental violations discovered. He finds that it is possible to pinpoint positions on the imagery within eight meters of actual geographic position with no additional ground control.

Many of OSMRE's efforts, thus far, have focused on the use of IKONOS 1-meter stereo imagery for monitoring the mining activities. The ability to generate 10-foot contours from the imagery has allowed for an enhanced ability for the inspector to examine the physical characteristics of the mine without having to go through the laborious task of scanning aerial photographs. Coupled with the field collected GPS data, and scanned paper permit maps, IKONOS data provides a powerful tool that OSMRE inspectors can use for the enforcement of SMCRA. Examples of cases were shown where 1-meter IKONOS derived products clearly indicated areas where the mining industry was committing a major violation of federal codes and regulations on strip mining.

The effectiveness of change detection using time-series imagery was also included in the discussion. Here, inspectors are able to determine whether the mines have followed compliance standards by looking at a series of images over a given period of

time. Recent advances in mobile computing technology have allowed inspectors to carry this imagery to the field in a portable digital assistant (PDA), so that an accurate verification of any particular suspected violation can take place.

Although LiDAR data have been shown to provide a more powerful model of the mining activities (LiDAR can generate a 2-foot contour map with 6-inch precision). The decision regarding whether to use LiDAR or high resolution stereo data to generate Digital Elevation Models (DEMs) depends on cost and the details of the particular application involved. The ability to generate a high-quality digital DEMs allows for the generation of 3-D virtual fly-throughs of mining sites. The talk concluded with an impressive 3-D slide show of the mining activities using stereo-pair IKONOS imagery.

***Remote Sensing of the Built Environment***

*DOUGLAS O. FULLER, ASSISTANT PROFESSOR, DEPARTMENT OF GEOGRAPHY, GEORGE WASHINGTON UNIVERSITY*

Dr. Fuller's discussion of remote sensing and the built environment provided an interesting case in point that higher resolution in EO imagery is not necessarily the most important criterion for analyzing features in an urban environment. Rather, the inclusion of a greater number of spectral bands, ranging from the visible to the thermal wavelengths of the electromagnetic spectrum, is an often overlooked but essential component in urban image interpretation and analysis. The spectral properties of certain urban features such as bridges and roads can vary from one spectral band to another. Therefore, by including a larger number of bands, there is a greater likelihood that the remote sensing software program can distinguish any given feature from another.

An example of Loudoun County, Virginia, outside of Washington, DC, helped to illustrate this point. Remote sensing has been invaluable for tracking the spread of impervious surfaces (parking lots, roadways, rooftops, etc...) in Loudoun County, an area that experienced a 55% population growth from 1997-1999. Dr. Fuller's model of the spread of impervious surfaces in this county provided an interesting analysis of how county GIS, aerial photography, and Landsat ETM+ imagery can be combined to predict potential environmental outcomes associated with increased urbanization. Dr. Fuller also expressed some of the frustrations of the scientific community concerning the costs of high-resolution commercial satellite imagery for scientific studies.

***Uses for High-Resolution Commercial Satellite Imagery for Nuclear Nonproliferation***

*COREY G. HINDERSTEIN, SENIOR ANALYST, INSTITUTE FOR SCIENCE AND INTERNATIONAL SECURITY (ISIS), WASHINGTON D.C.*

Corey Hinderstein began her discussion with an overview of the potential uses of high-resolution commercial satellite imagery to track sites of international concern in inaccessible locations. Its use in arms control treaty regimes was the main focus of this discussion. In particular, she showed how high-resolution EO can be used by the international community both to discover and to monitor the build-up of nuclear facilities around the world. The nuclear facility that was recently discovered in Khushab, Pakistan, using IKONOS 1-meter imagery of the area provides a good example of the benefit of understanding and interpreting high-resolution EO imagery. According to Ms. Hinderstein, it had been known that the site had a plutonium production reactor, but it had not been understood exactly how the reactor was acquiring the 40,000-ton heavy

water input needed to run the plant. The IKONOS imagery allowed the investigators to identify several structures associated with the heavy water production, and then compare these with a known production facility in India. Without 1-meter imagery, this would not have been possible.

As a monitoring agent, the use of such imagery could play a crucial role in supporting the International Atomic Energy Agency's missions. The Tuwaitha site in Iraq, and the Es Salam reactor in Algeria, illustrate examples where nuclear build-up went relatively unnoticed by the IAEA because it did not utilize the high-resolution EO resources, such as 1-meter IKONOS imagery. These resources could also increase the adherence by the international community to treaties such as the Nuclear Non-Proliferation Treaty (NPT), Comprehensive Test Ban Treaty (CTBT), and the Fissile Material Cutoff Treaty (FMCT).

In conclusion, Ms. Hinderstein emphasized the need for governments to remain accountable to their compliance to these international treaties. Commercial imagery could play a valuable role in monitoring this so as long as the level of data analysis and interpretation remains of high quality. See <http://www.isis-online.org/> for further information.

### ***High Resolution Commercial Imagery Utilization at MCIA***

*TERRENCE V. BUSCH, SENIOR GEOGRAPHER, MARINE CORPS INTELLIGENCE ACTIVITY*

Terrence Busch provided an overview of some of the major commercial imagery products that the Geographic Analysis Branch of the U.S. Marine Corps provides for its operations around the world. In fiscal year 2001, for example, this branch provided 27 customers with 525 new products, 1450 reprinted products, 3000 + web objects, and more than 28 virtual/fly through products. The MCIA works within the small framework of mapping within the USMC, each individual operation being associated with a Marine Expeditionary Force (MEF), and all map training being conducted at the Defense Mapping School (DMS). One of the main uses of commercial imagery that Mr. Busch pointed out was for determining mobility for troops and vehicles for each of its operations. GIS software programs allow an image analyst to examine various terrain features and determine the most feasible transportation routes available for a given area. With the advent of high-resolution imagery, feature extraction has become a major component of the mapping division. Higher resolution imagery also provides a better image base for generating classification maps, which are in turn used for improving the analysis of the area's trafficability for each operation.

One of the main issues that Mr. Busch faces when dealing with high-resolution commercial imagery has been with the licensing and distribution restrictions. The GLIDE program (Geographically Linked Information Dissemination Environment) allows its users to search among various interactive web-based maps. However, as Mr. Busch pointed out, these licensing and distribution restrictions imposed by the commercial imagery providers reduces the capacity of this program to disseminate information on the Internet. Another major issue has been the increased reliance on 1-meter unclassified data as the primary source of geospatial data. This imagery is generally associated with higher costs, slower data processing, and reduced geographic coverage for a given area. Despite these limitations, the geographic division of the MCIA has been able to generate an

image archive of over 50,000 CDs and maps, a resource which is playing an invaluable role for the USMC operations all over the world.

***Open Panel Discussion***

Q #1: How are the users of high-resolution imagery merging this information with other types of data?

K.B.: OSMRE merges as many dependable data sources as possible—GPS, aerial imagery, satellite imagery, LiDAR data, engineering drawings—into a single product that can be taken into the field. Mobile computer systems have played an invaluable role in making it possible for OSMRE investigators to take merged data sets to areas of concern within a mine, using them to examine potential violations of the regulations.

T.B.: Fusing high-resolution data with base line maps.

K.B.: The aim of merging different data sets is to reduce costs while improving regulatory oversight. High-resolution imagery allows inspectors to do a more thorough job, and thus, using the satellite imagery allows the office to reduce on-the-ground inspection costs.

Q #2: At what point does research and development produce operational software packages that outside parties can benefit from?

T.B.: For our small unit at the MCIA, it is hard to move into the operational phase because of the high map turnover rate and therefore, not much time can be allocated to develop operational software.

C.H.: Funding is a difficult issue because in order to allocate funds for imagery, one has to prove that the information is of value.

Q #3: How do traditional aerial photographs compare with IKONOS 1-meter imagery in terms of the cost/benefit ratio?

K.B.: There really is no comparison since aerial photographs demand a greater time and energy input than IKONOS does. Aerial photos must be individually scanned and require greater processing. They also need ground control points to be orthorectified and geometrically corrected. With IKONOS, it is easy to get within 8 meters accuracy without setting up ground control.

Q #4: Is it possible to get 1:2000 scale cadastral maps using IKONOS imagery?

T.B.: Yes it is possible, but there is the issue of vertical building heights creating a potential source of error. It is difficult to get high vertical accuracy with IKONOS and therefore, it is not as good as LiDAR is in producing cadastral maps.

Q #5: *Imagery Activism*: What kind of feedback is coming from the community as a result of these types of analyses using high-resolution EO?

C.H.: In general, most of the feedback has been positive. I am surprised by the lack of interest from the IAEA in using these techniques. There are some important issues in sovereignty that get raised when one wishes to use a high-resolution image to provide evidence for non-compliance to international treaties and laws.

**AFTERNOON SESSION:  
GOVERNMENT POLICY, COMMERCIAL IMAGERY  
STRATEGY (CIS), AND REGULATION**

***Commercial Imagery Strategy***

*KEVIN O'CONNELL, RAND, Chairman*

Presidential Decision Directive (PDD)-23, in 1994, set the stage and provided the broad view for a commercial imagery strategy (CIS). Basically, PDD-23 was meant to create a “win-win” situation for the government and commercial sectors. But, the government has had a heavy hand because it has been a customer, patron, regulator, and competitor—commercial firms need to keep this multi-layered role in mind. Now, we see market risks actually rivaling regulatory issues as an issue of major concern.

Recent commissions, e.g. those examining the National Imaging and Mapping Agency (NIMA), the National Reconnaissance Office (NRO), and the role of space within the Department of Defense have all been critical of the government's role, so a new, enlightened strategy on using commercial systems must be formulated soon—this new CIS should go well beyond just establishing requirements for merely buying imagery. See <http://www.rand.org/> for RAND publications.

***NIMA's Commercial Imagery Strategy 2001***

*WINSTON A. BEAUCHAMP, NATIONAL IMAGERY AND MAPPING AGENCY*

The US Government has requirements for unclassified satellite imagery. The allocation of commercial requirements that use low and medium resolution instruments [for NIMA, Ikonos is considered medium resolution, ed.] allows National Technical Means (NTM), focus on high current interest and priority intelligence needs. As commercial systems can meet the majority of the source collection requirements for geospatial readiness, planning needs to be begin for the post-2010 imagery collection architecture now.

On 27 November 2000, Directors of NIMA and the NRO agreed that the 1999 CIS needed to be updated. Various commissions and studies over the last few years have recommended such action. The NIMA, NRO, and Space Commissions all express the concern that a new CIS should be formulated. Among the USG requirements that must be accounted for in a new strategy are improving geospatial readiness and responsiveness, complimenting NTM in high interest areas, and meeting unclassified imagery requirements for US Imagery and Geospatial Information System (USGIS) customers.

The goals of such a CIS 2001 should be to provide sufficient imagery for source data for the near-Global Foundation Data program, outsource production of data for this program, provide adequate additional collection to fill all low and medium resolution requirements by 2010, and allow the NRO to focus on the development of advanced technology for future collection systems. The first tenet of the CIS 2001 is related to intelligence collection—making advanced purchases of commercial imagery data allows providers to invest in next-generation systems. The next tenet concerns outsourced production—digital information service contracts allow end-to-end management in support of geospatial readiness. The third tenet addresses additional collection—as

providers add capability, additional requirements migrate to commercial systems. The final tenet relates to advanced technology—by relieving NRO of low and medium resolution requirements, flexibility in future NTM systems is allowed.

Commercial imagery is valuable for many reasons. It supports and enhances US competitiveness in the field of remote sensing. It can help guarantee the information edge and contribute to information superiority. Since it is unclassified, it is easier to handle and share, especially with allies. Commercial imagery can augment NTM capabilities to address unsatisfied requirements, provide more access, and act as the basis of new unclassified products and services. Eventually, this imagery may be more cost-effective than use of NTM.

PDD-23 (discussed above) and the Space Commercialization Promotion Act of 1996 lay much of the ground work for CIS 2001. The key provision is that the USG “shall not undertake activities...which duplicate activities available from the commercial sector, unless such activities would result in significant cost savings to the Federal Government...”

Next steps include NIMA starting a CIS 2001 Implementation Team. CIS 2001 has been endorsed by a number of recent reviews including USSPACECOM CIS Forum. Commercial Imagery is a major issue during the Intelligence Program Review, and is included in recent crisis supplemental funding requests for counter-terrorism and Homeland Defense. See <http://164.214.2.59/> for map products and other NIMA information.

### ***Uses Of Commercial Imagery***

*MARK BRENDER, SPACE IMAGING, Inc.*

“A Picture is worth a thousand words,” as the old saying goes. The Space Imaging’s IKONOS satellite’s 1-meter resolution imagery is currently being used in many and diverse ways. The media use the imagery to report on critical events. Included in this category are national security, crisis, and disaster related occurrences. Human interest events make up the other broad category of imagery use within the media. Sports, entertainment, and novelty events can significantly contribute to the public’s understanding of the commercial imagery business.

Competition in this business is good, and the Pentagon’s (NIMA’s) Commercial Imagery Strategy (CIS) also is a good start. But the strategy is not funded, so it’s merely a study in a blue folder. The government, with few exceptions, has not yet looked upon commercial imagery as a useful, perhaps critical commodity, in the way they do business for the taxpayer. The government—on a larger scale—should move to outsource imaging and mapping services and even consider moving to subscription-based models with the commercial sector, in which certain data are purchased routinely. The US commercial remote sensing industry is a ‘national asset’ that is not yet being exploited by our government. Part of the overall problem is that many agencies and organizations do not use these new technologies as well as they might. Additional information regarding Space Imaging and its products can be accessed at: <http://www.spaceimaging.com>.

***Assessment Of Remote Sensing Data Use By Civilian Federal Agencies***  
*SHERRI STEPHAN, SENATE GOVERNMENT OPERATIONS COMMITTEE*

The Congressional Research Service recently conducted a survey of twenty agencies to better understand how federal non-DoD agencies used remote sensing data and technology. In the wide range of agencies surveyed, all but four reported some use of remote sensing data in conducting their missions. The most often cited application was for environmental and conservation purposes, with ten agencies reporting extensive or moderate use in this regard. Seven agencies reported extensive or moderate use of these data for early warning, mitigation, monitoring, and studying the impact of natural disasters. Many other uses were reported, including treaty monitoring, basic and applied research, and mapping.

The most common sources of these data were other USG agencies, e.g. NASA, NOAA, and USGS. Other sources include non-US entities, e.g. European Space Agency, and commercial businesses such as IKONOS. Concerns about using these data included problems in availability of these data, problems in accessing and using the data, cost and licensing issues, and lack of expertise in using the information. The bottom line is that USG agencies use remote sensing data in varying degrees and in varying ways.

***Discussion***

Comment- There was a lot about "transitions" in these briefings: transition to thinking about remote sensing, and transition from government to commercial uses and concerns, for example. There seems to be a need for new, more balanced views in this subject to reflect the new realities in today's environment.

Comment- Industry needs to defend itself.

Comment-Right now, commercial imagery is somewhere between a good idea and a good business!

**SHUTTER CONTROL AND ACCESS TO IMAGERY DATA**

*JOHN BAKER, RAND, Chairman*

***Review Of Legal Issues In Commercial Imagery***

*JOANNE GABRYNOWICZ, NATIONAL REMOTE SENSING AND SPACE LAW CENTER*

Questions addressed by Prof. Gabrynowicz included the validity of a commercial contract mechanism ; the exclusive status of the contract; the nondiscriminatory access policy; licensee obligations to the National Satellite Land Remote Sensing Data Archive; and some media issues and an invitation to First Amendment scholars. She also addressed issues of balancing security and transparency; a private system operator's obligation to file a plan for public benefit purposes; and a possible amended Archive provision.

Prof. Gabrynowicz noted that NIMA's purchase of exclusive rights to coverage of Afghanistan involved a conventional commercial contract for goods and services. A contract mechanism is explicitly provided for in the regulations. Thus, the contract was not *de jure* "shutter control" even if it may have been *de facto* "shutter control." As a "shutter control" contract it was improperly executed because the regulations require that it be executed at the Secretarial level. Further Research would be required to determine

whether or not the contract, as executed, constituted an administrative or due process infraction.

She also discussed the specific citation of the Outer Space Treaty and U.N. Principles on Remote Sensing in the NOAA regulations and the application of the "sensed state" provisions under the circumstances. Since, in this case, the sensed state was a nation that harbored an organization that attacked the U.S, the right to self defense justifies not making images available to Afghanistan but this could change depending on the establishment and recognition of a new, legitimate Afghani government. Related issues such as denying imagery to bordering "friendly" states and the "denied parties" list maintained by licensing agencies were also discussed.

Regarding First Amendment issues, Prof. Gabrynowicz noted that generally, the media do not have an inherent right to non-public information with the historical exception of criminal trials. However, she also noted that the law suggests a plausible argument that First Amendment interests are implicated when the government attempts to monopolize information of public concern that was once available in the free market. The circumstances of the government-private sector contracts pose an invitation to First Amendment scholars that include analysis of the use of public funds to purchase the images, the narrowness of the national security standard used in the regulations and potential on-going temporal and geographic restrictions.

Under "future considerations" Prof. Gabrynowicz addressed two issues: making the Afghani images available to the National Satellite Land Remote Sensing Data Archive and enforcing the regulation that requires private systems to file an implementation plan "to provide widespread access to its unenhanced data for non-commercial scientific, educational or other public benefit purposes."

Once in the National Satellite Land Remote Sensing Data Archive, data are in the public domain. The declassification of Corona and other data may be a precedent for making the Afghani images available in the future either from the government or from the company, in the event that the company plans to purge the data. A possible amended Archive license provision could require public interest data to be made available to the Archive on "reasonable terms and conditions."

Regarding the implementation plans, the First Amendment is clearly of public interest. Future plans could include a specific provision to make imagery available to the media at an appropriate time.

### ***NOAA Perspective***

*TIMOTHY STRYKER, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION*

The various interests, military, private, and civilian public good, must be balanced. The idea behind shutter control is that it is a means to an end, i.e. to foster a robust commercial imagery industry and US technological competitiveness while meeting national security concerns. Various US policy statements, PDD-23 for instance, consider shutter control a tool for use in meeting national interests. See <http://www.licensing.noaa.gov/> for licensing information.

Obviously, there are gray areas in this policy, so questions of flexibility result. However, the US, more than other nations, have at least articulated a policy, and these open policies may actually play into the hands of foreign competitors.

***The Media and Satellite Imagery***

*BARBARA COCHRAN, RADIO-TELEVISION NEWS DIRECTORS ASSOCIATION*

The USG has effectively exercised shutter control by end-running its own rules. There is a constitutionally sanctioned method for settling disputes between the USG and the press on whether material should be prevented from being published. These decisions are made in a court of law, with the burden on the government to show a clear and present danger to national security if such material is released.

The licensing rules call for such disputes to be decided entirely in the executive branch, and for shutter control to be exercised under much broader conditions, such as concern about foreign policy interests. However, the USG has conducted an end-run around these rules by its recent contract to be all imagery for Afghanistan. In effect, the government is using taxpayers' money to keep these images from the public. Finally, because the government issues licenses in the first place for these imagery activities, companies are being blackmailed, in effect, into cooperating.

Instead of fostering these activities, then, the USG is preventing the operators of commercial satellites from selling their products to as many customers as possible, and therefore is forcing potential media customers to look elsewhere. Television news producers are using satellite imagery almost daily to make a complex story comprehensible to the public, but these images are mostly from archives, and current imagery is lacking.

The USG may argue that imagery needs to be withheld to protect US forces and operations. However, the American press has an excellent record in keeping secret certain information that may compromise these activities. In any event, these are not the images the media are seeking. Rather, images that show refugee movements or could provide independent damage assessments are what the media seeks. These images could enhance America's understanding of the conflict, and of the humanitarian issues involved. Instead, the public's money is being used to deny them this information.

By withholding these images, the USG is undermining its own credibility. American's don't know whether to believe the government's assertions about various issues, e.g. civilian casualties, because there is no independent voice. Our country is strong precisely because these independent voices are available. It is as if the government is afraid to trust the public with the truth. See <http://www.rtnda.org/> for additional information and media perspectives.

***The Future Of Hi-Res Satellites***

*WILLIAM STONEY, MITRETEK*

In 1972, the Landsat 1 system had a ground sample distance (GSD) of 80 meters. Now with IKONOS and Quickbird, GSDs are under 1 meter. Mr. Stoney presented a short presentation that illustrates the growth of interest in satellite remote sensing around the world. The charts illustrated that in the next several years more foreign government and private one meter or better systems are planned to be placed in orbit than are currently being planned by the us firms. This trend should be an important factor in any discussion of how to deal with this new capability. We may have less control than we currently feel we have.

### ***Discussion***

Comment—Standards for shutter control are very broad; they probably would not stand up in court.

Comment—What about new areas of conflict, e.g. Somalia? Will the government continue to have “check book” shutter control?

Comment—Do not agree USG is afraid to test shutter control directly, so is using backdoor approaches. Really, the government is trying to get best equity in this situation.

Comment—What is the signal sent (with checkbook shutter control)? Is this a policy or procurement issue? How do other nations fit in?

Comment—Is there a slippery slope here? We had formal shutter control policy, now it seems as if shutter control practice will be very informal, and not direct.

Comment—Satellite imagery is another kind of information in a way—it is synoptic in nature. The current NIMA approach is a blunt instrument in that it denies a whole class of data, not specific images of concern. This is a real problem and issue.

### ***Summary Comments***

*ANN FIORINI, CARNEGIE ENDOWMENT FOR INTERNATIONAL PEACE*

A key question is whether transparency or secrecy is to be operative with respect to commercial imagery. Should there then be a change in standard for FOIAs?

Is satellite imagery a public or private good? This is an important distinction. If it is public, then it is by definition “non-excludable” and “non-rivalry” in nature. If it is a private good, then it is “excludable” and usable.” It appears that this type of imagery is really something in between, a “club good,” so to speak. This makes the issue messy by definition.

The final question to address is “who controls.” Will previously agreed upon and stated UN principles hold up? What happens as other nations begin to operate similar systems? There are no easy answers. The report, *Secrets for Sale: How Commercial Satellite Imagery Will Change the World*, can be accessed at <http://www.ceip.org/>.

Comment—The UN Principles on remote sensing are increasingly under attack from within.

### ***Conclusions***

*JOHN BAKER, RAND*

Both in this panel, and over the course of the day, we have seen very interesting and diverse applications of commercial imagery data. This is certainly a plus for the business. The signs of progress in making use of commercial satellite imagery were reflected in the thoughtful presentations in this morning's session by Kyle Bohnenstiehl highlighting the use of Ikonos imagery for monitoring mining regulation compliance; the presentation by Corey Hinderstein from ISIS on how NGOs are making increasingly effective use of satellite imagery to address public policy problems of great importance, such as monitoring foreign nuclear weapons proliferation. Doug Fuller, of GWU's Geography Department, gave an excellent presentation on the utility of overhead imagery for assessing trends in the rapid development of the transportation and infrastructure in Northern Virginia, and the important environmental impact questions that it raises. Finally, Terry Busch presented a fascinating account of how the USMC takes advantage

of a broad range of imagery data sources, including multispectral commercial satellite imagery to provide the Navy and USMC in providing timely maps, charts, and increasingly sophisticated automated tools that utilize geospatial data for supporting their operations in both peacetime and conflict. However, we have also seen much uncertainty expressed about where this new industry is heading. This uncertainty results from a number of factors. First, the industry is still new, and therefore still is in transition. Second, expectations were very high, so even though the glass can be seen to be half-filled, as it were, there may be disappointment in some quarters that original expectations are not being met. However, perspective is called for. Applications generally take years to evolve, and we are still very early in this industry's development. Slow growth is to be expected, and is not necessarily bad, or foretells the industry's ultimate failure. Obstacles, such as USG competition, are part of the playing field to be navigated and better understood. For example, is USG competition always a bad thing, or is it something to be encouraged in some realms?

The real "wild card" in this discussion is shutter control. Although it is an important safety valve for national security issues, policies on image restriction need to be both better explained and examined by government officials. For example, what exactly are the USG's concerns about use of imagery in Afghanistan? Perhaps it would have been better to invoke formal "shutter controls" than to restrict access to high-resolution U.S. commercial satellite imagery through a NIMA contract, which broadly denies access to imagery while sending an ambiguous signal to other countries concerning whether this is a national security issue or a commercial contract question. In some respects, the Afghanistan operations are the best case for testing why and how shutter controls should operate along the lines of the regulatory guidelines that much time and effort was expended to develop within the US government and with the US commercial firms.

Overall, this has been a good day—many relevant and important issues were presented, giving a good "snapshot" of where commercial imaging business is today. The bottom line is that there are many promises and problems in the business of commercial remote imagery sensing.