

Commercial Satellite

Remote Sensing Symposium

Improving the International Business Environment

PROCEEDINGS

May 13–15, 2003
Washington DC

This unique symposium examined the challenges and opportunities of the growing global commercial remote sensing industry.



Commercial Satellite Remote Sensing Symposium PROCEEDINGS

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CONTENTS

May 13, 2003

Welcome	3
Opening Remarks	3
Keynote Address	3
Panel 1: The Current Market	5
Moderator and Panelists	5
Moderator's Opening Remarks	5
Opening Remarks by Panelists	5
Moderator-Posed Question	5
Questions from the Audience	6
Luncheon Program	
<i>The Intelligent Digital Horizon and its Benefits to Business, Consumers and Government.</i>	11
Panel 2:	
Remote Sensing— A Solutions-Based Business	13
Moderator and Panelists	13
Moderator's Opening Remarks	13
Opening Remarks by Panelists	14
Questions from the Audience	15
Panel Discussion	16
Closing Remarks	17
Panel 3:	
Remote Sensing— A Solutions-Based Business	18
Moderator and Panelists	18
Moderator's Opening Remarks	18
Opening Remarks by Panelists	18
Questions from the Audience	20
Closing Remarks	21

May 14, 2003

Opening Remarks	22
Keynote Speech	22
Questions from the Audience	23
Panel 4: Policy— A US Perspective	25
Moderator and Panelists	25
Moderator's Opening Remarks	25
Opening Remarks by Panelists	25
Questions from the Audience	26
Luncheon Program	
<i>Commercial Remote Sensing: The Future</i>	30
Panel 5: Policy— A Non-US Perspective	31
Moderator and Panelists	31
Opening Remarks	31
Questions from the Audience	32
Panel Discussion	33
Closing Remarks	34
Panel 6: Financing Remote Sensing	35
Moderator and Panelists	35
Moderator's Opening Remarks	35
Opening Remarks by Panelists	35
Panel Discussion	36
Questions from the Audience	37

May 15, 2003

Program Overview and Opening Remarks	38
Keynote Speech	38
Questions from the Audience	39
Panel 7: Summary Session	41
Moderator and Panelists	41
Moderator's Opening Remarks	41
Opening Remarks by Panelists	41
Questions from the Audience	43

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Commercial Satellite Remote Sensing Symposium PROCEEDINGS

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MAY 13, 2003



GREGORY WITHEE, Assistant Administrator for Satellite and Information Services, National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce, welcomed participants to the Commercial Satellite Remote Sensing Symposium on behalf of the sponsors, NOAA, the National Aeronautics and Space Administration (NASA) and the US Geological Survey (USGS). Mr. Withee introduced Vice Admiral Conrad C. Lautenbacher, Jr., US Navy (Ret.), Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator.



Opening Remarks

Conrad C. Lautenbacher, Jr.
*Vice Admiral US Navy (Ret.),
Under Secretary of Commerce
for Oceans and Atmosphere
NOAA Administrator, US
Department of Commerce*

NOAA organized this symposium in response to the current state of the commercial remote sensing (CRS) industry, as well as recent and potential near-term growth of the sector both in North America and internationally. NOAA's mission is one of science, service and environmental stewardship.

NOAA is responsible for the civilian operation of remote sensing satellites and recognizes the importance of enhancing this resource. NOAA is a great supporter of interagency coordination and to date has coordinated the licensing of 18 CRS systems, 36 license amendments, and 28 foreign partnership agreements.

This is a focused meeting that seeks to address current issues in the CRS industry. The purpose

of the symposium is to share unique expertise and discern new insights with a view to developing more productive policies for the future. NOAA staff will be happy to follow up on the results of the meeting. The release of the President's policy on CRS provides a timely and significant basis for discussion during the symposium.

Vice Admiral Lautenbacher thanked the Program Committee and the staff of the Institute for Global Environmental Strategies (IGES) for coordinating the symposium and introduced the Honorable Donald Evans, Secretary, US Department of Commerce, to present the keynote address.



Keynote Address

The Honorable Donald Evans
*Secretary, US Department of
Commerce*

The Secretary opened his remarks by recognizing the landmark role performed by the CRS industry in prosecution of Operation Iraqi Freedom. There is no doubt about the tactical advantages delivered to the war-fighter by CRS imagery. The war was shorter than it might have otherwise been, and lives were saved, because of remote sensing (RS) imagery. The CRS industry should take credit for that and take great pride in the contribution it made to the effectiveness of the campaign. In addition, the availability of CRS imagery of the theater of war allowed the media to provide war coverage in a way that had never been seen before. Representatives of the CRS industry are

to be thanked for their support of Operation Iraqi Freedom.

New CRS technologies will help to shape defense policies and strategies in the future. The Department of Commerce is keen to facilitate networking through this symposium and looks to the identification of new commercial markets and strengthening of public-private partnerships. While this dialogue is clearly international and global in nature, the US should play a role in defining and leading the CRS industry in the world.

The role of government is to create conditions conducive to the creation of wealth in the US. The US controls one-third of the global economy and the long-term fundamentals are strong. The government needs to understand what makes it easier for the US CRS industry to compete. Current monetary and tax policies aim to accelerate job growth and, essentially, Department of Commerce support of the CRS industry is all about creating jobs; this is central to the American Dream.

The Department of Commerce recognizes the promise of the CRS industry. This industry has the potential to not only increase productivity nationally, but also globally, while also playing a significant role in ensuring that national security, homeland security and international security are sound. As representatives of the CRS industry work to build overseas markets and develop international partnerships, they are encouraged to work with the Department's Foreign Commercial Service Team. The Department of Commerce will do all it can to promote export and marketing opportunities for the industry.

To date, \$2.8 billion has been invested in the CRS industry and three CRS satellites are currently in operation. Additionally, an array of small firms supports the industry. CRS is poised for great market penetration. The President's new policy on CRS is an indication of government support for, and interest in, the CRS industry.

An Advisory Committee on Commercial Remote Sensing has been established to engage expert advice so that the government can better serve the industry in the future. Topics under consideration by the Advisory Committee include improving the licensing process for advanced technologies and a review of the decision-making process.

The Secretary thanked Vice Admiral Lautenbacher and Mr. Withee for organizing the symposium and assured those present that the Department of Commerce is committed to creating a good environment for the CRS industry in the US and around the world.

PANEL 1: The Current Market

This panel will provide the context for the rest of the symposium by examining the current market and identifying key issues and challenges.



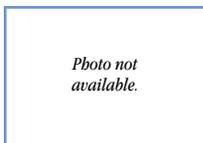
Moderator:
Martin Faga
*President and Chief
Executive Officer, MITRE*



Panelists:
Ronald Birk
*Director, Earth Science
Applications Division, NASA*



Robert Dalal
*Chief Executive Officer,
Space Imaging*



Charles Mondello
*Senior Vice President,
Corporate Development,
Pictometry International*



Jean-Marc Nasr
*Chief Executive Officer,
SPOT Image*



Ron Stearns
*Principal Analyst,
Frost & Sullivan*

Moderator's Opening Remarks

Some of us expected the world to be awash in CRS by now. However, we failed to recognize the difficulty of building the CRS market and the need to develop new users through education and training. At present, most remote sensing products are in the hands of experts. The new White House policy on CRS is a very welcome development but is it enough to take the industry to the next generation?

Opening Remarks by Panelists

The panelists agreed that both the aerial and space sectors of the CRS industry are growing. In addition, they expressed the need to see broad-based use of CRS in all areas of government; if the industry is to grow, the government will have to put money into CRS development. The new White House CRS policy, where as it does open the door for foreign providers [in the US market], needs to have money attached to it to be effective. The CRS industry was seen to be trustworthy and to serve the needs of government in both Europe and the US during Operation Iraqi Freedom. NIMA has become a major customer for both Space Imaging and for CRS products generally, and, as a result, the relationship between government and the CRS industry has evolved significantly over the past year.

Moderator-Posed Question

Will CRS processing become truly successful?

Panelists agreed that this is a difficult area. The capital required to develop a successful processing operation suggests that the marketplace will only be able to sustain one or two large players. The situation in France is somewhat different from that in the US because the French government owns 100%

of the satellites. However, SPOT 5 data is being managed differently from earlier-generation SPOT data. A public-private partnership has been established to provide user services with a view toward putting the development of CRS on a fast track. SPOT is looking for transatlantic cooperation in this endeavor.

Recent successes during Operation Iraqi Freedom aside, it should be remembered that the CRS industry has survived failures pretty well in the past, and is comprised of very hard-working and dedicated individuals. However, more government investment is needed; the industry will reach profitability if government support is forthcoming.

The American Society of Photogrammetry and Remote Sensing (ASPRS) study (ASPRS/NASA 10 Year Remote Sensing Strategic Forecast) is extremely valuable in illustrating the health and status of the CRS industry. The study indicates an industry-wide value of \$300–\$350 million with robust growth in 2003. Both NIMA's ClearView program and the launch of SPOT 5 are major benefits to the industry in 2003. The US government is more supportive of the CRS industry than it has been in the past, and as a result, strong growth is anticipated in the satellite side of the business. CRS continues to be used for petroleum exploration and telecom uses are increasing as that industry continues to recover.

Panelists emphasized that the visibility of the CRS industry had been greatly enhanced by Operation Iraqi Freedom, providing the sort of publicity and goodwill that could not be bought. It was noted that "on-demand" imagery was a significant requirement during the Iraqi conflict and panelists strongly recommended that the industry should immediately start to develop the necessary technology to enable the smooth and efficient provision of CRS data "on-demand" to meet similar needs in the future.

Questions from the Audience

1. *Should NASA help other federal agencies to use remote sensing?*

NASA conducts research and contributes to the knowledge base of the US and the world through its remote sensing assets. Imagery is shared with other agencies—for example, with the USGS for mapping purposes, and with NOAA. Training government departments in specific applications of RS is a significant issue, which NASA continues to address.

2. *What agency should be the "NIMA" of civil agencies?*

This is a very important question and a big challenge. Look for agencies to develop a systematic approach to identifying a point of contact [as part of the civil agency response to the new White House policy on Commercial Remote Sensing].

3. *How much support will the US government provide to the international CRS market?*

The US government has purchased SPOT data and SPOT Image anticipates significant US government use of its data in the future. SPOT Image has established two partners in the US, one for civil users and one for government users. SPOT management hopes this arrangement will better serve the needs of the US government. It is hoped that the new US space policy will further facilitate the SPOT Image-US government relationship.

4. *Is the CRS industry poised for survival of the fittest or is it better postured for consolidation?*

The CRS industry is somewhat fragmented with 40% of the industry comprised of start-up companies representing and servicing both providers and users of data sets. Not all of the current companies will survive in the long haul. Space Imaging, for example, has been in business for eight years and is eight times larger than the nearest US competition and should not be viewed as a start-up company. Both Raytheon and Lockheed Martin (early investors in CRS with Space Imaging)

are strong supporters of the remote sensing industry and have assumed Space Imaging's debts.

In 2002, 65% of Space Imaging's business was international. Sale of SPOT Image data outside France has grown from 10% to 90%. In 2003, the US government took a bigger share, but the international market has a huge role in the development and growth of the industry. There is a great need for capitalization and the US industry is looking to the industry base in the UK, France and Germany to mobilize funding. We need to see the emergence of strong US companies capable of leading the global CRS industry but expect to see consolidations along the way.

5. *What percentage of commercial satellite imagery is for national security? How big is non-government use?*

DoD is one of the largest customers in both the space and aerial sectors. Agriculture, forestry and environmental protection account for the largest portion of non-military uses of CRS on a national scale, with some mapping uses in local markets.

6. *What is the growth rate in the commercial remote sensing industry?*

The ASPRS study saw growth of 14% two years ago and 9% one year ago. Responses to a survey distributed by ASPRS following the September 11 attacks suggested the potential for a slight increase in business over the next few years.

Panelists noted that the recovering telecom industry made significant use of CRS products in late 2002 and 2003. Also, analysts suggest the industry will see increased local use of CRS information as local jurisdictions develop a better understanding of the homeland security responsibilities delegated to them by the federal government. Further, as the economy rebounds, the CRS industry should benefit from product purchases related to the construction of previously postponed infrastructure projects such as those related to pipelines and power lines.

Therefore, it is reasonable to assume an annual growth rate of 8–10% for the industry in general and growth on the satellite side could be double that. Panelists stressed that federal government directives such as Clear-View commitments are driving the accelerated growth rate in the CRS industry on the satellite side. Approval for CRS imaging less than 1 meter would also boost the CRS industry.

7. *What are the hopes and fears of the panel related to a federal civil procurement authority?*

The moderator interpreted this question to address the issue of streamlining from the procurement standpoint—consolidation, with a central agency obtaining CRS imagery on behalf of the civil sector government agencies. Panel members suggested that a consolidated approach would help to introduce structure to data requirements and purchase, especially in relation to data sets and requirements that involve multiple data layers such as the national map that the USGS proposes to compile.

8. *Is the emergence of UAVs a threat to the CRS industry?*

Panelists did not view UAVs as an imminent threat to the CRS industry. They cited the example of Ikonos, which has been very successful in both commercial and military applications. However, the continuity of data collection is critical for commercial customers and some users are concerned about the continuity of data streams as CRS corporations look toward second-generation satellites.

Panel members agreed that user requirements will drive the type and resolution of imagery that is available in the future. The ASPRS study indicates that while many current users opt for 1-meter resolution, there is significant demand for .25- to .5-meter resolution across education, commercial and government markets with the largest market growth likely being in hyper spectral imagery.

Space Imaging plans to launch its next-generation system, with .5-meter resolution, in 2006. SPOT 5 is the last satellite in the cur-

rent SPOT family. The Pleiades Program is on track for launch of a two-satellite constellation at the end of 2007, providing .7- and .5-meter resolution.

One panelist contended that timely delivery of data is the most important factor, more so than resolution. Panelists noted that one reason for launching the two-satellite Pleiades System is to better respond to the timeliness issue. With this constellation in orbit, SPOT Image will be able to deliver imagery of any place on the globe within 24 hours. It was suggested that the inability of the CRS industry to deliver imagery speedily is one reason that CRS has not taken off so far.

The panel noted that the availability of current imagery is important. The industry also needs to demonstrate that CRS data can meet the required standards. Ideally, CRS would provide a set of products that are interoperable, verified and demonstrated. NASA and NIMA have participated in a study of these requirements. However, there has to be a balance between government requirements and what can be sold commercially via the Internet. Panelists noted that aerial firms are meeting a lot of high-resolution needs and both aerial and space imaging provide unique capabilities and both have viable roles to fulfill in the future. In addition, one panelist noted that when it comes to archived data, there appears to be a market for very recent imagery and very old imagery.

9. Will the industry benefit from addressing “cost-per-pixel” or “quality-per-pixel” issues in order to expand the user base?

Panelists agreed that price is the bottom line but appropriateness and relevance of the data and speed of delivery are also important. The industry is striving to deliver products that the customer regards as good value. Determining what constitutes “good value” within the limits of what the customer can afford is the next step.

10. Has NASA shared any lessons learned from the Landsat Data Continuity Mission (LDCM) initiative with NIMA?

LDCM is in the procurement phase so it is not appropriate to comment on lessons learned until the process is complete. However, with 30 years of Landsat experience to draw on, LDCM is based on the proposition that the commercial sector has the capacity to build the necessary satellites and provide continuity of Landsat data while additionally providing other data sets.

11. What is the outlook in licensing data for government customers and non-government customers?

The ClearView program is a good indicator of the licensing trend on the DoD side. There is a need for agencies to work together to develop a vision of what is required on the civil side.

12. Do the license and fee policies reduce market opportunity? They are different for each satellite provider. There are different licenses for DoD, state/local government and international partners. This makes it very difficult to plan homeland defense exchange and coalition operations.

The variation in licenses has to be preserved because the value attached to the products by the users varies and this has to be portrayed in the pricing policies.

13. Since the US government has become more dependent on CRS providers, should the government insure the providers?

The current model requires commercial providers to obtain commercial insurance and that insurance is very expensive. CRS products would be cheaper to the government if the government were to self-insure.

14. Will 1-meter radar systems be competitive with optical satellites in the next 5–10 years? Italy and Germany appear to be planning such systems. Why are there no plans for a commercial US system?

The German system is being created by a public-private partnership and the Italian system, Cosmo, will be 100% government built and operated, so neither is comparable with

the US commercial companies that receive no subsidy from the government. The US commercial industry is not going to try to compete with Radarsat, which has Canadian government backing, or other government-sponsored systems.

However, while the US CRS industry has no current plans to compete in the area of radar data, panelists foresaw other openings for commercial development within the industry in the future. For example, there are high costs associated with data storage. The current focus is on the rapid turnaround of data. NASA, for example, has 18 satellites with 80 sensors and this raises questions about where all the data goes and how to archive it effectively. It is important to match input and output requirements. New data management engines are needed to keep data and data processing flowing and the new systems developed to meet these requirements will need long-term capacity.

It was noted that significant improvements in data storage have been driven by the entertainment industry, for example, in animation production. And the next generation of EOS-DIS is looking for cheaper storage and greater capabilities. Interoperability is paramount and panelists reported that NASA and NOAA plan to move technology and needs development responsibilities into the public sector.

15. *How is the CRS industry going to achieve the development and launch of second-generation systems?*

In order to sustain a commercial business plan the industry needs the US government to endorse second-generation systems as an anchor tenant. At the same time, governments need more CRS products. While strategies may vary from government to government, the industry is likely to see comparable levels of support in the US and Europe.

16. *New countries are providing sources of high-quality data, e.g. Russia, Japan, and Israel. Will their new satellites expand the market or dilute it?*

Panelists agreed that there are certainly new players on the horizon and it will be a crowded marketplace. However, there are a lot of potential customers who currently do not have ready access to RS resources. Furthermore, the market can be expanded through collaborations between CRS providers. The market is also likely to grow when the CRS industry achieves a measure of financial stability and customers can be confident in the continuity of data streams.

17. *The cost of processing software is significant. Is the industry making efforts to develop common standards and more interoperable software packages?*

The moderator observed that there is a large number of data processing and value-added providers and that this is an issue for their consideration rather than the satellite operators [the current panelists].

Panelists suggested that the major issue related to data processing is that people want answers not raw data, so the real question is not the provision of desktop processing capabilities but providing answers. Not all customers are looking for imagery per se. The value-added community needs to place greater emphasis on providing information. Another concern is that the industry has been slow to acknowledge that newer users need more help.

18. *Is the technical workforce adequate to sustain and grow the CRS industry? If not, what can be done to increase a workforce that can translate remote sensing data into information for users?*

Panelists reported that studies looking to the future show a smaller pool of talent in some key areas such as satellite sensor technology, for example. A US Department of Labor study has identified the geospatial information sector as a key area requiring the development of new talent in the future. However, industry representatives on the panel believe there is sufficient talent available to sustain the industry.

19. How can commercial systems best support the educational and scientific requirements for high-resolution data?

One panelist, addressing the scenario in the US, contended that the commercial sector needs to demonstrate the validation of CRS data before federal and state authorities will underwrite the regular use of CRS data for educational and scientific work. It was also suggested that a lack of understanding of how to acquire commercial digital data sets on the part of the educational and research communities in the US inhibits the use of CRS in these sectors. The situation is somewhat different in France, however, where SPOT data is available virtually free of charge to the educational community.

20. If the US government insures private CRS systems and provides contracts for \$.5 billion and more, are they still private companies?

In the view of one panelist speaking from the industry perspective, if a corporation is privately financed, it is a private entity. Even with government insurance the company would have to sustain itself through cash flow in the form of profits and revenue.

21. What are revenues projected to be in 2003 for Space Imaging?

At the time of the symposium, revenue projections for Space Imaging for 2003 were in excess of \$200 million according to a corporate representative.

22. How many CRS satellite companies can the US support?

The last few years of operation in the aerial remote sensing market are probably a good guide to likely developments in the satellite market. The last 5–6 years have seen consolidations in the aerial market and CRS business probably cannot continue to support three companies in the satellite arena. Therefore, consolidations should be expected unless more commercial users emerge or more government support is forthcoming.

23. The CRS industry has not grown as expected over the past 10 years. What needs to change to enable anticipated growth?

Industry representatives believe that the US government needs to embrace and endorse the CRS industry to serve government needs. This will provide revenues to sustain CRS business. The path selected by NIMA is a great step in this direction. NIMA is Space Imaging's best customer. Also, the new space policy goes a long way to address improvement in CRS-government interactions.

On the government side, panelists suggested that national and international mapping programs should recognize the capacity of CRS to meet requirements.

However, licensing is a priority issue. It is also important to provide tiers of information and to develop new market segments to replace those that falter.

Panelists also indicated that replacing satellites is also very important and this raises questions as to whether investors are ready to support the development and launch of new satellites. SPOT Image, for example, sees a need for data from .16-meter resolution to very wide swaths and panelists were not convinced that investors were ready to step up to finance this range of requirements in the commercial sector. Additionally, panelists indicated that there is a perception that the industry has underperformed (a view that discourages potential investors), while, in fact, 8–10% growth per year (double on the satellite side) is a very good rate of growth. Bad growth predictions in the mid-90s have harmed the industry.

It was also noted that some experts believed that the benefits of the CRS industry are well-recognized by the US government and the scenario of government customer, as anchor client will not change in the near future. Greater civilian government investment would be a good thing and this looks possible under the new space policy.

Luncheon Program

The Intelligent Digital Horizon and Its Benefits to Business, Consumers and Government



Arpad Toth

Senior Vice President, Operations and Product Development, Inciscent Corporation

The many new technologies developed over the past 15 years, such as fiber optics, broadband communications, and HDTV have finally stacked up to place us at the beginning of an exciting new future. This presentation encompasses “digital everywhere,” the intelligent universe, nanotechnology, the Internet, objects that think, the hardware/software convergence, and biotechnology (and its convergence with IT).

Digital Everywhere

Digital communications are now well established in the civil, military and consumer services sectors. We have identified the need to protect streams of digital data and those protections are being put in place at present. Digital encryption is being developed as a part of integrated platforms and digital financial transactions are developing rapidly.

Intelligent Universe

The special and specific applications of the past are giving way to agent-based applications showing up in machine-to-machine and human-to-machine interfaces. TiVo is an example of such an in-home system. These systems have to be accurate, personalized and trusted. Derivatives of such systems can be seen in government use. The intelligence of computers is doubling every 18 months and computers are getting smaller simultaneously. The new trend in wireless data transmission and mobile computing is developing very fast. Data storage is another area that is undergoing revolutionary change. This industry is being consumerized. The question is: What do consumers want to have at home?

Nanotechnology

The US government has just increased funding for nanotechnology research. Clearly it can be a seriously destructive technology, but it will have an enormous impact on medicine, education, business and government. Nanotechnology will also redefine remote sensing with a new generation of sensors: personal sensors that can be located in the body, or worn on the wrist, or as a “smart shirt,” or a device carried in the pocket, can monitor a range of organs and conditions. “Smart dust” provides microsensors that can monitor a chemical environment or conditions at a geographic location. All these devices communicate wirelessly. They can be used for military purposes or they can be customized for difficult or dangerous environments.

Internet

The Internet today is a very passive and unstructured system that many people find unfriendly. An agent-based solution is required. You are applying to the Internet for extra brain-power in human-to-machine and machine-to-machine interfaces. The next-generation Internet will have new address protocols and will be 1,000 times more powerful than the existing Internet, with extensive video capabilities including HDTV delivery. It will take two minutes to deliver high-quality video programming that currently takes two hours to deliver. Watch for a lot of changes in the Internet over the next five years resulting in the emergence of an integrated, multipurpose Internet, including, for example, Internet telephone.

Major changes are being seen in television delivery with Internet based format providing split screen display to facilitate data transfer. The implications of these innovations are extensive. For example, teleimmersion can provide the integration of virtual reality and multimedia capabilities to provide a shared experience for the solution of complex situations in an aug-

mented reality where physical reality is augmented by virtual reality.

Other innovations include “smart shirts,” like a T-shirt with sensors that interact with the body, and intelligent artificial limbs.

Objects That Think

Machines and equipment that think will be an everyday occurrence within 10 years—from printers to surveillance systems that can coordinate precision targeting, and eyeglasses that will respond to nanotech sensors in the body. Now is the time to be asking what opportunities these technology developments open up for the commercial remote sensing industry.

Hardware/Software Convergence

It is probable that the next-generation systems will be over-designed, but we are moving towards systems that are reconfigurable. Future systems will redefine applications such as wireless communications, although seamless interfaces are necessary for optimized architecture for particular applications. We are moving toward self-teaching carbon software systems. In the area of networking, hybrid analog/digital systems are a future trend. Broadband Internet networking packets will become universally available and will be adaptive to user needs. The focus will be on both physical and logical development of systems. PDAs will see development of video platforms and seamless coexistence of multiple application platforms will be routine. With widespread interoperability and seamless communication between applications and platforms, business developers, for example, the CRS industry should avoid getting compartmentalized into vertical markets.

Biotechnology

The convergence of biotechnology with IT and computing is resulting in a major leap forward. The human genome project is just one indicator of what is becoming possible in this domain. Along with a new generation of supercomputers we are coming to understand how the human brain works. Twenty to 30 years from now we can anticipate implants to provide augmented brain function. These innovations are taking place in an advanced part of the world where we can expect to see applications of artificial intelligence in the home, in games, robotics in toys, and where television broadcasting will be completely redefined.

When can we expect to see these innovations begin to impact our daily lives?

- Intelligent universe 2010
- Nanotechnology. Late in this decade.
- Internet 2005 (sooner in the military).
- Objects that think. Already happening, but should be widespread by 2008.
- Hardware/software. Already happening.
- Seamless coexistence 1–2 years
- Reliable adaptive networking. 2015
- Next-generation supercomputing. 3–6 years
- Biotechnology Already happening. Should see steady development over next 30 years.

The moral of this story?

The results of this technological convergence have major “human-use” implications in addition to an increase in life expectancy and widespread use of robotics. These innovations are here and available for exploitation by the CRS industry.

PANEL 2: Remote Sensing – A Solutions-Based Business

This panel will engage a variety of practitioners to discuss new, critical applications of remote sensing.



Moderator:

Wanda Austin
*Senior Vice President,
The Aerospace Corporation*



Panelists:

James Clark
*Director, Quick Reaction
Combat Support,
US Air Force*



Anthony Kane
*Director, Engineering
and Technical Services,
American Association of
State Highway and
Transportation Officials*



Michael Lewis
*Boeing Air Traffic
Management,
Boeing Corporation*



Jay Parrish
*State Geologist,
Commonwealth of
Pennsylvania;
Member, National States
Geographic Information
Council (NSGIC)*



Mark Schaefer
*President and Chief
Executive Officer,
NatureServe*

Moderator's Opening Remarks

Remote sensing made everyone more involved in Operation Iraqi Freedom than has ever been the case in the past during a war. The public saw simulations and bomb damage assessments, and, as a result, the public has come to recognize the major role that remote sensing can play in terrain and situation monitoring.

It is noteworthy that shutter control was not imposed during the action in Iraq and that CRS corporations provided timely data delivery to government customers. The CRS industry is experiencing improved sales and development of new applications as a direct result of Operation Iraqi Freedom.

However, many challenges remain. We need to educate the community about the many uses of CRS beyond the war-fighter applications. There are licensing and funding issues, and we need better and more efficient data processing capabilities. Limited government and private funds are available to channel into the industry and this has limited growth. New customers, particularly public customers, are beginning to see new uses for CRS. State and local governments are using RS increasingly for homeland security applications, power and pipeline placement, roadways and even trash collection.

Agriculture is a huge market if the right market segments are developed at the right price. Much remains to be done, for example, in the area of precision crop management. The mining and petroleum industries also use CRS. The mapping applications of CRS are key to extending the use of remote sensing by the legal, insurance, transportation and real estate markets.

Opening Remarks by Panelists

Schaeffer: From the perspective of non-profit organizations and government agencies involved in nature conservancy in the western hemisphere, imagery is a basic necessity for monitoring critical wildlife habitats. Five years ago, Landsat was the only option. Now there is a diversity of offerings and the environment can be seen in exquisite detail. In the conservancy area the benefit/value ratio is critical. The biggest challenge is gaining access to data. Many organizations are looking for freebies or discounts. Contracts that make data available to multiple conservation groups might help in this connection.

Some data interpretation tools are being developed. The conservation community needs algorithms to detect change over a 10–15 year period. Hyperspectral imagery will help to detect invasive species and flyover simulations will contribute to understanding landscape change over time. The conservancy community is gaining access to CRS data and is anxious to find ways to take advantage of this new resource.

Parrish: At the state and county level, insufficient personnel are educated in the use of remote sensing for monitoring land cover, forests, urban sprawl over time, or for geological mapping. Such uses of RS are a stepping-stone to a Global Information System (GIS). Cheaper software makes a big difference to these users. With the arrival of higher resolution imagery it is no longer a toss up between satellite and aerial imagery. The licensing policy of each state is important. In Pennsylvania, data purchased by the state is made publicly available with the objective of passing on image data to other state users. This means that the counties could use RS data to monitor properties, etc. For local disaster monitoring data must be provided within 24 hours.

Lewis: The demand for air transportation will outstrip the ability of the air transportation management system to manage air traffic. The current air transportation management system can

probably support 25% growth, but the industry could grow 300%.

The next-generation air traffic management system infrastructure will be designed to support 300% or even 500% growth in air traffic. This will incorporate high-bandwidth systems, precision surveillance and precision information on runways, hazards, etc. Indeed, precision atmospheric and terrain information are key to the next step up for the air traffic management system, and a space-based system fits these requirements. A 4-D digital map is required to address aviation hazards. Visibility is a major limiting factor at present, hence the importance attached to precision terrain mapping for the next-generation system. Digital terrain maps today are .9999996 safe. A future space-based system needs to handle this requirement in a way that is absolutely reliable.

Kane: The major applications of RS in ground transportation are planning, management and operations. The states are responsible for 4 million miles of highways as well as some airports, ports, and a variety of modes of transport. Motorists incur \$7 million annually in out-of-pocket costs because of highway conditions and delays. Emergency response and maintenance cost \$250 billion each year and \$1 trillion is lost as a result of delays each year. The states are therefore challenged to provide better operating systems. The use of RS would aid better environmental decision-making. For example, fly-thru simulations would help with highway planning. It is noteworthy that various RS techniques were used in designing the new Woodrow Wilson Bridge in Northern Virginia.

Coordination with the auto industry is part of the solution. Automated braking systems and remote systems for visualization, cruise control, and for aligning the vehicle with the roadway for rollover avoidance will all contribute to smoother traffic flow and a reduction in accidents, which are responsible for 50% of non-recurring work delays.

Just as in other sectors, state governments need better tools in order to maximize benefits from remote sensing data.

Clark: India, Canada and France offer 1-meter products as well as the US. In the military arena, commercial imagery is used for combat operations, humanitarian missions and training. The key to usefulness is obtaining the most current and accurate information. Sometimes the commercial product meets these key requirements. The use of CRS has to be balanced with data from government sources. It is critical to be able to share data with coalition partners, for example the UN. In Iraq, Afghanistan and Kosovo the US military has used a full range of image resolutions from 30-meter to .68-meter, both in color and black and white, and has applications for multi- and hyper- spectral imagery as well as panchromatic products.

The government sets its own standards for processing imagery. Commercial remote sensing image processing companies located in the Washington, DC, area were used for a time, but experience revealed that this was not a cost-effective strategy. The military is the largest user of commercial imagery ground stations. A direct downlink system is under development to get data directly to the war-fighter. Downlink systems have to be cost-effective with realistic costs for long-term use. The military needs multi-capability ground stations designed to handle multiple satellites. CRS companies should be sure to be cost competitive and cost-effective in order to be an attractive option for military use.

Questions from the Audience

1. *What is the ratio of local to regional remote sensing applications in the area of nature conservancy in a given year?*

Of approximately 75,000 image requests filed annually, up to 75% are local. Typically, conservation groups look at regional ecosystems and help government agencies make decisions in the broader context. Much of the work concerns such issues as wildlife corridors and places where the transportation system intersects a wildlife habitat.

2. *What price change in commercial imagery would make your business more accessible to the CRS industry?*

One panelist would like to see CRS imagery prices similar to those charged for aerial photography. Another panelist was of the opinion that \$2,000–\$3,000 per scene would be reasonable but warned that the imagery needs to be packaged for licensing and the industry must also ensure that fees do not price CRS out of the market.

3. *What are the commercial applications for space-based radar?*

There is the question of the commercial value of the data. Radar-based data is a very technical data source. There is considerable overlap with DoD security applications; there are several applications but they are not typically commercial. However, the future holds great promise for new resolution radar systems planned for over the next five years.

4. *Does Pennsylvania have the same policy for other commodities bought from the private sector as it does for data? For example, do other commodities paid for by tax money also have to be in the public domain? If not, why is data different?*

No, the Pennsylvania policy applies to information. Therefore, if you generate information using tax dollars, that information has to be available to the public.

5. *What is the range of CRS products derived from imagery and what was the top product used for Operation Iraqi Freedom?*

Multispectral imagery was a big hit during Operation Iraqi Freedom. RS was used to tell manmade structures from natural formations, to look at the status of dams and water levels in reservoirs and rivers, and to look for soil changes such as evidence of large holes being dug to bury evidence. Mosaics of multiple scenes were also extremely useful in providing 27-foot accuracy anywhere in Iraq.

In terms of expanding the range of applications for CRS products, one panelist suggest-

ed that RS could be invaluable for real-time transportation support. Police, fire and emergency response teams are potentially key users of real-time applications. Market models need to be explored to determine who provides the information and the cost of that real-time information. Provision of a continuous data stream might also be considered “real-time” information. However, it would not be realistic to expect individual users to absorb the costs. For example, 40% of auto accidents involve vehicles running off the roadway. There are multiple uses for “knowing-where-you-are” data. One such example is for snowplows to ensure they are indeed on track and plowing the roadway when there is heavy snow.

Panel Discussion

1. *What differentiates military satellites from commercial satellites?*

The value of commercial satellites when you have military satellite capability is the subject of an ongoing debate in Washington, DC. However, we are very much aware that it is essential to balance the two in order to compile vital information. Furthermore, the more satellites there are in the sky, the more complicated it becomes for the enemy on the ground.

2. *What would this group like to see from a “civil NIMA”?*

Panelists expected US government agencies to provide guidance on this in response to the new space policy. NASA, NOAA and USGS have tremendous mapping capabilities and it would be beneficial to see better interagency coordination to enhance the use of government assets. However, the panel noted that new restrictions on sharing data imposed since the 9/11 attacks have reduced the cooperation between state and local government.

3. *With the explosion of unmanned vehicles supporting remote sensing for the DoD, do the panelists see derivatives of these systems successfully competing with satellite-based systems?*

The panel acknowledged that RS was used to position the Predator UAVs during the Iraqi conflict and suggested that commercial applications for UAVs will be whatever the commercial industry can come up with. However, the panel did not believe that a camera on a UAV at 15,000 feet would replace satellite imagery.

4. *Discuss the use and value of archived data.*

Archived data can be very useful in looking for indications of environmental change over time. Conservationists would be interested in price breaks for older data. The transportation sector finds archived data useful in tracking land use changes.

5. *There are various levels of technical expertise required to take raw satellite imagery and create information products or GIS data layers. Within your organization, what is the general level of expertise?*

The current challenge in the airline operations sector is to develop this sort of expertise. There is next to nothing right now and establishment of a single clearinghouse for information products is a long way off.

A similar gap in expert image data processing exists at the state government level where geologists are the main users at present. Simplicity is the key. If the system is simple, more of the community can use the product. Access would be greatly improved if a customer could use the CRS information without having to turn to a GIS expert.

Closing Remarks

Austin: The community has not discussed how users and potential users should communicate requirements to the industry.

Clark: Sincere thanks to the CRS industry for the substantial contribution that CRS imagery made to coalition forces in the execution of Operation Iraqi Freedom. CRS information was especially helpful in fulfilling humanitarian aspects of the mission and the CRS industry is to be thanked for taking the leap of faith in starting the commercial companies and achieving operational capability.

Kane: There is tremendous potential for the applications of CRS imagery. With state departments becoming smaller and smaller, an automated decision process needs to be worked out to save time. Talent is being brought into state and local government and lots of people want to share information between states.

Lewis: There are huge opportunities for the CRS industry in the needs of the next generation of precision data systems. One challenge will be to integrate data sets so that the user can exploit available information.

Parrish: I would encourage the industry to flood the market with cheaper data rather than hold out for a higher price.

Schaeffer: The data from CRS imagery is a tremendous resource that remains largely untapped. We need to do a better job at helping potential users understand the rapid changes that are taking place in the industry and we need to provide integrated products.

PANEL 3: Future Systems and Products

This panel will enable the industry providers and users to present their views of the future (markets, technologies, etc.).



Moderator:
Gregory Withee
*Assistant Administrator for
Satellite and Information
Services, NOAA,
US Department of Commerce*



Panelists:
Ghassem Asrar
*Associate Administrator
for Earth Science, National
Aeronautics and Space
Administration (NASA)*



Stephen Coulson
*Head of the Support to
Market Development
Section, Earth Observation
Applications, ESA/ESRIN*



Jeffrey Grant
*Vice President, Intelligence,
Surveillance and
Reconnaissance, Northrop
Grumman*



Douglas Hall
*Chief Executive Officer,
EarthSat Corporation*

Moderator's Opening Remarks

NOAA has a unique role in that it both licenses the CRS industry and also serves as an advocate for the industry.

I want to renew the invitation extended earlier by Secretary Evans to come and talk to us at NOAA as an advocate for the CRS industry. To date, 18 licenses have been issued, and 28 foreign partnership agreements have been approved with a value of \$800 million. However, most of these missions have not yet flown.

During this panel, we will discuss how the commercial remote sensing industry can be a part of a global remote sensing system.

Opening Remarks by Panelists

Grant: Most of the existing civil government RS satellites are sun-synchronous systems with a net efficiency of substantially less than 5%. This is not a good business model because the customer may have to wait days, weeks or months to receive data after placing a data request.

The next-generation remote sensing satellite proposed by Northrop Grumman will utilize high-resolution optical technology employed by the James Webb Space Telescope. Its orbit would permit it to provide up to three hours of daily coverage at .5-meter resolution over a target area in the northern hemisphere. This next generation satellite will have slow scan video capability and an onboard weather sensor to be sure you can see the site (cloud-free view). The next generation satellites will show two orders of magnitude improvement over current government satellites. The US Secretary of Defense, Donald Rumsfeld, challenged the CRS industry to stay a year ahead of overseas RS capabilities and for government agencies to keep two generations ahead of the competition.

Hall: We have to look at what is happening in terms of data. There are many new satellites, especially imaging satellites, resulting in an unprecedented growth in the availability of data. It will be a major challenge to ensure that the data is used and there is an associated need to develop a better understanding of end-user needs. EarthSat Corporation has been classifying vegetation and land cover data for NIMA for three years and along the way the corporation has invested a great deal in getting better at providing the information NIMA wants. Technologies have been developed to automate parts of the process. New processing techniques are essential to fully exploit the new sensors that are coming on line.

We need uniform sets of data across the world so that various information products can be meshed with each other. Significant development of ground segments will be required if this is to be achieved.

In the future we expect to see information and data extraction moved upstream in the process. Capabilities such as automosaicking will be built into the ground-processing segment so that we end up with a seamless process from data collection to end-user use. In order to achieve this level of efficiency we will need to see some of the future investment in the industry going into data exploitation.

Coulson: Discussions are underway in Europe at the present time to determine the most suitable next-generation RS configuration to provide benefit to Europe. Satellites see the big picture and governments deal with big picture issues so the government is seen as the major customer for Europe's RS satellites. Beyond defense, meteorology is the major use of RS satellite data in Europe. Despite the fact that Europe has had its own RS data for more than a decade through ERS 1 and 2, most Earth observation applications remain largely R&D or come in the form of one-off demonstration projects. There is no single consolidated service industry but a series of small niche providers. Government customers are largely interested in global monitoring for environmental and security uses.

Eighty-three million Euros will be invested over the next five years to identify and engage European government users for RS imagery. ESA

will be looking at European political requirements with a view to demonstrating the benefits of Earth observation for particular applications and to show that the benefits would justify the cost. ESA is looking to go ahead with two or three demonstrations costing 10–15 million Euros each. The main target will be small companies. In Europe the market for Earth observations is tending to grow as the result of small university-based operations that are opening new markets. One objective of the marketing strategy will be to get those university spin-offs to team with bigger companies and plug them into the commercial offerings.

The marketing effort will also take time to listen to the client in order to better understand the market and to connect the right people at the right time. A lot of money has been devoted to space hardware but the services sector has been neglected. We have to remove the financial and technical barriers and provide users easy access to the information they need. Trends, scenarios, impacts and forecasts are under current discussion.

Asrar: The field of remote sensing has been around for half a century. We started pushing to develop and demonstrate the technology in the 1960s. Eighteen Earth observation satellites have been launched under my leadership of NASA's Division of Earth Science.

In the 1960s, we spent an entire decade conducting technology demonstrations and we have benefited in a great number of ways from that decade of experimentation. For example, we learned and began to refine the uses of satellites for weather prediction during that time. We also learned that you couldn't wait 10 years to get data.

The 1970s can be typified as a decade spent defining scientific experiments to answer specific questions that could be addressed by Earth remote sensing. As a result, we started to study the chemistry of the atmosphere from space and we saw the beginnings of space-borne oceanography. Internationally, we embarked on a mission to understand how our planet functions as a system. This initiative required a new multi-platform, multi-system approach. The ultimate benefit of this program is support and improve-

ment of daily life on planet Earth.

We also had to learn how to build the necessary satellites, instruments and sensors, and how to extract information from the data. The scientific discoveries that have stemmed from the Earth observing program are the practical realization of this mission. On the practical side, we have learned that we must consider the end-to-end system. Robust scientific research requires a robust information extraction system. More than half of NASA's annual Earth remote sensing investment is focused on the ground segment: on information delivery and information synthesis.

As we look toward the future, I believe we are shifting from a "push" approach to a "pull" strategy, investing funds to meet ultimate scientific objectives. Therefore, the architecture on the drawing board is changing. We need to be able to reconfigure systems to meet new needs while delivering information to the end user in a timely manner.

Access to information in a usable and affordable manner is of paramount importance. We expect to see information extraction pushed upstream so that information can be downloaded directly to the end user. One key to improving the flow of information is to ensure that standards and protocols are compatible between systems. Therefore one of the ultimate ingredients of success is the development of partnerships. The life cycle of the Earth monitoring business is long and this requires stability in relationships and partnerships. The RS community needs to acknowledge that applications offered in the future should be long term with long life cycle time and cost structures. I believe that past and present [government] investment in remote sensing will serve public and private sectors well.

Questions from the Audience

1. *How does the panel see the roles of public-private partnerships in development of long-term growth of the industry?*

The end user is the government; there are few private sector end users. Therefore, it is important to understand how to meet government goals. The government is driving

information requirements. Commercial operators need to be more efficient and more flexible. However, panel members saw tremendous growth potential for remote sensing and partnerships will be central to that growth. New dimensions to public-private partnerships will emerge as RS use increases. The CRS industry is likely to be the provider of RS products as well as the provider of value-added services.

2. *Are European and US policies converging or diverging with respect to raw data provision?*

In the case of ESA's ERS remote sensing data there are two competing consortia each with four-year contracts for data distribution and each consortia is free to set commercial prices as it sees fit. There has been a dramatic increase in the use of ERS data under this arrangement. Previously, sales were approximately 2,000 scenes per year. Now, sales are at a level of 8,000–9,000 scenes per year. It is all a question of pricing. ESA is waiting to see whether a reduction in the cost barriers to access data will open the way for service industries to develop new uses for Earth observation data from the ERS satellites.

3. *How can public-private partnerships advance the development and application of more advanced technologies (e.g., SAR, hyperspectral imaging)? What role should international cooperation (government-government, government-industry, industry-industry) play in these partnerships?*

Partnerships will be essential. Long-term investment and risk reduction are required to implement new technologies. Space-based radar is effective and there are some interesting civil government applications so this might be a good government-industry "crossover" technology. Hyperspectral imaging needs to be demonstrated. The role of government is to demonstrate the benefit of new technologies and encourage adoption by the broader remote sensing community. Because of the huge expense of advanced systems, government is in a better position than industry to take the risk to demonstrate new systems.

Our past model in the US has been serial in nature. If the US government and the CRS industry can find a way to work together it will be possible to shorten the life cycle from development and demonstration to injecting the benefits of new technology into the mainstream.

4. *Is there a market for automatic image processing, including product fusion?*

Panelists see automatic processing and product fusion developing. Information can certainly be enhanced by combining data from several sensors. Some longer-term thinking is needed on this subject to be sure that the industry is meeting customer needs, especially for automated data fusion, and the industry needs to focus on end users in determining end products. This will involve developing tools for specific products to be derived from multiple streams of data. It might be appropriate to talk about information fusion, not just sensor information. There is more and more interest in forecasting; therefore modeling capabilities need to be integrated into the data fusion concept.

5. *Does NOAA plan to place instruments on commercial satellites or place commercial sensors on its own satellites?*

Space has been made available for a commercial sensor to fly on an upcoming NOAA GOES satellite. The only cost the commercial partner would need to meet would be the cost of integration on the satellite. To date, such arrangements have not resulted in any flight opportunities. However, there will be three additional satellites with similar opportunities available on each of them.

6. *We have heard of the limitations on acquisition (cloud, night, location, etc.) that can cause very long delays for customers between request and receipt. That delay limits usefulness and acts against growth or demand. Is there a possibility of greater cooperation between providers to create a "virtual constellation" so that a single demand could be met in the shortest possible period?*

The challenge is to tie the mosaic together. And is it possible to make the whole greater than the sum of its parts? The industry should take advantage of its multiple capabilities to offer multiple products. Failure to do so could result in a missed opportunity to promote the next generation of remote sensors. Panelists emphasized that it is important to adopt the standards and format of downstream data. Distributed systems of this type are likely to stand the test of time.

It was noted that the international charter for disaster management already does this. The operating agencies collect data in support of response to natural disasters.

Closing Remarks

Grant: The government, in becoming the market maker in the commercial market, should be a demanding customer thus helping to define future trends and needs in the industry.

Hall: The mistake of the past was to develop a solution and then look for the problem that needed to be resolved. We have to do things the other way around in the future.

Coulson: Governments have many problems that need to be solved and can use Earth observations in defense, science and meteorology. The industry must deliver the information and demonstrate that it brings benefit. I anticipate it will take 4–5 years in Europe to determine what is clearly defined as a benefit and what is a reasonable cost.

Asrar: The uses and benefits of Earth remote sensing have been clearly demonstrated. RS has a unique capability and it is here to stay. We need to bring intellectual focus to how to apply this new information. We need leadership to make it happen and to deliver RS to the global community. This is why NASA and the US government are committed to this business.

Commercial Satellite Remote Sensing Symposium

PROCEEDINGS

May 13–15, 2003

Washington DC

MAY 14, 2003



Opening Remarks

Gregory Withee

*Assistant Administrator for
Satellite and Information
Services, NOAA, US Department
of Commerce*

Mr. Withee thanked the US Chamber of Commerce, NASA and Mondavi Wines for hosting a very enjoyable reception at the Chamber on the evening of Tuesday, May 13. The reception provided a valuable networking opportunity for participants and provided fascinating insights into remote sensing applications in the California wine industry. Mr. Withee then introduced Gil Klinger, the director of space policy for the National Security Council.



Keynote Speech: Space Policy

Gil Klinger

*Director, Space Policy, National
Security Council*

In June 2002, the President directed the administration to review US space policy. The US Commercial Remote Sensing Policy of April 25, 2003, is the first result from that policy review. This policy document supersedes PDD 23 and introduces major changes in four areas. A Fact Sheet summarizing the new policy is available at the Office of Science & Technology Policy Web site: http://ostp.gov/html/_pressreleases.html (click on “US Commercial Remote Sensing Policy April 25, 2003”). One compelling reason to update US CRS policy is the fact that PDD 23 was released in 1994 and much has changed since then.

Writing a new policy document relevant to the state of the CRS industry today was comparatively easy; the challenge will be in implementation.

The new policy reflects a significant shift in the relationship between the US government and the US commercial remote sensing industry as illustrated in the first stated goal of the new policy:

“... the United States Government will rely, to the maximum practical extent, on US commercial remote sensing space capabilities for filling imagery and geospatial needs for military, intelligence, foreign policy, homeland security, and civil users”...

NIMA will provide the principal interface between government and the CRS industry for the national security sector. Additionally, the policy places increased emphasis on the use of CRS by civil agencies. Furthermore, the policy aims at improving the level of cooperation between federal and civil agencies and NASA in fulfilling the needs of the national security community.

The policy approach, with respect to licensing and export requirements, is similar to that for government acquisition of information from the CRS industry: it is structured to enable the industry to compete aggressively in the global marketplace. Specifically, the policy recognizes that CRS is a rapidly evolving global industry and removes former barriers to the construction of certain types of CRS satellites. At the same time, in the interest of national security and homeland security, the government reserves the right to restrict usage to US or US-approved customers.

The two-tier licensing system requires no change to the existing State Department munitions list or the Land Remote Sensing Policy Act of 1992. Exports will continue to be evaluated

on a case-by-case basis. As a general rule, the administration favors the export of those goods and services that are comparable to goods and services that are already available, or likely to be available soon, on the open market. When contemplating overseas business the CRS industry should take note of the overall relationship between the US government and the proposed recipient country. Goods and services and technologies that set the US apart from the rest of the world could be contracted for export but on a selective and rare case-by-case basis. The State Department will maintain a list of “crown jewel technologies”—a sensitive technologies list—a point of contact for that list will be established and that list will be made available to the CRS industry. Any export of these (or other sensitive technologies) will be made only under a specific government-to-government agreement. Once such agreements are in place, the new policy will enable international transactions to be executed more expeditiously.

The government recognizes a growing, vibrant, remote sensing industry and wants to establish a long-term relationship between the industry and the US government. It benefits the government to have commercial goods and services widely available to the US government and our friends. We also recognize that adversaries are likely to have access to these services in the global marketplace. Other countries have remote sensing systems, and between availability and unauthorized use we have to work on the assumption that CRS products are widely available.

US Commercial Remote Sensing companies did an exemplary job during recent events [in Iraq, providing timely delivery of imagery products to the US defense, intelligence communities, and our allies].

The policy calls for specific actions to be completed by relevant government agencies within 120 days from issue of the policy. Execution of the policy is in the hands of the executive branch agencies.

Questions from the Audience

1. *Space Imaging has requested a license for .25-meter resolution imaging; would this be available for sale [to users other than the US intelligence community]?*

Licensing comes under the purview of NOAA. That agency adjudicates all licensing applications. The new policy places no inherent restrictions on resolution for the CRS industry.

2. *How does the panel view turnkey systems for allies?*

CRS companies are encouraged to market such systems aggressively as part of the effort, implicit in the new policy, to develop stronger CRS industry-government relationships. Each case will still be looked at on its individual merits, but the policy opens the door more widely to RS exports and explicitly encourages these sorts of relationships. Specific turnkey systems should be discussed with the Department of State, Department of Commerce and involved agencies.

3. *What are the standards concerning shutter control in the new policy?*

There is no change from pre-existing policy on shutter control. Existing interagency agreements remain in place. The US government retains a range of capabilities and options to protect both the US and our allies. Indeed, the discussion of shutter control is misplaced. The real topic of discussion is the protection of the US, our allies and our interests. This is a subject that guides NOAA in every license that is issued for RS.

4. *How are civil government agencies to implement the new policy when they are operating with reduced funding?*

The policy directs the agencies to make funds available to purchase CRS products. The Department of Commerce, the

Department of Interior and NASA are tasked to develop a more integrated set of requirements for RS and to determine the goods and services that they will need. The defense agencies have a better-developed management structure to interact with the CRS industry. The civil agencies are not as well organized and they will have to make a business management decision in order to coordinate CRS purchases.

5. *What is the future for foreign contributions to the US remote sensing market?*

There is no exclusive “buy American” language in the policy document, but the focus is on the US government’s relationship with the American CRS industry. NIMA on the defense side, and the relevant agencies on the civil side, will have to work at the relationship issues.

6. *Do we need to improve the “turning radius” on policy?*

We see the new policy having a positive impact on the process of reviewing and processing license applications. The government is striving to get everyone on the same page, hence the decision to share the sensitive technologies list with the industry. We are explicitly looking for ways to improve the process of reviewing and issuing licenses.

7. *How does the new policy deal with non-US sources?*

The new policy leaves the door open for access to overseas components for integration in RS satellites. The basic business approach embraced by the policy is to allow CRS companies to execute the most cost-effective deal.

8. *Does the new space policy replace the existing National Space Policy?*

No, the new US Commercial Remote Sensing Policy replaces only PDD 23.

9. *What are the specific issues that are to be addressed within 120 days of issue of the new US Commercial Remote Sensing Policy?*

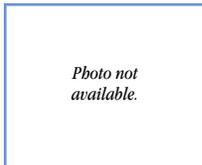
You can discern what various agencies are responsible for during the 120-day period by reviewing the document at the White House Web site: http://ostp.gov/html/_pressreleases.html. We believe policy-making is generally more effective when agency responsibilities are clearly identified and some agencies are already beginning to work on their assigned tasks.

PANEL 4: Policy—A US Perspective

This panel will explore the successes and challenges related to US commercial remote sensing policy.



Moderator:
James Lewis
*Senior Fellow and Director,
Technology Policy, Center for
Strategic and International
Studies*



Panelists:
Max Clayton
*Lt. Col. US Air Force, Space
and Missile Defense Policy
Division, Joint Staff J5*



J. Christian Kessler
*Director, Export Control
and Conventional Arms,
US Department of State,
Nonproliferation Bureau*



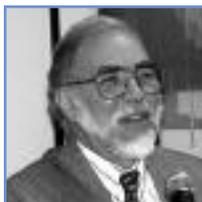
Kevin O'Connell
*Director, Intelligence
Policy Center, RAND*



Timothy Stryker
*Remote Sensing Licensing
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Services, International
and Interagency Affairs,
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Liam Weston
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Ball Aerospace and
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Ray Williamson
*Research Professor, Space
Policy Institute, Elliot
School of International
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Washington University*

Moderator's Opening Remarks

The implementation of PDD 23 was handled very differently from the implementation plan devised for the new US Commercial Remote Sensing Policy. Many of us will be watching developments very closely since the group in charge of implementing the new policy in the civil agencies is a very risk-averse group of people.

In this panel we will discuss where we are now compared to 1991, when we started talking about many of the issues discussed today in the new policy.

Opening Remarks by Panelists

Clayton: I would like to congratulate the industry on the tremendous success of CRS involvement in Operation Iraqi Freedom. CRS products sold overseas made a particular contribution, for example, in proving, from space, that there was no environmental disaster in Southern Iraq [oil wells had not been torched in vast numbers]. The Iraqi experience showed that space-based resources enable speedy delivery of critical information. The insights of embedded reporters were a completely new experience made possible by modern technology and frequently illustrated with CRS imagery. The DoD had to make determinations about the release of imagery that balanced the benefits of an informed public against the reactions of adversaries.

Kessler: It is important to assure the new CRS industry that we take matters very seriously. The new policy speaks to the CRS industry competing successfully in the global marketplace while protecting security interests. We need to establish stronger and broader relationships with a number of allies in order to permit more candid discussion of sensitive issues. Internationally, crises arise frequently, and in many forms—not just military crises but, for example, humanitarian crises. We need to

discuss a whole set of issues with overseas partners to ensure that we can meet all threats and all situations. Many of our allies share similar policy objectives with us and we expect a good level of cooperation.

O'Connell: The administration is to be congratulated on issuing the new Commercial Remote Sensing Policy but we need to recognize that the hard work starts now. Supporting policy documents will be required in order to implement the new policy. A new policy was clearly needed to deal with the reality of current CRS industry activities. It will also be necessary to push our allies to define their policies on how their governments deal with control of CRS both in peacetime and during a crisis. The government needs to be clear and firm concerning its expectations from civil agencies. NIMA's ClearView and NextView programs are good examples of the new approach to CRS purchase.

Our expectations have gone up exponentially over the last few years as RS capabilities have improved. The CRS industry has to be a part of the ongoing transformation of the intelligence community. For example, we are now talking about data fusion, and the commercial industry will help in exploiting the data.

Stryker: In the US remote sensing arena we have a very clear separation of government and industry, which is rather different from some other countries. We have a legal regulatory regime that is published for everyone to see, and the need now is to focus on implementation actions in compliance with the new policy. The government has multiple roles as customer, regulator and industry advocate overseas. NOAA works to review foreign partnership agreements within 60 days and to complete actions in 120 days. A great deal of work will have to be done to implement the new policy. We have very good relationships with the other civil agencies involved.

We are very much aware of the Rumsfeld Commission's recommendation that the US CRS industry stay a generation ahead of the foreign competition. We have formed the Advisory Committee on Commercial Remote Sensing in

order to bring together a lot of expertise to help NOAA move forward in dealing with new licensing applications. The Advisory Committee has already conducted productive discussions on some international issues. We want to work in collaboration with other agencies on quite a lot of issues and we are looking to use the same model overseas for working with foreign governments and companies overseas.

Weston: The DoD did a great job in contracting with industry during Operation Iraqi Freedom. The playing field is somewhat uneven for the CRS industry internationally because US companies have been unable to export their products. But not every export represents a threat to security; quite often imagery exports can enhance alliances and increase allied capabilities.

Williamson: I would like to add my congratulations to Gil Klinger and others involved in developing the new policy on CRS that supports the industry and increased transparency. However, it is not clear how the civil agencies will incorporate commercial data into their work. Certainly none of them has taken on the role of connecting with the commercial industry to date. Some agencies have used visualization and fly-thru techniques but it would be good to see the US Department of Agriculture or the US Bureau of Land Management begin to make effective use of RS data.

Questions from the Audience

1. *Is the new policy sufficient to keep the US CRS industry in the lead [internationally]?*

The new policy is a positive step but there is no doubt that the US CRS industry is up against fierce international competition. Implementation of the new policy will be key to the success and competitiveness of the US industry and an integrated approach to product compilation in the future is another important factor. PDD 23 did not provide much guidance on this aspect.

2. *Comment on the failure to develop a comprehensive value-added sector in the industry.*

There is a perception that the capabilities of RS are other than what it can really be used for. The industry needs to think in terms of end-to-end systems so that users can derive the information they need from the product that is delivered to them.

3. *Comment on the requirement for government-to-government agreements for international CRS trade.*

The purpose of government-to-government agreements is to facilitate and accelerate international CRS trade. Establishing government-to-government agreements could slow things down, but, once established, such agreements could be very positive for licensing of services. Turnkey operations for allies are not a risk area and we could work to improve our performance in this business area under the government-to-government agreements.

4. *What does the licensing policy say about foreign ownership limits and foreign board representation on US remote sensing companies?*

This has not changed. We are looking at effective controls, not bright line ownership limits. We want foreign investment in advanced CRS systems.

5. *Is there still a policy in place that restricts the resolution for radar satellites for a commercial license?*

Yes, we do restrict SAR for general commercial availability, with the most advanced capabilities reserved for US government-approved users. Each application is dealt with on a case-by-case basis, based on overall system parameters.

6. *How does the US deal with the probable growth of the commercial satellite industry overseas? What if that product gets in the wrong hands? How can the US respond?*

We have to assume that commercial imagery is in the hands of anyone who can

pay for it. Therefore we have to plan for that scenario, which means we have to drive upmarket in the intelligence sector. It is hard to assume the notion of control in the digital age and it is very hard to limit what information gets out. We have to be vigilant. If an adversary's use of space [or space resources] were a threat to US or allied security then we would deal with that threat.

It should be noted that much high-resolution aerial remote sensing data of US territory is processed overseas. So, we need to look at US security needs in a broader perspective than just focusing on satellite-derived data, products and services.

We should perhaps consider turnkey operations as opposed to access to sensitive technology. Turnkey operations are very attractive. Surrey Satellites have exported more than 20 turnkey satellite systems in the past five years. With turnkey systems, the data is the point, not the satellite and sensor technology that deliver the data. In the US, we have created our own problems by not recognizing the capabilities being developed elsewhere. If we focus on turnkey operations we may be able to reopen the question of availability of some US systems.

The key is end-to-end systems providing answers not just data.

It's important to think about specific adversaries when defining policies. The staff of the Office of Export Controls and Conventional Arms Nonproliferation Policy at the US State Department spend a lot of time doing just that.

7. *The new policy identifies private systems as contributing to "US military, intelligence, and homeland security." Will this have a chilling effect on foreign customers and investors?*

The US is the only country where truly private companies are selling remote sensing data. The US is the only country where the customer can come to the remote sensing company and get the data before the government sees it.

8. *Does the panel think that this policy and the regulations will enable and/or facilitate the emergence of balanced US–non-US joint ventures operating an international constellation of remote sensing satellites?*

It's a possibility. More and more countries are engaged in remote sensing and the US CRS industry will be likely to negotiate whatever provides the best mix of capabilities.

9. *Explain how the commercial remote sensing industry can revolutionize processing and exploitation techniques, including applications for government users who mostly use national sources.*

Commercial firms have much experience with government customers in the areas of data processing and RS information exploitation, and are developing many new services in this regard. The commercial companies can also be a part of the discussion of how intelligence gathering is done, particularly as it pertains to some of the acquisition issues.

10. *The objectives of national prestige, national security, and national sovereignty motivate satellite remote sensing programs around the world. Could the panel estimate how many there are and how viable these markets are for the US industry?*

The quality of US remote sensing products and the timeliness of delivery from US providers makes them competitive with other systems. There is every opportunity for the development of a very robust market. Many governments have the desire to operate their own systems, but the US commercial systems can offer superior value and should be in a position to deliver a better product. The RS market has undergone a big change between 1994 and 2000. It will be a ferociously competitive market.

11. *There were instances in the past when operational agreements between the US and its allies were overruled by policy-based decisions. Will there be a mechanism to prevent such problems (e.g., shutter control) from surfacing in the future?*

The panel was not clear on the intent of the question but concluded it perhaps addressed an implicit intent of the new policy concerning operational agreements and policy implications.

Circumstances where policy overrides operational implementation are always an issue. Governments have their reasons for imposing controls on access to data. Not many countries are going to be commercial providers of remote sensing. However, many countries will want their own satellites for a variety of reasons [including control of access to data]. The US Department of State is involved in ongoing discussions with other governments and there is a shared perception that imaging data is extremely valuable and access to it cannot be restricted. We have a shared interest in working to deal with this issue.

12. *Has shutter control been replaced by self-censorship by the American companies? If so, will that stimulate foreign sources of information during wartime?*

No. US CRS data was readily available during Operation Iraqi Freedom and nothing bad happened.

13. *Does this policy and the speed at which NIMA will award a NextView contract have anything to do with Boeing's delays in building a next-generation intelligence satellite system?*

No. The speedy turnaround in awarding the NextView contract by NIMA reflects the intelligence community's increased reliance on commercial remote sensing.

14. *Is there a policy on provision of commercial remote sensing data at low cost to the US research community?*

NASA has authorized a commercial data purchase for proposals from the scientific community and this has been seen as a valuable way to help scientists to use commercial data. However, it remains important for the industry to develop better ways of using the data.

15. Are downlink receiving systems, data processing systems, and exploitation tools covered by the new policy?

The US government licenses an end-to-end system for operations or export.

16. How well will the intelligence community of analysts accept commercial imagery? Is there prejudice?

We are seeing greater acceptance and integration of CRS data into NIMA and DoD information sets. On the DoD side, there was a bias towards using CRS during Operation Iraqi Freedom, especially in respect of coalition operations. Therefore CRS was seen as extremely helpful. It is a demonstrable benefit to the US for others [outside the US intelligence community] to be able to understand what is going on. Analysts have an overload of information. The challenge is to organize the data effectively and recognize that certain data is valuable for certain functions.

17. What is the panel's opinion of the concept of two-tier operating licenses in regard to developing a business plan for advanced remote sensing satellites? Does the panel believe the US government must make any commitment to cover the top tier?

The availability of quality data from the US has created a problem. The US is trying to maintain the lead in RS [resolution] but the government realizes that higher resolution imagery, such as Quickbird's proposed .61-meter imagery, will have to be shared at some point.

18. How have NIMA contracts helped the CRS companies? What has been the Wall Street reaction?

ClearView and NextView represent the most serious government commitments to the US CRS industry in many years. There are complex trade-offs that must be weighed, but government expenditures are now crucial to the advancement of the industry.

In terms of perceptions of the US CRS industry, it was very important to have the government involved in some way. The ClearView contracts helped to get the industry afloat. The NextView contracts will have a similar, but possibly somewhat smaller, effect.

19. From a policy and export point of view, what constitutes a "turn-key" remote sensing system?

Some degree of information has to be provided to the customer, but the contractor is essentially responsible for "delivery to orbit" of the system that provides the turnkey operation to the customer. Non-US nationals do not get access to the inside of the satellite, so there is no technology transfer.

20. How successful has the CRS industry been in the homeland security environment?

This is a good market but navigating the intelligence issues is complex and this commercial market has gotten off to a slow start. There needs to be a new and broader discussion on intelligence issues. There are opportunities in other areas of homeland security. For example, NASA has undertaken a study of remote sensing uses in transportation that points to a significant potential for use of RS in improving transportation security throughout the country. Whether you are using national or commercial data, the specific homeland security tasks and data delivery and analysis processes remains to be worked out.

Luncheon Program

Commercial Remote Sensing: The Future



Gérard Brachet

*Former Director General,
Centre National d'Etudes
Spatiales (CNES)*

A considerable amount of SPOT imagery was sold to the DoD during Gulf War 1. At that time, SPOT was the only commercially available data and the DoD could not distribute spy satellite data to allies so SPOT was able fill that need. Timely delivery of the data was the key to the success of SPOT use in that context.

The challenge for the future commercial remote sensing industry is to transform the system into an information provider. This involves filling the gap between the system operator and the community of users. A great deal of progress has been made since the early days of the SPOT system, but we still have a long way to go. In the mid-1990s, 50% of SPOT imagery went to the defense community. Now there is broader use of commercial imagery, but the civilian market has not developed as expected. In the future we expect to see significant use of digital modeling and growth of the value-added industry.

With experience, we see that only fresh data really sells, and, as a result, today most SPOT data is collected on request. Therefore for timely and efficient delivery of information the operator has to be in close communication with the customer.

The policy debate about data handling is obsolete. The market now dictates the conditions under which data will be exploited and we have to be pragmatic in dealing with data handling and transfer issues in the policy area.

We have seen some very successful international cooperative ventures and we have also seen fierce competition between competing systems.

The remote sensing industry needs both cooperation and competition. There are examples of cooperation in meteorology and competition in scientific research.

SPOT managers maintain close contact with the scientific community in order to understand and anticipate the needs of research customers.

In broad terms, the remote sensing industry remains at a crossroads with a solid customer base amongst scientific operations but with innovative commercial business development not yet secure.

The Disaster Charter that emerged from UNISPACE III has greatly expanded the use of remote sensing in emergency response situations. Prior to 1999, most government agencies involved in disaster response did not use space-based information. The program put in place at UNISPACE III was operational within three years and has been activated several times, for example, to help recovery crews in the Turkish earthquake. Only civil agencies can originate activation of the system and only minimal training is needed for the responders going into the field. There are many scenarios for future international cooperation.

The new US policy on CRS is a positive development. However, we have to remember that there are 15 nations with remote sensing programs, each at a different stage of development and with varying levels of general public education about the applications and benefits of RS. This makes for a very difficult situation. The French government has never given the green light to publish a policy document on commercial use of remote sensing although such a policy does exist. Europe should attempt to establish a common strategy for monitoring RS distribution and usage but things are moving very slowly.

PANEL 5: Policy—A Non-US Perspective

This panel will provide an overview of non-US laws and policies, and discuss government balance of control and promotion and the important link between policy and market.



Moderator:

Joanne Gabrynowicz
Director, National Remote Sensing and Space Law Center, School of Law, University of Mississippi



Panelists:

Canada: **Phillip Baines**
Senior Advisor, Science and Technology, Canadian Department of Foreign Affairs and International Trade

Photo not available.

Israel: **Menashe Broder**
Chief Executive Officer and a Director, ImageSat, International N.V.



Germany: **Ernst Koenemann**
Head, Earth Observation, German Aerospace Center



India: **K.R. Sridhara Murthi**
Executive Director, Antrix Corporation



France: **Vincent Sabathier**
Attaché for Space and Aeronautics, CNES Representative, Embassy of France

Opening Remarks

Baines: Remote sensing is a global activity, but it is an industry that requires regulation by national governments. The Canadian policy on access control dates from 1999. Recent agreements on sharing RS data include an arrangement with Norway. A government-to-government agreement with the US has treaty status. Canadian policy allows for the interruption or reprioritization of RADARSAT data to serve Canadian security interests. The Canadian government controls the satellite and data dissemination and is also responsible for licensing, shutter control, etc. Data is available in a multi-tier system. The specific data supplied to a customer will depend on that customer's "access profile." The launch of RADARSAT 2 in 2005 will narrow the gap between the defense and civil markets.

Broder: In Israel, the cornerstone of law on satellites and imaging is a 1957 law controlling goods and services. A 1986 law addressed aerial photography, but the current regulations, issued in 1991, apply to all military equipment and the Ministry of Defense deals with all matters covered by the 1991 code. Israeli law basically follows US law, requiring an export license to discuss or export space products. Unlike the US situation, where the State Department has assumed control of space/satellite export matters, the Israeli Ministry of Foreign Affairs has nothing to do with licensing for remote sensing satellites or products.

With respect to ImageSat, which is 100% funded by private investors, policy is decided exclusively on the basis of the national security interests of Israel.

Koenemann: There is a clear change underway in Germany to move from a focus on science to an emphasis on education as part of an effort to expand commercial space activities. There is a growing demand for remote sensing data, for envi-

ronmental monitoring, and for security needs, and the German government is looking for greater commercial involvement upstream and downstream. This is being implemented through project management contracts and partnerships. Efforts are being made to promote public participation. For example, Astrium is contributing 27% towards the cost of satellite development for one new program and Astrium will market the data from the new system [in return for the up-front technology investment].

Germany has nothing like the legal and regulatory framework that exists in the US. A German space law is being prepared which essentially incorporates the Outer Space Treaty and other relevant international treaties into German law. Security concerns are addressed in legislation in an approach that is similar to the Canadian system.

Murthi: India has four Earth observation satellites and the data is available to India and other nations. There is a very large body of users and an end-to-end integrated program is offered. The remote sensing industry in India is worth \$68 million but not all of this income is generated through Indian satellites. The value-added market is approximately \$40 million per year with some 200 businesses providing data processing solutions and deriving information from data for customers.

Space operations in India are controlled by an Executive Order approved by the cabinet. The Department of Space is responsible for satellite licensing. The order requires that all international obligations be recognized and makes a national commitment to space services to serve the national good. Users obtain licenses to use data and data distribution is centralized under the National Remote Sensing agency. The government reserves the right to control data distribution for security reasons. Indian data is available to other nations within the UN framework. An alliance has been established with Space Imaging for distribution of Indian satellite data in the US.

Some 5- to 8-meter resolution data of sensitive areas is withheld. Users of 1-meter resolution data are screened. There are both government

and commercial users for 1-meter data in India. There is a 25-year plan for remote sensing needs and uses in India that encompasses environmental reports, large-scale maps, disaster management support and scientific understanding.

Sabathier: In France, remote sensing is a factor in foreign policy, security issues and scientific research. Our focus currently is on public-private partnerships. We do not believe the market is sufficient to sustain a large commercial market. A large amount of data is used for scientific research but potential for revenues from the research community are small. The government is pursuing the POGO model: Privately Operated, Government Owned (the SPOT 5 model). Or alternatively, we may look at enterprises that are privately operated with the government as first customer.

The major role of the government in France's remote sensing industry is to try to grow the market by developing new applications. We see a significant need to expand the field of users and develop new applications more rapidly. We believe that the scientific community is the group most likely to develop new applications so we have to keep data flowing to scientists.

Questions from the Audience

1. *How will the new US policy affect policies and laws in your country?*

Panelists welcomed the new policy and expressed the hope that the new policy will help to clarify user interests and thereby contribute to growth in the CRS sector. Each country must decide its own priorities and security issues. A commercial company like ImageSat has no official voice on matters of policy and law, but ImageSat does not see any problems with the new US policy and is ready to provide data and information to NIMA.

Overseas data providers would like to know what is on the US State Department's "sensitive technologies" list in order to avoid designing satellites or sensors utilizing parts

that they will be unable to obtain from the US. Therefore the panel anticipates that representatives of interested foreign governments such as the German Department of Economy (which handles exports) will request discussions with the US government on this matter. Panelists liked the 120-day implementation approach. In the past it has taken a long time to achieve clarification on how a new policy will operate.

Panelists noted that the multi-tiered approach is very similar to the way Canada is proceeding in protecting national security interests so the new US policy appears very familiar. The intent of the policy—that the US CRS industry should “lead the pack” is encouraging. PDD 23 took a “follow-the-pack” approach.

2. Do the panelists make data available to imaged states?

The German government’s position is that an imaged state can ask for the data.

In Canada, RADARSAT 1 provides data to imaged states.

The panel noted that an existing UN Resolution provides for delivery of data at a benign level of resolution to imaged states for certain activities.

data but still has to make the decision on whether to sell data at cost or give it to the scientific community. One option under consideration would be to make pictures that are more than three months old available online.

3. Is it desirable to coordinate commercial remote sensing data policies/licensing requirements among spacefaring countries? If not, why not? If so, how can this best be approached?

One panelist was of the opinion that it is important to have a level playing field. However, other panelists felt that while coordination of policies and requirements was a good idea, it would not happen because different governments have very different perspectives on CRS. The French government, for example, is resistant to commercial operators. And nations have different security concerns so this would be difficult to coordinate. It was suggested that more cooperation would tie businesses up in more red tape with the result that the commercial corporations would never be profitable and governments would have to continue to support them.

4. Is the Israeli list of prohibited countries the same as the American list? If the American list changes, does the Israeli list get automatically updated?

Currently the Israeli list of prohibited countries is the same as the US list. If the US list changes, the Israeli Ministry will review the situation and decide what action to take on the Israeli list.

5. Where should we go to find the relevant laws of your country?

In Germany there is an official book of government publications and they are also available online.

In India, policies are published in the Gazette and on the government Web site in India.

For the Canadian statutes see the Canadian Department of Justice Web site at: www.justice.gc.ca.

Panel Discussion

1. An existing UN Resolution provides for delivery of data at a benign level of resolution to imaged states for certain activities. Does India limit imagery sales of higher resolution imagery?

Imagery to 5–8 meters is freely available in India. Users have to apply and be screened for use of 1-meter resolution data.

2. What is the French policy on the commercial sale of remote sensing data?

French policy on sale of RS is being developed. The French government wants to encourage the scientific community to use RS

For Israeli public policy, see government publications, but security classifications never get published.

For French statutes, refer to national law and the government will coordinate efforts when national security requires it.

The moderator noted that it is important to remember that we are dealing with very different systems that present policies, regulations and laws in differing forms.

6. *If the majority of interest and revenues come from national security organizations, how much pressure exists to buy indigenous data first? Are there other issues relating to the purchase of satellite data from foreign sources?*

There is no pressure in Canada to make a priority of buying Canadian data. The Canadian government departments buy the best imagery available at the best quality and price. German policy is similar to that of Canada—buy the best imagery available at the cheapest price.

In France, if the information the government needs is available from SPOT, the French government will take the SPOT data because it has already paid for it. In instances where SPOT data is not available, the French government will purchase data from foreign providers.

7. *Define “public” and “private.”*

In Canada there is no consensus on these terms for application to commercial remote sensing satellites. In India it depends on the source of the investment. We define “public” as paid for with tax dollars. In Germany “public” tends to refer to scientific applications. “Private” implies a commercial line of business development.

Closing Remarks

Sabathier: This is a difficult time in the development of the remote sensing business but I believe CRS will take on a greater role in the future.

Murthi: We have seen commercial remote sensing systems delivered to orbit and functioning, and recently we have seen them playing a major role [in Operation Iraqi Freedom]. At present the CRS systems are driving policies and we need to update CRS policy to facilitate industry growth. There are genuine concerns about the uses for which data is purchased so regulations are certainly required.

Koenemann: The dual use of data is probably the biggest challenge that Germany faces along with clarifying and implementing the concept of public-private partnerships in alignment with government policy. The next 2–3 years should see us working through these issues.

Broder: The satellite market needs further development; it is not healthy yet. We need to see more commercial satellites. Until then, commercial companies will always need government help.

Baines: We are into a hybrid phase. The Canadian government wants to foster CRS policy because the sooner the CRS industry flourishes, the better it will be for all of us.

In conclusion, the moderator expressed thanks to the panelists, the sponsors and the planning committee for making this dialogue possible.

PANEL 6: Financing Remote Sensing

This panel will identify and discuss the finance and investment issues related to promoting commercial remote sensing.



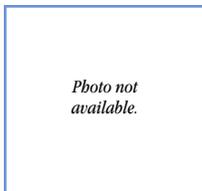
Moderator:
Warren Ferster
Deputy Editor, Space News

Moderator's Opening Remarks

No commercial remote sensing satellites that have achieved orbit and operational status have been lost to date. However, Digital Globe invested approximately \$72 million to achieve operational status and Space Imaging invested about \$120 million. NIMA has indicated a willingness to invest up to \$500 million over a six-year period to obtain CRS products and to foster the next generation of CRS satellites. On the commercial side, Lockheed Martin and Raytheon agreed to write off Space Imaging's accumulated debt but both corporations had also indicated that they would not put more money into Space Imaging, which amounted to a major condemnation of the CRS industry by corporate aerospace. With the success of CRS applications during Operation Iraqi Freedom it appears that Lockheed Martin and Raytheon are reconsidering commitment to CRS. Clearly, the Iraqi war was good for CRS and the new policy on CRS is an industry-friendly policy.

In addition, people who have invested in this industry to date have probably lost their money. Nobody is investing in this industry now and nobody is able to recapitalize their space systems.

Consolidations amongst Digital Globe, Space Imaging and ORBIMAGE are inevitable. Three US CRS companies will not survive in the long haul.



Panelists:
James Hirsch
Consultant, JVH Associates



Ed Jurkevics
Principal, Chesapeake Analytics



Andrea Maléter
Technical Director, Futron



Armand Mancini
Executive Vice President and Chief Financial Officer, ORBIMAGE



Armand Musey
Analyst, Near Earth LLC

Opening Remarks by Panelists

Mancini: The question we confront right now is whether the industry can attract the volume of business it needs in order to survive and grow. Representatives of the industry think this can be achieved but we have the memory of the mid-90s failures (Iridium, ICO), and we see other aspects of space-based business doing better, Direct TV for example, and now satellite radio (although its

growth is behind expectations). Furthermore, the effort to grow the CRS industry is being conducted in a tough stock market climate. The recent user gains in the defense arena are good but the industry cannot focus only on government users. However, with government support (government as user or partner) the CRS companies should be better positioned to attract financing. The remote sensing industry is in its infancy and revenues suggest that it is starting to do well.

Maléter: The CRS industry has to determine how to differentiate itself from the likes of Iridium and make it clear that CRS is not a communications business. Likewise, it is important to educate investors that CRS serves a different market from the aerial photography sector. With education on its role and uses, the CRS industry relationship with the government is likely to be different from that experienced by the space communications and aerial photography companies.

Musey: A key question is whether investment capital is available to the CRS industry. Currently the industry has enormous over-capacity. For CRS to be attractive to investors we will need to see consolidation, introduction of more user services, and increased demand for CRS products. NIMA's ClearView program is not so much an investment as a government bailout to keep the industry going.

Jurkevics: The models suggest that you need 5–6 satellites providing 1-meter resolution in order to provide good coverage. A one-satellite operation is a sub-economic proposition. Therefore what is needed is a diversified firm with satellites working other applications in addition to meeting the requirements of the intelligence community.

Hirsch: Models call for a three-year capitalization with operational satellites in the fourth year, and growth projected at 13% per annum. Operating costs are gauged at 10–12% of revenues for \$60 million capitalization with \$325 million in sales in the first year of operation. Frost and Sullivan calculate the total worldwide market to be \$325 million to \$350 million. A

market of that size is not going to sustain four US companies and overseas competition as well.

This would imply that the US CRS industry is indeed dependent on the US government for survival. NIMA will invest a minimum of \$500 million, budgeting \$192 million in the first year. The CRS industry may well sink or swim on how it handles implementation of the funding profile for NextView. This program opens the door to taking CRS to a new level where it can become viable and self-sustaining, but the next-generation satellites must supply better quality data.

The new policy directs the civil agencies to work together, but according to the ASPRS study, 14 civil agencies spend a total of \$200 million annually on both space-based and aerial imagery.

Panel Discussion: The Potential for Success and the Need for Investment in the CRS Industry

Musey: Venture capitalists are flush with cash but they do not see attractive investment opportunities in the CRS industry at present.

Jurkevics: With 50% government users and 25% international users there is never likely to be a successful US commercial remote sensing industry. The word "commercial" itself is a problem because it does not suggest an industry that is sustained by government funding. Congressional committees, for example, believe they have to deal with the CRS industry in isolation from other discussion of space imaging assets because of the "commercial" label.

Hirsch: In part, the CRS industry is struggling and unable to attract investment because future products and services are not clearly defined for potential investors. Design and construction of second-generation systems will be driven by national security requirements; and in that, there is a danger that the systems and sensors developed may make CRS products too expensive for the commercial customer.

Maléter: The industry needs a mix of users, government and civil.

Questions from the Audience

1. How much have each of you invested in the industry personally?

Musey: I bought shares in Hughes, and broke even when I sold them three years ago.

Mancini: A whole lot!

Maléter: I've bought Landsat pictures.

Jurkevics: I'm a shareholder and supporter.

Hirsch: I have no investment in the industry in order to avoid conflicts of interest.

2. Mr. Mancini remarked that there's not much funding available for commercial remote sensing. How does he view the related value-added community?

The value-added market is a very different model from the CRS satellite [provider] segment of the industry (the segment that the investment community is skeptical about). But while the market model is different, the companies engaged in the value-added business tend to be much smaller and the industry is much more fragmented, making it more difficult for investors to identify good investment prospects. Market analysts are looking to the value-added sector to develop new markets for the CRS industry, so this could make them attractive investment prospects, even for the satellite operators.

3. What is the panel's opinion about the potential for smaller specific-use satellites to alter the economy of this industry?

There are some efforts in this area with agricultural models. There's potentially a huge corporate market for such applications and this might be a viable market if satellite design and development costs can be reduced.

The question is whether you can convince investors that demand exists for specific-use small satellites. Additionally, while proving the existence of this niche market, the industry also has to overcome the general recession in satellite demand.

The new CRS policy attempts to ease problems with respect to the export of satellite parts, and this may help both US-component providers and the small-satellite market.

However, the panel recognized that the US government still requires case-by-case review for export of satellite components.

4. How do government laws, regulations and policies affect a private company's financing? Specifically, is there sufficient transparency worldwide for potential investors to make appropriate decisions?

Until recently the big concern vis-à-vis investment in the CRS industry was the potential for shutter control. Since Operation Iraqi Freedom, that has become less of a consideration. One panelist noted that investors are used to dealing with "government risk" in areas of national interest.

5. Doesn't NextView require the provider(s) to be financially viable? Who is best positioned to demonstrate this requirement? Who will provide our industry such capital?

At \$200 million, NextView will not finance production of the next satellite in a commercial constellation, so a CRS company will need an aerospace partner who is prepared to make a significant investment in order to achieve financial viability.

Panelists felt that if a CRS company has the right model and the right satellite builder it would be possible to raise the money to construct additional satellites.

6. Can the panel envision a truly commercial client that satellite data providers can rely on for long-term revenue growth?

The end customer is often in government but not necessarily the US federal government. There are regional applications and there is a lot of international distribution market potential including value-added applications. However, it is important to be careful about the definition of a "commercial" client. What we are dealing with is a commercial image as a commodity. The true value in the CRS market may drift from the satellite operators to the value-added sector, and we may see some of today's operators move into the value-added market to capture some of those earnings.

Commercial Satellite Remote Sensing Symposium PROCEEDINGS

May 13–15, 2003
Washington DC

MAY 15, 2003



Program Overview and Opening Remarks

Charles E. Groat
Director, US Geological Survey

The new policy on
Commercial Remote Sensing
focuses on the value of data

and the increasing role of the commercial sector in providing this data. We will have to ensure that we can supply the resources, including the necessary technical know-how, to acquire the task-specific information that future users will require. A review conducted in 2002 revealed that a lot of remote sensing data is not used because the civil agencies do not have the resources to acquire the data.

The USGS National Map will use high-resolution, hyperspectral and radar data from test systems, and we would welcome commercial sector involvement in compiling some of the more complex data. We are also interested in looking at new applications. The USGS will certainly work with vendors in meeting new needs for the National Map and we will try to provide access to scientific work for commercial vendors.

We are committed to using more commercial data and recognize it as an underutilized capability. I believe we are at a great frontier in high-resolution products, and we are exploring ways to use commercial remote sensing to support production of the National Map.

There is a huge audience interested in information products from remote sensing. It is to be hoped that the value-added industry will expand the market with a suite of broader applications that will help to establish a viable and healthy commercial sector that will be a driving force in the remote sensing/intelligence/information industry.



Keynote Speech: The Information- Sensitive Environment

Roberta Lenczowski
*Executive Director, National
Imagery and Mapping Agency
(NIMA)*

NIMA was established in 1996. The largest part of the agency's operation is the timely, relevant and accurate production and analysis of geospatial intelligence in support of national security. NIMA also has responsibility for acquiring the relevant geospatial information and for "innovation"—development of the technological tools and concepts for obtaining and analyzing appropriate data.

The Central Tasking Office (CTO) coordinates NIMA's commercial data programs. The emphasis in geospatial intelligence is on context—the "what" and "where" segment of intelligence gathering. Information must be precise and accurate but also complete. This requires extraction and analysis, and is very dependent on tradecrafts. All data is reviewed on the basis of source, currency, objective accuracy, and quantity of ambiguity. Bringing together the geospatial and intelligence operations creates tension but results in synergy.

Great importance is attached to the development of a particular picture. Visualization can take many forms. It may be black and white, multispectral or monochromatic. We also use LIDAR and 3-D imagery, and imagery is annotated, for example, creating overlays to monitor agriculture. We may also animate images. An example would be draping high-resolution images over LIDAR. We are still refining these capabilities but they have already been employed in connection with the Superbowl and the most recent presidential inauguration in Washington, DC.

Our “Value Pyramid” for development of information begins with real-world facts and climbs through data to provide information, knowledge and wisdom. Doctrine, strategy and statesmanship are derived from wisdom and this is where the real value lies for those who work with the information we output.

In a situation like Operation Iraqi Freedom, key information that we need to share with allies is information on where we have been and where we are going. This requires multiple collection sources with a distributed and shared production system and the timelines are measured in minutes and hours. We are mainly dealing with digital information and NIMA is moving toward a fully digital environment. We are looking for interoperable commercial solutions in working with these advanced data sets. The intelligence community is becoming increasingly dependent on the commercial sector for imagery and we are working to integrate the image and geospatial sides of the operation.

What we refer to as the “need to distinguish” is the area of information gathering that is sensitive to content and resolution. Here we are concerned with content, density and resolution, timeliness, integrity, and accuracy and utility of the information. NIMA is responsible for assuring geospatial intelligence. The agency must ensure that the necessary information exists and is accurate and complete.

Remote sensing information is readily available and widely dispersed, and there is now an expectation that information from remote sensing data will be readily available. We are working with special reference graphics to provide a common frame of reference when using RS products. We learned the value of CRS during Operation Enduring Freedom, and we now see CRS as an important source and are developing ways to make CRS a more valuable tool in the execution of our responsibilities. For example, we are working to facilitate the incorporation of commercial imagery in end-to-end products. We want to bring commercial imagery direct to NIMA workstations. During Operation Iraqi Freedom, we were able to reinforce our relationship with

the CRS companies, and some of our customer communities are also using CRS imagery now.

Unclassified CRS imagery was used, for example, to determine what protective action to take for launch of UAVs. Space Imaging products were used in connection with the beach attacks in Southern Iraq and Quickbird imagery was used for monitoring dams. DigitalGlobe supplied a 36-scene ortho-rectified scene to the UK, and British forces also used Quickbird imagery to assist in clearing mines and in determining that it was safe to off-load cargo from ships.

There is much discussion of “data fusion.” NIMA is working on 2-D and 4-D perspectives and temporal renditions that will be accessible through Web interfaces. These tools are being commercially developed and we look to the CRS industry to help provide the solutions to challenges in the intelligence, defense and diplomatic arenas.

Questions from the Audience

1. *Describe the NextView Program.*

This is an ongoing procurement activity so it cannot be discussed in any detail. A Request for Information was put out in April in large part to ensure that the commercial companies have the capabilities that the intelligence community will require in the future. We are looking for innovation and creativity. The RFP should be released in May 2003 and our intent is to make an award selection by the end of the fiscal year. NextView is focused on understanding the capabilities and capacities of the follow-on suite of CRS satellites.

2. *What is NIMA’s role in relation to the Department of Homeland Security?*

NIMA supports the homeland security effort and works with other agencies as appropriate. We supply support to the CIA in combating the terrorist threat upon request. We also provide support to the structure of the National Map (USGS).

3. *What is the future trend likely to be in uses of CRS by the intelligence community?*

Last June, NIMA was directed to use commercial imaging to the greatest extent possible for geospatial mapping activities, and the trend is toward increased CRS use for operations in the future. We are looking to off-load requirements from national sensors where the information is available from commercial sources.

4. *How do you merge the purchase of CRS data with the use of value-added producers? How does NIMA buy value-added services?*

We should look for a tidal linkage between satellite operators and value-added information providers as we move into the future. The industry is not yet ready for one central point of contact. As an interim fix, we may move to having images delivered directly to information extraction contractors.

5. *One of the implementation actions in connection with the new CRS policy requires the civil agencies to come up with an approach for a mechanism for interaction with the CRS industry for purchases from commercial providers. But at the end of the day, an agency has to have money to buy commercial imagery. What advice can NIMA give to the civil agencies on this matter?*

NIMA will support the civil agencies as they work through that.

PANEL 7: Summary Session

This panel will provide a view of the future of commercial remote sensing. The panelists will provide their overview and respond to the views presented over the previous two days of the symposium.



Moderator:
Nancy Colleton
President, Institute for Global Environmental Strategies



Panelists:
John Curlander
Chief Executive Officer, Vexcel Corporation



Dan Dubno
Producer and Technologist, CBS News

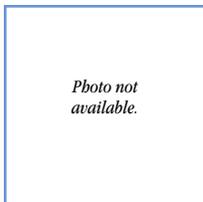


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Wade Larson
Manager, Business Development, Space Missions Group, MacDonald Dettwiler and Associates (MDA)



Herb Satterlee
President and Chief Executive Officer, DigitalGlobe

Moderator's Opening Remarks

Three agencies—the Department of Commerce, NASA and the USGS—cooperated to host this symposium because they recognize that Earth observation is critical to many of the challenges facing us today. Their collaboration is indicative of the excellent cooperation between civil agencies that we can expect to see applied to developing a civil agency implementation strategy for the new CRS policy. Discussions at this symposium have also ensured that representatives of the commercial community will be engaged in the planning process.

Opening Remarks by Panelists

Curlander: We have about 100 people focused on ground systems, specifically the reception and processing of remote sensing material. Work falls into three main areas: industry-government relationships; market—market size and market analysis; and the information versus data discussion.

Historically, this industry has had a very strange relationship with government. In the early days of the industry, commercial remote sensing was seen as a threat to government, and to some extent, the government is still fighting us. The US government cannot control CRS—the technology is out there and people overseas have it. Now that imagery is universally available, the government finds itself in a tug of war between security and the health and viability of the commercial industry. The ultimate answer may be privatization rather than commercialization of the remote sensing business.

The market for data is \$350 million per year. But what is the market we are seeking? Historically, the government has purchased space system infrastructure and the data comes free. Now the government is shifting from buying infrastructure to buying data.

That is the future of the market; it is already happening with the Landsat Data Continuity Mission. ClearView and NextView adhere to the same trend. It could take 5, 10 or 15 years for the government to completely shift gears, but this is a huge market, worth possibly \$50 billion per year.

With the Landsat Data Continuity Mission the customer wants to see the raw data, but this is not always the case. The industry needs to provide what the customer wants and sometimes that is information, not data. It depends on the market: the intelligence community, mapping community, scientific community, etc.

There isn't a great market for commercial imagery at the moment and it is a very fragmented market made up of many small pieces. The value-added market is also comprised of small businesses and it will develop too; but the real lead in development lies with the government [as user and the customer who will identify future requirements].

We are on the cusp of the golden age of remote sensing. The explosion of high-resolution satellites and the huge quantities of data that will be available will be significant. It is not easy to make CRS a viable business but it will happen. Greater integration with the commercial providers is essential and specifically preparation of integrated end-to-end products for government customers.

Dubno: Five years ago, people didn't think you could deliver RS imagery in 24 hours. Operation Iraqi Freedom has changed that perception; we saw the future and the broadcasting community now understands imagery. During Operation Iraqi Freedom we saw radical imagery illustrating such things as bomb damage and allowing the public to see exactly what was going on. Access to that imagery went hand in glove with positioning of the embedded reporters. Transparency was seen to be a very strong tool. Both the release of key imagery and taking the embedded reporters into the field were great successes for the defense establishment.

This time the commercial companies released only images that posed no risk to US troops. The companies will release more material next time there is such a conflict. The widespread use of CRS imagery and imagery products by the media

during Operation Iraqi Freedom has changed the perception of 'seeing' amongst the American public and the public is now very much aware of what remote sensing is. In summary, the new technology has changed how the media does business and how America understands what is going on. Both the press and the public need further education. We have to do something to prepare the public for the 'wisdom' element in the use and interpretation of imagery.

Larson: The US government poses a number of "over-border" challenges to the remote sensing business. In the past, the balance between security concerns and fostering growth of the CRS industry was managed poorly. The US government does a good job in this area in the new policy, especially in the post-9/11 world. The policy opens the way for augmenting commercial systems to help to deal with the security threat, and the government has assumed the role of stimulating the industry in the regulatory area. However, both are defined relative to the US, and the US is the biggest market for Canadian RS products. The free-trade approach in the new policy will benefit the domestic US CRS business over international companies. However, only 50% of \$200 million in sales by Space Imaging in 2003 were US sales. The Radarsat model for government use of remote sensing has not been successful in Canada. Just one Canadian government agency makes routine use of Radarsat data. We need to see cultural changes in the user community and better products and services.

A lot of the RS industry is very fragmented and vertically disjointed. MacDonald Dettwiler is exceptionally well integrated vertically from satellite development to data output and relationships with customers. However, we believe horizontal integration is key to the future. Even so, revenues do not equal cost without government input. As an industry we should not regard it as a mark of failure that we sell primarily to governments, but we need to move from a "push" model to a "pull" model. We look to the remote sensing industry to procure the information that is needed and provide the value-added products, thereby pulling the industry along a path of future development.

Satterlee: I want to thank NOAA, NASA and the USGS for organizing this symposium. There has been a great deal of detailed, relevant discussion and a great deal has come out of this meeting. I add my thanks, also, to Gil Klinger and his team for the new CRS policy. Thanks to NIMA for the ClearView and NextView programs. We also look forward to seeing USGS move forward aggressively in making use of CRS.

DigitalGlobe's volume of business tripled from the second day of the Iraqi war and it is continuing to grow. Both Space Imaging and DigitalGlobe tested a model in working with the government during Operation Iraqi Freedom. We are learning from experience, and now we have to figure out how to work with the government customer. We were able to supply some data in as little as three hours, but our license did not permit us to release data publicly in less than 24 hours. The CRS industry has had a slow takeoff but we are now looking 10 years ahead. We are looking for commercial applications of RS, for example, in the areas of agriculture and conservation. Imaging is just one level of product delivery. Users need information in a format that makes it convenient to make decisions. We are looking at homeland security applications. After 9/11, we recognized that information is valuable to first responders. Image data can be used in emergency management, for example, in looking at chemical plumes, for infrastructure mapping and environmental mapping (environmental remediation), for tracking oil and gas seepage, and for growth modeling. Visualization products can be extremely useful in a wide range of applications.

We need to improve the international business environment. The companies need to listen to the customers and build new products that solve customers' problems. More tailored products are needed. This applies extensively in local markets where it is important to tailor products to address local issues. Our partnership with SPOT Image provides access to new markets and we are working to develop additional marketing and software partners.

The government does not react quickly to license requests, so we have submitted a request for a .25-meter system. We are more excited about the future of the CRS industry today than ever before and we are confident that things are improving for the industry.

Questions from the Audience

Considering the current level of high-dollar government remote sensing programs (e.g. NASA, NOAA) and the International Inter Government Consortia, how do you view the near-term and long-term impacts on the "commercial" remote sensing business?

The impacts are significant, but whether the impact is positive or negative is specific to the governmental body and its intentions. Countries or groups of countries that are financing the development of systems primarily for defense purposes tend not to harm the commercial providers as they keep the data to themselves or share it in a limited fashion. Countries that provide subsidies that support commercial entities can be a negative if the commercial entity uses the subsidy to support below-market pricing.

Overall, this has not been a significant issue to date but it could become a major question over the next decade. If the commercial enterprises are to survive, the industry must be better at delivering the right product and services to the customer in the desired format exactly when it is needed.

Time constraints did not allow for more questions of this panel. In closing remarks the moderator thanked the panelists for their time as well as the sponsors and the planning committee who worked to make this meeting possible.
