Asia-Pacific
Economic Cooperation

REPORT FOR WORKSHOP ON

APEC NETWORK BUILDING

– APPLIED SPACE TECHNOLOGY CENTERS

(REED+ WORKSHOP)

APEC Policy Partnership on Science, Technology and Innovation

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APEC NETWORK BUILDING – APPLIED SPACE TECHNOLOGY CENTERS

(REED+ WORKSHOP)

Far East Federal University, Vladivostok, Russia
APEC Policy Partnership on Science, Technology and Innovation
October 16-17, 2012

ScanEx
RESEARCH AND DEVELOPMENT CENTER

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Preface

The workshop “APEC Network Building – Applied Space Technology Centers” was held at Far East Federal University, Vladivostok, Russia on October 16-17, 2012 under the supervision of the Federal Space Agency of the Russian Federation (Roscosmos). This workshop provided a forum for various experts and stakeholders involved in forestry and remote sensing areas to discuss and review the application of satellite data for sustainable forestry, development and support of REDD+ project (which helps to protect forests and prevent climate change) as well as attraction of investment for the implementation of joint bi- and multi-lateral project in APEC region.

The workshop was conducted as the key element of APEC Project IST 07/2011A. The workshop was co-organized by APEC Secretariat, Roscosmos, Research & Development Center ScanEx with support of Ministry of Economic Development of the Russian Federation, Far East Federal University and Far East Branch of Russian Academy of Science.

The event was mostly dedicated to examining the best available tools and approaches for implementing best practice in application of satellite data for sustainable forestry support and implementation of projects aimed at reducing emissions from deforestation and forest degradation.

The participants included experienced academicians, business people, governmental officials, international NGOs and representatives of 11 APEC and 3 non-APEC economies. The workshop consisted of 6 plenary sessions, invited lecture, breakout session, comprehensive discussions that lead to a number of follow-up recommendations accepted by all the participants.

We thank all the participants for their contribution and energy. Particular thanks to the facilitators and break-out facilitators as well as the speakers and all those who sent their comments to the draft write-up. We would also like to express our deep gratitude to Mr. Luis Enrique Vertiz and Ms. Norila Mohd Ali from the APEC Secretariat who have guided and supported us in delivering this project and ensured the success of the workshop

We fully anticipate that the outcomes of the workshop will be beneficial to overall objectives of the APEC Policy Partnership on Science, Technology and Innovation.

Project Overseer

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International Contractual Directorate Deputy Director
Federal Space Agency

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Workshop Summary and Recommendations

Delegates from 11 APEC economies (Canada, China, Chile, Chinese Taipei, Indonesia, Malaysia, Peru, Russia, Thailand, USA, Viet Nam) as well as France, Israel and the UK met in Vladivostok, Russia during October 16-17, 2012 to participate in the workshop on APEC Network Building – Applied Space Technology Centers. The workshop was conducted as the key element of APEC Project IST 07/2011A. The workshop was co-organized by APEC, the Russian Federal Space Agency (Roscosmos) and Research & Development Center SCANEX with support of Ministry of Economic Development of the Russian Federation, Far East Federal University and Far East Branch of Russian Academy of Science

The workshop attended by 90 delegates, saw experts in satellite Remote Sensing (RS) technologies, officials/experts in Forest Management, Fishery and Marine Resource Conservation, Emergencies Management, representatives from Space Agencies, Universities, Academy of Science, Satellite Operators, Environmental NGOs sharing experience and best practices in application of satellite data for sustainable forestry support, development of REDD+ projects and Applied Space Technology Centers (ASTC) networking, as well as use of satellite technologies for sustainable marine resources development, emergency preparedness and management and development of new perspective projects.

RS persons presented information about application of satellite data for sustainable development support; peculiarities of use of different types of satellite images for forestry; wildfire alarm web-based services; ASTC network development. Space agencies representatives reported about current and future remote sensing projects; development of satellite programs. Forestry agency representatives presented information about using of satellite images for forest inventory and monitoring.

Academia persons presented reports on plans for ASTC development; application of satellite data for REDD+ project, monitoring of forest leaseholders activity, in forest certification; international cooperation in satellite monitoring of emergencies; use of microwaves for weather and forestry monitoring. Satellite Operators demonstrated current possibilities and trends for development of satellite imagery; geo-spatial solutions for REDD+ support; contribution of operative satellite data to environment security; application of satellite radiolocation data for nature resources monitoring. NGOs reported on application of satellite data for REDD+ and joint implementation climate/forest projects, it's monitoring and validation; use of multi temporal satellite data for stocks and budget of forest biomass; development of REDD+; monitoring of protective forests.

Recommended umbrella solutions include:

REDD+

- to stress the need to include countries with boreal and temperate forest in the REDD+ process and propose APEC to play the key role in that since it bring together countries with different forests;

- include statement on encouraging participation of Russia in activity directed to reduction emissions from forest deforestation and degradation;
- need to have clear and localized definitions of forest and to elaborate on considering some plantations a subject of REDD+;
- to join the efforts of governments and NGOs of different economies in mapping forest cover and REDD+ project towards reaching agreements on integration and solidarity in prevention of climate change and global warming.

Institutional

- need for mechanism and help to encourage the remote sensing data by end users and local communities;
- to schedule training sessions/workshops for local communities under APEC umbrella;
- encourage institutes in the field of forest resources and marine resources to attend, so the remote sensing data can be produced into forest and marine thematic product with support of multi-discipline knowledge and in-situ data;
- need for information on data available, going on research;
- need to ensure access to remote sensing data, received within the interaction frames, to a wide range of users - scientific and educational institutions, researchers, etc., to accumulate knowledge and skills in handling Earth remote sensing data;
- different specialists need to be attracted to discussion of issues related to international cooperation development (including lawyers, economists, programmers, researchers, etc.);
- this meeting was useful, because it brought together different stakeholders, including data providers, researchers, NGOs and governments. It is useful to ensure that similar meetings will take place in future under APEC umbrella.

Economical

- need to develop mechanisms which help to simplify or provide access at low/no cost to remote sensing data and software;
- need to develop cooperation and integration of users and suppliers of satellite data to reduce the cost and shorten the terms of such data supply. In some cases, public funds need to be attracted;
- good to have a special policy to access the remote sensing data (e.g. open license paid by the government).

Networking

- there is an unbiased requirement in improvement of international cooperation mechanisms in issues of reception, processing and distribution of satellite data in APEC;
- combination of possibilities of RS satellite systems of different economies, including beyond the Asian-Pacific Region will allow for integrated use of space imagery data, having different properties;
- commercial companies operate in different economies, being distributors of satellite data and/or handling such data in direct reception mode. It looks challenging to include

such organizations into a network interaction, in particular, on the emergency issues. Specifics of legislation, security, etc. need to be taken into account though;
- within the frames of a network interaction it is important to exchange not only RS data, but experience of working with satellite imagery data as well.

"Developer - user" interaction

- need to know user's requirements in the data (resolution, number of bands, revisit time etc.);
- need to specify what kind of products and data are needed. This shall consider peculiarities of particular economies;
- data providers would like to learn the gap between current needs of users and future;
- developers to increase Corporate Social Responsibility roles in relation to support of REDD+ projects in developing economies.

Web

The need to create a web-portal, in particular based on FEFU, intended for a wide range of users was emphasized, in order to:

- accumulate important experience in sphere of remote methods of studying forest and marine resources;
- collect resource on one platform, including satellite imagery data, presented both on commercial grounds and those in free access, with the possibility of their remote processing;
- establish a remote council of experts, ready to consult on optimization of certain models use to resolve certain tasks of each separate region;
- adapt the scientific language for all possible groups of users from schoolchildren to commercial organizations;
- create a friendly interface, adapted to widest possible range of users;
- provide all required references to additional information;
- ensure feedback with users.

Welcoming Remarks

Vasily Gudnov, *Head of International Legal Department of the Federal Space Agency, International Contractual Directorate*

Dear ladies and gentlemen, conference organizers and colleagues !

I'm glad to meet you here in the Far East and it is a pleasure to see such a variety of participants, representing many APEC economies. As you might already know, Russia pays much attention to development of this particular area and to its integration into it, contributes much effort and a lot of capital into development of own infrastructure and establishing close business relations in this area. Economy development nowadays cannot be imagined without application of hi-tech tools and assets and we look at space technologies, and in particular, at Earth remote sensing as the tool for solutions in different trades and industries. As it has already been mentioned, this is forest control, forest fires monitoring, sea bio resources conservation, remote sensing methods application for emergency response.

This is not our first experience of working in APEC, we have already operated in different directions, for example, in satellite navigation systems application for transportation solutions. Our experience shows that such an interaction applied by the APEC economies for outstanding solutions enables to work out an integrated approach, leads to mutual understanding, development of common methods, interface, ensures experience generalization to make applied areas scientists and specialists understand each other better, to forge closer scientific and practical relations between them.

I hope that you will be able to find common language at this conference, that it will be interesting for you to learn about new directions of activities in the Russian Federation, to share your experience with us and to come to the unanimous conclusion on how and in which direction our joint cooperation should be developed.

it is no mere chance that we hold this event within the walls of the Far Eastern Federal University. The question of training new young promising skilled workers is acute not only in Russia, but in many APEC economies as well. One of the primary tasks in our activities will be discussion of such issues as exchange students, opening new training centers, setting up relations with existing personnel training centers. Demand for specialists in applied space technologies will only be increasing from year to year. I will not be drawing your attention any longer and give floor to the specialists. Once again, welcome in Russia, at the Far East and hope that this event will be informative and pleasant to all the participants.

Thank you !

Opening Remarks

Dr. **Anvir Fatkulin**, *Far Eastern regional Training Center Director, Far Eastern Federal University*

Good morning dear conference participants !

Allow me to greet you on behalf of the Rector of the Far Eastern Federal University Sergei Ivanets and wish you a successful and fruitful work during the conference. It is very logic to have this kind of event based on the Far Eastern Federal University. My colleague has just spoken about the importance of training stuff for the entire Asia-Pacific region and nowadays Russian federal universities are summoned to be a locomotive for regional economies. This is especially topical for the development of innovative economy, referenced by our government and our President.

Earth remote sensing, satellite technologies for us are now new. We train people mostly in such discipline as hydrometeorology. Material base have been developing and we have big plans in this direction development. The Space Monitoring Space is being established in Primorie Territory. This will be a center based on the consortium of the Far Eastern Department of the Academy of Science, Far Eastern Federal University, Ministry of Emergency, Administration of the Primorie Territory. I hope that we will create such a center to put these strands of knowledge and work onto a new level. Applied sciences will be developed at the FEFU and personnel training and students exchange will be conducted. Our university position itself as an international one and by 2019 will are to have 7.5 thousand foreign students already. Hopefully, among these students we will have those who will learn satellite monitoring, Earth remote sensing and will be apply these technologies for the needs of the economies of their countries.

Good luck in the conference !

And all the best !

Opening Remarks

*Academician **Peter Baklanov**, Director of the Pacific Institute of Geography of the Far Eastern brunch of RAS, Vice-President of the Russian Geographic Community, FEFU Department Head*

Dear chairman, dear conference participants!

About a month ago the APEC 2012 Summit was closed in Vladivostok. This is one of the most important political events attended by several thousand people, starting from leaders and chief executives of 21 world economies and ending with representatives of business circles, journalists, etc. Various issues of development of the region, more effective development of APEC were discussed. However, the central idea was the integration and innovation for more effective regional development. If we talk about innovation, it is clear that this is a very multi-faceted phenomenon, covering different areas of social development, but informatization has the central place here and first of all the use of space-based information, space technology and of remote sensing for better development. It's a pleasure to see that this area is being developed in different countries, in this case - the countries and regions, which are combined in APEC.

Dear colleagues, I would like to emphasize that the use of space in APEC information is even more important because the territory and waters of the Asia-Pacific region includes a large trans-boundary regions. This means that they include river and sea basins that cross state borders. Let's take, for example, the west coast of the Pacific. This is the Bering Sea basin, this is trans-boundary region, consisting of Russian and American parts. Okhotsk Sea basin is the trans-boundary region including the Japanese part of both land and maritime economic zone, but of course most belongs to Russia. The Japanese or Eastern Sea basins, as they say in Korea, this is the trans-boundary region, consisting of water areas of 5 countries. The same can be seen in other basins - the Yellow, South China, East China, and the Philippine Sea. Along the eastern coast of the Pacific Ocean, we also have a large aqua territorial regions, well, and finally, in recent years, political scientists, economists and other scientific fields begin to talk about trans-Pacific mega region. The essence of these regions, as shown by our study is that changes in environmental management, use of resources, both efficient and non-efficient, in one part of the basin, in one economy is transmitted to other parts in other regions. It is necessary to monitor, predict, and only through collective efforts. I mean the assessment of the region, the constant monitoring of the border region, which is impossible without space technology, without space information. In the presence of a stable legal basis, it can become fruitful.

If we are talking about sustainable development, it is nearly impossible to achieve sustainable development of countries and regions without space information without satellite monitoring. Furthermore, we come to the conclusion that only the monitoring of environmental conditions, monitoring of fish stocks, forest fires, etc. is not enough. We need a broader approach to the monitoring of regional nature, I mean large and various regions. Environmental monitoring without space information, without serious center to receive and process the relevant spatial information, is impossible.

This kind of conferences and trainings certainly deserve the highest support. And where universities join effort and existing research centers in terms of training and science - this

is useful in two ways. We in the Far East made significant steps in the use of space information. I very much welcome the fact that the emerging Federal University is very interested in the organization of such research, training. There are major advances in the use of space-based information in the Far East Branch of the RAS, in large institutions like Pacific Institute of Oceanography, Institute of Computer Science and Control, at the Pacific Institute of Geography, the Institute of Marine Biology, and a number of other institutions.

Dealing with the problems of regional development and facing the use space information, you notice that the technical level of and access to space data, its volume, are ahead of the level and contents of tasks. Level, volume and types of tasks for the needs of the economy, regional development, both at the economy level and at the level of regions and municipalities lag behind the possibilities that we have to obtain space information, so we need to work here. Using the experiences gained in different countries, and our colleagues have a very interesting experience, and those who take part in our conference, and those who do not take part, it applies to developing countries in the region and the world powers it all can give a very good positive effect in our development.

Of course, the largest task being the general objective of this conference - is to meet the challenges of sustainable development of countries and regions. I believe that the goals and objectives of this conference are defined correctly, the "cast" is very interesting, and I wish on my behalf and on behalf of the leadership of the Far Eastern Branch of the Russian Academy of Sciences great success in hosting the conference.

Opening Remarks

Alexey Narovetsky, *the Department of Communications, Primorsky Territory Administration*

On behalf of the Primorsky Territory Administration I welcome the conference participants!

Issues addressed at the conference are reflected in the problems the administration is facing. This refers to the use of remote sensing data in practice, in order to improve the economic situation in the region, to produce investment programs and plans for the near future. I would like to draw attention to the importance of this event for another reason, this year marks a lot of events, including APEC summit in Primorie. This gives impetus to a new vector of development.

I would like to wish you success in your work and the development of practical applications of satellite technology in the administration of Primorsky Krai.

Thank you !

Opening Remarks

Dr. **Vladimir Gershenzon**, *General Director of ScanEx Research & Development Center*

Thank you very much for your participation, for coming to the conference, we are grateful to Roscosmos for understanding that public-private partnerships can be embodied in the form in which we try to carry out these activities - scientific conferences.

At the same time, despite great efforts in the state space as the Asia-Pacific region and the rest of the world, commercial operators, as they say, are "drivers of implementation" and the practical implementation. We would like to express special thanks to all the world's leading operators of satellite imagery, which have come a long way. Many spent more than 20 hours, and some - more than 30 - hours to reach the event. You and I have a unique opportunity to hear all the leaders.

The following representatives are with us today: representatives of the Digital Globe - the U.S. commercial operator, of Astrium Geo - the Europe's largest commercial operator, of the MDA - the world's largest Canadian radar operator, of the ImageSat International - one of the most successful commercial operators of VHR imagery, representatives of the DMC - most recently on the market and very productive British company that fills the gap between public and commercially oriented VHR data programs. This is a unique opportunity when the operators are willing to share their knowledge and information technology and best practices in the subject area, which will be mentioned here. First of all, this conference will focus on issues of forestry. I hope that the work will be interesting and productive.

For me personally, it is also quite revealing event, a quarter century ago, I took an active part in the expeditions, which were sent from here, from the coast of Vladivostok and for me there is a striking contrast between the modern city of Vladivostok and the period when it was impossible to find a free place to moor at the quay, when the trams ran, which were impossible to wait for, and there were a lot of specifics which, hopefully, are gone for good. Moving together in this fast-growing region to the economic positive development, we should not forget about the environmental issues, and the challenges associated with sustainable growth and interaction in the region.

Thank you !

Workshop Agenda

Day 1	
8.30 - 9.00	**Registration**
9.00 - 9.20	**Welcome and Opening Remarks** Vasily Gudnov, Federal Space Agency (Roscosmos) Anvir Fatkulin, Far East Federal University Baklanov Petr, Far-Eastern Branch of Russian Academy of Sciences Alexey Narovetsky, Primorsky Territory Administration Vladimir Gershenzon, RDC ScanEx
9.20 - 10.10	**Keynote lecture:** Lars Laestadius, World Resource Institute, USA *"REDD+ and Beyond: Forests and Landscapes as a Climate Opportunity"*
10.10 - 10.20	**Workshop Participants Photo Session**
10.20 - 10.35	**Coffee Break**
Session 1 10.35 - 12.00	**Applied Space Technology Centers (**Chairman Oganes Targulyan) Vladimir Gershenzon, RDC ScanEx, Russia "A*pplication of Satellite Data for Sustainable Development Support*" Marina Sergeeva, RDC ScanEx, Russia *"Universities Applied Space technology Centers Network in Russia – Current Status and Future Development"* Shiann-Jeng Yu, National Space Organization (NSPO), Chinese Taipei *"Chinese Taipei National Space Organization, it's Remote Sensing projects and plans for it's development"* Sergey Krasnopeev, Pacific Institute of Geography FEB RAS, Russia *"Applied Space Technology Center in FEFU – an important factor for regional economy development and Remote Sensing Network Building"*
12.00 - 13.30	**Lunch**

Session 2 13.30 - 15.00	**Remote Sensing, Forest Monitoring and REDD+** (Chairman Vasily Gudnov) Kirill Borisov, Roscosmos, Russia *"Satellite technologies and their application for sustainable forestry"* Patrick Houdry, Astrium GEO, France *"REDD at national & project scales: dedicated geo-spatial solutions to meet user needs"* J. Paul Stephens, DMC International Imaging Ltd., UK *"Daily imaging – operational Earth Observation for improved management of natural resources"* Marco van der Kooij (MDA, Canada), Brian Milakowski (WWF, Russia) *"Detection and Validation of Logging Activity using Radarsat-2 in Southern Khabarovsk Krai"* *Part A: Introduction, methodology and results - Marco van der Kooij, MDA* *Part B: Background and Validation - Brian Milakowski, WWF Russia*
15.00 - 15.30	**Coffee Break**
Session 3 15.30 - 17.20	**Remote Sensing, Forest Monitoring and REDD+ (**Chairman Lars Laestadius) Pang Yong, Institute of Forest Resource Information Techniques, Academy of Forestry, China *"Forest change detection and biomass mapping in the Greater Mekong Subregion (GMS): results from pilot sites"* Vladimir Manovich, Roslesinforg, Russia *"Using Materials of the Earth's Remote Sensing by Conducting State Forest Inventory in Russia"* Alberto Lopez, Digital Globe, USA *"Smart Forest Management techniques and support to the UN-REDD programme using WorldView-2 Satellite Data"* Rani Hellerman, Imagesat International, Izrael *"Contribution of EROS B data to Environment security"* Evgeny Lepeshkin, Evgeny Chuvasov, Amur branch of WWF Russia *"Forest climate projects in the Russian Far East: potential for sustainable development"* Dmitry Dobrynin, RDC ScanEx, Russia *"The peculiarities of different spatial resolution data processing in forest dynamic analysis"*
17.20 - 17.30	**Announcements**
19.00 - 22.00	**Gala Dinner**

DAY 2	
Session 4 9.00 - 10.15	**Application of Satellite Data for Natural Resources Monitoring (**Chairman Marina Sergeeva) Marco van der Kooij, MDA, Canada *"New Large Area Monitoring Applications of Spaceborne SAR"* Lars Laestadius, World Resource Institute, USA *"Global Forest Watch 2.0"* Mikhail Karpachevskiy, Transparent world, Russia *"Possibilities for Use of Multi temporal Landsat Images for Assessing Stocks and Budgets of Forest abovegtound Biomass in the Russian Federation"* Leonid Mitnik, Pacific Oceanological Institute FEB RAS, Russia *"Severe weather and forestry monitoring using passive and active microwave sensing"*
10.15 - 10.45	**Coffee Break**
10.45 - 12.00	**Applied Space Technology Centers** (Breakout sessions) *Breakout session 1 - Forest* *Breakout session 2 - Emergencies* *Breakout session 3 - Marine resources*
12.00 - 13.00	**Lunch**
13.00 - 14.00	**Breakout sessions Report back**
Session 5 14.00 - 14.20	**Remote Sensing - Far East Forests (**Chairman Mikhail Karpachevskiy) Kirill Bazarov, Information and Cartographic Center, Pacific Institute of Geography FEB RAS, Russia *"Features of a cameral decoding for the mixed broad-leaved woods of Primorsky Krai South"*
Session 6 14.20 - 15.20	**Remote Sensing & Emerging Environmental Issues (**Chairman Mikhail Karpachevskiy) Anatoly Alexanin, Institute of Automation and Control Processes FEB RAS, Russia *"The experience of international cooperation for satellite monitoring of environment during the Fukushima disaster"* Ku Kassim Bin Ku Yaacob, Fisheries Research Institute, Malaysia *"Seaweed Production in Sabah, Malaysia in Relation to Sea Condition Observed by Satellite"* Georgy Potapov, RDC ScanEx, Russia *"Complex fire monitoring system based on operative satellite imagery"*
15.20 - 15.50	**Coffee Break**

15.50 - 16.10	**Workshop Recommendations and Next Steps** (Chairman Oganes Targulyan) • Next steps APEC economies can take to incorporate observational tools into new REDD+ project planning; • Next steps for Azia-Pacific region Applied Space Technology Centers network development; • Workshop recommendations; • Topics for proposal for possible follow-up workshop; • Other issues.
16.10 - 16.30	**Workshop Closing remarks** Lars Laestadius, World Resource Institute, USA Kirill Borisov, Roscosmos, Russia Vladimir Gershenzon, RDC ScanEx, Russia Oleg Shcheka, Far East Federal University
16.30 - 16.45	**Workshop Adjourn**
17.00 – 18.30	**Excursion**

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Reports of the Workshop

Lars Laestadius, World Resources Institute, USA

"REDD+ and Beyond: Forests and Landscapes as a Climate Opportunity"

Good morning everybody. My name is Lars Laestadius. ScanEx asked me to speak about the thing called REDD, and I made a very nice title for my presentation. But then I spoke to someone who said REDD is dead. And I decided to change the title of my presentation accordingly. So the question is, "Is REDD dead?" And this is a complex question and I decided that before I can answer it, I actually need to go backwards and ask the question, "What is REDD?" And before I can answer that, I need to answer the question, "Why is REDD?

Why do we even have it?" And once I've done that, I will go forward and ask, "Well, what is now to be done, if REDD is dead, or if it is not dead?" Or, in Russian, "shto dyelat" (what to do ?)

So this is the outline of my presentation, starting from the top left. But before I do that, I just wanted to show you where I'm coming from. So maybe as you can see, this is Washington D. C. That is the white house, "nash byeli dom". This is congress, Capitol. And this is my institute. So we're a little bit at the margin of things, but we are still in the big picture. It's called the World Resources Institute. We are a main office in Washington D.C. and we have about 200 people there. We have recently opened a small office in Beijing, currently about ten people, and a small office in Dehli, in India, ten people. And we will also open a small office in Brazil soon. This is our office. Actually, we don't have the whole building, but it looks very impressive.

My institute is a private non-profit research institute. So we have five main programs. One is "Climate and Energy", one is "People and Ecosystems", this is where I am, "Governance and Institutions" is another one, "Markets and Enterprise" works with business for sustainable development is one, and finally, we have a big program on "Sustainable Urban Transport" – they work in Turkey and in Mexico City with public transportation.

We have a board of directors, just to let you know what sort of organization we are. Our chairman of the board is James Harmon. He used to be the chairman of the American Export-Import Bank under the Clinton administration. We then have some names maybe you know. We have Fernando Henrique Cardoso, the former president of Brazil. We have Al Gore, he's maybe known from Gore-Chernomyrdin collaboration a long time ago as vice president. Goran Persson is the former prime minister of Sweden. And our current director is Andrew Steer who just joined us. He used to be the climate ambassador of the World Bank. He's a British national. And there are other important people there as well, but I will not speak more about them.

Because now I have to answer this question, "What is REDD?" So REDD as you probably know stands for Reduced Emission from Deforestation and Degradation. And why do we

need this? Well, here is one answer. This slide shows the initials … from land use over time. And so there are two curves there. The green one shows emissions from land, and the white one shows emissions from burning oil and gas. And as you can see, well sometime between the wars, the white graph began to explode, and it is growing very rapidly. But the green curve is also significant and it is also growing. And the purpose of REDD is really to bring down the green curve.
Another way of looking at this is like this. There is a small red square that you can may be see. It shows the portion of global emissions that belong to forest change and forestry. It is almost twenty percent. Although now it has dropped to twelve percent. It is not because deforestation has gone down, it's because the other emissions have gone up. So that means that the proportion has become less, but it is still important. And the question is can you reduce it somehow. And historically too, we have had a lot of emissions from land use. This is a study that we have made recently together with the University of Maryland. So the person who actually made this map is Pyoter Patopov who is a Russian person who works at University of Maryland.
This is a simulation of where forests could grow in the world if there were no people. This is based on climate, this is based on soils, it is based on eco-regions. And this is where forests are actually growing today. And this is now from remote sensing. So the contrast between these two maps is interesting.
So clearly, the world has lost a lot of forests, and that means that it has lost carbon dioxide, and it has lost water, and it has lost nutrients and lost soils. They're actually not lost, but they're in the wrong place, and this makes a problem for the ecological system. So more than a quarter of the world's forests have disappeared already because of deforestation. But the problem is even more serious because some of the forest that we still have left has been degraded in different ways. It is not as dense as it would be in the natural state. So taken together this means that one-quarter has been deforested and another quarter has been degraded, roughly speaking.
So here's another way of looking at the world's forests, the potential forest, and the current forest, and some of this has been converted into crop lands. Another big part has been converted into grazing lands, pastures for animals. We still have some virgin forest left. You certainly find them in Siberia, you find them in Canada, in Brazil, in Central Africa, some in Southeast Asia. And this is continuing. The red area up here, based on MODIS I believe, showed that the current ongoing deforestation, so that this is the marginal expansion of the human footprint in the forest. And the first purpose of REDD was to stop the marginal expansion of the footprint. The red color on the map was the problem, and people were worried because it was happening very quickly, and said we have to stop it somehow. It is not good.
But, before I come to REDD, I want to make this point that forests actually can grow back. This graphic is from IPPC, and it is difficult to read. But nevertheless, if you look at the countries at the top of the picture, this will be Eurasia, it will be North America, you see that over time that they used to have red color, but most recently they're coming to green color, and this means that the forests are taking up more carbon than they are giving out. And they do this because they're actually growing back. If you look at the tropical countries on the other hand, you see the red color increasing very, very strongly. This is carbon dioxide going up into the atmosphere, and this is worrisome.
But it's nice that the green color is there. We tried to estimate this. So this is again the area, the former forest area of the world – forest area that has either been converted, or degraded. So this is significant area. We looked up population and we looked up some other things, and based on that we made an hypothesis of areas that could maybe be

reforested or at least restored. And you see it here, you see the red color is the ongoing deforestation, and the green color is areas already deforested or degraded, that could maybe be turned back into forests. This is a very, very big area, and this is a potential that we think has been overlooked so far. But, I will come back to this.
Now, just to show you, this map has three main colors. There are two greens and one brown color. So the dark green color is areas that we think could be restored back to forests, because of wide-scale restoration. The light green is areas that we think could be restored back to some mix of people and food and trees. We call it mosaic – this may not look like a forest, but it has potential for more trees. And finally, finally the brown areas, which could of course be restored back into forest, but they are in places like Northern Siberia where there are not so many people, so it is maybe not realistic to restore them. You see the brown areas up in Siberia, Russian forest, and Canada. You see the light green areas almost everywhere. And you see some of the dark green areas as well. But note that the proportion green is very big to the red.
So that is the question, what is REDD? Finally. Well, REDD is response to this question, this problem. This is the world trying to stop what is happening badly with the world's forests, and try to create incentives for something positive to happen. To some people of course, REDD just means this – they go to meetings, and meetings, and meetings, and meetings all the time. And I've been to some of these meetings and, how to say, the air is rather thin in these meetings. There is not so much substance there unless you are a lawyer or like international negotiations. This climate process, it moves in jumps. It makes one jump every year where all the countries come together to meeting called "COP". This stands for Conference of the Parties, meaning the parties to the convention.
So some of these have been particularly important with regard to forests. The next one is going to take place in Doha in December of this year. So what is the point of REDD? Most countries at some point had a lot of forests, and then they have lost a lot of forests, and we have seen that it is possible for the forest to come back. So what REDD is trying to do is make a bridge to stop the countries from going down all the way before they come back up again. This is the purpose of REDD.
And now it is getting complex, and I apologize for this. You say that maybe, you say well why is he showing us this you may say? We are remote sensing people and we are not so interested in these negotiation formalities. But, I will tell you two things. Number one is this is just a very, very small part of the complexity. And number two, this is important for you to understand.
So, inside of the climate convention, the UNFCCC, the United Nations Framework Convention on Climate Change, there are two different tracks on forests, and one is the Kyoto protocol that you have heard about I'm certain. And inside the Kyoto protocol, there are three different things you can do. The first one is this one, land use, land use change and forestry. This is for the northern countries, the people who signed the Kyoto protocol. They have the clean development mechanism, CDM. This is for rich countries to help the poor countries, basically. And finally we have the joint implementation which is a bit of the same.
Now, for this Kyoto protocol, this is only signed by countries who belong to Annex 1. In other words, this is only for the rich countries. And these are the countries that have signed the Kyoto protocol. Russia is on the list. China is not. India is not. And most countries are not. So these are the countries that can fund, these are the ones that can put money into the CDM – the Clean Development Mechanism. And the idea behind this is that rich countries, they emit a lot of carbon at home, and they can then pay money to other places where it is more cheap to improve the technology.

This has worked in some cases, but it has not worked very well for the forest sector. If you look inside of the ring here you can see that very few forest projects have actually been approved under the Clean Development Mechanism. It has not been successful to help with deforestation.
And because of this, at least in part, the framework convention has opened a second track about forests which is called Long Term Cooperative Agreement because they don't know if it would be a protocol, what it will be. And there you find REDD.
And so we ask why is this important, why do we need to know these distinctions. Well it is important because the rules are very different, the definitions are different, the mechanism is different, and they also apply to different places in the world. So this REDD+, for example, is for developing countries, and it does not have the same forest definitions as here for example. And these forest definitions are different from the forest definitions here. And this makes a big difference. Also if you want to use satellite images to actually monitor forest change.
But the point behind REDD is really for rich countries to pay poor countries to stop deforestation. So this is the driving thing here, and this is why some people say that REDD is dead, because rich countries do not want to pay. And if rich countries do not pay, poor countries do not want to stop deforestation because they say "we need development" and then REDD is not working very well.
Something important happened recently in Mexico. And that is that REDD became REDD+. So what is this plus? Why is the plus important? Well, this is the most serious part of the presentation, so please pay attention. This is the text that was agreed in Mexico. If you cannot read it, but there are some things you can read. It talks about the condition for REDD. It says that poor countries, developing countries need to get adequate and predictable support. This means they should get money from rich countries. If they get money from rich countries, they should do many things. They should slow, halt, and reverse forest cover and carbon loss. This is the official text. And what does it mean?
It now means five things. It used to be that REDD was only reducing emission from deforestation, but look now, there are five points now inside of REDD+.

So you have de-forestation, you have degradation, but you also have conservation of forest carbon stock, you have sustainable management of forests, and you have the last one – enhancement of forest carbon stock. And this is another way of saying 'trees growing back' and capturing carbon dioxide from the atmosphere and putting it back into vegetation. So all of this is now part of REDD+.
It also says that countries have to make a national strategy or action plan and it says that they have to construct reference scenarios for what would happen if they don't get any money, because they would get paid only for additional effort that they make, so the reference is very important. So particular these two things in the rings are important also for remote sensing people. But there is more. It also says that counties have to put in place a robust and transparent national forest monitoring system. They can start with the sub-national monitoring system, but eventually it would become a national forest monitoring system. And they also need a reporting system what they say, how they take into account safeguards, indigenous peoples, all sorts of other things – ecological factors. They have to be careful with what they do. And they have to address to drivers of de-forestation, have to look at the land-tender system, and moreover. And finally do this in faces. It talks about national strategy, implementation of national strategy, and what is important, number 3.1 – which is Measurement Verification and Reporting, MRV. So what is to pay attention to here is, I think, the National Forest Monitoring System and the last

one, MRV. And what this means in real language is that rich countries don't want to pay money to poor countries, and poor countries don't do anything with these money. Rich countries don't trust poor countries. They say: 'we want reporting. You have to tell us exactly what you do with the money in a transparent way, and we want to see the results. Then we would be happy pay. But only when you make the subsidiary system. And of course poor countries say in response that ok, maybe, but you really have to give us money, otherwise we won't do anything. So you see that this MRV Measurement Verification and Reporting is extremely important in this mechanism. If you don't have a good system for this there will be no trust and the money won't flow and things will not happen.

So now the question is the REDD dead. And some people really like to say this. And particularly in Washington, D.C., where people like to say such things. But, as a forest, you have slash-and-burn agriculture, and then you don't have your forest anymore. So is REDD really dead?

Well, the diagnosis is that the system has to have set it up. It's not good. But first, this is too difficult to stop de-forestation. We are poor countries. The countries in the North took down their forest in order to make development. We have to do the same. We are the poor country. We need our forest. We need to use it. Now the complaint is that the statist mechanism is too complex. You saw there rules that I showed you. And this is just a small part of all the rules that are there. You haven't seen anything yet. This is just a little bit. It is very complex. And then of course it's expensive to do this. Because it's high transaction cost to do it. An the most critical – there is no money. Rich counties are not to pay because the economy is not good. Europe is not doing well, America is not doing well. Nobody has extra money to spend. And while the climate is not important right now so they don't want to spend. And many people say – there is no money there for REDD is Dead.

However, a few years ago people were very optimistic about the REDD is Dead. And they said – this will be just wonderful. We pay them. They stop de-forestation and everything will be good. Now the same people are completely the opposite. Everything is terrible, it will not work. It's dead. And… I was not so optimistic before, I'm not so pessimistic now. But we could recalculate. So why do we have REDD? Or we have it because forests are important to climate and to people. So, what is REDD? Actually, it's not REDD anymore, it's REDD+. It includes also Trees Growing Back, it includes Sustainable Forest Management. So is it dead? Maybe. Maybe not. But I think not for long. Because forests are very important to the climate. If you call it REDD or something else – it doesn't matter. The world will somewhat have to deal with the forest problem. One way or the other. So it will come back even if it's dead. So the question is what to do. Here I think the remote sensing has a very important part to play. And you know this. I would just point to a few things.

I think it's a very important guidance by studying these documents. And I agree they are difficult to read. But this is written by lawyers and this is very important text because this is what decision-makers look at, this is what are guides policy making. And if you reed this carefully, you see that there are actually some very interesting things there. So you can see what do we need to measure with our satellites – de-forestation, forest degradation, conservation, forest management, and forest re-growth. It's all written there, it's all part of REDD+. And also, beside this, establishing a reference level – we'll come back to this. And there is more – it says what do we need to build. We need to build a robust and transparent National Forest Monitoring System in each country – and most countries do

not have this. And we need to have a system to measure, verify and report activities. Without this REDD+ will not work – these are all official agreements.
So countries need to do this MRV. You need to have a consistent delivery of information. And this is not just a one-time map, this is a system. It has to be long-term and planned, and it has to be somehow linked with decision-making. So, at least 50 countries need wall-to-wall annual mapping of the forest and carbon, and they were near of having it. But they need it. I suppose you could do it on the ground but it's not realistic. This is where the remote sensing has to come in. I mentioned the reference scenarios. They are very important because the rich countries pay to the poor countries so that they do something different. And the question is – how do you measure what they do different? You can measure it only if you have a reference scenario – this is what would have happened hypothetically if there would have been no money. And it is very important to have this reference scenario. And how do you create one? The very good way would be to have long-time series. And this is again where satellite images can help. You can certainly use Landsat to come back to at least to 1990 or you could you whatever images you have in order to create time series and you get much, much better reference scenario that can not so easily be manipulated by whoever wants to manipulate. So right here is a very strong source of the men for remote sensing. And now we have the definitions. These are the definitions under the Kyoto Protocol. Forest area 0.05 - 1 hectare counters have a choice. Now, the potential minimum height of the forest 2-5 meters. And the question is – do these definitions support remote sensing or not? In my experience it's very difficult to measure some small details with satellite images or maybe in the future we'll get there. But these are the people who decide the definitions now. It looks like these. They are bureaucrats. I'm sorry, I say the way it is. They are not technical people. They understand this as lawyers understand the process, not like remote-sensing technical person would understand. They need help. If they are going to come up with definitions, that actually allow remote sensing to be used. They need help from you. You need to work with your decision-makers that are part of this climate conference, and actually suggest to them definitions that work together with remote sensing. Because we need remote sensing. We cannot do these 50 countries, we cannot do this wall-to-wall mapping with people under ground. It's not possible. It's not realistic. So, the transaction cost has to go down. And that means that the definitions will have to be adopted. It is very important. I'm coming toward the end now. So forest in the climate process, I think, is more than REDD+. Or the REDD+ is already now a lot. But all countries one by another in the future will have to pay the attention to forest and climate.
So the opportunity here to put in some sort of Earth observation platforms is very big. The need, the need is enormous. I don't see any other ways of doing it. Remote sensing has to come in here somehow. There is a lack of information that can be used to monitor de-forestation degradation in tropical countries. New technologies are coming, but they are not really known to the clients. To understand these technologies the poor countries may not have the technical expertise to understand and absorb these technologies. So it's not enough just to have the information, somehow it's necessary to reach out to the positional users so that they really understand the potential of new technology. And this is not happening as effectively as it should. Developing counties need better access to data. And finally done, this is my personal thing, don't forget that forests also can grow back. And it's very important to monitor de-forestation, and it's also comparatively easy, because this is a big change, this is a constant change and it happens quickly. But re-growth is little trees growing dispersed over big space, slow change – this is more difficult. But it's important too and we need to not forget about it. And I'm finished. Thank you very much.

Vladimir Gershenzon, RDC ScanEx, Russia

"Application of Satellite Data for Sustainable Development Support"

I would like to thank Lars for a very nice clear message, addressed to all operators. And Lars said that the problems we discuss are very important and the countries are waiting for technologies, countries are waiting for the opportunities. So this is an important direction of activities, both in an economical sphere, and an informational sphere that we will discuss in more detail soon. I will show you the slides in English. I will speak in Russian, and my slides will be in English. So, it's kind of a mixed presentation.

Let me thank one more time the organizers of this event, Roscosmos and our partners from the Far East Federal University and the Far Eastern branch of the Russian Academy of Sciences. Let me emphasize that the problems we want to discuss at this event, these problems pertain to the network collaboration development. We want to foster collaboration among the allied centers which use remote sensing data for sustainable development of the regions, not only focusing on the forestry sector, which is the primary focus of this event, but also in the broader sense. Because first we have been asked to focus on this narrow topic, I mean REDD in the first place – reduction of emissions from deforestation and degradation of forest cover. But, in a broader sense, in a broader context, we wanted to talk about fisheries, transport sector, prevention or disaster management which is important because the next application was approved taking into account the strong positions of Vladivostok Center of Disaster Prevention and Disaster Management. This is the application of remote sensing data in the disaster management sector. Also we speak both about natural disasters and human induced disasters, and also to climate change issues.

We plan that during these two days of this event, and also during the next year. The last year's conference was held in Bali, and the last conference showed that the main purpose is to get acquainted with the topic, to get you more familiar with the topic. And then, after the initial interest, next year this interest can be confirmed by specific tangible results of implementation of specific methods. We hope that the discussions that we have here – these discussions can foster, can provide initiative for large scale projects for implementation, large scale regional projects to demonstrate the opportunities of economic mechanisms to other regions, to other participants, especially as we are on the crossroads between the sustainable natural resource management and the application of modern technologies of remote sensing.

We also hope that we will be able to find together with you the financing mechanisms. We hope to attract new investments, to attract new financial agents, new mechanisms of financial sponsorship available to other market players that will foster implementation of remote sensing data in the ongoing projects in the environmental area, for the goals of green growth and other environmentally oriented topics.

I will also inform you about ScanEx Research and Development company, because not all of you are familiar with ScanEx, and I will explain why ScanEx was selected as the co-agent for this event. ScanEx will be working together with other organizations to more actively implement remote sensing technologies. So, ScanEx has a history of more than twenty years. ScanEx is involved in processing hydro-meteorological data to ultra-high resolution data, very-high resolution data, low resolution data, medium resolution data, so all kinds of remote sensing data. And we work to support this horizontal technological niche. We disseminate knowledge about prospective applications B2G, B2C with our prospective partners and ScanEx works towards more efficient implementation, practical implementation of remote sensing data and technologies. We want to make it simpler, lighter, more readily available so that technologies can be used at all levels ranging from educational purposes to fundamental research.

During our twenty year history, ScanEx started with the development of technologies in a very confined world. Right now, we underwent a big change and we work on the international level, on the broader market. We started our work on the domestic market when everything was made in Russia. All technologies were developed in Russia starting with data acquisition to data processing, archiving, data management, and publication and dissemination and visualization, data visualization software, processing through the internet, through web portals, etc.

We attracted many other participants in these activities at all levels, regional level, local, and also on the federal level, so that we worked to make this trend more sustainable, both in an economic and informational context. We tried to cooperate with our international partners in all subject areas we're interested in. This was documented by the large number of installations and software products that we developed. We established several data processing centers. We worked with our international partners, receiving their remote sensing data from their satellites and constellations of satellites.

It is our pleasure to participate in international forums where ScanEx activities were highlighted, and we received awards, diplomas of certain international organizations. And we were quite pleased. So we want to provide informational support at all levels to facilitate exchange with other informational systems, informational processing, data processing systems. And we want to serve many types of clients, and clients who think not only…The partners that work for informational outsourcing who fulfill their organizational data management functions, who develop certain performance and data management protocols.

To answer this demand, ScanEx had to establish a network of ground stations which cover the whole territory of the Russian Federation and the Russian shelf zones involved in transportation and offshore natural resource extraction. As I mentioned, we work with several programs. The left column shows several programs that we cooperate with. This list includes government programs. We think to include Chinese remote sensing satellites. This list also includes commercial partners, commercial programs, the programs that enable us to get access to the internet. We also every year implement new programs. Our colleagues from Astrium Geo confirmed the beginning of trials for SPOT-6 which was launched recently, and you can see the imagery acquired by this space craft.

We hope that by the end of this year, SPOT-6 imagery can be processed by our stations. This is a very successful sensor with resolution of 1.5 meters which can be used to monitor small size agricultural lands – 60 by 60 kilometer plots. So, this is an example.

We also supply our technologies to our international partners. We supply software packages ready to use among our installations. We are very proud to mention more than twenty leading universities in the Russian Federation created remote sensing data centers.

And our universities now take part in the implementation of original programs in the remote sensing data sector. They teach students and experts in various applications of remote sensing data. Some centers are quite small. Some centers are quite simple. You can just install a satellite dish on the roof, and then this still includes very complex network of data processing, very complex methods of data processing, because you work with both directly acquired data and also archived data, data acquired from the web.

One example is the Rosreestr (*Federal Service for State Registration, Cadastre and Cartography*) project which is on the final stage of its implementation. This project will complete the coverage of the whole territory of the Russian Federation with 1.5 meter resolution MS images. This kind of program has become quite popular in Russia because it supports modern web-mapping service access to data for other federal agencies, for other clients. And also they support licensed access to data.

Another example, this is the DMC program which I mentioned in my welcome address. This year, for the first time, this is the first experience in the world of such a project when we fill the gap between publicly available high-frequency data and high-resolution data with low frequency. So we filled in this gap to facilitate high-frequency monitoring of forest cover, of agricultural lands, vegetation. So you see that this program is being implemented quite actively and now we have provided stream-flow of data including many applications.

Another example is monitoring of fires, wildfires, and informing the public, public information about the wildfires for many services, including information through the web portal Yandex, well-known in Russia.

And another example is monitoring of the Northern Sea route. This route is used for marine transportation of goods. This is an example of cooperation between Canadian geo-location programs and our ground stations, and Russian ship carriers, and marine transport which uses this data in their every-day activities to reduce the transportation time. This is very important for the APEC region and countries, because the Northern Sea route is the fastest, the shortest way which connects the Asian-Pacific regions with European countries, through northern ocean.

The climate is changing, so the navigation period becomes larger, longer. So we expect that every year, the navigation period will become longer and longer due to climate change, to global warming. So I will not speak in great detail about fisheries and management of the fishery sector. After the last APEC summit, we delivered a presentation on wild salmon in Hong Kong. And we were quite disappointed because many companies in the Russian Far East were beyond the legal catch of salmon. So, they were involved in illegal, in poaching of salmon. But recently, the number of illegal salmon poachers has been greatly reduced, and this is quite an optimistic development.

This is an example of EROS B image in the far north where you can see the wild sea mammals, wildlife in their natural ecosystem, in their virgin state. Because every contact with civilization harms these populations. So we work in cooperation with WWF to prevent negative consequences of contact between civilization and wildlife.

The last example, the last remark of my presentation is as follows. We observe that remote sensing technologies become the feature of our every-day lives. This is the flash mob of Samara students. This flash mob was organized just one minute before the overpass of the satellite. Also, this example was repeated in Yakutia. This is a flash mob in Yakutia where the school students organized a flash mob and the image was acquired by EROS B. So, this is another picture. This is the picture of our center in Moscow, and we organized an internet contest where we organized a tender and selected the winners of the designers. We called this symbols of the third millennium. So the question was how to best describe the symbols of the third millennium.

We selected specific symbols that will be depicted. These symbols talk about the internet and energy-saving technologies, and environmental technologies, water resources, and the protection of wildlife. Then the symbols that we selected, the winning symbols, our designers drew these symbols on the roof of our building in Moscow, and the images were acquired from space. So if you visit our web page, you will see the development of this project, how the first symbols appeared on the roof and how more and more symbols are now being depicted. And they are clearly visible from space.

We expect certain results. We want to strengthen cooperation between Russian and international companies and agencies in the sector of applied remote sensing technologies. We hope to develop new innovational technologies and high-tech trends to implement remote sensing data in sustainable economic growth, and sustainable management of natural resources in APEC economies. And we hope that all our participants can join in this process. We see it as a network initiative. Thank you for your attention.

Marina Sergeeva, RDC ScanEx, Russia

"Universities Applied Space Technology Centers Network in Russia – Current Status and Future Development"

Good morning once again. I would like to focus your attention on educational topics, because developing economies, emerging economies need personnel, need professionals. This is why we think this question is very important. Here, you can see a table showing current status, a shortage of personnel in the Russian Federation. Speaking about specialists, Geo-IT specialists with university training. Such specialists are in shortage and basically the shortage is two-fold, meaning two-times less specialists than required. What can be done?

We should think about it when we start working with school children and speaking about our experience in this field. So in Russia, Kazakhstan and Spain, we established twenty centers for remote sensing and mention that the universities shown here are leading universities in Russia, including Moscow University, St. Petersburg University. This is a center opened in Archangelsk in Federal University. The center opened in 2011. This is a map showing our centers, and you can see the concentration is for the European part of the Russian Federation. The Russian Federation Far East is not covered with our training centers, but we hope that this issue will be changed, and Far Eastern Federal University will also get involved in this effort. Such number of universities, such number of centers is very interesting, but the important thing is integration, so that the whole thing starts to work as an integrated community, correspondingly.

In April 2011, a consortium known as UNIGEO was created. UNIGEO stands for university geo portals. So heads of centers, deputy heads of universities got together and signed an agreement on consortium in Saratov State University.

What is the idea of the consortium? It is integration, integration of research, it is exchange programs, exchange of students, common summer training camps. This summer, we organized such a summer camp run by specialists from Moscow State University. Now we are launching a program of virtual lectures. Each university is a center of this or that competence, it employs specialists, the best specialists for something, and if it becomes possible to share of this experience, this is in the interests of everybody. For instance, lectures by Perm University, but professors will be from Petersburg and Moscow State University. Then colleagues will get together for an event to discuss everything. The consortium has its own structure as shown on this slide. The head is selected, a chairperson, Mr. Sadovnichi here, who is the head of Moscow State University. There's a board comprising the director of Archangelsk University, Moscow Institute for Geodesy and Cartography, Samara Aerospace University, and one of the faculty of Moscow University, plus leading specialists from other institutions.

Our consortium has numerous objectives as you can see how many. So five slides all in all showing objectives and challenges and gradually the consortium has started working on it.

This slide shows what we have. Here you can see ScanEx station. It may be a meteorological station or complex – in certain cases a combination of hardware and a certain set of software is used with due regard for specifics including software needed for deciphering information plus geo portals. This is the way it looks like in every university. With such hardware, any university may use available equipment for training purposes plus to carry out work for required purposes. For instance, original monitoring and providing required information in order to facilitate decision making for original administrations.

And this slide shows our interaction with a Russian aerospace agency and as a result, now we have the opportunity to use free of charge data from the Meteor-1 satellite. So this week we are to complete testing, and then we start our practical work. So once again it is absolutely free of charge to universities so that universities can use it for training purposes.

Now, several examples of how our centers operate. This is the center in Moscow State University established in late 2010. So they have a geo portal with a great number of images and archives. The initiator was the geological faculty – other faculties get access, basically all those interested may get access to images. They have stations at their disposal in order to update data in their geo portal.

This is actual implementation including articles in the scientific magazines and all the rest.

And this is the center in Samara State University and we are proud of this project. This center was established in 2007, and it has been progressing alright. They're good friends with the Russian Academy of Sciences. They're working in close collaboration with the government of Samara Oblast. They do a lot of useful work.

Shown in the tables are works carried out in the interest of Samara Oblast including GIS for Samara Oblast agriculture, forestry, and everything. And within two years, they made some fifty million Russian rubles which is quite a lot for a Russian university. They are progressing alright, they're getting more and more powerful. They have bought another station, then another one, and now this is quite a significant for-profit center. They're working on agricultural issues as you can see, and another example.

And again, it is quite interesting. Perm State University. Five years ago, this university simply could not find volunteers to train them on our technologies. Now, they have an entire faculty to train specialists. There is a line of employers who'd like to employ graduates of the university immediately. And this year, they had more volunteers for every site of the faculty than the mean figure for the university. If the average figure for the university was 124 points, here it was 244 points.

One more thing I would like to mention, now we are testing a portal known as Geo – it comprises a number of universities, consortium members, all volunteers may join, and there will be a social network and every university will have individual pages so everyone can write whatever on the page about themselves. And you can see the relevant emblems and you can see that one may work through a common portal. The great thing is here, people have a chance to use meta data, and of course everything can be discussed in the rest of all universities, plus common projects are shown here. And very quickly, I'll simply summarize that we establish relevant centers in Moscow, secondary schools in Moscow, in Kursk, and projects like Children Care, and school children I invited to come and touch everything with their hands. And this is very important. We organize competitions for school kids. Thank you.

Shiann-Jeng Yu, National Space Organization (NSPO), Chinese Taipei

"Chinese Taipei National Space Organization, it's Remote Sensing projects and plans for it's development"

Good morning again. I'm from Chinese Taipei. I work for the National Space Organization. This is the Space Agency of Chinese Taipei. So in this presentation I'll introduce our research centers based in NSPO and I will emphasize the contribution in data capability of FORMOSAT-2 - our remote sensing satellite and then I will show our future of remote sensing satellites, the follow-on of FORMOSAT-2 - it is FORMOSAT-5. Before I introduce the NSPO I'll have to introduce our organization. NSPO is one of the organizations under National Applied Research Laboratories (NARL). It's our mother institute and the founding was support by the government almost by 100%. From this chart you can see that we have so many different research institutes: typhoon research, disasters and ocean research centers. So it's quite variable. 01.10.13 This is an introduction of NSPO. NSPO was founded in 1991. It's now in Chinese Taipei Hsin-Chu City. The manpower is about 200 people, and the budget is about 40 000 000 USD. This is the budget profile. We have almost 71 000 000 dollars. Now it's around 70.1 million dollars. It's to run the two satellite programmes. One is FORMOSAT-5, another is FORMOSAT- 7. The space program in Chinese Taipei, we have two phases. One is from 1991 to 2006. We established the necessary infrastructure, especially in our integration and test facility and the ground test facility. We carried out three satellite programs. One FORMOSAT-5 is from remote center, and FORMOSAT-2 is remote sensing center. And the FORMOSAT-3 is the weather satellite for space weather prediction. Now we are in the second phase of space program. It started from 2004 to 2018. We are focusing on developing self-reliant space technology in Chinese Taipei. We are now executing our FORMOSAT-5 and FORMOSAT-7.

So, on this chart you can see Phase 1 and Phase 2. We are now in the second phase of FORMOSAT-5. I especially announce that we have some sounding rockets. Performance was profound. And we're working to international cooperation, recently we have Corper, Degista, Tallin. We have strong and successful satellite series. FORMOSAT-1 satellite was launched in 1991. In 1999 it expired. These are still operating – FORMOSAT-2 and FORMOSAT-3. FORMOSAT-2 was launched by 2004 and is now still operating. FORMOSAT-3 was launched in 2006.

The FORMOSAT-2 programme system characteristic is like this. The remote sensing sensor is 2 meters. It's 2-metre resolution. The daily revisit is unlike the other remote sensing satellites revisit capability. It now is distributed to world-wide users from more than 37 countries. This is our mission orbit. It's altitude is almost 900 km and the inclination is almost 100 degree. Period is 14 revolutions per day. We use sun-synchronous orbit. We can use daily revisit capability. FORMOSAT-2 is made totally for domestic users, like agricultural users and land use request. It's made about directional focus and Chinese

Taipei capability can provide the information world-wide. We sell the satellite images through the SPOT-systems in cooperation with SPOT. Actually FORMOSAT-2 has actively provided images to support the natural disasters, I will show our data. Some examples are our efforts. We are also one of the members of the Sentinel Asia. We provide the support for the UNOSAT. I want to show you some capabilities, results of support of natural disaster. This is our support. We've launched FORMOSAT-2 satellite to support earthquake in South Asia. The next is California wildfire. 01.16.16. You can find the flame here. And the next is supporting of Indonesian volcano and the ice shelves. We can provide the data from the south part…. /illegible/. And we also can monitor the blue-green algae, this example is in China in 2008 and the Sichuan earthquake in 2008. And this is Typhoon Morakot monitoring in 2009, severely damaging Chinese Taipei in south parts. This also support of the Chile earthquake in 2010 and the Pakistan floods in 2002. The most infamous earthquake in 2011 in Japan. We supported data to Japan government. As to future plans, we are now building FORMOSAT-5 satellite with 2m resolution. It is scheduled to be launched in 2015. It is now at the critical design review stage - the CDR stage. The most important in remote sensing is to integrate our domestic companies to research activities in order to build our remote sensing instrument. This is the system specs for FORMOSAT-2 and FORMOSAT-5. FORMOSAT-2 has daily revisit satellite and FORMSAT-5 will be a 2-day revisit satellite. So they will be complementary. The resolution is 2 meters in panchromatic and 4 meters in multispectral modes, which is better than FORMOSAT-2. The other specs are almost the same as in FORMOSAT-2. This is our final chart. We welcome any opportunities to international cooperation and space research. So thank you for the opportunity to introduce ourselves. Thank you.

Sergey Krasnopeev, Pacific Institute of Geography FEB RAS, Russia

"Applied Space Technology Center in FEFU – an important factor for regional economy development and Remote Sensing Network Building"

Basically I'll be talking about the common vision we have in the Far Eastern Department of the Russian Academy of Sciences, our vision of the applied space technology center. A few words as an introduction – one of the top priorities for 2012 is to make collaboration more intensive, collaboration in the field of high-tech. This is very important for economic development, for sustainable development, for dissemination of knowledge, strengthening of international ties in research and applied research and fundamental research. Remote sensing monitoring can provide synergetic effect for economic development, and to improve management at all levels.

Now I will briefly inform you about the current state of affairs. First of all, in our institute for automation and management, since 1999 we established this center for remote sensing monitoring which was awarded the status of collective publicly accessible center. We have capacity to receive low resolution and medium resolution meteorological imagery. Besides, our colleagues have very impressive achievements in the calibration, in the primary processing of meteorological data from meteorological satellites which enable many users for the data required. We have very impressive achievements in assessing solution tasks for research of oceans, color of oceans. We have results in microwave sensing of oceans and calibration of radar data.

This example shows one application of how the data can be used to detect oil spills from vessel discharge. We work with DEM – Digital Elevation Modes…we have experience in metric correction, authentication of data and high-resolution data, development of photo mosaics and determination of vegetation type.

This example shows the wildlife, this is the example where we detected the large mammals. We have very strong ties with international organizations. The administration of Primorskiy Krai now understands that the potential of the remote sensing data sector. And we developed the program to implement remote sensing data and imagery in the day to day activities of the Primorskiy Krai administration. We support the initiative of the Far Eastern branch of the Academy of Sciences and the Far Eastern Federal University in their efforts to create educational programs to develop applied technologies of remote sensing data processing in this university.

So what are the potential uses? First of all, it is a high-tech, complex data processing algorithm which facilitates all stages from data acquisition to processing to serving our clients. We also facilitate public access to remote sensing data and to software products. We educate students, and we also perform projects in the area of international cooperation. Primarily, the basis for functioning the center is commercial. So we plan to

market the results of our activities, market the results of our research projects, and our educational projects to make it commercial.
The main clients – who are the main clients of our services? So as we see them, the most important client is the administration of Primorskiy Krai, because right now, the administration implements the program which is called implementation of remote sensing data for socio-economic development and innovational technology development or Primorskiy Krai, 2012 to 2014. In the framework of this program, remote sensing data are actively used for the purposes of land use management, cadastre of agricultural lands, creation of new maps and development of a unified mapping base, environmental monitoring of forests, environmental pollution monitoring, and other uses. I will mention some of them.
It is fisheries, territorial zoning and land use planning, ice breakers, ice fleet, crisis management, and disaster management, geological monitoring, seismic monitoring, implementation of research projects in monitoring of geological systems. To provide solutions for all these tasks, and to serve our clients, to provide the data to all our clients, it is not sufficient to use only existing technological means. We foresee that there will be the demand to purchase ground stations manufactured by UniScan to receive SPOT-6 and EROS-B imagery, because this imagery can cover most areas of the demand in remote sensing data.
We will also organize the reception of the DMC platform, DMC imagery for online monitoring, real-time monitoring, for disaster management and crisis management. We hope to establish cooperation with Roscosmos, the Russian Space agency, to develop projects that work with radar imagery like Arkon or Kondor.
Now I'd like to talk a little bit about the directions of our work. It is scientific projects, improvement of scientific algorithms of generation of standard products using Russian imagery and data acquired by international satellites, international space craft. So we work with Russian satellites managed by Roscosmos, and also with international satellites launched by the Chinese, by the European space agency. We have examples of successful collaboration, successful implementation of certain projects.
For example, we solved the problem to improve the quality to process data from a Japanese satellite NBSAT, just solved a certain problem in the research of oceans. We determine the color of ocean water. We receive the data from Chinese radar from Chinese satellites. We use this data also in our research projects in the ocean to determine the concentration of chlorophyll in the ocean waters. Also, we have a very successful example of developments of technological processes and the solution of applied tasks in applied oceanography and applied meteorology.
Another direction of our activity is organization of technological infrastructure, fine tuning of technological processes of data reception, data storage, data archiving – this is a very important area of our activities. We use international standards in this area and also national standards like *RosGosStandart*, the Russian standard, and the unified geo-data standard which was developed by the order of Roscosmos.
This is an example of editor's program software, programs which prepare meta data compatible with all mentioned standards.
Another direction is integration in information systems. This is an example of integration to the web portal of the European space agency. Another example is the organization of infrastructure of special data. Here we provide online access to geospatial data and provide access to analytical processes, provide opportunities for remote processing, remote data processing to certain users.

In conclusion, I'd like to mention that organization of remote sensing data centers will facilitate direct reception of data from many satellites, will provide informational security, will serve many clients, will serve many demands at the regional level. It will help to develop modern industry, modern infrastructure. Utilization of remote sensing data will facilitate sustainable development and will help to implement modern technologies. Implementing remote sensing data in many economic sectors – it will also foster cooperation with international operators in many adjacent sectors. And we believe that these tasks can be fulfilled because we have very qualified personnel who work very actively. So we look very optimistically in the future.

These remote sensing centers which operate, which function in the universities, they can be used for educational purposes and for fundamental research purposes. They will also foster cooperation with private companies. And they will help to accelerate the implementation of innovative technologies to bridge the gap between the fundamental research and applied science. Thank you.

Kirill Borisov, Roscosmos, Russia

"Satellite technologies and their application for sustainable forestry"

Good day, good afternoon dear colleagues, dear friends. Let me, on behalf of Roscosmos welcome you here on the far eastern land for the second time. Let me thank all of you for coming and for participation in this international forum.

First of all, I think that all of the participants are more familiar with the capacities of space craft which are used by European and American operators. In my presentation, I will inform you more about Russian space craft which can be used in APEC economies for the development goals of this region for sustainable economic development. Currently, we the practice to develop integrated products, to develop integrated applications for remote sensing data. In Russia as well as other countries, we have a long history of these activities – since the 1990s. We have a long history of cooperation with the Russian Academy of Sciences, with the Russian forestry sector, and we have a long history of cooperation with European institutions in the framework of the seventh program of the GMES program – this is an EU program.

These projects have been carried out using Russian satellites as well as using the data acquired by using international space craft. Before I turn on to the next slide, yeah, let's actually turn on to the next slide. There are many numbers which show the technical characteristics and capacities of Russian space craft which are currently in orbit. The characteristics include the swath, the resolution. But before I turn to the technical characteristics, let me speak about the concept of the development of the space industry which is being discussed right now, and which is to be approved in Russia.

Right now, there is an existing legislative document which spells out the directions for development of the space sector until 2030. This document spells out such goals as development of the moon and other planets. But for the nearest future, we have modest priorities. The priorities include utilization of remote sensing data in the interests of the Russian economy, in the interests of sustainable economic development. And in this context, the most important goal is to develop multiple uses for remote sensing data, especially which are acquired by Russian space craft.

The development goals of the Russian space sector made us combine the data acquired by Russian space craft with the data acquired by international space craft. And we are planning to develop a sustainable constellation of remote sensing satellites, including low orbital space craft, geo-stationary space craft, and high elliptic space craft to cover the whole spectrum in terms of resolution and spectral bands.

Now let me briefly comment on this table. This table shows currently operating space craft "Resurs-DK" – a space craft which has been in operation for many years since the 1990s. It is still functioning. It was launched in 2006, as a three-year resource, but it has been serving twice as long, for six years right now, and it's still acquires data.

Meteor M1 is a hydro-meteorological satellite which has many sensors which acquire remote sensing images of the earth. We have multi-zoning spectral scanner with special

resolution of 60 meters and 120 meters. The data acquired by this sensor can be used to solve problems in disaster management. The main sensor for hydro-meteorological tasks is a multi-zoning scanner, MSUMR, with special resolution of one kilometer in multi-spectral band, and with a swath of 2,000 kilometers. The information acquired by this satellite is used mainly for hydro-meteorological purposes, but also it can be used in the forestry sector and also for environmental disaster management.

Elektra L satellite was launched in 2011. It is a hydro-meteorological, geo-stationary space craft, and it has very high capacity with average renewal time of only half an hour. Low resolution – this space craft has special resolution of one kilometer in monochromatic mode, and four kilometers in the infra-red band.

Canopus B satellite – this is an example of a satellite which is used in disaster management. This satellite was launched in July this year. Currently it undergoes tests, and we are planning by the end of October to complete the testing stage, and we will commission it into the operational stage. The main client for this satellite is the disaster management ministry – it will be used to manage environmental disasters. The technical characteristics of this satellite are as follows. There is pan-chromatic resolution of 2.5 meters, and multi-spectral resolution is 12 meters.

Also this satellite has… no, I'm sorry, I'm talking about the next satellite MKE, this is a small sized satellite for specific tasks and this satellite also has the sensor, the camera, this is also a pilot project. So now it undergoes tests and in case of successful completion of the test stage, it will then be turned onto mass use. It has hyper-spectral sensors with special resolution of 50 meters. I will inform you more about the specific features of this specific sensor.

Hyper-spectral information is a new type of data which is used to solve specific tasks. For example, to determine the type of vegetation, to identify some problems with vegetation, to detect certain species for instance, species which contain narcotics – drugs, to detect special types of species. These are the kind of tasks solved by the Far Eastern Academy of Sciences.

Another satellite on this list will be launched by the end of this year. This is Resurs-P satellite. This satellite has been delivered to Baikonur space launching grounds, and after pre-launch tests, it will be launched by the end of this year. It is a high-resolution satellite with special resolution of 0.9 meters. This satellite has a hyper-spectral sensor and medium-resolution sensors with a wide swath. The technical characteristics you can see in the table. Hyper-spectral has spatial resolution up to 30 meters, and medium-resolution sensor has spatial resolution of 12 meters in pan-chromatic mode, and 23 meters in multi-spectral mode. We are planning that the average data renewal period from this sensor will be 3 or 4 days.

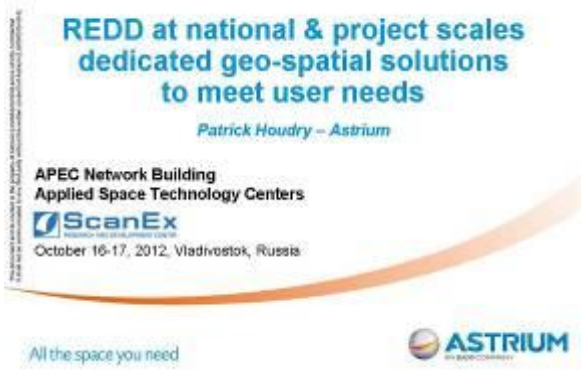
This is what we plan to have in orbit by the end of this year, 2012. But speaking about our future plans, the near future, next year we are planning to launch another space craft, Elektra L type. We will have two geo-stationary satellites which will acquire imagery with high periodicity. Also, next year we plan to launch Meteor M2, the second space craft of this type. And by 2014, we are planning to launch another Canopus B satellite. We plan to complement this satellite with infra-red camera, infra-red sensor to solve problems in forestry, in disaster management, to detect wildfires with the dimensions of 5 meters by 5 meters – very small.

By 2014, we are planning to launch another Resurs-P space craft. So this is, just very briefly, our plans for the near future to develop the remote sensing data acquisition sector. The next table shows the capacities for utilization of remote sensing data to solve the key tasks in the forestry sector. These tasks include mapping. All satellites can deliver

information excluding geo-stationary satellites, all other satellites can be use potentially for mapping.
Also, another task is monitoring of the environmental condition of forest resources. All space craft can be use to solve this, including geo-stationary satellite Elektra. Also, another problem, another task is monitoring of infrastructure in the forests. Geo-stationary satellites can be used for this purpose. Also, high-resolution satellite Canopus B, with high resolution of 2.5 meters can be directly used for this type of task. The images we currently receive from Canopus B, we already tested, they can be used for infrastructural analysis of special objects within the forestry sector.
Forest resource inventory and monitoring of environmental disasters are the two tasks. The next slides illustrate software products that can be developed in the forestry sector. Not the products themselves, but the illustrations that can help you to understand what kinds of tasks can be addressed. For example, the imagery from Resurs-DK space craft, from Meteor, Canopus B space craft, the data acquired from these satellites can be used to determine quantitative and qualitative characteristics of forest resources.
This slide shows the image acquired by Resurs-DK compared to a Landsat image. This shows monitoring of new cuts of forest, new logging stands, and we can later decide whether it's legal or illegal logging. This kind of information was acquired by Resurs-DK's satellite in pan-chromatic mode. I mentioned already that it is still working, so we still receive imagery from this satellite.
This example shows an image acquired by Meteor M1. This slide show Archangelsk Region, and this image is used for comparison, for analysis of felling areas. This shows the data acquired by Meteor M1 satellite with spatial resolution of 1 kilometer. This slide shows the kind of data that we use to analyze the situation with forest fires.
This image was also acquired by Meteor M1, examples of images with different resolutions. This is also an image acquired by Meteor M1. This image shows the capacities of typical problems solved by hydro-meteorological service, and also the crisis management center. This information was used in disaster management.
This image was acquired by Elektra M. This is a geo-stationary satellite with low resolution, one kilometer in pan-chromatic mode and four kilometers in infra-red mode. But the renewal capacity is only half an hour, thirty minutes. So, this is used for online or real-time monitoring of large forest masses, large forest areas.
This slide shows the capacities of hyper-spectral sensors. As I mentioned, we see very large prospects. We foresee considerable demand for this kind of data, especially in the forestry sector. Now I think this drew me to the end of my presentation. Thank you for your attention.

Patrick Houdry, Astrium GEO, France

"REDD at national & project scales: dedicated geo-spatial solutions to meet user needs"



Good afternoon everybody. First of all I would like to thank the Organization Committee and ScanEx for the opportunities you gave us to present the concrete examples of what we have done in the field of REDD. I apologize for my English. I think the jet lag could be the cause of my bad English. Sorry. I would like to be very concrete and would like to show you the very concrete examples of what we have done using the full range of satellite image we did.
And I was very happy with the presentation of WRI this morning, because the main messages I think have been given to the floor. We'll make the link with what I'm presenting to you. So, of course satellite imagery is very important in our technology for making REDD. As far as due information is concerned with REDD, we see three main areas where due information can provide variable information and I would say essential information.
Of course it seems you know very well a capability to estimate the reference mission level which is very important to establish the crediting profile of any project, to estimate the, let's call it, the rights of de-forestation and to be able to, let's say, prepare the level of performance, that will allow to reduce and to cure this de-forestation and degradation. REDD, I think, has been mentioned this morning and the foundation of REDD is a national policy that will be implemented. Countries, stepping in the REDD, they will develop the national policies taking into account local characteristics, cultural areas, and so on, and it's a very important tool – to have maps that allow to manage, allow to cure, rise an obligation of full actors participating in REDD, because REDD is not a question to cure de-forestation, but also to find new activities that will be alternative against de-forestation. You cannot just say local communities to stop cutting forest and find other energy, you have to propose something else. So it involves additional actions, and everything should very well mapped. And long-term new issues should be very well managed. Too much projects are stopped just because of disputes about lands. Everybody think to have the right on land, on the use of land, and it's really the key factor jeopardizing the REDD projects. And of course all what relates to MRV (Measurement, Reporting and Verification) for which satellites we want to monitor the forest cover, but monitor to feed the MRV which is an obligation for project not only for national entities, but also to manage risk, because REDD is a process engaging a lot of factors in the ground with different activities and you have to manage all the risks that are relative to these activities. I'll show you the very concrete example.
So, how Astrium can contribute to that. We have comprehensive archives to step back in the past. And these are very important features to establish the base line of the reference mission levels. Of course we don't have all the archive of all the countries since 1990, we have to complete with own data, but our archive are very useful to establish the reference mission level. Of course we have a fleet of satellites, with 2 new satellites that have been launched within the last year: Pleiades and TSX, - it is the new generation of SPOT family.

We have something which is important to send that we can commit within long-term provision of satellites like SPOT-6 and SPOT-7. We can ensure the continuity of the mission until 2024 and it's also important because our objective is to protect the investments made by our users and customers. We've also developed very innovative technology to be able to use these images in various context and calling for mass-processing and for also very integrated solutions to fix certain important issues. I'll shortly outline some of these issues. And we've also full range of, say, infrastructure to deploy and to reinforce our users and customers.

We're active in the REDD since 2008. Foundation of our engagement is the contract signed with the French Development Agency to deliver large bulk of data on different type of maps and in the Congo Basin countries I will show you this project. We've been involved in many, many projects to deliver imagery but also automatic maps. And also what is important, to be an active player and to bring the best value we can, we want to be engaged with the REDD on the daily basis and we want to have a partnership with scientific community. While working with NGO, we've developed methodologies that have been recognized and adopted by the scientific community which was for us very important. We're proud also to be involved in Planet Action activity which is incorporated to share responsibility in program to deliver hundreds of images to small REDD projects. So, be concrete now, as far as mapping is initial for establishing the forest policy, very concrete example of what we have done in Brazil, in Mato Grosso, but also in other states. So it constituted 80% of de-forestation in the Amazonian forest where we delivered state-wide seamless mosaics in natural color. Over here, it looks like one image, but of course it's made of hundreds of images and you can work at different scales to have a global view of where forest is, where are the main de-forestation patterns, you can get closer to see all the anthropogenic activities and you can establish what we call Rural Environmental Cadastre which is an important tool in Brazil. It is a mandatory tool, the state has to establish the status of the rural environmental cadastre, because it's the obligation for all the farmers to preserve some natural area, to stop de-foresting primeval forest and also to restore some degraded land. Everything is recorded in the database and they did use our imagery to do so. And today we are delivering the same type of product in some South Africa republics. Here the situation is a little bit different because in fact these are poor counties…. rainforest area because there are concession forests and there are lots of inventories made by forest companies. But as for transition forest, also for dry forest in fact, information today is very old and we have to refresh and establish the national strategies and also to understand where the forest is and is this forest worth investing the REDD program.

Few words on the programme we've development with the French development agencies. France is one of the six countries, joining a program in Copenhagen. I don't remember the name of the programme, but they've put a lot of money to make REDD a reality… For the French Development Agency (AFD) remote sensing is a very important tool to give the tools for countries to have access to the information in a way to establish proper policy. Today they recognize that too many countries are pushed by international community to develop policies, but in fact they don't have access to the information to do this properly. And we really believe that our imagery can help these countries. So it was the foundation of our project with AFD where we've deliver an archive of images for monitoring the rainforest of 6 Congo Basin countries and we've also deliver automatic maps as we have established for the Central African Republic the baselines. We have rather large bulks of data we've deliver to the African countries. Few words about the baseline activities because I think it was a good job and we learned a lot on how to establish these baseline

products which are key for different countries. Among inputs we have the national strategy. For example in Central African Republic, the RPP, the Readiness Preparation Programme was adopted and accepted by FCPF and World Wildlife Fund, financing the initial readiness activities. You have also of course all the guidelines established by IPCC also with international finance. You also have the methodology set up as the REDD today is eligible on the voluntary market. It's quite important also to take into account what is done in the voluntary market and to take into account the choice to rely on the VCS methodology. VCS leading the most influent voluntary standard. Because developing the baseline at the national level should be used by project developers. We're very close to what lot of people are discussing about these approaches – how to make a baseline at a national level. We can help project developer to use this baseline for establishing the crediting profile of the project. And hundreds of images.02.12.04. Of course when we're stepping back to 1990 we have three or two epochs, where we monitor deforestation rates, it means images with different sensors, different spectral characteristics, different viewing conditions, different atmospheric conditions and you have to manage that properly to make valuable product. In fact this type of exercise establishing the baseline you have 2 times. Specification phase where you have to discuss a lot with the local beneficiaries. Because this map should be useful for them. They will be responsible to report the international community so you cannot say 'here is the forest ' but they have also to adopt the product, to bring the value in the product. We have to take into the account the national characteristics, how the forest is made in different countries and to try to make the link with IPCC guidelines. It's not so easy sometimes. We have also to take into account the carbon sequestration potential of the forest. 02.13.11. And sometimes you can aggregate some different forest types because it's quite difficult to recognize these forest types, sometimes it's better to discriminate these forest types as they correspond to very different carbon … capabilities and it's very important to give value to that. So, how we did work? We worked to be able to manage hundreds of images. We have used processing suite that we've developed which is called Overland, which allows to turn image, any optical image, working in visible line, what you call biophysical layers. Starting from the different spectral channels, you have a set of non-quality layers like green-cover fraction, canopy roughness, and so on. Our production is very powerful because you have direct interpretation criteria to apply on different images. It's also a big problem – correction of atmospheric conditions. Sometimes it can be very harmful if you have hazes or high vapor concentration - you can misinterpret image properly. We did work on this way. We did work intensively with a local beneficiary to make sure that those specifications were OK for them, to involve them in the validation and the calibration process. And we were able to deliver maps at the national level. One word on the validation. Validation is also a tricky issue to be very well advised by statisticians because when you have very fragmented forest and you have a lot of diversity of forest types, it's very easy to say 'I have a 100%-accuracy map' or 0% accuracy map". According to the special presentation of this class you have to be very careful in the validation process to really tag the … point...

On the project you see here we did work for a project developer in Cambodia. We did develop with our forest colleagues from UNF Internationale, the French forest office international branch, we did develop this product. But there was an issue to discriminate two different forest types. All the images were taken during the dry season and we want to discriminate deciduous forest from other forest. We were to rely on radar imagery to achieve that. It was very important for the project developer because the business plan was really relying on the capability do discriminate these two different forest types corresponding to different carbon sequestration potential. So here are the other typical

monitoring at a regional level. So it was in Mato-Grosso. Of course in Brazil de-forestation rates are quite impressive and the magnitude is very high. We did provide the register called the de-forestation rates of Zoul in Mato-Grosso, for last 25 years, but as I said this morning, monitoring should also get closer and to see all the activities that can take place in a REDD project. And now we have typically in fact we have conservation of natural forest here. We have improved … (sorry, I cannot see the pointer)… So, preservation of natural forest here. You have national forest expectation, here you have plantations with commercial spaces, but also restoration of degraded land with native species. If you read the literature about REDD you can see that projects are pretty much complex. And within the same area we have different types of activities – we deal with preservation, restoration, plant growing and also agricultural development, because local communities need to have access to the photo.

Here the resolution is also important. You need to have the swath and the acquisition capability allowing to monitor large areas but you also need an access to detailed information thanks to the resolution. So here it's the typical case of photo telling forest concession in Africa, Cameroon. If you look at global scale between 2006 and 2011 it looks nice, big pattern of the forestation, there is a large agricultural area that is quite well managed. Here, in this part of the image. But if you get closer, you can see some… Here is the preservation area where no anthropogenic activity is allowed. So, you can see some disturbance and if you need to get closer once again and to access to the high resolutions to get evidence of illegal activities with tracks and also with illegal logging.

One word about automatic processing. Sometimes it is very efficient to apply some automatic processing on the imagery to get evidence of the degradation and forest disturbance. Here's the other image. Photo interpret can see some disturbance, …. and there are some shadowing effect showing that forest cover is disturbed. Thanks to the automatic tool we have developed your access to this and you can see that it is fully organized logging conducting to de-forestation. So if it is legal, you can be sure that the full area will be de-forested in 1-2 years from this image. So risk management is also an important issue for REDD project developers and for the countries to be able to go to the ground and to stop illegal activities or any activities that can jeopardize the establishment of the project.

I will conclude. Seeing that REDD is of course the conciliator between the national level and project level but I would say that our needs are the same as of the national level, the key issues are the access to the large amount of data but also the capacity building of the countries. We need to develop the national strategies that have to autonomous and we have to develop our own MRV. On the project level there are more data on demand and they prefer to rely on the services. That is why we're developing service and I will shut my presentation I will take time of my colleagues, but I can give you more details if you want on this type of service that we are delivering not only for REDD projects but for any forest professional working in the field of concession of forest, improve forest management in REDD, we're delivering services with forest experts because we need to be able to interpret correctly any image, we need to know how the forest is growing, how the local communities are using the forest, otherwise you can misinterpret what is given by the image.

It's my final chart. So, Astrium is committed to support REDD, we ensure the continuity of missions, SPOT-6 and SPOT-7. SPOT-7 will be launched within 1 year. The Pleiades 1B will be launched by the end of the year, so we have a new constellation of satellites that are fully advanced to help the REDD countries and the REDD project developers. We are also continuing to develop tools and methodology to be in strong attention to the

complementary between optical and radar imagery to develop more efficient monitoring tool. And we want do deliver high quality solutions because we do believe that we have the technology to achieve the high quality MRV to be able to achieve high quality REDD projects and this is what will attract public and private readiness to invest more money in the REDD and to make REDD really successful. Thank you for attention.

J. Paul Stephens, DMC International Imaging Ltd., UK

"Daily imaging – operational Earth Observation for improved management of natural resources"

Well, thank you very much indeed for your opportunity to present the work of DMC International Imaging. My title is "Daily Imaging - Operational Earth Observation" to really improve the management of natural resources. The DMC International Imaging made constellations of satellites build by Surrey Satellite Technology. I'll talk a little bit more about this and the opportunities they bring for REDD+. Just a bit of background. Surrey Satellite Technology is pioneer of small law-cost spacecraft. It has been acquired by EADS Astrium in 2009, currently building the 22 payloads for the Galileo Navigation System, plus 4 satellites for MEO, and it has currently 500+ stuff, and DMC International Imaging is collocated at the moment with the smaller team providing imaging services in the world. The concept of DMC, which stands for Disaster Monitoring Constellation, was to achieve daily imaging anywhere in the world using the constellation of small satellites. Partners and Net each own and operate satellite. And various nations involved work together to provide free disaster response through the International Charter. And my role is to commercialize that data for other applications. You can see that our members include Algeria, Nigeria, Turkey, China, Spain and UK. An unusual mixture for such a cooperation but it works very well. DMC International Imaging is the coordinator for disaster response and for commercial imaging services. The concept was to arrange satellites with a swath of 650 km in some synchronized orbit to enable us to have access to any part of the world every day. The first generation had 32-metre ground sampling distance. The new generation has 22 meters with greatly improved image quality. We use the same bands as LANDSAT – for continuity we use red, green and near-infra red, and very closely calibrated to LANDSAT within 1%. Recently I went to Baikonur to watch the launch of the UK DMC-2 satellite, which was an exciting moment for me. More recently we've launched NigeriaSAT-2 and NigeriaSAT-X satellites. NigeriaSAT-2 in addition provides 2.5 meter pan-chromatic and 5m multi-spectral in addition to the wide swath, 32 meter, multi-spectral. Here is an image showing the pan-sharpened imagery of Salt Lake City.
My role is to provide commercial imaging services with a range of multi-spectral, pan-chromatic, hyperspectral to forestry, agricultural and environmental services. And key to this is a very high-quality radiometric calibration so that the images from each satellite can be used independently together with confidence with other satellites such as LANDSAT. I live in a small cloudy country, England. It's very difficult to get an image of our island because of cloud. This Landsat compilation took 2-3 years. Of course with the nice big image like DMC you can get this on one sunny day, and by imaging everyday you can get the image when the day is clear. This is very important for cloudy countries, especially in the tropical regions. The imagery of 22 meters provides very large image but with plenty of details. (Here the Brazil de-forestation). But working together with many satellites allows

us to provide continental coverage by, here is just an example, two satellites, covering, e.g. Europe, in a few days. It was done in 5 days. We are able to cover continental scale very quickly and comprehensively. And I'm very pleased that we're working now with ScanEx to provide direct near-real time service to ScanEx ground stations across this large territory, enabling rapid response imaging for services within Russia and the region.
I mentioned disaster response. DMC is a member of the International Charter for Disaster Response. And we play a very active role in imaging and responding to many disasters. One recently was the floods in Thailand and showing here before and then after shows the devastating extends of those floods that they experienced. In fact disasters happen very frequently and so our team is extremely busy on disasters around the world, most of which are water-related. In agriculture we play an increasingly strong role. We provide through Astrium Geo-Services with 2 DMC satellites. We cover the whole of the US 48 states. Every 15 days with less than 30% cloud and the US Department of Agriculture commissioned this in 2011 and repeating this in 2012. What is very much to see is that they get improved results of using Landsat, which is primarily due to the very high temporal frequency, which enables with phenology to discriminate between different crops and so it showing that the degree of accuracy has greatly improved. And this leads on to precision agriculture, where we have customers, also including Astrium-owned FARMSTAR service, in many countries using this data to provide guidance to farmers, to reduce the fertilizer costs and improve their crop yields, providing in-field data. We've been working with Japan as well. They have had great success in being able to discriminate rice yields using the high temporal frequency of the data. But the key topic of this presentation is, of course, forest monitoring, and the advantage of this very wide swath imagery – 650 km, with the resolution of 22 meters – is to be able to cover large areas of territory very quickly and repeatedly. We've been working for a considerable amount of time with many researchers here in this case looking at peat forest fires in Kalimantan. Forest area classification again in Indonesia supporting projects working with World Resources Institute. And then unusual forest change indicating maps using very high-frequency imagery. And of course validation has very important. So working on the ground with local organizations, in this case working with World Resources Institute, in a programme sponsored by the European Space Agency to monitor change in Kalimantan.
One of our key customers is the Brazilian Agency NP. We've been working with them since 2005 to provide the full coverage of the Amazon Basin, usually twice a year, to support the annual de-forestation programme. And I'm pleased to say that this year we now provide the direct downlink service to enable them to try to replace MODIS at 250 meters with DMC to 22 meters. So that they have a better change of catching people in the act of de-foresting. This then allows them to drive the de-forestation map and I'm pleased to say that the data we're providing to Brazil is now an open-licensed dataset, enabling wide verification of the changes. We use this of course then to be able to drive change maps using our data and looking again at other sources of change including forest fires. By processing the digital images each year we look at the change of forest cover and then are able to drive the incremental change which results in the final map.
We've had interest of course working in all parts of the world, I notice that Peru we provided to MINAM in Peru informational…area of interest and we also worked in Kalimantan providing data on the long-term fires that have been burning in the peat. And change detection in that area of course is another thing that this imagery is able to support. In REDD+ programme we've been able to support the country Guiana by providing full country imagery and again this is an important part of MRV programme which we are supporting. But recognizing that imagery supply is not enough we formed,

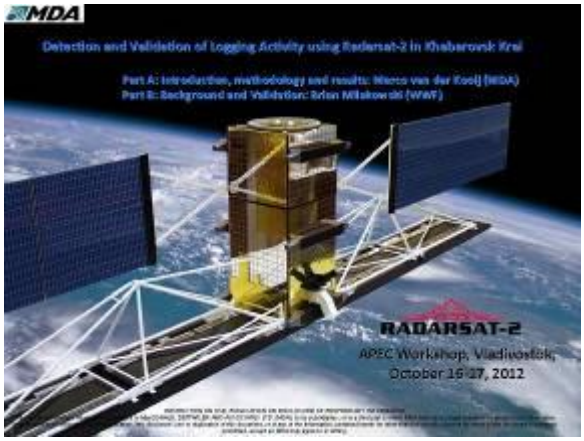
we had looked at forest governance here, recognizing that most imagery provides you with annual mapping and data continuously and well-calibrated data, we still need to put that in the context of the REDD+ governance programme. So we have formed an International Forest Management Consortium, which has at its members Astrium, World Resources Institute, several UK Universities and specialists in timber tracking, finance and carbon auditing. Our expertise that allows us now not only provide the timely and accurate data to support monitoring of forests, but also address the many other parts of the important triangle shown here on the screen. For example, Helveta as a company that provides tremendous expertise in timber tracking technology for ground proof data and validation of remote sensing techniques. We also have Carbon Auditors Ltd., who provides the models and capabilities for driving carbon accounting from remote sensing data. Putting those together that really provides a very wide range of skills that enables us to help and support the implementation of programmes.

But I thought you might just like to see a little look into the future. We have 3 1-metre satellites at construction at the moment called DMC-3 which will be providing daily revisit at 1 meter and with 4 meter multi-spectral due to launch in 2014. We also have new synthetic aperture radar satellite in construction called NovoSAR which is a joint Surrey Satellite Technology - Astrium programme. And the modes have been specifically designed for both forest monitoring and indeed for ship detection and marine surveillance which is a very interesting area itself. And we're aiming to try to put together constellation on the same module as the DMC with additional ownership and so we have opportunities to join that constellation. The first images come from national air-borne instrument showing extremely good imagery, AspenSAR which is an exciting new instrument. Above all this is a new approach to SAR, because it's a small satellite which makes it very affordable and much more accessible. So, this range of satellites from the original DMC constellation with the wide swath optical moving into the 2.5-meter range satellites, now 1 meter in construction, and then synthetic aperture radar, with a very broad range of sensors accessible through DMC International Imaging.

Many of these now allow to examine on different scales the forest and resources that you are concerned with. And in the future of course with the addition of the new sensors we'll provide a greater range of sensor variety to assist with that task. I want to show you one new plan. I wish to put together a programme called Daily Planet. My aim is to image the entire world surface daily at 20 meters. And by doing so we'll have a new paradigm. You will be able to access any part of the world with daily imagery repeatedly at high-quality. I have every expectation that we'll put that in place within the next three years. This will then give access to monitoring at a scale not possible at this resolution before and I think you'll find that this makes a great difference to the type of things we are trying to achieve together. So, thank you very much indeed.

Marco van der Kooij (MDA, Canada)

"Detection and Validation of Logging Activity using Radarsat-2 in Southern Khabarovsk Krai"
Part A: Introduction, methodology and results



Thank you very much for being here and for the Far East University and ScanEx for organizing the workshop. I'd like to acknowledge my colleagues from MDA and also the people we worked together on this specific project – it will be the focus of this presentation. The colleague from WWF Russia, Bryan Milyakovsky will present a second part of this presentation, which really is the important part of the forestry analysis will be presented there. The content will be, it's displayed right here. At first the short introduction of the MDA Radarsat-2. Then we will first of all mention the concept, the whole idea of using space-borne SAR as a change-detection machine for very large area high-resolution monitoring to really use the radar for its strength which is surveillance, repeated acquisition. We will see that the specific results of the presentation, the focus of the presentation – forestry is certainly not the only application where we can make major improvements in how we detect change and damage on the Earth surface. Our focus will be on the forest degradation monitoring. Specific benefit of this whole approach to forestry is that we're able to do a precise forest canapé structure change detection. And we can do that because of the resolution of the data and because we have a systematic approach to repeatedly acquire data for very large areas. We will talk about methodology and also about the products that we create and which will also be the products that will be presented later in the context of the forestry validation. The examples of the validation activities. One example is Brazil and then of course the main validation activity here is the Southern Khabarovskiy Krai, in the area here. We'll quickly go through it. MDA - is the Canadian company that's based in Vancouver and it's headquartering in Vancouver, Canada. And it's focused on information solutions and has customers and officers around the world. MDA is quite well-known for some of the radar satellites that have been created but also for other satellites and also for some of the hardware robotics on the US space shuttle and the International Space Station is build by MDA.
Then of course the ground station business and a lot of the air-borne SAR – another URV technology. The EO Earth observation services focus in particular on radar-based, interferometry-based services in Oil&Gas industry as well as the maritime monitoring services. Of course the space-born radar missions are one of the most important and well-known missions, Radarsat -1 which was launched in 1995 and is still in operation after 17 years and is still working very well. It is way beyond the original design life for the satellite. The second satellite is the Radarsat – 2 which was launched in 2007, which is still of course active. We expect it to be present for the very long time. Thirdly, the Radarsat constellation mission. It is the designed mission which is now still a number of years away from being available. The Radarsat -2 image modes. I want to spend a lot of time talking

about it but just want to mention that the modes on the left side are typically the higher-resolution beam modes like spot-light ultrafine. They are typically intended for monitoring and imaging small areas repeatedly such as for Oil and Gas monitoring. On the right side you see the larger swaths that are typically used for maritime and ice monitoring. The intermediate size swath is interesting and we're going focus on that. This graph and I hope you can see it from far, is sort of indicating an area where the image modes were created recently, in the last couple of years, after the launch of the satellite. So what we were able to do was to reconfigure the ground segment and the space segment to some extent to create additional image modes that are particularly aimed at increasing the swath width of the 3-, and 5-metre resolution data. So, what you see here is on the left side access. You see the resolution going up to 1 meter and at the bottom you see the swath width ranging from 20-30 to 100-150 km. What's very important is that you see that this increase in this direction of some new image modes now arguably do have a high resolution (which you could call high resolution – 5-metre radar data) and still at the very large swath – 250 km. And that will be the focus of this presentation. The modes that are available at WMF (wide multi-look fine) are already available for the last 2 years. They are single look. They have 5 meters resolution and they are used for a lot of work already done in the last couple of years, I'll show it here as well.

Just a few words on this new mode, the XF-mode, Extra fine, because it fits into the existing modes that we have. So this mode has a 5-metre resolution, 3 m pixel spacing. And a nominal swath width is 150 km. Image size is 150x150 km. It is to be released. It's technically ready and has been tested but it's not officially available yet, will be available next month. This images, they are very very large. They have as many as 2.5 billion pixels per image. That requires significant processing and analysis capabilities that you work with. As I mentioned the similar mode is already available at 90 km swath which is little bit smaller. Why is it so important to have a 150-km swath? Because having a 150-km swath gives us the ability to repeat very very large areas every 24 days. Almost unlimited-sized areas can be covered every 24 days that way using the same geometry.

Some of these archive are already exist in Eastern Russia, in Japan, in Brazil and some other areas, where areas a size of a million km2 or more might be continuously monitored with those modes. Just want to mention that you can connect to the archive, it's actually visible on the web-site here, the CO NET. You can see what data exists and you can see quicklooks of the imagery. What is very important to mention is that Radarsat-2 has very large capacity. It was designed for large area monitoring and currently the residual capacity, unused capacity of the Radarsat – 2, is approximately 10 minutes per orbit. There is a very significant capability. Of course, it can only be utilized if data has downlinks locally so that there is no load on the already existing ground stations. That represents a significant potential for a large area coverage. For instance, even less that half of the capacity will be sufficient to cover the world's forests, certainly the tropical forests, every 24 days. You see the actual modes at the bottom, we are going to skip that. The use of radar for land change detection. So, the resolution is very important. The resolution is probably the most important parameter in terms of what you can extract in terms of information. At the same time we need a wide swath in order to create a sufficient archive and be able to repeat and do the change detection. We need to use the exact same or almost same geometry, which means that we acquire the data stacks. So like interferometry stack but we don't do interferometry we do change detection, amplitude change detection. Because of acquiring all this data we can do filtering, speckle filtering, both in time and space. And that really helps us to do accurate change detection. This really shows the concept of stacking and how you can filter the data in time. With the radar

you can truly do a temporal analysis, temporal modeling of your reflectance, which is a very unique capability of radar. It has not been exploited yet. This is just a quick visualization to make it clear how you can - for small area, 1x1 km area - how you can actually go from one image, where you see the speckle noise, in the left side, to an image which is a temporal multi-look image where certainly you see the dramatic information content in terms of the vegetation and the texture which is visible in the data, even at 5-metre resolution. So how do we do change detection? This is really the critical aspect of this forest application.

It's what we can call the canopy structure change detection. It's important that we have a high-frequency radar like C-band, perhaps, S-band, expand which is very contradictory to what the typical opinion is about the use of radar. The reason why we need C-band or High Frequency Radar is that we want the reflection to happen at the top of the canopy. That's how we can do canopy change detection. If the resolution of the data is high enough to get the information of the structure of the canopy, then certainly we can do the really interesting change detection that is not possible with lower resolution data or with data that penetrates through the vegetation. So it's actually good to have no penetration. So, on the left side you see 2 individual images, before and after forest cut. It's very difficult to interpret individual SAR images and that is exactly what we don't want to do. What we want to do is to look at the changes. On the right side you see the forest cut of about 100x300 meters. You can see the outline of the cut very clearly. And it is possible because of the resolution of the data because you actually see the changes of the shadow that has occurred due to the forest cut.

You can see dark edges on the right side and increases of backscatter on the left side, which is really how you can systematically detect and look at these changes. Two classed of the changes that you can see – one is small forest cut which is argued to be the degradation and I would call it a large forest cut of the size. And at the bottom you see actually the selective logging, which also really becomes visible even in single images as 5-metre resolution. If we take the difference between two images like that, make sure that they're properly co-registered. You can actually see large trees even in single images like these. Let's push the limit to higher-resolution SAR data and show the benefit of the radar data compared to high-resolution optical. The solution for degradation monitoring is not to go to high-resolution optical but to look at systematic acquisitions of the radar which is much easier and more reliable, and have the benefit of exact repeat to be able to see the changes very clearly. So, this image on the left is on high-resolution optical image, and on the right – a year later, the same area. We see some of the changes on the right side, in the plantation in China. However the main object of the investigation here is the central portion of the image, which shows selective logging activity, which is very difficult to see in the optical data. However if we take the radar imagery, and this is from the spot-light imagery, so it has pretty high resolution imagery, we can see individual trees that are taken down. They are really hard to see at all in the optical images. So just to go back to the imaging. Maybe you can see some change at the bottom but you need to spend a lot of time looking at that. So now we can clearly delineate individual canopies that have been removed.

We can even see some evidence of the actual trees that move into the plantation due to the certain changes that have occurred. So, summary of this comparison is that radar data have a great advantage of being able automatically create change imagery saving a lot of time and resources to create that, and then quickly create change maps while that is much more difficult with optical. Let's quickly go to validation activity we did in Brazil, north-eastern Brazil. Of course very cloud-covered particularly in the winter time. I believe that

since December there are still not been a single optical image collected over the area. Certainly during that time we did this activity first between December 2011 and May 2012 the images are available. What we did was we looked at the sequence of Radarsat imagery that was collected every 24 days and basically had a partner in Brazil doing over flights with an expert analyst onboard who went to the detected site that we steered him to watch. Of the 8 locations that were indicated they found illegal working activity in 6 of those locations. And 2 of them were natural canopy loss. This is the result of the selective logging that took place crossing the border of the Provincial Park and so we see the actual process from month to month and the photos that were taken in the area of those locations show the selective logging activity that you can see here. I guess I'll quickly move to the next speaker in a minute. It is his area of interest, he acquired a lot of imagery since late 2010 over the South-Eastern Russia and the analysis is focused on the small area indicated. We used the series of images in the summer of 2011 and the series of imagery in the summer of 2012 and use that to detect the changes that happened over the 1-year time period. This was also created automatically. Here are few visual examples of a small area to show the kind of product that we provide. The imagery here, these are the images shown on the top, they are 3-looks, basically 3 images combined for each of the summer. So, 3 images for the summer 2011, 3 images for 2012. The difference images are shown of the bottom-left, which shows some very specific changes that are probably hard to see from the distance. On the right, on the bottom, we see what you could call a 'damage image' which is effectively measured for the standard aviation, so for the change of the amplitude in a local area, so that helps us to delineate these areas. The interpretation will obviously be done afterwards. The big advantage of the use of SAR data is that it might support more effective and also efficient use of Earth observation, and the human resources involved.

Repeated imagery already exists for some of these areas. They can be used for test purposes, and the applications of interest includes forest degradation and re-growth, but also emergency response and damage assessment as well as urban sprawl, environmental damage and validation activities and trials ongoing. I think I'm run through my time. Thank you for now.

Brian Milakowski (WWF, Russia)

"Detection and Validation of Logging Activity using Radarsat-2 in Southern Khabarovsk Krai"
Part B: Background and Validation

Thank you. My name is Brian Milakovsky, I'm the Forest Projects Coordinator at the Amur branch of WWF Russia. We had the great opportunity to collaborate with Marco Van Der Kooij of this Radarsat change analysis in the south of Khabarovsky Krai, this being a portion of Rayon imeni Lazo, Lazo county of southern Khabarovsky Krai. I need to say that this project would have been impossible without great help from the Khabarovsky Krai Forest Department and specially the Forest Control Department which gave access to information about legal and illegal timber harvesting in the study area. Very quickly I just want to say why our organization, WWF Russia was very interested to participate this project. Korean pine-broadleaf forests of Primorsky province, the Jewish Autonomous province in southern Khabarovsk province are biodiversity hot spots in Russia, and are significantly threatened by unsustainable and illegal forest use that exists parallel to legal forest use. Since 2008 our organization has been attempting to use high-resolution optical images to monitor forest management activities including illegal logging. I can say, with only limited success because of the great difficulties of detecting illegal selective logging, not clear-cutting. But the removing of individual high-quality trees from mixed stands is extremely difficult. I think many specialists here will appreciate that. So we were very excited for the opportunity to work with Marco Van Der Kooij on the use of Radarsat imagery – Radarsat data as a potential new approach to detecting selective logging in complex mixed species forests. Very brief a bit of context about southern Khabarovsky Krai. The regime of forest use here. Legal forest use here is carried out by private companies that receive 25 to 49-year leases to conduct timber harvesting on government forest lands.

Also in unleased forests some forest tending activities take place, I mean by this "rubki uhoda", "sanitarnie rubki", these kinds of harvest that can take place in unleased forest, such as Riperian buffer, pine nut harvesting zones. In certain forest types such as spruce-fir or birch-aspen forest, clear-cutting is permitted and that is fairly easy to observe and monitor this with remote sensing. In the biologically rich Korean pine-broadleaf forests, only selection harvesting is allowed. And as I said there has been a great challenge to monitor that activity. It needs to be pointed out that in southern Khabarovsky Krai as well as in neighboring territories such as Primorsky Krai there is a crisis of illegal logging. According to an analysis carried out by our organization, two times more Mongolian oak, which is the most valuable hardwood species in the region, two times more with harvested for export in 2010, than was permitted for harvest by the government. 50% of the export of the oak is illegal. We believe the world crisis here is entirely appropriate. Lazo county, Rayon imeni Lazo of southern Khabarovsky Krai is the hot spot of illegal logging in that province. More that 45% of the volume of illegal logging recorded across the entire

province, was recorded in that one county which makes up only a few percentage points of the total area. This is wide-spread, low-intensity removal of single high-value hardwood trees. I'll show you some examples here. So again, this is now for instance the kind of de-forestation that we've been seeing on the images of the Brazil today. This is targeted removal of the highest-quality, highest-value trees from mixed stands. The economic and ecological impact of this logging is vastly out of proportion to the volume. A relatively small volume is removed, but it is the highest value trees performing the greatest ecological benefit, such as large nut producing – oak and pine. So, it's a relatively small volume removed with a very large ecological and economic impact, unfortunately. As you can see, such trees as this.

Korean pine has been banned for commercial logging since 2010. However in the study are we worked with some level of illegal logging of the species has continued. So as you can see, not large scale illegal clear-cutting, but illegal selective logging removing relatively small number of trees. Just for comparison, these are legal logging sites within the same study area. I think you can imagine for GIS specialists how much it is easier to detect something like this from space than smaller scale harvest such as this. That's been our challenge. Now we'll discuss the project we conducted with Marco Van der Kooij. He provided change analysis for this study area in southern Khabarovsky Krai. These are forest leases. If you just see grey – those forests are unleased, bluish color is timber-leases generally for 49 years. We received information about legal and illegal logging that had occurred in the study area in the period 2011-2012, which is the period when Marco conducted change analysis, from the Forest Control Division of the Khabarovsk Province Forest Department. They analyzed documents such as these and gave us a list of those places where the legal logging was committed and also where they have detected illegal logging.

Our specialists who work in that region were able to provide some very pin-point data about where illegal logging is taking place including points, stumps of illegally logged trees, which is very good verifying this data. Something very important to point out here – you can see the red polygons of permitted logging sites, the white is change detected by Marco, which we are hypothetically presuming right now to be logging. A very large overlap between what was detected and areas that where logging with permitted in 2011 and 2012. Like I said, a majority of logging detected in the change analysis, was on sites where logging was permitted in those 2 years. It's about 75%, which is a very good first indicator of the ability to detect logging change with Radarsat change analysis. About 69% of those areas where logging was permitted, had change detected on them. This is because timber leaseholders after ask for greater area to log than they actually will log in a year. So the fact is that only 69% of the permitted sites showed logging is not surprising. We believe almost all of the legal logging that occurred on this territory during that period was detected my Marco. Those legal sites with no-logging committed, were probably simply not logged, but we are in the process of checking that in the field.

It's a little bit difficult to say exactly how accurate we were because no one can give a perfect figure for how much illegal logging took place in the study area. We can't know about illegal logging that no one has yet detected. However, thanks to Marco's analysis, we have discovered many areas that are worth investigating as potential illegal logging sites. Potential, I need to point out – we cannot call them illegal logging until they've been verified on the ground. Here is simply just an example of the overlap. Red here is detected change, blue is permitted logging sites – so, fairly high level of overlap, as I said, about 75%.

Here's an example. This is a composite image that Marco made, showing change from the leaf-on season of 2011 to the leaf-on season 2012. What appears like holes in the uniform landscape is timber harvesting. The blue here are the outlines of areas, where logging was permitted in 2011 or 2012. So here is a fine example of timber harvesting taking place entirely within permitted boundaries. However we also detected what appears to be potential illegal logging sites where change detected in Marco's analysis does not line up with permitted logging sites. We see various things here. Both partial overlap where a legal logging site is visible and change is visible there as well, but they don't overlap perfectly. Some of the change takes place outside of the permitted area. We call this 'strain', beyond the boundaries. Some logging sites that are simply entirely outside of permitted areas were also detected, or change was detected - we are now confirming in the field if there indeed was logging. Also a large amount of logging was detected in unleased forests. We don't yet have information about legal logging in unleased forests. We are in the process of receiving that information right now. That is the contracts for the state logging enterprises. Here is an example that shows a few of those phenomena I was talking about. You see here the blue is permitted logging sites – a large complex of logging here was permitted in 2012, and the timber leaseholder carried out all of that logging, but here is the potential area of strain beyond the legal boundaries. And here potentially is a logging site entirely outside of the boundaries. If we presume that this is logging, which would be extremely logical, since the logging there was permitted here in 2012, then it's very difficult to interpret this is anything different than logging, but no logging was permitted there. So this is a prime candidate for a field check. Here is a very interesting situation, quite similar. Legal logging sites, small legal clear-cuts. We looked at the forest inventory, for the information in this area. These are small forest clear-cuts permitted in aspen forests where clear-cutting is permitted. No logging was permitted here. This is a Korean pine broad-leaf forest. We believe that what may be happening here is straying into more valuable forest type, after those valuable hardwood species without permission. This is another example of a potential illegal logging site entirely outside the boundaries. Here we may be looking at low-density logging outside the boundaries, which doesn't show up as such a strong signal. Field checking will give us some idea if that's indeed what we're seeing here. Here is a little bit more logging outside the boundaries, in our interpretation. Last thing I'd like to say is that what we seem to have potentially detected is a significant amount of straying or small unpermitted logging sites near to legal logging sites. This is a very common strategy for timber theft in the region, because conducting illegal logging near a legal logging site reduces suspicion. It means that nobody wonders why there is logging equipment and logging trucks in that area. So it's a very low-risk way to steal timber. However, we detected a relatively small amount of illegal logging completely separate from legal areas. In the experience of our specialists there will be some illegal logging in those areas, very low intensity theft of individual valuable trees. If we could push this methodology farther to detect that kind of illegal logging it will be even more valuable than it already is, for law enforcement. Here we see a very easily detected logging site, but very difficult to interpret anything here. However, our specialists collected GPS points on the stumps of illegally logged trees – so we have very precise data about where the illegal logging took place, the number was here. If we look very carefully we can indeed potentially see an area of somewhat lighter, brighter pixels. The next step of our project will be attempting to understand whether we can indeed interpret that as forest change that would only be possible in the next step of our project which involves field checking. Just want to point out – this kind of harvesting individual large valuable trees producing a relatively small canapé gap as you see here lit up – so a major challenge is detect from space. However be

believe we're getting close to that with Radarsat change analysis. The next steps right now are preventing forest rangers are conducting field checking, again, with great assistance from Khabarovsky Krai, Provincial Forest Department. We really need to determine the threshold of detection the logging intensity that we can detect using Radarsat. Let us understand what kind of illegal logging will be possible to detect, which is very important for practical application of this. And that is the next stage of our project that we will be beginning in the near future. Thank you very much, one word – I think it is because of the major potential of the Radarsat – 2 change detection analysis for detecting selective logging in mixed forests, which has been very difficult to do with optical imagery, I think it is highly worthwhile assessing the possibility of systematic acquisition of Radarsat data for the Far-Eastern region. Thank you very much.

Pang Yong, Institute of Forest Resource Information Techniques, Academy of Forestry, China

"Forest change detection and biomass mapping in the Greater Mekong Subregion (GMS): results from pilot sites"

Forest monitoring is important for the estimation and evaluation of the state of forest resources, carbon sequestration, and the results of forest program implementation. It provides a key source of information used to for the crackdown on illegal logging, forest fire monitoring and early warning for forest degradation, the reduction of deforestation, and the improvement of forest quality. Also, forest monitoring to support sustainable forest resources management can provide the earth observation data and technical support needed by countries to effectively fulfill their obligations arising from international environmental agreements (e.g., United Nations Framework Convention on Climate Change.

The area of the GMS and Malaysia project ranges from 92.2° to 119.3° east longitude and 0.8° to 29.2° north latitude, with total land area of 317,242,000 ha and total population of 348 million. It includes Cambodia, the People's Republic of China (Yunnan province and Guangxi province), Lao People's Democratic Republic, Malaysia, Myanmar, Thailand, and Viet Nam. The total forest area is 148,128,000 ha reported by Forest Resources Assessment 2010.

The project area has a diverse geographic landscape including massifs, plateaus and limestone karsts, lowlands, fertile floodplains and deltas, forests (evergreen andsemi-evergreen, deciduous, dipterocarp, mangroves and swamp), and grasslands. The region's geographic variety and consequent variety of climatic zones supports significant biodiversity, with more than 1068 new species discovered during the last ten years. The geographic region encapsulates 16 of the World Wild Fund for Nature (WWF) Global 200 Eco regions. The region's biodiversity is ranked as a top-five most threatened hotspot by Conservation International. High forest coverage and rich forest resource result in large amounts of wood export from this region. The WWF states that the region is particularly vulnerable to global climate change.

The primary goal of the project is to estimate forest coverage and above-ground carbon stock in the GMS and Malaysia. The approach will integrate multi-sources remote sensing data, ground measurements and other thematic geographic data. The outcomes of this project will help to clarify how, when and where the forests changes in the GMS and Malaysia. The approach will determine forest coverage and biomass estimates through the following specific objectives:

i). Develop pan-GMS and Malaysia forest cover mapping techniques to monitor forest cover type changes in the region, using both optical and radar remote sensing techniques.

ii). Develop a framework for forest carbon estimation using ground measurements, spacebornelidar sampling data and imaged remote sensing data.

iii). Produce forest cover maps of 2005, and 2010 at 30-50m spatial resolution and forest cover maps annually from 2005 to 2010 at 300-500m spatial resolution.
iv). Produce a forest carbon storage map for 2005 in the GMS and Malaysia at 300-500m spatial resolution.

A project steering committee comprised of national representatives and international experts will be established. This committee will communicate and make top-level design for the whole project. One recommended national representative was recommended. Milestones and main deliverables will be discussed by this steering committee.
Institutes with intensive remote sensing technologies and forest resources will be organized as an algorithm development and training group. The common data processing and forest information extraction methods will be explored and developed. Technical progress and innovative methodologies will be regularly synthesized and feed to support operational data processing through training workshops and progress meetings.

The reference database and middle resolution forest mapping activities will be carried out by each country's organizations. Annual forest map of coarse resolution and forest carbon storage map will be done by the methods development team. After each forest coverage and carbon storage map generated, they will be evaluated by a validation team. Then the steering committee will do analysis with other related information.
The working packages are as

WP1: Project design and management (including training)
WP2: Methods development (including Algorithms)
WP3: Remote sensing data acquisition and pre-processing
WP4: Ground truth database development (compiling existing data)
WP5: Mid-resolution forest mapping product
WP6: Coarse-resolution forest mapping product
WP7: Forest carbon storage mapping product
WP8: Reporting and dissemination

WP1, WP2, WP7 and WP8 will lead by the Chinese Academy of Forestry, GOFC-GOLD and the University of Maryland with inputs from involved countries. The data of WP4 will be distributed in each country but serve for this project. WP4, WP5, WP6 and WP7 will be carried out by the national forest institute or university of each country in the GMS and Malaysia. Relevant forest mapping techniques and software tools will be developed into a streamlined production system in WP1 and WP2. And the production system will be distributed to the team of each country through training courses/workshops. The data will be distributed to each team, who will do the mapping and validation by themselves. Classification and mapping activities are proposed to be done by each county's team for their country task.

1st PHASE RESULTS

1) Remote Sensing Database. We have built remote sensing database including coarse resolution remote sensing data for the whole region, mid-resolution data of 2005 and 2010 for whole region, fine resolution data for 16 test sites of 2010 circaand space borne Lidar data for whole region. For coarse resolution remote sensing data, the MOD09A1 and MOD13Q1 data products were acquired.For mid-resolution data, we collected Landsat TM/ETM+ data and HJ CCD data of 2005 and 2010 with contributions from USGS, UMD, and some remote sensing agencies in China.RapidEyedata with 5 m resolution is used as high resolution in this project for detail mapping and validation purpose. GLAS Level-1A

altimetry data (GLA01), level-1B waveform parameterization data (GLA05) and level-2 land altimetry product (GLA14) were used to estimate forest height and biomass. The GLA01 data include the transmitted and received waveform from the altimeter. The GLA05 data contain waveform-based range corrections and surface characteristics. The GLA14 data contain the land elevation and land elevation distribution data.

2) Coarse-resolution forest mapping. In this research, time series MODIS NDVI data from 2005 wereusedfor forestcover mapping of the Greater Mekong Subregion and Malaysia. In order to reduce cloud and other noise effects, Harmonic Analysis of Time Series (HANTS) was performedon the time series MODIS NDVI image. To distinguish ambiguous landcover classes, hierarchical mapping and decision tree classification were performed for land cover classification with the support of phenological features of vegetation.

3) Mid-resolution forest mapping. Using TM orthorectification images to make geometric correction, HJ-1 CCD satellite optical remote sensing data over Mengla, China and Phongsail, Lao PDR is acquired with the date of this image is January 4, 2010. Using band 3 and 4 of the image, we generated NDVI diagram to distinguish between vegetation and non-vegetation. Mask non-vegetation and produce vegetation image,the classification of supervised result is shown in Figure 4. Using the ground truth data, this image classification results are tested, the overall accuracy is 87.6%. Mixed forests and broad-leaved forest, shrub and forest occurs the higher proportion of errors.

4) Forest disturbance mapping. Landsat data has 30m spatial resolution and its historical images can be free acquired from the United States Geological Survey (USGS) website. Forest disturbance in Landsat image has a series of spectra-time attributes which are different from non-forest and not disturbed forest (Huang et al., 2008 & 2010). Based on these assumptions, we adapted Vegetation Change Tracker (VCT)developed by Huang et al. (2010) to this area. The forest training samples can be detected automatically. Then the integrated forest index (IFI) was calculated. Themulti-temporal IFI images were investigated using time series analysis. The forest disturbance history was re-built.

5) Forest biomass mapping. Using maximum entropy method, combined with ICEsatGLAS data and ENVISAT MERIS, EOS MODIS optical data, we generate the distribution of forest biomass for the Greater Mekong Subregion as shown in Figure 6. This estimation is based on the ground reference data acquired in Yunnan province of China.

To increase forest cover and improve forest quality are main objectives of the APFNet. The APFNet Project “Forest Cover and Carbon Mapping in the Greater Mekong Subregion and Malaysia” is under this umbrella. The forest coverage map from this project will reflect where and when the increased forests are. Since the inception in September of 2011, remote sensing database were built and some reference data were collected. From some first results from pilot test sites, the objectives of this project are feasible. With efforts of each organization and participant, the ground measurements and mapping activities are undergoing. More information about this project is available at http://www.apfrm.net.

Vladimir Manovich, Roslesinforg, Russia

"Using Materials of the Earth's Remote Sensing by Conducting State Forest Inventory in Russia"

Good afternoon dear colleagues. I realize you are tired by now. It goes without saying, forests on our planet play an important role. Actually, in all processes, specifically in the bio-environment, if you look at Russia, it becomes aptly clear, you can hardly think about forest change detection without using present day technologies.

In the beginning, I would like to say a couple of words about our organization. Structurally speaking, we are reporting to the Federal Forest Agency, we are a state-run organization and the area of our activities you can see everything on this slide. We have thirty-five branches throughout the country all the way from west to east, and we are providing services which are needed. Government is interested, business is interested, and so on. Our services may be divided into two parts.

First of all, it is a part that belongs to the interests of all national agencies. So this is work on cadastre, computing services for environmental agencies and international activities. The second part of our services includes services for a variety of market players – forest planning, design work, geodetic work, and numerous survey works. I have to tell you that we understand alright the importance of monitoring work, and Rosleskhoz pays serious attention to this process.

On this slide, you can see the scope of materials, the scope in terms of reference, and if you think of the entire scope of work, it is 150 to 170 million hectares, and we increased resolution from five up to two meters to make sure that the quality of materials that we generate gets better and better.

Now, speaking about specific space systems that we use in our every-day lives. As you can see on this slide, we have migrated to higher resolution imagery from SPOT, and we have been working quite successfully starting in 2005 with ScanEx. And, apart from ScanEx, we work with Sovzond. And on this slide you can see that we use dimension systems quite alright.

Now, very briefly, in thinking about our technologies, on this slide you can see the process related scheme. Just to explain in a very simple way. So, speaking about national inventories, there is agreed statistics, and in Russia we have been working with maps for 1 billion, 200 million hectares. So we use available maps already alright. We understand all maps are different, and some are not quite accurate. But thanks to space images, if you look on the right-hand side, we have high-resolution images and they're quite useful. They contain a lot of details. So as of today, we work quite efficiently using applied space technologies.

Another important thing for us, starting in 2005, Rosleskhoz has restarted monitoring activities and we think it is very important. And as you can see in the table, we have been

monitoring continuously what's happening with the logging, how well it's interrelated with the Russian forestry code. So, this table gives you an idea of the scope of our activities.
As for the technology works, it is along this slide. So this is a real-life situation. Again, we have grids alright, we have basic information, then we add an additional layer of requirements, documents that clearly show which areas are meant for catalogs. So, of course, there are primitive terms, but this is what happens in real life. And this is an example of composites, and what's actually happening.
And on this image you can see more examples of detected violations in two Russian constituents (federal subregions). Basically the black area is the area from where timber was stolen. And within the latest period we have managed to detect losses to the tune of 8.0 to 8.5 billion Russian rubles a year.
And, to conclude, just several slides explaining our perception of the remote sensing role for forest planning. As a matter of fact, this is the methodology which is included in our letter of instructions. So after high-quality remote sensing data appeared, this opportunity was implemented. I mean primarily the automated image recognition method which uses high resolution data. Also processing of stereoscopic images – there is software which recently appeared on the market which allows us to do it. So, there is also a combination of different methods when a combination of optical and radar band images.
The method of automated image recognition is presented here. This method was implemented only after the software became available on the market. Stereoscopic images, here I must tell you that already in the Soviet times, we had the methods, the techniques. But now, the methods became much more sophisticated.
Now the next slide shows a radar image. Here, the task was to achieve a breakthrough in three years time, using the experience of our international colleagues. So, in principle, I want to say in conclusion that our company took part in this conference with great interest. There were many impressive presentations. Our company is ready to take part in various projects of forest inventory and forest resource management which use remote sensing data in Pacific region countries.

Alberto Lopez, Digital Globe, USA

"Smart Forest Management techniques and support to the UN-REDD programme using WorldView-2 Satellite Data"

Because of the audience is full of experts in all the remote sensing industry, I'll try to make quick presentation of what we have in our constellation and how we're addressing the products and services related to forests in the future. And what is a big change in our strategy to work with partners in vertical segments. I will concentrate specifically on how we're working on the REDD+ programme and we're getting very good results that we will show you farther. You know the history probably of all the satellite sensors and we've been since 1992 as a company operating, but first operating commercial digital satellites was QuickBird in 2002, and where was the first sub-meter satellite into space. So we are concentrating on the very high resolution space. Our three satellites are given the resolutions that are 1 meter. For most of you in the forest, you'll be always considering this is probably a very expensive source of data. What we're saying is that's not the case – the case is that we didn't reach the economies of scale. I think we are now in that moment and we have to take an advantage of it. Since 2009 that we have operating WorldView-2 we're accounting not only with just a satellite remote sensing technology, but we have full a constellation. So I will talk about that in detail. For most of you who have been living through the evolution of remote sensing, we are today in the 4th era, what we call the 'Analytics'. The problem is not anymore the pixel, let's forget about the pixel. We are concentrated on "what it is in pixel"? It's not anymore just data, it's not even information. We are on the service to the insight. What we are concentrating on is what are the problems, the vertical problems, how we can contribute to solve it. Are we going to be the unique and only solution? Definitely not. But we are trying to bring the difference to make this viable in all senses. So, I'm not going to talk about what is better – optical, radar, lidar, and probably it will be the combination of all those. And that actually is what we are going to be showing. For those who are not so familiar, the 3 satellites are available today – QuickBird, 60cm-pixel resolution; WorldView-1, 41cm-pixel resolution resampled to 50cm-pixel resolution, and WorldView-2. You can see in this slide – we'll be launching by 2014 our next satellite WorldView-3.

I will concentrate in the presentation on 3 main aspects that made us different to everybody else to bring us at most of the business the last-mile improvement that helps us to deliver the added value required to make this viable in larger scale and in massive application. The first thing is that we are providing huge capacity due to the constellation and the agility – this is one of the aspects. Second aspect to talk about is, in particular, affecting the WorldView generation, which is the gyros technology that we are implementing in the satellites, allows us to do stereo pairs capture, so we can collect stereo from the satellite and that gives a big difference in terms of calculation of volumetrics and real accurate DTM and DSM models. The third part will be related with the

8-Band technology, or Multiband technology that we are providing today with the WorldView-2 which includes several bands that are crucial for the forest analytics. And finally, I wanted to give you a very brief description of what is going to be WorldView-3. It will be launched with 31-cm panchromatic resolution. I want you to point out on the multispectral resolutions - 1.24 meters. It will give you the idea of what we can do with that and you'll see what we're doing today with WorldVide-2 you can imagine how this is going to be evolving. We are including 17 bands in total. On top of the 8-Bands we will add short infrared new 8 bands in order to gather specific segments like elements you can find in the soil, in mining industry, oil & gas, but this definitely a new step forward. Today we have the revisit time of 1.1 days, so every 26 hours we can repeat a capture. And that for WorldView-3 will go on beyond, it will be in the range below the day.
The collection you see is huge amount of km2 captures, but let me move forward. This is the spectrum that we will have on WorldView-3 you see on the right side. We've been selecting 8 specific bands that are going to be used for the specific markets that you see down in the slide. It is a pity that you cannot see all the details but basically you see there a couple of segments – one is agricultural and forest where this will give us much more data than we can really accurately use. Many of you have been using hyperspectral information from airplanes. The trick is not in how many bands you can have, it's just if you're able to manage proper bands for the proper work and how you do this analysis. As we're talking about huge amount of data processing, we're talking about the biggest library available. Today we have 2.8 billion km2 stored. We are growing every day at 2.8 million km2, that's around the size of Mexico, every day. That's giving us an idea of where we are moving forward. We are in the Cloud era, Cloud generation, Cloud processing, so we're not talking anymore about small areas, we're talking about countries, we're talking about huge amount areas, and we're talking about a huge amount of computer processing capabilities. This is where we are moving forward. This is an example of what we have captured in the month of June, in 30 days we captured these orange areas and that gives you the idea of where we are moving forward. Obviously you know how all this works. You used to be familiar with our full ground stations, downloading in a range of 1.1 million km2. Since the end of 2010 we started opening more ground stations and increasing this capability, so in last 2 years we are moving to the range of 2.8 million km2. So in 2 years we more than double, and we will end up by next year having a total of 12 ground stations. So we combine all that. It's not any more a question of, what we used to call in the industry 'spaghetti', anymore, we are talking about real coverage and real monitoring capabilities. I've been showing you some videos about how it all works, for those of you who are more experts on the field, and not so much remote sensing experts. I will go forward to different factor that I wanted to explain, that is the Control Moment Gyros. This unique technology is allowing us to work on a slew time, below 10 seconds. This scene example in Chinese Taipei with QuickBird, that's the kind of capture you can have but if we see the WorldView, the amount can be multiplied by 7 easily just because of the agility of the satellite. That gives us the major difference on capture, not only for the mission planning and contiguous capture that could be in the range that multiplies by 3-4 the capabilities of the standard or the old generation gyros, but also the possibility to have stereo or even triple-stereo captures. We've been even making some examples where we had, just to show how much we could get, 28 images within 2.5 minutes in the same point. Obviously that in the commercial point of view, if customer is willing to pay so much, then definitely we will do it, but that is not the standard product. But we can talk about stereo and triple stereo – that's something we're moving in. The second feature I want to show is the 8-Bands. I know that many people have been talking about the difficulties for the optical satellites to capture

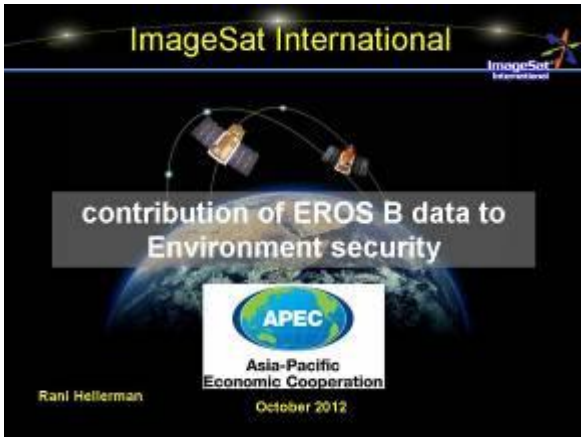
cloudy areas and obviously we are not going to be here eliminating the clouds, but definitely we are working around the clouds.
Here I'm showing the images about Bogota which is for all of you one of the areas which was more difficult to capture imagery because of the clouds, but definitely with our revisit time and with our capacity we're able to have multiple collections in the world, in the most of the places. So that's not anymore a huge problem as it used to be. So here are the details. Let me go into the last aspect of differentiation that I want to concentrate, because that would be the foundations of what we are doing in the REDD+ programme. And that is the 8-Bands. In this sense, as you can see down in the image we are including Coastal band, which is allowing us to do things like bathymetry from satellites, and it's already one of the verticals we're delivering with partners' solution, but we're concentrating on this in forest, in particular – yellow and red edge bands. That will show us very unique possibilities. Here you have an example of summary of what kind of applications we are doing with the bands.
Red edge is a capability that we're using in order to monitor for example chlorophyll A plus B activity in the forest, so this is allowing us to find out the strength of the plant, to differentiate definitely better on the activity of the plants, and also is giving us the chance to get a better classification to the level of the type of tree. So this is definitely a big difference because it's inferring absolutely in the calculation of carbon absorption as we will be able to see in the REDD+ programme. The second band I want to emphasize is the yellow band. In the yellow band we are able to detect distress we can see on the plant. Basically here we can be anticipating disease, anticipating what is the activity in the plant again. I'll get on very quick on this. As we are adding automatics in cloud working classifications, for example here you see Sochi where we were doing automatic classification of the different type of trees, and grass, and soil, or even man-made infrastructure at the pixel level, and this is fully automated, so basically it's giving us the chance to move to the next steps, so we are able to differentiate at the 3rd level which is the tree species, not as an aggregate of trees, but as the species. For example, as you could see before, we can differentiate from the Norway maple, from the Red Sunset maple, and so on. It's a very big difference in order to do very precise calculations. Let me focus now on the examples we've been working on. Several of you had been talking about the different methods and illegal logging and different other practices.
I'll go up very quick for that. In these forest inventories, where we have an area of interest, what we've been able to do is not only to identify the natural forest but also detect illegal logging with the very precise view at the 50-cm pixel level, and even detect a substitution of natural forest for palm plantation, which in terms of REDD+ is one of the biggest frauds that we can find – just substituting the distortion from natural forest which obviously has got much better carbon efficiency than palm plantation. But obviously the agricultural activity over there is obviously very interesting on that. On the down left you see how we've been working with the several bands able to get here, like you can see on this example. We are able to detect at the country level and different species. For example, here we're observing the near infrared, red edge and red bands. Combining different type of bands we'll be able to detect different activities. In this monitoring area, in The Chihuahua, Mexico you'll see 6 areas, you will observe very different forest configuration. This is the number 1 and number 2 is absolutely different. Here you see small trees areas. Even we are detecting infections, like the beetle infection on the trees, because of the yellow and red edge bands analysis at the tree level as you can see. Or even find out all the plant orchard areas, so we can definitely see how the forest is being reconstructed, how the forest is being recovering after fires or planned interventions. With all that, we're

working with several partners. I will show you the results we've currently taking on with one of the partners, GMV, that we are doing in Mozambique. We are talking about huge area, but I want to emphasize on something that this morning Lars was talking in the REDD+ we're not only talking about illegal logging but we are talking about the conservation, the constant monitoring, so are we going to be able to monitor over the years, yearly by yearly, and calculate this kind of amount of massive areas of carbon, and preserve, etc?
Yes. We're working on the certification processes and working also not only on the biomass calculation, something that obviously would be right there, in case you're working on the L-band it will be obviously find a better solution, but also we are going to be able to see the health of the trees, of the species, and I think this is a very important point that we've focusing on. As you see it's not only the REDD monitor review and verification processes that we work on, but also, what's most important, on the forest management. We are not focusing on projects founded by specific government, etc. - they have an inventory only. We're working on really sustainability and management of forest. So we've working with paper companies, we're working with companies that really have an influence on the forest, and where we can have an initiative to keep the biodiversity and the health, so that we can really monitor what's going on in the forest. Obviously you know all the process how we can go from land use to the forest verification, and I want to emphasize that on top of what you already said, for example Brian talked before about illegal logging, and yes, we can compliment the kind of work we've been doing by having a better definition of that avoiding almost 94% of the cost of the ground truth, of the teams working on the field, which is a huge reduction of cost.
Definitely we're working in this process implementing what mister Jong and our representative and Vladimir said before in Roslesinforg, including lidar, as part of it, so basically we believe that the similar process of what we are doing now in Mozambique case study, where we're presenting a PDD which is a project definition for the REDD+, to move from what we know today about MDL projects, which is the very small range of projects, into a wide and extend national project. In case of Mozambique we are talking about 300,000 km2, so we're talking about instead of measuring tons of carbon, we are taking about millions of tons of carbon, that's the process. Basically you have a work on the field to characterize the specific type of ground truth data, and we can expand at the certain level infeasible from the monitoring point of view with lidar. Then we can have the correlation and get a very accurate result with our satellite solution. In that sense, we are able to do a crown-tree determination and counting, we're working on the estimation of the biomass and the transformation of that into carbon absorption. This is for example an idea of how the crown-tree is working. Here you see counted by species the number of trees – the full size and even the timber dimension of the chest level. With all this definitely you can infer the biomass, but this is the difference. Here is what we can see at the crown level and obviously with automatic process that we do, you could count all the trees. So there we go, this is something you are experts on that. And this is the process we are following up. In summary, here you see that we have an area by the possibility of doing a stereo we have the height of the trees, we can have the volumetrics, with the 8-Bands species determination we can determine what every crown is. So, you see on the right, when we are qualifying the trees, but also we're qualifying the biomass index and the type of tree level so that it could be transformed into carbon analytics and carbon result. That's an example. And in the case study I'm showing you one small area that we processed automatically. This area is 1,900 km2 out of these 300,000 km2 that we've captured just for the work. This is the kind of data, it was available, so basically there are 37 countries in the world that could be potential beneficiaries of the REDD+ activities.

And this is what you can find all across the tropical areas – very old and inaccurate information, but even with that, even without ground truth we implemented processes to determine the density on forest-non forest by including not only the NDVI index but also the soil index, so then we can have maps of densities that we can use with EVI, for example, processing to get biomass analysis that for planning we could get very good results on where you have dense, open or sparse areas. As you can see here, and in this area we found all different type of, and if you match it with the real imagery you see that this automatic work is matching perfectly. So that is a proven process that is really working and it also gives us the results of, for example here you go out high carbon absorption of high carbon sequestration areas, medium or low, but we could do obviously more classification but this is a good indicator for the government, in this case for Mozambique, to prevent and protect very high value carbon areas and put emphasis over there for that is specific. And that's giving a huge value in terms of how that could be transforming to credits. In summary, yes, we are moving 16 times farther in terms of resolution but it's not only that. It's also including the 8-Bands without ground truth and without lidar we are in ranges of 80%-plus accuracy in terms of carbon accounting, in mass automatic carbon accounting. Obviously if we include just ground field test and some lidar in the small areas we can correlate and get even beyond 90% which is far enough for that kind of REDD+ monitoring because this is something that we definitely can monitor each year. Thank you very much. That was my presentation. We are concentrating on visualizing a better world.

Rani Hellerman, Imagesat International, Izrael

"Contribution of EROS B data to Environment security"



Good afternoon. In this difficult hour of the day I will try to keep you awake. First of all I will tell you who we are. As you already know and already saw the demand for the high-resolution data is growing the commercial operators playing a very important role in this area. The historic use of this data – it all starts with the military. As you know the very high-resolution data started only for military and now it moves to the civilian market and more and more applications, as you can see and as you saw here today, develop for the civilian market. Who we are? We are ImageSat International, we are the owner and operator of EROS satellites, we are providing our services and products for defense and also for civilian market. Right now we have 2 satellites in space. EROS A was launched in 2000, 1.9-metre resolution and it will last until 2014 or 2015. The EROS B, 70 cm resolution was launched in 2006 and will remain in space at least until 2020. Both of them are panchromatic, no color in these satellites. The satellites are working mainly in real-time direct download to ground stations. The agility and the accuracy – I will talk about it very soon. The data is in high quality, the resolution is 70 cm of EROS B as I said. It's good accuracy and good agility of the satellite to collect data. The ground segment. We have few options to deliver ground segment. We have our own kit of ground segment and we have the ability to deliver also ScanEx ground station which fully supports the EROS satellites. It means that the UniScan ground station can download directly processed EROS data. If we are talking about the building blocks, we have the satellites, spacecraft, we have the ground control station and we have the ground receiving station. Our main advantage in the market is that we can close this loop to get there in local, in the customer sites. It means the customer has the ability to make the mission planning, to make the programming, to task the satellite, to upload the commons, and to receive the data in real time. In order to make you wake you up let's listen to some music, so here is how it works. We start with the mission planning. In this case the customer operators are doing the mission planning, they are doing the programming, they have the orbits of course, they are choosing which targets to take, and they are doing that about 20 minutes before the pass. So once the satellite is rising in the ground station the commons that just prepared are uploading to the satellite through the antenna and immediately, few seconds afterwards, the data is downloaded directly to the ground station. Here you can see the real-time download, you see the quick look here on the screen to see whether everything is ok, and then immediately the data is going to the processing system, and the processing is done automatically and the high-quality data is processed and created automatically in the station. So it means from mission planning and programming to full resolution data in your hands the whole cycle is less than 30 minutes. For many applications that you need the real-time acquisition and you need the real-time data download for many applications. If we are talking about applications, these are the applications that everyone knows already

for satellite imagery, so we skip the military and defense and we go to the environment security. We'll go through the images and we see some examples of how does it work. Here's the music again… One can think that the panchromatic data cannot be used for agriculture but in many cases you can use also from 0.5 to 0.9 micron data for agriculture, for looking at the fields, for making measurements, to see irrigation results. Even for agriculture, even it's not a straightforward you can use the panchromatic data. For oil, we talk about monitoring the oil fields, oil spills, pipeline monitoring… These are all images of EROS B. Most of them downloaded to the stations in Russia… Oil spills…Pipeline monitoring. And this is very, very interesting. ScanEx has made a research about breeding zones of these animals. It's amazing how can you see and make a research from space on these breeding zones to protect them while they're breeding the babies. Ice and flooding. Ice breaks. You see the situation of the ice, and then the maps of the results. Blocking roads. And all this data as I said you can see in real-time. This is a firing forest. Counting trees. Even with panchromatic data it is able to count how many trees are there. Natural disaster for emergency. Flooding – before and after. Monitoring change detection of urban area, mainly to find illegal buildings. We have many projects like this in Europe. And monitoring also infrastructures, covering the area here with EROS B data. Updating maps, without the music. And of course creating the GIS databases with all this information. To summarize that, and I want to make it short because today you've heard a lot about the operators and the capabilities of the satellites. Just to summarize the approved performance of 70 cm satellites in space and as I said, the most important thing here is the ability, and the ScanEx very soon will be able to make their own programming, their own mission planning, their own tasking – everything will be done here. Nothing to send to our main ground stations, but from here they will be able to control the satellites, to control the camera of satellite, to make the programming, and whole imaging cycle will be taking less than half an hour. This is the main thing here and we are the owner and the operator of the satellites, and we have the flexibility to find and to create any type of business model that makes sense to us and to the customers. That's it. It was short, but I hope you liked the music.

Evgeny Lepeshkin, Evgeny Chuvasov, Amur branch of WWF Russia

"Forest climate projects in the Russian Far East: potential for sustainable development"

The participants will have two speakers on the subject, and the topic today is forest climate projects in the Russian Far East. The projects we will be referring to today deal with applied space technologies, at least in passing. Of course we would like to use such technologies not in passing, but profoundly.

Okay, speaking about the key problem – if you look at the territory, this is the area for the Amur tiger, and at the same time we see the forest area reduced from six to three million hectares. It is a problem and Brian Milakowsky already mentioned it. I'll just mention a few key things like illegal logging and illegal hunting, killing of Amur tigers and killing other animals, and the forest fires. The results of illegal logging – great damage is produced and as a result, most valuable types of trees are cut out, and only the least valuable trees remain – ill trees in many cases.

Speaking about actual results of such logging activities – bio-diversity suffers, bio-mass suffers, the value of forests goes down, social functions also, plus changes in hydraulic regime.

What I'm talking is not the first project, my colleague will speak more on the first project, but my part is Cedar project, and a new methodology that we propose to use. The first method is use of a strictly protected natural areas or areas which are planned for a specific protection. We have quite a few such territories and, correspondingly, such areas will enjoy much higher status. The second approach is no-harvesting zones…sorry, I've forgotten to mention another thing. A project is being implemented in Jewish Autonomous Republic, Primorskiy Krai, and adjacent areas, and basically it is three Russian territories – I do not have much time. My colleague will make his part of the presentation. Corresponding parts of no-harvesting zones are taken specific care of.

Another thing is forests meant for industrial use. We have certification procedure. We have FSC certified areas which may become part of climatic projects. So these are forests that will change scenarios – no logging and such projects are important in terms of additionality – the so-called additionality. A small territory under the project is basically buffer zones of Ussuriysk nature reserve – *zakazhnik*. Its currently the territory leased by the Ussuriysk Academy of Economy. So they're working to fight forest degradation. They're implementing a number of training projects which are important for sustainable development of forestry.

And other projects comprise our work with lawmakers. An important part of course is forest monitoring, and we are facing a number of problems, problems which Brian Milakowsky already mentioned, and we hope that monitoring techniques will help us to fight illegal logging in restricted areas and we hope that we'll be able to display new approaches.

And another piece of work is at the political level. We are doing our best in order to justify corresponding mechanisms to enable implementation of climatic projects, plus replication of the Bikinsky forest project (we will talk about it later on) and other approaches that we use in the Cedar project. For this I would like to give the floor to my colleague - Evgeni. He will speak about the first project. It is a climate related project. It is in a very early stage so far.

Good afternoon, everybody. Bikinsky climatic project is basically the first forest project in Russia. The key objective is to preserve original forests in the Bikin River Valley. Here on this slide you can see the logos of our supporters, helpers and supporters. A few words about the value of Bikin Forests and why we have decided in favor of Bikin Forest. It is the biggest untouched forest of the people of Ugede and thrity-five tigers live within the territory, which is 1.5% of the tiger population.

Our project is divided into two stages. Stage one is financed by a German financial initiative. Project development and all actions, all steps are financed by the ministry. Here you can see a representative of the Ugede people. They are still very closely connected with nature the way they celebrate holidays. And this is their food reserves.

The project started with the procurement of required equipment and technical documentation. In other words, they were explained how to fish, and now they've studied angling, so to speak. Seventy-five million rubles all in all are to be used to protect nature, to fight illegal logging and illegal hunting. And in our opinion, this will help the aboriginals, plus internet and radio in the area will help to improve life quality.

As for project monitoring, we all understand how difficult it is to identify an insignificant amount of logging. So we used available monitoring techniques alright, and then we organized field inspections. And basically this is it. Thank you.

Dmitry Dobrynin, RDC ScanEx, Russia

"The peculiarities of different spatial resolution data processing in forest dynamic analysis"

Good afternoon dear colleagues. I am the very last to speak. What I would like to say in the very beginning – we have a lot of opportunities now to select materials, to select what we want. Today there's a lot of advertising, all market players are pretty active. But, there are not too many works devoted towards analysis, explaining how to process data, if we are dealing with data of various resolutions, more detail, less detail. So we all understand the importance of high-resolution images, and less detailed images are needed to select areas for subsequent, more detailed experiments. And on the other hand, it is extrapolation of the results obtained in the process of detailed study. So pretty often, our colleagues operating in remote sensing disregard what I've just said.

Nevertheless, let's give it a try. So basically, my presentation is an overview of low-resolution data and up to very high-resolution data. So basically, I will tell you just one word, the color, and you will understand everything for deciphering and data interpretation. While what we need is a good visualization technology. Results are still very important. So in such a way we compare dynamics and in Russia, this is a very sensitive point. If you take any forestry organization or forestry entity, you may collect the data, you may organize the data. But if you take a region, then it becomes quite problematic to evaluate data for the entire region. And this is why such remote sensing technologies are very valuable, in order to assess forestry in the region.

This is just an example. This is what we did for one NGO working on Kyoto, forest analysis of Kyoto locations. This is Altai area. Here you can see results of minimum processing of raster data, and you see colors green and red. So we'll say that forests are disappearing, but here the trend is quite the opposite. Of course, it's pretty young forest and the biomass is not very impressive. But still, this is what we have, and this is why we decided to implement such a model. This is the results of raster analysis shown in the red. There is obvious change over the last nine or ten years, and in wide, probable changes.

As to scale, maybe we are up to one-millionth. So how does the descriptive material work to select the detail area of interest? This example shows the trend which occurred between 1989 and 2011. So this is positive dynamics, how the pine forest regained the previously arable land.

This slide shows how spectral properties are combined with the structure and contextual characteristics to reconstruct the object. So this algorithm enables us to specify complex characteristics of lands where deforestation takes place. And we are also able to construct complex models of special detection and identify hot spots which are the primarily focus of our interest.

This is a typical example of Landsat imagery and SPOT-5 imagery without panchromatic images. So after image processing, geo-informatics processing plays a very important

role. So the change in special resolution affects this. It calls for the implementation of GIS-based processing algorithms.

This slide shows how the structure of logging is combined with wild fires. And this also shows positive dynamics of reforestation. This example shows operational control and modernization of forest maps. This is a specific example of a forest farm using a Landsat image with two infra-red and two visible channels. Our students performed the reconstruction of the area and created the map. Then we provided the verification onsite and we detected change in comparison with the old map.

This is not big news that we can use remote sensing images for mapping, because the forestation maps are quite outdated in this country. We need to create new maps, or renew the available information. This method can be used by a forest farm to extrapolate the maps for the large areas. High-resolution images can be quite useful. But, they take a lot of space on hard disk, and they require quite a lot of computer resources for processing. And they affect the kind of information that can be extracted. So sometimes the low-resolution images can provide certain advantages. It depends upon the task. The structure, first structure, is very important to us. We are not interested in small-scale heterogeneities, we are interested in large scales. So we come up with correlation algorithms which can take a lot of computing time, but they can produce certain results.

Using ultra-high-resolution images, we obtained new possibilities. We can perform taxation on the tree species level. We can detect individual trees using ultra-high-resolution images. This is an example of coniferous forest and the new growth. This is not sparse, this is dense forest. And this is a unique example of an algorithm that has been developed by ScanEx. It's a unique software, and now we are looking for partners who work in this area and who have the data on vegetation type, on tree species to conduct this kind of project.

We constructed potential boundaries of trees. We developed the model of radians, how the tree reflects light and we can detect the potential point of the tree trunk to verify the data. White spots, here you see white spots on the slides show the target model which here we detected the middle age birch trees that grow underneath the pine trees. So we can detect what is below the first layer of canopy.

Correspondingly, using iterative algorithm, we can provide classification of vegetation type of tree species. We can reconstruct the maps for taxation of forest species composition. Depending on the type of images that we use, the logic of image processing also changes. Many properties cannot be reconstructed at different angles. Our experts must have a good deal of experience to create this kind of a map. Our department, our lab, conducts research on new methods of reconstruction of tree species, vegetative cover.

This is an example of coniferous, dark coniferous forests on South Sakhalin. It was fifteen years ago, and beginning from this project, ScanEx opened the area of field verification. We also participated in these field trips to verify the results of our remote sensing algorithms. Thank you.

Marco van der Kooij, MDA, Canada

"New Large Area Monitoring Applications of Spaceborne SAR"

Thank you very much for coming in so early. So the title of my presentation is New Large Monitoring Applications of Space-born SAR. So there will be two main topics. One is a bit of a continuation of large area land application, really, using the radar as a tool of surveillance for large areas and to allow precise change detection. Yesterday we looked a little bit at the forest applications, and I'm going to try to show a little more of the other applications as well that are possible with similar methodology. First of all, I have to apologize, the examples are not as well worked out as yesterday. But I think the principle is to show the idea behind it, and maybe you get a feeling for what can be done. Of course the attempt here is to show specific applications and help in the Far East with specific benefits. So we've made an attempt to do that, but we're still a little bit early. The specific example is the Primoryi explosion for which we have optical and SAR imagery, and the work that I'm showing here was done by ScanEx, and I'm just showing the slides here. The same area has some maritime applications. Radarsat-2 has some strong capabilities for large area surveillance of the ocean as well. And so we will go through some general slides on ship detection and the detection of oil spills. And the examples that we will show will include examples done by ScanEx and for areas here in the Far East. And we might need a little bit of help from ScanEx people to help explain the background of some of those. 4:22 – So here just the quick few graphs of the image modes of Radarsat-2. And I know the screen is small and it's hard to, so I'm going to talk in general about it. The swath width, size of the images varies from about 10 to 20 kilometers for the highest resolution imagery, to about a 500 kilometer swath for the ScanSAR modes, which are used for maritime and ice applications. The higher resolution beam modes, which are called Spotlight, Ultra-Fine, Ultra-Fine Wide, they are typically used for small areas, small specific targets that are repeatedly observed for the purposes of interferometry or military applications. The modes in the center of this picture are typically approximate one hundred kilometers in size or larger, and they can be used for surveillance of land surfaces, similar to what we discussed yesterday. Some of these new modes are also suitable for maritime applications, and one of these modes is called Wide Fine, which is a ten meter resolution mode for a 150 kilometer swath. And as we will see, that mode is quite suitable for some specific higher resolution applications on the ocean surface.

First of all, we'll show just one specific example over land which relates to an area that is not in the Asia-Pacific. I could not find one quickly at hand. But recently there was an earthquake in Iran that was in the news in August where a lot of damage was caused by a moderate sized earthquake. And some of the information is listed here – magnitude was a 6.2, 6.0 earthquake in northeastern Iran. There was not a lot of information made available by the Iranian government on the damage, even though there were a lot of offers of help by the international community. The nearby towns were suspected of having damage initially and that includes the town of Ahar which is indicated in the little circle there. And so

some of the initial high resolution optical imagery and photos and efforts were targeted to that location. It was pretty quickly in the news within a couple days, or very relatively quickly local photos of the damage came in and it became clear that several hundreds of villages in the rural areas were heavily damaged or destroyed. So by having one pair of imagery over the area – unfortunately, of course, we did not have a systematic monitoring approach over the area at high resolution. But we did have imagery acquired not too long ago in March 2012 or April 2012, and so together, with the imagery of September, which was a good two weeks after the earthquake, could at least look at the concept of seeing what we could do with the…if we could detect some of the noise, the backscatter, basically, the damage, and measures of damage in the area. And it basically suggests, and I hope you can see it a little bit, I tried to show it on this graph. What it shows is all of these dots are basically clusters of small villages. The radar resolution is high enough to see, you can actually zoom into the area and you can see individual villages. The resolution of the data is five meters and the incidence angle is relatively large, 45 degrees. And so we have pretty nice quality radar imagery for the area before and after, and that allows us to do some analysis of the damage and statistical measures for those little villages. What it shows is that the area in the circle, and that's actually very close to the epicenter of the earthquake, we see something like fifty, more than fifty dots that have very enhanced noise in the backscatter. And so those are areas of suspected damage, which indeed agree with the location of all the damaged villages in the area. You can see it on the internet, many photos that are visible, the specific targeted locations are indeed there. So the idea here is to show that with high resolution, repeated radar acquisition you can get extra information out, this actually very useful and unique, and is not available easily for right now. And a good example is to look at the disaster charter which is in the organization that provides earth observation imagery for disasters. And what you see there is that some imagery is produced for the city of Ahar which is to the northeast of the actual most affected area.

Now of course the imagery collected here is arguably not timely for the immediate response. The purpose of this exercise was more to show the principle of this capability. So now there is one example where the work was done by ScanEx for purposes of the local application in Primoryi. There was an ammunition depot explosion sometime in early 2012. And both optical and radar imagery, high resolution radar imagery was used to do some analysis of this area. The imagery is presented in the following picture. And you can see that the actual ammunition depots are located in a forested area. The actual location of the ammunition dump is in the center, the actual explosion took place in the center of the red circle. So the objective was to see if you could put to use high resolution optical and radar data to do an analysis of the impact. In this case, we are only looking at a single radar image which has some value, obviously, but I think it would make sense to combine this type of image with imagery acquired prior to the event, and get a more refined analysis of the impact of the damage on the area. And so this something that will continue, and we hope to continue to work with ScanEx for these kinds of local applications.

So these are just the local zoom in, sorry the next. This is the local zoom in. In this case, it is somewhat obvious that the adaptation is relatively hard, but it does give information about the area, even with single imagery. The maritime application, this is a very typical problem. We are talking about immense areas, very large immense areas with potentially hundreds or thousands of targets. Typically the areas are remote and there are very limited assets to monitor and to detect. So, there is no single data source or sensor that can actually deal with this problem successfully. So it's a matter of a combination of sensors that need to be used.

One application area is the maritime surveillance for oil slick detection which is a very successful application for Radarsat. The Radarsat resources can be used in many different ways. One main approach is to target specific existing resources using detection from the radar. Another approach is to look at random areas that are unknown and see what kind of information can be obtained about the general presence of ships.
I'm going to move quickly through this. The idea of the so-called "cueing" where your target your airborne resources based on detections from satellite. I'm going to have to keep going given the time that we have here. I'm going to go through this following image. So we'll talk a little bit about the … modes for maritime application. So we do know the larger swath, the ScanSAR modes, the 500 kilometer swaths, and they can be very useful in detecting relatively for a very large area, large ships, on the order of 100 to 150 meter ships. What I think is particularly interesting is to consider using the modes, the newer modes that are now available called the 'Wide Fine' which have a 150 kilometer swath. So still pretty large coverage and have a resolution of 10 meters at dual polarization. So you can detect much smaller ships with those modes and still cover large areas.
This is another successful approach to use ship detects from Radarsat data to correlate the detections with other satellite information. AIS, those are basically detections, or they are beacon detects from satellites. So satellites, actual AIS satellites detect the ships that voluntarily provide their position using AIS beacons. And so by correlating the position of detects in the radar imagery, with the locations of the AIS, you can really find out what ships are not collaborating with the AIS methodology. In this case, you see a ship in the far bottom right that has been detected and has no beacon for voluntarily providing their position information. So obviously it would be an interesting target to consider.
Here is a second application and I'll just finish with that one, it is an oil slick released by a ship, and combining it with the location of the AIS detects for that specific ship, you have additional proof that the ship, that specific ship actually dumped that oil. So it can be very helpful. So given the time, I'll have to skip the other examples. ScanEx has done several other examples in the Far East with … monitoring of illegal fishery that can be discussed separately after the meetings. Alright, thank you.

Lars Laestadius, World Resource Institute, USA

"Global Forest Watch 2.0"

Good morning everybody. I decided to change the title of my presentation a bit. And now I will give you a preview of an initiative by my institute, and a few others that is called Global Forest Watch, version 2.0. This is the continuation of something we started more than ten years ago called Global Forest Watch that was to a large extent sponsored by IKEA. But now this is more modern. So we combine a number of features here, gathering the information, analysis, sharing. And we do it because there are data problems from the viewpoint of the user now. Users may feel that data is not available, or it is too later, it is not accurate, it is inconsistent among different countries, it's too expensive, top-down made, not interactive, too technical for regular people to access, data are dispersed so you cannot combine them. These kinds of problems which we are trying to deal with. And the wish here is something like an information system for forests, and potentially a global information system.

So what we have is that we have a number of sources of information in the public domain. They are there, they are rich, but they are complex and confusing, and not very well brought together. On the other hand you have the users, companies, big companies like Nestle for example, buying commodities, governments, environmental groups, others, that need information but cannot get it properly. So the niche for Global Forest Watch 2.0 is to combine the supply and the demand for information, that is to meet somehow. And we see a number of potential users for this. I'm sorry that you cannot see very well the text here. Buyers of wood, palm oil, etcetera, suppliers of the same who may want to show that they can do this without involving deforestation, for example, because markets want this. Governments who may want to better enforce their own laws and see what is happening. Not all governments have their own capacity to do this. Donor agencies, we spoke about the REDD+ yesterday in the context of monitoring and verification. This has a role. Environmental organizations and the media, newspapers and so on.

So what I'm showing you is very preliminary, is what the Americans would call a 'sneak peak.' This is not yet finished. But we have a number of partners, there is Google, University of Maryland, the Center for Global Development in the United States, ScanEx that many of you know, OSFAC in Africa, Imazon in Brazil, and we would be happy to have others, Global Forest Watch Canada. This is meant to be a very inclusive exercise. So what I'm going to show you now is very much on construction, in effect the whole initiative. We have a website that looks something like this for now, will look different later. The idea here is that you can go to this website in the public domain, and find information about forests in different places. I can even see myself what is there. But, there would be functionalities for different things, crop sourcing analysis and for staying updated about forest change. So at some point it will be possible for local people to take pictures with a telephone and upload to this website, and it will show somehow. You will be able to

subscribe to change alerts for any particular part of the world that you're interested in. If something happens there, this website will tell you. There will be blog stories. You will be able to download information if it is there. And then there will be information by country, if this is how you want to find your information. Use Brazil for example. You can look at forest change, you can look at concessions, and you can combine the two and see if deforestation is happening inside the protected areas, or outside of protected areas, which could be interesting. Cameroon, again you have forest change, you have concessions, and we have collected this kind of information. It is very seldom put together in this way. You can look at concession and find out what, whose concession is this, what kind of property does it have. And for that matter about detected areas as well.

And another example is from Indonesia – zoom in – and here you have forest change, this is now based on Landsat. You have year by year and can see how forest change is growing. We can zoom in, look at the same thing. Of course this is Landsat. And we can then combine this with, for example, concessions for oil palm which are being often criticized for causing deforestation. This website would be able to let people know if in fact a particular concession is causing deforestation or not, what is happening there. Government agencies may be very interested in this kind of information because it helps them keep an eye on what is happening out there. You can zoom in again and look at the concession. You can see information about this concession, you click on it and you get this information – change, forest cover, legal status. This particular concession has very little deforestation for example. It has more than a thousand hectares of forest left, and more than two-thousand hectares is classified as production forest, which is illegal for oil palm development.

So there will be a governance system for this. My institute, the World Resources Institute, will be responsible for the overall management of the site. We will develop partnerships, data sharing agreements, we have with NASA, Google, Imazon, Transparent World, etcetera. We are looking for many, many more. Anyone who wants to contribute data to this particular site is welcome to do so. There will be a global advisory group. Olga Gershenzon whom many of you know from ScanEx will be one of them. Rebecca Moore from Google, Professor Matt Hansen from the University of Maryland, whose team has done this global change analysis based on Landsat 30-meters for the whole world. Carlos Souza from Imazon, and others. And maybe also representatives from agencies of United Nations, private sector, depending on who will show an interest. So the plan is that this would be launched officially next year sometime. We're waiting for Professor Matt Hansen to finish his global 30-meter resolution forest change analysis which, when he's done, will show change every year from the year 2000 up until the year 2011. And we want to have this ready, otherwise we don't have a global forest watch.

We will be engaging key officials, we will eventually be moving to higher resolution. So we will maybe, two years time, we will have a monthly update based on Landsat information, and eventually move to 5-meter resolution with daily updates. But this is so far just a vision. And eventually, to pay for this, we hope that someone will be actually willing to buy this information from us. But it is a non-profit undertaking.

So with this, we hope that for the global community we are solving a number of information problems. So making information easily available, near real-time. The forest change alerts will be potentially coming two times per month. In the beginning on MODIS and later on Landsat, and even later on something else. The information will be accurate and trusted, it will be possible to see where it is coming from. Because it is remote sensing based, it would be consistent between countries. It would be freely available. We are not asking users for this. There is this interactive component with crowd sourcing that people out

there can contribute their own information to the site in the context of the overall data sets. No training required in order to use this site. We will very, very much try to make something that is user friendly, which is a difficult thing to do. And finally, we have the potential here to integrate many different data sets, so in a sense, this is a multi-sensor approach. Or what some people will call democratization of information or access to satellite imagery. And, I will stop there. Thank you very much.

One more thing I forgot to say. As I said, this is under construction, and I really mean that this is under construction. So as you see if you have any idea how this could be used, or how you could contribute, or something that we should do, something that we should not do, a particular application that you would like to see, please talk to me. I would be very interested to know. Thank-you.

Mikhail Karpachevskiy, Transparent world, Russia

"Possibilities for Use of Multi temporal Landsat Images for Assessing Stocks and Budgets of Forest abovegtound Biomass in the Russian Federation"

Dear colleagues, my topic is not probably that complex but actually concerns how to use simpler methods to get more accurate information: this would be the right name for my topic. This is my first slide and, as you can see, it begins with a river valley.

You heard our colleagues yesterday and actually, this is the category that is at the very heart of research work, the place that we call the Russian Amazon. I represent an NGO. We are not a governmental organisation, our business is very versatile, we are involved in mapping forests, borders and boundaries of preservation areas, and we are monitoring what is happening in certain territories as a result of human activities. We are doing our best to generate new tools and distribute those tools via our website. We think people are lazy and that they will be able to do more if they just sit in their office in front of the computer, but we would be more successful if we went and did some field work. I want to provide additional explanations, on the left monitor in front of us, you will see, written in Russian, Vladimir Lenin - 100 years old. The idea was to make sure that this inscription could be seen from space or from an aircraft.

Just to explain why we map forests and assess forest cover and why we assess forest biomass: we have reasonably powerful governmental organisations who are doing that type of work, but actually the latest map is dated 1990 and this memoir was based on a Soviet land book from 1974. In 2003/4, the scientific community created a forest map of Russia basically detailing forestation, but nothing really came of it. Although a great variety of things are available, we still feel that there is a demand for more. We can show you that there is an interest in getting more accurate information on what is happening in the Russian forest; even the state does not have enough information. Much has been said about the need to change models and that we have to work more intensively. Everybody says that these projects, plan-related projects, and basically absolutely everything requires new tools to use when evaluating the forest biomass. This is a map of the Russian forest, of spot forestation. It is the only map of its type and has been heavily criticised. In fact, everybody criticises it; people want something more detailed.

Now, a few words about the difficulties we face when evaluating carbon and other things. The explanation is easy: the sources of information are official, they come from official governmental bodies, and, what is more, even this information, which is made available, is difficult to access. On the other hand, the information to which I refer comprises purely statistical figures, and figures are not enough to carry out a detailed analysis. There are examples of relevant graphic materials that we have used successfully but these examples are exceptions. Another problem is that the data is obsolete and actually nothing is being done at this point. This is a site supported by Greenpeace Russia and this is a question about forest data: only 24% respondents said that they have data, which is 10 years old, or

less, the largest number said the data was 11-25 years old, and a significant number of those surveyed said that the data they use is older than 25 years.
Transparent World is implementing a number of projects but ours is just an individual project. The big idea is to provide information on the current status of Russian forests. We are partners of all the resources institutes, a Russian studies' representative, and a member of WWF. Together, we try to settle existing problems. With regard to geography, these are our park areas: south Siberia, Russian Far East, and Northwest Russia. As for what we are actually doing, we are trying to create forest maps using Landsat, and at present we are working on Northwest Russia. We have plans to create a simpler map for the massive part of Siberia and the south of the Russian Far East. In the Russian Far East is quite difficult to assess many of the forests, which explains why we use Landsat. We have info from Landsat, which is 35-40 years old and is available for us to use.
These are forests, classes of forest. It is quite easy to differentiate different types of forests and to roughly assess forest age. It is quite easy for us to tell if a forest in the area is young and we can identify forests that were burnt 20-30 years ago, as well as see older forests. This shows that Landsat is a simple tool and, yet on the other hand, it provides detailed information. This is a map of the Komi Republic, in the European part of the Russian Federation. Not very many classes but this is OK for our purposes and you can get a general idea of the current status of forest. We have two maps of the South West of the Komi republic: one map is Landsat, roughly 20:10, and this is on the left hand side. On the right hand side, you'll see a a map based on an image taken in the middle of the 1970s, meaning that the time difference is 35 years, making it a valuable tool to help evaluate what has been happening over this period. Our website also details a number of interesting ways besides those, which I am currently showing you.
As for available steps, we are trying to use any available images for the evaluation of carbon stocks. It is by no means ideal either but in any case this is what we have at this time. We would like to get maps for various periods, which will facilitate a comparison of the forest so we can see what has been happening and we will try to use ICCC methodology when we make our evaluations. This is a report to calculate the balance and the flow of carbon, so that, forest-planning material can also be used. As an alternative, or rather as our next step, we hope to be able to use not only Landsat images, but also images that directly meet our purposes, for example radar images. The European community is working on this issue and, hopefully, we will see some new initiatives in the future and then we will be able to compare data and material on carbon stocks and carbon flow. It will be interesting to see whether the available data is good or not that good.

That is all. Thank you.

Leonid Mitnik, Pacific Oceanological Institute FEB RAS, Russia

"Severe weather and forestry monitoring using passive and active microwave sensing"

You may remark that oceans are quite far away from forests, but the issues close to my heart are the things that we watch in the ocean and, in any case our research work is based on microwave sensing. Microwave sensing can also be used to answer concerns about the forests. I was involved in experiments when microwave technology was being used to try to fight forest fires. This was at the time when aeroplanes were equipped with microwave thermometers, which were used to measure not the surface temperature but the microwave range. In the past maps were created based on these. So, taking into account the current status of technology and the price of microwave hardware and even the insignificant weight of these devices, it becomes possible to use this technology as an efficient means of fighting forest fires. Airborne microwave detection is quite efficient, the infrared range can clearly identify the location of the sources of fires, and remote sensing, not just from satellites, but also those on aeroplanes and at altitudes can also be quite efficient.

Now, new models have been prepared, based on the measurements taken, in order that the results of the remote sensors are interpreted correctly. It goes without saying that accurate calibration is needed and that calibration is not always there. We are now looking at microwave ranges once again, and on this slide, you can see two graphs. The one on the left hand side shows the levels of emissivity and brightness. The sources of the fires could be different. I tried to analyse the literature available on the internet and work is still continuing with regard to my interpretation. Many people continue to display an interest in my work. Similar things could be used on satellites. It is very important not just to detect fire but also to evaluate the class of fire danger. The class of fire danger is basically a document concerning the temperature and humidity and, of course, the difference between the two points is taken into account. So, we carried out analytical work and, as you can see, all the forests can be differentiated, in certain forests the probability of fire is really insignificant, but in other places the opposite is true. Fire hazard has a lower or higher probability depending on precipitation and humidity. So we can use satellites, satellites which have been launched and which use radiometers to signal the proportion of humidity in the soil. The soil has a large effect on this and, hence, salted ocean and salted soil solidity become critical parameters. Measurements are taken in millimetres so we can use larger crops for our analysis. A combination of studies and a combination of microwave sensing used together with other technologies provide interesting results regarding fires of various intensity. These are things we discussed during our meetings. Another issue we discussed was severe weather conditions, where we are actually planning an individual meeting on severe weather. As a matter of fact we used a number of satellites; we used American, Japanese, European and a 27-channel microwave system on Meteor-M №1 (and another satellite will be launched next year). As for our approach, it is a combination of measurements and different ranges and our objective is to study processes. This is why

radar data, not everyday data, but data collected before, during and after, allows us to get positive results. These are microwave radiometers that we use and these ones allow us to identify major threats both to the ocean and on the ground. There are also scatterometers. QuikSCAT and MetOp ASCAT scatterometers unfortunately are of operation by now. The data is represented on this slide, and the good news is that the data is improving. We used the Aqua satellite and in May, we saw a Russian scatterometer and the areas were quite impressive . Yesterday we had quite an interesting presentation relating to this same topic. Here you can see polar cyclones over the Sea of Okhotsk and you can see scatterometer data. This is a wind field algorithm and our in-house algorithms were used in that particular case. You can see the Pacific Ocean in a particularly agitated state and major snowfall, about one metre high. We have talked a lot about the importance of international cooperation, since weather in various parts of the world is interconnected. Let's take a look at this polar cyclone. All of this was done using microwave sensing data and all critical parameters were taken into account. Actually this is nothing new, we see this every year specifically in the Sea of Okhotsk. If you make a comparison with tropical cyclones, wind velocity creates very high waves. So it is to be anticipated, it is not images but rather figures that one consults when it comes to weather forecasting. A Russian satellite shows wind speed exceeding 30 metres per second and with various frequencies . Another example shows a tropical cyclone and the important part played by water vapour, which I have just mentioned. This animation shows what is happening in the atmosphere. Now, with tropical cyclones it is impossible to evaluate wind velocity, as with cyclones in Japan - cyclone that affect the weather in Russia. The results of the measurements and the Doppler radar station's monitoring of what happens close to the sea is a useful tool. Similar things also take place in Chinese Taipei and Korea. These measurements are from an area close to the North West of Chinese Taipei. This is a mega typhoon depicted using a combination of optical measurements and microwave sensing. This information is very valuable. An image of the super cyclone Magi, pixel 75 by 75 metres for 105 km wide, depicts the very eye of the storm. You can see the lines of attack and what is happening with precipitation. It is a combination of radar scatterometer with a resolution of 25 by 25 kilometres and microwave sensing. In my opinion this is really important information and if we are really interested in the processes taking place over the ocean then this data with this type of resolution is pretty important. Finally, I will say that on May 8, a satellite was launched to study a basic water cycle, called Shizuku in Japanese, meaning "a drop of water". The spatial resolution is pretty good and interesting data could be expected. This is another image taken by the satellite of typhoon and precipitation, shown here in various colours. It goes without saying that Satellite Landsat 8 will be launched pretty soon with new sensors and everything it needs to improve weather forecasting and forest monitoring.

Thank you.

Kirill Bazarov, Information and Cartographic Center, Pacific Institute of Geography FEB RAS, Russia

\"Features of a cameral decoding for the mixed broad-leaved woods of Primorsky Krai South"

Dear colleagues, I am Kirill Bazarov from the Information and Cartographic Centre and my topic is the specifics of cameral decoding for mixed broadleaved woods in Primorsky Krai. Such woods are specific and normally they are very fragmented so decoding information is a challenge especially since cameral decoding is a problem in the territories around the border. You have heard about the preservation area in Kazarsky Park in Primorsky Krai, which comprises an area of several nature reserves (*zakazniks* and *zapovedniks*). Basically, what I am going to talk about is related to the work I am doing within these strict nature reserves. The images we use have medium resolution, Landsat images with a period starting 1987 through to 2009. We have devised a special methodology to help identify woods with same type of trees. I will show you examples of five images from 1987. These images were made on hill slopes and uneven illumination makes automatic classification very difficult because the whole image is based on the speculative tendency of the pixels. However, there is an algorithm and correction is possible . The original image is needed, as are digital models for the territory and data regarding elevation and the sun's position at the moment of the image's formation. The result is in front of you, so the picture is somewhat smoother now, the vector mask of clouds has been added up. It is exactly over our area of our interest and so clouds and cloud shadows are all taken into account. As for classification within cloud masks, we have 55 classes overall. Classification was done, applying filter and smoothing methods and then we exported data from the raster format to the vector format.

The primary information in the master file is mean values for each class, every category. Using these values we got those curves and then we started aggregating classes. In order to make sure that we get the right types we have to make sure that intensity and correlation match. On the slides you can see a couple of examples, this is where we worked on classes and this is how we accumulated classes into types and we used various classes which correlate to those you see on the map. You can also see that there are some major polygons in the areas shown and all the rest is formed by various counters, very fragmented and yet further proof of very serious fragmentation of mixed broadleaved woods in Primorsky Krai. We then apply relative indices for every type and the most important thing is field verification of data received and after verification we may change and redesign those results.

Anatoly Alexanin, Institute of Automation and Control Processes FEB RAS, Russia

"The experience of international cooperation for satellite monitoring of environment during the Fukushima disaster"

My topic is international cooperation for satellite monitoring of the environment during the Fukushima disaster so the objective of monitoring was to get information regarding the pollution of Russian territory following the Fukushima tragedy as a result of clouds that moved from Fukushima over the Pacific ocean to Russian air space. I am talking about clouds polluted by Fukushima. We pooled our resources together of two centres of collective use: the Centre for Satellite Monitoring, which uses mostly polar-orbiting satellites and weather satellites and the second centre which was made up of two research institutes and one university (not on a federal level, it is a sea maritime university). You can see certain tools, LIDARs mostly, and the vessel; this ship called Nadezhda, Russian for "hope". So, of course such monitoring would probably not have been possible without the cooperation of our foreign colleagues and I would like to express my thanks to my Japanese colleagues and Japanese professors who worked with us on these problems as well as my colleagues who distributed information and data measurements after the disaster.

Basically, the information we received was enough to go ahead with monitoring and evaluate the situation. People explained who was working on the problem ,who worked on website and which European models could be used. Another university,, Toulouse university, allowed us to use its models for the movement of water in the ocean. Without these models we would have been unable to succeed. We received official data later on and Russian data was provided by EMERCOM and RosHydroMet. We also received measurements taken by the Russian Air Forces; Russian airplanes measured radiation in the air space and in doing so they flew pretty close to the jap islands. As a matter of fact , the evaluation of radiation was done indirectly. Major isotopes: iodine 131 and caesium, 2 isotopes. Iodine has a period of 8 days and if the iodine structure gradually goes down in the water samples, then most probably there was no radiation atmosphere. If it had grown it would have meant that there was radiation. So we started with the movement of clouds and we applied it to channels and to atmospheric parameters: this is very primitive monitoring of the movement of air mass and those clouds that flew over Fukushima. Should the clouds have started moving to the shore then, of course ,we would have applied specific measures. The areas most at risk were those with precipitation; hence we focused on them and used radiometer data, a piece of hardware that provides and updates information twice a day and which is installed on many satellites. This meant we could not remove precipitation but we could reduce the probability of precipitation so everything was quite successful in our opinion. Basically, nothing moved towards the continent and we carried out a large amount of research to evaluate the atmosphere and the status of the sea of Okhotsk. You can see the routes and what we were monitoring. Satellite monitoring testified to the fact that there was nothing terrible and we received

confirm of positive results as LIDAR provides the structure of atmospheric layer. There is also a model for atmospheric dynamics and there are measurements taken by Russian military planes. This allowed for interconnection with the layers and then we used the model to decide on the comparison of data from their resources. On this slide you can see several examples, various levels, categories of particles. Movement of particles depends on altitude and, thank god, we have seen nothing over the Sea of Okhotsk. We used the images from Onoma station, the data and the speeds, in addition to the data on the internet. You can see location of stations for radioactive measurements and the corresponding data for iodium and caesium which is more dangerous and the period of self-destruction of which is 70 years. By the end of April there was nothing left, meaning that the concentration had come down to an acceptable level so the pollution was less than 90 becquerel per litre and all that was by the end of April. It was actually no more than 100 becquerel. And this what we received form the satellite monitoring there. This is the model from mid-April showing the radiation moving to Russia. Russian observation posts basically saw nothing during this time; the expected time of arrival was April 29th , but nothing of the sort had occurred. We were following pollution propagation by current and we used microwave sensor data. Our resolution of course leaves much to be desired but it was good enough to evaluate the dynamics of what was happening. We also used data provided by Toulouse, a model, so u can see the dynamics. If you click you will see the dynamics. Just click. No, OK forget it. Anyway this model matches all that we thought from outer space. The models and satellite data, if compared, show the movement of polluted waters so we used sea surface velocity computation methodology and automatic synoptic disintegration of air currents to cabrilate data on currents. We then applied multimetric information. However, analysis of our results clearly indicated that by August the concentration in our upper layers went down significantly so the concentration was below the threshold of values, which means the mass of radioactivity went to the bottom of the sea and then probably the majority of radiation was absorbed by the plankton. To monitor movement of pollution in the ocean was hardly reasonable in practical terms, though of scientific interest . Here you can see our long-term graphs for the polluted areas and then the pollution added to the river flows and the heavy rains. In August there was a tropical typhoon and yet stations in the delta of the river still did not show any radtiation, which means the radiation is in the ground . Another picture showing radiation propagation, this is the area where Russians go fishing and of course radiation in fish may be dangerous, but it is a separate subject of course and not exactly our subject. There were workshops on that topic, and we think this still requires further study. Our opinion is that there were no serious consequences from this disaster for Russia but there is ground for further research work. Thank you very much !

Ku Kassim Bin Ku Yaacob, Fisheries Research Institute, Malaysia

"Seaweed Production in Sabah, Malaysia in Relation to Sea Condition Observed by Satellite"

Thank you Mr. Chairman. Good afternoon. My name is Ku Kassim Bin Ku Yaacob from Fisheries Research Institute in Pulau Pinang Malaysia. Today I would like to talk on Seaweed Production in Sabah, Malaysia, in Relation to Sea Condition Observed by Satellites. Why I chose seaweed? Nowadays when people talk about reducing emissions, they always forget about reducing emissions from the ocean. Okay. Actually the seaweed is what we call the forest in ocean. For two days, we have been talking on the forests on land.

Now the forest is in ocean. My presentation outline will be an introduction to seaweed industry in Sabah, sea condition, seaweed production in relation to sea condition, and then conclusion. I have just 18 slides only. I think less than 10 minutes.

For the introduction, the seaweed in Sabah was introduced in 1978 by an American company which cultivated the seaweed commercially in that year. And since then it has become an economically important natural resource for Sabah as well as for Malaysia. Actually in Sabah, Semporna is the sole seaweed producer in Malaysia, I will show you the map later. In this area there are species of *kappaphycus alvarezii* is cultivated, about 100 percent cultivate this species. And since 2006, they seen tremendous increase of this industry in Sabah, since the demand for this seaweed is very much high right now.

Okay, this is a *kappaphycus alvarezii*, …, there's the cultivation site. This right in Sabah – I took this from the internet - …there's the wet species and dry species. Actually this seaweed is considered as main source for reducing carbon in the atmosphere as well as in the ocean. That is why it is called a blue carbon, it can see all the carbon in the water and this seaweed can absorb twenty-five to thirty percent of the carbon in the water. So you can imagine how the seaweed is important in reducing carbon dioxide.

As this seaweed grows based on fuel factors such as light, temperature, salinity, water movement, and also nutrient. As you all know, light is the main factor for seaweed, for its growth. Temperature, seaweed doesn't like very high temperature because it will kill the seaweed. Salinity, this actually the marine species, the salinity should be above thirty, and then maybe less than thirty-five, thirty to thirty-five ppt. It also needs water movement for nutrient supply, nutrients such as phosphate, nitrate, and a few others. Seaweed production in Sabah, mainly in Semporna, Kunak and Lahad Datu, this area has quite suitable factor for seaweed cultivation such as shallow, salinity 30 to 35, and sandy seabed, also there's a vast coral reef area within this cultivation area. This map of Sabah here, and this is Semporna at the tip of Sabah.

This seaweed industry in Sabah from 2006 to 2010, you can see the tremendous increase in terms of area from five-thousand three-hundred something in 2006, to seven-thousand nine-hundred, about eight thousand hectares. In terms of culturists, the number of culturists we have in 2006, five-hundred twenty – in 2010, one-thousand one-hundred and

fifty-five. In terms of production, wet seaweed, wet weight in tons, in 2006, we have forty-three thousand. And then in 2010, two-hundred thousand, increase of about five fold, just in five years. And for value in Malaysian ringgit in 2006, six million, and in 2010, 83 million ringgit - means 830 million rubles.

What about the sea condition? Actually I took this from NOAA database, it is the wind condition in Sabah in 2010. Actually Sabah experienced not so small monsoon late in the year, actually in November – November-December-January-February-March, it's months of monsoon followed by transition period around this area. And also southwest monsoon during July, August, September – July, August, September is southwest monsoon. And also we have the transition period in September.

This is a pretty picture. I took this from NASA web site (oceandata.sci.gsfc.nasa.gov). This is the sea temperature the reddish piece shows that it was 30-31 degree. The greenish shows about 27, and blue shows 25 or 26 degree. So you can see in Sabah, during the early of the year 2010, quite cool. And then becomes warmer in the middle of the year and cool again at the end of the year. This due to the northeast monsoon which brings seawaters from the northern hemisphere from the Philippine Japan Sea and so on to us in Sabah.

This is the mean temperature at Semporna. This is Semporna. This is the mean temperature at Semporna, in February, less than 30.5 and then increase in March-April-May, warmer. June-July becomes cool again and then in September is the warmest season, September and October. And then towards the year end, it becomes cooler.

These are the chlorophyll A distribution in these waters. I took this data again from oceandata.sci.gsfc.nasa.gov website. Actually the original format of this data is in HDF so we have to reprocess and to come up with this picture. And for chlorophyll A, we have in Semporna in the beginning of the year it's quite high chlorophyll A content, it's about 0.7 milligrams per meter cubed. And then this decrease tremendously towards the middle of the year, very low, and high again in the end of the year.

This data's in Semporna, but you can see this another phenomena in Sabah. I just want to show you that in north of Sabah. This is, how you call it, as offshore plankton bloom. It's due to some process, due to the, how we call, wind condition in Sabah during that time. Strong winds that take the phytoplankton bloom in the north of Sabah.

These are the production of seaweed in Sabah in 2010. Actually, I just have the data for this year only. I also have the data for other years, but I could not appreciate the data, I could not benefit the data because it very much has so many errors on the data, so I just can process the data for 2010 only.

This is the monthly production of wet seaweed in Semporna Sabah in 2010, you can see the…during January it's quite low, eight-thousand tons, and becomes high in the end of the year in December to twenty-four or twenty-five thousand tons per month. These seaweed are produced by 2,900 culturists in Sabah. So we convert… not two-thousand nine-hundred culturists, but 2,900 hectares of seaweed cultivation site in Sabah.

And if we can see that, this is the simple version, if you can see that production of seaweed in terms of tons per hectare size decreases as the wind increases. And in this wind that took from … quite far off shore, because it neared the Semporna area, we do not have any data. So I took a little bit offshore from that area, a little bit offshore. The production of seaweed decreases with the increase of wind speed in Sabah. The production of seaweed decreases also with the increase of chlorophyll. This is chlorophyll that is Semporna area. But for the temperature, we could not determine any relationship for that time, 2010. But if we can get more data in other years, maybe the relationship will be more clear.

The present study shows that we can have a general relationship between production of seaweed with sea condition. My observation shows that there's a negative relationship between production of seaweed with chlorophyll as well as wind speed, while other things did not show any clear vision. However, estimation is now, we still need to have more data, especially on the seaweed production to confirm this situation. Also we have to further analyze the data to confirm the optimum level of the seaweed production based on the sea condition. Also in the future, if we can get a clear relationship, we can predict how much seaweed…we can produce with another sea condition. And lastly…we also have to take into account multiple factors when selecting the site for cultivation. Now we have already the factor for chlorophyll, wind, and also we have to, what we call take into account of sort, water depth, the cost of transportation whether further offshore or just nearby the shore and so on. So this will be in the future.

Thank you very much.

Georgy Potapov, RDC ScanEx, Russia

"Complex fire monitoring system based on operative satellite imagery"

Everybody is tired so I will not talk for a long time. I will inform you about the project which we have been implementing the last 30 years to help develop a complex system of fire monitoring as this has a direct link to the protection of forest resources and therefore is of direct interest to this conference. Before I begin with my project description, I will try to illustrate the project by certain illustrations but first I will speak about several points. This is based on the experience of fire monitoring in Russia. First of all we have different regions and the regions differ in size and accessibility. Some regions are densely populated. We had wild fires in densely populated areas in 2010 and there was panic among the population, but in Siberia the situation is difficult as there are often big fires there but the region is sparsely populated. Fires happen there every year, this year the established damage was three times more than the years before but the regions are so remote and difficult to access that no one tries to put out the fires. We have seen the fire come very close to settlements or special protected areas, such as nature reserves, on several occasions. This naturally adds a specific interest. In remote areas it is difficult to observe fires using land observation systems, the only way to monitor wildfires is through space. We have a system of government statistics that estimates the damage from wildfires but it does not work as it is based on the reports of local authorities and there are big discrepancies between the data. Independent organisations have criticised the statistics so they are not to be trusted. On top of this, I should say that we have to use certain data and we need the data for forested areas to classify wildfires before they can classified into forest fires, bush and under-bush fires, even our colleagues form Transparent World cannot supply us with standardised data which we can use.

So, these problems occur and instead of talking more about problems lets suggest solutions. It is necessary to create a unified database on fires like the FIRM (fire information management resource system) system: a NASA project implemented together with the University of Maryland. It is a global database but is insufficient when it comes to Russia due to the time delay because Russian specialised communities like the Ministry of Forest Resources do not use data from global databases; they use us as the data source and rely on their own information sources. The problem is in creating a unified database using a complex system of data collection and unified standard data processing methods. Not all the information has to be accessible; for example, the number of cars involved in fire extinguishing, this information cannot be made accessible, but other types of information that is critical to human safety, this information should be made publicly available. We have to develop a new system for analysing this info and we need to analyse information from different sources despite the fact that we mostly use remote sensor data. We have to use other sources of information too because remote sensor data cannot cover all our demands.

This gallery of products based on MODIS was created in 2004. These products include fire masks. This is algorithm mode 14, well known to experts, and this algorithm for MODIS data processing is used by FIRM. This is a global service, this is a gallery of scenes based on MODIS products, which include fire masks. In 2010, when we had the catastrophic wildfire events in densely populated areas we overlaid these fire masks with an interactive ma[and launched the Kosmosnimki fire photograph project. Since then this project has included new services and based on this proven technology we have worked to develop

the services demanded by our clients including EMERCOM which asked us to develop a special channel from which they can download information from external sources. If it weren't for us they would use only their own sources. In the end, the result was that the system became a complex one which use multiple sources of information. Within the database of EMERCOM, they have a similar system of fire monitoring called 'Kaskad'. In 2005, if I remember correctly, we launched a project for the Ministry of Natural Resources, the main goals of which was fire monitoring in nature reserves. This year we came to the stage when we launched the second version of the Kosmosnimki fire photograph service. We adhered to the following thee principles in the development of this service: over time we allowed our system to develop into a specialised information system. Our experience with EMERCOM the Ministry of Natural Resources showed that we had developed an enterprising solution. Besides this we also cooperated with the safety and protection service as it would be impossible to develop this system without increased cooperation with the public. We have also included additional services which make this system more complex, such as the fire alarm service.

Once you have the data you can create additional services, desired by the end use; a good example is the service which was discussed after the floods in the Crimea - the alarm service. This was much needed in 2010 and so we tried to give our service an external interface to make it interpret data. This is an example, a technical description of our service and an example of its use. So we can use different websites, Yandex, for example, and their applications download our data about fires. I will continue briefly. This is an example of an integrated solution based on our technology. This is an example of service delivered upon the request of the Ministry of Natural Resources. The core part is the geographic portal which contains interactive maps, while the essential parts are the database about the fires and the external services which accompany the system of information support, people call it cloud services; for example, we can download online images of areas with fires. Forest watch is another component and the fire alert service is yet another. The latter is an additional component which is used to alarm people; the users or subscribers to this service. They can subscribe using their mobile phones, sending a text, short message, or email. They will receive information by email or text. This is useful as in some areas many people work in the fields and may not have broadband. They do not work in an office but may still be very interested in this data.

As a matter of fact our solution is the same as the EMERCOM solution but with addition of the geo portal with public access. There is a slide showing the main components and this is a list of web services that we add up for fire monitoring. There are systems which may change applications and data. If we are interested in collaboration work we have to agree on methodology and notion first and in the case of fires, methodology is what matters. We have to agree on language and description. This will be the standard for our web technology and for GIS technology. If you need to exchange information you may use open standards to change data using various information systems and we can integrate and consolidate information sources. For example, we may take information from the Rosreestr or from media sources, like weather forecasts, which may also be important to fire protection, or fire indices may also be computed. This is also very important for our purposes but let's not waste time now. This is an example of a high resolution image, it is quite all right and it is great for low temperature fires and if it is low temperature in general.

Point five: when you see a trail of smoke or just a bit of a fire or something similar, then we use fourth channel infrared medium resolution. This is one case when infrared med res is used and this decision is based on operators, analysis conclusion and, if required, extra

services may be added as fire cannot be detected in many of these cases. Another example, a serious problem here, is shortage of high definition information, there is a certain gap filled only by low-resolution images. Now we are using our own infrastructure but this use of low definition is not good enough in certain cases. On the other hand , colleagues of Digital Globe have already talked about high definition but fragmented images and this can be pretty expensive and there is another niche: high resolution or spatial resolution with a wide spectrum of channels is used by many who try to save money and into those cases where medium resolution is disregarded.
As for technology, the important thing is to be able to automatically integrate data and treat it as a service but the process should be speedy enough. You understand the situation: sometimes we have to compromise in order to meet the objectives. If you take Primorsky Krai and the project implemented with WWF there, we had to integrate data from video cameras, from forest watch, so basically that was little more than a pilot phase. Now the integration of data received from various sources is very important as it is otherwise impossible to settle problems relating to cloudiness or anything else. I have a couple of words on the automatic algorithm that we use: speaking about forest fire monitoring there are three major factors to focus on: expedience of operation, accuracy of operation, and in order to settle all the problems we have to use available methodology, and completeness of data, which depends upon the availability of data form various sources. Data verification is only possible if we have high-resolution data and we also need a specialist to verify our data, and a good response time is also very important.
I have nearly completed my presentation so as for algorithms that we use for our service, this actually is a categorisation of hot spots. The basic algorithm provides information on individual pixels which can be identified as possible fires. To analyse information more accurately we should use a divisional algorithm which works with density and we use a special density involving the proximity of points and time density. So, if points are located close enough in terms of time to each enough then this may indicate fire. This makes our work easer and we can refer to a visualisation of what I mean. Instead of a mass of points, you'll see groupings of points, and you will see fire spots or non-dangerous fire spots, e.g. agricultural fires. In many cases internal statistics may differ due to agricultural fire, as can the water sources and you can see what's happening to the water in the river. Classification of hotspots makes it possible to evaluate burnt territories and actually that can be done pretty quickly, even within minutes, using satellite data. Then you will get a picture like that on an interactive map and see the counter of a probable fire and you may also receive additional information on such fires, for instance, the surface, or you can change the mode and get carbolated data. This is filtration of manmade problems. This is the use of the automatic algorithm so u see there are spots in the same area and then using certain classic parameters and our database and archives we can specify the sources of the fire, we used Wikimapia which is lets users identify the nearby facilities: gas fields, oil fields, industrial sources, flares used to burn down associated gas, etc. This way we have a database comprising 170 objects and we also have a set of filters and if a hotspot is in the area of manmade facilities it is indicated correspondingly.

Thank you very much for your attention.

Closing Remarks

Lars Laestadius, *Professor*, *World Resource Institute, USA*

Thank you again. As you know I live now in America, but I am a Swedish person. And in that sense I don't belong to APEC. But it has been very interesting for me to be here. As an outsider, it's evident to me that there are, this is a very diverse collection of people. There are different actors here. You have the government people. You have the satellite image suppliers. You have the environmental groups. I don't know that there's anyone here from the forest industry but, well, in a sense. It is a variety of group here, there is also a variety of countries obviously. But there is also a variety of natural conditions inside of these countries that meet here, and even different ecosystems. So it's a great variety here which is, it's unusual for all this variety to come together. And the fact that it has come together is by itself a good thing. Usually when things come together that usually don't come together, it is a good thing. And so I think this meeting has been a good thing for that reason.

It felt that the communication was useful. At the same time, though, it also felt as if there is potential for much more that we were somehow not able to come to. There are difficulties here with different languages, different cultures, different time zones, some people are tired and some people are at home, etcetera, etcetera.

And there is much complexity in all this diversity. So you could say, ah, the meeting did not succeed. I would turn it the other way around and say that the meeting was successful but there is potential to do something more with this group. At the people level, of course, because I spoke to many people – there are many people I did not speak to for reasons of language and other things. Countries still form their own communities more than – it's not one community, it's a collection of many distinct communities here. They need help to come together, and this takes time. The Asia-Pacific Community, maybe we think about it as East and West somehow united or separated by the Pacific Ocean, this is interesting. For me what is interesting is North and South coming together inside of APEC, because that means in the forest side, you have anything from boreal forests to tropical forests. And it seems to me that the – it's an interesting dimension here to bring northern forests more into the climate discussion than they have been. REDD is very much focused on the tropical southern countries, but the climate, I think, does not respect that. And all forests really should make a contribution in the climate sense. So for me it is interesting to think that maybe APEC can be an umbrella to make that happen.

So it seems to me, just as we talk about the Landsat continuity mission, there is a need for some sort of continuity mission following this meeting as well. We had in our group talk about some sort of website and I'm certain this would be nice. However, it seems to me that there is a need for people to come together again somehow in order to begin to realize more of this potential that is here in this very unusual combination of people. So, I would like to see this, and I would like to see, of course, APEC support something like this, whatever that means. It probably means some travel support. It should also mean support for translation and other things, if you really want to turn this into one community.

But, in summary, I think this was a useful meeting, and I'm grateful for having been invited to it. I have met many interesting people here, I've seen other people have met interesting people, much useful conversation was heard, and I look forward to the future.

Thank you very much !

Closing Remarks

Kirill Borisov, *Deputy director, Technical Policy and Quality Directorate, Federal Space Agency*

Thank you for this opportunity to say my words of thanks !

It is really a pleasure to see so many people from different country, people who came here to discuss a significant problem, one of great importance not just for APEC but also for the entire globe. It is no accident that we have people from Asian-Pacific regions, but also people from the USA and Europe, The problem we have been discussing is important to every region so the Russian Space Agency and Scanex, the organisers of this event, are participating in other events. The public and not for profit organisations have one objective: reasonable use and protection of resources and remote sensor data, which could be very valuable.

This conference has enabled network building and provided instruction on how to correctly use available information and get the best payback. The opportunity to discuss problems and to find new ways to settle our problems will surely help sustainable develop of economies, including the economies of APEC.

I would like to thank the participants of this conference for their courage: some of you spent more than 20 hours travelling here. I hope it isn't your last conference and I want to wish everyone success in their activities devoted to the interests of the entire planet.

Closing Remarks

Vladimir Gershenzon, *General director, RDC ScanEx*

Thank you very much and once again I would like to thank all those who decided to attend this event we are quite pleased with the turnout !

As a matter of act, basically all the leading commercial operators, from the UK, Israel, Europe, America, got involved and participated in this meaningful event: meaningful for the region and meaningful for everybody involved. It seems to me that this time, as never before, we have managed to implement the idea of sustainable development, managed to think globally and yet locally at the same time.

We are very aware of commercial programmes and commercial partner projects and we have in mind global processes and challenges. At the same time we are solving local tasks and implementing new technologies and we listened to some very strong presentation which demonstrated the scale of these phenomenon. We witnessed the use of new procedures of data processing and the implementation of new methods and the development of new solutions to existing problems important to forestry. We had contributions from Russian forestry sector who are still here in the room and I feel that we managed together here among different types of people to reach a balance among different applications of remote sensor data. The space systems that are currently on orbit and that supply information and data support decision-making and help develop economic processes with consideration to the environment sustainability of this region.

So let me thank you and thank the forest organisations and the forest branch of the RAS. We observed their willingness to participate and a higher level of commitment in trying to achieve a new turn of the screw in the process. They always kept in mind the neighbouring regions, taking their consideration to a new level.

I wish success to everyone involved in information dissemination and to anyone who implements specific projects and provides network solutions. This event shall be continued by their everyday actives, new initiatives, information exchange, and the organisation of commercial programmes. I hope for success and better information and an improvement in of information exchange. I foresee new web resources being created to facilitate information exchange. Of course, we will send CDs to all the participants but I feel the need for a web resource as well.

Closing Remarks

Oleg Shcheka, *Deputy pro-rector, Far East Federal University*

Thank you organisers, dear colleagues, and dear participants of the international scientific and practical conference !

Several previous speakers expressed their gratitude to those who came from neighbouring countries of the Asia-Pacific region and I think that this is the first time that we have had such good weather in 11 years. This region has its own specific character. The specify element is that each event or disaster inevitable affects neighbouring states as it does not respect political boundaries, hence the need to take preventative measures, and deal with consequences and reap benefits.

I looked through the report of this conference and its conclusions and appendices and I was pleased to see that you were able to propose sound solutions to the administrative leaders of this region and that you helped to improve collaboration because it is our common task to improve living standards and preserve nature and natural resources and this region is rich in natural resource.

I thank those who came here and spent time travelling here and the conference organisers who spent their efforts and time as well !

Pictures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• Washington, DC – 200 people
• Beijing – 10 people
• Delhi – 10 people


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