



United Nations Office  
for Outer Space Affairs



ROSCOSMOS  
Russian Federal  
Space Agency



The Government of the  
Krasnoyarsk Region



**RESHETNEV**  
C O M P A N Y

Academician M.F. Reshetnev  
Information Satellite Systems



**United Nations • Russian Federation**



# **Workshop on the Applications of Global Navigation Satellite Systems**

**18–22 May, 2015**  
**Krasnoyarsk, Russia**



**Dr. Victor Kosenko, Dr. Vasily Zvonar, Marina Molokanova**

United Nations • Russian Federation

# Workshop on the Applications of Global Navigation Satellite Systems

**18-22 May, 2015**  
Krasnoyarsk, Russia

## Sponsored by:



- United Nation Office for Outer Space Affairs



- Russian Federal Space Agency (ROSCOSMOS)



- The Government of the Krasnoyarsk Region



- Academician M.F. Reshetnev "Information Satellite Systems"





- **Mikhail KHAILOV**, Deputy Head of Roscosmos, Federal Space Agency (Roscosmos), Moscow, Russian Federation
- **Victor MESHKOV**, Deputy Head of Department for new challenges and threats, Ministry of Foreign Affairs, Russian Federation
- **Nikolay TESTOYEDOV**, General Director, JSC Academician M.F. Reshetnev Information Satellite Systems, Krasnoyarsk, Russian Federation

- **Victor TOLOKONSKY**, the Krasnoyarsk Region Governor, Russian Federation
- **Nikolay KHOLODOV**, Chief Federal Inspector in the Krasnoyarsk Region, Russian Federation



# participated in the WS-2015

# 75 Participants from 20 Countries, 2 International Organizations

- Argentina
- Bangladesh
- Bosnia and Herzegovina
- Brazil
- Bulgaria
- China
- Colombia
- Finland
- India
- Italy
- Lao DPR
- Mexico
- Mongolia
- Morocco
- Nigeria
- Pakistan
- Russian Federation
- Tunisia
- United States of America
- Uzbekistan

• United Nations

• European Space Agency





# Participants









# **Workshop Programme**

## **Presentation Sessions**

- **1: Overview of Global Navigation Satellite Systems in Operation and in Development**
- **2: Update on Satellite-based Augmentation Systems**
- **3: Using and implementation of GNSS technologies**
- **4: Global Navigation Satellite Systems Infrastructure**
- **5: GNSS and space/atmospheric weather monitoring**
- **6: Capacity building, training and education in the field of GNSS**
- **7: GNSS applications and technology development**
- **8: GNSS applications: National Programmes**
- **9: GNSS applications: Case studies**

## **Discussion Sessions**

- **1: Developing of Partnerships and Networks**
- **2: Capacity building, training and education in the field of GNSS**
- **3: Workshop Views and Recommendations**

# Workshop Objectives

- “(a) Strengthen regional information and data exchange networks on the use of GNSS technology, including various training programmes and capacity-building needs in GNSS and its applications;
- (b) Develop a regional plan of action that would contribute to the wider use of multi-constellation GNSS and its applications, including the possibility of one or more national and/or regional pilot projects, in which interested institutions could incorporate the use of GNSS/GLONASS technology;
- (c) Define recommendations and findings to be forwarded as a contribution to the work of ICG.”



# Technical Tour & Discussion Session





# Technical Tour: Information Satellite Systems





# Technical Tour: Information Satellite Systems



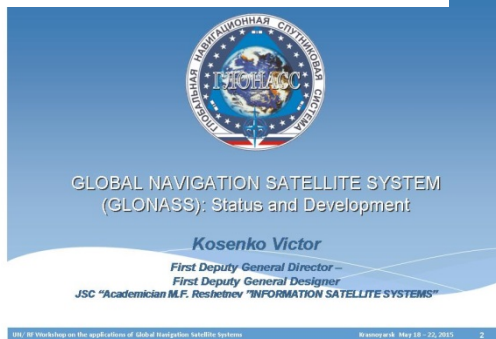


# Session 1. GNSS in Operation and Development

## Session 2. Update of SBAS (8 presentations)



United Nations / Russian Federation Workshop on GNSS applications  
18 - 22 May 2015, Krasnoyarsk, Russian Federation



UN/RF Workshop on the applications of Global Navigation Satellite Systems  
Krasnoyarsk, May 18 - 22, 2015



### FAA WAAS Update



Presented by: Deborah Lawrence, FAA

Pres  
Date

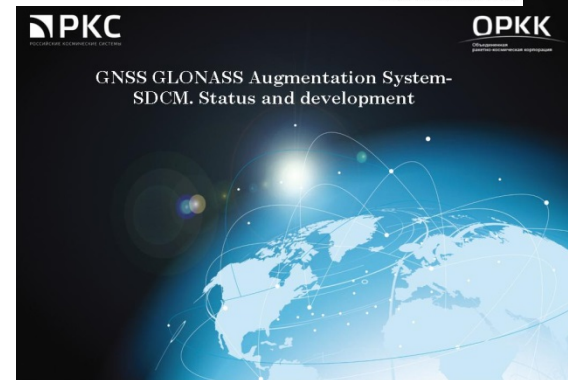
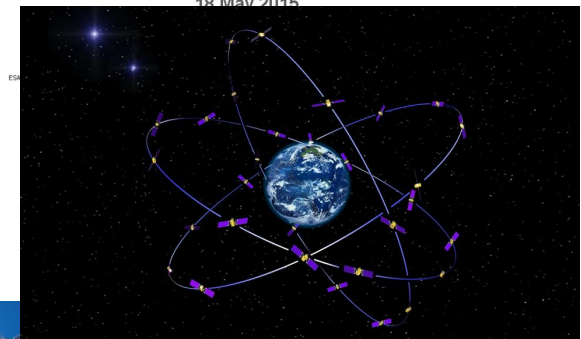


### EGNOS Programme Update

prepared by ESA-EGNOS Project

presented by Dr. Jörg Hahn  
European Space Agency / ESTEC

UN/RF Workshop on the Applications of  
GNSS  
18 May 2015





# 3. Implementation of GLONASS/GNSS Technology (8 presentations)

"GONETS SATELLITE COMPANY" PUBLIC CORPORATION



The RKS-Doroga Navigation and Data System (RSS-Road NDS) as Basis for Effective Organizational and Technical Regional System

Application of Global Navigation Satellite Systems

Equipment development approaches for GLONASS navigation signal simulation with the purpose of user navigation equipment testing

Kokorev Sergey, JSC «MOB «COMPAS»  
Krasnoyarsk, 18-22 may 2015

SEAMLESS NAVIGATION AND COMMUNICATION SPACE "GONETS-GLONASS" IN THE RUSSIAN FEDERATION. APPLICATION FIELDS.



Open Joint-Stock Company  
"Research-and-Production Corporation  
"Precision Systems and Instruments"

Improving the accuracy of  
GLONASS in the interests of  
operational and a posteriori  
applications

Vladimir Pasyukov



1



Realization of high-precision  
navigation mode

Sergey Silin

Krasnoyarsk, May 18-22, 2015

United Nations/Russian Federation Workshop on Applications  
of Global Navigation Satellite Systems  
18-22 May, 2015  
Krasnoyarsk, Russia



Krasnoyarsk region



REPORT

Deputy head of the regional authority  
State Advisor of the Russian Federation 3 classes  
V. Tereshkova

The topic:

«The practical use of automated information  
System operational search and rescue using the  
resources of space search engine emergency  
vessels and aircraft in the Krasnoyarsk region»

Krasnoyarsk



«Approbation results for Design Bureau Navis' engineering  
solutions for shipping, precision agriculture and geodesy»

«Результаты апробаций технических решений КБ НАВИС  
в судовой навигации, точном земледелии и геодезии»

United Nations/Russian Federation Workshop, May 2015



Докладчик: Митянов Д.Ф.

# Session 4. Global Navigation Satellite Systems Infrastructure (7 presentations)

Russian Federal Space Agency (Roscosmos)  
Central Research Institute for Machine Building, Federal State Unitary Enterprise (FGUP TSNIMASH)  
Information and Analysis Center for Positioning, Navigation and Timing (IAC PNT)

## CURRENT STATUS OF GLOBAL TERRESTRIAL REFERENCE SYSTEMS IMPLEMENTED IN GNSS

Igor Gusev, Olga Sanakina

## Finland's public precise positioning service based on nationwide GNSS network

Dr Laura Ruotsalainen,

Department of Navigation and Positioning  
Finnish Geospatial Research Institute, Finland  
19. May 2015



## GLONASS from India: review of the revitalised system performances

Anindya BOSE<sup>1</sup>, G Sateesh Reddy<sup>2</sup>, Shreya Sarkar<sup>1</sup>,  
Debipriya Dutta<sup>1</sup> and Manjit Kumar<sup>2</sup>

<sup>1</sup>GNSS Activity Group  
The University of Burdwan, INDIA

<sup>2</sup>Research Centre Imarat (RCI), Hyderabad, INDIA

Email: abose@phys.buruniv.ac.in

UN/ Russia Workshop on Application of GNSS  
Krasnoyarsk, Russian Federation  
19 May, 2015

National University of Uzbekistan  
National Centre of Geodesy and Cadastre  
Astronomical Institute of the Uzbek Academy of Sciences

## Intermediate reference frame for Uzbekistan topographic maps

Mirmakhmudov E.<sup>1</sup>, Prenov Sh.<sup>1</sup>, Magdiev Kh.<sup>2</sup>, Fazilova D.<sup>3</sup>

<sup>1</sup>National University of Uzbekistan  
<sup>2</sup>National centre of geodesy and cartography (Uzbekistan)  
<sup>3</sup>Astronomical Institute of the Uzbek Academy of Sciences

phone: (+998-71)234-67-54, (+998-90) 966-38-80 (cell.)  
e-mail: [erkia\\_mir@yandex.com](mailto:erkia_mir@yandex.com), [erkia\\_mir@mail.ru](mailto:erkia_mir@mail.ru)

United Nations/Russian Federation Workshop on the Applications of Global Navigation Satellite Systems, Krasnoyarsk, 18-22.05.2015

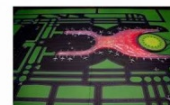
State Scientific Center of the Russian Federation  
VNIIFTRI  
National Research Institute for Physical-Technical and Radio Engineering Measurements

## Time-frequency and metrological assurance complexes development for GLONASS system

(United Nations/Russian Federation Workshop on Applications of Global Navigation Satellite Systems)  
18-22 May, 2015  
Krasnoyarsk, Russia

Sergey I. Donchenko – General Director  
Oleg V. Denisenko – Deputy General Director - Head of Department

## Current Status and Future Navigation Requirements for Mexico City New Airport



SCT AEM



## A-GLONASS application practice

Sergey Silin

Krasnoyarsk, May 18-22, 2015



# 5. GNSS and Space/Atmospheric Weather Monitoring (7 presentations)

## Навигационные измерения ГЛОНАСС/GPS в полярных широтах

Докладчик – Фатеев Ю.Л.  
Профессор ВИА СФУ

UN/Russian Federation Workshop on the Applications of GNSS  
Krasnoyarsk, 18-22 May, 2015



**IONOSPHERE AND SPACE WEATHER  
INVESTIGATIONS IN BOSNIA & HERZEGOVINA  
USING OS SOFTWARES  
preliminary results**

**Medžida MULIC,**  
Vroa, E., Krdzalic, D., Horosovic, D., Netro, R.  
UNIVERSITY OF SARAJEVO

U.N./ Russian Federation  
Workshop on GNSS Applications  
- Embrace Space Weather  
Program/INPE -

National Institute of Space Research

Presenter:  
André João Rypel – Office of Ocean, Antarctic and Outer Space Affairs  
Ministry of External Relations - Itamaraty

United Nations/Russian Federation Workshop  
on the applications of Global Navigation  
Satellite Systems

**GPS-TEC and Equatorial Plasma Bubbles  
observations during the period 2002-2013**

BY  
D. J. SHETTI

DEPARTMENT OF PHYSICS,  
SMT. KASTURBAI WALCHAND COLLEGE,  
SANGLI - 416 416  
INDIA (M.S)  
18 - 22 May 2015

SUGAC

SUGAC: Sofia University GNSS Analysis Center

Tzv. Simeonov (1), D. Sidorov (2), N. Teferle (2), G. Guerova (1), E.  
Egova (1), **K. Vassileva (3)**, I. Milev (4), G. Milev (5)

(1) Faculty of Physics, Sofia University St. Kliment Ohridski, Bulgaria  
(2) University of Luxembourg, Luxembourg  
(3) National Institute of Geophysics, Geodesy and Geography, BAS,  
Bulgaria  
(4) IPOS - BuliPOS GNSS network, Bulgaria  
(5) Space research and technology Institute, BAS, Bulgaria

United Nations/Russian Federation Workshop on the Applications of Global Navigation  
Satellite Systems, 18 - 22 May 2015, Krasnoyarsk, Russia

## IONOSPHERIC TOTAL ELECTRON CONTENT DISTURBANCES OBSERVED BEFORE EARTHQUAKES: AT TASHKENT AND KITAB GNSS STATIONS

Husan Eshqumatov

Ulugh Beg Astronomical Institute  
Institute of Nuclear Physics  
Uzbekistan Academy of Sciences, Tashkent, Uzbekistan

Krasnoyarsk, Russian Federation, 18-22 May 2015



MIIGAİK  
1779-2013



## EXPERIMENTAL STUDY OF REAL-TIME IONOSPHERE PARAMETERS USING THE SPECIAL MULTI-GNSS EQUIPMENT

A. Maïorov, V. Nepoklonov, A. Kupriyanov, E. Matskin,  
R. Davlatov, D. Morozov  
The Moscow State University Geodesy and Cartography

UNITED NATIONS/RUSSIAN FEDERATION  
WORKSHOP ON THE APPLICATION OF  
GLOBAL NAVIGATION SATELLITE  
SYSTEMS, 18-22 May, 2015, Krasnoyarsk, Russia



# 6. Capacity Building, Training and Education in the Field of GNSS (8 presentations)



## New Approach for Prompting International GNSS Education

Prof. Dr. WENG Jingnong

International School, Beihang University  
BeiDou International Exchange and Training Center  
UN regional centre (RCSSTEAP) in China



MODERN TECHNOLOGY OF  
TRAINING SYSTEMS FOR SATELLITE  
NAVIGATION



## About the teaching of radio navigation theory

Povalyaev A.A.

JCS "Russian space systems"  
Moscow aviation institute  
(National research university)

Krasnoyarsk, 20 may 2015 r



MIIGA  
1779-2015



Research and Education training centre of highly qualified specialists in the field of application satellite navigation technologies GLONASS/GNSS) in Moscow State University of Geodesy and Cartography

Rector of the Moscow State University of Geodesy, Cartography (MIIGA)

Prof. Andrey Maiorov ,

Vladimir Klimov, PhD, CEO of the Association GLONASS/GNSS Forum

Prof. MIIGA, Deputy CEO of the Association GLONASS/GNSS Forum,

Andrey Kupriyanov

United Nations/Russian Federation Workshop on the Applications Global Navigation Satellite Systems, 18-22 May 2015, Krasnoyarsk, Russian Federation



# Session 7. GNSS Application and Technology Development (6 presentations)

Recent Experience in Operating the First QOS of SLR in Brazil

Introduction  
Brasília city  
The UnB  
GLONASS station at UnB  
Associated Research  
Conclusion

## Recent Experience in Operating the First Quantum and Optical System of Satellite Laser Ranging Installed in Brazil

Renato Alves Borges, Geovany Araújo Borges,  
Gennady Saenko, Andrey Pavlov  
raborges@aerospace.unb.br, gaborges@unb.br, g.saenko@mail.ru,  
pavlov\_andrey@hotmail.com

Universidade de Brasília,  
Brasília - Brazil



OJC - RPC - PSI,  
Moscow - Russia



UN/Russian Federation Workshop on Applications of GNSS  
IEBC, Krasnoyarsk, Russia  
May 18<sup>th</sup> – 22<sup>nd</sup>, 2015

School of Geomatic sciences and Surveying Engineering, IAV H2, Rabat, Morocco

CRASTE-LF, Rabat, Morocco



## Example of Use of GNSS and Laser scanning for Dams monitoring

Mourad BOUZIANI  
Department of Geodesy and Surveying  
ESGIT, IAV Hassan II, Morocco  
  
Coordinator of GNSS Master Curriculum  
CRASTE-LF, Affiliated to the United Nations

United Nations/Russian Federation Workshop on GNSS -- Krasnoyarsk, Russian Federation -- 18-22 May 2015

United Nations-Russian Federation Workshop on the Applications of Global Navigation Satellite Systems  
Krasnoyarsk, Russian Federation 18 - 22 May 2015

## Seismic risks assessment around the Mediterranean region

Dr. Ferdaous CHAABANE (presenter),  
Alexis Rigo (Project PI), Martinez-Díaz José,  
Dr. Tahayt Abdellilah, Briole Pierre, Mourabit  
Taoufik, Bezzeghoud Mourad.



## Fishing in View: Satellite Technology based Monitoring, Control and Surveillance System for Pakistan Marine Sector

Iftikhar Khan  
Section Head (Design & Development)  
GNSS Division  
Pakistan Space & Upper Atmosphere Research Commission  
(SUPARCO)  
UNITED NATIONS  
Office for Outer Space Affairs

Workshop on the Applications of Global Navigation Satellite System  
18-22 May 2015, Krasnoyarsk, Russia



## Improvement of GLONASS Time Generation and Its Synchronization to UTC(SU)

A.S. Bandura, P.P. Bogdanov, A.V. Druzhin, A.E. Tiuliakov,  
A.Y. Feoktistov  
  
"Russian Institute of Radionavigation and Time" JSC,  
Saint-Petersburg, Russia

United Nations/Russian Federation Workshop on Applications of Global Navigation Satellite Systems  
18-22 May 2015, Krasnoyarsk, Russia



# Session 8. GNSS Applications: National Programmes (4 presentations)



## GNSS as a new field of cooperation for Argentina

Stanislav MAKARCHUK  
Unit of Cooperation in the International Projects of  
Exploration of Universe and of Satellite Navigation

Comisión Nacional de Actividades Espaciales  
ARGENTINA

Krasnoyarsk, Russian Federation  
20 of May, 2015

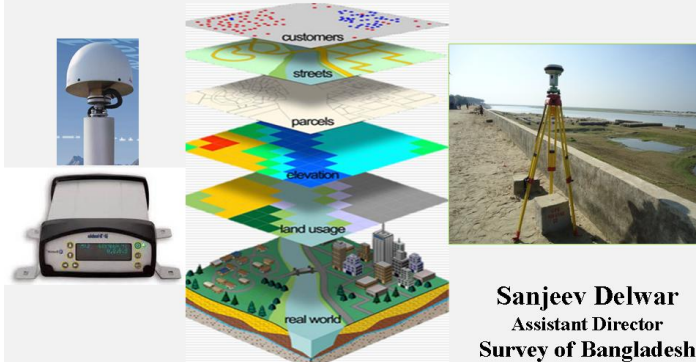


NATIONAL UNIVERSITY OF MONGOLIA  
DEPARTMENT OF GEOGRAPHY  
Laboratory of GIS and Remote Sensing

## GNSS application in Mongolia

Bolorchuluun Chogsom  
Sumiya Altangerel

## Aiding Surveying and Mapping with the Help of Global Navigation Satellite System (GNSS) in Bangladesh



**Sanjeev Delwar**  
Assistant Director  
Survey of Bangladesh



## Signal Structure, Interoperability, and Geometry

Tom Stansell  
Consultant to the Aerospace Corporation  
Tom@Stansell.com

18-22 May 2015  
Workshop on Applications of GNSS, Krasnoyarsk, Russia

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# Session 9. GNSS Applications: Case Studies (6 presentations)

21/05/2015 UN/Russian Federation Workshop on the Applications of GNSS 1

**ICTP** The Abdus Salam International Centre for Theoretical Physics

**Training on EGNOS-GNSS in Africa (TREGA)**

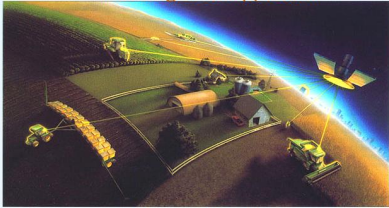
**ICTP- TREGA project – Case Study**

S.M. Radicella, X. Otero, C. Paparini, O.E. Abe, H.R. Ngaya,, B. Nava  
ICTP, Trieste, Italy

presented by Dr. Claudia Paparini

United Nations/Russian Federation Workshop on the Applications of Global Navigation Satellite Systems (GNSS) applications  
18 -22 May 2015

**Synergy between GNSS and GIS Application for Monitoring Land use Production An Integrated Approach**



Muhammad Umar Iqbal  
Manager/ Section Head GIS  
Space Technology Applications Directorate  
Pakistan Space and Upper Atmosphere Research Commission (SUPARCO)

Workshop on the Applications of Global Navigation Satellite System  
18-22 May 2015, Krasnoyarsk, Russia

**Challenges for positioning and navigation in the Arctic**

Slides prepared by  
Anna B.O. Jensen  
KTH - Royal Institute of Technology, Sweden

Updated and presented by  
Laura Ruotsalainen  
Finnish Geospatial Research Institute (FGI)

on behalf of the  
Nordic Institute of Navigation

United Nations/Russian Federation  
Workshop on the Applications of Global Navigation Satellite Systems  
Krasnoyarsk, Russia  
May 18-22, 2015

**INCORPORATING THE BROAD CONCEPT OF GNSS AS A TOOL OF HIGH IMPORTANCE IN ACADEMIC ASPECTS AND APPLIED RESEARCH IN COLOMBIA, SOUTH AMERICA**

**Héctor Mora-Páez<sup>1,2</sup>, José F. Mejía<sup>1</sup> and Néstor Castaño<sup>1</sup>**

<sup>1</sup> University of Manizales, Science and Engineering Faculty

<sup>2</sup> Colombian Geological Survey, GNSS GeoRED Project

**Performance Evaluation of the GPT2w and UNB3M Tropospheric Delay correction Models over Africa**

By  
<sup>1,2</sup>Isioye A. Olalekan, <sup>2</sup>Combrinck Ludwig, and <sup>1</sup>Botai O. Joel

<sup>1</sup> Department of Geography, Geoinformatics and Meteorology, University of Pretoria, Pretoria 0002, South Africa

<sup>2</sup>Hartebeeshock Radio Astronomy Observatory (HartRAO), P. O. Box 443, Krugersdorp 1740, South Africa

**GNSS measurements in Ulaanbaatar and its vicinity**

Erdenezul Danzansan  
Institute of Astronomy and Geophysics MAS, Ulaanbaatar, Mongolia  
[erdenezul@iag.ac.mn](mailto:erdenezul@iag.ac.mn)

Andrei Miroshnichenko  
Institute of the Earth's Crust SB RAS, Irkutsk, Russia

United Nations/Russian Federation Workshop on the Applications of Global Navigation Satellite System, Krasnoyarsk, Russian Federation, 18 – 22 May 2015



# Views and Recommendations

## **Spectrum protection and IDM:**

Participants recommended ICG to “conduct technical seminars and lectures focusing on GNSS spectrum protection and interference detection and mitigation. ...Proposals made for further consideration by ICG:

- (a) develop educational materials on sources of interference to GNSS, including an explanation of the difference between radionavigation satellite services and radiocommunication services and why radionavigation satellite services are more vulnerable to interference
- (b) conduct a survey to identify national and international regulations on spectrum protection, their possible inconsistency and necessary improvement.”

## **Capacity building, training, and education:**

Participants recommended ICG “...to establish an international centre with the active support of the Providers’ Forum and scientific organizations. That centre might grow into a network of centres around the world, focusing on GNSS science and technology, and all dedicated to the advancement of GNSS research, applications and education. The centre would provide capacity-building and technical guidance to nations that wished to engage in GNSS science, technology and education, including training on GNSS instrumentation and data processing and analysis.

Participants noted that JSC ISS had offered to host such a centre.”

# Lessons Learned

## Follow-up Projects/Initiatives

## Next Steps



ICG Experts Meeting

Vienna, Austria, December 14-18, 2015



# Thank You for Your Attention!



**52, Lenin Street, Zheleznogorsk, Krasnoyarsky region, Russia, 662972**

Tel. (3919) 76-40-02, 72-24-39 Fax (3919) 72-26-35, 75-61-46, e-mail: [office@iss-reshetnev.ru](mailto:office@iss-reshetnev.ru), <http://www.iss-reshetnev.ru>