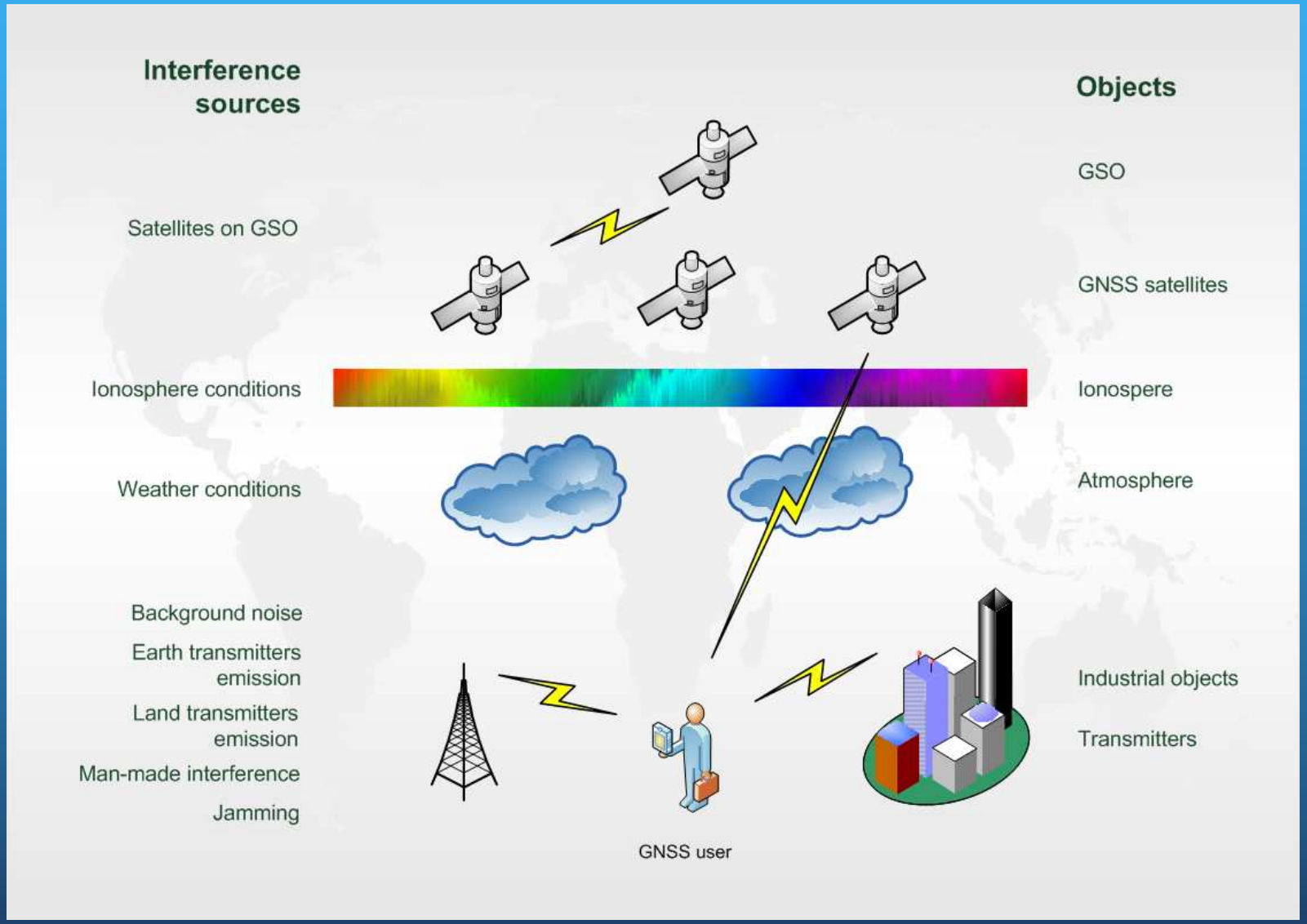
ICG WORKING GROUP A
8th Meeting of The International Committee of GNSS. Dubai, UAE
10-14 November 2013

International of interference detection & mitigation system for GNSS

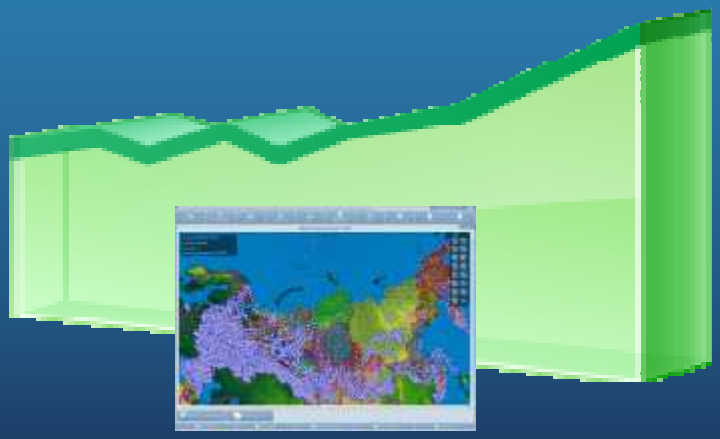
Dr. Stanislav Kizima, ITU expert
Russian Federation
Design Bureau "Vector", Deputy Director General
kizima@vemail.ru

GNSS signals propagation medium

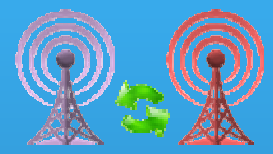


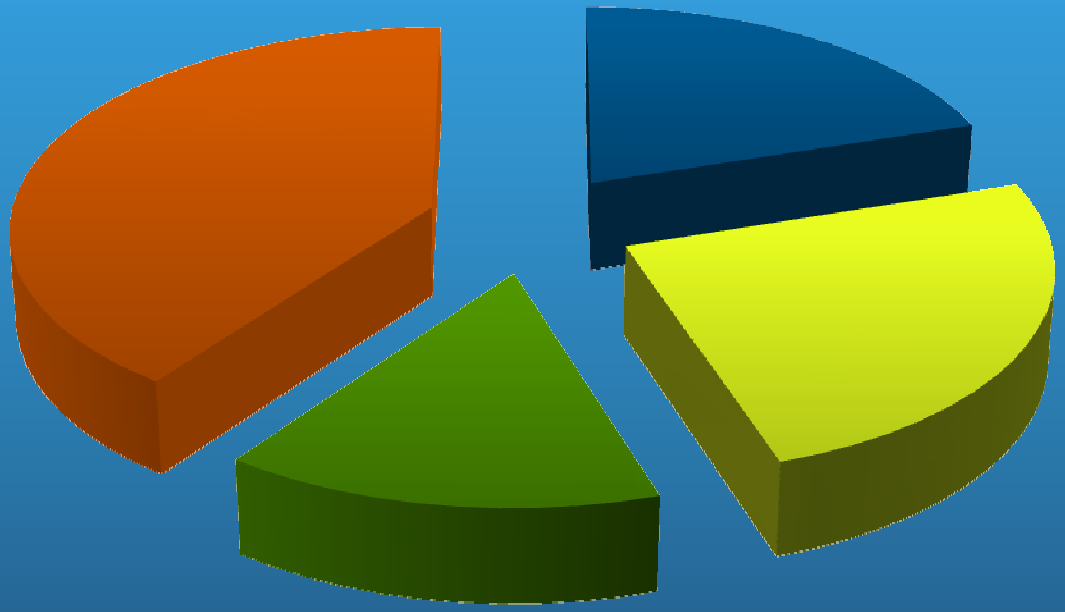
Reception and operation conditions of GNSS user equipment

- Global increase of numbers of transmitters
- Global increase of frequency bands usage
- Global increase of numbers of interferences



Interference sources of radio signal reception





- Illigal emissions - 20%
- Frequency planning problems - 25%
- Hardware failures man mistakes - 15%
- Intermodulation, out-of-band emissions - 40%

Interference detection in GNSS. Technical problems

- GNSS failures caused by interferences
- GNSS users mobility. Short time interference period and GNSS malfunctions
- Probability of GNSS malfunction due to other technical reasons and signal propagation medium conditions

Interference detection in GNSS. Human aspect

- Users do not initiate interference monitoring and its elimination in GNSS
- Users think that the GNSS failures caused by technical and other reasons

Interference monitoring problems

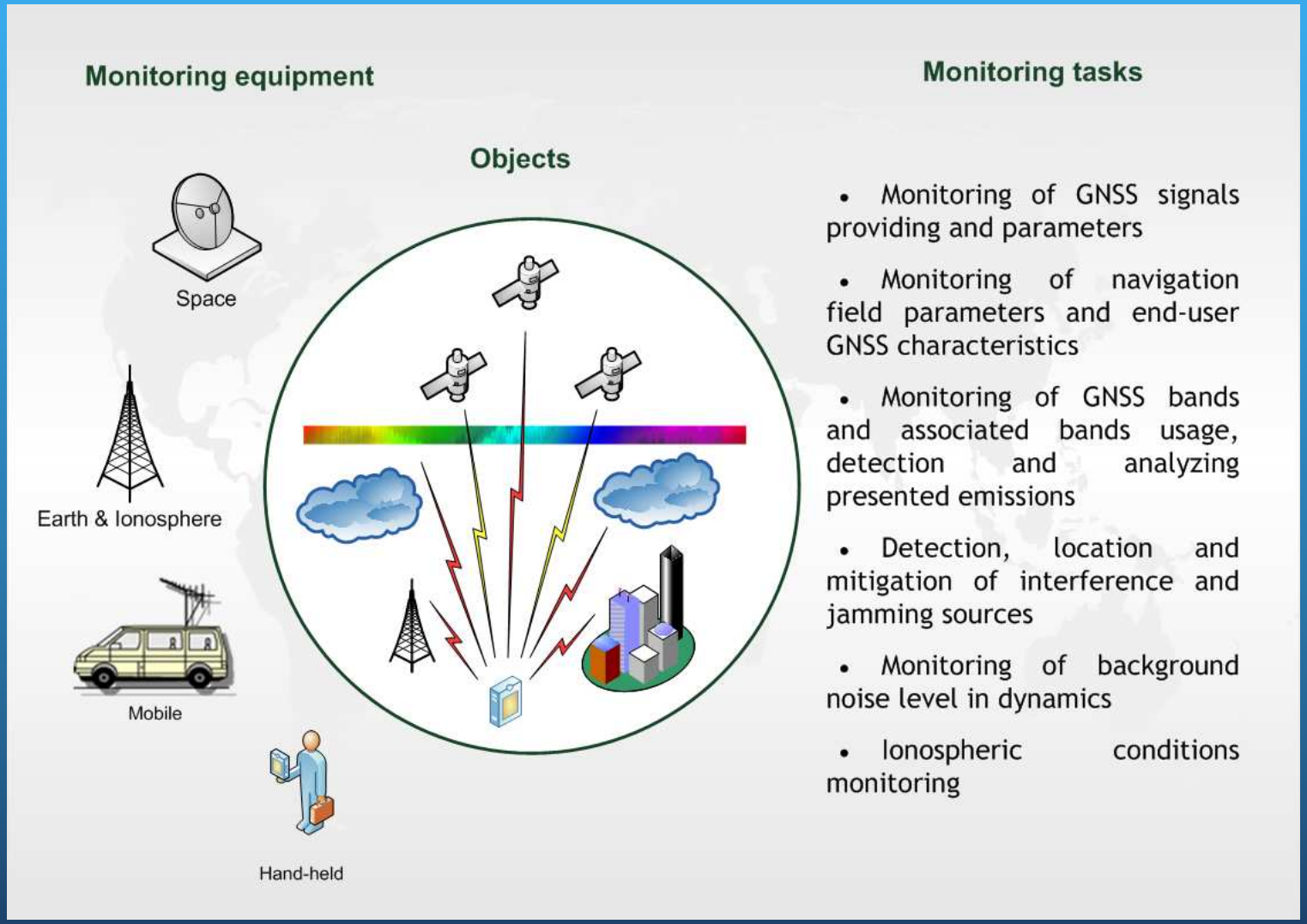
- Absence of special equipment for GNSS end-user monitoring and measurement of:

- Parameters of GNSS navigation field
- Frequency bands usage in GNSS and in near frequency bands
- Industrial interferences in GNSS bands
- The dynamics of the manmade noise background
- Ionosphere conditions
- Parameters of effectiveness of GNSS services in end-user conditions

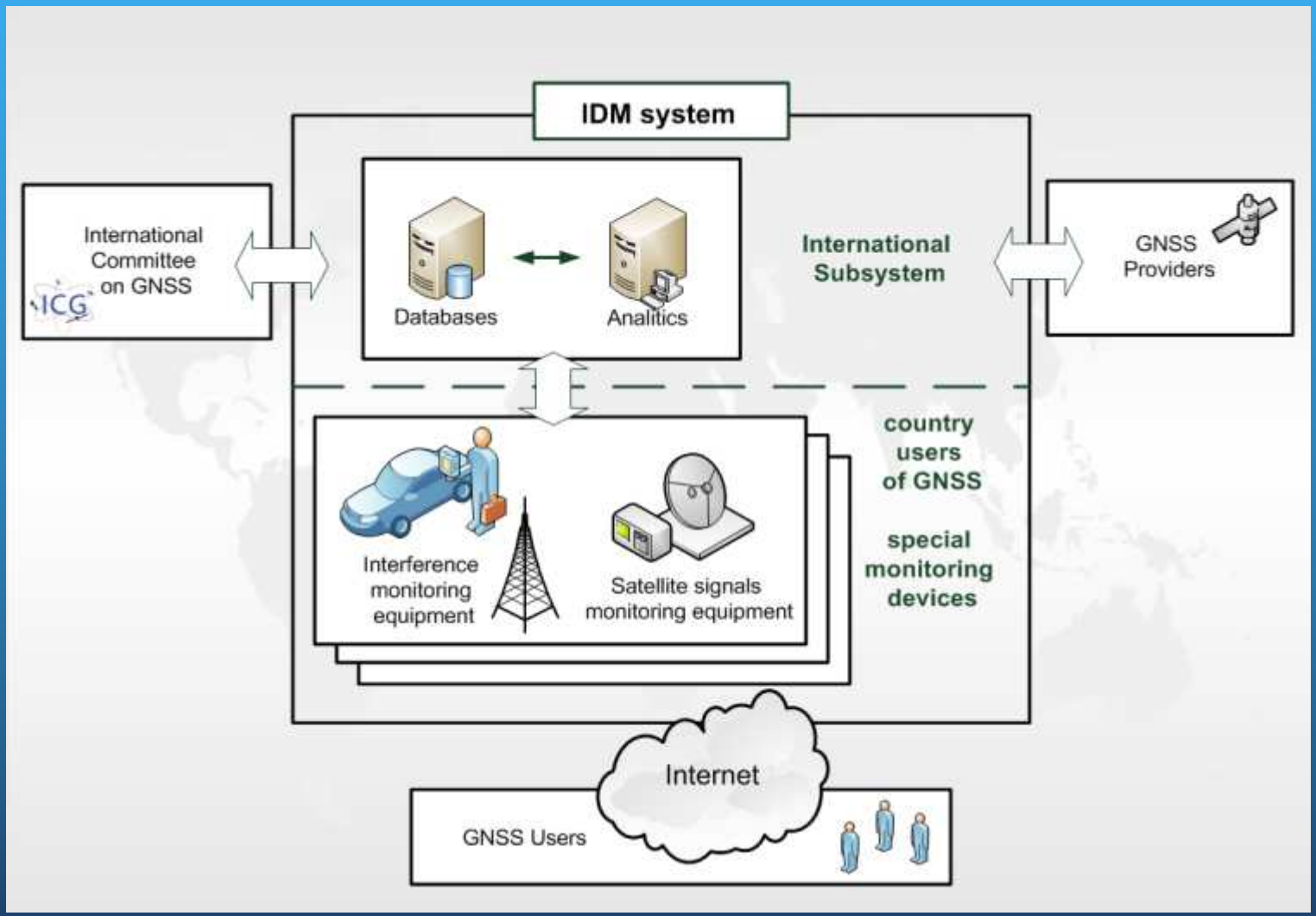
Resolving problems of interference monitoring in GNSS

- Development of special equipment for monitoring of:
  - GNSS signal parameters
  - navigation field parameters
  - propagation medium parameters
- Conducting research. The calculation of limit Values of parameters of the propagation medium GNSS signal
- Development of services for GNSS users equipment for:
  - automatic alert of parameters of GNSS signals availability
  - signalization of worsening of GNSS signal receiving conditions, probability of navigation quality decrease and of navigation failure
  - alert of need for measurements for interference sources localisation

GNSS interference detection and mitigation system tasks



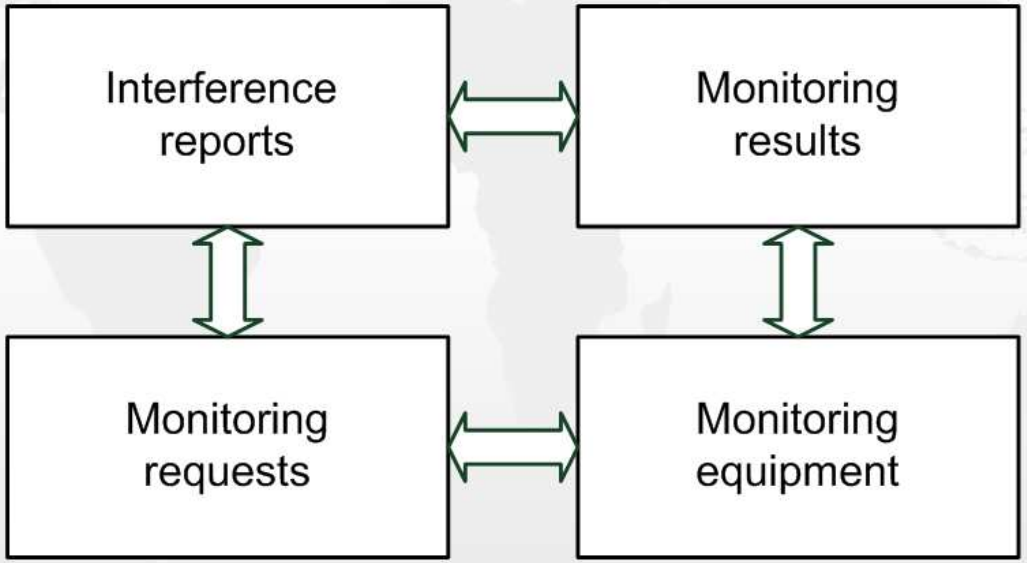
International interference detection and mitigation system for GNSS



Database of international interference detection and mitigation system for GNSS

IDM system database server

Database structure



International IDM system. Results of monitoring

Data provided for specified time and place:

- List and characteristics of GNSS satellites. Data of satellites radio access
- Frequency band usage. Transmitters in GNSS frequency bands and in near bands
- Background noise level
- Ionosphere conditions
- Interference sources and their characteristics

International IDM system services

IDM system analytics server

Analytic reports

- Actual GNSS end-user capabilities
- List and characteristics of GNSS satellites
- Interferences for GNSS
- Monitoring results
- Result of interference sources location

Analytic services of the IDM system

- Calculation GNSS satellites footprints
- Calculation of GNSS signal quality in specified areas
- Calculation of probability of interference from radio stations working in same regions with GNSS users. Calculation using data of radio stations working on associated frequencies taking into account the intermodulation, out-of-band emissions, side emissions, emissions on harmonics and subharmonics
- Identification of potential interference sources by searching correlations in interference database
- Calculation of spectrum utilization parameters for specified areas, compare results with actual spectrum measurement and using result to locate potential interference sources
- Calculation of maps of radiation noise and integral interference for specified areas
- Calculation of areas of application radio monitoring equipment

Cooperation within the international IDM system

- Prepare and approve of Recommendations of the International Committee on GNSS for organization of international cooperation and creation of an international interference detection and mitigation system for GNSS
- Signing international cooperation agreements on interference detection and mitigation for GNSS
- Prepare and approve of formalized data exchange formats for interference detection and mitigation
- Establishment of national formalized data exchange services for interference detection and mitigation
- Provide quick reaction on interference reports. Develop interference mitigation system for GNSS

Creation of IDM system database server for GNSS

- Determination of administrator of international IDM system
- Create and approve of formalized data exchange formats for interference detection and mitigation
- Development of servers for collect, consolidation, exchange and processing data
- Creation of services of international IDM system for GNSS
- Development of service for import and export data for cooperation in international IDM system for GNSS
- Provide quick reaction service on interference reports. Provide interference mitigation system for GNSS.

international IDM system. Results

- Provide actual data about GNSS capabilities
- Data consolidation of results of GNSS propagation media conditions monitoring
- Data consolidation of results of interferences monitoring
- Interaction for quick reaction on interference report
- Interaction for quick interference mitigation for GNSS

Thank you!

“Vector” Specialized DCMM&S
18, Sucharevsky Val, Moscow, 127018, Russia
Fax: +7(495)640-54-91
www.sokb-vektor.ru