М И И Г А и К

The Moscow State University of Geodesy and Cartography
(1779-2010)

The Moscow State University of Geodesy and Cartography education system and the global navigation satellites systems applications

President of the University- Prof. Victor Savinych
Rector of the University- Prof. Vasily Malinnikov
Deputy of Rector of the University- Prof. Andrey Maiorov,
Prof. Andrey Kupriyanov

United Nations/Moldova/United States of America Workshop on the Applications of Global Navigation Satellite Systems
Chisinau, Moldova, 17-21 May 2010

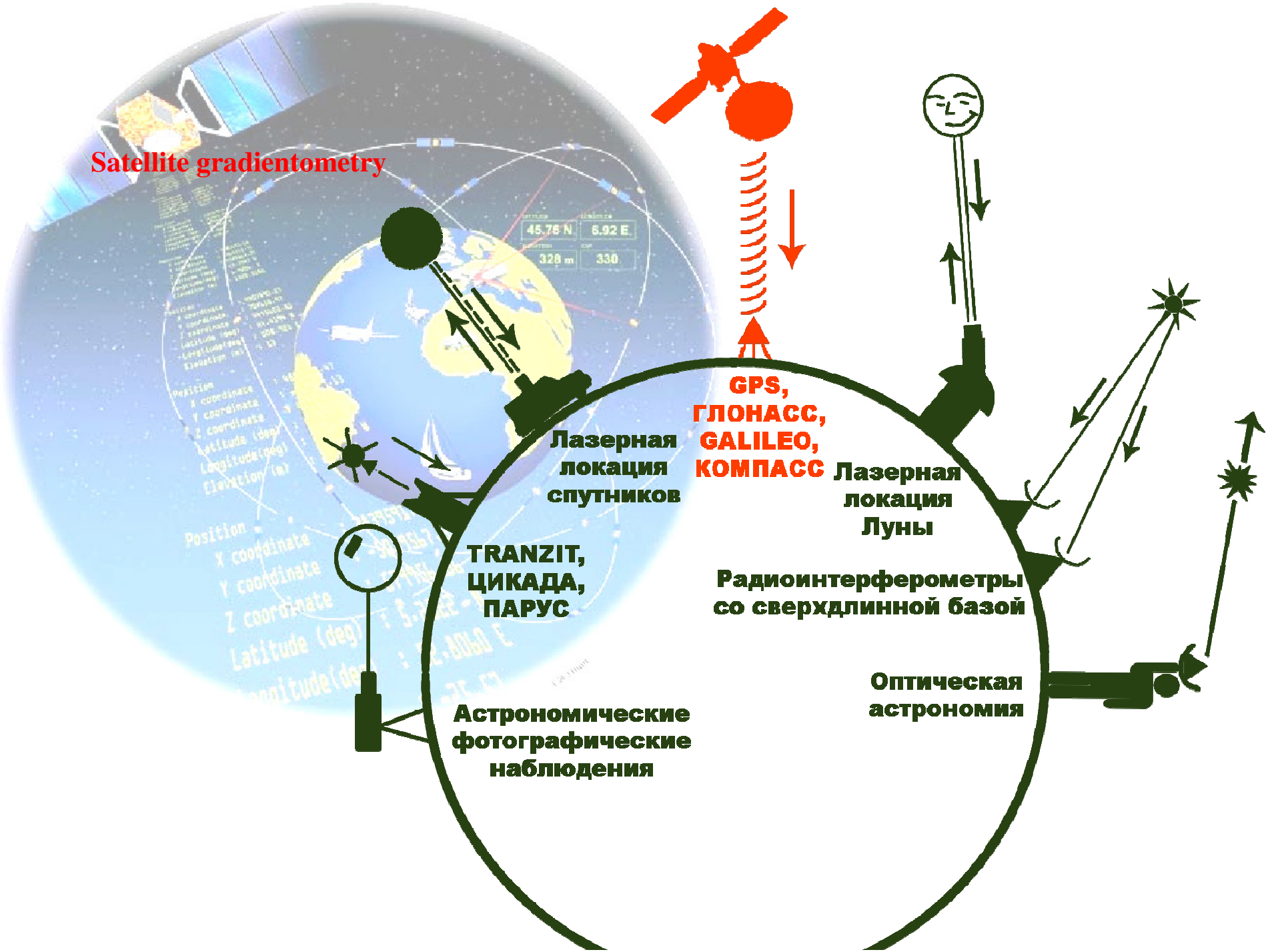
MIIGAiK est. 1779

MIIGAIK MUSEUM. THE SUITE OF ROOMS

Учебная аудитория №9

МЕТЕОРОЛОГИЧЕСКАЯ ОБСЕРВАТОРІЯ
КОНСТАНТИНОВСКАГО МЕЖЕВАГО ИНСТИТУТА

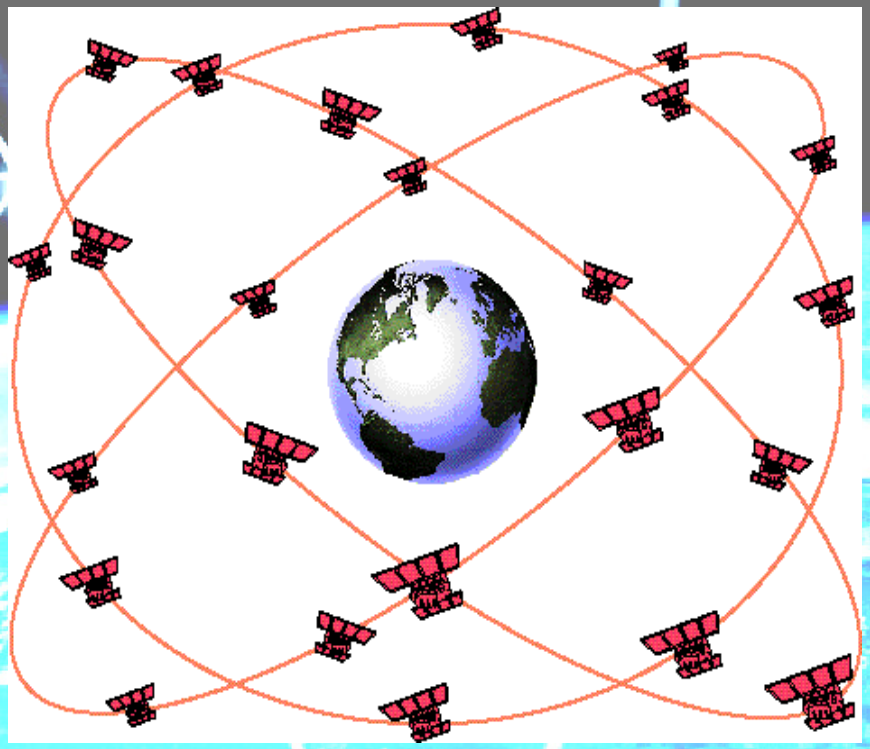
- Съемка 1910 года


Satellite gradientometry
GPS,
ГЛОНАСС,
GALILEO,
КОМПАСС
Лазерная
локация
спутников
Лазерная
локация
Луны
TRANZIT,
ЦИКАДА,
ПАРУС
Радиоинтерферометры
со сверхдлинной базой
Оптическая
астрономия
Астрономические
фотографические
наблюдения

GNSS era

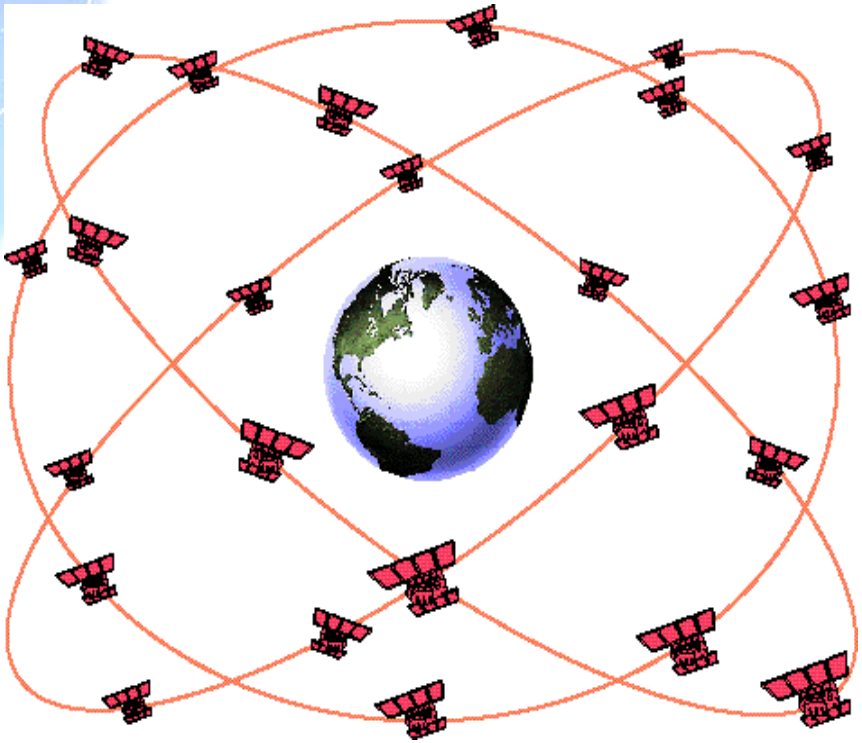
GLONASS

Селективный доступ	Нет
Режим AS	Нет
Разделение сигнала	Частотное
Кол-во спутников	24
Кол-во орбитальных плоскостей	3
Период обращения	11’15”
Время	UTC (USSR)
Система координат	П390

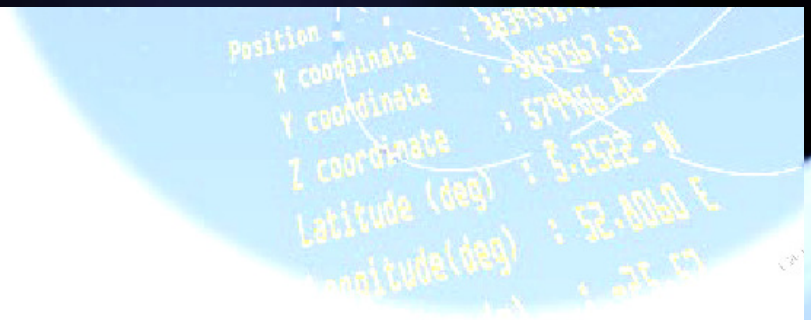


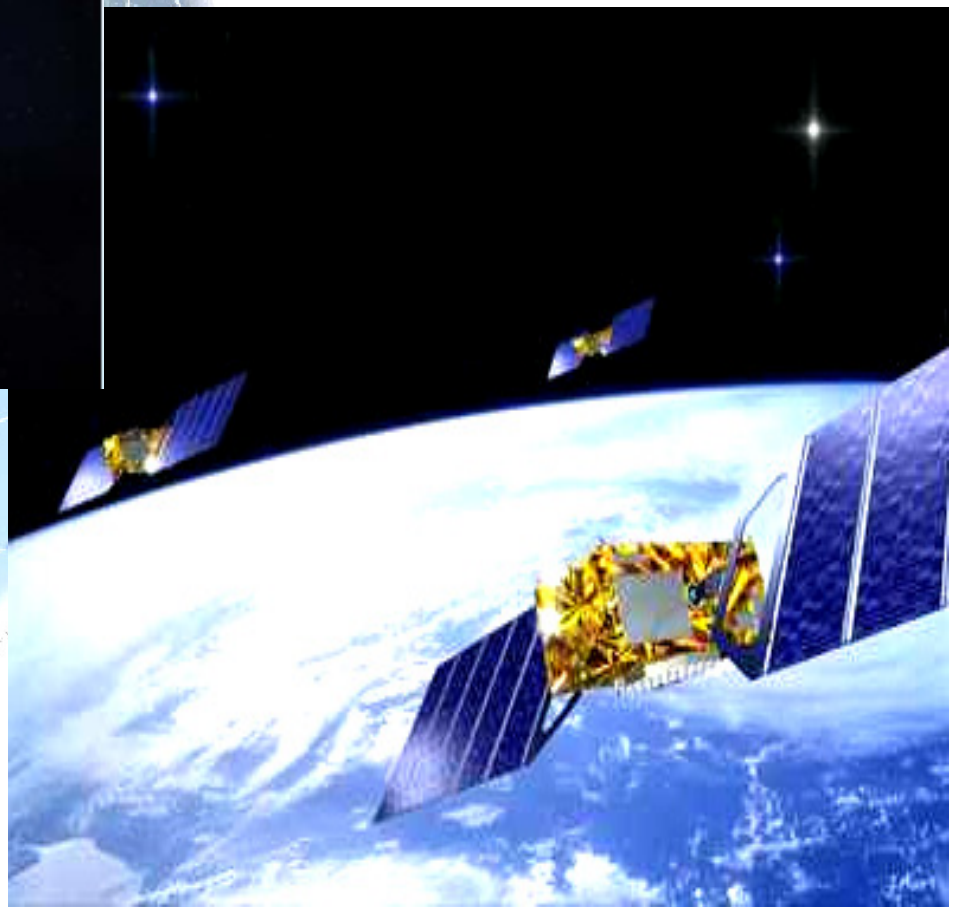
GPS

GPS	
Селективный доступ	Нет
Режим AS	Да
Разделение сигнала	Кодовое
Кол-во спутников	24
Кол-во орбитальных плоскостей	6
Период обращения	11’58”
Время	UTC (USNO)
Система координат	WGS84




Galileo


Position
X coordinate
Y coordinate
Z coordinate
Latitude (deg)

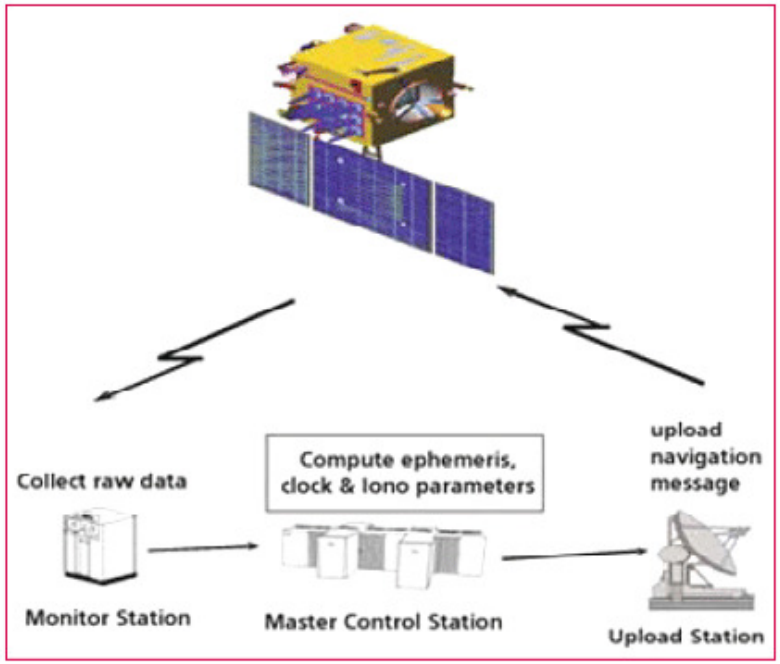


IRNSS

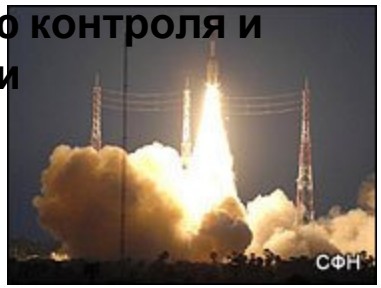
Индийская региональная навигационная спутниковая система (Indian Regional Navigation Satellite System), сокращённо IRNSS, только недавно была окончательно принята к реализации правительством Индии. Бюджет проекта составил более 300 миллионов долларов. IRNSS будет обеспечивать только региональное покрытие самой Индии и частей сопредельных государств.

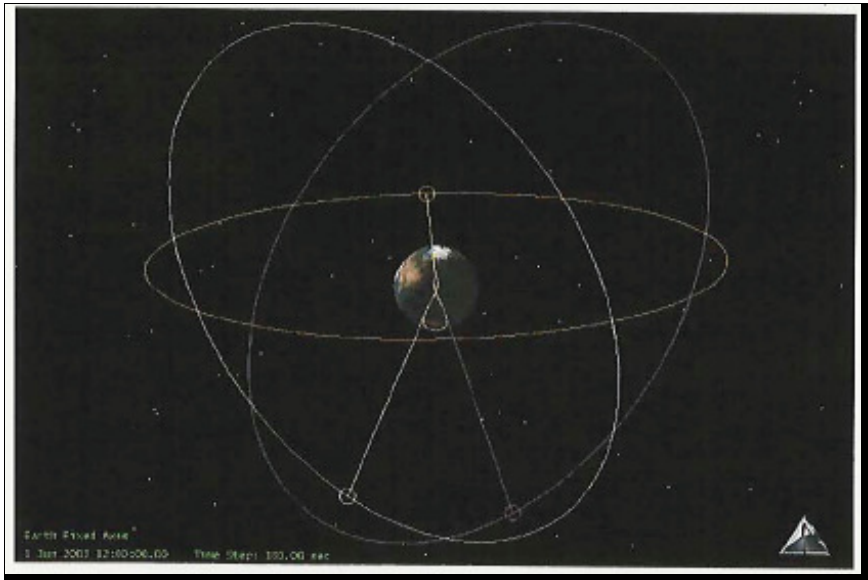
Общее количество спутников системы IRNSS: 7. Проектная дата завершения работ: 2011 год. Текущее состояние: первый спутник будет запущен в 2008 году.

Основные блоки IRNSS



- **Четыре спутника из семи в RNSS будут размещены на орбите с наклонением 29°**
- **Спутники IRNSS будут использовать платформу, которая используется на русском метеорологическом спутнике Kalpana-1 с массой 1330 кг мощностью солнечных батарей 1400 Вт. Полезная нагрузка будет включать два 40 Вт твердотельных усилителя**
- **Земной сегмент IRNSS будет иметь станцию мониторинга, станцию резервирования, станцию контроля и управления бортовыми системами**



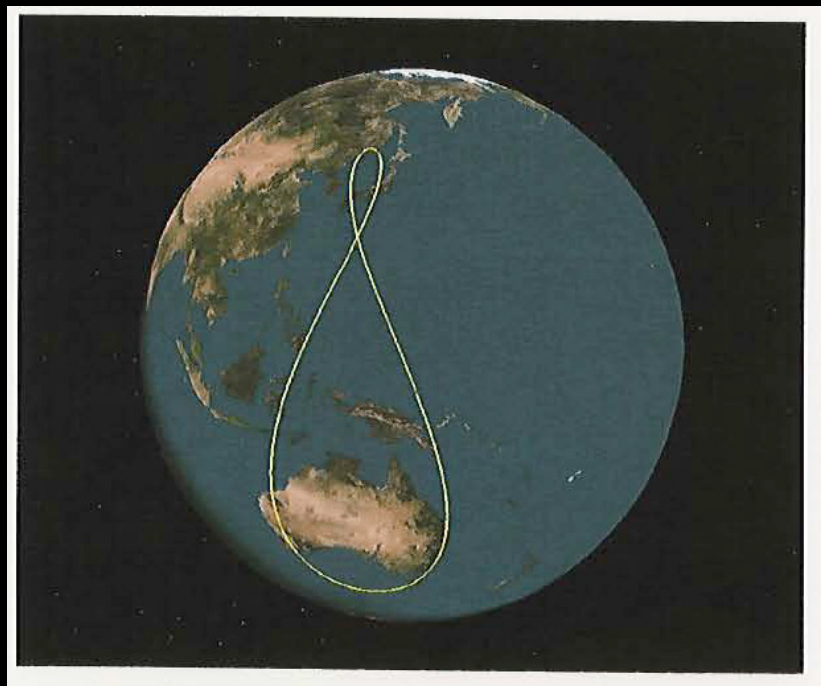


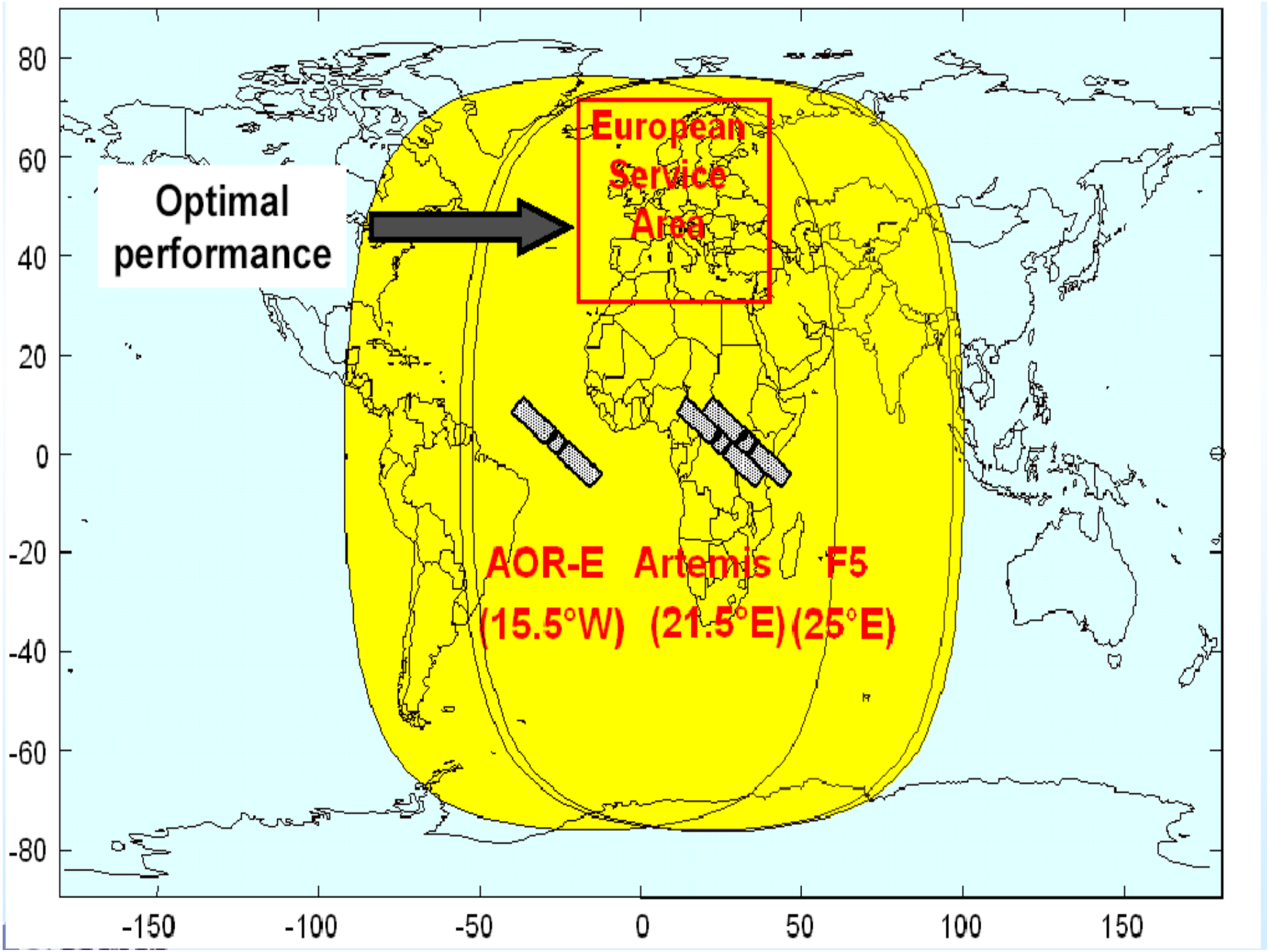
QZSS – Quazi-Zenith Satellite System (Япония)

•Три спутника находятся на эллиптической и наклонной орбите, расположенные в разных орбитальных плоскостях с одинаковой траекторией

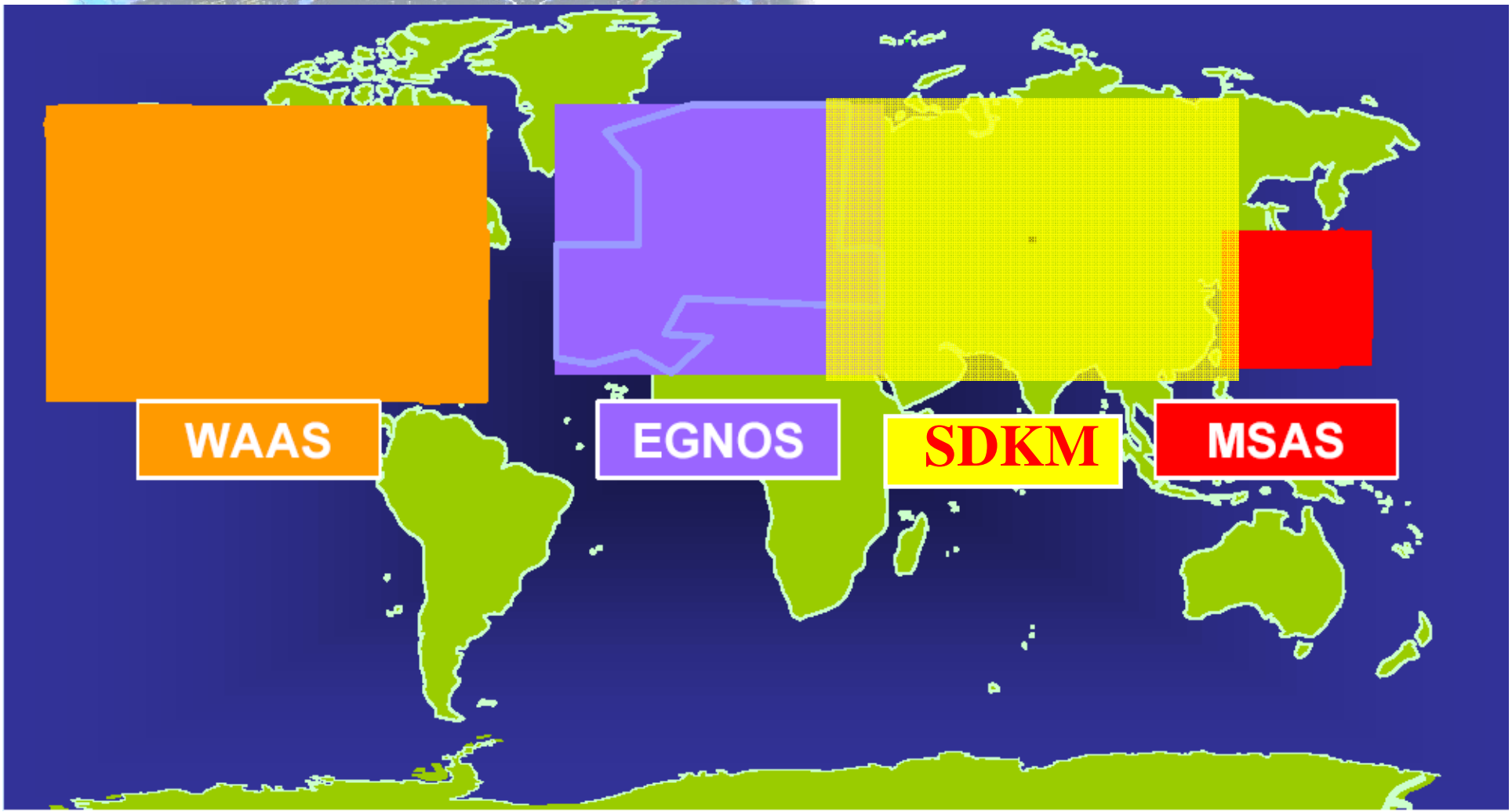
QZSS сконструировали так, что хотя бы один спутник из трех всегда находится в зените над Японией

a=42164 км
i=45 deg
Ω=120 deg apart




Optimal performance
European Service Area
AOR-E (15.5°W)
Artemis (21.5°E)
F5 (25°E)
80
60
40
20
0
-20
-40
-60
-80
-150
-100
-50
0
50
100
150

Глобальные системы коррекции



Education

- **RUSSIAN FEDERATION-**

  has two higher education institutions geodesy and cartography profiles
- **(bachelorr's programe, specialisation,**
- **master's degree programme, graduate school, doctoral candidacy, extended education, professional development .**

  The major disciplines are: applied geodesy, astronomy-geodesy, aerial survey, space geodesy and navigation, cartography, remote sensing, applied informatics in geodesy, land registry, cadastre, etc.

- **Moscow State University of Geodesy and Cartography (MIIGAIK), Moscow**
- **Siberian State Acadeny of Geodesy (SGGA), Novosibirsk**
- **At the present time, in MIIGAIK and SGGA are studing more than 10,000 students and the past graduators**
- **The class of graduators is mote than 1000 annually.**

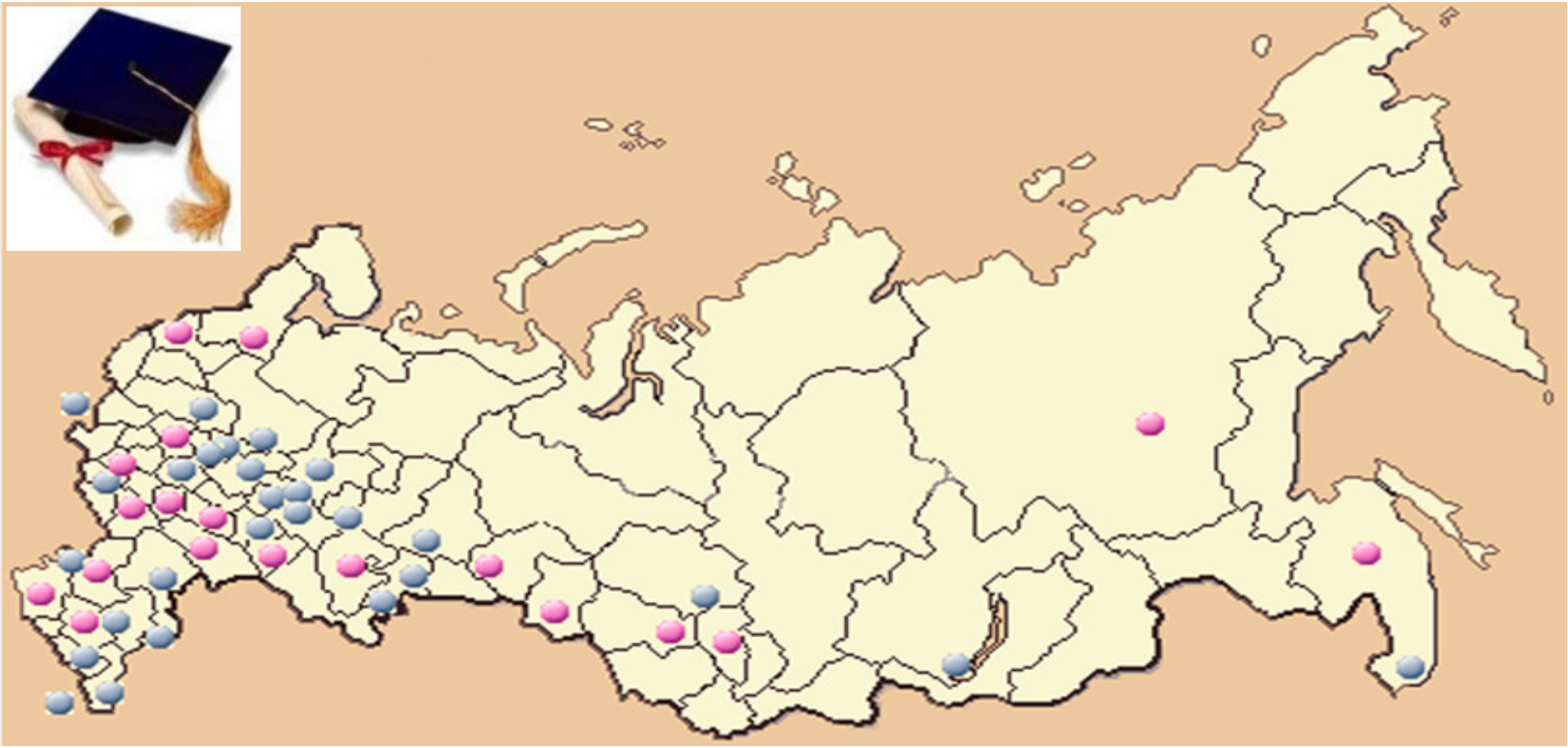
The main specialites in MIIGAIK

- GEODESY (Applied geodesy, Astronomo-geodesy, Space geodesy),
- Photogrammetry and remote sensing,
- Aerial survey (Remote sensing and monitoring of the Earth from space)
- Laser equipment and laser technology
- Information systems and information technologies
- Applied informatics (in survey, in informatics systems)
- Management and technologies of information protection
- Land management and land cadastre (Municipal cadastre)
- Cartography
- Optic-electronic equipment and systems
- Jurisprudence
- Finance and credit
- State and municipal management
- Enterprise management

The education structure of Moscow State University consist on several levels:

- **pre-higher education professionally oriented with high-school children, including distance education,**
- **Bachelor's program**
- **Specialization**
- **Master’s degree program**
- **Graduate school**
- **Doctoral candidacy**
- **Extended education, Professional development**

The Educational Tutorial Association under MIIGAIK includes 35 higher education institutions of Russian Federation



More than 300 students graduated at the chairs of geodesy of institutes and universities annually

MASTER'S DEGREE PROGRAM

- **“GEOGESY”**

  GNSS technologies in geodesy, physical geodesy, geodetics methods for study of Earth geodynamic processes, the Earth gravitation study, astronomy-geodesy, space astrometry, theory of celestial mechanics, mathematical astronomy, gravitational astronomy, theory of motion of satellites and the orbit determination on base of on board measurements, geodetics applications for municipal administrations, mathematical treatment of measurements, software development, aero and space imaging, photogrammetry and phototopography, space remote sensing, charts and atlases design, graphics and revision, geoinformation technologies, cadastre, land and real estate monitoring and inventory etc.

- **“OPTO-TECHNOLOGIES”**

- **Applied optics, Optics and Optoelecrtonic equipment, Laser equipment**

GNSS SPECIAL COURSES

- Base course: Global Navigation Satellite Systems
- Space Geodesy
- Space Navigation
- Orbital Methods
- GNSS reference networks applications for monitoring of global, regional and local geodynamic, etc.,etc
- Survey technologies, methods and equipment on base of GNSS signals

POST-GRADUATE EDUCATION, GRADUATE SCHOOL

- Geodesy (INCLUDES ALL GNSS APPLICATIONS)
- Optical and optoelectronic equipment and systems
- Economy and management of nation's economy (in sectors including economy, development and management of enterprises, industry branches , complexes
- Land management, cadastre and land monitoring (INCLUDES ALL GNSS APPLICATIONS)
- Cartography (INCLUDES ALL GNSS APPLICATIONS)
- Aerospace research of Earth, photogrametry
- (INCLUDES ALL GNSS APPLICATIONS)
- Geoinformatics
- (INCLUDES ALL GNSS APPLICATIONS)
- Geoecology

THE MAIN STRATEGIC PARTNERS

(as the example0

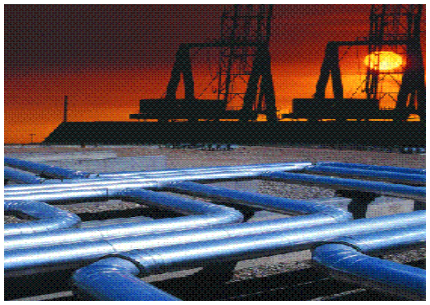
Ministry of Economic Development and Trade

RUSSIAN SPACE AGENCY

Ministry of Transport

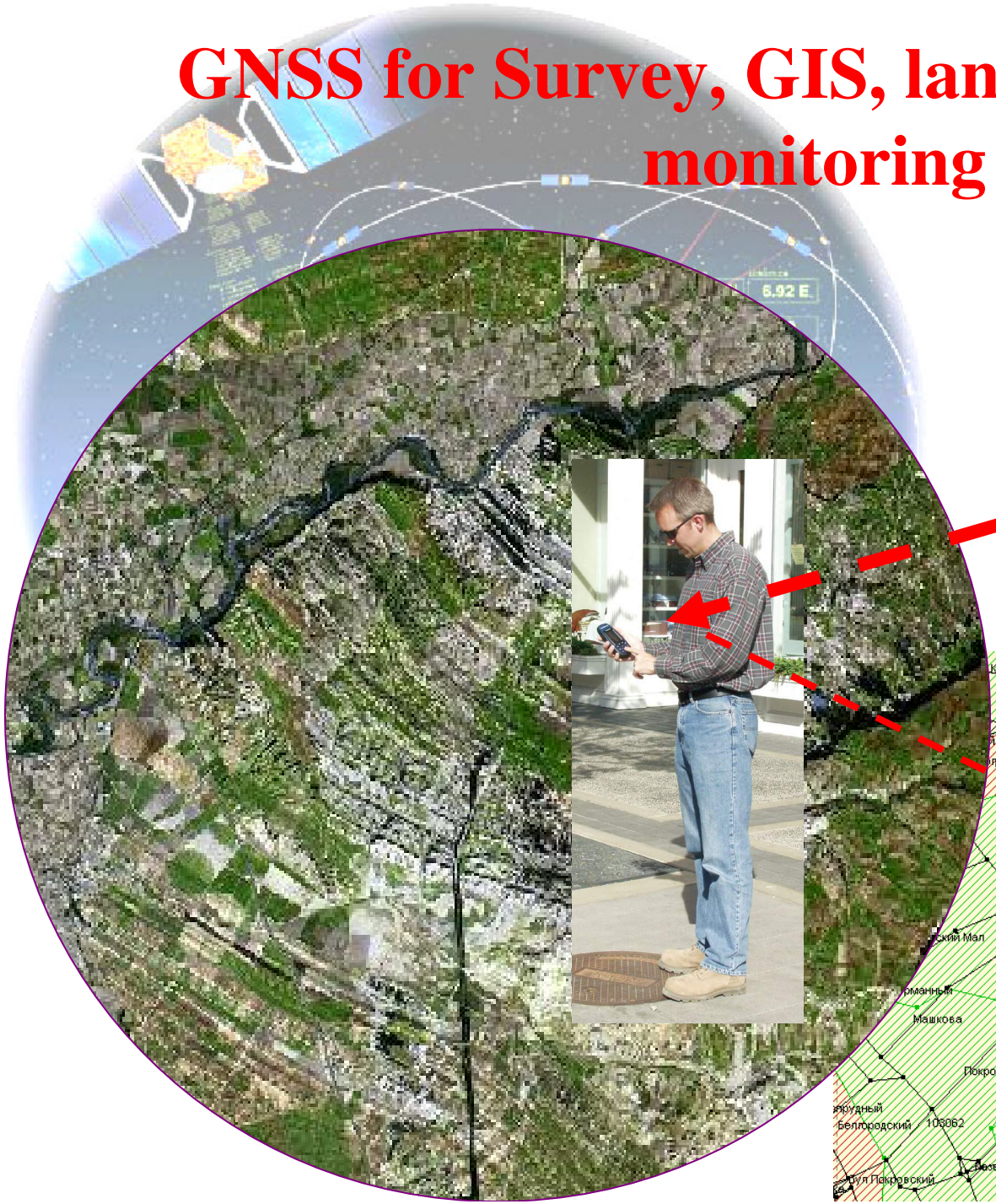
Ministry of agriculture

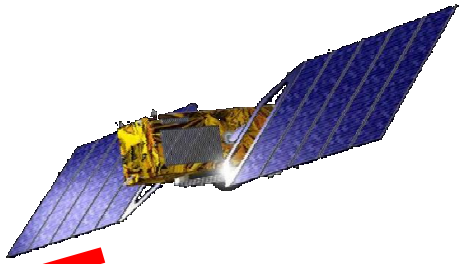
Rosreestr

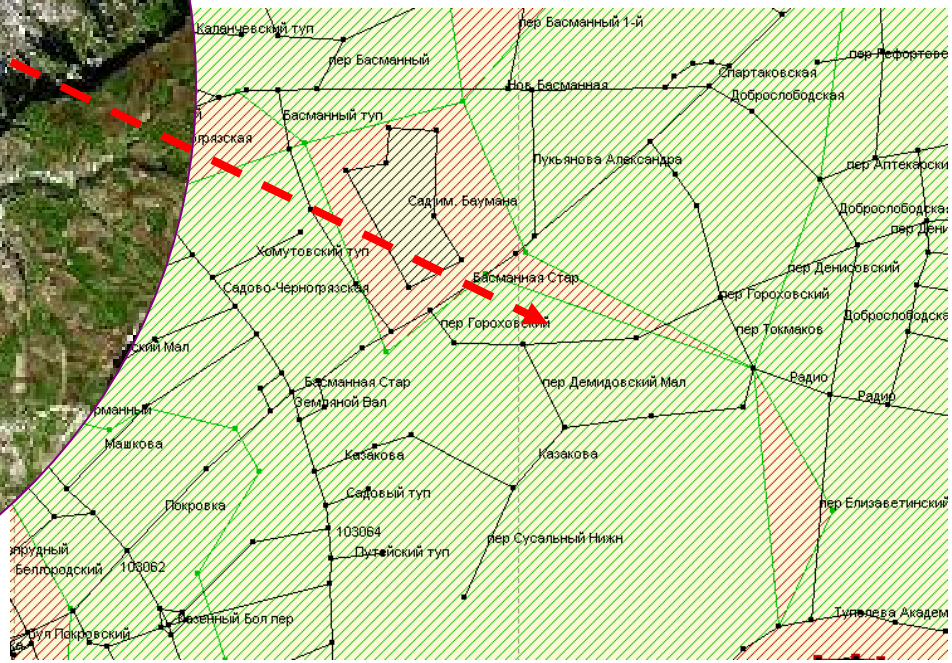


Oil and Gas sector

GNSS for Survey, GIS, land cadastre and monitoring



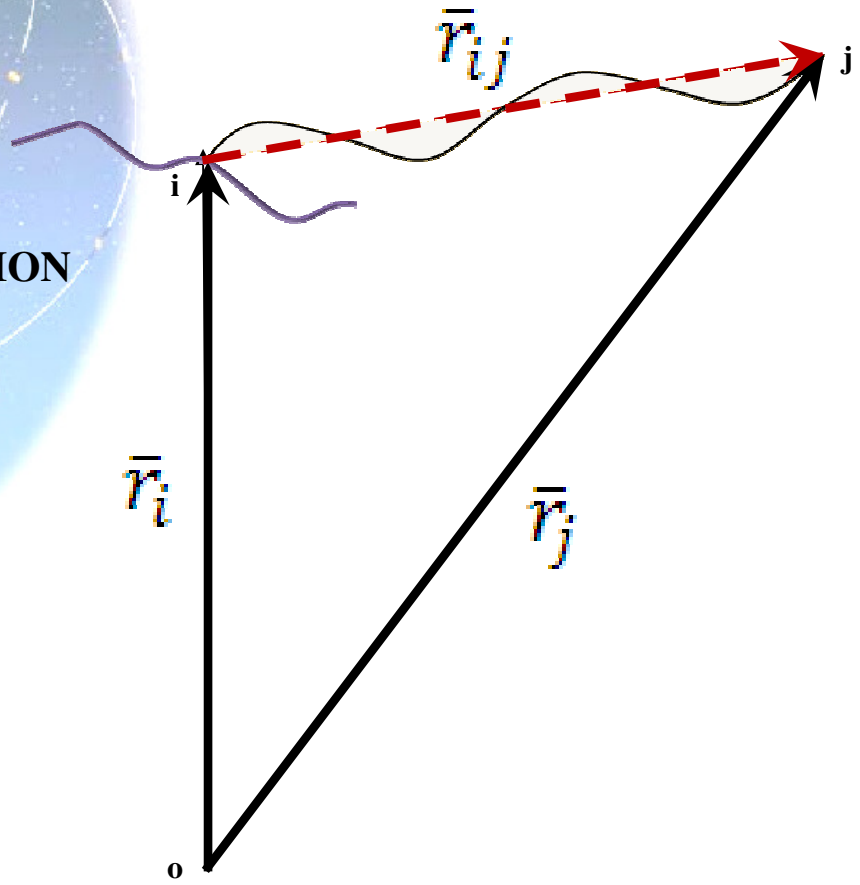




FUNDAMENTAL GNSS VECTORS SOLUTION

Доплеровские наблюдения
Фотографические наблюдения ИСЗ
РСДБ
Лазерная локация
Кодово-фазовые измерения

$$\bar{r}_{ij} = \bar{r}_j - \bar{r}_i$$



GNSS APPLICATIONS FOR RAILWAYS

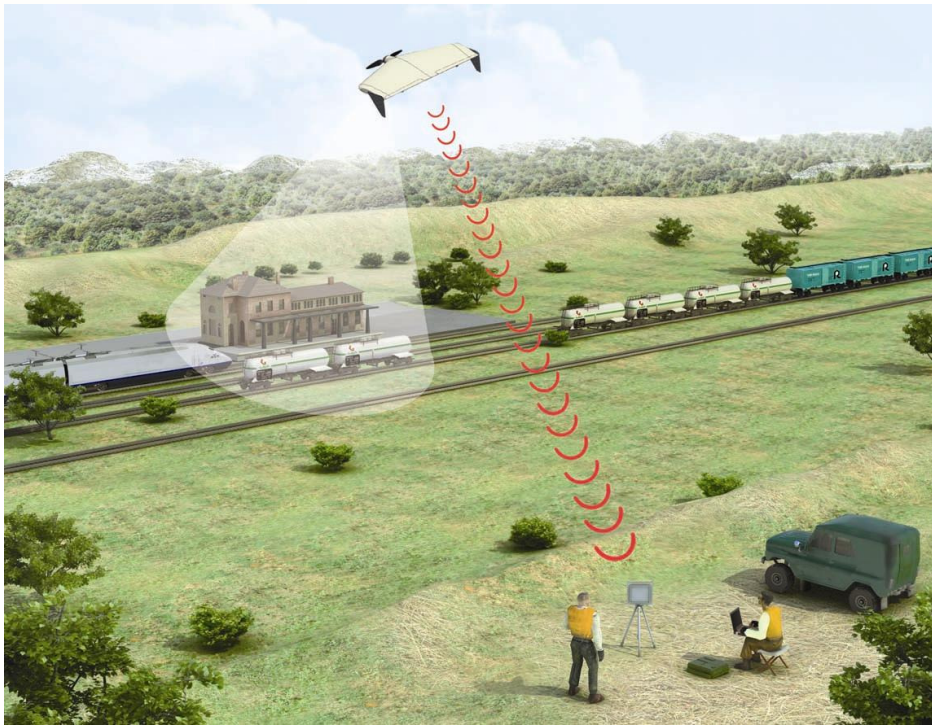
GNSS FOR CONSTRUCTION

Land monitoring and inventory

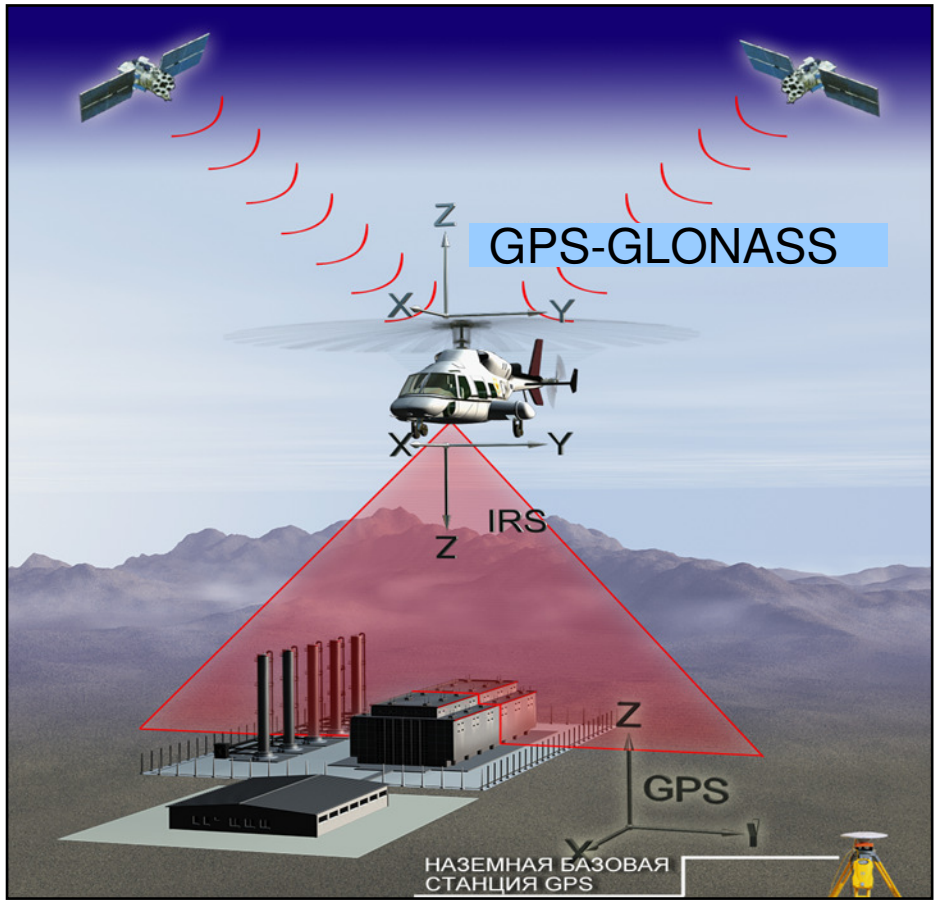
GNSS for electricity lines survey

RTK for machine control

Unmanned aircraft monitoring for ground infrastructure

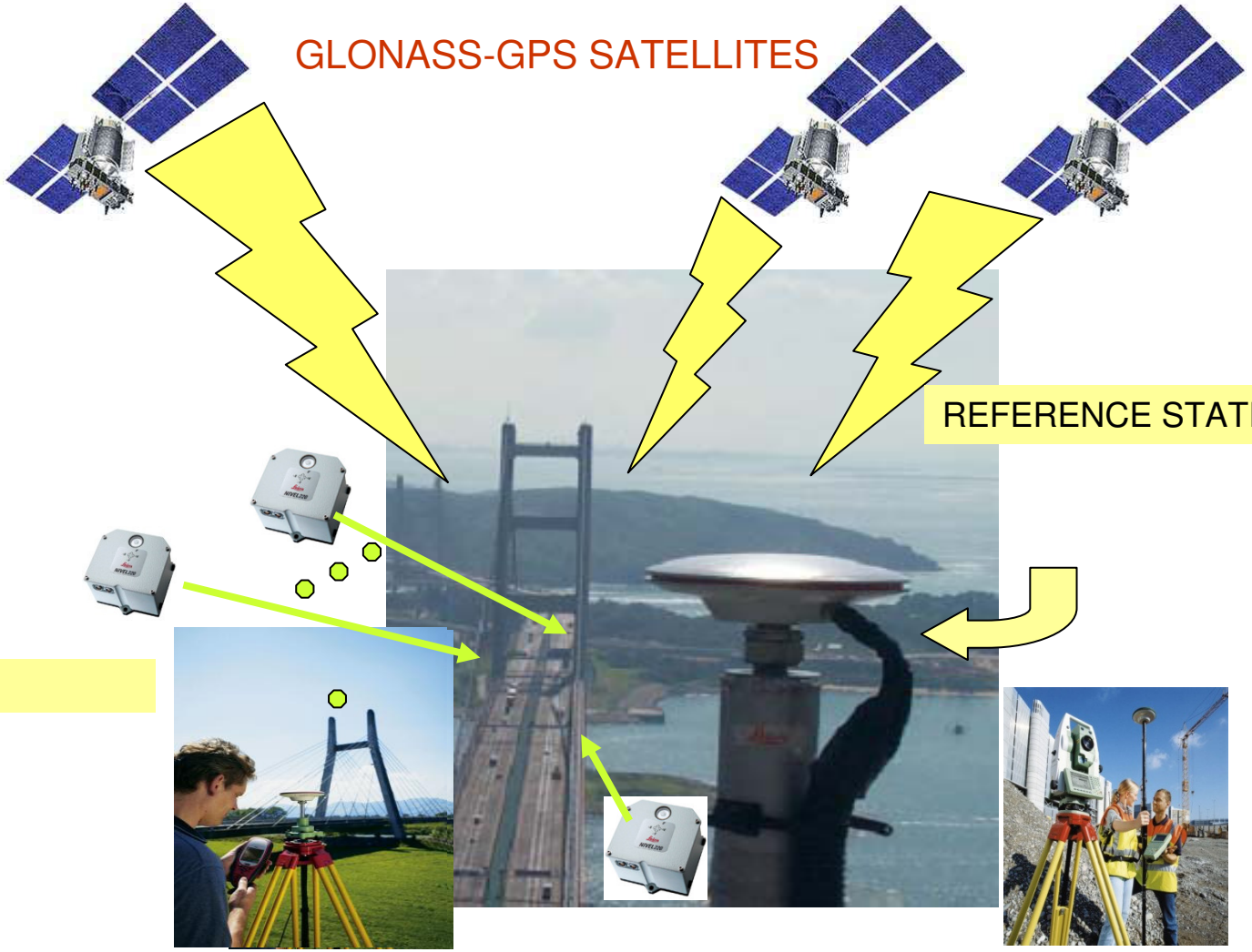


Air born laser scanning



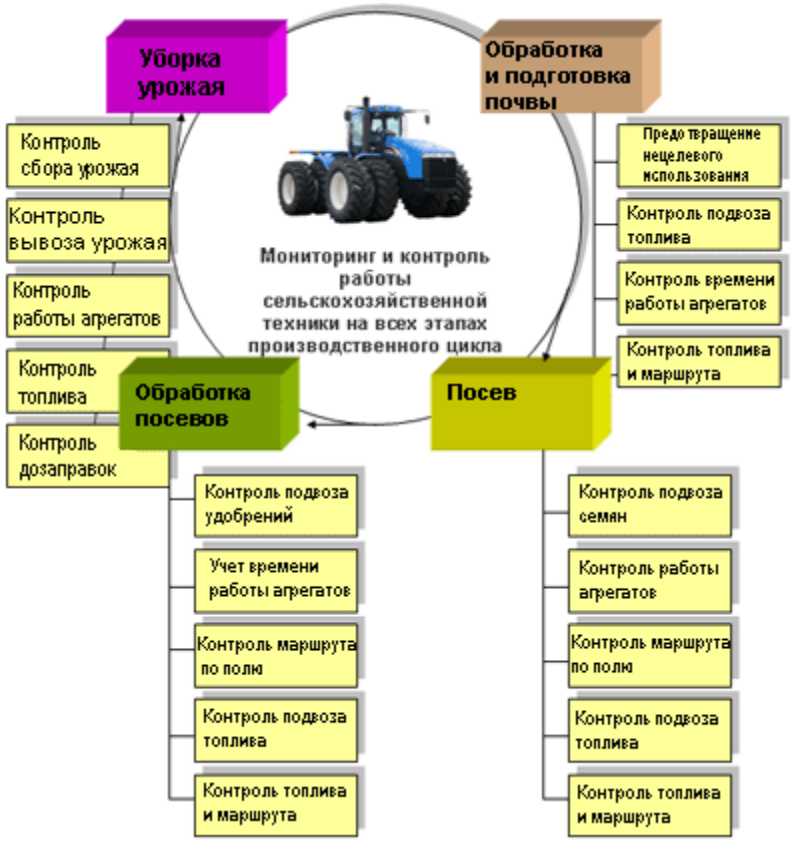
-
-
-

REAL TIME MONITORING



GNSS for precise agriculture


Самоходный опрыскиватель ОСШ-2500 отечественного производства



GNSS FOR MINING

NovAtel

MAGELLAN-Ashtech

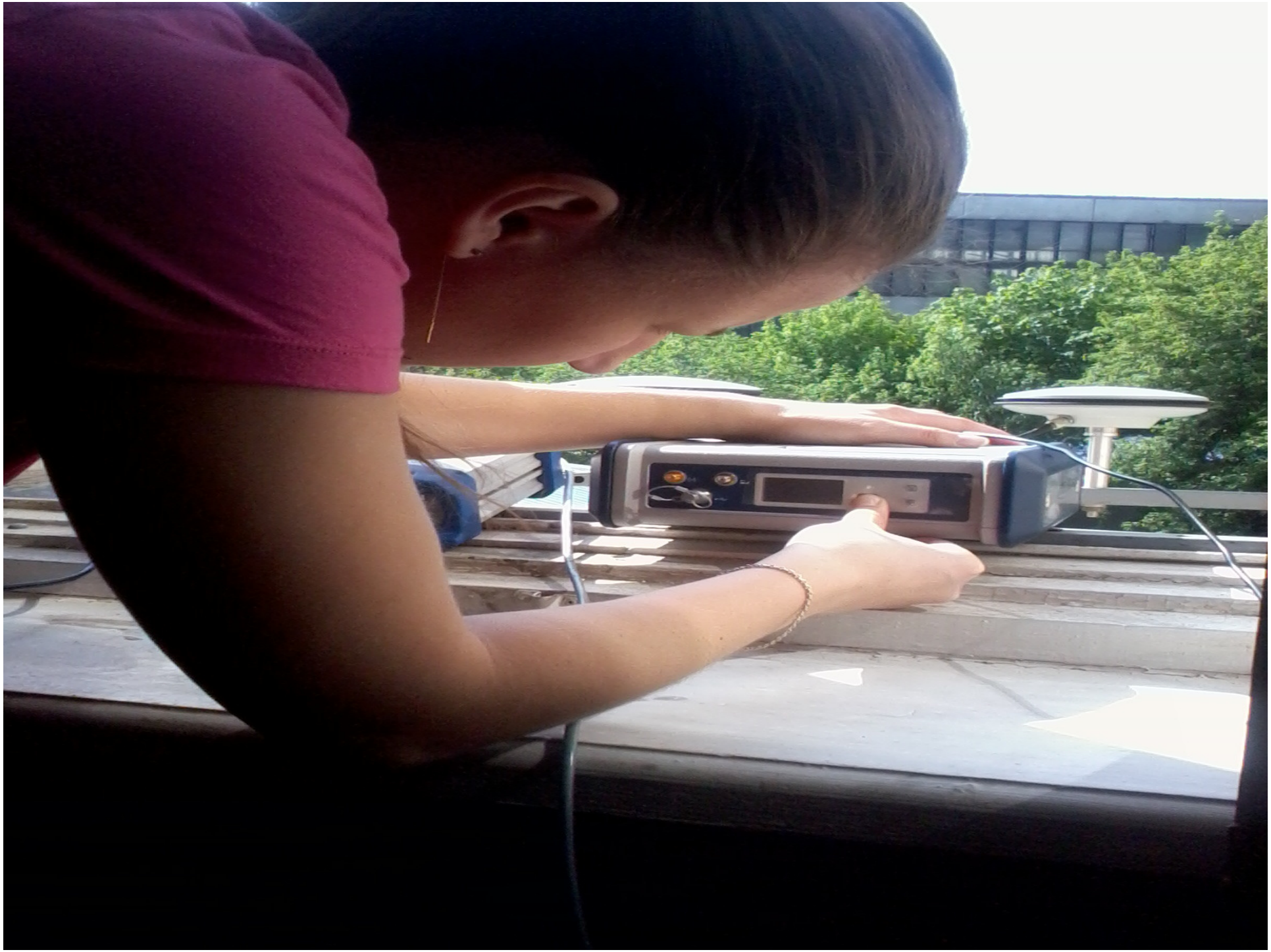
TRIMBLE

TOPCON

LEICA


VGA
TERMINAL
DATA
LINK
12-24V


DC-V3
MAGELLAN



The example of the part of training course of field application GLONASS-GPS equipment

THE EXAMPLE OF TRAINING COURSE FOR GNSS EQUIPMENT OPERATION

Thank you very much!

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