



Belarusian State University



**BSU aerospace activity:
education, research and
development**



The leading educational center in Belarus, founded on October 30,1921



1 November 1921,1390 students started attending classes in its three faculties: labor, medical and social sciences. Only 14 professors and 25 candidates of sciences (Ph.D) were among first lecturers.

BSU today

- 20 faculties and educational institutes
- lyceum
- college
- 3 scientific-experimental stations
- 3 museums
- 4 scientific-research institutes
- 115 scientific-research laboratories
- 25 scientific centers
- 12 unitary enterprises



BSU today



The BSU student community comprised of almost 29000 undergraduate and Master degree students, 663 Post-Graduate (Doctoral) and 11 Post-Doctoral Students.

BSU today

University staff:

7398 (8680) staff members, including:

- 2477 lecturers
- 1900 researchers and research engineers

Lecturers:

- 6 academicians of the National Academy of Science of Belarus
- 7 corresponding member of the National Academy of Science of Belarus
- 291 doctors of science
- 1350 candidates of science



BSU INTERNATIONAL COOPERATION

Year	2007	2008	2009
Number of agreements	123	182	221
Number of countries	29	45	50



International Scientific-Technical and Educational Exhibitions

In 2009 year

- **34 exhibitions** in the Republic of Belarus

- **5 exhibitions in Russia** (Moscow, Saint-Petersburg, Nizhni Novgorod and others)

- **17 exhibitions abroad** (Germany, Latvia, Korea, Kazakhstan, China and others)



Participation of BSU in USSR, Russia and international space programs



Mir project (USSR)



Venera project (USSR)




Buran-Energia project (USSR)



International Space Station



The University Partners



Universities of Russian Federation: Lomonosov Moscow State University, Bauman Moscow State Technical University, Siberian State Aerospace University, Samara State Aerospace University

Universities of Ukraine: Dnepropetrovsk National University, National Technical University of Ukraine, National Aerospace University

Universities of Kazakhstan: Karaganda State Technical University, Gumilyov Eurasian National University

Universities of Europe: ECM-Office (Germany), Fontys University of Applied Sciences, Institute for Business and Management (The Netherlands), Lessius University, Department of Industrial Sciences (Engineering) (Belgium), Technical University of Berlin, the Institute of Aeronautics and Astronautics (ILR) (Germany)

Space Remote Sensing Systems, 1988 (Mir)

- Since 1985 BSU has been developing optical methods and equipment for Earth remote sensing. As a result different space remote sensing systems have been designed.
- BSU specialists have participated in many international projects: FIFE-89 (USA), КУРЭКС-86, - 88, -91. They have developed scientific equipment for aircraft laboratories.



Interactive microprocessor-based video-spectrometric system «Гемма 2-видео» (functioned on board «Кvant» module «Mir» station, geocological experiment, 1988).

Board video-photometrical system «BΦC-3M», 2000 - 2002 (ISS)

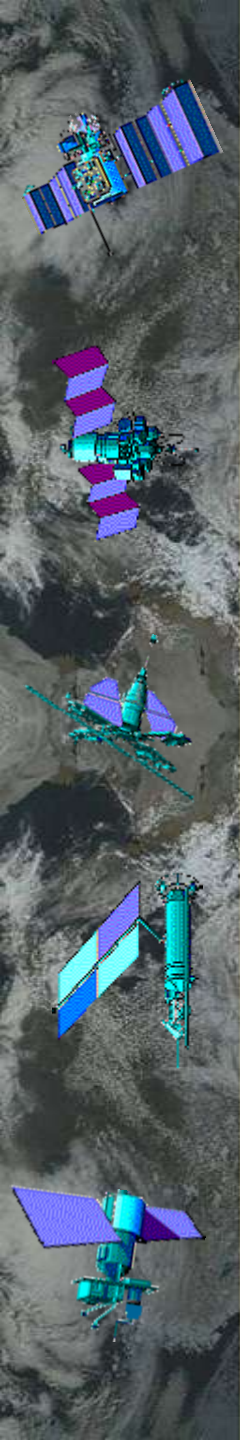


- Designed to an automatical remote registration of optical emission at atmosphere.
- Able to register Red Sprites and Blue Jets.
- Used in experiment «Atmosphere and Magnetosphere Electromagnetic Interaction» on board International Space Station (ISS) in 2000.



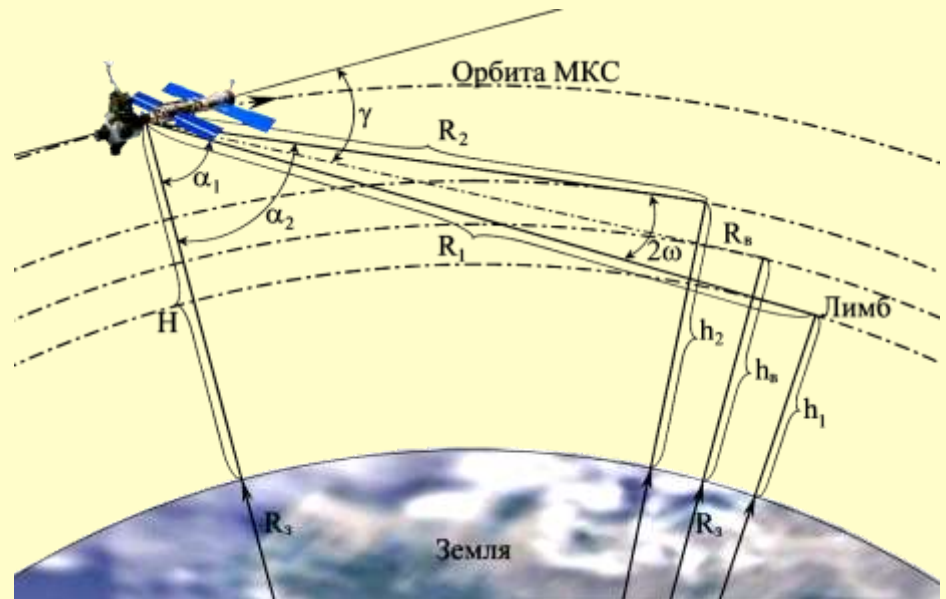
Photospectral system «ФСС», 2000 – today (ISS)

Designed to research reflected emission spectrum from underlying terrain and to obtain visible photographic image on board ISS -1 - ISS -24 (experiment «Ураган»).



Spectrophotometrical system «СФК», 2007- today (ISS)

- Developed as part of «Космос-СТ» program.
- Designed to hydroxyl and monatomic oxygen emission detection and registration on board ISS.



Hydroxyl space experiment

Spectrometers and spectroradiometers (today)



MC-08



MC-09



MC-10



MC-12

Spectroradiometers series MC (radiation brightness and rapid analysis of radiation, scattering, transmission, absorption and luminescence characteristics of various objects)



Spectrometer ПBC-02
(the emission, reflection and absorption spectra)



Spectroradiometer ПСР-02 (spectral density of energy brightness and the polarization characteristics of radiation)

Aircraft Control System (today)



Aircraft АН-2

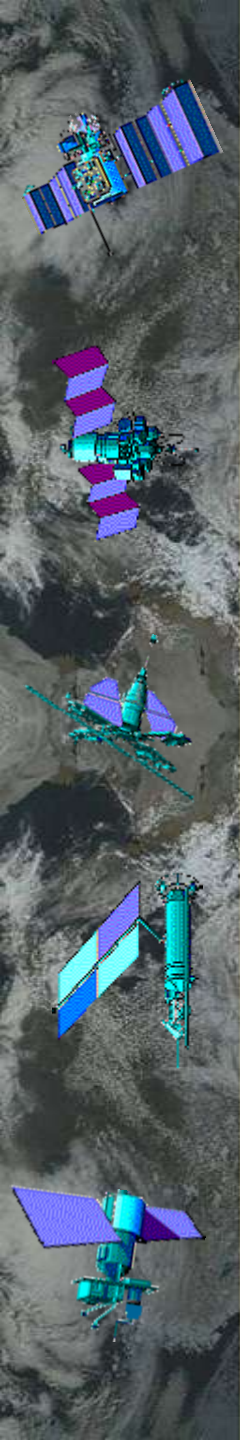
Aircraft vide spectral
system «BCK-2»
(Designed to forest range
remote control)



Aircraft emergency situation control system

Cooperation in educational Programs and Projects

- Participation in joint Russian - Belarusian programs «Космос-СТ» and «Космос-НТ».
- Joint international project of Lomonosov Moscow State University and Universities of South Korea and Mexico on realization of space project «Татьяна - 2», and also project «Скафандр».
- Participation in project CRIST in the context of TEMPUS program.

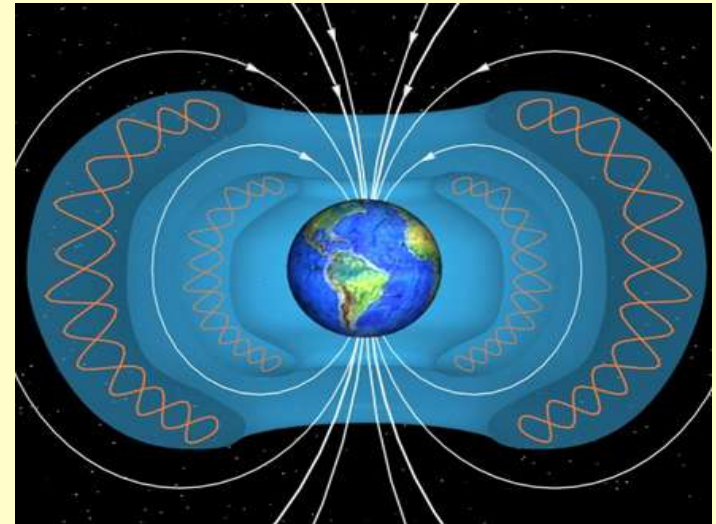


BSU Participation in the University satellite Tatiana-2

The main purpose of the experiment is study of interaction of the atmosphere, ionosphere and magnetosphere of the Earth by means of the orbital detectors. BSU aerospace educational center received and processed scientific information and telemetry from the microsatellite.

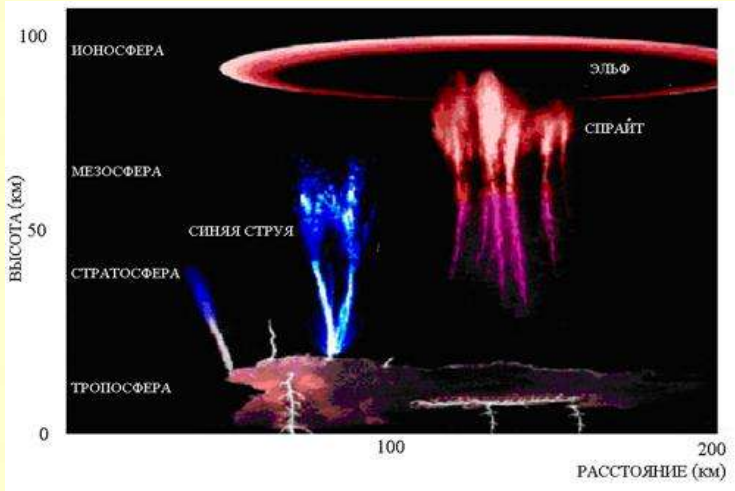


The satellite's equipment observes the atmosphere of the Earth



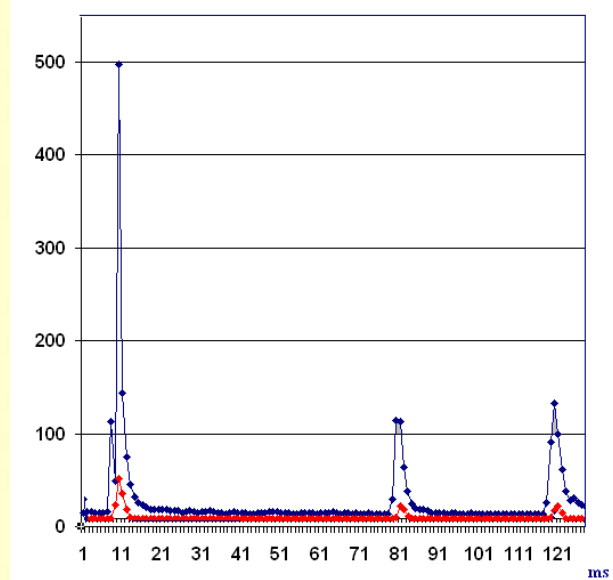
The Earth, the atmosphere and the ionosphere surrounded by the magnetosphere.

The University satellite Tatiana-2 (Results)

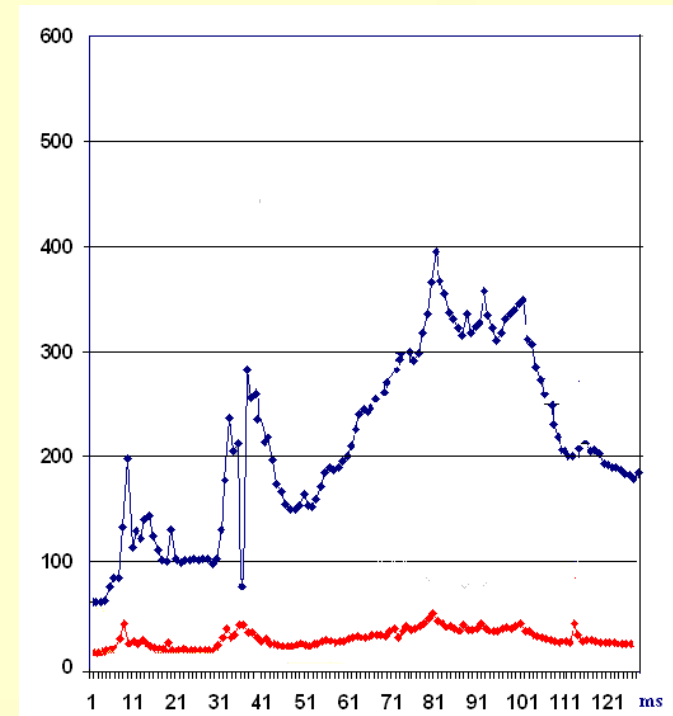


Data were obtained on UV flares and IR flares in the upper atmosphere.

Transient events in the atmosphere



The UV flares (blue) and IR flares (red) in the upper atmosphere



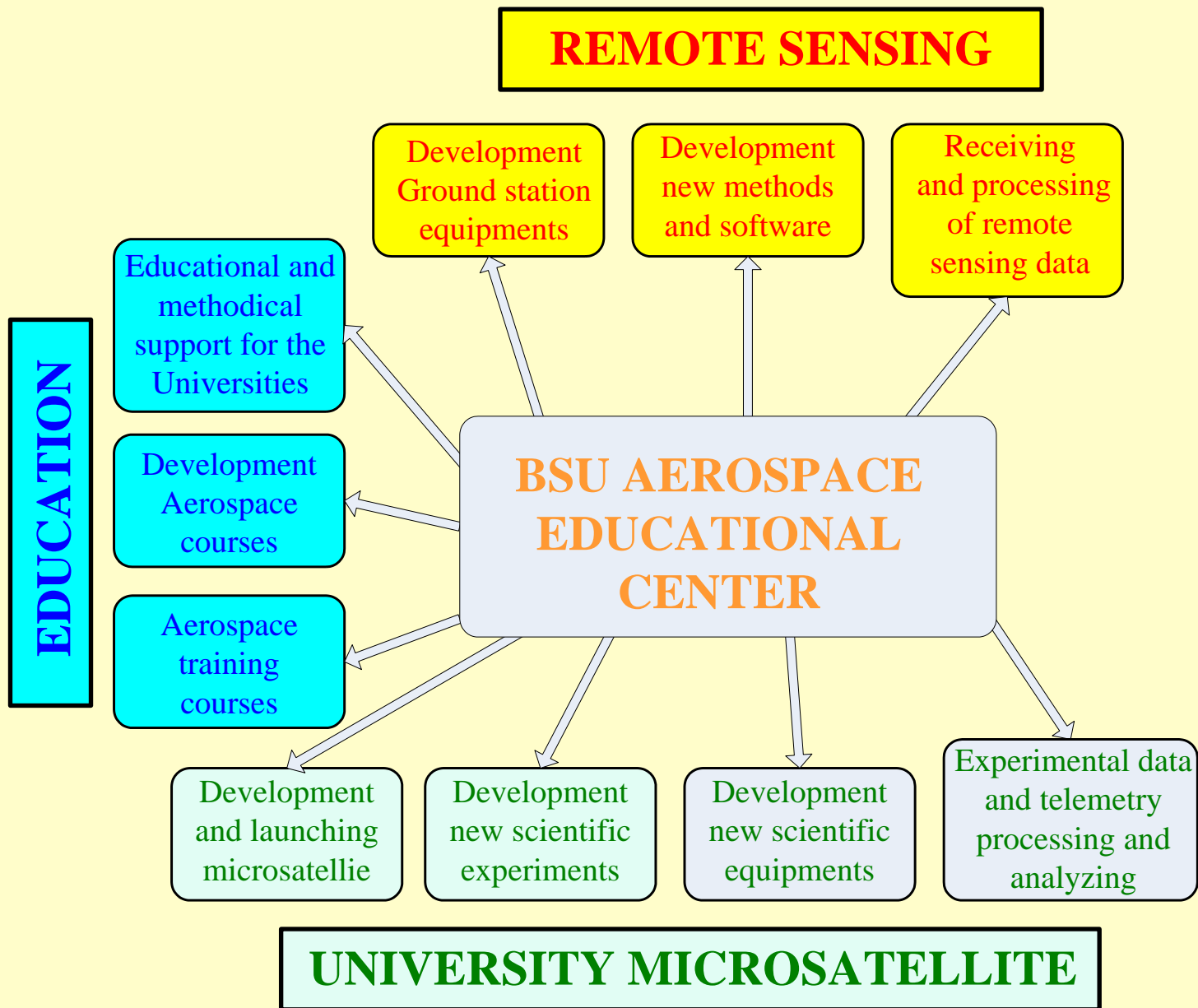
The huge (gigajoule) UV flares (blue) and IR flares (red)

BSU aerospace educational center: structure, research and development

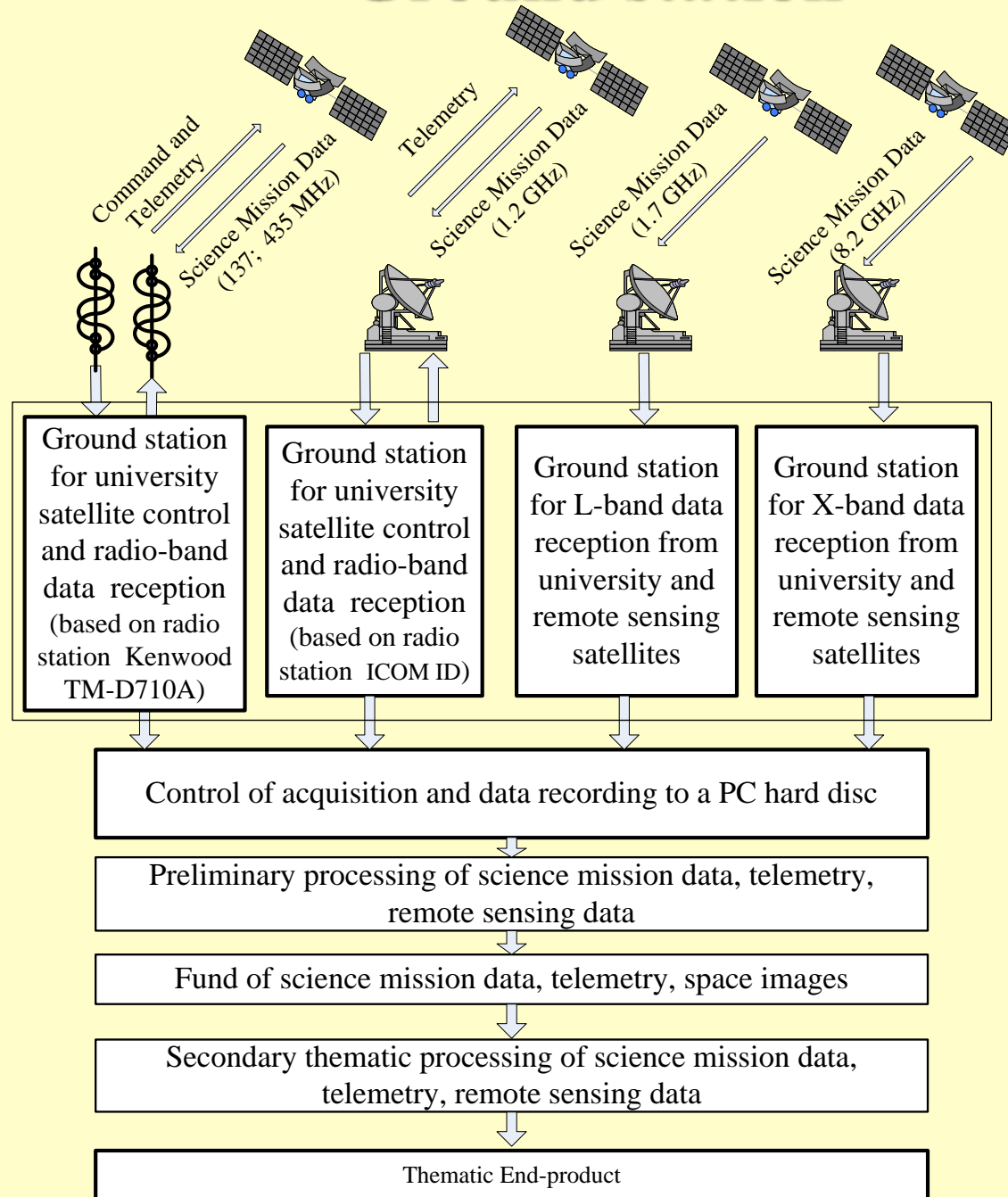
Main aims:

- To develop it into authorized center in the fields of GIS technologies and monitoring (ESRI, ERDAS, Leica products);
- Providing the process of training specialists in remote sensing data reception and processing with educational programs;
- Receiving and processing of remote sensing data;
 - Working within the Belarusian Earth remote sensing space system corporate network;
- Development new scientific experiments and equipments.

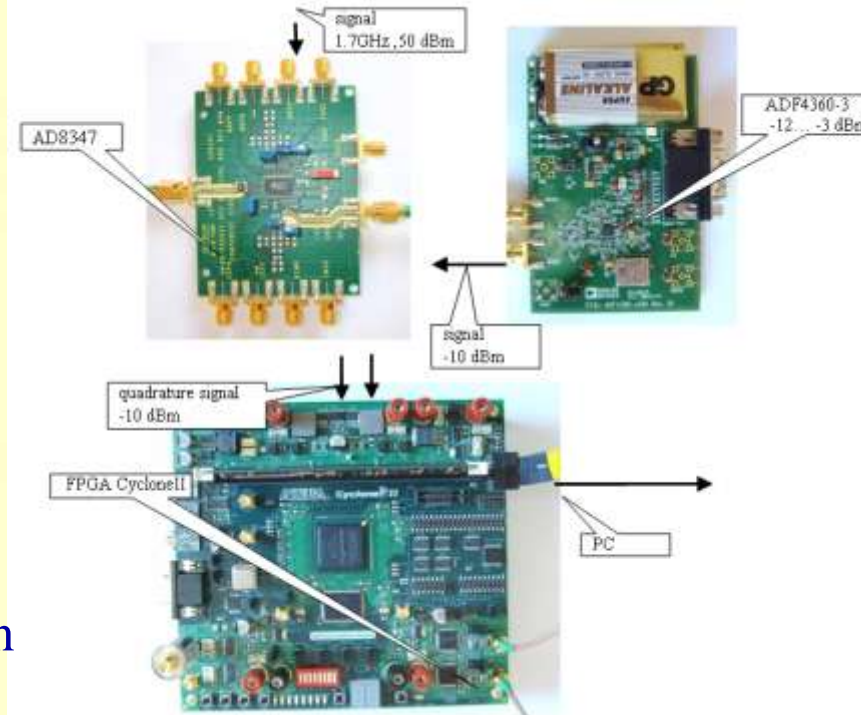




Ground station

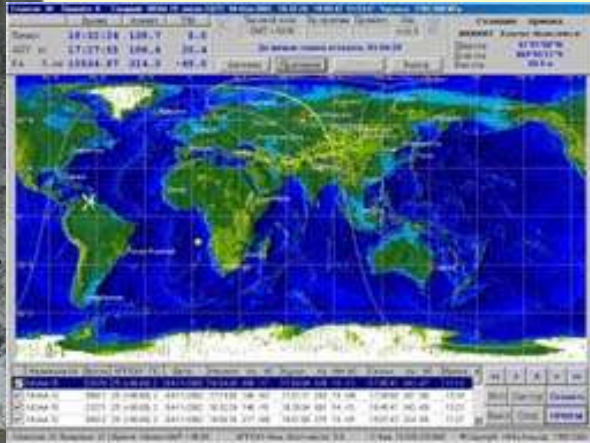


Ground station for L-band data reception from university and remote sensing satellites

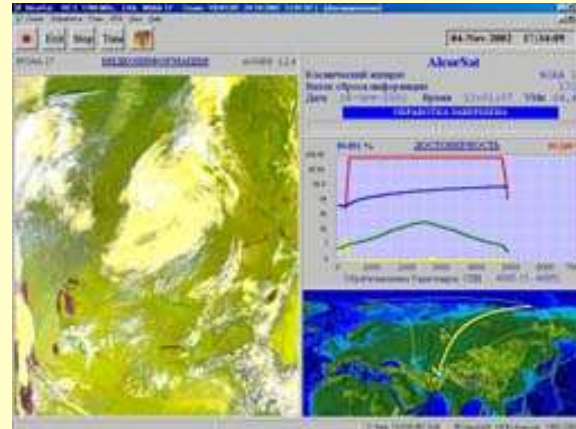


Development
Ground station
equipments

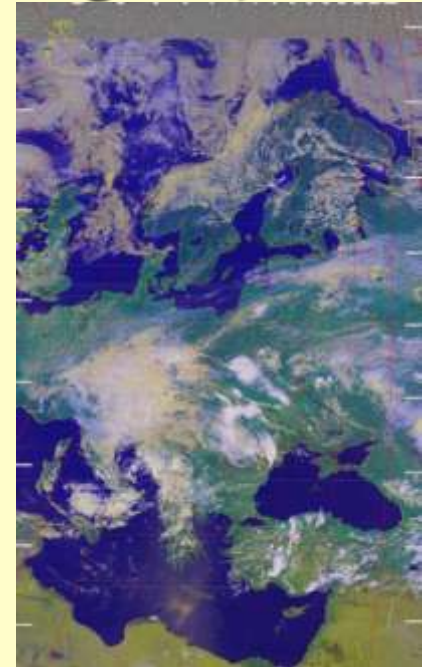
Ground station for L-band data reception from university and remote sensing satellites (processing data)



Control of acquisition



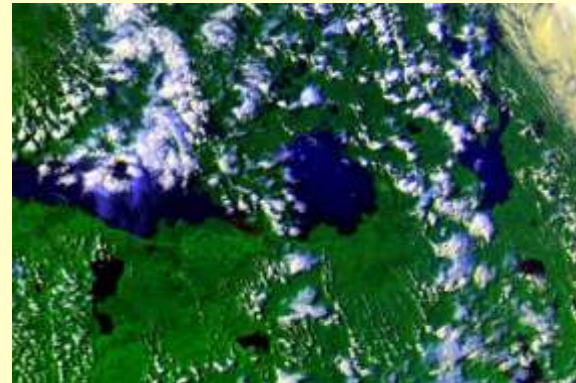
Decoding information



AVHRR image from NOAA-19



Visualisation and preliminary processing



Feng Yun-1D image, CHRPT format

Aerospace Education in BSU

2008 г. – BSU aerospace educational center was opened.

2009 – new specialization “Satellite information systems and technologies” was opened.

2010 – new speciality “Aerospace radio electronics and information systems and technologies”.

2010 г. – course of lectures in **Small Sized Satellites for specialization «Satellite information systems and technologies».**



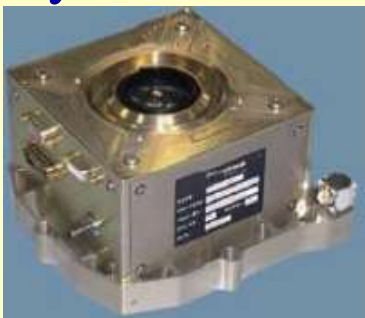
Aerospace courses for “Satellite information systems and technologies”

- Small sized satellites ;
- Global navigation satellite system;
- Statistical theory of radiotechnical systems of remote sensing, radar and navigation;
- Communications satellites;
- Image processing and remote sensing;
- Databases;
- The object-oriented approach and programming;
- Optical and radar-based observations;
- Spacecraft system design;
- Electronics in space;
- Space Technique and instrumentation.

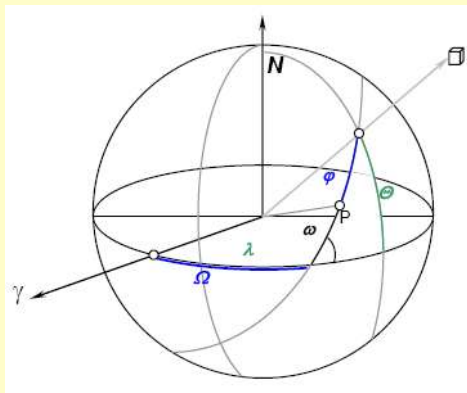


Course “Small sized satellites” (Lectures)

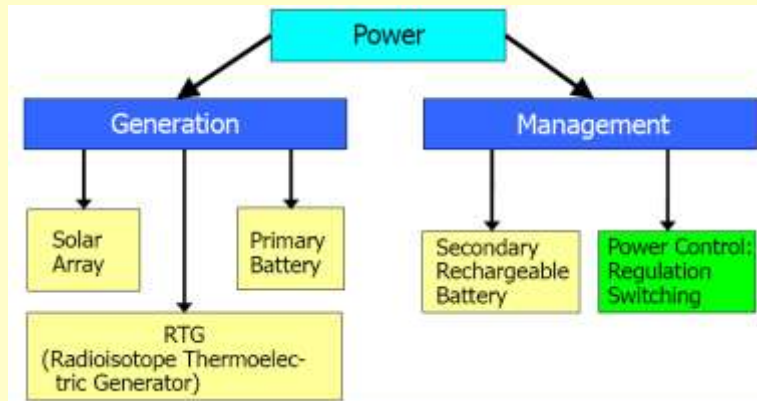
Lectures presented on the origins of spacecraft flight dynamics and control ; spacecraft system; spacecraft and mission design ; spacecraft system engineering ; propulsion systems.



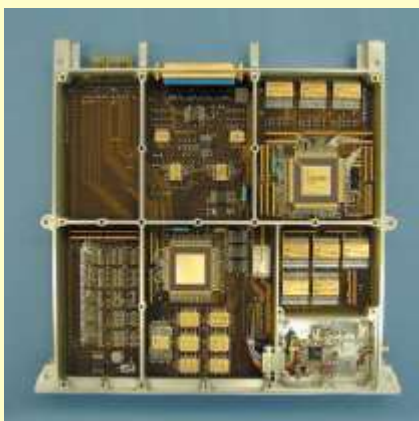
Control System
(Active Pixel Sensor)



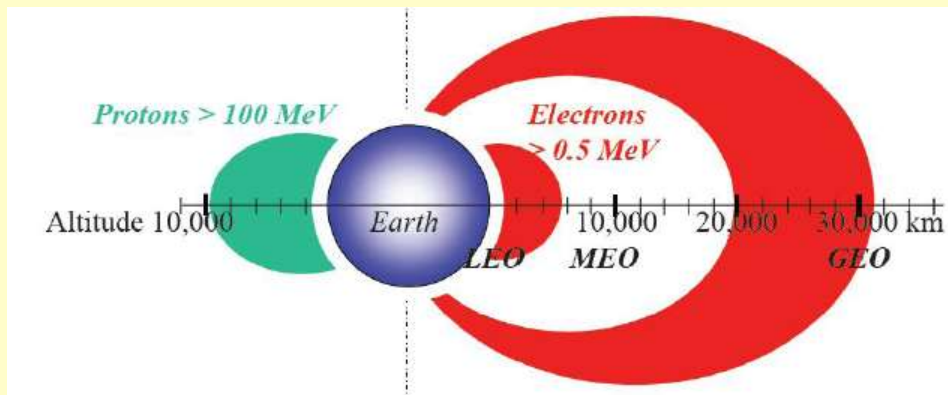
Satellite Dynamics



Power System Design



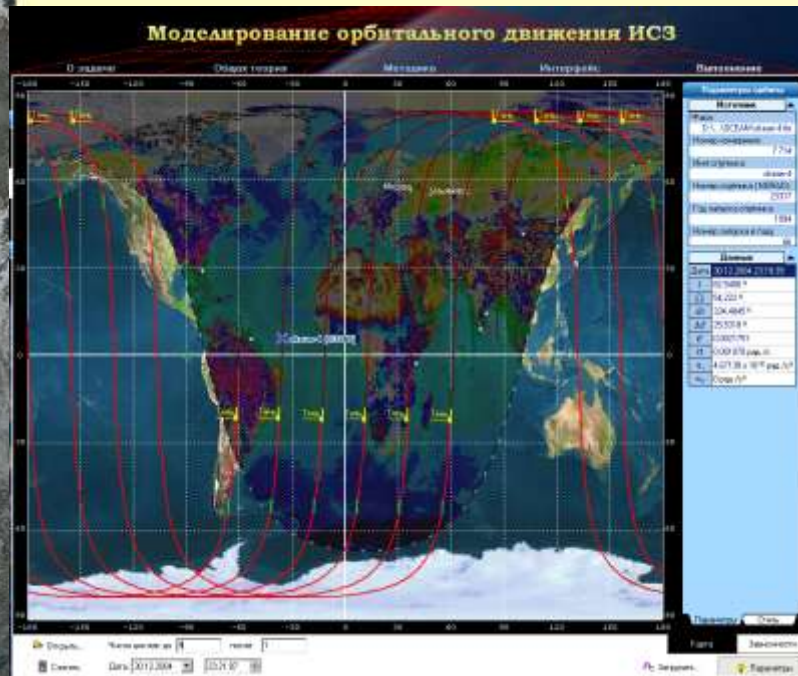
Control System
(GNSS/GPS Receiver)



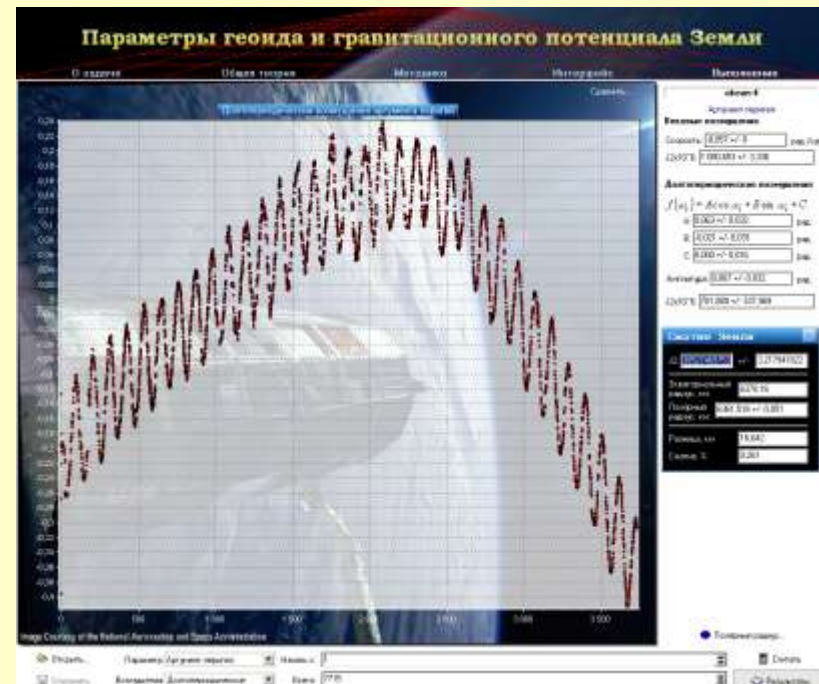
Space Environment

Course “Small sized satellites”(Practice)

The purpose of the lab exercises is to introduce the students to the methods of the measurements, to the modern conception of near-Earth space structure and the physical processes and phenomena occurred in it. It's also intended to the teaching of the basic methods of experimental data processing and analyzing.



Satellite Dynamics
(satellite's orbit)



Calculation of the second zonal harmonics
of the Earth's gravitational field

Aerospace training courses, seminars, conferences



Professor BMSTU (Russia) Vlasov I.B. and members of seminar **“Global navigation satellite system”**



Creators University satellite Tatiana-2 (Russia) and members of seminar **“Small sized satellites”**



“Education and Space” (IV Belarusian Space Congress)



BSU University microsatellite (Project)

BSU University microsatellite will be intended for solving applied, scientific and educational issues as well as training students of BSU and other universities in control methods of spacecrafts and information processing out of space.

The project will be developed by collaboration of the Universities and the Institutes of Russia, Ukraine and Europe.

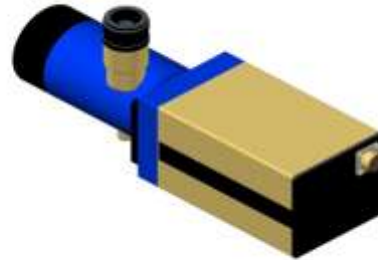
The main purpose of the experiment is study of interaction of the atmosphere, ionosphere and magnetosphere of the Earth by means of the orbital detectors.



Scientific equipments



Detector for the weak fluorescence image



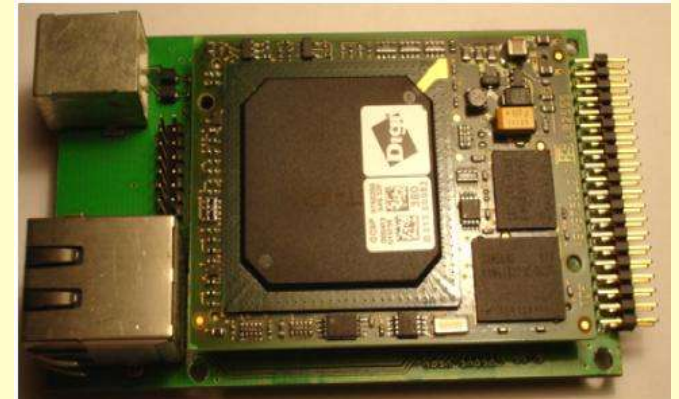
Detector for the spectral image



Detector for the high-altitude fluorescence



GNSS/GPS Receiver

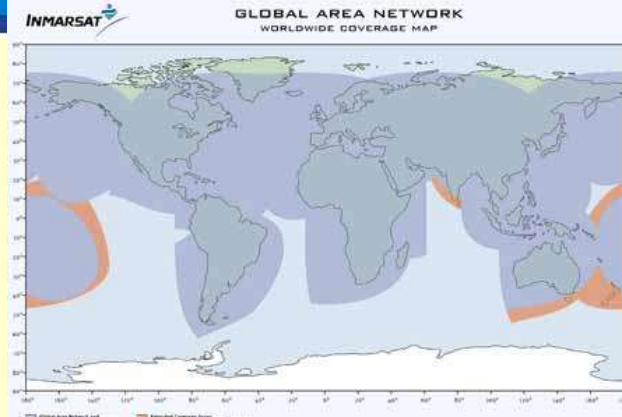
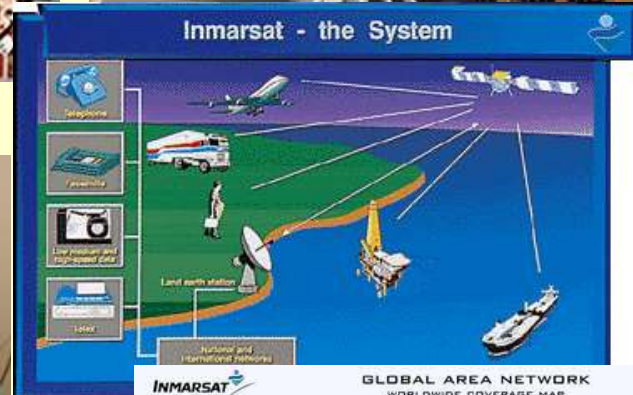
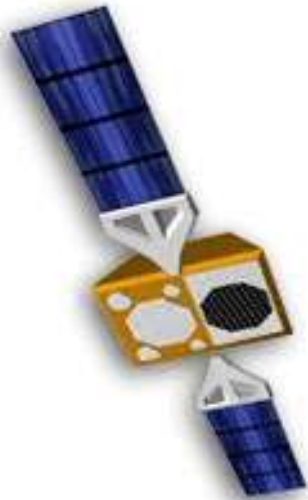


Information units, which record and transmit the scientific information



Spectrometer

Control System based on Communications satellites





Thank you!