Project of the Russian Academy of Sciences - "Chibis". Micro-satellite platform for applied-scientific studies

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ИКИ

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1.INTRODUCTION

The program of scientific studies on the micro-satellite "Chibis" – "Basic research of the methods of the space monitoring of potentially dangerous and catastrophic phenomena with the use of micro-satellite technologies" –

is subprogram in the Program of basic research of the Presidium of Russian Academy of Sciences "Changes in the environment and climate, natural catastrophes".

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2. RESEARCH PROGRAM FOR THE "CHIBIS" TYPE MICRO-SATELLITE

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A. Monitoring the atmosphere: - the control of distribution and trends of greenhouse gases (CO_2), - the detection of the large ejections of dangerous substances into the atmosphere.

Monitoring the atmosphere from space is conducted with the aid of the wide spectrum of the methods of remote sensing.

Thus, for instance, for monitoring of

- the content of ozone it is used, as a rule, spectroscopy in the UV and visible region,

- monitoring sediments - in the radio-frequency band,

- temperature profiles - in the thermal range.

Such observations constantly are conducted from a number S/C.

In also the time remains the number of the problems, which have great practical value, which were not solved generally, until now, or on which already long ago there are no fresh data.

Example of this task - monitoring the complete content of CO_2 in the atmosphere.

Atmospheric carbonic acid, as basic greenhouse gas, plays the most important role in the climate of the Earth, absorbing the thermal radiation of the earth's surface, and preventing its emission into the space.

Monitoring of low component and harmful impurities in the atmosphere is another most important task.

Measurements by the method of solar radioscopy will make it possible to obtain the data about the scattered pollution due to the high sensitivity

Similar irregular measurements were conducted from onboard of "Shattl" it is only in the beginning of the 90th annual.

Measurements on the base of micro-satellite with high spectral resolution in the broad spectral band in combination with the theoretical examination of the processes of the transfer of harmful substances will make it possible to make a serious contribution to the solution of this problem.

B. Space weather: observation of the state of the ionosphere, the radiation belts, solar wind.

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It is at present widely acknowledged that studies in physics of sun-earth connections not only give important fundamental results, but also be the focus of practical attention because of the observed influence of solar activity and terrestrial magnetic storms both on the fitness for work of contemporary technical systems and on the biosphere (including man).

These studies confirmed the need for the guarantee with applied information about the space weather of the wide circle of domestic users in the science, national economy, medicine and in other spheres.

In connection with the development of the means of space communication and navigation, the mastery of northern territories, transpolar overflights of civil aviation, etc., in the future the dependence on the solar- space factors only will be strengthened.

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For the successful forecast the developments also of monitoring the magnetic storms and other similar catastrophic disturbances together with the ground observations are necessary the measurement of interplanetary space (solar wind), radiation of the Sun, magnetosphere and ionosphere, carried out by specialized S/C.

Is important the fact that the micro-satellite ensure a maximally low level of onboard electromagnetic interferences, which usually hamper measurements on large S/C.

C. Monitoring of the forest fires, other dangerous phenomena and objects on the Earth.

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Today there are sufficiently detailed satellite methods, which make it possible to ensure monitoring different dangerous phenomena on the earth's surface and evaluating their consequences.

Such phenomena include both the natural cataclysms and the results of the human activity, which can lead to the irreversible changes in the environment.

The application of micro-satellite with the contemporary equipment will make it possible to create regional system with the high characteristics.

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D. Astrometrical research.

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Onboard camera is intended for the optical observations of bolides and meteor showers in the Earth's atmosphere from onboard of micro-satellite.

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In connection with the problem of comet- asteroid danger and all with the increasing quantity of starting of automatic spacecraft the study of the distribution of small bodies in the near-earth space

is extremely urgent.

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3. MICRO-SATELLITE PROJECT IMPLEMENTATION PROCESS.

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The use of the micro-satellite in the infrastructure frame of the Russian Segment of International Space Station (RS ISS).

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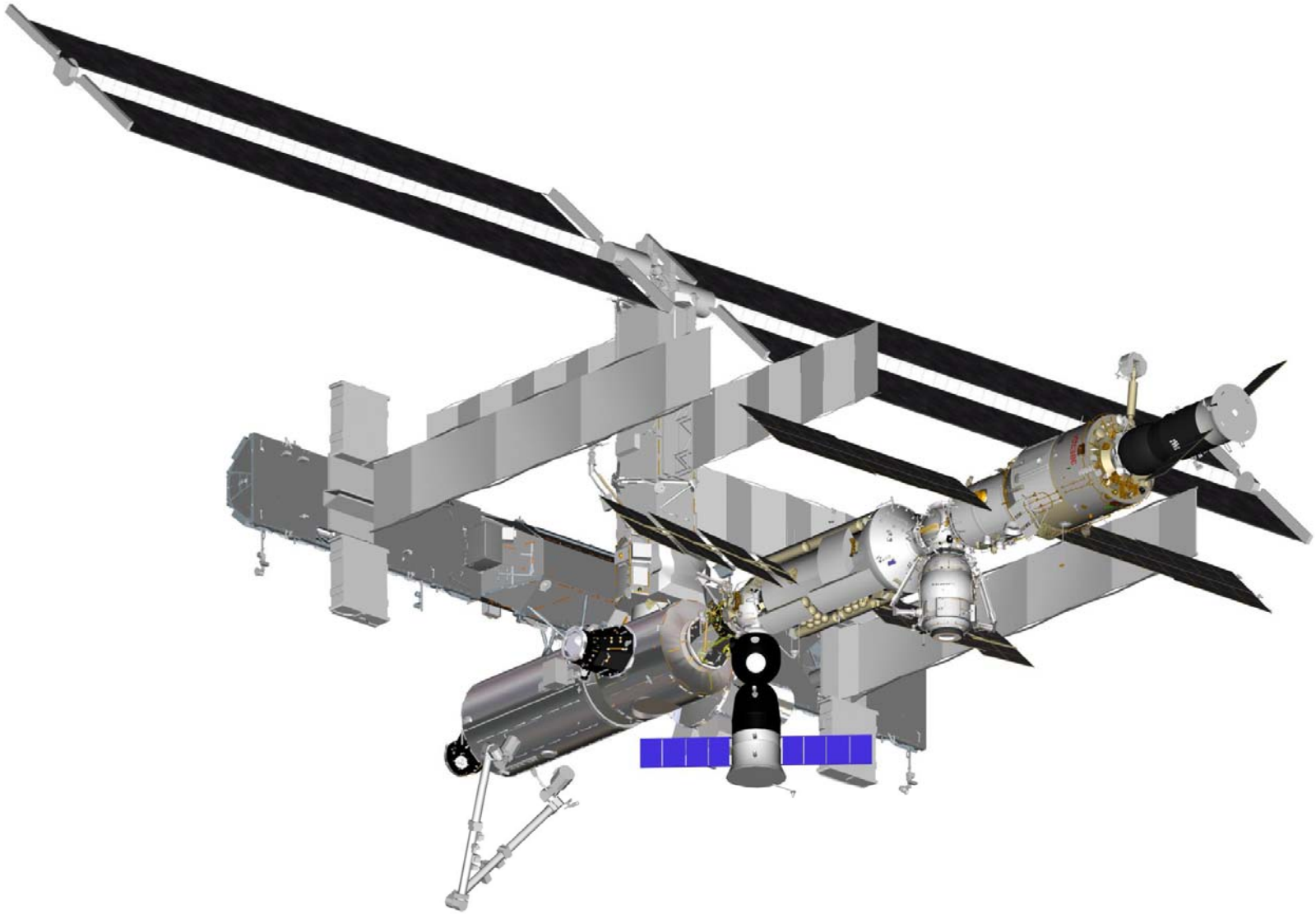

3.1. MICRO-SATELLITE “KOLIBRI-2000”.

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“Kolibri-2000”

http://www.energia.ru/english/energia/sci-ducation/microsat/microsat-02.html

The realization of Russian-Australian scientific - educational micro-satellite "Kolibri-2000" March 20, 2002, delivered into an orbit by "Progress M1-7", was by the first item of the Program of Scientific – Educational Micro-Satellite (PSEMS' 2002-2007).

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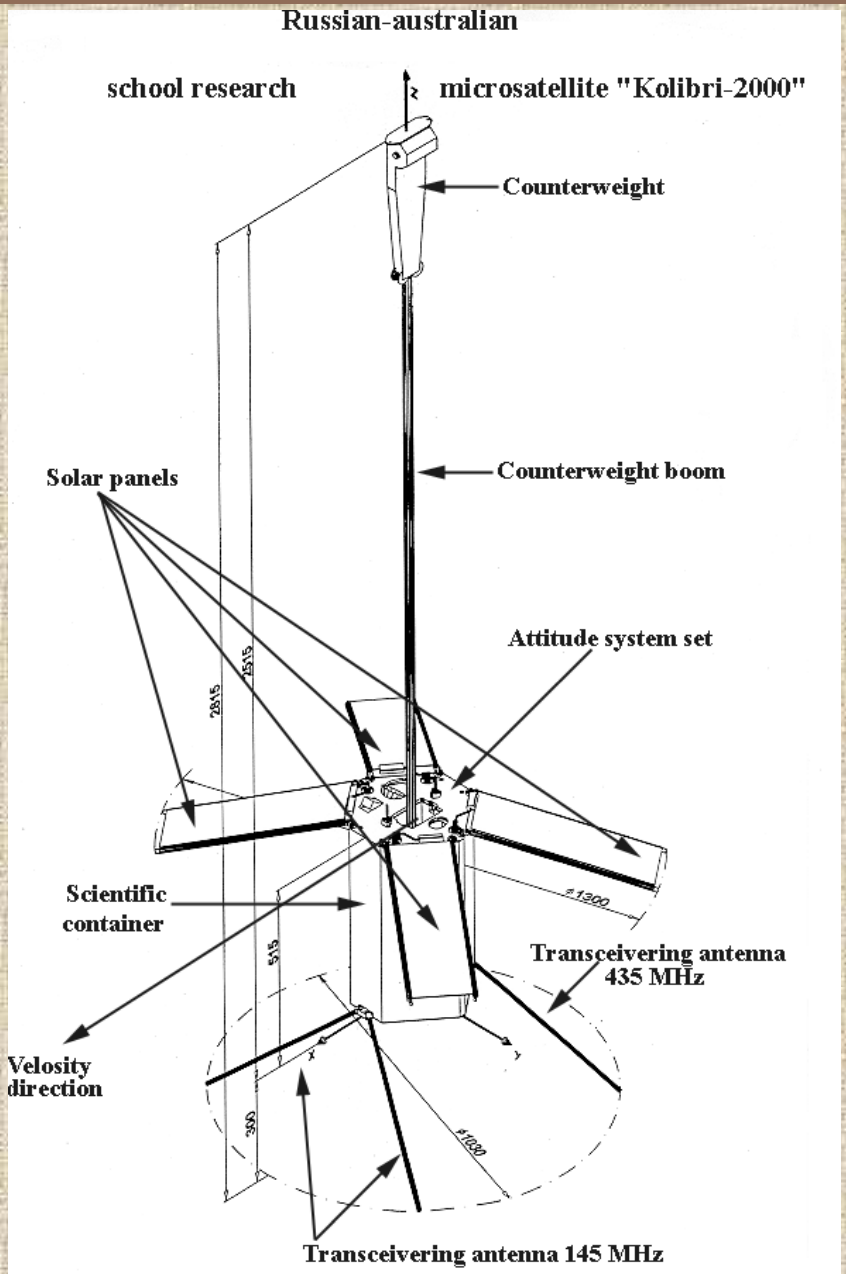

Russian-australian
school research
microsatellite "Kolibri-2000"
Counterweight
Counterweight boom
Solar panels
Attitude system set
Scientific container
Transceivering antenna 435 MHz
Velosity direction
Transceivering antenna 145 MHz

The basic characteristics of the "Kolibri-2000":

1. **Weight** **20,5 kg, including:**

- ***scientific equipment*** **3.6 kg:**

- flux-gate magnetometer 0.8 kg;

- analyzer of particles and electric fields 2.8 kg

- ***magnetic-gravitational stabilization and one-axis orientation system*** **2.7 kg**
- ***service system*** **with: 12.5 kg**

- transmitter / receiver and the buffer store with capacity of 2 Mbytes 1.9 kg

- power supply system (12 +2/-3 V, 3.5 Ah) 5.1 kg

- cables, connectors 1.9 kg

- construction and thermo-regulation system 5.3 kg

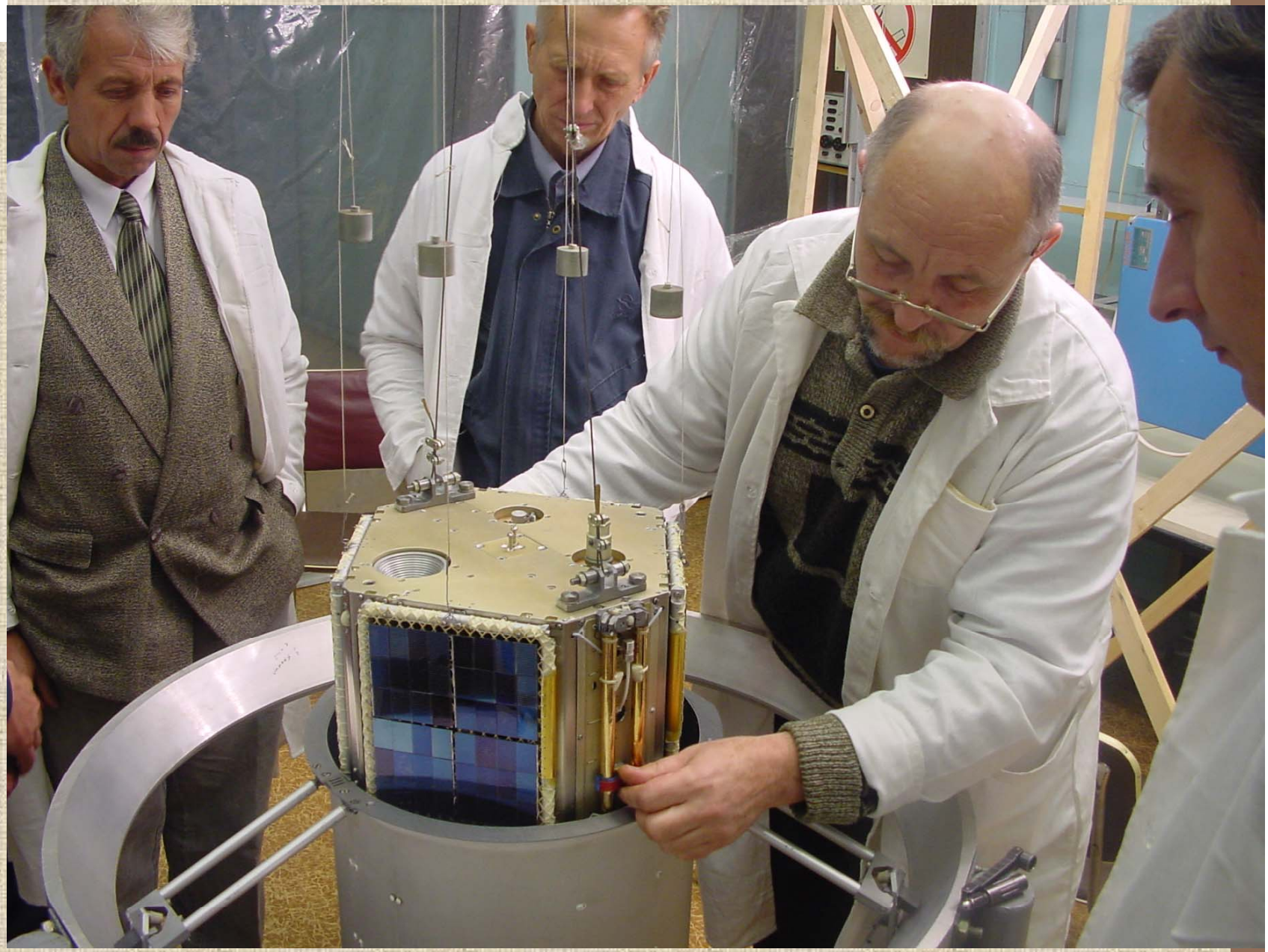
2. Power capacity from 0.5 m^2 solar panel up to 30 W;

3. An orbit of ISS;

4. The system of orientation with accuracy of orientation not worse than +/- 10^o;

5. Telecomand and telemetry link 145/435 MHz; from 300 to 4800 bauds

6. Information ability 1.5 Mbytes/day.



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Basic scientific results of the first scientific-educational micro-satellite "Kolibri –2000".

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Poster reports - June 29, 2006, Thursday

Section IV, Basic Space Sciences in High-School and Cooperation in Space Education Projects

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3.2. MICRO-SATELLITE “CHIBIS”.

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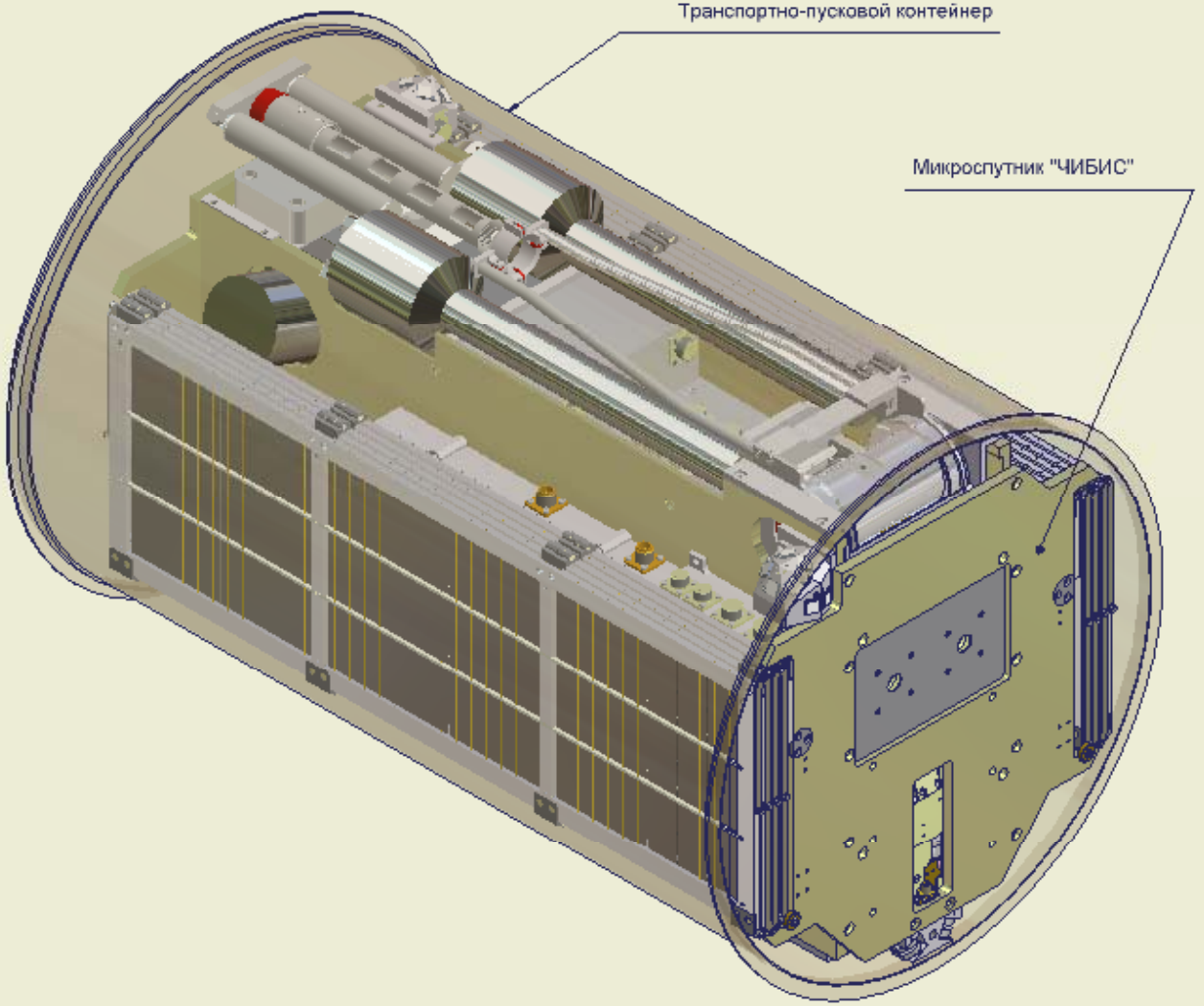
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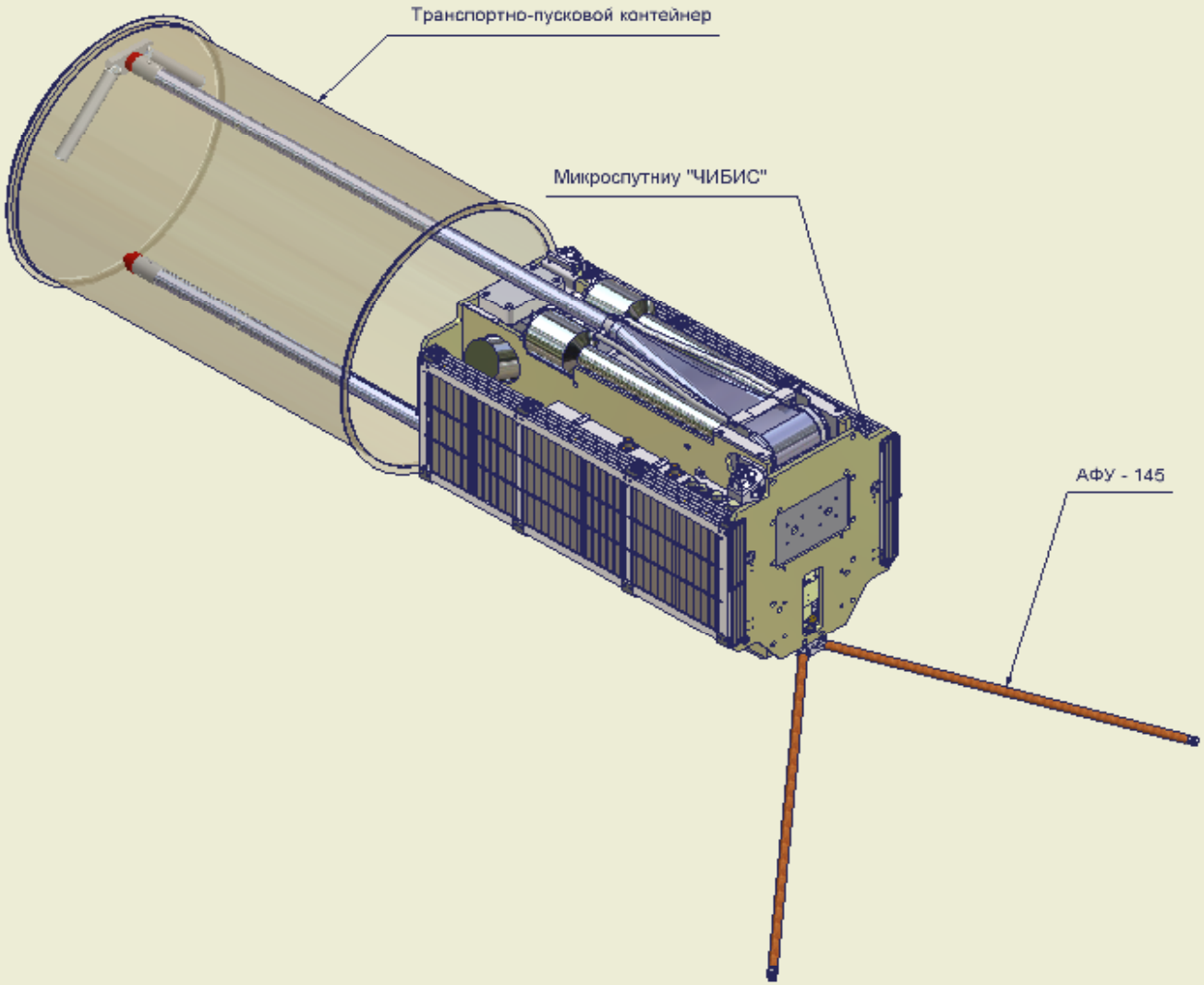
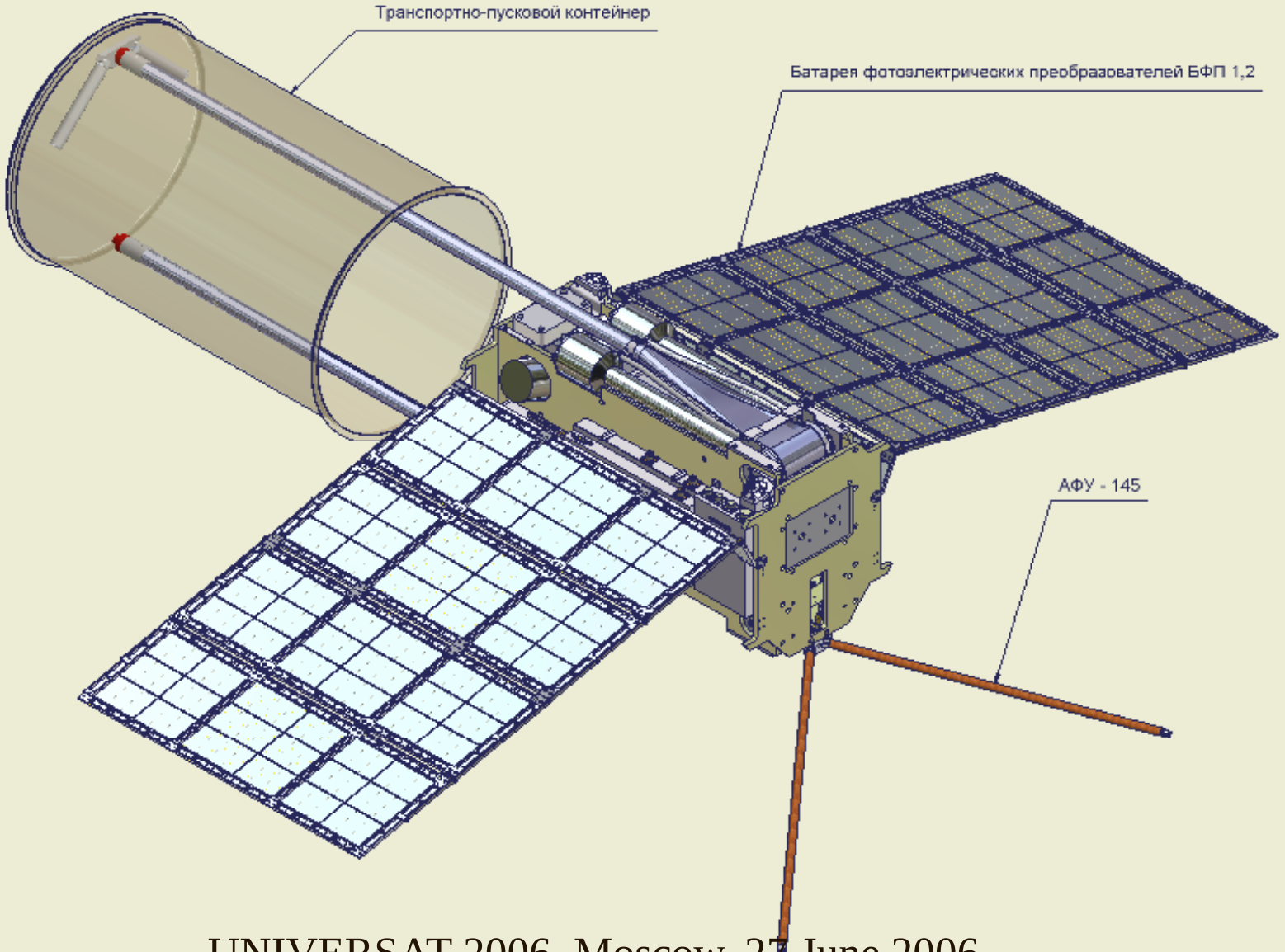
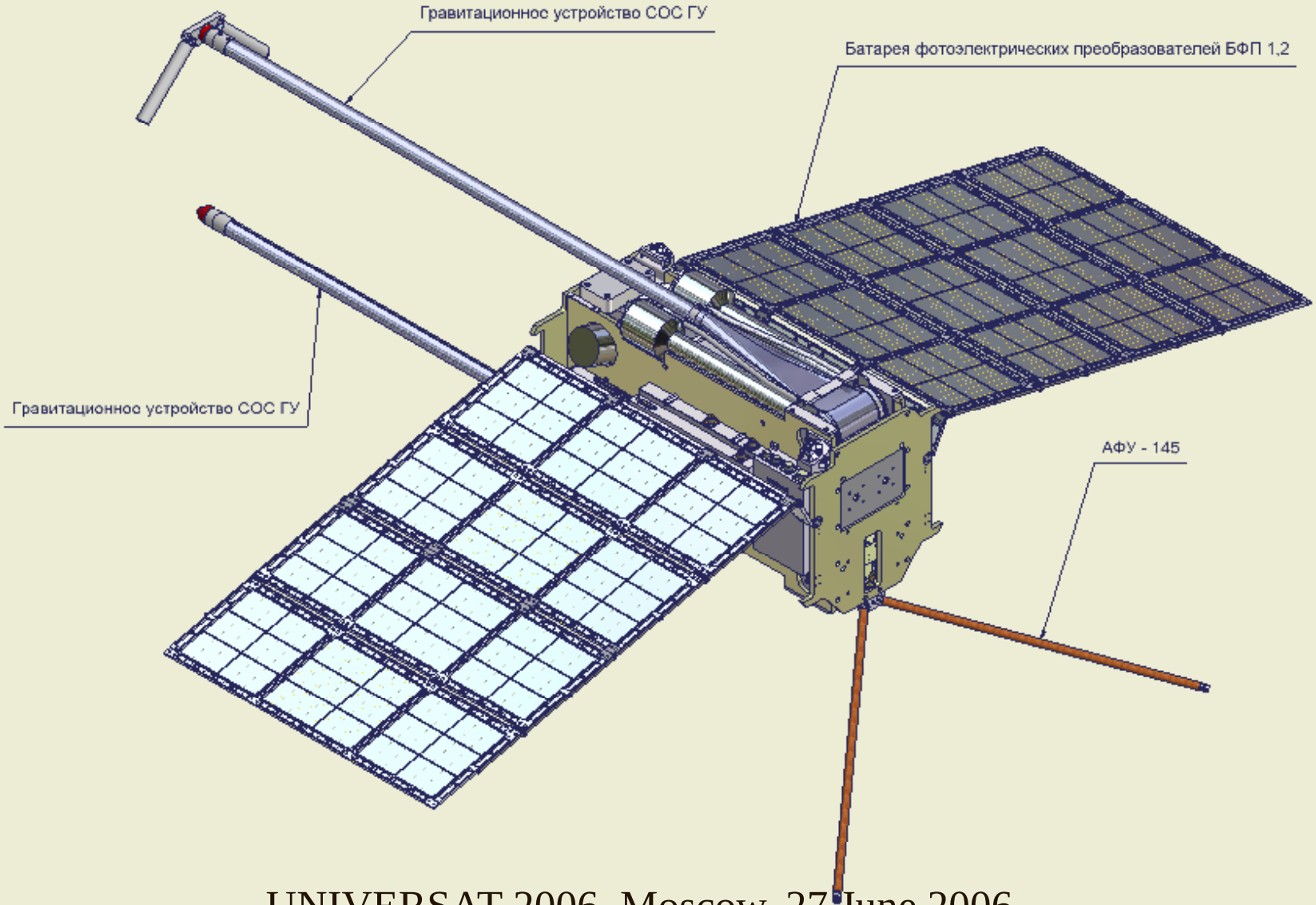
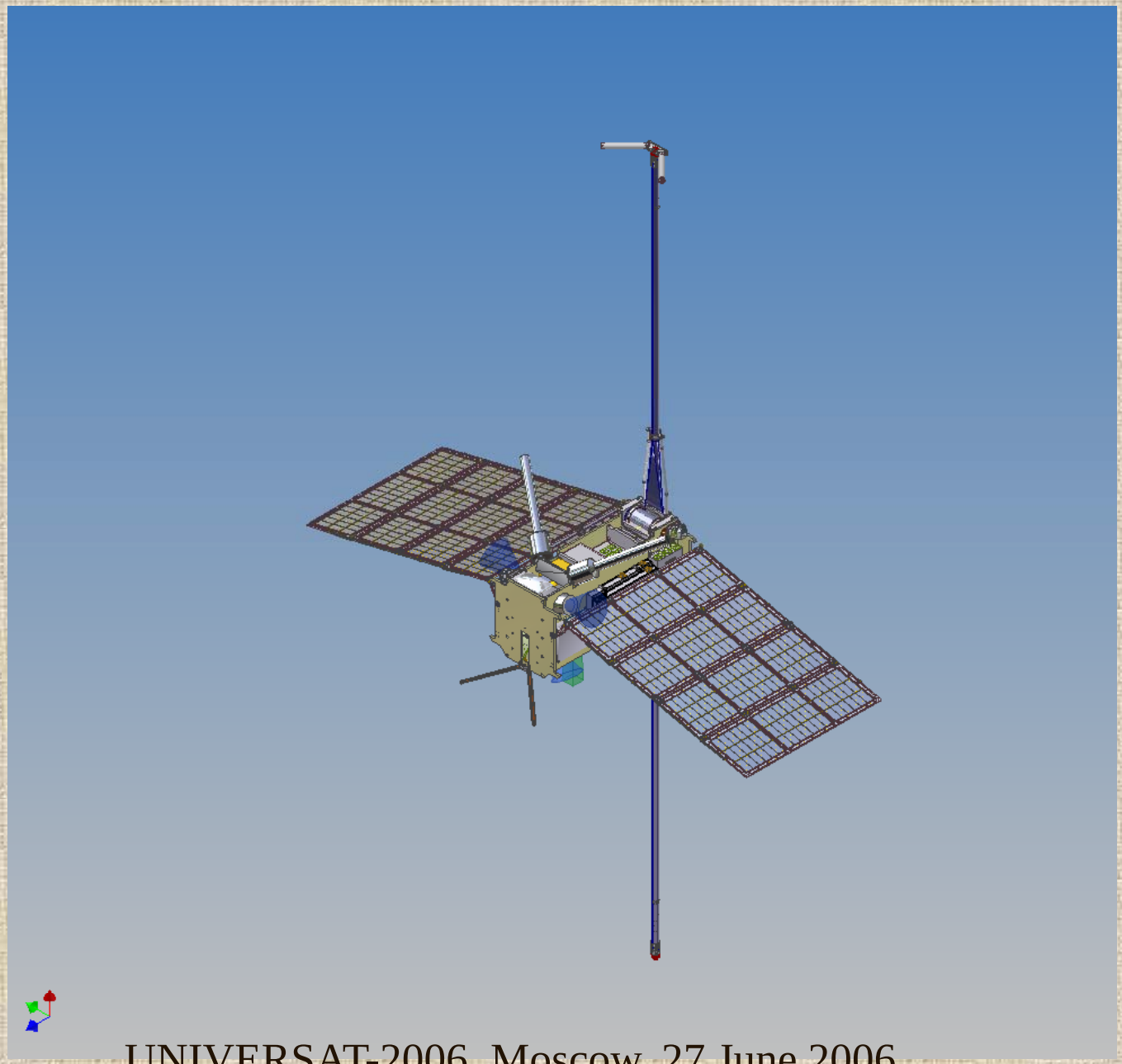
Микроспутник "ЧИБИС"


Транспортно-пусковой контейнер
Микроспутниу "ЧИБИС"
АФУ - 145


Транспортно-пусковой контейнер
Батарея фотоэлектрических преобразователей БФП 1,2
АФУ - 145


Гравитационное устройство СОС ГУ
Батарея фотоэлектрических преобразователей БФП 1,2
Гравитационное устройство СОС ГУ
АФУ - 145



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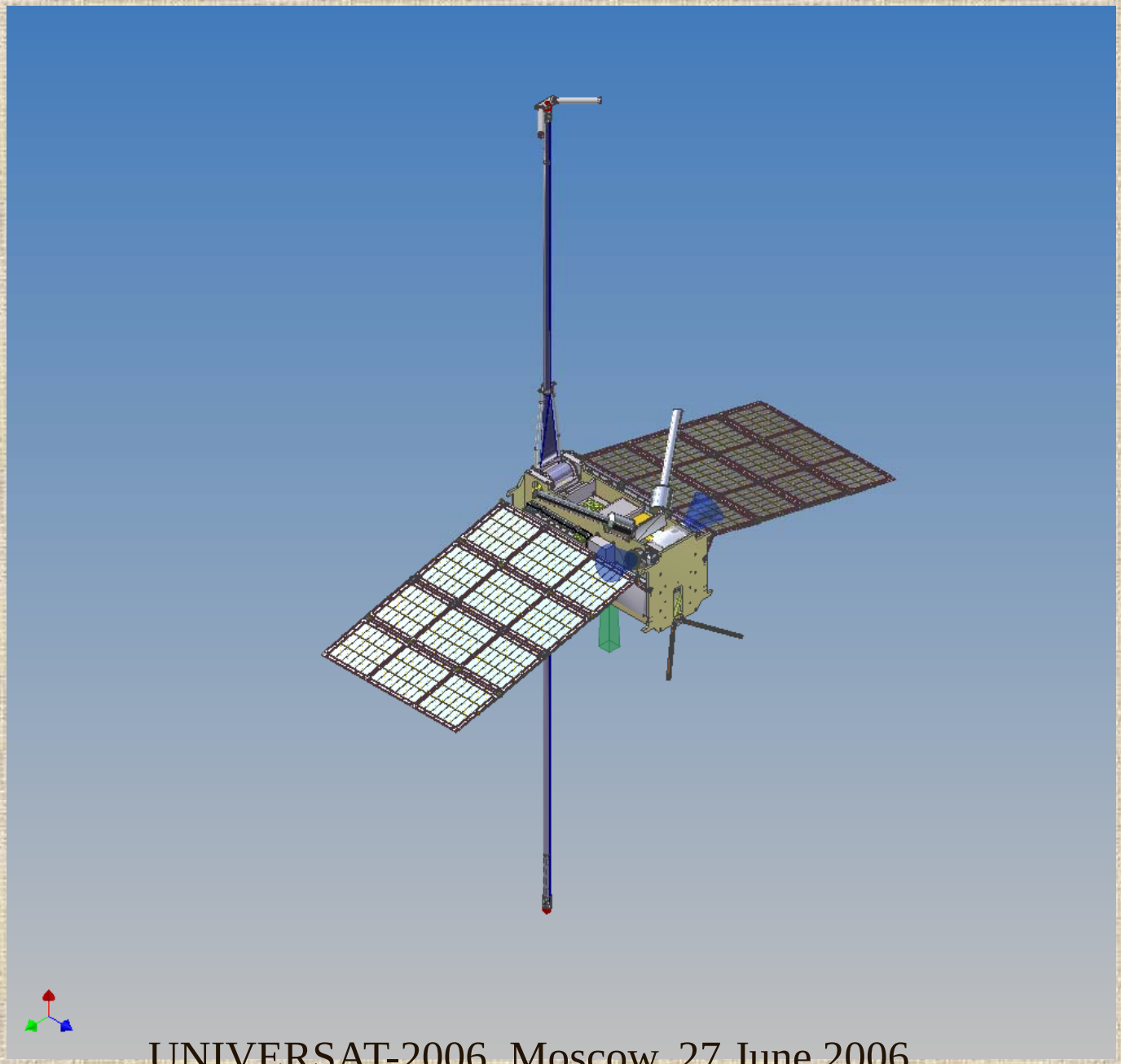

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The complex of scientific instruments:

- spectrometer for measuring the complete content CO_2,
- the camera of optical range,
- low-frequency flax-gate magnetometer,
- high-frequency search-coil magnetometer,
- the analyzer of the electromagnetic emissions,
- the detector of ionospheric plasma.

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Fundamental technical characteristics of the micro-satellite "Chibis".

Mass - 40 kg.

Scientific instruments - 12.5 kg.

Service system - 18.2 kg.

Construction and temperature control system - 9.3 kg.

Orbit - circular with the height ~ of 480 km.

The time of active existence - not less than 1 year.

Orientation systems: a) types: the electromechanical (electroflywheels) magnetodynamic (electromagnets) gravitational (boom);

- accuracy of the determination of orientation from the sensors (starry, solar, the horizon)and system GPS - GLONASS to 2- angl. deg.
- accuracy of guidance (electroflywheels and opto-fiber DUS) +/- 3 - 15 angl. deg.

Data-transmission system:

- S/C-Earth - 28 kbit/s

- the capacity of onboard storage - 8 Mbytes

- the volume of the adopted from the board information

- ~ 50 Mbayt/day

The radio frequency of command and telemetering links

145 and 435 MHz.

The system of onboard power supply 50 W:

4. SERVICE SYSTEMS OF THE "CHIBIS".

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Composition of the support systems of microsatellite “Chibis".

1. System of control:
- elektromakhovik - 4
- optovolokonnyy DUS - 3
- electrodynamic damper - 3
- onboard "Pentiym" with the electroautomatic
- starry sensor - 1
- sun sensor - 2
- horizontal scanner - 2

2. Power supply systems
3. System GPS-Glonas.
4. Radio system of the method of commands and transmission of official information.
5.Sistema of the collection of scientific data.
6. Radio system of the transmission of scientific data.

The flight control and the reception of information, including images and spectra, is accomplished by a point of reception and transmission of information IKI RAN, located in Tarusa sity, the Kaluga province.

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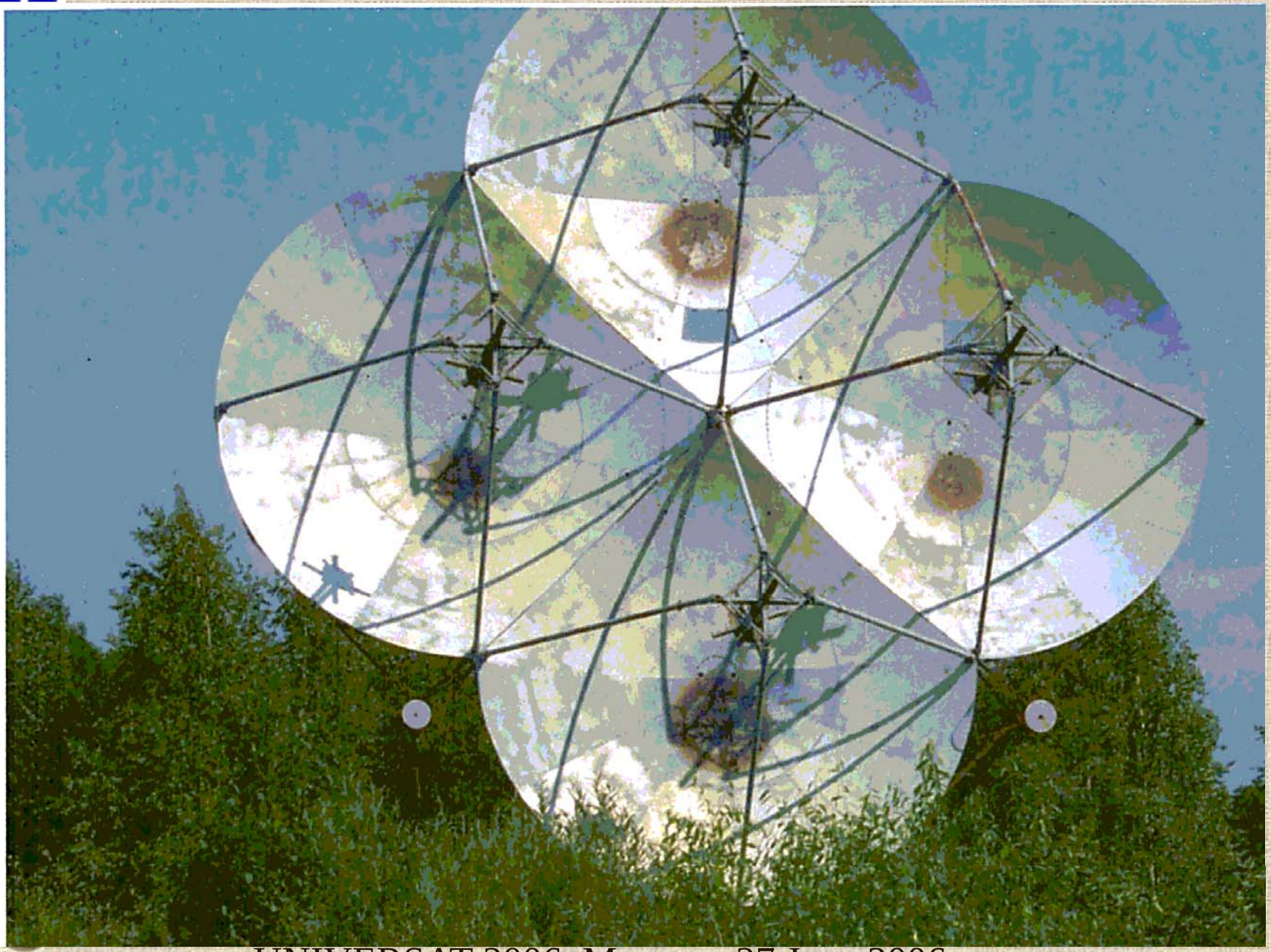

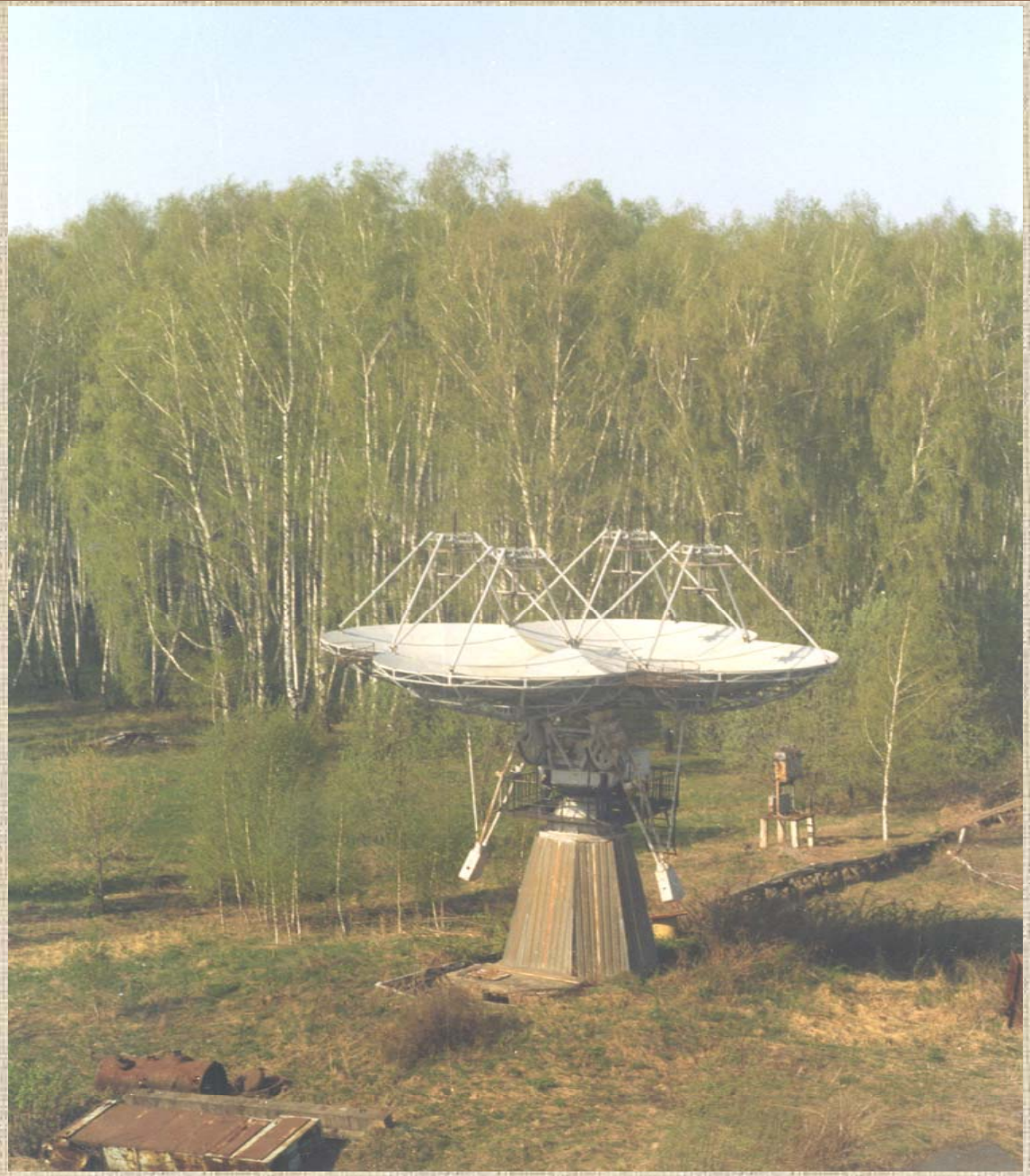

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5. EDUCATION.

Space today - the medium of active practical human activity.

The results of the mastery of space are used in the science and technology;

the need for their introduction in the formation ripened.

Natural method to report the achievements of space studies to the general public - formation and its first step - school.

Micro-satellite in this aspect are the unique teaching aids, comprised according to the principle from the simple to the complex and intended for the contemporary system of school formation.

Development, creation and use the MS requires training new specialists for their production and maintenance.

The directed training of such specialists extremely must be begun as fakul'tativ, already in the secondary school, improving subsequently these knowledge in university.

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CONCLUSION

At present in IKI RAN is conducted the development (phase A) of the microsatellite "Chibis" (launch it is planned on the end 2007)

International Seminar
“Application of space methods for studying the problems of the health of man, potentially dangerous and catastrophic phenomena with the use of the universal micro-satellite platforms”
(Russia Federation – UN, 2007)

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Seminar carried out
the Space Research Institute of
the Russian Academy of Sciences
(IKI RAN, Moscow)
http://www.iki.rssi.ru/
in the territory of the Special Design
Bureau of the Space Instrument
Manufacture of
the IKI RAN (SDB IKI RAN, Tarusa)
http://tarusa.ru/skbkp1/skb.htm.

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It is especially important to note that
this Seminar is included in
the Plan of the action (2006 - 2007) of
Roskosmos and the Russian Academy of Sciences,
dedicated to the celebration of
100- anniversary from the birthday S.P.Korolev,
150- anniversary from the birthday
K.E.Tsiolkovskyi
and
50- anniversary of the launching of
the first artificial earth satellite

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Launch opportunities MS in other orbits are studied by following load, including solar-synchronous and circumpolar orbits.