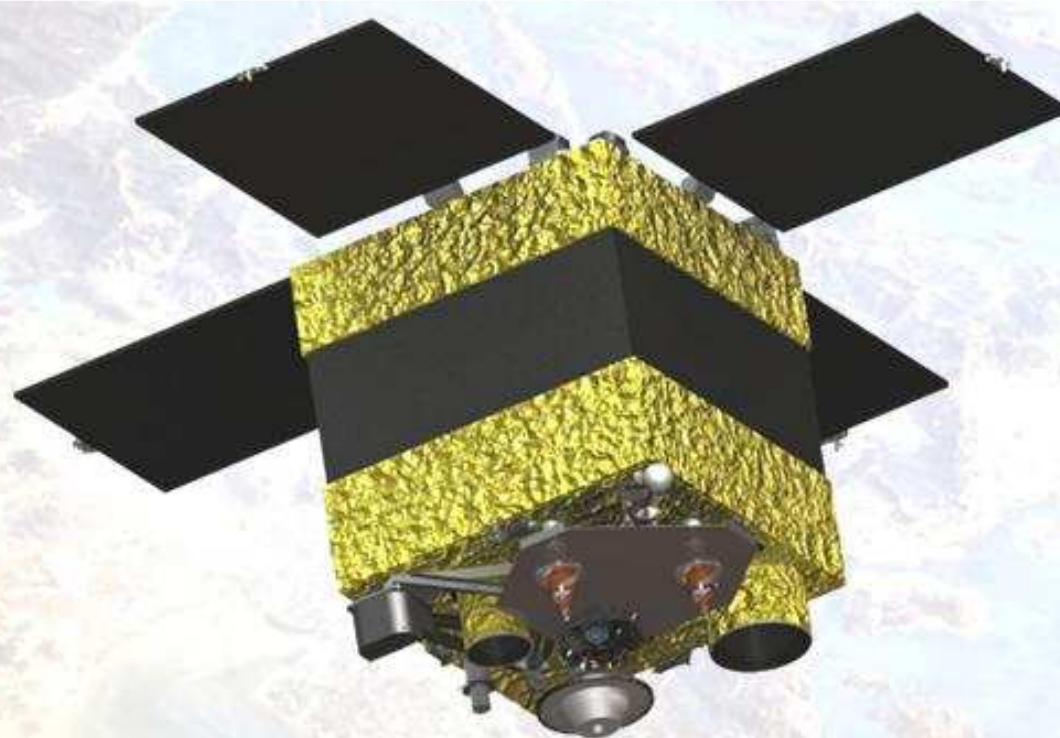


**SICH-2 EARTH REMOTE SENSING AND ATMOSPHERE  
PARAMETER RESEARCH SPACE SYSTEM**



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**The Sich-2 EARTH REMOTE SENSING AND ATMOSPHERE PARAMETER RESEARCH SPACE SYSTEM is intended for reception from space of optical-electronic observation data and making information production on the base of these data.**

**The information production of the space system will provide possibility of its use for solving the following main industrial, socio-economic and scientific tasks:**

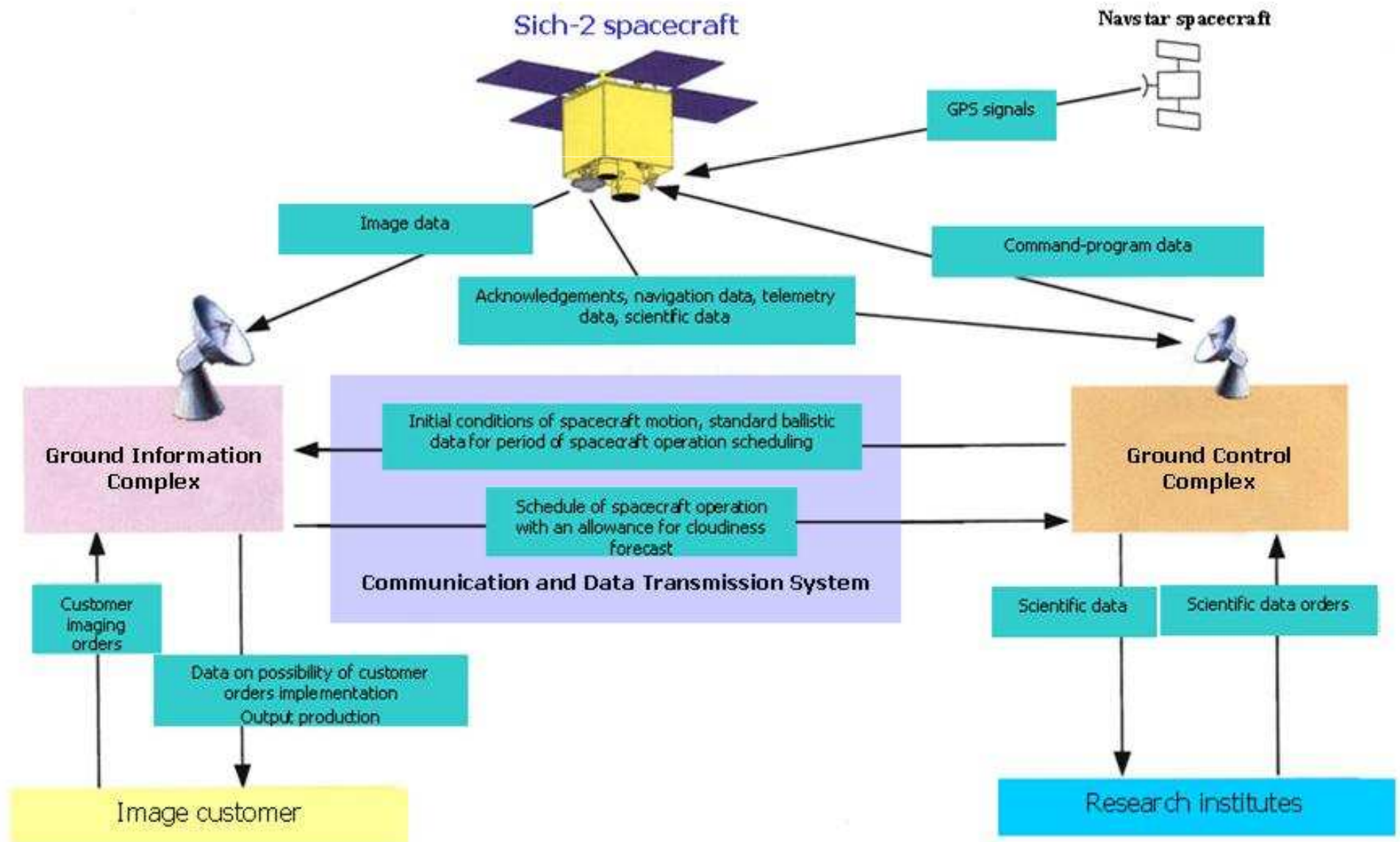
- a) reception and delivery to customers of the Earth optical-electronic observation data with the purposes of:
  - ensuring economical activity including agriculture, land use, town building, environment pollution monitoring and evaluation, mapping, and crisis monitoring;
  - solving scientific tasks;
  - commercial use at the international market;
  - informational provision for solving tasks of state agencies and structures;
- b) developmental tests of advanced technologies and technical facilities of space systems;
- c) reception of data from Potentsial scientific onboard equipment: measurement of ionosphere plasma parameters.



## **The system includes the following:**

- Sich-2 spacecraft;**
- Ground Control Complex;**
- Ground Information Complex;**
- Communication and Data Transmission System**

## Diagram of interaction of Sich-2 system components





## Main characteristics of space system

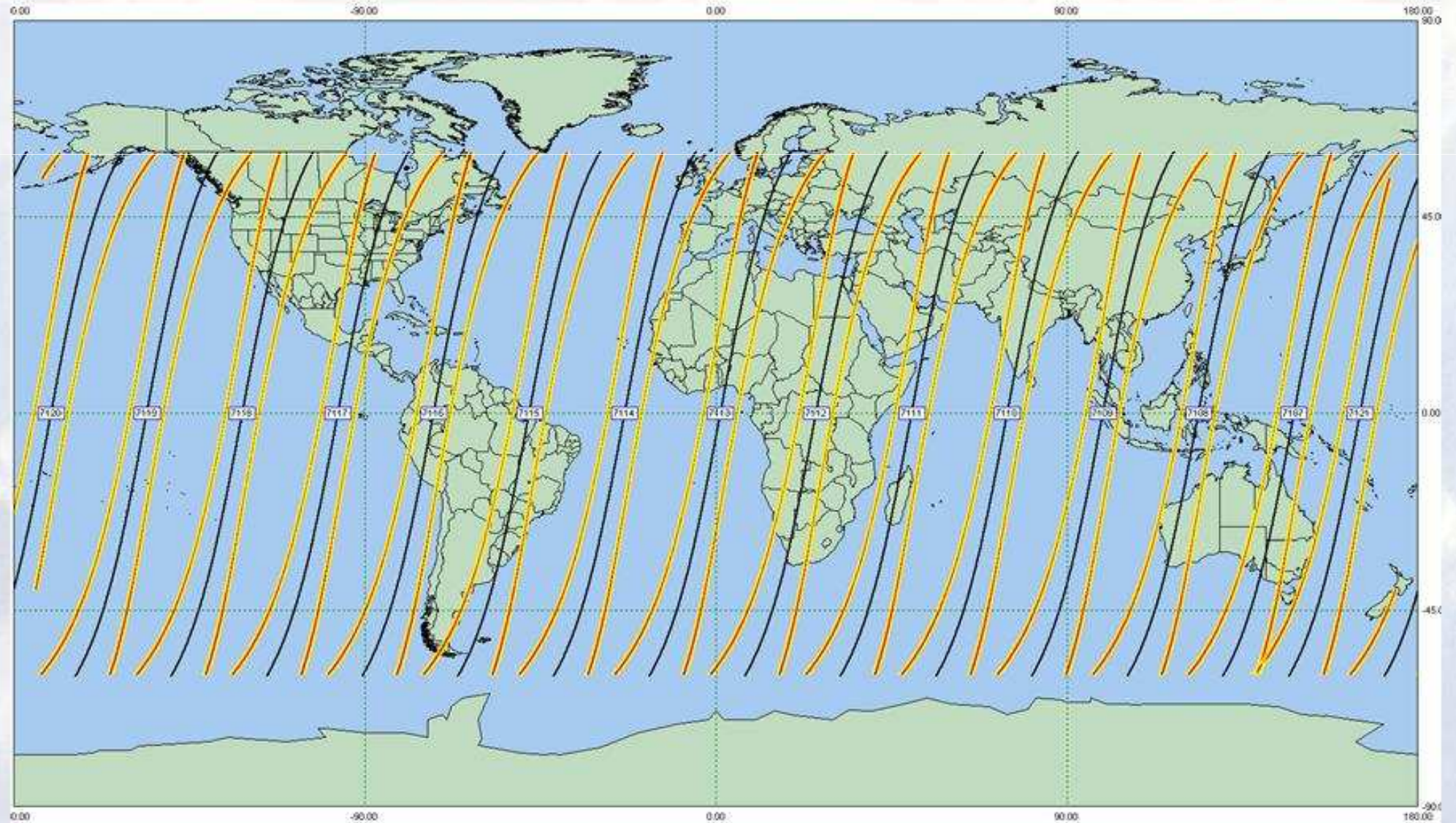
<b>Territory to be monitored</b>	<b>from 86°S to 86°N</b>
<b>Imaging periodicity</b>	<b>no rarely than 1 time in 4 days</b>
<b>Time from image completion to information production issue</b>	<b>no more than 1 day</b>
<b>Accuracy of geodetic affixment of objects (without use of reference points)</b>	<b>no worse than 2 km</b>

## Types and characteristics of imaging

Imaging type	Panchromatic	Multispectral	Middle IR imaging
Spectral bands, $\mu\text{m}$	0.51... 0.90	0.51... 0.59 (green) 0.61... 0.68 (red) 0.80... 0.89 (near IR)	1.51... 1.70
Geometrical resolution at imaging to nadir, m	no more than 7.8	no more than 7.8	no more than 46
Swath width at imaging to nadir, km	no less than 46	no less than 46	no less than 55

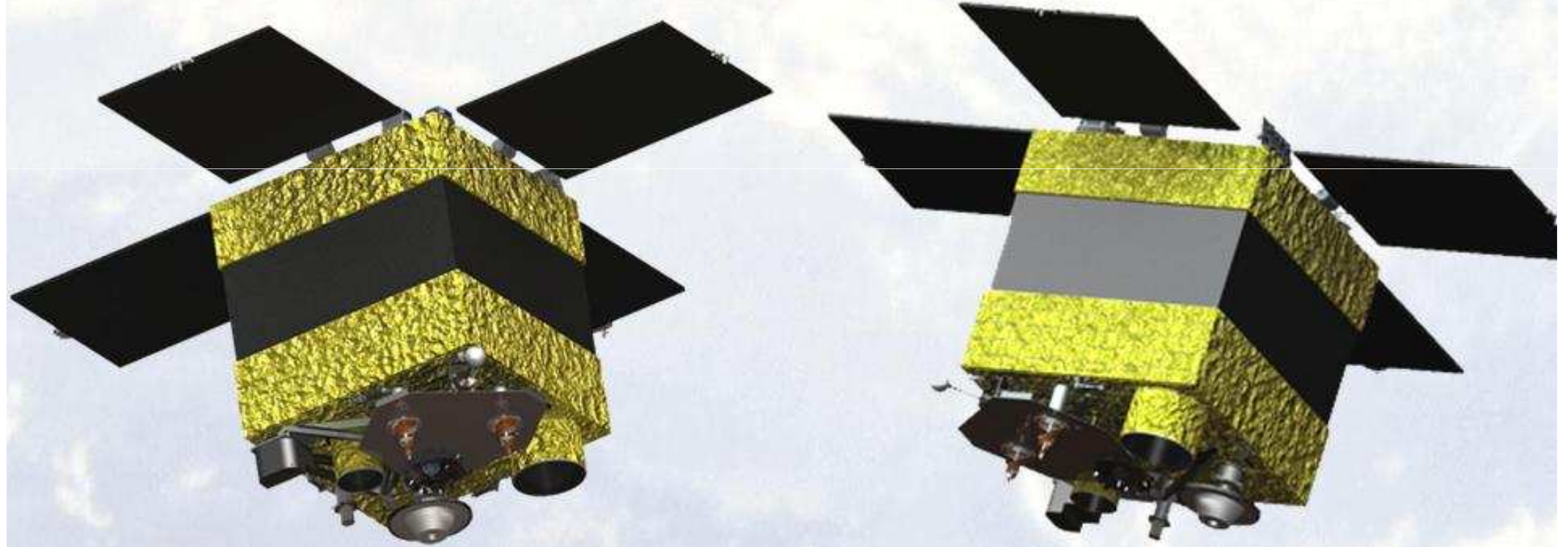


## Possible coverage zones for one day





## Sich-2 spacecraft



Sich-2 spacecraft was developed by Yuzhnoye State Design Office against contract with National Space Agency of Ukraine and is a modified version of the Egyptsat-1 satellite injected into orbit in April 2007 in interests of the Arab Republic of Egypt



## Examples of images from Egyptsat-1 satellite



a) Kerch Strait (summer);



b) Kerch Strait (winter)



## **Sich-2 spacecraft composition**

Sich-2 spacecraft is a space platform with integrated payload in its structure.

Sich-2 spacecraft payload includes the following:

- **Multiband Earth Imager providing reception of digital images of the Earth surface in panchromatic and multispectral bands;**
- **Middle IR Earth Imager providing reception of digital images of the Earth surface in the middle IR spectral band;**
- **Payload Command and Data Handling Subsystem providing acquisition, memorizing, compression (if needed) and storage of image data;**
- **X-band equipment of Communication Subsystem with antenna-feeder device providing transmission of image data to Ground Data Reception Station;**
- **Potential Scientific equipment providing measurement of parameters of neutral and charged particles and electrical and magnetic fields at ionosphere altitude level.**

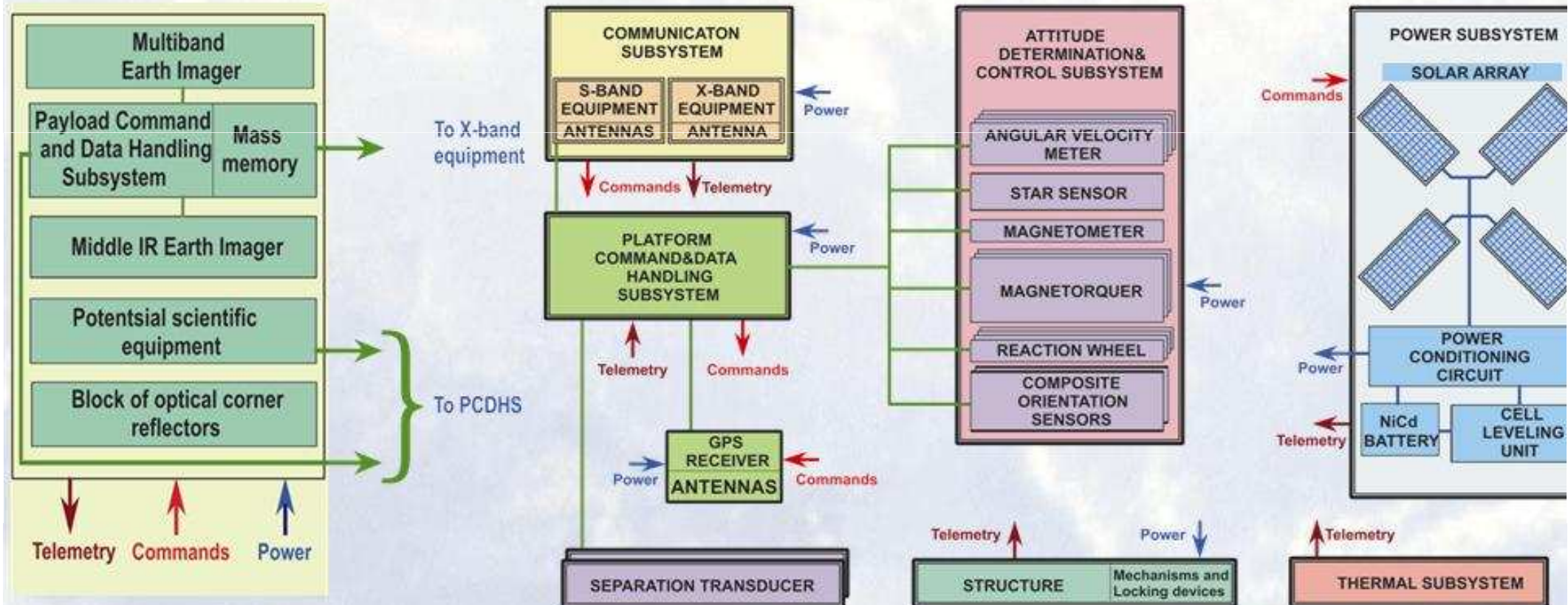


## Spacecraft platform composition :

- S-band equipment of Communication Subsystem with antenna-feeder devices providing reception of control commands and transmission of telemetry data about status of spacecraft subsystems;
- Platform Command and Data Handling Subsystem providing control of spacecraft subsystems and acquisition of telemetry data from subsystems;
- Attitude Determination and Control Subsystem providing pointing and stabilization of spacecraft at payload operation sessions and spacecraft orientation in stand-by mode between the sessions;
- GPS Receiver with antenna-feeder devices providing determination of navigation parameters of spacecraft;
- Power Subsystem providing power supply of spacecraft onboard equipment;
- Thermal Subsystem providing keeping the spacecraft instruments temperature in specified limits;
- Structure providing specified relative position of instruments.

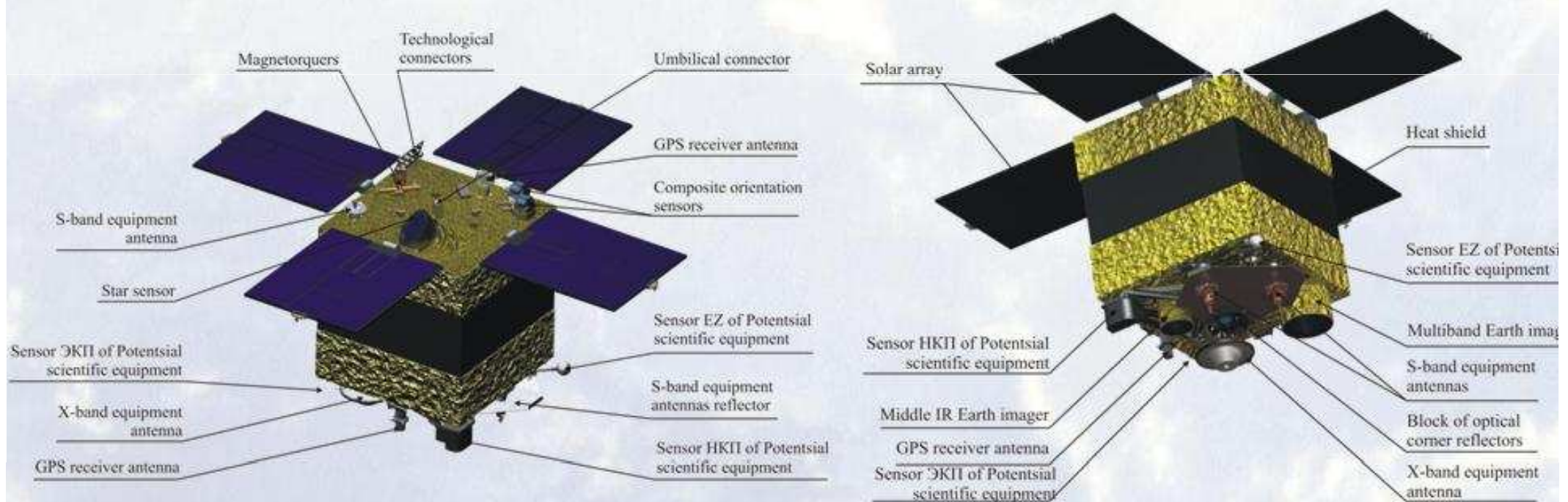


# SPACECRAFT COMPOSITION



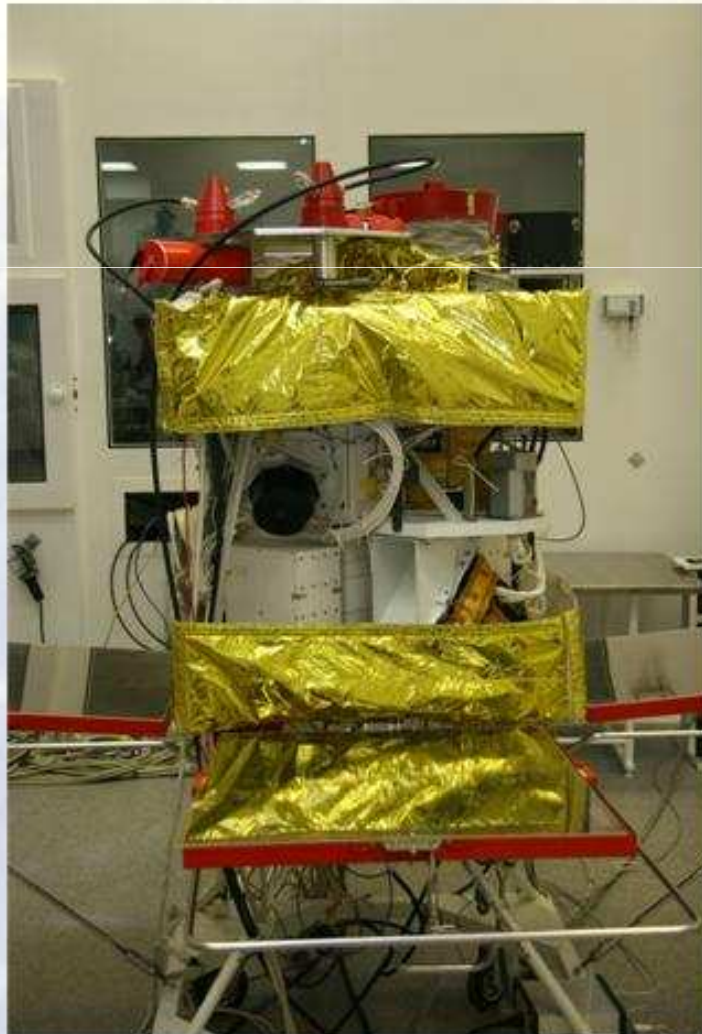


## SPACECRAFT LAYOUT





## Sich-2 spacecraft at acceptance tests in clean room of assembly workshop





<b>Mass:</b> - spacecraft - payload	176 kg 50.2 kg
<b>Orbit:</b> - type - altitude - inclination - local mean solar time at descending node	circular sun-synchronous ~668 km ~98.1° 10 h 30 min
<b>Orientation :</b> - type - off-nadir pitch and roll angles - duration of rotation from -30 ° to +30 ° - orientation accuracy - angular velocity accuracy - orientation determination accuracy	active, three axes ±35° ~ 90 s no worse than 0.2° no worse than 0.005°/s no worse than 0.06°
<b>Stereoimaging</b>	at one orbit
<b>Periodicity of imaging (with off-nadir rotations ±35°)</b>	no more than 4 days
<b>Imaging capacity</b>	no less than 50000 km <sup>2</sup> /day
<b>Lifetime</b>	no less than 5 years
<b>Launch-vehicle</b>	Dnepr-1



Multiband Earth imager	
Spectral bands	0.51...0.90 $\mu\text{m}$ (panchromatic) 0.51...0.59 $\mu\text{m}$ (green) 0.61...0.68 $\mu\text{m}$ (red) 0.80...0.89 $\mu\text{m}$ (near IR)
Resolution at imaging to nadir from altitude 668 km	7.8 m
Swath width at imaging to nadir from altitude 668 km	46.6 km
Middle IR Earth imager	
Spectral bands	1.51...1.70 $\mu\text{m}$
Resolution at imaging to nadir from altitude 668 km	39.5 m
Swath width at imaging to nadir from altitude 668 km	55.5 km
Payload command and data handling subsystem	
Operation modes	Data memorizing Data compression Data playback Direct transmission
Volume of mass memory unit	2 Gbytes
X-band communication subsystem	
Information data rate	30.72 Mbit/s
Modulation	OQPSK



## Potential Scientific equipment

Potential Scientific equipment was developed for measurement of particles and electromagnetic fields parameters in the Earth upper atmosphere. Implementation of the Potential experiment will promote to development of methods of diagnosis of field and plasma characteristics of geocosmos and creation of the satellite-based instrument complex with the purpose of monitoring and forecasting space weather and diagnosis natural and technogeneous catastrophes.

### Potential Scientific equipment composition

Unit	Measured value
Kinetic parameter sensors	Neutral particles concentration Pressure Charged particles concentration Electron temperature
Electric probe	Electric field potential
Fluxgate magnetometer	Earth magnetic field vector
Electronic unit	Volume of scientific data acquisition system memory is 4 Gbytes



**Data from Potentsial Scientific equipment will promote to:**

- development of methodology for synchronous registration of parameters of electromagnetic, neutral and charged components of the upper atmosphere;
- developmental tests of procedure of ionosphere plasma parameters diagnosis using data of measurements of spacecraft potential fluctuations with the help of electric probe;
- study of wave activity of the upper atmosphere using analysis of separate events and statistic regularities;
- detection of electromagnetic structures using spacecraft measurement data;
- clarification of characteristics of electromagnetic noises of the Si4-2 spacecraft platform;
- understanding of processes taking place in the Earth ionosphere and atmosphere at execution of combined experiments with ground facilities of active influence on ionosphere



## Expected results

Solving national tasks:  
natural resources monitoring,  
rational nature management,  
technogenic and natural cataclysms  
forecasts,  
cities growth monitoring

Extension of international cooperation in  
the field of the Earth remote sensing for  
solving global and national problems by  
exchange of satellite data;

Increasing level of state safety and  
defense by:  
prompt evaluation of possible damage  
from potential threat;  
information support of activity of high  
military-political authority of state and  
defense and law enforcement agencies



Solving tasks:  
agriculture,  
land use,  
town building,  
environment pollution monitoring and  
evaluation,  
mapping

Development of procedures of diagnosis  
and forecast of technogenic and  
natural cataclysms (including seismic  
activity forecast)

Development of fundamental scientific  
knowledge of physics of solar-terrestrial  
links;  
space weather monitoring





**Yuzhnoye State Design Office**



**THANK YOU FOR ATTENTION**

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