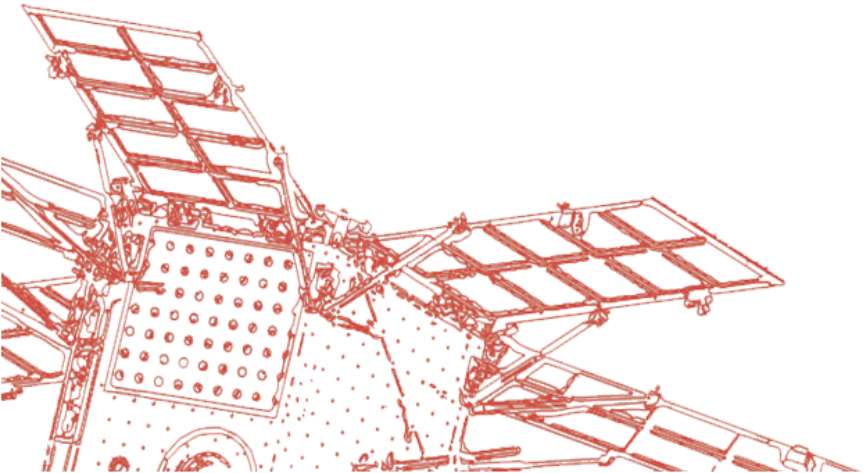
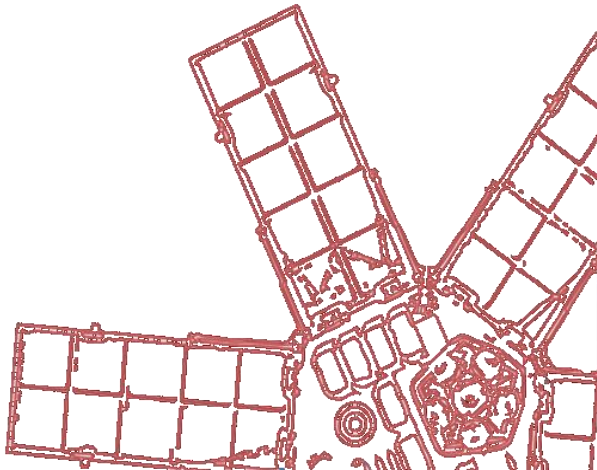
SPUTNIX

About Company



Moscow, 2020



About us

Activities

Satellite platforms and devices

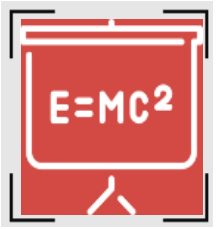
•Full cycle of developing, producing, assembling

TM/TC ground stations

•Ground stations for telemetry receiving and small spacecraft control

TM/TC ground stations

•Ground stations for telemetry receiving and small spacecraft control

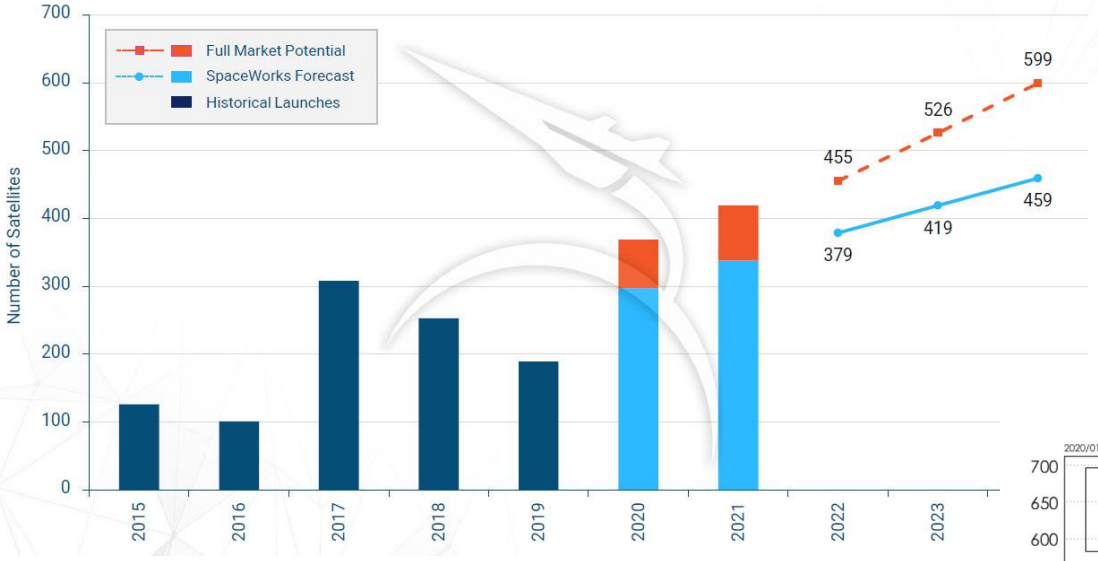


Aerospace education

•Educational programs for aerospace students

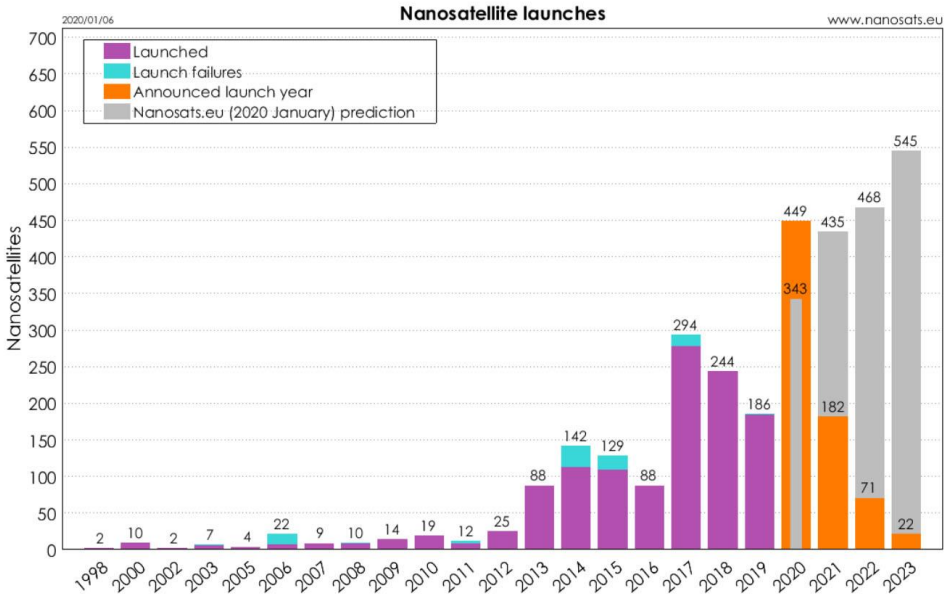
- SPUTNIX – Russian private space company
- Founded in 2011, resident of Skolkovo
- A highly professional team of aerospace engineers
- The company has leading competences in the field of small spacecrafts creation

Status and forecasts for the small satellite segment



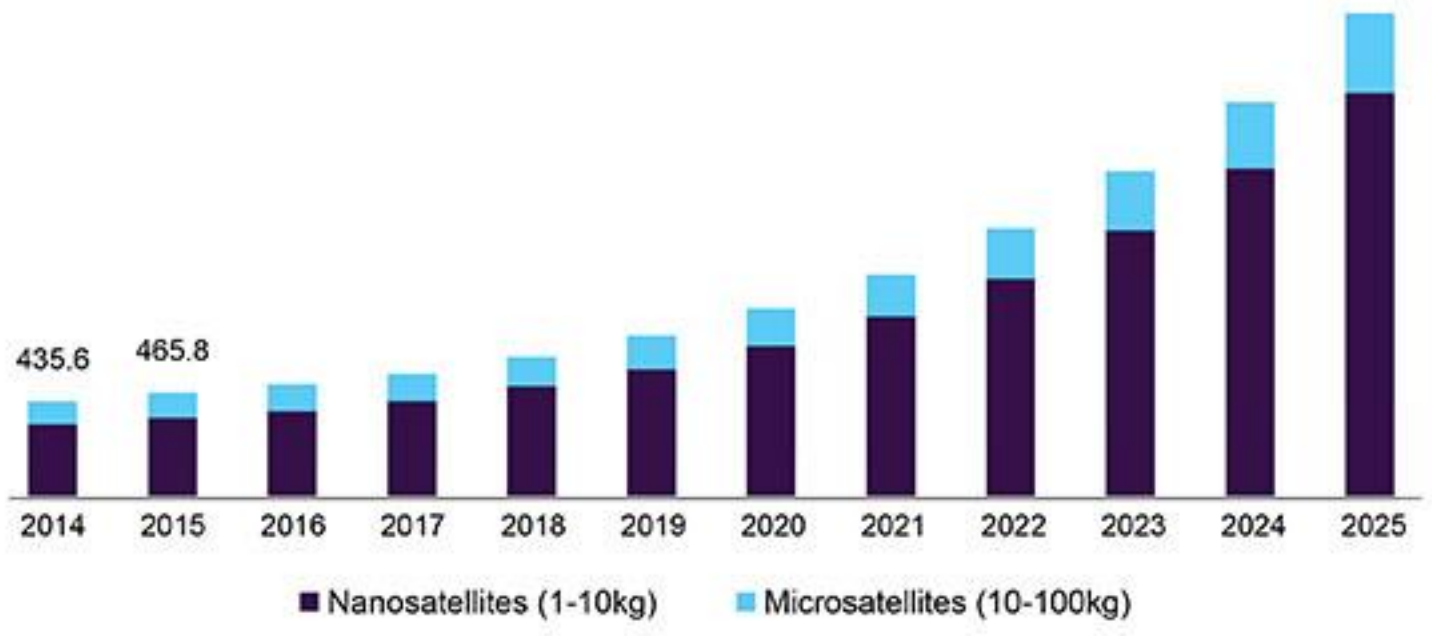
Small satellites launch forecast (1-50 kg). (SpaceWorks)

Nanosatellites launch forecast (1-10 kg). (Nanosats.eu)



According to analysts, over the next 5 years will be launched from **1800 to 2400** nano and microsatellites

Status and forecasts for the small satellite segment



Micro and nanosatellites market in the USA, mln. USD (Grand View Research, 2019)

The global nanosatellite and microsatellite market size was estimated at USD **1.28 billion** in 2018 and is expected to develop at a **22.2% CAGR** from 2019 to 2025. Growing demand for miniaturized satellites across various industry verticals is expected to provide an impetus to the market. (Grand View Research, 2019).

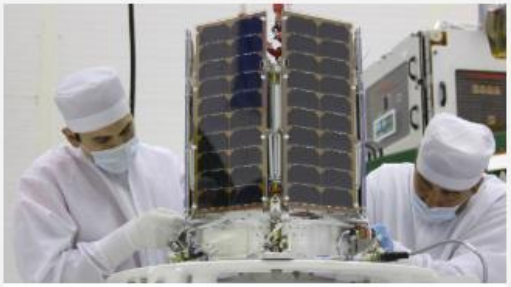
Satellites and subsystems in orbit

Chibis-M

Mass - 34,4 kg

Purpose - Scientific sat

Launch date - 25.01.12



TabletSat-Aurora

Mass - 26 kg

Purpose - Remote sensing

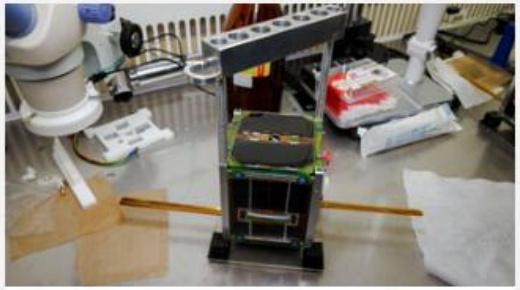
Launch date - 19.06.14

Al-Farabi-1

Mass - 2 kg

Purpose - Ed-Tech sat

Launch date - 15.02.17

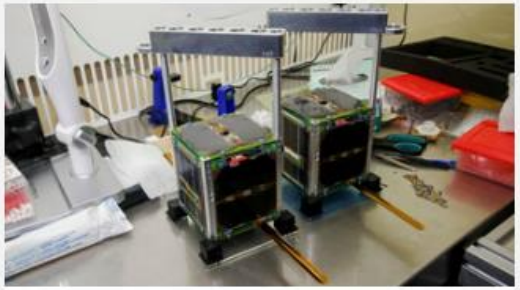


SiriusSat-1

Mass - 1,45 kg

Purpose - Ed-Scientific sat

Launch date - 15.08.18



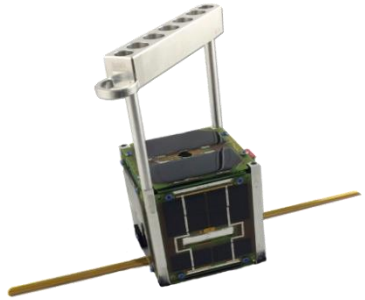
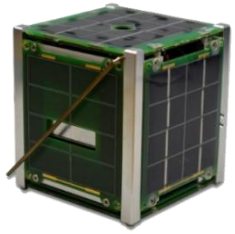
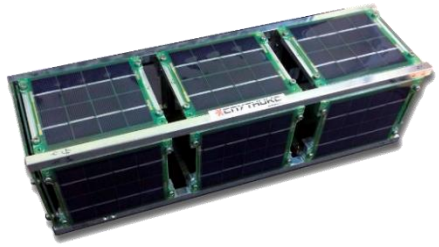
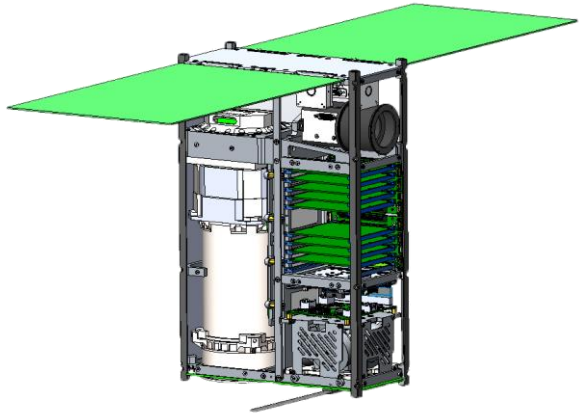
SiriusSat-2

Mass - 1,45 kg

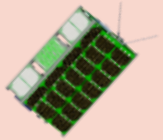
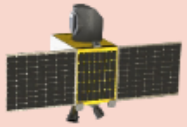
Purpose - Ed-Scientific sat

Launch date - the end of 2019

2020 planned missions

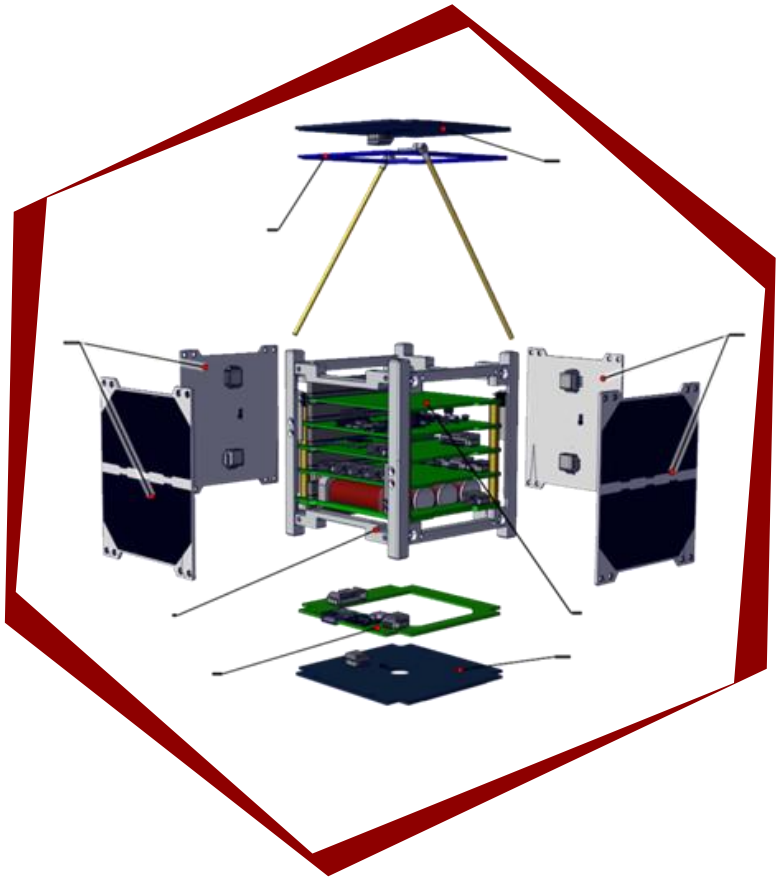
		
SiriusSat-3 Purpose: Ed-Science Launch: 2020	**Saudi Arabian customer** Purpose: Education Launch: 2020	**MIEM HSE Sat** Purpose: Education Launch: September 2020
		
Sirius 3U Purpose: Ed-Science Launch: September 2020	**ChallengeOne (TELNET)** Purpose: IoT (TechDem) Launch: September 2020	**6U TechDem** Purpose: Remote sensing Launch: September 2020

Types of platforms and mission options

Satellite	Platform	Mass	Mission	Creation time	Platform cost
	**CubeSat 1U**	1 kg	- Science - Education	5 month	from 35K Euro
	**CubeSat 3U**	4 kg	- Science - Education - ERS (50-100 m) - Object monitoring	5-9 month	from 70K Euro
	**CubeSat 6U**	10 kg	- Science - Education - ERS (up to 5 m) - Object monitoring	8 month*	from 350K Euro
	**TabletSat**	10-100 kg	- Science - Education - ERS (up to 5 m) - Communications	10 month	from 850K Euro
	**TabletSat-50**	40-60 kg	- ERS (up to 5 m) - Communications - Monitoring - Technological experiments	10-12 month*	from 1,1M Euro
	**TabletSat-ERS**	120 kg	- ERS (from 0,6 m) - Communications	12 month*	from 5,8M Euro

* - in small series

Nanosatellite CubeSat-platform “OrbiCraft-Pro”



OrbiCraft-Pro is

Nanosatellite CubeSat-standard platform. 1U, 3U, 6U form-factors.

OrbiCraft-Pro platform ideology

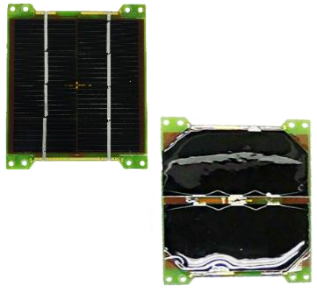
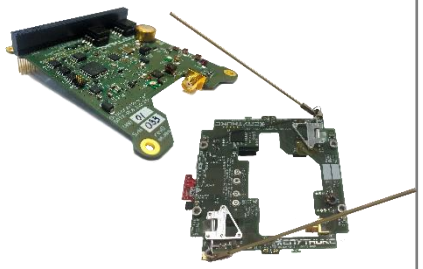
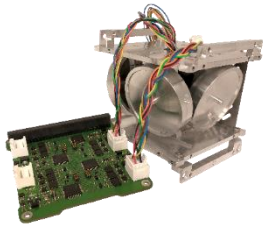
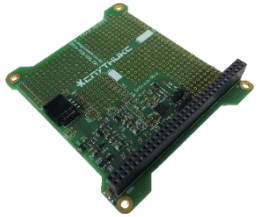
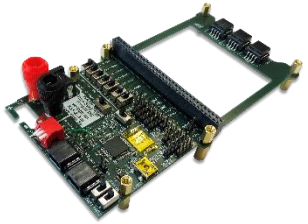
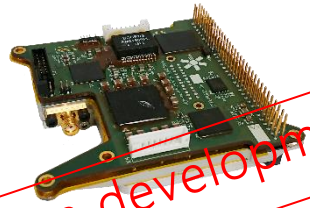
Unification of mechanical, data and power interfaces reduces time and financial costs of the development, assembling and testing of a spacecraft.

Flight qualification

OrbiCraft-Pro platform obtained flight qualification due to spaceflight of satellites SiriusSat-1 and SiriusSat-2.

CubeSat devices

SPUTNIX produces all basic subsystems of a nanosatellite, from structure to antennas.

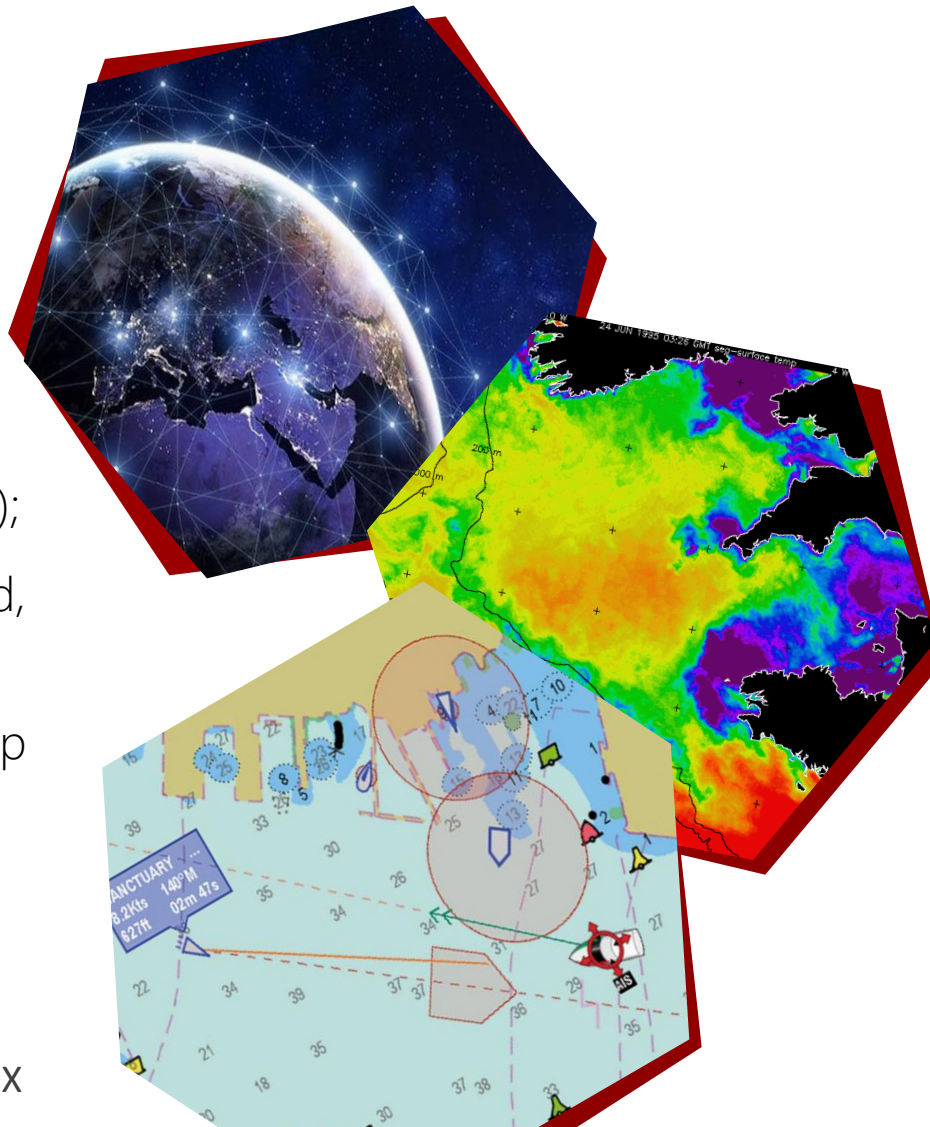
Structures	Si and AsGa Solar panels	Power supply system	On-board computers	UHF communication system
				
Sun sensors	**ADCS**	**Payload baseboard**	**Development kit**	**X-band communication system**
				

Own developments

Space missions based on OrbiCraft-Pro platform

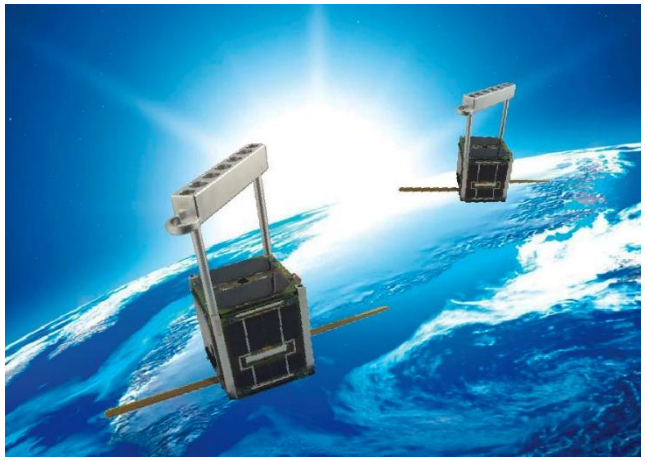
Depend on integrated payloads:

- Educational missions (implemented, since 2014);
- Scientific missions (implemented, since 2012);
- Internet of things (IoT) (planned, from 2020);
- AIS (planned, from 2021);
- Experimental missions (implemented, since 2014);
- Remote sensing: 50 m resolution (3U) (planned, from 2020);
- Remote sensing: up to 10 m panchromatic or up to 15 m multispectral (6U) (planned, from 2020)



Scientific missions

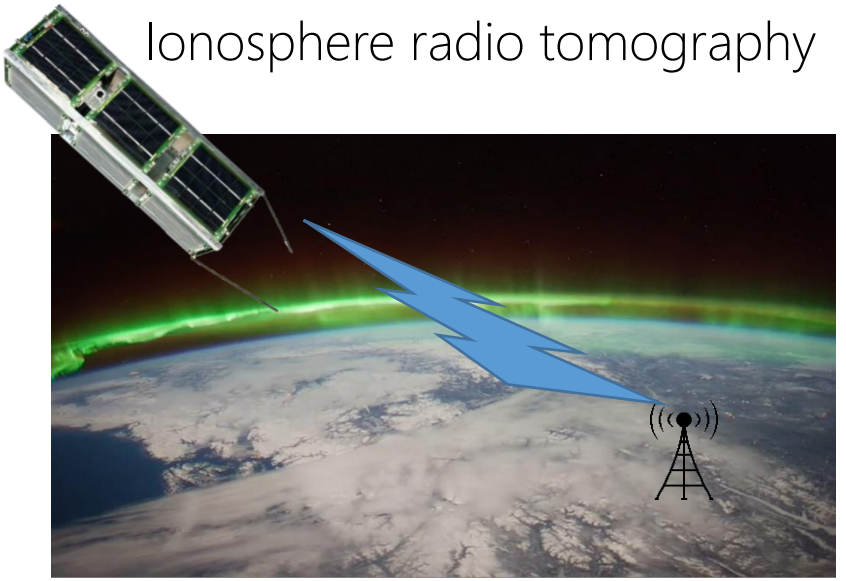
Charged particles detection



Cosmic ray detections or «space weather» research. The data acquired from the ray detectors will be useful in circumterrestrial space studies and in monitoring of radiological environment. Contains scintillator and double photo-electronic amplifiers with high-voltage power source.

Implemented

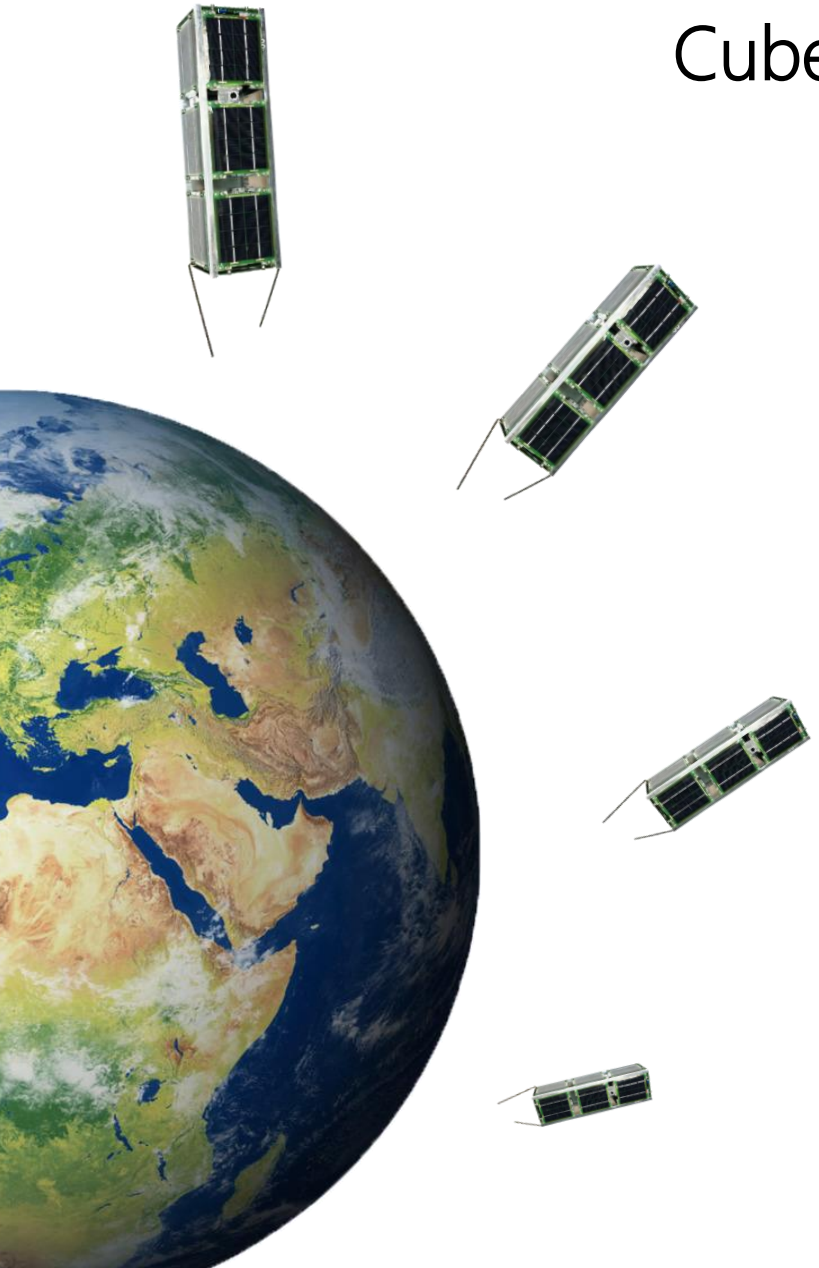
Ionosphere radio tomography



Dual-frequency transmitter (150 MHz and 400 MHz)
Transmitter is developed in cooperation with Space Research Institute scientists (Russian Academy of Sciences).

Plan for 2022

CubeSat technology for IoT



CubeSat satellite constellation is reliable and affordable space solution for Internet of Things.

IoT can be used in such fields as: production, transport, mining industry, etc.

Satellites provide global coverage, in comparison with limited ground infrastructure.

Using of LoRa technology.

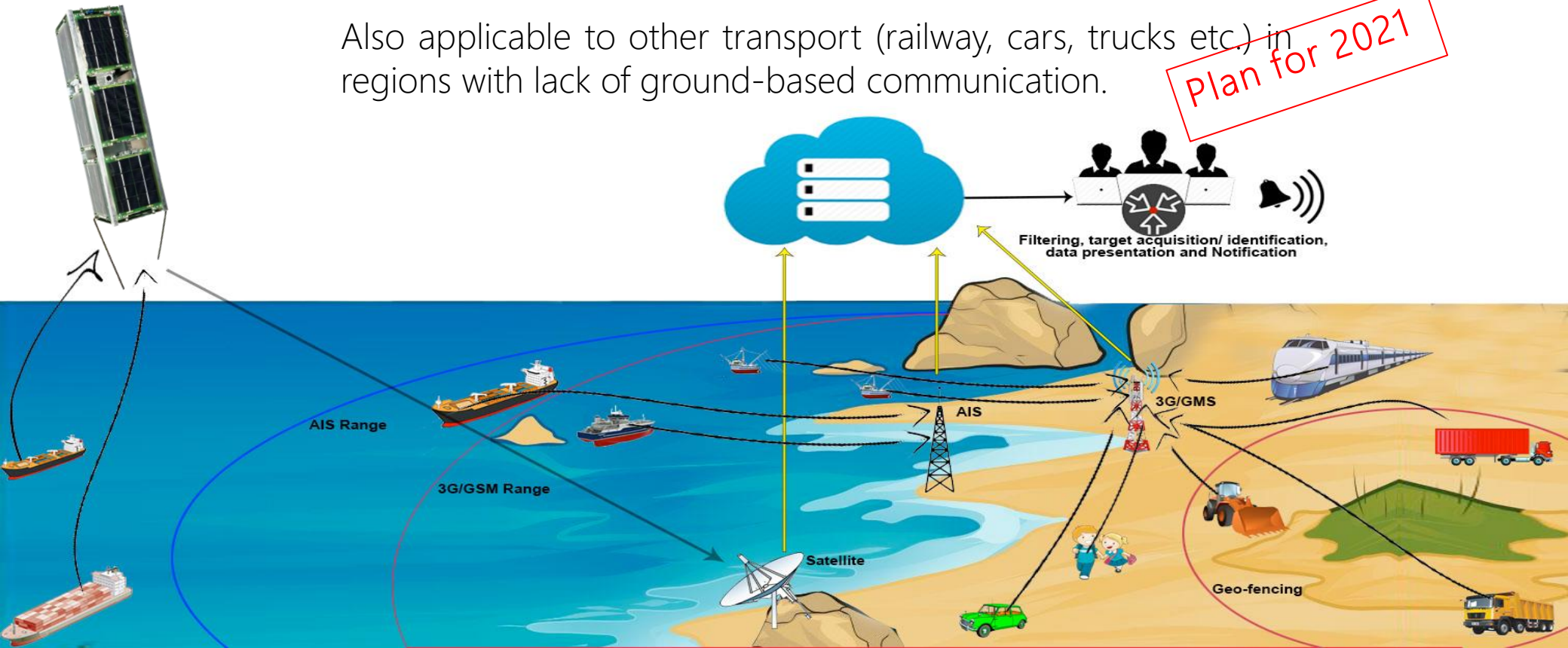
Plan for 2020 - 2025

Automatic Identification System (AIS)

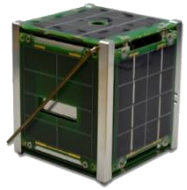
AIS - automatic tracking system that uses transponders on ships. AIS is intended to assist a vessel's watchstanding officers and allow maritime authorities to track and monitor vessel movements. It is especially relevant for safety of private yachts and small vessels.

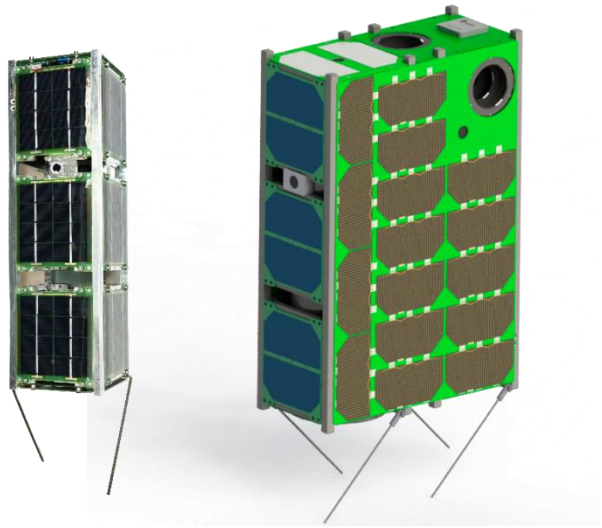
Also applicable to other transport (railway, cars, trucks etc.) in regions with lack of ground-based communication.

Plan for 2021



Possible missions: Experimental mission



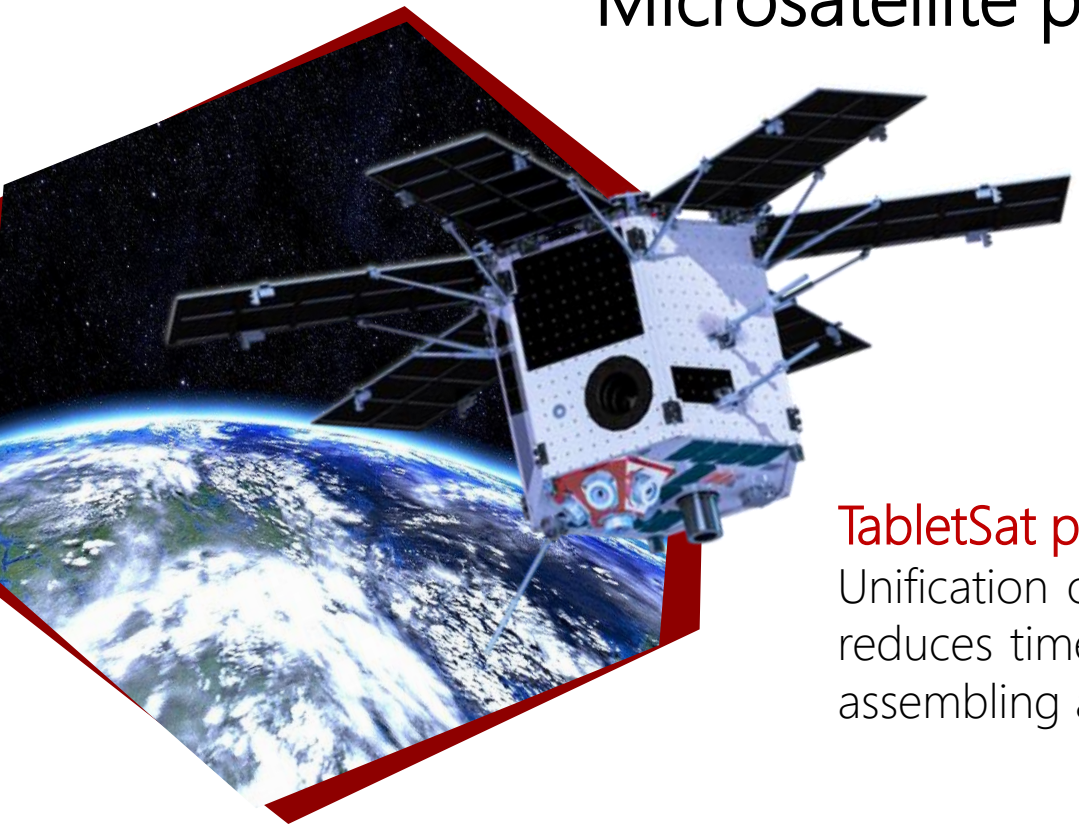


1U, 3U, 6U form-factor CubeSat platforms for space flight of customer's payload, experiment or device for technical demonstration.

Different modifications of the platform allow to vary the level of customer's participation in mission development.

Modification	Educational	Experimental	Flight	Profi
Description	Basic CubeSat kit for manual assembly and adjustments (DIY)	Assembled and verified by manufacturer CubeSat unit, ready for payload integration and testing	Assembled, verified, and calibrated by manufacturer unit, passed all qualification testing with or w/o payload.	Fully tested flight unit with installed and calibrated 3-axes orientation system and GaAs solar panels.

Microsatellite platform “TabletSat”



TabletSat is

a set of on-board systems and structural elements sufficient to develop 10…200 kg small satellites, providing integration and operation of various payloads.

TabletSat platform ideology

Unification of mechanical, data and power interfaces reduces time and financial costs of the development, assembling and testing of a spacecraft.

Flight qualification

TabletSat platform obtained flight qualification due to TabletSat-Aurora technological demonstration satellite spaceflight in June 2014.

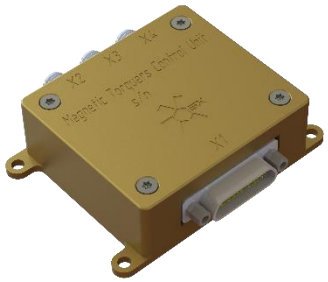
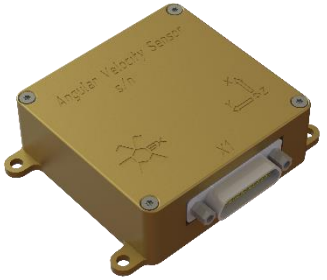
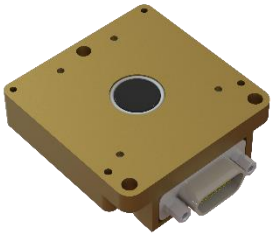
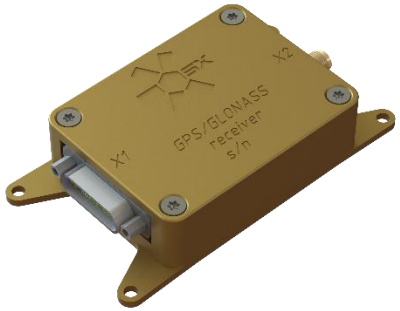
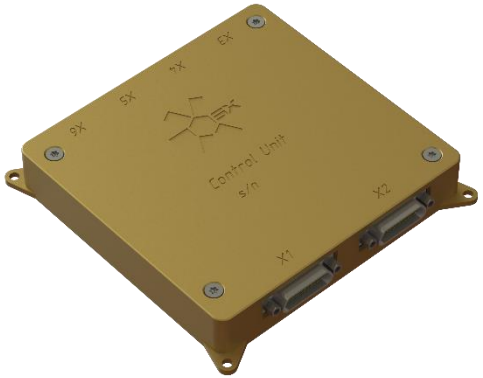
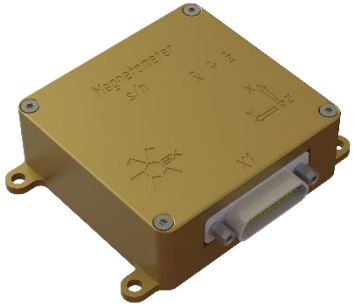
Microsatellite platform “TabletSat”

Parameters

Mass	10…200 kg
Mass of payload	0…100 kg
Payload daily average consumption	10…200 W
Data transmission speed	Up to 100 mbps
Memory capacity	Up to 128 Gb
Orientation precision	Up to 15 ang. s
Positioning precision	Up to 20 m
Power supply bus	12 V
Data bus	CAN2B, SpaceWire
Lifetime on orbit on 400…700 km	3…5 years

Type of works	Month 1		Month 2		Month 3		Month 4		Month 5		Month 6		Month 7		Month 8		Month 9		Month 10	
Developing																				
Producing and delivery																				
Assembling, payload integration, testing																				
Acceptance tests																				
Pre-launch preparations																				

Examples of microsatellite devices

Magnetic torquers control unit	Magnetic torquers	Angular velocity sensor	High-accuracy sun sensor
			
GPS/GLONASS reciever	**Onboard computer**	**Magnetometer**	**Small reaction wheel**
			

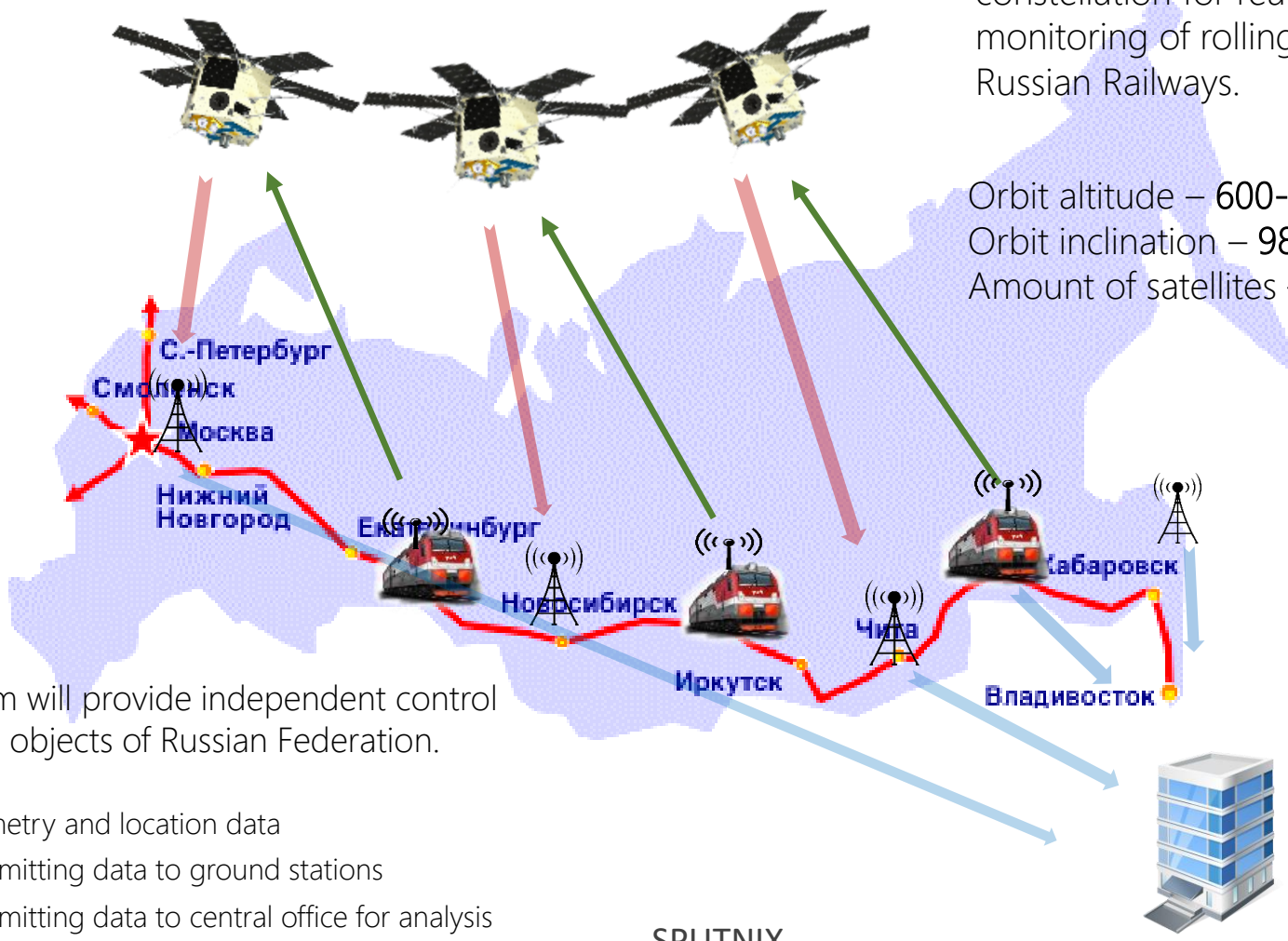
Own developments

Perspective missions: Rolling stock satellite monitoring

Customer: Russian Railways (RR)

Russian low-orbit small satellite constellation for real-time monitoring of rolling stock of Russian Railways.

Orbit altitude – 600-800 km
Orbit inclination – 98 deg
Amount of satellites – 50-100

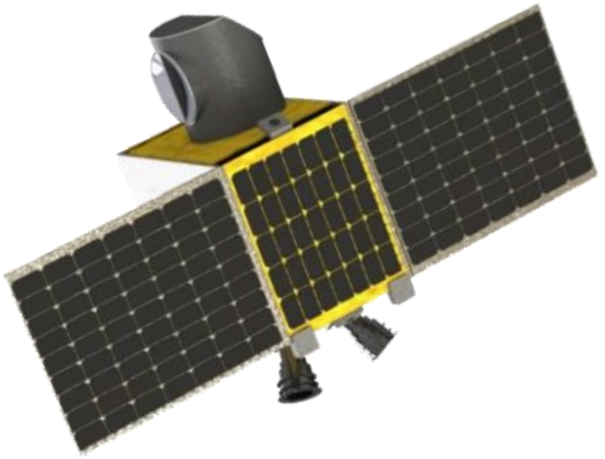


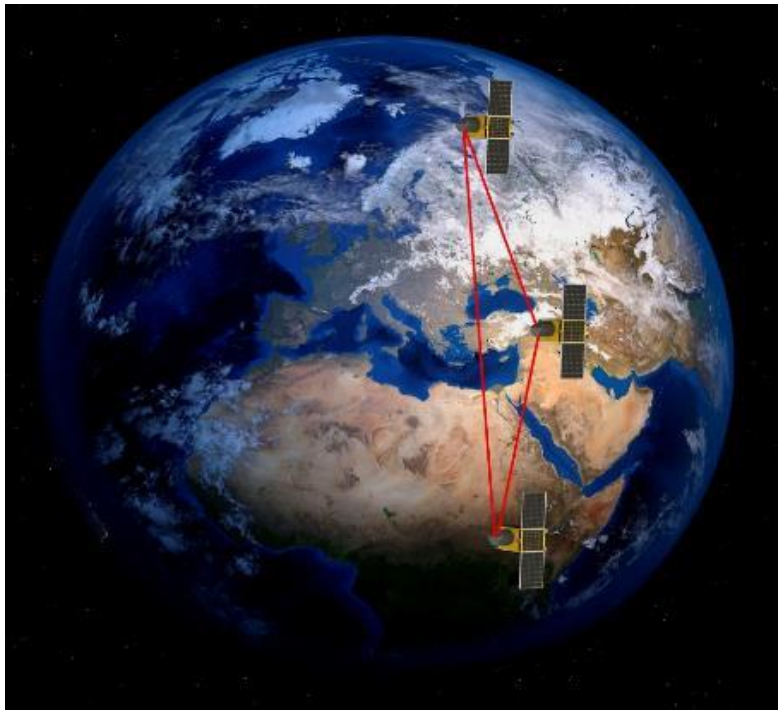
Russian system will provide independent control after strategic objects of Russian Federation.

- Telemetry and location data
- Transmitting data to ground stations
- Transmitting data to central office for analysis

Perspective missions: Laser communication

Project aimed on testing of space components for domestic laser intersatellite terminals, which will be used in advances projects on the field of telecommunication and data transmitting.



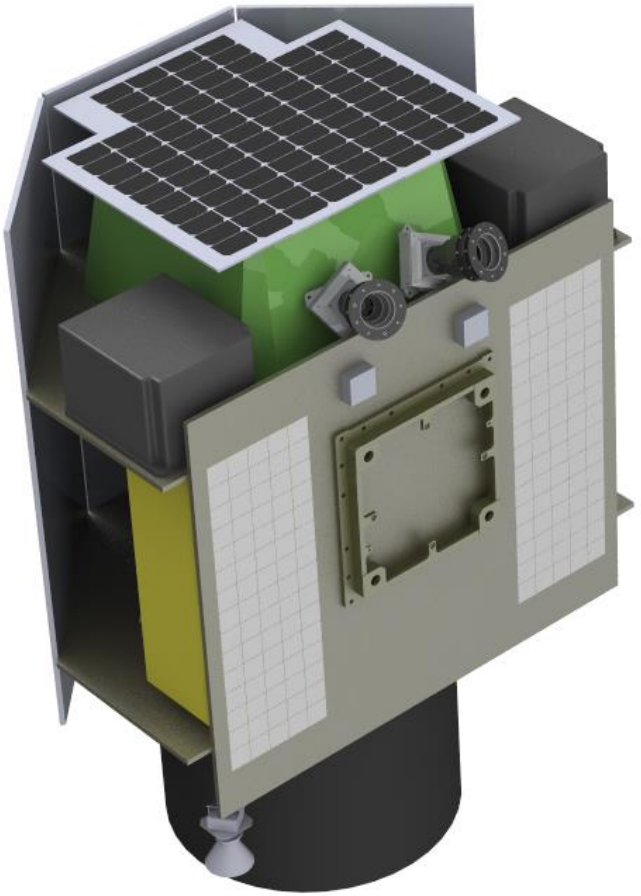


Payload is a terminal of intersatellite optical communication for building up intersatellite communication lines (in orbit plane, as well as interplane).

Microsatellites: Platform “80-200 kg”

Platform included into “Sfera” governmental program

Parameter	Value
Mass of spacecraft	80 – 200 kg
Power of spacecraft	180 – 450 W
Mass of payload	20 - 80 kg
Power of payload	30 – 180 W
Stabilization accuracy	Not worse than 1·10-3 ang.deg in sec
Orientation accuracy - Orientation finding - Orientation holding	 3 angular sec 10 angular sec
Production time of one spacecraft (small series)	8-12 months
Lifetime on SSO	3-5 years
Launch vehicle	Soyuz-2.1B (Russia)



Microsatellites: Platform “80-200 kg”

Project aims

- Developed multi-purpose small satellite platform 80-200 kg for creating of competitive in price and technical characteristics remote sensing spacecraft.

Project results

Stage 1. Remote sensing (RS) small satellite platform, assembly and test of flight model.

Stage 2. Creating of RS small satellite platform ready for commercial realization. Small series production and selling platform to Russian and foreign customers.

Total cost of the project

(thous.roubles)

680 196

Budgetary means:

Grant - 258 787

Contribution to charter capital – 217 350

Extrabudgetary funds- 204 059

Project timelines

Stage 1. RS small satellite platform, assembly and tests of flight model.

- **2 years 11 months**, until 2023.

Stage 2. Creating of RS small satellite platform ready for commercial realization. Small series production and selling platform to Russian and foreign customers.

- **1 year 1 month**, III quarter 2023 - III quarter 2024 *(considering schedule of launch vehicles)*

*extrabudgetary funds provided by RSS and SPUTNIX own funds.

Form of support

Grant – R&D – Contribution to charter capital – commercialization

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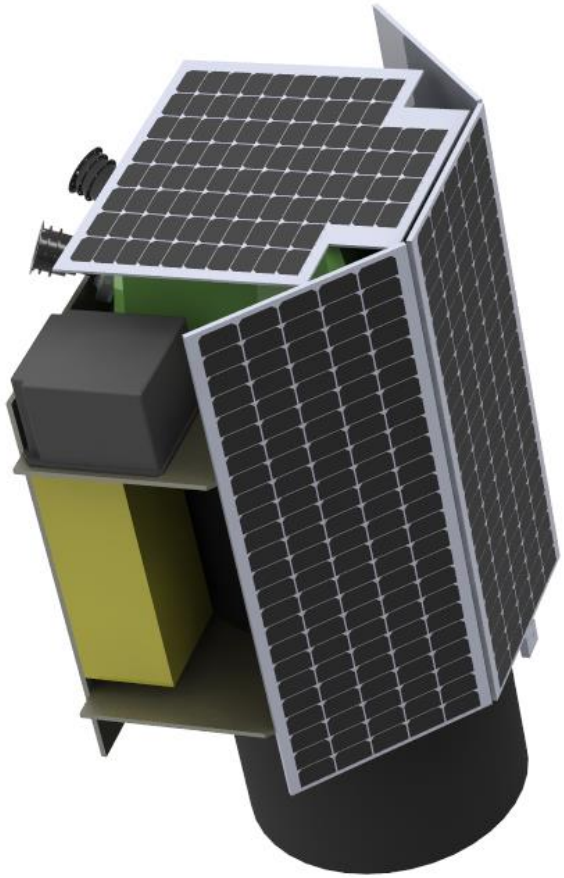
SPUTNIX

Idea of the project and ways of realization



Short description of the product

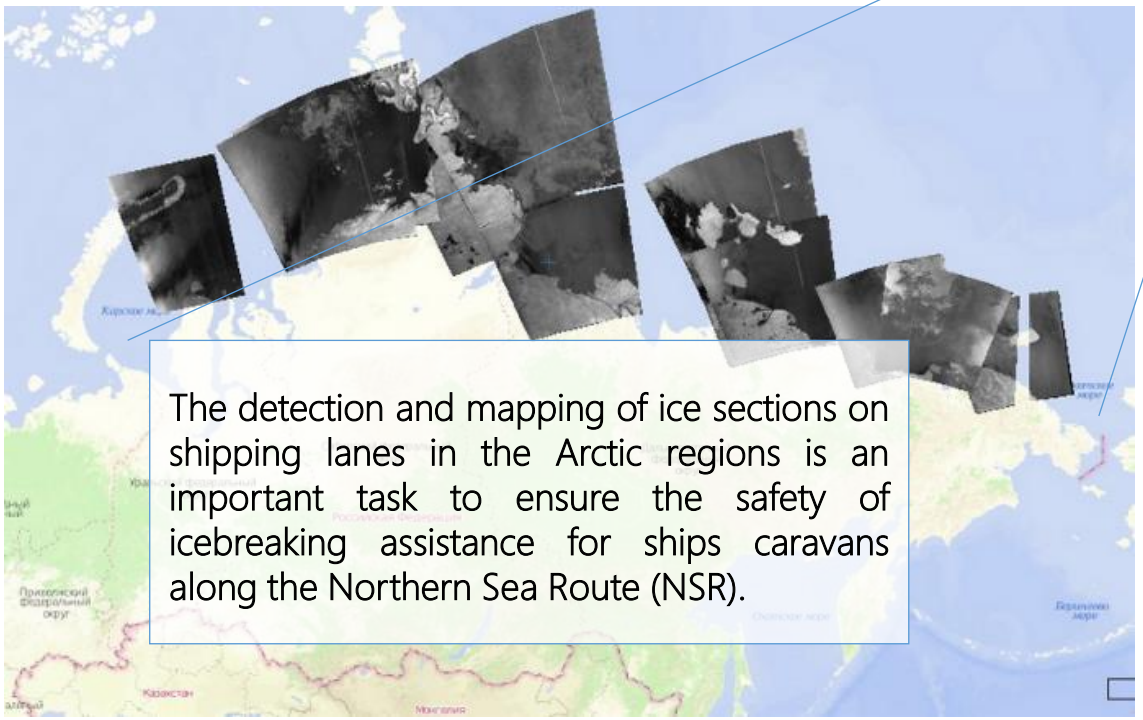
- Development of economically profitable platform, which will suit the needs of domestic and foreign customers.
- Main approach – development of components of on-board systems providing functioning and control of MCA weighing from 80 kg to 200 kg.
- ADCS meets the requirements for remote sensing tasks, which covers the needs for all other tasks (taking into account energy supply).
- Reducing launch costs and increasing launch efficiency by adapting the platform with various launch vehicles (LV) as a secondary payload.

Perspective missions: Northern Sea Route radar remote sensing

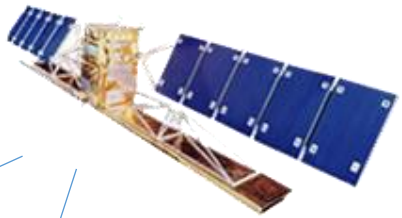
Customer: Rosatomflot

РОСАТОМФЛОТ

Russian system of real-time satellite detection of ice situation along Arctic shipping routes.



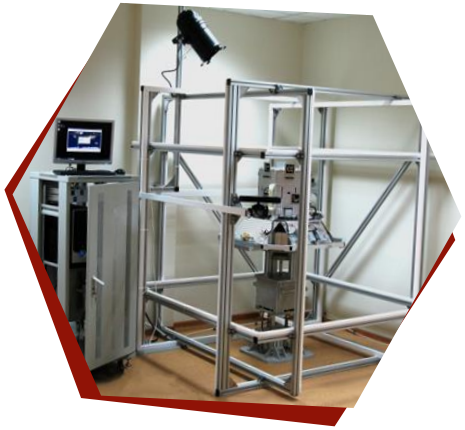
The detection and mapping of ice sections on shipping lanes in the Arctic regions is an important task to ensure the safety of icebreaking assistance for ships caravans along the Northern Sea Route (NSR).



Orbit altitude – **500-600 km**
Mass – **200 kg**
Swath – up to **250 km**
Resolution – **1 m, 3 m, 15 m**
Cost – **near 1,2 bill roubles**

At present Russia does not own radar satellites, which provide navigation along Northern Sea Route. Russia has to buy radar shots of Radarsat – Canadian satellites. Meanwhile Russian system will provide independent access to this information.

SPUTNIX is actively developing aerospace education



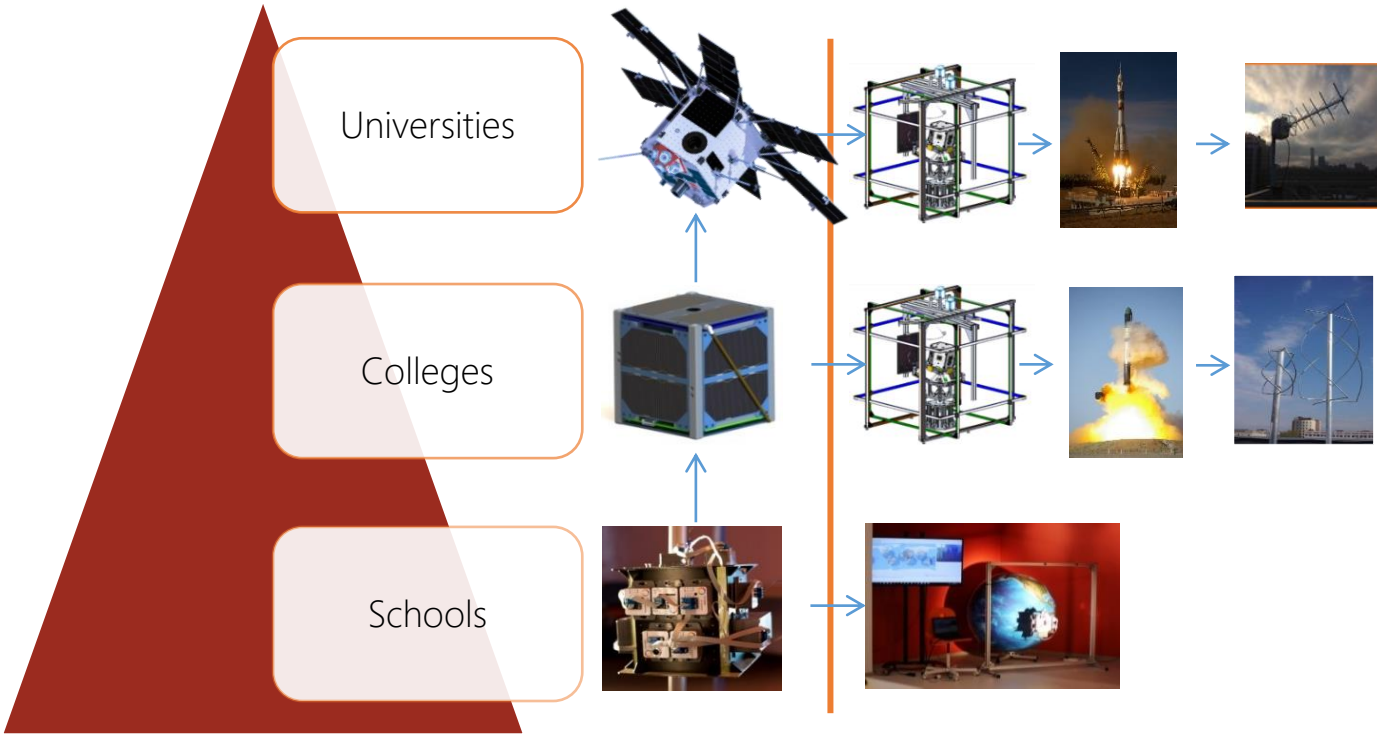
Turn-key solutions for aerospace laboratories

Workshops and specialized sessions

Schools and universities competitions

SPUTNIX provides all the necessary equipment for laboratory, as well as software and teaching materials

Key-products



Additional

- Micro- and nanosatellites;
- Professional test benches and simulators;
- Mission control centers

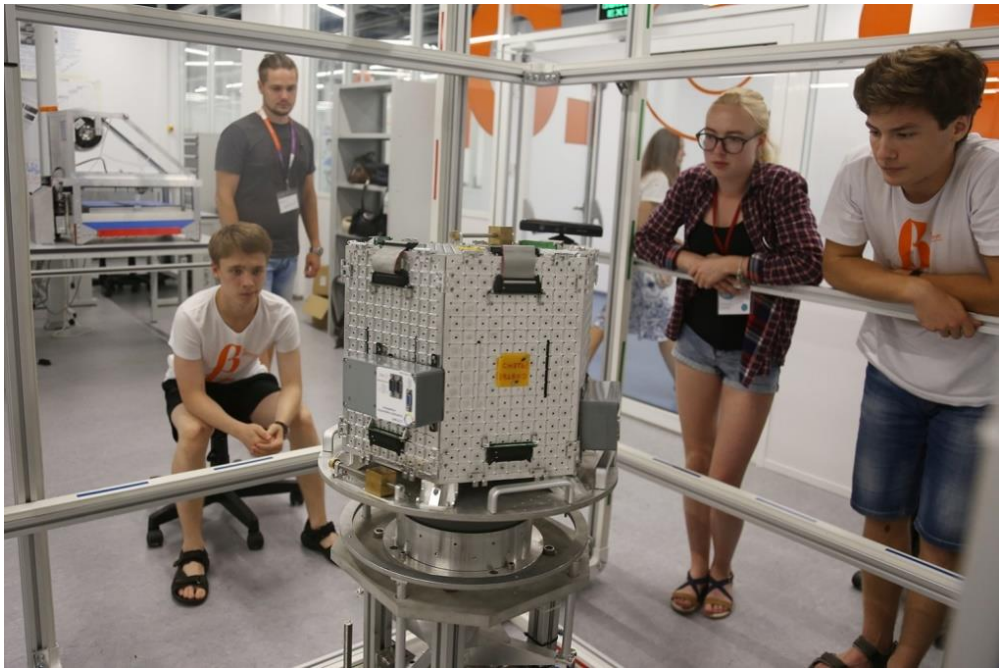
- CubeSat-format satellite kits for self-assembling;
- Orbital motion simulators;
- Amateur radio stations

- Functional mock-up of the satellite (with on-board computer, reaction wheel, sensors, and camera);
- Complex of space environment simulators

Aerospace laboratory is a complex solution for aerospace education

Students will obtain professional skills:

- Spacecraft Design, Assembly, Programming
- Payload development and Mission planning
- Spacecraft testing
- Telemetry receiving and Telecommand
- Satellite data analysis



These skills are to be applied on practice:
WorldSkills competence R54 "Space systems engineering"

Learn the basics using functional models and simplified systems

"OrbiCraft" is designed to learn the basics of spacecraft design and assembly.

It represents the kit of simplified satellite subsystems for self-assembly of functional model.

It allows to get functional prototype of the satellite, to learn control algorithms, and to easily learn how to program on C and Python languages.

"OrbiCraft" Satellite functional kit and "Terra" Complex of space environment simulators

Using "Terra" you can simulate spaceflight

- Big rotating Earth globe simulates orbital motion of the satellite;
- Magnetic frame creates magnetic field around the satellite;
- Spotlight simulates the Sun;
- Sensors on the globe surface simulate Mission Control Centers work;
- "Virtual MCC" software visualizes radio-covered zones for satellite control.

OrbiCraft

OrbiCraft - CubeSat

Instructions and teaching materials on wiki-page:
orbicraft.sputnix.ru

SPUTNIX

Assembly and programming of the real satellite

Using OrbiCraft-Pro satellite platform, you can build the satellite and launch it into space.

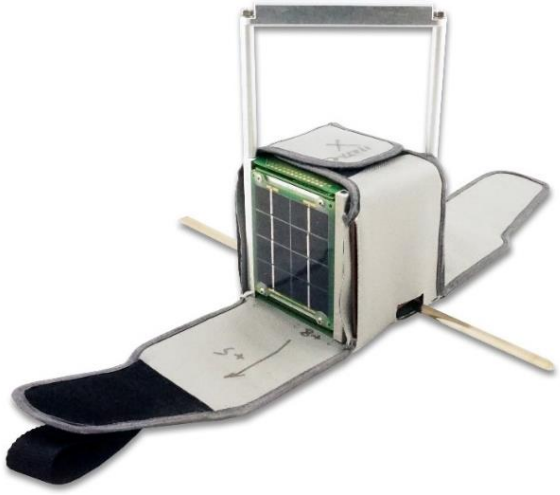
All the necessary subsystems and guidance materials make satellite engineering easy for every high-school student.

"OrbiCraft-Pro" CubeSat platform

Students of all ages and countries create their own CubeSat-format satellite. Join the community!

1U 3U

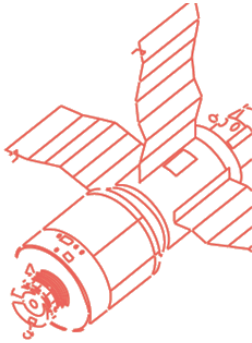
In August 2018, CubeSat satellites assembled by school students were launched from the ISS



Now the opportunity to launch a satellite into space is available to every educational institution!

Test benches

Pre-launch tests of the satellite on professional laboratory equipment



Test bench allows to conduct experiments and analyze ADCS algorithms of the spacecraft in ground conditions.

Test bench contents:

- Magnetic field simulator (three-axial)
- Sun simulator
- Air bearing with moving platform (weightlessness simulator)
- System of independent measurements (positioning in space)
- Operator's workstation
- Software

Attitude Determination and Control System test bench

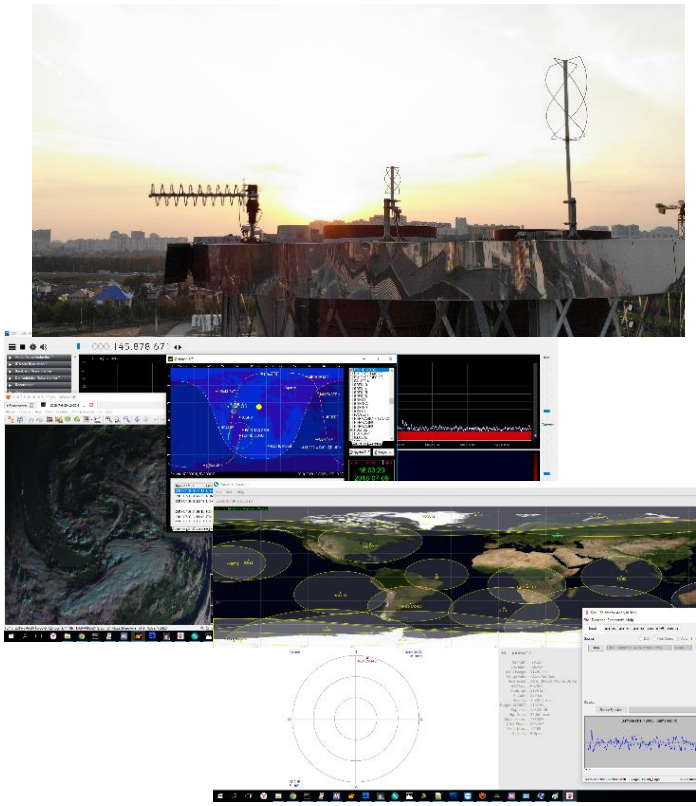
Own developments

Telemetry receiving and telecommand from Mission Control Center

Complex allows to receive signals of the real satellites in amateur radio band.

Types of radio signals available to receive:

- Telegraphic radio signals, the Morse alphabet for Doppler's effect demonstration;
- NOAA and Meteor-M weather satellites shots, which can help to study weather events and temperature distribution;
- Telemetry of more than 50 satellites for altitude, angular velocity, temperature examination.



Two-way radio channel allows to receive telemetry as well as transmit control commands.

After the launch of your satellite two options will be available:

1. SPUTNIX can operate the satellite in orbit

Or

2. Customer controls it from own Mission Control Center

"Zavitok" Data receiving and satellite controlling station

Own developments

Our partners