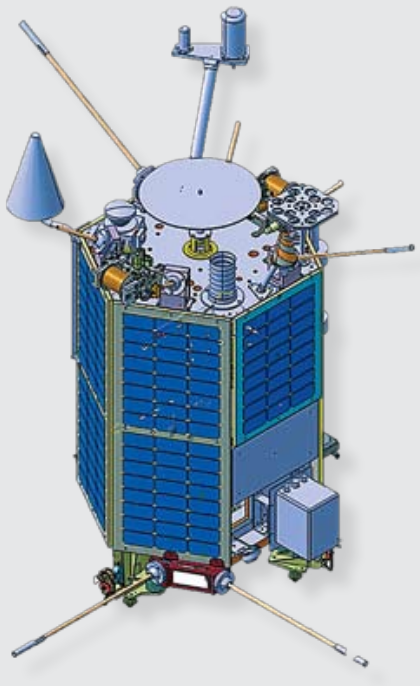
MiR for future ISS-Reshetnev projects

Academician M.F. Reshetnev Information Satellite Systems constantly develops new solutions for space technologies. The small spacecraft MiR (Yubileiny-2) is one of them. The satellite was named after Mikhail Reshetnev, the founder and the first director of the company. The previous satellite for scientific purposes – Yubileiny – was placed into orbit in 2008 and since then it has exceeded the designed lifespan by three times and now is still carrying out its mission. ISS-Reshetnev has recently completed MiR, and the satellite is to be inserted into LEO with the next launch of a Rockot vehicle.



Importance of small satellites

Small satellites play a great role and are of high importance for the development of modern space technologies. Spacecraft of this type have many advantages and are valued on their small dimensions and relatively low cost. In addition to this, such satellites can be launched in cluster with other spacecraft, which results in reduced expenses. Small satellites are used for testing new engineering and technological solutions and carrying out research missions. What is more, these satellites can be manufactured within a short period of time, which makes them highly attractive and suitable for projects with tight time limits.

Academician M.F. Reshetnev Information Satellite Systems has been designing and developing small satellites from the very inception of the enterprise. Besides the Strela-1 and Strela-1M series, ISS-Reshetnev also developed amateur radio satellites of the Radio, Zeya and Mozhaets series. Many of these spacecraft had quite short mission lives, but nevertheless they enabled the Reshetnev Company to succeed in testing new telecommunications and navigation technologies and studying the influence of space radiation.

Platform configuration

The new small satellite, like its predecessor Yubileiny, is based on the unified platform of the same name. The platform comprises an unpressurised hexahedral instrument module, divided into three parts by honeycomb panels (namely upper, middle and bottom panels). The upper panel encloses the payload; the middle panel carries instruments, whereas the lower one includes magneto-gravitational AOCS (for 3-axis stabilized small spacecraft) and antennas for navigation sensors.

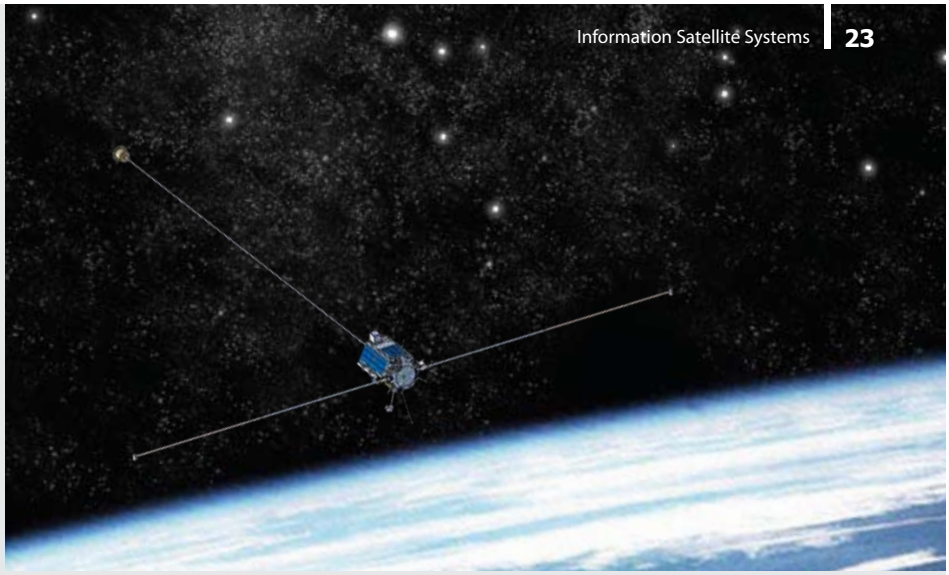
Solar panel modules, mounted on the outer side of the instrument module, are made of high-efficiency triple-junction gallium-arsenide and supply the spacecraft with energy during sunlight. The hexahedron-shaped instrument module provides the required effective area of solar panels in various positions of the spacecraft relative to the Sun. A nickel metal hydride battery is a source of energy for the spacecraft during eclipse periods.

The platform features a passive thermal control system – the required thermal parameters for the on-board equipment are maintained within specified ranges by using thermo-optical properties of external surfaces, electric heaters, insulation system and heat pipes.

MiR in-orbit mission

The research satellite MiR enables testing new advanced technological solutions introduced by ISS-Reshetnev and a number of its associate companies. In particular, MiR is to be used for effectiveness verification of the following structures and components: contoured heat pipes, new technological enhancements for onboard radio equipment and small-sized sensitive, high-precision elements of AOCS (including small-sized magnetic torquers for satellites' AOCS). These tests would contribute to the further technological enhancement and development of satellites yet to be designed.

A number of experimental instruments for the MiR satellite have been manufactured with the participation of students and research members from Siberian State Aerospace University (SibSAU). The company closely collaborates with this university, allowing students to be involved in the process of satellite production. The research and education center "Space systems and technologies" held by ISS and SibSAU, and joint activities under the MiR project provide extensive training and hand-on experience for talented young people, who in near future might work for the Reshetnev Company.



Some instruments designed and produced in tandem with SibSAU are used for testing the remote Earth sensing technology, in particular, it is a camera intended for observing the Earth surface. Nowadays ISS-Reshetnev pays great attention to developing the remote sensing technology.

The payload also includes a small WEB-camera – an important instrument enabling ISS specialists to continuously observe the satellite's deployment mechanisms and monitor the performance of satellite components, structures and instruments made of advanced composite materials. In-orbit performance data will be analyzed and referred to in the manufacture of next-generation satellites.

The new satellite is also tasked with testing the optical properties of solar concentrators, using an experimental solar panel module. In addition to this, a compact navigation receiver installed in MiR (intended to obtain the spacecraft's orbit parameters using the GLONASS and GPS technology) will also undergo flight tests.

The MiR satellite will fulfill its orbital mission in the circular low Earth orbit. The designed active lifespan of the spacecraft is one year.

MiR specifications	
Orbit type	low Earth orbit (up to 1500 km)
Telemetry and command frequencies	
- Uplink	145 MHz
- Downlink	435 MHz
Radiolink frequency	2.4 GHz
Platform mass	30 kg
Payload mass	35 kg
Payload power supply	no less than 40 W (orbit average)
Mission life	1 year

The satellite's mass is 65 kilograms. It is expected that MiR will be launched by a Rockot vehicle from the Plesetsk Cosmodrome. Due to the satellite's small dimensions it will be inserted into orbit as a hosted payload.

Electrical testing of MiR