

IAF ASTRODYNAMICS SYMPOSIUM (C1)  
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Author: Ms. Irina Ponomareva  
Russian Federation

Mr. Ruslan Frolov  
Russian Federation

Ms. Nadezhda Egorova  
Russian Federation

Mr. Oleg Garanin  
Russian Federation

Mr. Alexander Filippov  
Russian Federation

Mr. Konstantin Enaleev  
Russian Federation

Mr. Sergey Ivanov

Bauman Moscow State Technical University, Russian Federation

Mr. Pavel Kozlov  
Russian Federation

RASSVET-1 TECH DEMO MISSION FOR BROADBAND INTERNET CONSTELLATION: ON-ORBIT  
RESULTS AND LESSONS LEARNED

**Abstract**

Three spacecraft designed and built by Bureau 1440 team were launched on 27 June 2023 initiating technology demonstration mission for the prospective internet constellation. The goal of Rassvet-1 comprising three 80 kg spacecrafts of identical design was to test all major satellite subsystems and experiment with the communication payload. The mission plan included experiments with simple ground-to-satellite communication and those involving the intersatellite links.

The talk mostly covers the spacecraft dynamics and flight operation side of the mission.

The mission design requirements along with the launch capabilities constraints led to the specific choice of the target orbit altitude and relative speed of the spacecraft during separation from the upper stage. The chosen parameters allowed to guarantee a suitable schedule of communication experiments for various flight schemes.

An important element of the orbital constellation's flight control center is the flight dynamics software. The software package developed in Bureau 1440 allows performing such routine flight dynamics calculations as processing the satellite navigation system readings; estimating the satellite orbits; calculating the ground station contact time; planning the communication experiments and providing the orbital data for ground antennas.

As the experiments involving intersatellite communication required precise relative positioning of the satellites, which were equipped with the low-thrust propulsion system. Using a dynamically generated maneuvering strategy, the relative speed and intersatellite distance were controlled. One of the experiments that relied on the propulsion system was changing the order of the satellites arranged in a train formation. Several reordering operations were successfully implemented from December, 2023 to February, 2024.

As an option to control the relative motion, the differential drag technique was also employed. Drag area control has been successfully used to ensure uniform positioning of the satellites in a train.

By March, 2024 the three satellites completed the main program, the key mission objectives were achieved (including ground-to-ground communication link via one, two and three satellites). Rassvet-1 is currently in an extended mission to act as an engineering lab where ideas for the coming tech-demo missions are being tested.