

Russian Orbital Service Station (ROSS) Plans



Representative model of the Russian Orbital Service Station during the "Armiya 2022" exhibition. [1]

Russia has been actively developing plans for its own space station, known as the Russian Orbital Service Station (ROSS). This initiative gained significant attention following Russia's decision to gradually phase out its participation in the International Space Station (ISS) due to geopolitical tensions, particularly after the invasion of Ukraine in 2022. Here's what is currently known about the ROSS project.

1. Purpose and Strategic Goals

- **Independence from ISS:** ROSS is envisioned as a national space station that would allow Russia to maintain a continuous human presence in space independently of the ISS. This move is partly driven by the desire to ensure that Russia retains its capabilities in human spaceflight and space exploration amid deteriorating relations with the West.
- **National Prestige:** The project is also seen as a way to demonstrate Russia's technological prowess and maintain its status as a leading spacefaring nation.

2. Station Design and Configuration

- **Modular Structure:** ROSS is planned to be modular, similar to the ISS, with the potential for expansion over time. The station would consist of several modules, including living quarters for the crew, scientific laboratories, and possibly commercial modules. The first stage of construction will consist of four modules: the base NEM-1 module, an upgraded NEM, a node module, and a gateway module. NEM-1, also known as Science Power Module 1 (SPM-1), will be the core module of ROSS. Initially intended to be launched to the International Space Station in 2024, NEM-1 will instead undergo 1.5–2 years of redesign to prepare the module for its new role as part of ROSS. As of 2024, NEM-1 is scheduled to launch in 2027 on an Angara A5 launch vehicle from Vostochny Cosmodrome, and the second core module (similar to NEM-1) is scheduled to launch no earlier than 2028. [1]
- Agena-5 has had three successful orbital flight tests since 2014, and a partial failure in 2021. The second ROSS build-up phase will include logistics and production modules, as well as a

platform module for servicing spacecraft. A commercial module for up to four space tourists is also under consideration. [1]

There are also plans for "multiple robotic systems on the exterior of the outpost to help with assembly and maintenance work".

ROSS is envisioned to include up to seven modules, with 2035 being the targeted completion date.

The station is also planned to control "a family of small spacecraft" (satellites) to be launched directly from the station and "circling the globe in its vicinity", which would be a space first. [1]

The station design is also likely to contain another first: Russia is riding the AI hype, it seems: "Artificial intelligence is quickly developing technology." said Vladimir Kozhevnikov, chief designer of ROSS, on July 2, according to a report by TASS. "We will use its support but basically we will use our brains, of course". What form this AI takes is unknown — and will ChatGPT get a building credit on ROSS modules? [2]

- **Highly Elliptical Orbit:** One of the unique features of ROSS is its proposed orbit. Unlike the ISS, which operates in a low Earth orbit, ROSS may be placed in a highly elliptical orbit. This orbit would provide better coverage of Russian territory. This orbit also allows easier Russian access to the station compared to the ISS and will enable more medical and physiological experiments to be conducted than what is currently feasible on the Russian Orbital Segment of the ISS. [1]
- **Autonomous Operations:** The station is expected to be capable of operating autonomously, with the option to be managed remotely from Earth. This feature would reduce the need for constant crew presence, allowing for more flexible mission planning. In contrast to the continuously crewed ISS, ROSS will be visited by cosmonaut crews periodically, operating in automatic mode most of the time. During their stays, cosmonauts will install new components, check scientific equipment, conduct experiments and perform maintenance and repair tasks. Roscosmos cites not only financial, but also safety reasons for this, "as it reduces the risk of cosmonauts receiving dangerous radiation doses".[1]

3. Timeline

- **Initial Launches:** The first modules of ROSS are planned to be launched by the late-2020s, with completion of the station expected in 2035. However, timelines in the space industry are often subject to change due to technical, financial, or political challenges. The first module of the cross-shaped outpost, the research and power node (NEM-1) is expected to be launched into a near-polar orbit in 2027, TASS reported. By 2030, it plans to have docked its four major modules, with two "special-purpose" modules scheduled for attachment by 2033. Roscosmos plans to send the first cosmonauts to the station in 2028 and has suggested the station can be operated without crew. [2]
- **Transition from ISS:** Russia has indicated that it might withdraw from the ISS around 2028, which aligns with the timeline for the operational readiness of ROSS.

4. Challenges

- **Financial Constraints:** Developing a new space station is an expensive endeavor. Russia's economy, which has been affected by international sanctions and the costs of the conflict in Ukraine, may struggle to fund such a large-scale project.
- **Technical Hurdles:** While Russia has significant experience in space station design (e.g., Mir and its contributions to the ISS), the development of new technologies and adapting to the highly elliptical orbit could present technical challenges.

- **International Collaboration:** While ROSS is primarily a Russian endeavor, there have been discussions about potential partnerships with other nations, particularly those not aligned with the Western bloc. However, the extent of international involvement remains unclear. Russia has been a principal member of the International Space Station since launch, alongside NASA, the European Space Agency, JAXA and the Canadian Space Agency. For its new station, it's looking at partnerships with Brazil, India, China and South Africa, in addition to other African countries. [2]

5. Strategic Implications

- **Arctic Surveillance:** The orbit of ROSS could provide extensive coverage of the Arctic, which is increasingly seen as a strategically important region due to its natural resources and new shipping routes emerging from melting ice due to the climate change. ROSS will operate at a 400-kilometer-altitude, near-polar and Sun-synchronous orbit, which will allow it to monitor the entire surface of the Earth, especially the Arctic region. This orbit will enable the station to serve two important functions: high-frequency observations of Russia from space, and easier access to the station compared to the ISS. [1]
- **Space Sovereignty:** The development of ROSS underscores Russia's desire to maintain sovereign capabilities in space, especially as geopolitical tensions with the West persist.

Overall, the Russian Orbital Service Station represents a significant step in Russia's long-term space strategy, aiming to ensure continued human presence in space and maintain a leading role in space exploration, albeit under more challenging geopolitical and economic circumstances.

It will be interesting to see how much of the planned Russian Orbital Service Station (ROSS) will be accomplished by 2038, and how much the current 2024 political situation with a multitude of severe political crises (Ukraine, Gaza, migration, European economics and climate protection) will influence those plans.

Reference

- [1] https://en.wikipedia.org/wiki/Russian_Orbital_Service_Station
- [2] Space.com <https://www.space.com/russia-space-station-timeline-2027>
- [3] General text: ChatGPT