



GLONASS Ground Crew Operations

OE Watch Commentary: The accompanying excerpted interview in the military-themed Russian periodical *Armeyskiy Standart* (Army Standard), of Lieutenant Colonel Rustam Yakhin, chief of the satellite testing and control section, discusses GLONASS ground crew operations. The GLONASS constellation is controlled by Space Troops of the Aerospace Forces (VKS) assigned to the Titov 153rd Main Space Test Center in the GLONASS command center. According to LTC Yakhin, his personnel conduct command-and-control sessions on GLONASS satellites when the satellites are within line-of-site of ground control stations. After the satellites' ephemeris (position) data are analyzed, the ground control crew executes commands to adjust the satellites' positions or conduct maintenance, if needed. The article indicates these command-and-control sessions are only conducted from ground control stations on Russian territory. **End OE Watch Commentary (Bartles)**

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11F654M Glonass-M spacecraft.

Source: Vitaly Kuzmin, <https://photos.smugmug.com/photos/i-tcvKps5/0/X3/i-tcvKps5-X3.jpg>, Attribution: CC BY 4.0



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Source: “Сердце ГЛОНАСС (Heart of GLONASS),” *Armeyskiy Standart Online*, 19 October 2020. <https://armystandard.ru/news/t/20201016108-7m6YN.html>

...One could say that the GLONASS control center in Krasnoznamensk is the heart of the system, and its brain. From here, Space Troops teams maintain round-the-clock and uninterrupted control of the entire orbital group of GLONASS satellites. *Armeyskiy Standart* was briefed on the status and future prospects of Russia's orbital group of navigation satellites by Lieutenant Colonel Rustam Yakhin, chief of the satellite testing and control section.

What are the main duties of your specialists?

Our center is the heart of the system. Combat crews of the G.S. Titov 153rd Main Space Test Center serve at the GLONASS command center. They ensure round-the-clock and uninterrupted control of the entire GLONASS orbital group. This is to where all the information flows, from all the tracking stations situated across the entire Russian Federation. The information is analyzed here. Incidents are identified. All the necessary decisions are made. Alongside the Space Troops combat crews, also taking part in this process are representatives from industry -- teams of specialists from the satellite manufacturer.

They are fully trained, all are graduates, and at their disposal are volumes of documentation on how to operate and control the satellites. It's impossible to commit all the documentation to memory, of course, but you need to know where to look. If need be, we can deal with incidents promptly without the industry representatives. About two hours is enough time for us to bring a satellite online.

How do you learn that something is going wrong with a satellite?

A satellite enters our radio visibility zone with a signal that it's malfunctioning. We download the telemetric data to analyze the status of the equipment on board. The telemetrics are encrypted, and the equipment is classified. The data team analyzes the parameters of the satellite's onboard equipment. Specialists identify the malfunctions and then compile a series of commands to rectify the situation.

Are issues resolved quickly?

There have been cases when we have needed 20-30 minutes. It all depends on the nature of the problem and the location of the satellite. The main thing is that the satellite should be within the radio visibility zone of our systems on the ground. Our command and tracking stations are only located on Russian Federation territory and the radio visibility zone, when we can run command-and-control sessions, is limited in duration to when satellites are above the country. When they come within our visibility, we have to quickly solve the problem.

So, your specialists are responsible for ensuring that each GLONASS satellite is in the right place and transmitting the right signal?

Our mission is to manage the GLONASS orbital group and its operation, and to maintain it in serviceable condition. That's what we're responsible for. So our specialists are on duty round the clock. Each satellite is under total control in every aspect. Our teams monitor the condition of the satellites and their onboard systems. They track the satellites to see they're in the right places, so that there are no dynamic processes, and to see that they're emitting "healthy" navigation signals.

We know the coordinates of each satellite and if it begins to move out of place, that impacts the accuracy of navigational devices. If a satellite is 100 meters out of place in orbit, the margin of error when plotting a location can be more than 10 meters on Earth. So everything is tracked and computed according to the program, and anything that goes wrong is quickly addressed. The serviceability of the ground-based resources is also monitored. They're located across the entire Russian Federation, from Kaliningrad to Kamchatka and from Vorkuta to the North Caucasus. We have several data communication channels to them, including backup and space comms. Anything can happen: bad weather, earthquake, and so on. If a station in Kamchatka is unable to carry out a planned command-and-control session with a GLONASS satellite, there are others that can step in. Command-and-control sessions can be rescheduled, or a station in, say, Ussuriysk, Komsomol'sk-na-Amure, Yeniseysk, or Ulan-Ude can quickly take over the session for itself.

Are the alert duty shifts round the clock?

Alert duty shifts run from 1000 in the morning to 1000 in the morning the next day. Most of our specialists, 95 percent of them, are graduates of the Mozhayskiy Military Space Academy, which is where how to control satellites is taught.

Are there career progression opportunities for the officers?

I can tell you about myself as an example. I graduated from the Academy as a lieutenant in 2006. I served in Yeniseysk. I was posted to Krasnoznamensk in late 2009 as a senior lieutenant. In 2016 I was appointed section head. That is, in six years I progressed from test engineer and senior lieutenant to section head and lieutenant colonel. On the pay scale, that's equivalent to brigade commander. I have 43 subordinate officers. There are no NCOs or enlisted men.