GLONASS STATUS UPDATE

Y. Urlichich, G. Stupak, V. Dvorkin, and S. Karutin
Federal Space Agency
53 Aviamotornay str. Moscow, 111250, Russia
Tel: + 7 495 673 97 29, Fax: +7 495 673 28 15,
E-mail: *sergey.karutin@rniikp.ru*

Abstract

The Russian GLObal NAvigation Satellite System (GLONASS) has been put into operation in the early 90s of the last century. It passed a difficult time and has been recovering now. The main aspects of GLONASS's development process are presented in this article, including the current status and international cooperation aspects.

There is no doubt that satellite navigation has become an essential part of our day-by-day life. We have already learned the advantages of using global navigation satellite systems (GNSS) while driving to an unknown place. You could use GNSS equipment without even noticing it. Today, transportation, energy, communication, agriculture, etc. rely on and have been continuing to introduce GNSS solutions.

GNSS systems, like GLONASS or the American GPS, were created to supply military applications, but they have provided a civil service since the beginning, and this service is dominating and playing a critical role for economic growth now.

Based on this, the Russian government defined the following state policy principles:

- GLONASS is a strategic element of national security and economic development
- GLONASS is a dual-use system
- No direct user fees for the civil GLONASS service
- Open access to the GLONASS civil signal structure for user equipment manufacture, applications development, and value-added services
- Encourage combination of GLONASS/GPS receivers' development and manufacture
- Compatibility and interoperability of GLONASS with GPS and the future GALILEO
- Promotion of the development of the GNSS global market
- Russian governmental users shall be equipped by GLONASS or combined GLONASS/GPS receivers.

These principles are supported by a number of actions like review of the GLONASS structure–now it is a complex system consisting of a space segment, augmentations (wide-area, regional, and local), user-equipment (mostly for governmental use), and a fundamental segment, which is responsible for Earth rotation parameter determination and forecasting, time reference frame formation, etc.

The system's space segment includes an orbit constellation of 24 satellites, allocated on three circular orbits (eight satellites each) with a height of 19100 km, a 64.8° inclination, and a period of 11 hr 15 min. Ground control facilities consist of several one-way and two-way measuring and uplink stations, located in Russia.

Currently (27 November 2007), GLONASS has 17 satellites in a constellation of which 10 are operational, 2 are in a commissioning phase, and 3 are in maintenance. The main driver of GLONASS development is the «Glonass-M» satellite with a 7-year lifetime and an additional L2 civil signal. During this satellite development, the phase satellite motion model was also improved and it helps end-users' navigation accuracy. An important role in this process is played by the "Qvazar-KVO" system, determining weekly Earth rotation parameters like world time with an accuracy (RMS) of 0.03-0.05 ms, pole coordinates with an accuracy of 0.7 ms of arc (RMS), and nutation and precession angles with an accuracy of 0.3 ms of arc (RMS).

Wide-area augmentation systems, like WASS, EGNOS, or MSAS, provide value-added service to users like integrity and a precise ephemeris. In order to cover the global gap between Europe and the Pacific Ocean and provide a high-quality navigation service, Russia is developing its own System of Differential Correction and Monitoring (SDCM), which would provide unified service with other space-based augmentation systems.

The GLONASS development program includes also several important points like:

- Providing continuous navigation in Russia supported by deployment of 18 satellites in the constellation
- Providing global continuous navigation supported by deployment of 24 satellites in the constellation
- Bringing GLONASS features to a level comparable with foreign analogs after 2010
- Modernizing the Ground Control segment
- Introducing a civil signal on a third frequency (starting with the «Glonass-K» satellite lunch)
- Ensuring compatibility with GPS and Galileo in navigation signals and Earth and time reference frames
- Following GLONASS modernization based on new satellite generation («Glonass-KM»).

All steps in this program are supported by a federal target program "Global navigation system," including five subprograms. Each subprogram has its own objectives, like GLONASS development and operation (Subprogram 1), developing and manufacturing GLONASS user equipment (Subprogram 2), implementation of satellite navigation in transportation (Subprogram 3), Russian Federation geodesic base development (Subprogram 4), and navigation equipment for special application development (Subprogram 5).

Another important aspect of GLONASS's developing strategy is international cooperation with objectives of coordinating systems «owners» action during the modernization process and to ensure the system's interoperability and compatibility for effective application in the consumer sector, and the national system's integration into international GNSS.

Russian experts are working with USA and EU representatives on intergovernmental agreements. There have been made numbers of fruitful meetings with Indian partners, as well as with Australian, Kazakhstan, and Uzbekistan experts.

In conclusion, it is necessary to mention that GLONASS development has an objective to become a system allowing its users to create value-added products using GLONASS services.

REFERENCES

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