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SATELLITE COMMUNICATIONS IN NEW SEGMENTS OF THE DIGITAL ECONOMY

Yuri Prokhorov, head of Russian satellite communications operator RSCC and Russian Signatory of Intersputnik, spoke to Intersputnik Today about the role of satellite communications in a digital economy, prospects of satellite communications in the 5G era, and innovative industry developments, including the deployment of Express-RV, a multifunctional satellite communications system designed for high elliptical orbits (HEOs).

Mr. Yuri Prokhorov, today almost every company in any field of activity feels that it is being affected by a global remodelling of the economy. Many countries, including Russia, are talking about the need for digitalization. What is the role of satellite communications in new segments of the digital economy?

As you have correctly noted, today each company faces a challenge: to remain in the traditional paradigm and disappear before too long, or transform and survive. For 60 years, our satellite industry has been one of the most high-tech sectors at the junction of new technologies and consumer needs. We have been working with "things digital" for a long time, we are a "digital" infrastructure for the provision of television and radio broadcasting services, mobile communications,telecommunications channels and much more.

An economy becomes "digital" thanks to complex multi-component technologies that link the economic, social and cultural relations of people. In the Russian Federation, a national program "Digital Economy" has been launched in order to develop a stable and secure information and telecommunications infrastructure for high-speed transmission, processing and storage of large amounts of data accessible to all entities and households. Such infrastructure is expected to help accelerate GDP growth and, by 2024, double the exports of Russian non-primary and non-energy goods and services, bringing the exports to $250 billion a year.

As a result of coordinated efforts of ministries, departments, state corporations and private companies, a high-performance export-oriented sector is expected to evolve, where satellite communications will be quite visible.

Satellite communications is precisely the industry where close international cooperation is systemic in developing satellite communication systems, including spacecraft, ground-based satellite control facilities and the provision of services, subscriber equipment, software, and customer service solutions. Our sector of operations is, by definition, export-oriented.

Not only do we increase our international revenues year in year out, but we are also achieving qualitative changes in tough competition to boost our share of the customer base. RSCC operates in 58 countries of the world, and we earn 51% of our revenues by exporting our own services. At this particular point in time, we are closely scrutinizing the Internet-of-Things (IoT) and industrial Internet for mobile objects, and see in it a great potential for international cooperation.

How do you plan to participate in this segment? After all, the satellites of traditional satellite operators, including RSCC fleet, work mostly with broadband channels through big enough subscriber devices, and IoT implies a transfer of meagre amounts of data from compact devices.

Yes, by default, IoT networks are terrestrial networks of small devices using unlicensed frequencies or networks using S- and L-bands.

We see the potential of our participation in providing IoT services using a combined scheme of Backhaul and Edge computing – aggregating data from multiple sensors and computing at terminal stations. For remote objects, it is easier and cheaper to use small-size devices that transmit very small amounts of data. But often such devices are quite plentiful, and the cost of a channel (between a control center and a terminal device) sometimes turns out to be quite considerable.

For IoT, it is quite practical to use VSAT equipment. Data collection is carried out at the base station or processed onsite, after which the data is transmitted to the central office, cloud or other necessary place. Besides saving on the channel, a package of communication services may be put together at the facility (video

At Skolkovo Satellite Communications Center – a subsidiary of RSCC. *Left to right*: Mr. Yuri Urlichich, First Deputy CEO, Roscosmos State Corporation; Mr. Oleg Dukhovnitsky, Head, Federal Communications Agency; Mr. Konstantin Noskov, Minister of Digital Development, Communications and Mass Media of the Russian Federation; Mr. Yuri Prokhorov, Director General, Russian Satellite Communications Company; Mr. Oleg Ivanov, Deputy Minister of Digital Development, Communications and Mass Media of the Russian Federation

surveillance, machine vision, remote control of mechanisms). A hypothetical base station can be located on almost any object: a car, an industrial installation, an electrical substation, a pump installation or a private house.

Will your new HEO satellite communications system Express-RV be used for new segments of digital services?

For the modern consumer, the Express-RV system is not conceptually much different from systems in geostationary orbit. The same frequency ranges and similar spacecraft platforms are used. The difference is that connectivity may be available with any moving object anywhere in the Russian Federation, including the waters of the seas washing its shores. Specifics of our country's territorial position are such that low angles of elevation of geostationary satellites do not support seamless communication in high-density compact urban areas, forests, etc.

From a consumer's perspective, another principal difference of the Express-RV system will be that it requires subscriber terminals having the ability to track the satellite. Spacecraft in HEO are constantly in motion relative to the subscriber device. Subscriber terminals supporting satellite tracking are already used on mobile objects (cars, trains, airplanes), except that the subscriber terminal itself is moving while the satellite in the GEO orbit remains "stationary". The cost of such equipment is quite high. Due to a massive development of the satellite "shifting" segment, a decrease of the cost of subscriber terminals by two orders of magnitude is expected. However, as the saying goes, time will tell.

And who is developing such subscriber terminals with a satellite tracking feature?

The communications-on-the-move market is quite large. A large number of companies are engaged in the development of new solutions, including subscriber terminals in motion. The most promising is the technology of active phased array antennas with electron beam scanning – these are flat panels with no moving parts. Such antennas can be built into the vehicle roofs without compromising aerodynamics. So far, there are no working terminals on the market with an affordable price tag.

Now the press says a lot about the new standard of mobile communication 5G. How does a satellite operator see its own future in the 5G era?

The very concept of 5G goes beyond mobile communications. This is not just a faster and more advanced standard than 4G/LTE. 5G is a completely new network infrastructure with a variety of technology options for access to such a network including Wi-Fi, femtocells, conventional wireless mobile networks, optical fiber and also satellite. No wonder it is called the "network of networks." This is a platform for many new applications and services. 5G networks will become the standard on the basis of which the Internet-of-Things infrastructure and Industry 4.0 will be built. The new standard has been developed by wireless communications for virtualization, automation and rationalization of service provision, regardless of the transmission technology used.

It is important to the satellite industry that, for the first time in the history of developing a new cellular standard, the possibility of seamless integration with satellite networks is being introduced into the early releases of the 5G standard. In all previous versions (2,3,4G), the satellite was included in the specifications in a very limited fashion and only after the standard was completely developed. Initiatives within various industry consortia (3GPP, Sat5G, SATis5, etc.) will ensure full integration of satellite communications in Release 16, which is scheduled to be out by March 2020 and will become the main governing standard for the implementation of 5G.

What potential markets within the 5G ecosystem will be assigned to satellite?

Once again, I wish to emphasize that 5G is a "network of networks" – an ecosystem that supports integration and seamless interaction with a variety of networks deployed for specific applications. The satellite network will be one of the networks most effective when operating at the edge of the 5G (Edge) network, where most of the traffic computing and processing occurs.

Which niche markets will be open to the satellite? First of all, those with the maximum possible use of technological and geographical advantages of satellite communications that offer the following: a possibility of guaranteed broadband connectivity of moving objects (at sea, in the air and on land); satellite broadcasting capabilities for delivering content to any number of receiving devices in the coverage area (media content, software upgrade); as well as guaranteed 100% coverage of a certain territory (connection of remote fixed objects).

For example, the use of 5G capabilities in Industry 4.0 implies continuous monitoring and full automation of the entire chain of production, transportation, storage and sale of a product. It will be a self-regulating and self-improving process based on the use of artificial intelligence, robotization and autonomous control, using unmanned solutions. The process of creating a product at remote objects will involve satellite technology.

The growth of networks based on the 5G standard in remote regions and mobile objects will occur through the deployment of local mobile networks to provide the above services, which will open up opportunities for satellite operators to develop intelligent technology platforms focused on these markets.

The most promising and profitable business for satellite communications will be services and applications for mobile objects, primarily, ships and aircraft, as well as ground mobile objects (cars, trucks, buses, railway transport). According to analysts, by 2023 the markets of sea and air transport objects connected to communication networks will be worth $ 8 billion each. In addition to providing mobile connectivity for the implementation of the 5G standard, it will be possible to provide a full range of new services and applications based on this standard, including the Internet-of-Things and Industry 4.0.

Nevertheless, despite such a bright prospect, mobile operators are out to grab a part of the radio frequency spectrum from satellite operators in C-band. To what extent will this affect the satellite communications market?

Indeed, the issue of mobile operators using the lower part of C-band in the 3.4-3.8 GHz frequency bands is very relevant and will be the subject of lively discussions at the ITU World Radio Conference 2019 in November 2019 in Sharm-al-Sheikh (Egypt), where official allocation of frequencies to 5G networks is expected to take place. Here, the views of the satellite industry are completely different depending on the region. For example, in those regions where C-band has no longer been in use for quite a while (Europe, Japan, South Korea), it has already been fully transferred to the cellular operators. In other regions, such as Southeast Asia, due to climatic features, C-band is the backbone of the telecom and television infrastructure of entire countries and regions, so the allocation of spectrum in this range will be problematic.

There is also a more pragmatic commercial approach. In the United States, a consortium of four majors operating satellites in the US market has offered mobile operators a deal to sell and quickly release the bottom part of the C-band frequencies (200 MHz). As part of the transaction estimated to be worth from two to four billion dollars, mobile operators should compensate satellite operators for the costs of developing and launching new satellites to operate only in the top part of C-band, as well as the costs of upgrading and readjusting all C-band ground stations (about 30,000 across the country).

As for Russia, the situation is, as always, somewhat special. First, it must be emphasized that the utilization ratio of C-band capacity on RSCC satellites is almost 100 %. C-band is used for backbone and mobile communications channels, as well as by government users to secure connectivity of critical infrastructure facilities. Also, as part of the Federal Target Program "Development of TV and Radio Broadcasting in the Russian Federation for the Period 2009–2018", the delivery of mandatory public television and radio channels included in the first and second multiplex, to 11 broadcast zones of the Russian Federation has been organized in the 3.4-3.8 GHz frequency bands.

It isdeserves a special mention that for the development of digital economy the most important milestone is the release of frequency bands below 700 MHz, which will be possible only in October 2019 after analog terrestrial TV broadcasting in Russia is shut down. These frequencies are needed for a complete coverage of the country with 5G networks. The 3.4-3.8 GHz band is primarily required by the mobile operators themselves to offload their own network.

What prospects do you see for TV and radio broadcasting, which for many years has been the main driver of satellite communication systems development?

On the television market, tremendously significant changes are under way. Making money in the traditional way is becoming increasingly difficult. The media community is focused on new technologies which, it is hoped, will usher in new forms of content monetization.

Television is moving away from traditional linearity towards the clouds and into the applications of intelligent processing of large amounts of data (Big Data). On this basis, a profiled consumer portrait and recommended services are being configured that offer targeted content. The practice of "targeting" the household is gradually shifting to "targeting" the viewer. Cloud technologies, actively promoted by companies like Google or Yandex, allow instant access to global content, that is, one produced anywhere in the world by a private or professional user, while hybrid cloud technologies support signal encoding in the cloud, untied to specific locations.

Another technological and commercial breakthrough is being demonstrated by the new market leader Netflix, which launched interactive television in the Black Mirror thriller. The principle "from story-telling to storyliving" is already a market reality – thanks to the broadband Internet and AI technology. Netflix has produced an interactive show for adults. The viewer can choose five different endings, built on the storyline. Merging content, games, broadband and artificial intelligence (AI), create the effect of total immersion. Thanks to interactivity, content producers have a very accurate understanding of the degree of viewer engagement. The dividing line between video viewing and gameplaying completely disappears.

In the television community, the talk of 5G as a disruptive innovation continues unabated. The undoubted advantages of the 5G technology are the incredible connection speed of 10 Gbit/s, and 1 ms latency, the speed of movement up to 500 km/h without losing the connection, and 100 million devices per sq. km, and so on. However, in our opinion, content broadcasting in 5G networks will be too expensive, due to the technological specifics of this type of service.

Mr. Prokhorov, what do you think about the prospects of increasing the flexibility of new satellites through the use of highly adaptive communications payloads?

In the press and at scientific conferences, heated debates are in full swing, questioning the wisdom of developing satellite payloads with programmable spatial, energy and radio frequency characteristics. Manufacturers link progress with achievements in multi-beam antenna systems, digital filters based on specialized microprocessors and multi-frequency highly stable frequency synthesizers. With all the obvious advantages of this technology, questions are still there, e.g.:

1. "Flexible" satellites are 50 to 100% more expensive than regular wide-beam ones;
2. Whereas the mass and energy characteristics of "flexible" and "conventional" satellites are equal, "flexible" ones can carry a significantly smaller number of transponders.

Many of our customers operate networks with all-Russia coverage, thus supporting demand for C/Ku band capacity in wide beams. Generally, domestic traffic is rather conservative and is not subject to significant fluctuations either in terms of volume or routes. Operators are trying to rent one slot for trunk lines and for area traffic in order to simplify the configuration of hub stations. To use multi-beam systems of "flexible" satellites operators will have to replace their ground infrastructure, which will result higher customer tariffs, and thus it is not very attractive. However, in the coming years, the the use of "flexible" payloads and their elements is relevant to RSCC, it can be considered when designing future satellites.