Space Forces in the Context of Russian Military Reform

Maj. Gen. V.A. MENSHIKOV (Ret.)
Doctor of Technical Sciences, Professor

The objective course of scientific and technological progress in the world and with it the evolution of weapon systems and military equipment brought about a situation wherein space has become a sphere of clashing (including military) interests of different states. Essentially, the world has entered a new phase of geopolitical confrontation, namely, the struggle for strategic superiority in space, which is intensifying with every passing year.

The creation and deployment, in near earth space, of orbital groups of space forces; the strategic tasks addressed with their use; the emergence of space weapon systems, whose orbital elements can produce an active impact (suppression, effective engagement, destruction, etc.) on possible targets; and the need to prepare space (as well as tracts of land where space infrastructure facilities are based) as a sphere of military operations—all of this has singled out space as a separate sphere of operations while its importance in warfare grows increasingly (see Table).

Today, more and more states are becoming increasingly aware of their geopolitical interests in the space sphere and intensifying their space activity. At present, of the 125 states involved in space activities, more than 20 have potential for independent development and production of space systems and equipment and satellite launches with their own or leased delivery vehicles, and are actively carrying out research projects on the military uses of space.

Thus, the U.S. administration, fully aware of the prospects involved, regards space as a sphere of its vital geopolitical interests. This is evident, in particular, from a number of organizational and scientific and technical programs: the creation of a joint space command, preservation of a substantial share of spending on space programs in the DoD budget, and implementation of priority R&D programs designed to develop space weapon systems of the 21st century. Furthermore, at the beginning of the next millennium, the United States will be able to put in place a global and highly effective space-based system to provide information support for naval forces, relying on a large number of compact spacecraft.

The Role of Space Forces in Warfare

Period	Trends	Tasks
1970-1990	The decisive role of the ground and air spheres with a limited importance of the space sphere	Identification of potential targets for nuclear strikes Strategic warning Combat command and control of nuclear forces
1990-2000	The growing role of the space sphere with the continuing strategic importance of air and ground supremacy	Space-based information support for the armed forces Mobile target area survey Creation of information and strike complexes and systems
2000-2010	The key role of the space sphere in achieving war objectives	Space-based information support for armed forces Active impact and combat support for armed forces Pinpoint (precision) impact, in space and from space, on spacecraft, space vehicles, ballistic missiles, bombs, elements of infrastructure, and army and navy forces Global non-destructive impact on particular regions and countries

So, we are seeing some well pronounced trends in the policy of the United States and other states: to assert their positions, as early as possible, in the military use of space and to employ new generation weapon systems to further consolidate their positions and to advance their national interests. This policy was reaffirmed, in particular, by U.S. President Bill Clinton's statement, in January 1999, about the possibility of revising the 1972 ABM Treaty.

In the past few decades, a powerful logistical and technical space base has been created in this country. At present the Strategic Rocket Forces perform such functions as detection of ballistic missile launches, provision of optical-electronic and photo reconnaissance, communication, relay, and combat command and control, and operation of topographic, geodesic, and meteorological systems and equipment, which already at this stage allows for a substantial enhancement of the operational efficiency of the national armed forces. Space systems play a key role in creating a unified information area in Russia; ensuring a rational and effective use of its natural resources; providing global telecommunications and navigation and environmental monitoring of land and seas, ensuring scientific development, technical progress, and so forth. Russia's space industry is still among the few branches of the national economy that retains leading positions on the world market. Domestic space technology serves as a base for the pro-

duction of competitive high-tech products.

At the same time, whereas in 1993 and 1994 the share of spending on military space programs in the defense budgets of Russia and the United States was approximately the same, in 1996 Russia's share shrank more than three times compared to the U.S. share. Production of space systems and equipment has fallen more than tenfold. More than 70 percent of in-orbit space vehicles are past their service life while the process of "aging" of the orbital group of forces has become effectively irreversible. The unique delivery vehicle and spacecraft production technology and the production and experimental base is crumbling while the existing launch, technical, or orbital command and control systems are long overdue for modernization. Advanced space development programs have been effectively stalled, running seven to 10 years behind schedule. Moreover, if within the next few years funding continues to be provided on the "leftover" principle, Russia will effectively lose its space-based deterrence capability. Due to financial constraints, a substantial number of R&D projects under the Federal Space Program have been either put on hold or scrapped altogether. Unless urgent measures are taken, in the very near future Russia could lose some of its unique, key technology that has no counterpart in the world. Implementation of some of the most important international obligations on fundamental research programs could be jeopardized. Inter-city communication and television broadcasting could effectively stop in a number of regions. With the current level of funding Russia would have to abandon all space activity in two to three years.

It is critical to look for a way out of this situation. For a start, it is important, as a matter of urgency, to define the **main short- and long-term priorities for the development of the space industry,** including its military component.

One of the priorities should be to ***ensure Russia guaranteed access to space***, including the following:

– f i r s t, development and production of space weapon systems and their major components at Russian enterprises by promoting new forms of cooperation between design and development enterprises, on a purely Russian basis, or by preserving the existing system but with a partial abandonment of the works (services) provided by enterprises that have ended up outside Russian borders;

– s e c o n d, maintenance and enlargement of orbital force deployment capabilities. This refers to a comprehensive program designed to ensure a stage by stage transfer of spacecraft and rocket launches from the Baikonur space center, including the provision of the necessary support systems, to Russian territory (building the Vostochnyy space launch center and expanding the Plesetsk space center);

– t h i r d, putting in place a "deterrence capability" to deter threats in or from space. In the present economic situation, the development of key elements of domestic systems ensuring the neutralization of possible threats in or from space as well as the creation of their one of a kind prototypes will help Russia demonstrate its resolve to uphold its national interests and international security

interests, also helping ensure effective deterrence, and

– f o u r t h, legal support for military space activity since the existing legal environment is not always conducive to its effective organization and conduct. This especially applies to legal regulation of the relations between the Russian Federation and FSU countries where key elements of Russia's military space infrastructure are now based.

Successful resolution of this problem will require **development and modernization of both spacecraft per se and their launch and command and control systems**. Analysis shows that the needs of operational/tactical formations of the armed forces for space information can be ensured in the most effective way only by creating relatively low-cost space vehicles with a mass of between 500 kilograms and 1,000 kilograms, putting in place mobile information reception and processing points (centers), and providing these formations with ground-based operational equipment. In this event information from aboard a space vehicle will be received by mobile communication points as this spacecraft passes over a zone of combat operations, or via relay systems.

The work done by Defense Ministry agencies and organizations on the development of new special optical-electronic reconnaissance equipment and an integrated space-based platform shows that it is possible, and necessary, to develop various purpose small-size (compact) spacecraft. It is expected that compact spacecraft-based military purpose space systems can perform up to 50 percent of functions of providing information support directly to operational and tactical level commanders.

Research shows that the task of producing *operational reconnaissance, communication and meteorological support compact spacecraft* (with an appropriate level of funding) can be accomplished within the next four to five years. Comparative analysis of technical and economic parameters and characteristics of traditional (conventional) and compact spacecraft shows that on basic parameters, compact spacecraft are just as efficient and efficacious as conventional ones, while on such characteristics as area survey (monitoring) frequency, weight, and production and operation costs, they are far superior.

As far as design specifics are concerned, we believe that advanced spacecraft models should be based on the following principles:

modular structure and continuity of development, which ensures the division of spacecraft into service and target-specific modules, allowing for older service systems to be effectively used in new spacecraft. Standardization of the service module not only shortens the production process but also helps cut financial outlays. A service module is developed and adjusted only once while its own production and the production of target-specific modules can proceed immediately;

non-sealed structure, which makes it possible to reduce the overall mass by excluding a sealed service container, transfer from an active multi-contour thermal regulation system to a passive thermal regime system, and combining the structural and thermal systems in the structure of the spacecraft instru-

ments compartment;

durability and endurance of components. This principle presupposes that electronic components and construction materials should have operational service characteristics ensuring the spacecraft's normal operation for 10 years or more, including the guaranteed electrical and physical and mechanical parameters under the impact of combined external factors.

The condition and development prospects of *launch systems* is just as important. In this respect, the Defense Ministry is closely cooperating with the Russian Aviation and Space Agency. Proton- and Soyuz-class space rocket complexes are undergoing modernization; work is in progress on a new light delivery vehicle, and in 1995 the design work was completed on the Angara-class heavy delivery vehicle. Successful implementation of this program will enable Russia, by the year 2005, to ensure the launch and delivery of spacecraft to working orbits within the entire range of the necessary altitudes and inclinations.

Further development of launching systems can be ensured also by cutting back on the number of operational prototypes and by standardizing them. Research shows that a reasonable number of rocket types in the launch system is four or five while their standardization reduces launching system costs by some 25 percent. By now some industrial enterprises have submitted proposals on creating a prototype standardized series of delivery vehicles based on a light-class rocket and a standardized module. The initiator of this project is the M.V. Khrunichev State Space Scientific Production Center that is currently working on the Angara-class rockets.

The main parameters of a standardized rocket are, in particular, the modular design principle with the option of increasing the launch payload and the use of the entire range of frequencies as well as the use of non-toxic rocket fuel components.

At the same time it is possible to make a wide use of decommissioned intercontinental ballistic missiles or the so-called conversion missiles (Rokot, Start, Strela, and others) as delivery vehicles for compact spacecraft.

The problem of creating a standardized series of booster rockets and modular spacecraft is directly linked with the development of a standardized launch complex capable of ensuring the launch of spacecraft with any "spacecraft + delivery vehicle" configuration. Theoretical and practical research shows that it is in principle possible to address this rather complex organizational and technical problem in the foreseeable future. Its realization not only ensures standardization of the main, basic elements of the space weapon system but also makes it possible considerably to modify and adapt the approach to the development of the ground-based infrastructure of Russia's cosmodromes (space launch centers). Preliminary estimates show that in this event the necessary resources for ensuring spacecraft launches (the area of launch centers, technical and launching facilities, and so forth) could be reduced by a factor of 10.

The aforementioned pathways for reforming the space sector could remain just on paper unless the **cosmodrome development** problem is not addressed as a matter of urgency.

The signing of interstate agreements (with Kazakhstan) on the Baikonur space center and on its 20-year lease by Russia partially alleviated the launch problem. In the foreseeable future, the following needs to be done in this field: expand the technical capabilities of the Plesetsk cosmodrome to ensure successful spacecraft launches; transfer the launch of light and medium-class delivery vehicles from Baikonur to Plesetsk, at the same time maintaining Baikonur's infrastructure to ensure the launching of heavy class rockets, and complete the deployment, and effective operation, of space command and control systems on Russian territory.

Of course, the entire problem of ensuring guaranteed access to space cannot be resolved by merely upgrading Plesetsk's capabilities. So work is already under way to develop and expand the technical capacity and capability of the Svobodnyy space launch center. To ensure that this country is able to continue to use the geostationary and solar-synchronous orbits in the future, advanced R&D is needed to ensure an optimal distribution of economic, human, and other resources, aiming to create in Russia a space center that together with Plesetsk would fully compensate for the loss of Baikonur.

Considerable attention also needs to be given to modernizing the **ground-based automated command and control system.**

In this context it would be expedient to introduce one-point spacecraft command and control technology based on the use of relay satellites. This technology will help minimize—and in a longer term, abandon altogether—the use of a diversified ground-based space command and control system, which has rather limited global, stability, and resistance capability. The new system could be based on command and control facilities built on the ground-space information/command and control network principle.

Ensuring Russia guaranteed access to space will enable it to respond effectively to possible threats and challenges in the space sphere while addressing the **strategic task of deterring aggression** wherever it might come from. We believe that the main lines of military space activity should be as follows:

f i r s t, ensuring a political and legal regulatory base in the space weapon development sphere, above all anti-satellite systems, and

s e c o n d, ensuring an effective operability and stability of the orbital group of forces through early space attack warning and implementation of measures to ensure both active and passive protection and defense of spacecraft.

In addition, even considering the country's current economic plight, the t h i r d line is still important, that is, to preserve and expand the scientific-technical, technological, and organizational base, which is the key to putting in place efficacious space warfare systems.

Thus, the specifics of Russia's geopolitical situation objectively lead to the

conclusion that the country's security interests are best served by priority development and use of such space systems that could help enhance the operational effectiveness of the orbital group of space forces, retaining the key elements of space infrastructure amid widespread financial constraints, and modernize and upgrade them in the future.