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OUTER SPACE – FIELD FOR CONFLICTS, FIELD FOR INTERACTION

This year can hardly be called a landmark in the space activities of the leading nations. However, 2008 indicated most of the problems and trends, which had mainly been neglected by the experts before, or at least, were not paid due attention to. At the same time, the consideration of this problem, including military and technical aspects, requires thorough studying of politics and economics as the underlying pillars of space programs development.

New spin of the international discussions on peaceful and military uses of outer space started on January 11, 2007, when China eliminated its own old meteorological satellite with the help of a ballistic missile. A year later, on February 21, 2008, the United States employed the sea-based Aegis missile and air defense system to shoot down the broken intelligence satellite. This event coincided with the inauguration of the Russian-Chinese initiative on concluding the international treaty preventing deployment of weapons in outer space. Such strange coincidence caused even more fuss in the world politics.

Nowadays it makes sense to analyze the current state and major trends in civilian and military use of outer space in connection with the evolution of the international system. The United States is in the heart of these processes; Washington rejects any constraints on military activities in space. So this article mainly focuses on the U.S. approaches. An additional argument in favor of such research perspective is the second review of the DOD's *National Space Policy* – the 1999 doctrine that should amended by 2009.

TRANSFORMATION OF THE U.S. SPACE POLICY

Above of all, let us turn to the history of the matter. In 1989 the U.S. leadership started the complex modernization of its space policy. The 1990s marked the review of objectives, the analysis of institutional effectiveness, the development of new patterns of cooperation between the government agencies and the businesses, etc. The following conclusions were made. Firstly, the fundamental criterion for the assessment of the U.S. leadership in outer space is the ability to use the results of space activities in affecting global processes.[1] Secondly, the major principles in space projects are decentralized management, elimination of inter-agency duplication, and deep integration with the business community.[2] Thirdly, the task is to gain maximum profit from the existing situation, when the United States has evident domination in the outer space, bearing in mind that such domination cannot last forever.

As far as the military aspects of the space policy are concerned, the U.S. strategic plans in the late 1990s shifted from naming the specific enemy to the concept of independent response to potential current and future challenges. In 1999 the first directive on space defense policy was issued – it identified the range of tasks to be accomplished by the

Department of Defense (DOD) and emphasized the growing role of the space forces in modern military construction.

In 2002 the U.S. Space Command was merged with the Strategic Command, and the military space functions were transferred to the Air Force Space Command. Supporting role in joint operations should be played by the space commands of the Army and the Navy (each of them dealing with the respective armed service) and special status was given to the space intelligence. This step indicated the long-term trend of transforming the Air Force into Aerospace Forces.

One has to note that the Air Force Space Command also comprises the strategic forces (21st Army equipped with Minuteman-2 ICBMs). This fact proves that nuclear weapons, which are highly dependent on space systems, make the Air Force – with its global attack concept, high-precision weapons, integration with satellite systems – capable of accomplishing a broad range of missions in any part of the world. Secondly, the availability of the ICBMs to the Air Force Space Command may indicate the readiness to deploy rapidly additional or reserve satellite defense network in critical situations (e.g. Russian ICBMs – SS-18 – are used for successful launches of commercial satellites).

In general, by 2006 the concept was shaped.[3] The 2006 directive implied for the first time that the United States denied any potential legal restrictions that might curb its space activities. After all, at that time Washington had already commenced a series of R&D programs, which required maximum field for maneuver. Hence, the course for gaining benefits from the U.S. domination in the outer space was officially fixed in the U.S. policy.

The policy review in the 1990s and early 2000s was an important step, but due to the bulky character of such modernization, systemic constraints and complexity of research tasks,[4] the outcome of these changes became evident only in 2008. The United States has reached the crucial stage in the transformation of its space program and it is a much more serious process than even the one that followed the curtailing of the U.S. Moon exploration program.

First of all, despite the debate in the Congress, Washington approved the final schedule of space shuttle flights, which should be decommissioned by 2010 (or if the schedule is amended – by 2011). Thus, the abandoning of the *Space Shuttle* project will last for two decades – this process started in 1990, when the United States took the course of reducing dependence on shuttles. The political decision to do so was eventually taken after the tragedy with the *Columbia* shuttle in February 2003.

Secondly, the *Constellation* project launched in 2005 and aimed at developing a new manned spacecraft – *Orion* – for flights to the Moon, and a heavy carrier – *Ares* – face substantial technological problems.[5] On the one hand, this may affect the deadline for making the system operational. On the other hand, the officially declared deadlines (2014 with respect to *Orion* and *Ares*) may differ from the really planned ones.

Besides, extra evidence of transformation is the increasing contradictions in NASA and the level of external criticism of the agency. In 2008, a group of NASA researchers set forth the alternative project – *Constellation Direct 2.0*. And in August 2008 the National Research Council published its report raising the issue of high program risks in the course of research activities on the project, which is supposed to be the highest strategic priority for NASA.[6]

Meanwhile, the new cycle of R&D in space technologies is under way. By the late 1990s and the early 2000s a new trend became obvious – the U.S. space market is being more and more occupied by the small companies, such as *SpaceX, Kelly Space and Technology, Rocketplane-Kistler*, etc. Another curious point is the involvement of strangers in space research, e.g. in 2008 the Naval Research Laboratory began to develop the concept of the *DALI* telescope to be placed on the backside of the Moon.[7] One also has to bear in mind the fact of existence of the NASA Institute for Advanced Concepts (NIAC), which funded the research teams in 1998–2007 and helped to verify their breakthrough concepts (even though it is not clear yet if this structure will be replaced by something else or has simply disappeared).

In other words, the United States passes to a new technological level with its space program. For 18 years now NASA promotes the principle of open-ended research concepts, which imply that the flexibility of R&D should be given new impetus by changing the funding schemes, moving the researchers from one sphere to another, etc.[8] Such approach hints that the outcome of the space program transformation is not clear even for the U.S. leadership.

Meanwhile, the United States confronts the situation when it may be left without a manned spacecraft – the program of space shuttles will be cancelled, the new system will not yet be operational. However, one has to bear in mind that manned spacecraft are of secondary importance in the United States, unlike in the Russian Federation. The most promising are unmanned missions into distant space and investments in R&D – so it is not important for the Americans that for some time their astronauts will have to use foreign spaceships to reach the orbit.

In fact, the decisiveness of the moment is not in keeping up with the deadlines for the new delivery system (not for orbital, but also for the Moon missions), is not in dependence on foreign partners in sending the astronauts in outer space in 2011–2015. Nowadays a different thing is crucial – the results of the transformation and further U.S. steps in outer space depend on the broad range of R&D in two spheres – spacecraft and space transportation.

It should be taken into account that one of the reasons for the transformation of the U.S. space policy was the intensification of the space activities in other countries, including developing nations. Today 43 states have their space programs (the EU cannot always be regarded as a single actor; it is also logical to consider China and Taiwan separately). An inevitable continuation of this trend is the growing competition in outer space, above all, technological competition.

Thus, the first conclusion comes – the potential of partnership and confrontation in outer space depends mainly on the U.S. progress in space exploration and implementation of space programs. The closer the Americans will be towards a breakthrough in this sphere (from development of principally new materials and spacecraft to changing the scientific perception of the Universe), the higher variety and unpredictability of behavior one can expect from the countries that lag behind.

SPACE: THE ZONE OF PEACE

The other side of the growing competition in outer space is the development of international cooperation in space exploration. Most of the states feel the demand for additional resources and technologies from outside, in order to enhance the effectiveness of their space activities. And there are two major cooperation patterns in this area.

The first model was elaborated in the United States in the early 1990s. It can be called the engagement model – the Americans deliberately incorporate other countries in the space projects.

Firstly, such approach enables the United States to get foreign investment in its space program – partners often work as subcontractors, develop some components of the space systems, etc., while the U.S. agencies supervise the implementation of the concept in general. Besides, if *prêt-à-porter* technologies exist, Washington often follows the easiest way and purchases them instead of making long-term investments in the development of U.S. indigenous systems (e.g. *Atlas-5* carriers got *RD-180* rocket engines made in Russia in accordance with the 1995 agreement).

Secondly, through such engagement the Americans can set the global space agenda and, hence, influence the partners involved in the space missions. Other countries become dependent on the U.S.A in space programs development, as their device-building and aerospace industries are targeted at obtaining mainly U.S. technologies and contracts.

Thirdly, the space partnership is widely used in promoting the influence of the state and national corporations in international politics. The examples are many. The most vivid ones are the multilateral cooperation on the International Space Station (ISS), or the *Sea Launch* Program which mostly applies the Russian, Ukrainian and Norwegian technologies, while 40 percent of shares belong to *Boeing* and this is the largest package.

The U.S. pattern is not free from flaws. One of them is the dependence of the space missions on the reliability of partners and their strict fulfillment of commitments. Another point of vulnerability is the domestic criticism, since the opposition in the Congress for political reasons can always condemn the administration for such dependence. The engagement model also poses the problem of access of the partners to the U.S. technologies and this requires permanent inter-agency and inter-state agreements.

However, in general the U.S. model is mostly applied to the fundamental research and those space activities that require the experience and technologies of others. This was the case with the ISS when Washington got the experience of using the orbital system (from Russia) in order to ensure the progress of its own space program. In principle, the creation and the use of the ISS may be called the apogee of the U.S. approach towards international cooperation in outer space.

The engagement model is still topical for the U.S. leadership, so there are no plans to cut down the scale of cooperation – on the contrary, it will expand due to the increasing amount of research. For instance, on July 29, 2008, the United States, Great Britain, France, Germany, Italy, Canada, Japan, India, and South Korea signed an agreement on cooperation in lunar exploration and in exchange of relevant data.[9] Nonetheless, when the ISS project is completed in the foreseeable future, such cooperation will be less institutionalized and more on the *ad hoc* basis. The United States may no longer need the ISS when the *Orion-Ares* system becomes operational, since the spaceship does not have a direct value for this station.

It is noteworthy that the United States already shifts to the concept of *ad hoc* cooperation in the defense area (this is a move from the paradigm of potential adversary to the paradigm of potential threats). International cooperation in outer space is not the value by itself for the United States – it will depend on the ratio of opportunities of the partner and his possible contribution to the U.S. space program, so that the cooperation may bring maximum benefits to Washington with minimal negative implications for the U.S. competitiveness. At present, there are no significant rivals for the United States in outer space; Russia and China are not the exceptions. So Washington will do its best to take maximal advantage from inter-state cooperation in this area.

The second pattern of international cooperation in outer space began to develop in Russia in the early 1990s – this was a chaotic and contradictory process. However, the model formed and now its basic principles are quite sustainable, even though an independent observer may doubt it.

The advantage of the Russian model is the use of domestic space capabilities on the international market in order to get sufficient money for internal space activities. The most effective interaction was maintained with respect to the ISS project; Russia also succeeded in provision of delivery services with all types of carriers. These services are attractive for other nations and corporations since they are cost effective and offer good value for money – the costs of the rockets do not comprise the costs of their development, as they belong to the Soviet planned economy, which no longer exists. The question is whether Russia will be able to continue to develop modern and effective space transportation systems.

In the conditions of the lack of indigenous systems, multilateral research projects with Russia's participation (space observatories, probes, etc.) help to maintain and develop the fundamental research – to make tests, to benefit from the time appropriated to each partner, to exchange data. For example, in mid-2007 Russia took the decision to participate in the new European space research program – *Cosmic Vision 2015–2025*.[10]

The participation in international projects enables the Russian space industry to compensate at least partly for the technological regress in some areas of space device-building and electronics.[11] This is achieved through joint development of system components and supplies of domestic device for foreign and international systems (e.g. Russian spectrometers were installed on the U.S. spacecraft sent to Mars).

A major drawback of the Russian pattern of international cooperation in outer space is the programmed stagnation of the space industry in Russia. The thing is that various international commitments do not enable the country to develop properly its own space industry, which continues to manufacture old-fashioned products – they are popular and on demand on the world market.

This strategy is caused by the lack of funding of new R&D by the state, by institutional ineffectiveness of the enterprises and agencies involved in the fulfillment of the space program, and by general inadequacy of the economic and political system and its government regulation mechanisms, which do not allow to attract private investments in research and in the industry in general. One of the eloquent examples is the project of *Clipper* manned spaceships closed in June 2006. Another evidence is the quotation by President of *Energiya* space corporation Vitaly Lopota, who said that the federal space program required substantial correction.[12]

One also has to note a non-visible, but still quite negative dependence of the Russian space program on the United States. Such state of affairs emerged already in 1993 when Russia entered the ISS project. Until 2006 NASA partly funded the production of Russian carriers, cargo and manned spaceship supporting the station. This was a sponsorship of the Russian industrial facilities, but it curbed technological progress. Besides, Moscow's reliance in the civilian sector on manned space flights (this is a tradition that goes back to the 1950s) and on expeditions to the station fully ties the country and its space research to the ISS project.[13] This requires permanent negotiation with foreign partners to get necessary agreements (mostly with the United States) on the very program (supplies and installation of equipment) and the schedule of the crew.

To cover partly the costs, most of the research done at the Russian segment of the station is carried out within the international cooperation framework and commercial contracts with foreign partners. For instance, according to the *Long-term program of applied research and experiments planned in the Russian segment of the ISS*, by 2008 only 20 percent of all planned experiments were carried out (75 out of 342).[14] Meanwhile, in 2001–2006 Moscow conducted 135 experiments under foreign contracts.[15] Thus, the Russian segment of the space station is operated most of the time to pay for itself.

Negative consequences of such cooperation pattern will continue to exist until the end of the ISS functioning and there are prerequisites for further deterioration of the situation. In 2009 Moscow plans to raise the permanent crew to six people, as it was initially planned; by 2011 Russia plans to expand its segment by installing new modules. Hence, the production of Russian spaceship should double, especially bearing in mind the curtailing of the *Space Shuttle* program. According to Head of the Federal Space Agency Anatoly Perminov, «Obviously, the implementation of international commitments will fail without fully-fledged national program on the ISS, these things are intertwined. Under these circumstances, we must speed up the work on further deployment of the Russian ISS segment.»[16] Besides, Moscow intends to extend the service life of the station from 2015 to 2020.

Such approach has clear reasons – without the ISS, the independent existence of the Russian space industry will be called into question, since *de facto* it stopped in its development in the late 1980s. The federal space program is calculated until 2015, while officially declared deadline for the emergence of new space delivery systems is 2020.[17] So Russia is not interested in curbing the ISS program before that date, since the station helps the country to maintain its status of important actor in outer space issues.

Meanwhile, even despite the inevitable emergence of alternative transport to the ISS, nothing changes in the policy as such – Russia has found another investor for *Soyuz* spacecraft, i.e. France (let's say the EU in general), because the Europeans have no experience in developing manned space systems. By the way Moscow follows the same strategy with respect to China and India – it actually sells them its own space experience and partly technological capacity. As a result, developing countries get strategic capital, while Russia obtains only financial assets to maintain its own industry and image.

In other words, the existing Russian model of international cooperation brings short-term benefits, but in the long run contributes to further decay of the Russian space industry. Such trend implies that if the country transforms into a *space driver*, as some officials fear, this would even be the fulfillment of the most optimistic scenario.

In general, peaceful interaction of states in outer space is the combination of national strategies and a powerful tool in the international competition. The latter will most probably continue to increase, since the activities in outer space may bring some undisputable and at the same time unpredictable dividends.

SPACE: THE ZONE OF WAR

Speaking about military aspects of the current space activities, one has to get back to the aforementioned facts – the elimination of satellites by China and the United States in 2007–2008. It is necessary to emphasize that these events draw the attention to the problems of militarization and weaponization of outer space, but are not the problems by themselves.

As far as China is concerned, it is not clear what the country was planning to achieve by shooting down its satellite with a ballistic missile. This showed that Beijing had not got anti-satellite weapons, for ballistic missiles can hardly play such role. Besides, this exercise provided additional arguments to the U.S. military representing the Air Force and Strategic Command in defending their budget for 2008 before the Congress.[18] Hence, it was either the outcome of political struggle within the Chinese ruling elite, or the demonstration of country's capabilities for East Asia only.

One cannot rule out China's desire to show that in the long run, if serious security threat occurs, Beijing is ready to rely on the 1960s methods – explosion of the nuclear device on the orbit (that's why the ballistic missile was used) and, therefore, elimination of the majority of spacecraft in the orbit within a few weeks. By the way, in the early 2000s the Rumsfeld group in the United States set forth the *space Pearl Harbor* concept. It means that the country dependent on satellites may face critical challenges for its orbital group. During the 2006 hearings in the Congress the discussion on prospective challenges in outer space started[19] and the participants named the possibility of nuclear weapons employment in the orbit, notably by China.[20] So the Chinese action six months after the hearings could be a sign of confirmation in the duel with the United States; but it also provoked those forces that stood for weaponization of outer space.

As far as the elimination of the U.S. satellite is concerned, the February attempt was aimed at shooting down the satellite, rather than at testing the anti-satellite weapon. The spacecraft was launched in December 2006 under the program of the National Reconnaissance Office, was experimental, but did not work due to some failure. It is quite probable that some technical components of the device would not be destroyed completely passing through the atmosphere, so it was decided to use the missile defense system to ensure preventive destruction of this satellite.[21]

It is noteworthy that this satellite was shot down at the height of 250 km. Technical characteristics of the upgraded Aegis sea-launched missile and air defense system included the capacity of intercepting the target above the atmosphere, which was incorporated into the modernization program in the mid-1990s.[22] It is also important that high-elliptical and geosynchronous orbits (about 3,600 km), which are used to deploy effectively communication and reconnaissance satellites, are not controlled by radio and optic electronic means of any country, let alone the inability to destroy precisely the individual spacecraft there.

Thus, even though the U.S. missile defense system has all the capacity of space weapons, it has no efficient anti-satellite capabilities. This is also true with respect to the anti-satellite missiles developed in the early 1980s by the U.S.S.R and the United States and installed on *MiG-25* and *F-15* respectively. In general, the hitting of individual communication and reconnaissance satellites can hardly be reasonable, unless special situations emerge.

The same relates to combat lasers. First of all, it is nearly impossible to focus the laser that is currently developed in the United States to hit the object at the geosynchronous orbit, or even to blind the enemy device, despite the declared range of fire (400–500 km). Secondly, the stationing of such system on the orbit (this is quite possible from the technical point of view) will require the deployment of a group with the few laser weapons. Why? Because nowadays about 400–450 satellites out of 800 belong to the United States, while others will have to be under permanent control to prevent potential threats to the U.S. interests.

So one may argue that physical elimination of the individual satellites is a deadlock and it is hardly tested by any country. It is much more effective to develop further the means of electronic warfare, including orbiting radio repeater satellite, which are now used, if necessary, to send the signal to the Earth from the geosynchronous orbit. In fact, the area of operations of the U.S. Air Force includes air, outer space and cyberspace,[23] the infrastructure of which is mainly situated in the orbit or can be affected from the orbit.

However, it is clear that the development of the military space activities is under way and the weaponization of outer space is regarded as inevitable by many U.S. politicians and experts,[24] so specific trends should be analyzed.

Nowadays a number of countries with access to outer space develop their own satellite navigation systems. The United States carries out *GPS-III* program, the EU nations jointly develop *Galileo*, China has *Compass*, India tries to set up the regional system – *IRNSS*, and Japan has also regional plans (*Quasi-Zenith* or *QZSS*).

All these systems are elaborated taking into account potential commercial benefits and possible integration with *GPS*. However, defense motivation is also evident – after the 1991 Gulf War the value of satellite positioning in combat operations grew immensely. And after the emergence of *GPS* on the world market, many countries had to face an unpleasant situation – the activities of national users of satellite navigation depended on the decisions of the U.S. administration. Moreover, U.S. global communication systems are *de facto* used for information gathering and such data collection puts the United States in a more favorable position against other nations (in politico-military and even economic sphere). Thus, there are prerequisites for the process of strengthening *space sovereignty* of other countries.

By the way, such trend is a result of extrapolation of politico-economic, down-to-Earth interests on outer space. For instance, the configuration of space satellite systems depends on the scale of foreign policy and foreign economic interests of this or that actor, as well as of his military and strategic plans.

As far as the United States is concerned, the system was established and modernized to ensure combat support for the troops located on different continents and to get commercial gains. The EU is the second largest world trade center, so the deployment of *Galileo* is mostly economically driven. But military interests should not be underestimated, as Europe equips its armies with high-precision weapons and *Galileo* has high planned accuracy of positioning – up to 3 cm.[25]

China's *Compass* is devised as a global system, but so far it is developed for regional needs and has military and commercial vector. Hence, its development will depend on the scale of the Chinese expansion abroad, including Africa. India and Japan are excited about the construction of regional systems, since they would like to optimize defense and economic activities in the respective regions. Obviously, another significant factor that affects the decision on deployment of positioning satellites is the willingness to learn new space technologies, i.e. to ensure economic modernization. One cannot rule out that Brazil may launch a similar project, which would resemble Indian or Japanese initiatives. As for the Russian *GLONASS*, I will speak about it below.

In general, the expansion in the number of players that would like to strengthen their *space sovereignty* through advanced orbital navigation systems (and communications, and remote sensing) has the opposite effect. They become *de facto* more dependent on their spacecraft and the intensification of space activities requires more and more resources to be invested. Besides, the aerospace industry, which obtains more human resources, higher technological and economic potential, starts to generate political objectives and affect the strategy of the state. As a result, the competition in outer space becomes a *drag race*, the interests expand and become more complicated and intertwined. The countries do not compete for the leadership in outer space – the United States will continue to play this role in the foreseeable future. They fight for stable positions in the *space hierarchy* and this will inevitably make the outer space a more conflict-prone zone.

A good example is the aforementioned Sino-Russian initiative on the prevention of the deployment of weapons in outer space voiced in February 2008 and rejected by the United States.[26] This proposal indicates that the two countries lagging behind from Washington in developing space technologies do not expect significant breakthrough in indigenous programs to meet this U.S. challenge. The refusal of the United States to undertake any legal commitments along with the ongoing situation of *drag race* in outer space may enable Washington to curb the existing system of space law and, therefore, provoke new international tensions. However, to take such steps, the United States will have to ensure support of a player or players with a relatively advanced space program. Much will depend on the U.S. ability to develop appropriate technological capacity – such work is under way not only in the United States, but also in other countries.

Nowadays the United States develops two new types of heavy carriers – *Ares-1* (and its super-heavy version *Ares-5*) and *Falcon-9*. The former will deliver the loads to the Moon, while the latter is a shuttle. Thus, Washington undertakes the steps to make the delivery of spacecraft to the high orbits cheaper and to ensure more intense space transportation flows. The country will then be able to expand at a qualitatively new level its scientific and economic activities in outer space and, hence, provoke a new spin of competition in this area, including military space activities.

One cannot rule out that a key space resource, the effective use and control of which will be extremely profitable, may become the areas of libration points (gravitation equilibrium) within the Earth-Moon system, let alone the geostationary orbit. In fact, during the entire history of outer space exploration only NASA and ESA spaceship worked in the libration points and the number of missions there will only increase in the next few years.[27] One has also to take into account two major trends in the development of spacecraft. On the one hand, it is the development of microsatellite technology; on the other hand, the production of spacecraft with the guaranteed service life of 10–15 years. All this should make the space activities more attractive for investments and, hence, will also give an impetus to economic and political rivalry.

Another important R&D area, which may affect the characteristics of the future conflict, is the work at aerospace systems. Nowadays, these activities are in the hands of private companies, which plan to develop the tourist suborbital spacecraft, e.g. *Virgin Galactic*. However, government agencies are also involved. In December 2008 there are plans to launch *X-37B* spaceplane at the low orbit in automatic test mode. This is the program of the U.S. Air Force, which is aimed at testing the electronic systems, the ability to enter the atmosphere, etc. [28] It is noteworthy that this project is a resumed NASA program that was implemented in the late 1990s.

In the long run there is a possibility of merging the technology of unmanned aerial vehicles (UAV), which can be armed with attack systems, and suborbital or low-orbit spacecraft. This corresponds with the aforementioned trend of transforming the U.S. Air Force into an integrated aerospace service.[29] And this may be one of the potential objectives for the U.S. missile defense system – to fight against such spaceplanes.

It is also interesting to look at the NASA research in the area of space nuclear engines – these activities resumed in 2003 (the so called *Prometheus* project). However, in 2008 it became more difficult to follow its funding, since the project was integrated into the Exploration Technology Development Program (instead of being included as a separate item into the NASA budget).[30] The prospects of this project are not yet clear, but one has to bear in mind that in the 1950–1980s the Soviet Union and the United States were carrying out such projects, including tests, and there is a great potential in this area. By the way if one of the actors gets principally new delivery systems, this may destabilize the situation in the conditions of growing rivalry in outer space.

Summing up the review of R&D, one has to point out that only suborbital spacecraft have currently the potential for being transformed into combat systems. All other things – from developing new types of spacecraft to fundamental research, such as nuclear engines or the Moon base projects, – have no military application so far. They simply enhance the capacity of space exploration and attract the interest of other actors, who want to obtain them.

Thus, the competition is increasing, the contradictions may aggravate, but one cannot expect real star wars or battles between spacecraft in the foreseeable future. Unless the new opportunities of outer space and specific benefits are clear, one will not be able to understand what the space should be defended from, or where, with which means and whom should be attacked. So far prospective opportunities exceed the potential risks of unregulated space activities and, therefore, new international legal mechanisms will hardly be created. On the contrary, the existing system of space treaties has all chances to disappear. At the same time, even though there are no space weapons yet, the medium for conflicts in outer space exploration is already being formed.

CONCLUSIONS FOR RUSSIA

In conclusion let us touch upon again the space policy and space program of Russia to emphasize different aspects of planning and implementation that may help the country to win in the global competition.

Firstly, it is high time Russia developed the complex strategy for its space activities and started the institutional reorganization of the entire politico-economic mechanism related to the space program. Otherwise the country will not be able to carry out an adequate space program in the future.

Secondly, to minimize the negative consequences of its international cooperation patterns, Russia should insist on extending the service life of the ISS after 2015–2016. The country should also try to abandon the idea of increasing the Russian crew at the station, while additional modules should be rented to other project participants, in order to cut the costs of their development and use. In general, it is necessary to shift the focus from manned space activities to automatic fundamental and applied research in outer space.

Thirdly, it makes sense to cancel the programs of modernization of the existing carriers, notably *Soyuz* manned spaceship, and concentrate on new types of materiel, which will be economically beneficial. The most successful project then may be *Angara* carrier rocket, but it is too difficult to assess its prospects so far.

Fourthly, Russia should probably postpone the deployment of the *GLONASS* system as a global one and focus on the regional version (the territory of the country and neighborhood). Russia has no capacity to pursue really global military and economic interests, which would require such global network. Besides, the localization of the system would help to cut the costs[31] and develop satellite technologies instead, including more investments in R&D. In fact, when the Russian troops are eventually equipped with high-precision weapons and UAVs (if this happens at all) and meet the aspirations of the Russian top leadership which wants the army to use the latest and most advanced defense technologies, it will be the time to replace the old generation of satellites. It would be easier and cheaper to do it when the system is relatively compact.

Fifthly, Russia should stop its initiatives of non-deployment of weapons in outer space. These efforts are logical from diplomatic point of view and due to the fact that Moscow lags behind Washington in this area, but in general, such activities send false signals to the political elite as such and affect its perception of threats coming from outer space. It is also necessary to avoid the intense development of space weapons or other forms of confronting such weapons – the research should stay at the level of verification of technical ideas, but it should not be transformed into large-scale programs aimed at meeting the alleged U.S. threats. The only exception is the work at UAVs and spaceplanes and the means to fight them. At the same time, Russia will hardly be able to develop effective aircraft in the new future, but in the area of aerospace defense it has strong positions.

Sixthly, Russia should do its best to take the maximum advantage of cooperation with the United States, despite all negative aspects of such cooperation pattern. At first, Moscow will have to admit that such cooperation cannot be equal, since Russia is weak, and the approaches should change, in order to change this state of affairs. And Russia will manage to make the U.S. side interested in such cooperation, if the country focuses on R&D and creative approaches.

In other words, the United States will find it attractive to take part in the solution of non-standard and far-reaching tasks in the space area, while Russia may benefit from such interest. Moscow will be able to borrow the U.S. ideas, technologies and approaches (mainly through direct communication between research teams). And, hence, Russia will avoid one of the *traps*, e.g. similar to those within the ISS project – Russia does what it can, while the United States develops its potential supporting the survival of the Russian space industry in exchange. A side effect of the creative approach might be the growing differences among the respective U.S. agencies (notably NASA) concerning further development of the space activities. This intra-agency competition may further raise the U.S. interest in cooperation with Russia.

Thus, the success in space rivalry – be it peaceful interaction or a conflict – depends on the effectiveness and coherence of the objectives, the ability to plan and fulfill specific steps in this area, to take advantage of one's own capabilities taking into account the capacity and strategies of other players. In the current situation when everyone chases the leader and the leader (Washington) enters the crucial phase of its space program transformation, it doesn't really matter where and who is the first to come and collect the ground or build a base. It is much more significant to have the distant perspective, to have an open horizon for the space activities, to take maximum use of the results of indigenous and foreign space programs and to generate (and verify) one's own interests outside the Earth. It is not clear today how much Russia will be able to adapt its space policy to such new reality.

Notes

[1] NASA. Final Report to the President on the U.S. Space Program, January 1993, http://history.nasa.gov/33082.pdf (last visited on June 6, 2008).

[2] NASA. Report of the Advisory Committee on the Future of the U.S. Space Program, December 17, 1990, http://www.hq.nasa.gov/office/pao/History/augustine/racfup1.htm (last visited on June 6, 2008).

[3] U.S. National Space Policy, Globalsecurity.org, August 31, 2006, http://www.globalsecurity.org/space/library/policy/national/us-space-policy_060831.pdf (last visited on June 6, 2008).

[4] Without mentioning historical aspects, we recommend to see the works by Alvin Toffler, Daniel Bell, etc.

[5] NASA. Report of Orion Project Office, July 2, 2008.

[6] Review of NASA's Exploration Technology Development Program: An Interim Report, National Research Council of the National Academies, http://www.nap.edu/catalog/12189.html (last visited on August 22, 2008).

[7] «Lunar Telescope to study the young Universe,» *Zhivaya Nauka,* March 11, 2008, http://livescience.ru/content/view/790/136/ (last visited on August 1, 2008).

[8] Report of the Advisory Committee…

[9] «The agreement on joint lunar research signed,» *Novosti Kosmonavtiki*, August 1, 2008, http://www.novosti-kosmonavtiki.ru/content/news.shtml (last visited on August 2, 2008).

[10] Decision of the Russian Academy of Sciences Board's Bureau on outer space. Institute of Space Research of the Russian Academy of Sciences, May 29, 2007, http://www.iki.rssi.ru/sovet/reshenie.pdf (last visited on August 7, 2008).

[11] C.f.: T. Solokhina, Ya. Petrichkovich, Yu. Sheinin, «SpaceWire technology for parallel systems and onboard distributed complexes,» *Elektronika: Nauka, Tekhnologia, Biznes,* No. 1, 2007, http://www.electronics.ru/issue/2007/1/7 (last visited on August 6, 2008).

[12] N. Yachmennikova, «Space as a reality: which space vehicle will replace *Soyuz*?» (interview with President of *Energiya* corporation Vitaly Lopota), *Rossiiskaya Gazeta*, February 5, 2008.

[13] Russia's expenditure on the Federal Space Program in 2008 should amount to 43 billion rubles (initially 32 billion); the 2009 draft budget speaks about 58.2 billion rubles. The structure of spending cannot be analyzed – it is too confused within the program framework. However, it is known that the Russian Space Agency spent over 11 billion rubles in 2003 only on the fulfillment of our international commitments with respect to the ISS. Taking into account the inflation, operational costs of the Russian segment at the ISS, *Baikonur* launching site, launching of space vehicles and other expenditure on manned activities in outer space, the latter consumes no less than half of the program budget. Besides, growing spending in 2009 must be connected with the plans to build and launch new Russian modules for the ISS, as well as with increasing costs of space vehicle production due to the planned stop of using shuttles.

[14] «Science at the Russian segment of the ISS – an exhibition devoted to the Space Day,» Federal Space Agency, April 8, 2008, http://www.federalspace.ru/NewsDoSele.asp? NEWSID=3175 (last visited on August 7, 2008).

[15] M. Tuleev, «We will soon see everything from above: by late 2007 *GLONASS* will cover 95–97 percent of the Earth surface» (interview with Head of the Federal Space Agency Anatoly Perminov), *Voenno-Promyshlenny Kurier*, June 14–20, 2006, http://www.vpk-news.ru/article.asp?pr_sign=archive.2006.138.articles.defence_02 (last visited on August 6, 2008).

[16] «Meeting of the FSA Board: results, prospects,» Federal Space Agency, November 9, 2007, http://www.federalspace.ru/NewsDoSele.asp? NEWSID=2567 (last visited on August 7, 2008).

[17] Ibid.

[18] Statement for the Record by Dr. Donald M. Kerr, director, National Reconnaissance Office, House Armed Services Committee, Subcommittee on Strategic Forces, March 23, 2007, p. 4, http://www.globalsecurity.org/space/library/congress/2007_h/070323-kerr.pdf (last visited on August 10, 2008).

[19] See, for example, Opening Statement of T. Everett, House Armed Services Subcommittee on Strategic Forces, June 21, 2006, p. 2.

[20] See: Testimony of M. O'Hanlon, Subcommittee on Strategic Forces of the House Armed Services Committee, June 21, 2006, http://www.globalsecurity.org/space/library/congress/2006_h/060621-ohanlon.pdf (last visited on June 8, 2008).

[21] There are three positions here. The U.S. view is that the satellite had some toxic fuel. Besides, beryllium components were mentioned that required special handling if the space vehicle had reached the U.S. territory (see: Satellite Re-entry, FEMA Disaster Operations Directorate, U.S. Department of Homeland Security, February 14, 2008). Russia believes that the elimination of the satellite was the a test of anti-satellite weapons. The third point expressed by Russian politicians and experts, as well as by some foreign observers, is that beryllium components proved the presence of new nuclear power sources onboard the space vehicle. None of the positions in fact seems to be completely true. The satellite was experimental and its functions were not declared, nor was declared its planned functional orbit.

[22] «Ballistic Missile Defense: 12 Years of Achievement,» Statement of Lt.-Gen. Malcolm R. O'Neill to the House National Security Committee, April 4, 1995.

[23] Air Force Doctrine Document 1, September 1997, http://www.globalsecurity.org/military/library/policy/usaf/index.html (last visited on August 12, 2008).

[24] Testimony of M. O'Hanlon…

[25] It is noteworthy that in the mid-1990s, the United States reacted negatively on the European plans to deploy such system, as it would have reduced the level of the EU strategic dependence on the United States.

[26] «U.S. rejects Russian call for new space treaty,» *Space Daily*, February 12, 2008, http://www.spacedaily.com/reports/Russia-China_space_deal_to_counter_US_shield_move_diplomats_999.html (last visited on August 15, 2008).

[27] To get more information about the use of libration points, see: N. Eismont, R. Nazirov, D. Novikov, *Movement of spacecraft with liquid crystal sail near the solar-terrestrial Lagrangian points L1 and L2*, Institute of Space Research, 2006, www.iki.rssi.ru/seminar/20060228/eismont.ppt (last visited on August 12, 2008).

[28] «U.S. Air Force will launch the robot space vehicle to the Earth orbit,» *Novosti Kosmonavtiki*, November 23, 2006, http://www.novosti-kosmonavtiki.ru/content/z25.11.06.shtml (last visited on August 12, 2008).

[29] Here one can turn to the following document: The U.S. Air Force Remotely Piloted Aircraft and Unmanned Aerial Vehicle Strategic Vision, 2005, http://www.globalsecurity.org/ military/library/policy/usaf/index.html (last visited on August 12, 2008).

[30] NASA. NASA FY 2008 Budget Estimates, http://www1.nasa.gov/pdf/168652main_NASA_FY08_Budget_Request.pdf (last visited on August 12, 2008).

[31] Under the Federal Program for *GLONASS* development, in 2009 the government should spend 31.5 billion rubles, even though in summer 2008 the group had 6 vehicles less (reduced from 18 to 12; with the planned 24 vehicles in operational mode and 30 spacecraft after full deployment). Besides, today the range of *GLONASS* customers is limited to Russian companies and state agencies, let alone the MOD. AFK Sistema also promotes Russian space navigation systems in Belarus.