International Security
Nonproliferation
Arms Control

DIGEST OF THE RUSSIAN JOURNAL

YADERNY KONTROL

(NUCLEAR CONTROL)

№ 8

Summer-Fall 1998

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Contents

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Address: P.O. Box 17, Moscow, 117454, Russia
Phone: +7+095-335-1955
Fax: +7+503-234-9558
E-mail: info@pircenter.org
Internet: http://www.pircenter.org

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Publisher: PIR – Center for Policy Studies in Russia
Dr. Vladimir A. Orlov, Director, and Executive Council Member
Dr. Vladimir A. Mau, Executive Council Member
Prof. Yuri Fyodorov, Executive Council Member

Interview

VICTOR MOUROGOV ON THE PROSPECTS OF NUCLEAR ENERGY DEVELOPMENT

[This interview was originally published in Russian in *Yaderny Kontrol*, No.5, September-October, 1998]

Professor Victor Mourogov, IAEA Deputy' Director General, Doctor of Technical Science, is interviewed by Yaderny Kontrol Editor-in-Chief Vladimir Orlov.

***YADERNY KONTROL*: Victor Mikhailovich, a continuing discussion on the IAEA's role and objectives is underway. You have been working in this organization for the last 3 years. In your opinion, what is the role of the IAEA and what role could it play in nuclear energy and nuclear security matters?**

MOUROGOV: Today I have no doubt that the Agency is a unique international organization which works to facilitate the peaceful applications of nuclear energy, and nuclear technologies in different spheres of activity in order to promote sustainable development of human society. At the same time it is a unique international mechanism contributing to both global nuclear safety and international security.

The Agency serves as a global store of nuclear knowledge and its everyday activities are aimed at extracting and disseminating this information around the world for practical use.

Q.: Will you tell us more about the main *promotional* functions of the IAEA at the moment? What is your view of these functions?

A.: The main function or, I would say, mission of the Agency lies in encouraging in every possible way the support of the peaceful application of nuclear technologies.

The range of technologies in use and yet to be used is impressive. In this connection, one can't help mentioning the example of Russia. Russia has achieved considerable results in developing ultramodern technology in the field of nuclear power for space engineering. Sometimes it seems to me, as an expert in this sphere, that it is a kind of magic, a sort of miracle. IAEA Director General ElBaradei has recently visited the IPPE State Research Center in Obninsk. He witnessed the work of the nuclear-pumped laser and highly praised the device. Now Russian scientists are figuring out how to utilize the device and discuss ways to move satellites from one orbit to another, to destroy space garbage, to transmit information at unlimited distances, to maintain communication with submarines, to sterilize volumes... And this is only one of the many recent examples.

If we speak about the role of nuclear energy, nowadays the nuclear power sector accounts for 7% of the world's energy balance. Some would say, '7%, so much!' I will say, 'Just 7%.' It is not much in comparison with an immense and practically inexhaustible potential for nuclear technologies that, in particular, could provide for sustainable energy development.

We should not run to extremes. At the time, when nuclear energy was born, people spoke about a 100% share of the energy balance, considering NP as the key technology for solving the principal problems facing humanity. To my mind, it is ridiculous to speak about the monopoly of any source of energy. We should think about an optimum combination of different sources, including nuclear power.

At present, with privatization underway in some countries, and with the coordinating role of governmental institutions diminishing, the significance of international coordination and cooperation in the field of defining an optimal energy strategy for sustainable development is growing. A vivid example was the Kyoto Conference on

preventing global climate changes (reducing carbon dioxide emission).

What should we do? If nuclear energy is to make qualitative leaps, we will need new engineering solutions and technologies. We should radically change our attitude towards the design and planning of nuclear reactors. These should be reactors with a deterministic level of safety. Second, we have to review the technology of an external fuel cycle which should provide for not only smaller volumes of radioactive wastes (there exists such *dry* technology at the laboratory level), but should also comply with nonproliferation principles or, in other words, be resistant-to-proliferation.

Q.: Are the main functions of the Agency limited to control-regulation and promotion?

A.: Not only. There could be a new mission connected with the unique, potential role and place of the Agency in the system of international security, originating from the reduction of nuclear arms and the process of nuclear disarmament.

As you know, after the end of the Cold War we inherited hundreds of tons of plutonium and highly-enriched uranium. How should we treat it: as a lethal, dangerously explosive heritage to be got rid of as soon as possible and a nightmare to forget? Or is it an invaluable wealth, an important source of energy? That's the dilemma. Or how should we use the knowledge and experience of those specialists who worked with nuclear power in the defense industry on both sides of the ocean? Taking into account its experience, the technologies concerned and its special place in the system of international relations, the Agency could answer this question for today and for the future. The answer should be practical, aimed not at a simple *good* or *bad* but at the rational utilization of this legacy.

It is the IAEA that could play a key role in reducing the nuclear threat, verifying and supervising the cutting down and elimination of the stockpiles of nuclear materials, for instance, through their use as fuel for nuclear power reactors, and through the application of nuclear expert knowledge solely for peaceful purposes.

The Agency could contribute its knowledge and experience to the cause of nuclear disarmament, using its advantages. These include the above-mentioned experience in promoting modern technologies; problems associated with the utilization of nuclear technologies (safety, nonproliferation, economic efficiency, environmentally friendly application); broad membership of the organization (now comprising 128 member states). The IAEA can provide for and maintain real transparency and irreversibility of disarmament.

Q.: How much time is left? How long is it possible to put off the idea of the IAEA participation in the process of nuclear disarmament?

A.: Obviously the sooner the nuclear weapon states concerned can agree on a role for the IAEA, the better. I sincerely hope that the IAEA Board of Governors will agree to a suitable formula in 1999, because the issue is before us.

The IAEA is the best rostrum to show the world how the problems of nuclear disarmament are being solved in a transparent way. What should be the degree of transparency? How can we obtain it? All these and many other corresponding questions should be answered within the framework of the IAEA's activities. Discussing these matters, answering these questions could lead us to the solution of the problem of a strategy for nuclear energy development. For when we say '*the future of plutonium withdrawal from military use*' the next words will inevitably be '*the future of nuclear energy*'.

Q.: What is your opinion on the future role of nuclear energy in Europe?

A.: It is difficult to speak about Europe as a whole. That is like defining an average temperature for hospital patients.

Western Europe has succeeded in obtaining a high degree of energy independence. This process was stimulated by the past oil crisis and following establishment of the OPEC. Western Europe has managed to change entirely the role of the coal industry. The social picture of many regions has changed; a large percentage of the labor force moved from the raw material industry into manufacturing; the transportation system was modified to move people and products of the engineering industry instead of raw materials. I hope that one day, Russia will be able to make such a transition.

The countries of Western Europe, a number of which obtain from 30 to 70% of electricity from the nuclear power sector, have reached the level of sustainable development. Some of them, for instance France, now have an energy output surplus.

At the same time, they actively introduce power-saving technologies. Energy sufficiency or even surplus makes them think in terms of maintaining rather than increasing the current level of nuclear power engineering, about improving safety and the economy of nuclear power stations. At the moment, in the field of nuclear energy these countries have everything: design, technology, engineering solutions, infrastructure, educational system, personnel... Absent, however, is a long-term program for nuclear energy development.

The situation is different in Central and Eastern Europe. Last summer I attended an international conference in Dubrovnik and had the opportunity to ascertain that many countries of this region do not envisage their development without the use of nuclear power. Sometimes nuclear energy accounts for half of their energy generation. They have dozens of reactors, manufactured in the Soviet Union. In fact, what we have in Central and Eastern Europe are the fragments of the former Soviet nuclear system. The system has collapsed but the fragments work. Russia continues to supply them with fuel, to take back the fuel, there are some agreements in effect... But inevitably pops up the question: what is their future? What is the optimal energy development strategy for the region?

Q.: This is true for Europe but in Asia the situation is different.

A.: Quite right. At the same time, Asia is becoming the center of world nuclear power. I mean China, India, Pakistan, South East Asia... 4 billion people, 2/3 of the world population... And such people through their governments have already made their choice in favor of future nuclear energy development.

In general, the developing countries use only 4% of the nuclear power produced in the world. There is no boom yet; it is in the process of ripening. In China the share of nuclear power in the whole energy production, per capita, is 100 times lower than in France. As an example: to reach the average level of Western Europe in annual nuclear energy production, per capita, China would have to build every year about ten 1000-megawatt reactors over the next 50 years.

Most of the Asian states counting on nuclear power development (mainly South East Asia, where this process may be impeded by the recent financial crisis), yet possess neither an advanced industrial infrastructure, nor a comprehensive higher educational system, nor a technological or engineering basis for handling wastes, not to mention the actual construction of nuclear power stations. However, they have the willingness a real need. Some of these states have already worked out or are elaborating long-term programs for nuclear energy development.

Coming back to the problem of nuclear energy in the developing countries, we can say that there exist several groups of states. Some of them have acquired advanced nuclear technologies and possess a well-developed nuclear power sector. However, they do not have a desire to develop it further. Others (Asia, North Africa and Latin America) are ready to start a new development of an energy sector. These groups should *be bridged* for exchange of

information. The *bridges* should be *built* by the IAEA.

Q.: But even the composition of these groups of countries in Africa and Asia is different.

A.: The capabilities of each country should be treated differently. For instance, it would be reasonable to explain to some sub-Saharan states the advantages of developing the renewable sources of energy, solar and thermal energy in particular. Other countries, for example, those of North Africa, which face the problem of seawater desalination, have difficulties in finding alternatives preferable to nuclear energy. I would like to point out that the problems of acute fresh water shortages or desalination are relevant for territories inhabited by 2.5 billion people worldwide. Nowadays, the lack of fresh potable water causes more deaths than armed conflicts. In some cases only nuclear energy can help to save maybe millions of lives.

The problem could be solved in the following way. 50-100 MW reactors could be constructed in a black box manner: serial manufacturing in developed countries as the product of the machine-building industry, and then delivered to developing countries on 20-year leasing terms. After that time they could be returned and replaced by new ones. Without refueling, reloading! Thus, we solve the problems of safety, operation, handling of wastes and nonproliferation. In fact, it would be a small-sized passive safety reactor. The proliferation and financing risks are both minimal in such projects: if they don't pay, dismantle the reactor and take it back.

Probably, at the beginning these reactors will be more expensive but, as you know, the most expensive position to be in is *no energy at all*. Transportable or floating small and medium-sized reactors can be moved from island to island, from region to region.

These and other projects alike are a good testing ground for international cooperation.

I suppose that international cooperation in the nuclear energy sphere is the key to determining its development, and it has bright prospects.

Q.: When you speak about the prospects of nuclear energy development, does it mean that the Agency studies this matter in detail and makes the prognoses?

A.: Yes, this trend is of top priority. At the moment, the Agency pays more and more attention to the future of nuclear energy, to the problems of strategy. The Agency starts by carrying out its principal tasks envisaged in its founding documents. The forecasts you are asking about do not require much money but their role cannot be underestimated. For some countries they serve as support in elaborating their energy development strategies, providing for the use of nuclear power; for other states they give reasonable grounds for concentrating their efforts on traditional non-nuclear sources of energy.

The Agency maintains new programs on the basis of international cooperation. These programs are endorsed by member states and include the comparative analysis of different sources of energy, taking into account their economic efficiency, safety, environmentally friendly application and risk to public health. Thus, as the only body in the UN family with an energy mandate, we study the role of different sources of energy (nuclear, coal, gas, petroleum, renewable sources, etc.) with the aim of providing sustainable development of the human society.

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From 1970 to 1989 Mr. Mourogov worked as Senior Scientist at IPPE in Obninsk. Then until 1992 he was Scientific Secretary of IPPE and Head of the Division on Organization, Planning of Research and Development and Advanced Investigations. From 1992 to the end of 1995 Mr. Mourogov was Director of the IPPE State Research Center of the Russian Federation, Chairman of the IPPE Scientific Council and Member of the Scientific and Technical Council of the Ministry of Atomic Energy of the Russian Federation.

PIR Center News

Summer-Fall 1998

1998, May 31 - June 10. At the invitation of the British Council Director of the PIR Center Vladimir Orlov participated in the *European Series-98* as a member of the Russian delegation. This conference of young politicians, businessmen, diplomats and scientists began its work in Madrid, then moved to Brussels and was closed in London.

The conference discussed a wide number of questions, concerning the present and the future of the European continent, role and place of the European Union. The Director of the PIR Center took part in the work of the panel, dealing with the problems of international security (and European security in particular). Among those who addressed the meeting were Catalonia Prime Minister Jordi Pujol; Spanish Secretary of State for Foreign Policy and European Affairs Ramon de Miguel; Vice-President of the Supreme Council on International Affairs of the Spanish Foreign Ministry Antonio Pedauye; British Secretary for Commerce and Competition Lord Simon of Highbury; European Commission Vice-President Sir Leon Brittan QC; European Commission Inspector General Graham Avery; NATO Secretary General Special Adviser on Central and Eastern Europe Christopher Donnelly; Director of Defense Programs Department of the Belgian Ministry of Defense, Brigadier Richard Dannatt; Head of the *British Technology Group* Ian Harvey; Director of Research of the British Aerospace Companies Society Prof. Keith Hayward; *Bank of England* Deputy Director William Allen; Deputy Commander of the forces in Bosnia-Herzegovina, Lieutenant-General Roderick Cordy-Simpson; Head of European Programs Department of the British Royal Institute of International Relations Dr Kirsty Hughes; Head of the *NatWest Group* Central Board, former British Foreign Secretary Rt. Hon. Lord Hurd of Westwell; Chairman of the British Council Baroness Kennedy QC; *Hawkpoint Partners* Vice-President Dame Pauline Neville-Jones; Deputy Chairman of HM Customs & Excise Alexander Russell; Director of Scientific Research of the International Institute for Strategic Studies Dr Gerald Segal; *Nortel Europe* President Gary Donahee; Professor of International Relations, London School of Economy Lord Wallace of Saltaire; and others. The participants of the conference visited the NATO Headquarters, the European Parliament, the *Bank of England*, London School of Economy, the *European Bank for Reconstruction and Development*, etc. British Foreign Secretary Rt. Hon. Robin Cook answered the questions of the delegates.

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1998, June 26 - July 2. Director of the PIR Center Vladimir Orlov was staying in Vienna at the IAEA.

The Director of the PIR Center had several meetings with Victor Mourogov, who is in charge of the problems of nuclear energy development. Vladimir Orlov met another IAEA Deputy Director General Pello, who is in charge of safeguards' matters. Vladimir Orlov held a meeting and talks with Head of the Section on Information Technologies in the field of Safeguards Kaluba Chitumbo. In the course of discussion the parties touched upon the problem of the IAEA databases and their improvement with the help of Russian sources. The Director of the PIR Center met Deputy Director General Senior Assistant Thomas Shea and discussed the matters, relating to the *Trilateral Initiative*. The conversation with Senior Coordinator, attached to Deputy Director General, Anita Nilson concerned the present situation of the IAEA databank on nuclear smuggling. The talks with Head of the Section on State and External Relations, External Relations Department, Dr Odette Jankowitsch dealt with the future contacts between the IAEA and the PIR Center. Vladimir Orlov addressed the IAEA officials at the seminar where he made a report, characterizing the threats of a possible unauthorized access to the fissile materials at the nuclear objects of the Russian Atomic Energy Ministry and the Ministry of Defense. In his address he also laid out preventive measures, taken by the Russian government.

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1998, June 14-17. Director of the PIR Center Vladimir Orlov visited Tel Aviv where he

took part in the international conference on the problems of international and regional security. The conference was organized by Jaffee Center for Strategic Studies of Tel Aviv University and Belfer Center for Science and International Affairs at Harvard University.

The main problems, discussed at the conference, were control over the export of nuclear and other sensitive materials and technologies; a wide range of non-proliferation issues; Russian-Iranian nuclear cooperation; Middle East peace process and its prospects. Military commandment of Israel, representatives of various governmental institutions and leading defense analysts took part in the opening ceremony of the Conference devoted to the 20th anniversary of the Jaffee Center.

Among those who addressed the conference were fellows of the Harvard Center: Graham Alison, Dr Richard Falkenrath, Steven Miller, Amb. Robert Blackwill, Ashton Carter; Jaffee Center Director Dr Shai Feldman; Jaffee Center Senior Research Assistant retired Colonel Eufraim Kam; Director of the International Institute for Strategic Studies Dr John Chipman; Editor-in-Chief of the *Indian Express* Gupta.

In his report Vladimir Orlov dwelled on the problems of present Russian-Iranian relations, the prospects for their development, regarding the current geopolitical situation as well as on the issue of dual standards in evaluation of challenges to the system of nuclear non-proliferation.

Israeli Prime Minister Benjamin Netanyahu received the foreign participants of the Conference in his Jerusalem residence. In the course of a long conversation Allison, Kemp, Blackwill and Orlov had a chance to share in detail their opinion about the present situation in the Middle East and discuss export control issues. It's become obvious that the views of the US and the Russian representatives considerably differ in the most spheres and are opposite sometimes. The Prime Minister concluded the meeting with short speech most of which was about Iran.

The participants had very informative conversation with Director General of the Israeli Committee for Nuclear Energy Gideon Frank (the parties discussed different aspects of Israeli nuclear program), Israeli Defense Minister Aid for strategic issues General David Ivri (defense concept of Israel), Secretary General of the Defense Ministry Ilan Biran (Israeli policy towards Iran and Iraq), advisors to the Prime Minister for foreign policy and top-ranking officials of the Israeli Foreign Ministry.

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1998, September 25. PIR Center Research Council held a meeting on the situation in the South Asia and role of Russia in the region. The Extraordinary and Plenipotentionary Ambassador of India to Russia Ranendra Sen took part in the meeting. He was accompanied by Embassy Councilor Arun Singh, Second Secretaries Jayant Khobrasude and Jyoli Sawarkar. In the course of an informal talk Amb. Sen shared Indian views on national security and informed the audience about his concerns on the situation in the region. Members of the Research Council Vasily Krivokhizha, Gennady Khromov, Roland Timerbaev, Andrei Zagorsky took part in the discussion.

The participants discussed among other subjects perspectives of nonproliferation regime transformation after the nuclear tests in India and Pakistan, military cooperation of India and Russia, impact that might have Russian-Pakistani possible military cooperation on the Russian relations with India. The participants also discussed Chinese factor in the region.

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1998, October 8. PIR Center held the conference "*Ratification of START II and Prospects of Elaboration and Conclusion of START III*". The conference was organized as a part of the PIR Center educational program for the Russian State Duma deputies and staff members. Representatives of the State Duma, Security Council, Foreign Ministry, Ministry of Defense, various organizations and mass media as well as representatives of the Embassies of the USA, Britain and Italy took part in the event.

Vladimir Dvorkin, Chief of the 4th Central Research Institute of the Defense Ministry of Russia, addressed the audience with report "*START II and START III: Parameters of Reduction of Nuclear Arms and National Security of Russia*". He said that since last September the Russian Defense Ministry had a series of discussions with leaders of Duma factions and committees on the present situation in strategic nuclear forces. The discussions showed that the Strategic Forces of Russia would diminish below the limits of the START II due to modest deployment of new weapons with no regards to whether the treaty is ratified or not. Col. Robert Bourdeau, a representative of the US Embassy in Moscow, also took part in the conference. He indicated the advantages that the START II implementation would give to both the United States and Russia. He demonstrated figures which proved that Russia would benefit from the ratification in terms of finance and secirity. Anatoly Dyakov, Director of the Center for Disarmament, Energy and Ecology, explored the issue of transparency in nuclear arms reduction.

Summary

Yaderny Kontrol (Nuclear Control)
Journal of the
PIR Center for Policy Studies
Volume 40, No. 4, July–August, 1998

This issue begins with an *Editorial* devoted to the idea of establishing the International Fund of Nuclear Disarmament. *Yaderny Kontrol* is positive that the time for the creation of such a Fund has come since bilateral cooperation (under the Russian-US "*Cooperative Threat Reduction Plan*") is important but not enough, especially for keeping dynamism in the process of reducing nuclear arms and promoting the safety of fissile materials in Russia, weakened by political and financial crisis. This Fund, which focuses its attention on Russia, must also monitor global nuclear disarmament and take into account new realities such as recent nuclear tests in India and Pakistan. *Yaderny Kontrol* believes that the Fund of Nuclear Disarmament would turn into an effectively acting mechanism of distributing donors' contributions on behalf of the major industrial countries and large private companies, if it is created within such a well-known and authoritative organization as IAEA.

The *Hot Topic* of the issue is the possible ratification of the START II treaty in the nearest future. With new facts from the State Duma's backstage, the article describes in detail the current processes and dynamics of this governmental body. The author examines the perspectives of the treaty's ratification in conjunction with the new Government under Yevgeny Primakov. 'The main contradictions are concentrated around the question of Russia's financial possibility to fulfil the terms and conditions of the treaty. This means that under certain circumstances including mutual trust, the Foreign Minister and the Defense Minister (and, probably, the First Vice-Prime Minister Yury Maslyukov, who is in charge of the economic support of arms reductions in Russia) can insist that the information in their possession is more accurate and up to date than the facts and figures of their Duma

opponents. The key factor to the success of this process is the trust of the members of Russian Parliament and there is little doubt that their trust will be diminishing. This means that time is working against supporters of the *quick ratification*'.

The *overview* prepared by PIR Center's staff writer Ivan Safranchuk tells about the *nuclear component* of President Clinton's September visit to Moscow. He uses the documents of the Summit (they are published in the *Documents* section) to analyze the materials of the final press conference, and makes a conclusion that the result is more than modest.

Igor Terekhov, Andrei Titarenko, and Vitaly Tsymbal in their article *Managing Problems of the Development of Dual-Use Technologies in Russia* state that 'the existing tendency to integrate military and civil (commercial) scientific and research projects, based upon double-use technologies and the control of their deliberate and planned development on the side of those [the most developed - **Ed.**] countries as well as government policies of such development, is underestimated by the Russian Government. The capability not only to preserve but to build up scientific and technical potential of dual use technologies still exists in Russia. The ways of solving the existing problems are well known. Unfortunately their solutions are still under way and legal status is still unclear. On the international level, the Russian Federation as a country is not a source of deliberate distribution of potentially dangerous military or dual-use products beyond its borders. Lack of attention to the scientific and technological sectors of the country, towards specialists working in sensitive areas and existing know-how, as well as its possibility for further development can lead to much more dangerous consequences. It can be a real threat not only to the Russian Federation itself but also for those who are quick enough to come to a conclusion that Russian intellectual potential from now on belongs only to trade and commerce.'

Gennady Gornostayev in *Russia and the World Market of Arms,* writes, 'The share of military production in the Russian defense industry dropped from 60% in the late eighties to only 20% at the beginning of 1998. It is mainly explained by the sharp decrease in military production and not by the conversion and increase in the manufacturing of civil goods and products. The age of the equipment used in the defense sector has significantly increased. In some branches of the military industrial complex, more than 40% of the equipment is obsolete and the technological structure is worsening. Even though Russia inherited the largest part of the defense industry of the Soviet Union, it can produce only 18-20% of arms independently. Approximately 500 Russian defense enterprises have ties with 1236 partners all over the CIS countries'.

'Disruption of the cooperative ties between Russian defense enterprises and their partners in the CIS caused significant losses. Nevertheless, we can mention some positive aspects in the above-mentioned. First of all the centralized system of forming cooperation between the manufacturers, which never took into account their own economic interests, was destroyed. Secondly, irrational cooperation and outdated facilities died out. And, finally, from now on enterprises are free to use their own initiative in searching for partners and establishing their own forms of cooperation.'

Amb. Roland Timerbayev, in the *History* section of the journal describes how the system of the IAEA safeguards was developed. The story is based on archive documents. 'There are many speculations as to the reason why the Soviet Union in 1963-1964 had changed its skeptical and critical attitude towards the IAEA safeguards issue. In reality, (I was working on the new Soviet position on this matter) it turned out that in the early sixties Moscow was becoming more and more concerned with the rapid development of West Germany's nuclear industry. It is sufficient to mention that by the year 1966, NPPs in West Germany were producing enough plutonium to build 60 nuclear bombs 20 kilotons each.'

'At the beginning of 1964 the Soviet Ministry of Foreign Affairs requested data from the State Committee on the Use of Nuclear

Energy of the USSR on the development of nuclear industry in West Germany. The answer came in March with complete and detailed information on the quantity, type, power output, and other characteristics of German research and power nuclear reactors. Special attention was paid to the contract signed by *Siemens* and the French Committee on Nuclear Energy on the construction of nuclear reactors functioning on natural uranium and using graphite or heavy water moderators'.

In the *Information* section of the journal special attention is paid to the news from Minatom as well as to the issues of nuclear security and the issues of missile export controls (in particular, Russian-Iranian cooperation and suspicions). Provocative statements of Minatom leadership on development of Russian-Indian nuclear cooperation are included as well as Minatom suggestions on how to accelerate Russian-Chinese nuclear trade.

Yaderny Kontrol (Nuclear Control) Journal of the PIR Center for Policy Studies Volume 41, Number 5, September–October, 1998

'The situation is critical at the enterprises of closed administrative territorial units (CATU),' the *Editorial* states, 'The Russian government was unable to keep its promises and provide for stable financing of the units and their core plants or pay in full for government defense contracts. Only 47.6% of the planned amount of money has been allocated to CATUs in the first six months of 1998, with no funding at all for defense contracts.'

The *Editorial* continues, 'The news coming to *Yaderny Kontrol* editorial board from Sarov (Arzamas-16), Zheleznogorsk (Krasnoyarsk-26), Snezhinsk (Chelyabinsk-70) and naval bases of the North Fleet reads like wartime reports from besieged cities. In Bolshoy Kamen (Primorsky Krai) people have not been paid for 18 months. In July the government promised to pay the 20-million-ruble wage arrears to the instrument-making plant in Trekhgorny as soon as possible. The process has taken more than two months, and even with such a delay people have not received all the money owed them. At the mining and chemical factory in Zheleznogorsk workers have received only an advance on wages (about 400 rubles), while their neighbors from the *Reshetnikov* scientific-industrial complex of applied mechanics have had no money for 3 months. With the average salary being a mere 1500 rubles (including a 60% regional bonus), the workforce has decreased by half. The administration at the Research Institute of Theoretical Physics (VNIITF) in Snezhinsk had to cancel all authorized bonuses since the alternative was layoffs. The Research Institute of Experimental Physics (VNIIEF) in Sarov got only one-fifth of their planned wages in the first half of 1998. Witnesses who have just returned from a trip to secret enterprises of the Ministry of Atomic Energy say that at some plants people are chronically undernourished.'

The *Editorial* cites the Duma's statement, "Strikes in CATUs may have more dramatic consequences than miners blocking railroads as they may lead to global environmental and political catastrophes.'

'The government should immediately solve the problem of timely financing of CATU enterprises so that their workers should not be humiliated. It is a matter of both keeping earlier promises and maintaining national security,' concludes the *Editorial,* 'At the same time, it is also necessary to think about the future of many CATU plants at a time when the Russian nuclear arms arsenals continue to be reduced. Will the state be able to bear this burden in the long term? Will defense conversion really make them self-sufficient? One option would be increasing the concentration of these enterprises with emphasis on the more promising ones while others, which are clearly non-viable, could be gradually converted or closed. It is worth studying the experiences of Georgia and Kazakhstan, which have sold some of their highly-enriched uranium to the United States.'

Gennady Khromov in his article entitled *India's Politics on Missile and Nuclear Nonproliferation* says, 'Possessing sufficient scientific and technological potential, as well as the necessary infrastructure for production, India seems to be in no rush to equip its army with missiles. Undoubtedly, economic factors are effecting programs devoted to missile production and the launching of missiles for defense expediency. At present, the country has at its disposal practically all of the key elements needed for the production of ballistic missiles of any range. Analysis of the situation concerning the realization of space and missile programs reveals that India is independently satisfying its own demands in the form of solid and liquid rocket fuels, in construction and thermoisolation materials, guidance and control systems, knowledge in the spheres of aerodynamics and flight ballistics, and the construction of multi-staged ballistic missiles and their refinement.'

In the essay *The History of the Safeguards Provisions of the NPT* Amb. Roland Timerbaev reveals that 'while working on suggestions for the article III of NPT, the Soviet Union based its policies on the conviction that fundamental safeguards can and should be vested in an international system of the IAEA safeguards - and only the Agency's ones. The key problem consisted in what role the Euratom system should play – should it be subordinate to the IAEA system or not. The completion of this important task was possible due to persistent efforts of the Soviet diplomacy as well as the joint diplomatic efforts of both sides involved, including the USA, which was also looking for a way out of the deadlock.' 'It is important to note the creative spirit, which reigned in both delegations. The Soviet delegation in Geneva knew that Soviet Foreign Minister Andrei Gromyko was personally and attentively acquainted with encoded telegrams from Geneva and intervened in negotiations only in extreme cases, usually trusting proposals submitted by the delegation.'

Viewpoint

PROSPECTS FOR A RUSSIA-CIS-PAKISTAN SECURITY DIALOGUE

by Dr Ayesha Siddiqa-Agha,
Deputy Director Audit,
Department of the Auditor General of Pakistan

[This article was originally published in Russian in *Yaderny Kontrol*, No. 3, May-June, 1998]

This article was written before the notorious nuclear tests, performed by India and Pakistan this year. However, it touches upon mainly the aspects of conventional arms trade. We presume that it will be interesting for our readers to get a full coverage of the state of affairs in the Pakistani Armed Forces and the ways it may affect Russia-Pakistan relations.

The strategic development in the form of the collapse of the Soviet Union and its division into fifteen independent states carried serious implications for a large number of countries in the world. It wouldn't be far-fetched to suggest that this transformed the chemistry of international politics. To begin with, this marked the end of the Cold War between the USA, and its allies, and the USSR. This presented countries that depended upon the East-West rivalry to feed their regional hostilities with large problems. It became clear that no longer would Washington and Moscow provide weapons for free or minimal cost to maintain politico-military control over these countries.

One of the most affected states was Pakistan. A natural corollary to the end of the Cold War was the arms embargo imposed on Pakistan by the USA. The Pressler amendment was mainly aimed at penalizing Pakistan for its nuclear activities, hence, all military and economic assistance to Islamabad was stopped in 1990. Earlier in the 1980s, Pakistan had been provided with the *state-of-the-art* American equipment to help it meet, what was considered as, the threat

posed by the Soviet Union. At that time the military regime in Pakistan had decided to capitalize upon the opportunity to fulfill some of its dire weapons requirements that were needed to counter the larger and more traditional adversary: India. The various government sources that I talked to admitted that at no point did the authorities feel that they were directly threatened by the USSR, but the convergence with American policy was necessary to acquire superior quality equipment from the western sources who were willing to provide the help at minimal cost to Pakistan. Thus, the breakup of the Soviet Union threw the Pakistani authorities totally off-guard. It was expected that there would be some kind of rapprochement between the two superpowers but such a drastic development was not thought of by Islamabad, nor were they prepared for this kind of a calamity. Unlike during the Cold War era, Pakistan could not hope to become closer to the United States again. With the Communist threat gone Washington was under no obligation to help its South Asian ally.

The end of the East-West rivalry, however, did not lead to the cessation of hostilities between India and Pakistan, or the arms race in the region. For Pakistan the situation did not change. Its military competition and needs *vis-à-vis* India continue, accompanied by the problems of the lack of a militarily superior partner which can provide Islamabad with military hardware and financial assistance to purchase weapons *off-the-shelf*. In addition, there is the growing military capability gap between Pakistan and India that will be described in the following section of this article. This description is aimed at enunciating Islamabad's weapons needs.

The Threat Perception and Weapons Requirements

American assistance in the 1980s had helped to improve Pakistan's military capabilities in relation to India. Within the two aid packages Washington transferred fighter aircraft, ASW aircraft for the Navy, artillery equipment, fire control radar, anti-ship missiles, old tanks and some other less significant hardware. The most remarkable transfer was of F-16 fighter aircraft and Cobra gun ship helicopters. The F-16s alone played a major role in improving Pakistan's general defense capability and in providing confidence in the military. After the initial acquisition of 40 F-16 from the first American aid package the PAF ordered another 72. These were to be transferred from 1991-97. The Pakistan Air Force had hoped to maintain 110 F-16s but was disappointed as a result of the arms embargo. Meanwhile, the service tried to manage through the procurement of inferior quality aircraft such as the Chinese F-7s. Some second-hand Mirage IIIs were also acquired from Australia during the 1980s that were overhauled and upgraded later, but this was not sufficient to match the Indian inventory that consisted of *top-of-the-line* Russian aircraft such as the MiG-25, MiG-27 and the MiG-29. New Delhi has recently upgraded its inventory by obtaining the Su-30 from Moscow. In addition, it had the British Jaguars, Sea Harriers, and the French Mirage 2000 fighter aircraft. Extremely conscious of the technological gap between its self and its adversary, Islamabad desperately tried to procure the French Mirage 2000-5. This, however, was impossible due to the prohibitive cost of the aircraft. The entire package was to cost Pakistan over US $ 5 billion, which it could not afford. A similar effort to get the Swedish Grippens was unsuccessful due to the US instructing Sweden not to supply these aircraft, which were fitted with American engines. Sophisticated fighter aircraft is one of the most urgent requirements of the Pakistani Air Force. At present the PAF is operating sixteen squadrons (about 300 fighter aircraft) out of which two consist of the French Mirage IIIs and Vs. According to official estimates around 120 of these 135 aircraft will be mothballed. In addition, it has the Chinese F-6s, A-5s and F-7s. All of these aircraft have limited fuel endurance.

In the 1980s Islamabad's primary focus was to beef up the overall defenses - an objective that the decision-makers tried to achieve through strengthening the Air Force. Despite being the largest service, the Army did not receive anything substantial. The prime procurement for the Army was the TOW

anti-tank missiles, Stinger shoulder-fired missiles, a few fire-control radar systems, Cobra attack helicopters, and second-hand, 1950s vintage, American tanks. The service's prime dependence was on Chinese tanks such as the T-59 to which were added the T-69, T-69II and T-85IIP. After the drying up of American aid the government felt the need to improve the Army's capabilities and a deal was signed in 1996-97 with Ukraine for its T-80UD tanks. This acquisition, it was hoped, would provide the service with firepower and mobility. This was in addition to having a certain deterrence value. Although the increase in the number of tanks will bring the difference between Indian and Pakistani tank inventory between 1979-80 and 1998-99, it would not offset the gaps in other areas such as missiles, missile defense systems, gun ships, etc. Furthermore, Pakistan must improve its surveillance capacity. Comparatively, India has been working on that front through developing its RPV, the Nishant and other systems. According to the Director General (Combat Development) of the Army, the service would be interested in a number of kinds of hardware such as mortars, artillery equipment, vehicles, etc. from the East European.

The Navy, which is the smallest service, did not manage to procure major weapon systems from the first American aid package. In fact, it was neglected throughout 1980s. A few pieces of hardware were procured from Britain towards the end of the 1980s, albeit cheaply. It was in the 1990s, nonetheless, that the service managed to acquire weapons such as British frigates and French submarines and mine hunters. These were in limited numbers and do not cater to the Navy's requirement of at least 20 naval vessels per year to meet the growing threat from the Indian Navy. The adversary's Navy, it must be pointed out, has a blue-water capability that Pakistan cannot match but needs to build a sufficient force to defend its territory, *sea-lanes-of-communication* (SLOCS), and EEZ. For this the Navy needs to add to its existing fleet of surface ships.

Arms Transfer Links with Russia and Other CIS Republics

Traditionally, Islamabad has never procured weapons from Moscow. In the days of the Soviet Union some hardware was acquired in the late 1960s. These consisted of a limited number of tanks, helicopters and some other less vital equipment. Again in the 1990s 12 Mi-17 cargo helicopters have been obtained for US $ 32 million, but the prospects of getting weapon systems is still not bright.

It is after the collapse of the USSR and emergence of the independent states that Islamabad has started to look towards these countries for armament. In 1996-97 a deal was signed with Ukraine for the acquisition of 320 T-80UD tanks for about US $ 600 million. In addition, another contract for the procurement of a 1200 hp engine from Ukraine is being negotiated. These engines will be fitted in Pakistan's main battle tank, the Al-Khalid. Islamabad has found the Ukrainian offer financially viable and the cost is a major consideration. These engines are being offered for US $ 0.25 million against the American Perkins engine worth US $ 1 million. No serious arms transfer negotiations were conducted with any other CIS republic. This particularly includes the Central Asian Republics with whom Islamabad had hoped to build stronger ties both economically and militarily.

An Assessment

Pakistan is becoming increasingly interested in procuring weapons on the Eastern European market. This interest, nonetheless, is not equally shared by all the three services. The Navy is the least interested in Eastern equipment. It signed a deal with China for transfer of technology and indigenous production of missile boats in Pakistan but is less inclined to obtain major weapon systems such as surface ships, etc. The service's team of five officers that were interviewed for this article expressed interest in the airborne early warning technology, close-in weapons, surface ships and other equipment, but it is highly unlikely that they would diversify due to two factors: (a) Navy's traditional bias for European equipment, and (b) the cost factor. It is believed that if the service starts procuring from East Europe it would have to

re-do its maintenance and weapon support systems, and that in the end would escalate the overall cost of equipment[1]. The chances for acquiring sub-systems were also ruled out due to the difficulty in *marrying* these with the existing platforms. In addition, fitting eastern sub-systems to these platforms would require serious cooperation between the Pakistani Navy and suppliers' engineers; a possibility that was ruled out due to the nature of the current diplomatic relations particularly between Pakistan and Russia. Skepticism in the East European states' ability to provide logistic support was also expressed. These reasons, however, were to camouflage the fundamental decision not to acquire Eastern equipment. One conclusion that could be drawn from the interview with the Navy's top brass is that despite the reservations the Navy may be tempted to procure Eastern equipment if nothing else is available, or major weapon systems are seriously offered for sale.

On the other hand, the Army and Air Force have revised their earlier policy not to procure from sources other then the West. The most interested is the PAF searching for the new, sophisticated fighter aircraft that it desperately needs. The Army also wants to enhance both the number of weapons and its quality. Whatever the motive, the main interest of both the services is to procure from Russia. The main explanation being Islamabad's realization that despite the breakup of the USSR it is Moscow that dictates terms as far as arms transfers or major policies are concerned. Therefore, the armed forces do not desire to buy weapons from a source that would not be able to guarantee after sale support. Tanks were acquired from Ukraine due to the supplier's industrial capability to provide completely manufactured units and spare parts to keep them running. The various Central Asian Republics offered their old weapons, an offer that does not interest Pakistan because of the suppliers' inability to provide spare parts.

For the Pakistani military the Eastern European market is limited in terms of sources of supply. Although Islamabad would be happy to procure from the non-CIS states, the greatest problem relates to these countries' technological limitations. The Pakistani defense forces are as technology minded as any other military and would not want to invest in inferior systems. This narrows down the search to one producer: Russia. This is certainly the perception of the Air Force that is interested in the *Su-27* series of Russian aircraft. According to the Vice-Chief of Air Staff, more then thirty sources were contacted to help PAF obtain the aircraft[2]. The service is also interested in Russian air-to-air missiles. It was in search of these aircraft that people from the Russian *mafia* were contacted but the efforts have not borne any fruits yet.

Currently, the PAF is evaluating three options: (a) procure directly from Russia, (b) acquire through a third party such as one of the other CIS republics, and (c) obtain these aircraft from China. It was said that the Chinese are engaged in negotiations with Moscow to allow Beijing to supply the Su-27 aircraft indigenously manufactured in China to Pakistan. The Air Force considers the first option as most difficult. It is felt that Moscow might find it hard to directly sign a deal with Pakistan due to the Indian lobby. This was allegedly the reason that killed a prospective deal for the Su-27 in 1994-95[3]. However, there are others who were of the view that a deal could not be struck due to PAF's interest in the French Mirage 2000-5 at the time[4]. What appears more likely is that until 1997 the PAF was certainly interested in buying the French aircraft and it would not have purchased any other aircraft had the President Farooq Laghari not interfered. His order to cancel negotiations with the French due to lack of funds left the service with the only option: acquire aircraft from a cheaper source. In this context the Air Force wants to obtain fighter aircraft at cheaper rates without compromising on quality. The other two options seem more plausible because it might save Moscow from any diplomatic embarrassment as far as India is concerned. An additional attraction for the PAF is that at this juncture about 70 percent of its fighter aircraft inventory is of Eastern origin.

Similarly, the Army is ready to obtain East European equipment. The service's major weapon systems and defense industrial

infrastructure is geared towards Eastern hardware. Most of the American M-48A5 tanks in the Pakistan Army are not in active use. Almost all the tanks are Chinese, that is basically Soviet technology. The major tank production facility, *Heavy Industries, Taxila*, manufactures the Chinese *T*-series tanks and it is believed that with the facility's experience it would not be difficult to learn how to overhaul, re-build and manufacture new tanks of Russian origin[5].

The Foreign Office officials do not think that it would be easy to procure these things directly from Moscow[6]. Their view can only be interpreted in the light of the history of Islamabad-Moscow relations, and problems that infest bilateral terms between the two countries. During the fifty years of Pakistan's history, its relations with Russia have been less friendly, if not altogether hostile. The Russian leadership's bias for India after the independence from the British in 1947 and the Pakistani leadership's tilt towards the West always hindered the establishment of good relations. The premature death of the founding father Mohammad Ali Jinnah in 1948, that deprived the country of his sound leadership accompanied with the Western influenced leadership that followed, did not allow the authorities and the military to re-think diplomatic relations with states other then that of the West. Moreover, with the growing threat perception the successive governments were too focused on getting equipment from the first world. In this respect America was one of the favorite choices of the leadership. Unlike Great Britain, the USA was seen as a land of opportunities that could provide Pakistan with military hardware to fight India. Jinnah who had tried to get armaments from Washington started this policy. It would not be far-fetched to suggest that weapons procurement and military security have been the *raison de être* of Pakistan's foreign policy and relations with other states.

It was to meet the military needs that Islamabad decided to join American sponsored security arrangements such as SEATO and CENTO in the 1950s. The idea was not to harm Soviet interests but to secure weapons from the USA. Indeed, this proved to be a good strategy because Washington transferred a large number of weapons free of charge. This strategy was again adopted in the 1980s when Islamabad collaborated with Washington to exaggerate the implications of the Soviet troop deployment in Afghanistan. The American CIA assisted by the Pakistani ISI planned insurgency operations against Soviet forces. This resulted in an eight-year long struggle that finally culminated in the withdrawal of Soviet troops.

Whatever Islamabad's intentions may have been, its involvement in the Afghan crisis added to the differences between Pakistan and the USSR. Moscow showed its wrath by bombarding Pakistani northern territory. The military developments during the 1980s formed perceptions that were inherited by Russia after the collapse of the USSR, and intensified Islamabad's skepticism of Moscow. During the 1980s there were people in the policy-making circle that believed or projected the Soviet invasion as collusion between Moscow and New Delhi to destroy Pakistan. One may debate the perception but it is true that people from Pakistan's decision-making circle are conscious of Russia's continued disenchantment with Islamabad based on the Afghanistan affair. It is believed that the memories of the 1980s would cloud the prospects of any improvement of links between the two countries. Officials at the Foreign Office do not consider arms transfers as the main issue. For them and for the government it is more important to improve bilateral terms in an overall manner. Unlike Pakistan-US ties, weapons procurement has never been the crux of Moscow-Islamabad links, and it is believed that unless good relations are established it will be difficult to benefit from the new Russian arms exports policy. In making such an argument the Foreign Office officials do not attach any significance to Moscow's desire to sell weapons or to the economic imperative of arms exports. Interestingly, this is not the approach that was adopted in dealing with the USA. The government believed that Washington would be forced by its arms production lobby to sell armament to Pakistan. It was with this thinking that the government continued to hope for the American equipment for which

partial payment had been made to Washington.

From the Ministry of Foreign Affair's standpoint there are three factors that have and will continue to pose problems for Pakistan in acquiring armament from Russia. First: The popular notion is that Moscow would not be willing to supply major weapon systems unless it decides to change the fundamental policy on Pakistan. The major impediment in the formulation of a new policy is felt to be the political chaos in Russia, and inability to assess South Asia as a region but as one of Indian influence. The people in charge of decision-making are those that made policies during the Cold War and these personnel are not likely to view Pakistan differently from how they are used to doing. Second: One of the greatest impediments to establishing good diplomatic or arms transfers relations is felt to be Moscow's skepticism regarding Pakistan. Islamabad is viewed as a country that played a major role in the Afghan crisis, and continues to play a role in Afghanistan against Russian interest.

Third, the issue of the Russian *prisoners-of-war*. In 1990-91 Moscow had sought Pakistan's help in getting back its POWs but Islamabad failed to deliver because of lack of control of the political situation in Afghanistan, including the Taliban. The Russian government, nonetheless, did not understand Pakistan's limitations. Such a perception is understandable considering the Pakistani army's involvement with the Afghan fundamentalist group and its past performance in dealing with other factions. Different Pakistani sources were of the view that the issue cannot be resolved because most of the POWs do not want to return to Russia. However, a solution can be found through providing Moscow with information as to the whereabouts of these POWs. As easy as it may sound the idea embarks upon major policy re-structuring by Islamabad. For one, the political government has to form a new and sound policy on Afghanistan, and take it entirely from under the ISI's control to its own. Also, it may have to consider a Russian solution to the existing Afghan crisis, of course, with concessions from Pakistan. This itself is not an easy task. It would require sustained political stability, and an intelligent and talented leadership to bring about such major changes. Despite the desire to improve relations with Moscow the present government in Pakistan does not seem to have formulated a solid policy pertaining to its own priorities or issues on which it would be willing to compromise.

This argument is presented despite the claims made by the various Foreign Office officials and confirmed by military sources that Islamabad has been trying hard for the past two years to improve relations with Moscow. Benazir Bhutto followed by Prime Minister Nawaz Sharif has been trying to visit Russia - a proposition that does not seem to be welcomed by the Russian authorities. Is it because the well-entrenched Indian lobby influences policy-makers in Russia? Or is it due to the fact that Moscow has not thought of taking official claims, made by Pakistani authorities, seriously?

Islamabad recently acquired 12 Mi-17 cargo helicopters from Russia but this sale does not denote Moscow's willingness to transfer equipment to Pakistan that would enhance the latter's military capabilities. According to the military sources a prospective deal for the MiG-27s was cancelled due to Indian pressure. Hence, it is felt that Moscow would be unwilling to sell major weapon systems. For example, in 1995 the visiting Director General, Joint Staff Headquarters took a shopping list with him but it was not entertained[7]. This conforms to the view of the Foreign Office. On the other hand, the Director General (ISPR) said that Moscow would be willing to sell any equipment provided it was paid in hard currency[8]. In his view, one of the major issues was the cost factor. He added that contrary to the common belief that Russian equipment was less costly it was found to be relatively expensive. In this he cited the example of the Russian T-72M tanks that were offered for sale in the early 1990s for a price that was found to be more then the T-80UD tanks provided by Ukraine.

Conclusions

It is clear from the above analysis that Pakistan's interest in Russian equipment is growing. This is due to two factors. First, Pakistan's increased requirement to upgrade its weapons. Second, unavailability of a Western source of arms procurement that Islamabad would prefer under ideal conditions.

A combination of these factors have made the armed forces look at the possibility to acquire weapons especially from Russia, which is considered the only country capable to provide weapon systems and after sale support.

The presence of a strong pro-Indian lobby in Moscow, and lack of smooth diplomatic relations between Pakistan and Russia, nevertheless, presently mar the possibility of procuring arms from Russia.

The political chaos at both ends is a prime reason hindering a change in policy regarding establishment of better diplomatic ties. Without an improvement in relations it would be difficult for Pakistan to try procuring Russian equipment and for Moscow to transfer major weapon systems to Islamabad. The government in Pakistan is making moves, albeit slowly to build relations with Russia. This in itself may send incorrect signals to Moscow. The Russian leadership could consider the slow pace as Pakistan's inability to revise its earlier anti-Moscow approach or seriously discuss arms transfers and other matters. The fact is that to develop an arms trade linkage, Islamabad would have to prove its credibility as a serious partner. In any case, neutralizing the pro-Indian lobby in Russia may not be an easy task. Considering the Pakistani military's pressing weapons requirements one wonders how long it would take Islamabad to speed up and attain a break-through. Similarly, Moscow would have to weigh its options for supplying weapons to a Pakistan that is traditionally hostile to India - a country which presently denotes a major market for Russian military hardware. By reaching out to Pakistan Moscow would have a better chance to play a more significant role and a balancing act in South Asia.

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[1] Vice-Chief of Naval Staff, Deputy Chiefs of Naval Staff for Operations, Maintenance, Service Support and Training & Personnel, *Interview with the author*, February 17, 1998.

[2] Ibid.

[3] Maj. General Salimullah, *Interview with the author*, February 1998. Being the head of the ISPR he is the official spokesperson for the armed forces.

[4] Director General (Combat Development) for the Army, Secretary Defense Production Division, *Interviews with the author*, February 6, 1998. The Secretary DP is the official who is responsible for vetting and implementing all decisions related to external and internal acquisitions.

[5] Chairman and Director General, *Heavy Industries*, *Taxila*, *Interview with the author*, February 10, 1998.

[6] Additional Secretary, Foreign Office, *Interview with the author*, January 27, 1998. The official has spent time in Moscow and is considered to be one of the Russian experts. Other officers interviewed were the section officer for Central Asian Republics and Pakistan's former Defence Attache to Turkmenistan.

[7] Director General (Combat Development), op. cit.

[8] Maj. General Salimullah, op. cit.

Analysis

NEW STRATEGIC ROLE OF *SMART* WEAPONS AND PROLIFERATION CONCERNS

by Dr Vitaly Tsymbal,
State Center for Military and Technical Evaluations on Dual-Use Projects and Programs, Moscow

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Recent times have witnessed an acceleration in the design and build-up, especially in the United States, of forces equipped with means of armed combat to which the Americans have added the epithet *smart*. In speaking of these weapons, however, many translators still use the term that has gained acceptance among us – *high-precision weapons* (HPW)[1] – even though, as shall be demonstrated below, it is not entirely accurate.

History and Definitions

Interest in HPW first surfaced among military and political circles as early as the 1970s, following the successful (in military and technical terms) use by the Americans of guided air bombs in Vietnam. It was at this time that certain terms were established: the slang term *smart bomb*, the more serious and broad concept of *precision-guided weapons* (PGW) and its Russian-language equivalent HPW, despite the fact that these same kinds of weapons were also defined in a different sense in the USSR – *guided means of defeat* (MD). The term *precision-guided munitions* (PGM) then came into use[2], which in Russia was also translated as HPW. The definition contained in publications stressed the fact that the word *precision* referred to any guided munitions (not only bombs) having a target strike probability greater than P = 0.5 throughout the entire range of launch (firing) distances for model targets. Specific mobile and stationary objects were used as targets: tanks, ships, bridges, radar stations, etc.

The successful application of HPW brought about the expansion of the range of types of MD and the conditions for their combat application. MD, which were in use even before the appearance of smart bombs – take, for example, anti-tank, anti-ship and anti-aircraft zenith and aircraft-based missiles – were applied mainly to the destruction of contrast targets against heterogeneous backdrops (sea, sky). New varieties of delivery systems made it possible to destroy low-contrast targets against complex backgrounds. The standard representatives of PGM were, in particular, air-surface missiles (the American AGM-65A Maverick, the AGM-4A Shrike, the AGM-83A Bulldog, the AGM-53A Condor, the French AS20 and AS30, the Anglo-French AS37 Martel, AJI68). This same missile category included many anti-tank missiles, such as the American TOW (BGM-71A), various air bombs with laser, infrared, television and other delivery systems and zenith guided missiles (especially the American Stinger, the French Crotal, the Franco-West German Roland). Foreign publications even ascribed some of the GDF in the Soviet Armed Forces to the category of PGM (their real names became widely known only after the collapse of the Soviet Union and publications in *Military Parade* and other journals). Experts did not think that HPW appeared only in the 1970s, but at this time there was a dramatic leap forward in the expansion of areas of MD application, and non-guided munitions were being replaced by guided ones in weapons systems for which guided munitions were non-traditional. This breakthrough was facilitated by numerous scientific and technical achievements in the fields of electronics, sensor equipment and technical applications of cybernetics.

At the same time, other conceptions of weapons development were also being worked on. The concept of *fire and defeat* provided for the improvement of not just delivery systems, but munitions power as well. Target strike probability was no longer considered to be the quantitative measure for weapons improvement; instead, it came to be the probability of target destruction. Numerically, the threshold value used was still the same - 0.5. Another concept, *fire and*

forget, sought to eliminate the participation of a human operator from the process of delivering MD to the target, which gave that person the opportunity, after firing (launching) the MD, to then address other combat tasks. The third concept, *lock after launch*, simplified weapons usage even further, primarily pre-launch operations. Unfortunately, many of these concepts, the implementation of which could more rightly have been said to have occurred through the creation of *high-efficiency weapons* (HEW), were relegated to the field of HPW in Russia. Hence the confusion, surrounding the terminology.

Also during the 1970s, the United States announced and implemented the first of the so-called initiatives or comprehensive programs dedicated to designing new resources for land-based military operations – the "*Land Combat Initiative*". First and foremost, this initiative was directed against the traditional method of preparing for and carrying out offensive military actions, i.e. the prior build-up of shock forces in the second echelon and their subsequent breach of enemy defenses. The main targets for these new destruction forces were tanks, along with the air defense artillery units covering the shock troops against air attacks. Among the systems that were developed, the most popular were the Precision Location Strike System (PLSS) and the Assault Breaker. Despite the fact that these systems were not unified under any particular concept abroad, many experts in Russia assigned them to one and the same class – intelligence-gathering and strike system[3]. Moreover, one further distortion of these concepts occurred. Although both of the above-mentioned systems in no way fall under the previously established definition of PGM, they were classified as also being among the HPW.

The logical development of HPW in recent times has been the creation in the United States of systems with sea-based long-range non-nuclear Tomahawk missiles. The successful application of these missiles, along with other new short-range MD (not only American ones), in the Persian Gulf and then in the former Yugoslavia has revived interest in HPW.

But in which HPW? Now, as a result of carelessness with the terminology, the situation is such that, despite the fact that there is an encyclopedia definition, various authors classify as HPW the actual HPW as per their original definition, and HEW, and Tomahawk missiles, and all kinds of intelligence-gathering and strike systems.

Unlimited expansion of any term is unproductive, especially given that we have other official definitions which have long been in use, and to which the term HPW is subordinate. These terms also set limits for the broadening of the concept of HPW. First and foremost, one must recall the definition of *weapons*, which are generally understood to mean '*devices and resources designed for the destruction of enemies in armed combat*'[4], or to be a general name for devices and resources being used to annihilate the enemy's combat personnel, equipment and structures[5]. The second component of the term HPW is *precision*. If we exclude from consideration *non-precise* types of weapons, such as weapons of mass destruction, geophysical weapons and so forth, then in reference to HPW the concept of *firing precision* or *target strike precision* should be used, which, as is common knowledge, is the 'probability assessment of potential landing (explosion) point locations for shells, missiles and bullets in relation to the target'[6]. More correctly, it is in relation to a particular point of aim (for example, the geometric center of the target). In the majority of publications on firing theory and practice, it is also indicated that for a target with finite dimensions, '*precision may be defined by the probability of hitting the target*'[7]. Accordingly, all that remains is to define the concept of *high* in the definition of HPW on the basis of the previously established concepts of *weapons* and *precision*. When should precision be qualified as being *high*?

At the present stage of military hardware development, many models of MD (missiles, shells, bombs, mines, and torpedoes) have such a level of precision, as do promising models of ray weapons, especially lasers.

In summarizing the aforesaid, one may formulate two definitions:

1) HPW are all MD, and perhaps certain models of ray weapons, having a probability of directly hitting particular single model target objects that is in excess of 0.5 for the entire range of firing (launch) distances, under all rated conditions for their application in combat;

2) HEW are means of defeat (guided and non-guided) having a probability of hitting model targets, including area and cluster targets, that is greater than 0.5 for the entire range of their combat conditions.

The first of these short definitions in respect of MD essentially coincides fully with the definition of PGM in the United States and NATO; it is also set forth in the Russian Military Encyclopedia. The second corresponds to the weapons being developed in accordance with the concept of *fire and defeat*.

However, the latest designs of MD and of means for their application are advancing even further, and it will be necessary to define new qualities, enabling us to speak of the advent of a fundamentally new phase in weapons development.

Firstly, the level of precision expressed as target strike probability of 0.5 has already been surpassed in many systems, and so the high capability of *improved* weapons to hit a target should probably be defined by another, more rigorous condition. For example: $P >= z$, where the irrational number $z = (\sqrt{5} - 1)/2 \sim 0.62$ is related to the so-called golden section, which has long been known to correspond to man's perceptions of perfection.

Secondly and most importantly, the installation in MD guidance and delivery systems of achievements in sensor and computer technology, of ever-more complex information-processing algorithms, advanced computer software and other developments in information science and cybernetics makes it possible to *intellectualize* weapons. This in turn makes it possible to trust that once fired into the target's region, means of defeat will perform such functions as seeking out the target, locating it even against a complex background or given interference, select the direction for running at the target and the most vulnerable segment of a complex target, optimize the conditions for shell destruction, etc.

These perceptions of new qualities and the new stage of weapons development enable us to formulate one further definition: high-intelligence weapons (HIW), which would appear to us to correspond to the contemporary interpretation of the English word *smart*.

HIW consist of such GDF, and perhaps several other models of weapons, which are capable of performing a number of intellectual functions in a human-like way in regard to seeking out targets and optimizing the conditions for their defeat with a probability in excess of 0.62 for the entire range of their firing (launch) distances, under all rated conditions for their application in combat.

It is worthwhile to recollect that generally speaking, definitions are not correct or incorrect. They may insufficiently reflect reality, they may be erroneous (i.e. with internal contradictions) or unproductive upon their practical application. The passage of time demonstrates the degree of productivity of any given definition.

Weapons Efficiency Specifications

During the development and improvement of advanced weapons, much attention was devoted to precision. But precision, in the strict sense of the word, is a technical specification rather than a combat-related one.

The fundamental quality of any weapon is its efficiency. According to the established concept, efficiency is '*the aggregate of the specifications pertaining to the extent of target destruction*', numerically 'expressed by the probability of destruction, the mathematical estimate of the number of targets destroyed, the guaranteed damage and other indices'[8]. In other words, efficiency is the fundamental combat specification of weapons, is

expressed by means of the damage being caused to the enemy and, naturally, is ensured by way of rational combining of all of the given weapon's subsystems. Hence one can speak of the contribution made to efficiency by each subsystem and its specifications.

The greatest contribution to weapon efficiency comes from target strike precision and charge force. Normally, the so-called coordinate laws of target destruction are used as sufficiently all-encompassing specifications for munitions; these laws are in the form of expressing target destruction as a function of the place of shell explosion. Often, however, the *quality* of a shell may be expressed not by a function, but by a number: the size of the destruction area or the radius of the circular model target destruction zone. In such cases, the destruction zone may not coincide with the actual dimensions of the target – it can be either smaller or larger than these dimensions, depending on the type of target and the type of shell.

So, as far as the definitions of HPW and HEW are concerned, it is important to stress that the first deals with a direct hit to the space actually being occupied by the target, while the second concerns a hit to a given zone or area of destruction.

In many instances, a high degree of weapons efficiency may be ensured by increasing either precision or charge force, especially through the rational distribution of the destructive effect over a [given] space. In connection with the aforesaid, let us take as an example one well-known[9] function: the probability of destruction of the target P as a function of precision (Greek sigma), expressed by the average square deviation (ASD), and also as a function of charge force q for the case of circular dissemination and a high-explosive blast effect upon the target. This function is as follows:

P = 1 - exp{-k * q^(2/3) * δ^(-2)}.

From the condition ΔP = (dP/dq) *Δq + (dP/db) * Δb = 0, it follows that Δq/q = - 3 * (Δb/b), i.e. the same relative increase in q affects target destruction probability three times less than does the same relative decrease in the ASD of δ. Hereinafter the simple Δ signifies the augmentation of the variable whose symbol comes after it, dP/dq is a partial derivative. The symbol "^" signifies that the figure following it in parentheses is being raised to a power. The symbol "*" indicates multiplication, and "k" is the coefficient characterizing the target's particular qualities. The importance of target precision as a weapons specification becomes clear when one compares the necessary force level (or number of units) for single-target destruction by nuclear and conventional (highly explosive) weapons. While the latter have considerable force (more than is necessary to defeat a target in the event of a direct hit), there is always a certain threshold precision value at which test units of destruction forces (conventional and nuclear) become equalized. At that point, conventional HEW, in terms of efficiency (when acting upon a single target) prove to be just as powerful as tactical nuclear weapons. In an analogous manner, if the ASD of dissemination is such that the shell will fall directly onto the target and the charge [within it] ensures target destruction, then HPW will also prove to be just as powerful as tactical nuclear weapons.

However, in those instances where the target is durable enough that one non-nuclear HPW charge is not capable of destroying it even in the event of a direct hit, simply increasing the high-precision weapons unit (within reasonable limits) will not bring about the destruction of the target. Formally speaking, this is expressed by the fact that target destruction probability, in the case of firing at the target "n" times, is equal to Pn = 1 (1-P)^n. Therefore, given values that are close to zero for the probability "P" of destroying the target with one shot (launch), it is basically impossible to increase Pn by way of increasing n.

HIW are another matter altogether. By earmarking strike points on vulnerable segments of the target and establishing special laws of destruction – especially, for example, when launching a series of strikes against one particular spot (gonging) – the

formula given above can be proved to be unjust. Damage accrues and various cumulative effects come into play, especially in the case of consecutive application of various destructive factors (shell splintering, high-explosiveness, flammability, etc.). HIW units may turn out to be applicable even for strikes against highly durable and protected facilities such as launch silos and state control centers or against environmentally hazardous facilities like chemical industry enterprises, nuclear power plants, dams and so forth. Thanks to the capability of seeking out targets in a particular region, the destruction of mobile missile systems is possible. Taken together, these capabilities signify that in terms of their efficiency, HIW are approaching the level of strategic nuclear weapons!

The next important point to consider when evaluating weapons is analysis of precision and efficiency as functions of firing (launch) distance. Of course, in the case of MD, not only the charge must be delivered to the target, but the delivery system apparatus as well. Therefore, the charge mass of the MD being delivered is less than that of unguided destruction forces. On the other hand, for many MD (especially HIW), precision is essentially independent of distance, while for unguided weapons precision drops as distance increases, and at a rate that is more dramatic than a linear function. As a result, the probability of target destruction at maximum distance declines sharply for unguided destruction forces, while it does not for MD. Even in the case of launch (firing) from a great distance, MD are still in the HEW category.

Thus, HIW enable complexes equipped with such weapons to ensure efficient firing at targets over a considerable territory or within the limits of a considerable efficient firing zone. In addition, there is one further circumstance that is extremely important. MD flight moves along trajectories that differ from ballistic missile ones, which allow for the calculation of the missile's launch point based on observing the trajectories, thereby reducing the probability of destroying HIW carriers in combat or in extended military actions.

Evaluation of this situation is possible only at a higher level of the hierarchy, where consideration is given not to the efficiency of a particular means of destruction but to the efficiency of the complex to which such weapons belong. Let us examine one simple example of such an efficiency evaluation.

The mathematical estimate for the number of targets destroyed by a carrier of defeat forces that are repeatedly performing the same combat missions, for the course of said carrier's *combat life*, may be expressed as follows:

$W = P * r * Q * n,$

where $n = 1/(1–Q * R)$ is the mathematical estimate for the number of combat missions (flights) of the weapons carrier (complex); "r" is the average munitions load of the means of destruction on the carrier; "Q" is the estimated probability of carrier non-destruction as a function of the conditions under which the MD are being used; and "R" is the estimated probability of carrier non-destruction as a function of other factors. In examining the influence of "P" and "Q" upon "W", let us note that the condition $\Delta W=(dW/dP)*\Delta P + (dW/dQ)*\Delta Q=0$ points to the ratio $\Delta P/P=-(\Delta Q/Q)*n$.

Given the values customarily used in calculations for, say, airborne carriers of weapons – Q = 0.98…0.97; R = 0.99…0.98 – we find that the contribution to W from the increase in the probability of carrier non-destruction Q is 20 to 30 times *more weighty* than the contribution from the increase in target destruction probability P. This fact, among other reasons, explains the tremendous attention paid to cruise missiles. To put it simply, they are *roaming* missiles with two very important properties:

1) their precision depends very little, or does not depend at all, upon distance, even when the values for distance are very great;

2) the enemy's observations of the missile in particular sections of its flight trajectory do not enable him to determine its starting place or to discover the

location of the system from which it was launched.

Let us note another significant factor which explains the influence exercised by the high degree of HIW efficiency on the nature of modern military operations. This factor consists of the quick acceleration of the process by which enemy forces are exhausted. The significance of this factor does not lie in the efficiency of a particular complex equipped with such forces, and may be explained only using the model of bilateral military actions, even the simplest of Lanchester models[7].

Omitting the mathematical computations, let us simply note that an increase in weapons precision, expressed by the value for the relative decrease in the ASD, has a greater effect on combat outcome than does the same relative increase in the number of complexes of weapons and munitions for destruction forces. On the whole, an increase in strike precision and effectiveness, especially when HIW are used, brings about an increase in 'effective early firing'. As a consequence, combat, using such weapons, proves to be of short duration. The size of the forces engaging in combat rapidly decreases to the minimum value on both sides, if both sides have been equipped with such weapons, or on the side having the worse equipment.

Analogous conclusions may be drawn on the basis of more detailed assessments made using models of far greater complexity, which approximate a description of real combat and operations. Experience in studying and carrying out military actions bears testimony to this fact, especially in the Arab-Israeli conflicts in the Middle East. Let us note merely that the high efficiency specifications of HIW models are attained, given a sufficiently high level of informational support for their application (intelligence, data transfer, combat management/planning). It also includes information supremacy, at least locally in the HPW application zone, over the enemy's radio, communications and detection systems. HIW, in *taking upon themselves* a portion of the intellectual functions, may in some cases reduce the requirements on the quality of support for their utilization.

In conclusion, let us turn for a moment to an evaluation of these weapons from the military economic standpoint. One possible approach is based upon using as the general economic index "S" of total costs for the destruction of a certain quantity "M" of model targets (objects of destruction):

$$S = sn * Nn + sk * Nk + sb * Nk * n,$$

where "sn" is the cost of one weapon; "sk" is the cost of one carrier (complex); "sb" is the cost of all types of support for one combat mission (flight) by the carrier in order to fulfil a combat assignment; $Nn = M * (1 + e)/P + Nk * r$ is the estimated number of destruction forces being spent on putting "M" targets out of service; $Nk = M/W$ is the estimated number of carriers required in order to carry out this same number of combat missions; and "e" is the relative percentage of destruction forces lost during the time of the operation as a result of enemy strikes against storage sites and positions for weapons preparation.

Let us note that the respective quantities of defeat means and carriers in the formula being considered here are balanced, i.e. on the average the weapons supply corresponds to the total number of combat missions (flights) made by units over the course of their *combat life*.

Using the ratios given previously, one can determine the specific costs for the destruction of one model target:

$$s = S/M = sn *(1 + e + (1–Q * R)/Q)/P + sk * (1– Q * R)/P/Q/r + Sb/P/Q/r$$

In the particular case of ($R \sim 1$; $e \sim 0$), which was typical of actions by the multinational airforce coalition against Iraq, this expression is simplified considerably:

$$s = (sn + (sk *(1– Q) + sb)/r)/Q$$

The calculations performed for model situations have demonstrated that even in those instances where an increase in

destruction force efficiency (the transition to the HIW category) is accompanied by a more than tenfold increase in the cost of each model, the total costs "S" for the defeat of the given number of targets decreases, and significantly, at that. This fact may be explained both by the reduced expenditure of destruction forces and by the reduced number of carriers required.

Also in favor of HIW is the important factor, more psychological than economic, of reducing losses among personnel (in companies, in combat calculations) using HIW. After all, what underlies the impassive concepts of complex *combat life* and 'probability of carrier non-destruction' for GDF are the lives and destinies of many people. The assessments given above are clearly approximations, but this does not negate their usefulness. More precise results may be derived from full-scale modeling of combat operations and modeling the military economy, but with these models it is more difficult to trace the interrelations among the various defeat means specifications.

Experience with using HPW in military actions fully confirms both the military-technical and the military-economic worth of creating HPW and supplying them to the Armed Forces. This would not be an indiscriminate transition to HPW or HIW. If one has analyzed weapons production volumes in the leading countries of the world, one cannot fail to notice the ever-increasing share of MD manufacture in the overall production volume of destruction forces.

The implementation of superior weapons, among other factors, enabled the multinational UN forces to achieve victory over the armed forces of Iraq in 1991. While only certain types of HPW have demonstrated their merit in previous armed conflicts over recent years (anti-ship missiles in the area of the Falkland Islands, anti-radar station missiles and guided air bombs in Lebanon), in the war against Iraq HPW were widely used and played a decisive role. The air-based anti-radar station missiles and Naval Forces' cruise missiles, in conjunction with radio and communications systems, ensured that supremacy was secured in the air and that aircraft losses were reduced to the minimum level (Q ~ 0.995 at the beginning of the war and 0.998-0.999 during its latter half). This enabled aircraft to use high-efficiency HPW: P > 0.5. In cases where high precision was not required – for example, during the suppression of combat units of Iraqi forces – non-guided weapons were successfully used. On the combat flights performed in order to make assessments, approximately 30 to 50 thousand MD may have been used, which made it possible to essentially eliminate Iraq's military potential and to predetermine the outcome of the war prior to the use of land forces. Moreover, one can say that without HPW, this war would have been altogether different and the United States might not have taken the risk of engaging in it, even under the UN flag.

From the military economic standpoint, the application of HPW also proved to be sustainable and not destructive at least for the countries, participating in the multinational coalition. Let us note that the economic capacities of NATO countries are such that less than one year would be required in order to restore the level of HPW estimated to have been used against Iraq.

Military Strategy Aspects of Contemporary HIW

At the outset, HPW were regarded strictly as a means of defeat which was applied in military actions and had operative and tactical effects. But once the military and political role of HPW had been analyzed[10], the dual nature of its potential strategic designation was noted: both as means of assault and as means of deterrence. This evaluation was brought to the military and political leadership of the Russian Federation in the form of special materials prepared by the *RAU-Corporation*, and they were greeted with understanding. The Statement issued by the Presidium of the Russian Federation Supreme Soviet "*On Priorities in Russian Federation Military Policy*", dated April 1st, 1992, reads as follows, 'Forces with high-precision weapons and delivery systems for them should become the main factor of deterring large-scale conflicts and local wars from breaking out against Russia and the

other CIS member states.' In a Statement made by two academies of science (the US National Academy of Science and the Russian Academy of Sciences), approved by the Presidents of the Academies on April 1st, 1994, long-range HPW were unambiguously classified as strategically dangerous types of weapons.

The serious nature of the article does not make one inclined to joke. But how else can one explain why the two above-mentioned statements had such an effect in Russia's governmental circles (April 1 in Russia is April-fool-day)? The Supreme Soviet, having infringed upon the right to determine the direction of Russia's military policy, was disbanded. The second statement (that of the two academies) was published only in the United States. In reality, the United States turned out to be the country setting the tone in the development of non-nuclear HIW, outstripping in this field not just Russia, but all other countries, as well.

Perhaps this is the reason why the US political leaders perceive the strategic significance of contemporary HPW and HIW not as lying in its dual nature, but merely as means of non-nuclear deterrence. On the basis of such statements, certain Russian political scientists hastily draw the conclusion that all of the new means of deterrence with which the US armed forces will be equipped are directed not against Russia – since the Cold War with Russia, or rather with the former Soviet Union, has already ended – but against third countries. Russia, as a nuclear power, is supposedly being regarded from the strategic standpoint, strictly in connection with its nuclear weapons. In this domain agreements exist, so there are no problems.

However, by attentively reading the components of the new 'global threat', described by President Clinton in his address while speaking on the budget for the 1997 fiscal year, and comparing it with the thus far unwarranted claims of the international community upon Russia, one can also come to the exact opposite conclusion. Namely, in military terms, for the time being Russia is perceived by America as a *doubly dangerous* country: both as the only country in the world capable (at least for now) of destroying the United States with its nuclear missiles, and as a source of *new* threats.

The US military and political leadership, while still paying attention to strategic nuclear deterrence (against the traditional nuclear threat), declares that 'in future, the greatest attention will be devoted to guaranteed deterrence by conventional forces' (against the newly emerging global threat).

The role of the air force is retaining its traditional importance, and at the same time the role of naval forces is growing considerably. In the "*National Military Strategy of the United States*", as is well-known, these forces are charged with three fundamental tasks: supremacy at sea; carrying military might beyond the borders of the continental United States; and deterrence in both of the senses given above (against the nuclear threat and *new* threats). Among the armed combat forces, 'smart weapon' (HIW) and 'smart targeting' are designated. The latter refers not only to these weapons' traditional capability to locate the target during targeting and to ensure that it is hit, but also to 'the determination of targets' importance to the enemy'.

The new sea-based HIW carrier, called the *arsenal ship*, is rigged with 500 standardized below-deck launchers for the vertical launching of various classes of missiles. The ship's design provides for a number of features to reduce its visibility, to include taking sea water into special tanks and making the transition to a half-submerged state. New missile modifications are designed to ensure the destruction of both stationary and mobile targets, and for multiple targets there is the multiple-charge option, the use of which can increase the potential number of highlighted targets destroyed in one volley of fire from 500 to 4 or 5 thousand.

Data exist which indicate that at the beginning of the XXI century, there will be three or four of these missile-carrying vessels in the US Navy.

Of course, the overall combat potential of these deterrence forces is tremendous. The United States will probably be able to contain any third country in the future, treating them just like Iraq in 1996, i.e. striking even when the government is resolving its own internal problems on its own territory, which for some reason contradicts the US *interests*.

Following the *logic* of the political scientists referred to above, one might think that all of these forces were designed for the deterrence of the *bad* countries, Iraq first among them, that are so often mentioned, or even of the leaders and warriors of certain African tribes. However, in comparing the number of the US missiles plus non-nuclear forces deployed on other (sea- and air-based) carriers with the total number of the Russian Federation's strategic missile systems (especially after the reductions that are intended and imminently upcoming), one must consider this total combat potential not just as deterrence potential, but also as potential for a disarming strike. In respect to the Russian Federation, the use of these weapons (or even an ultimatum with the threat of their use) could mean the instantaneous removal of all of the above-mentioned threats, real and imaginary, which the USA can see in Russia. But the USA will not announce such a pre-designation of these forces, for reasons which are entirely understandable, for some time to come, even though in theory it is not contrary to the international conventions restricting the development and application of weapons.
Moreover, the removal of these forces beyond the limits of the US territory and their deployment on missile carriers increases the impunity of non-nuclear HIW usage.

There are no grounds on which to speak of the US intentions, since we do not know what they are. We can, however, speak of military and technical capabilities, and they will soon make it possible to launch a destructive strike against Russia's strategic forces, thereby depriving Russia of any significant capability whatsoever of launching a counter-strike against facilities located on the US territory or other facilities with which the USA associates its *vital interests*. Because of these very qualities, the new weapons may destroy the status quo of strategic stability for two reasons: 1) the temptation to use these weapons on the part of the side monopolizing their possession, thereby *immediately solving all problems*; and 2) an act of *despair* on the part of the other side, having suddenly become cognizant of the violation of the balance of forces and the dramatic decline of its own role.

Conclusions

1. In one sense, the high-intelligence means of defeat that are now being created approximate nuclear weapons in terms of their combat capabilities, and they can also act as both means of aggression and means of deterrence.
2. Under these conditions, one can no longer view strategic stability strictly as a function of nuclear weapons even in superpower relations. The total (nuclear and non-nuclear) potential for aggression and the nuclear and non-nuclear potential for a counter-strike must be taken into consideration. It is also necessary to maintain strategic stability in today's world.
3. The obvious consequence of these conclusions is the concern expressed by the international community over how new non-nuclear strategically dangerous weapons are developed and disseminated and how international control over these processes is to be organized.

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Polemics

EVOLUTION OF RUSSIAN STRATEGIC OFFENSIVE WEAPONS

by Nikolai Sokov,
Senior Research Associate,
Monterey Institute of International Studies

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The unstoppable crisis with financing, the discussion around the signed but not ratified START II treaty, numerous purely technical problems with arms modernization, - all of it makes the life of servicemen an unending struggle for survival. If there are long-term plans for the evolution of strategic weapons (experience shows that they must exist), they remain closed to the public both because of secrecy requirements and simply because daily problems distract not just the servicemen, but also the political authorities and members of parliament. In such a situation, a view of an outsider, who is not directly engaged in highly complicated battles over the current problems, presents certain advantages: it gives the opportunity to analyze the long-term trends in the evolution of Russian strategic weapons and to predict how they might look like in 10-15 years.

Such a *bird's eye view* shows a situation, which, though difficult enough, is far from being as gloomy as many would see it today. The main conclusion is that if in the coming years Russia succeeds in assuring financing at least at the level, provided for (though, as we know, not implemented) in the budget, then by 2010 it will have a comparatively small - about 2,000 warheads - but well-balanced arsenal, which will feature high degree of resistance to a first strike of any existing nuclear powers or a coalition of them and capable, therefore, of a retaliatory strike. That is to say, nuclear weapons will reliably perform their key function, which is to prevent a large-scale military conflict. The strategic posture will also be flexible enough to accommodate practically any further nuclear arms reduction measures. The issue of the extent to which nuclear weapons can support other missions that had been assigned to them in recent years (such as deterrence of local conflicts) should be considered separately because it is not quite clear if nuclear weapons can cope with such limited tasks at all.

The frequent proposals to reject the START II treaty and return to MIRVed ICBMs should be assessed within this framework as well. Indeed, such a decision could allow a comparatively rapid build-up of the overall arsenal, but it would represent a return to the quantitative path of the development of the strategic arsenal. A simple and quick solution is not always the best one. Despite all the difficulties of its present situation Russia is able to place the emphasis upon the qualitative parameters of its arsenal instead of the traditional quantitative ones, assuring strategic stability through the survivability of its strategic weapons and the ability to ride out a hypothetical first strike.

The article begins with a brief review of the existing strategic modernization programs. Next, it is followed by an analysis of the main qualitative characteristics of the future arsenal, in particular its comparison to the plans developed prior to the disintegration of the Soviet Union. To conclude, I will propose certain considerations regarding the objective limits of the tasks that can be performed by nuclear weapons: these limits should define the further evolution of strategic weapons, as well as, apparently, the need in further reduction: it is senseless to create weapons for the tasks, which can not be accomplished by nuclear arms in principle.

Russian Strategic Modernization Programs

An innovation in strategic weapons development is staged modernization. During the Soviet period, all three or at least two of the legs of the triad used to be upgraded at the same time. At present,

modernization of ICBMs is in full swing: in the fall of 1997 a new Topol-M silo-based missile system was adopted for deployment, a road-mobile version of Topol-M is now awaiting its turn. The modernization of the naval component is only at the initial stage: in the end of 1996 the construction of a new Project 955 SSBN (Yuri Dolgoruky) was commenced; it represents further development of the Project 667 *BDRM* (Delta IV in NATO classification); a new SLBM is being designed for the new submarine. The new SSBN will become operational only in the next century. New heavy bomber is apparently only at the stage of concept development or, at the best, at the research stage.

Modernization is stretched over time slowly primarily as a result of financial problems. It is clear, that Russia simply cannot finance a large-scale modernization. Apparently, the selection of priorities (the sequence of the programs) is determined by other considerations.

After the breakup of the Soviet Union, the main producer of the ICBMs (NPO *Yuzhnoye*) remained outside Russia. The START II treaty in part reflected the complicated struggle over the withdrawal of nuclear weapons from Ukraine by prohibiting multiple individually targetable reentry vehicle ICBMs (it is worth mentioning that in the spring of 1992, at the stage when the basic provisions of the future treaty were being negotiated, the non-nuclear status of Ukraine still seemed a distant and difficult-to-achieve objective). The principal decision to allow only single-warhead ICBMs (the only type of ICBMs manufactured in the Russian territory) was then adopted. It is a separate question whether that decision was sufficiently well founded, but it required urgent completion of R&D on a single-warhead silo-based ICBM, immediately followed by the creation of an upgraded mobile ICBM to replace Topol, whose warranty periods would have expired by 2000[1]. It was expected that submarines could serve long enough allowing to focus the efforts on ICBMs. Heavy bombers TU-95MS and TU-160, which were produced in the 1980s, had even longer warranty periods and, in addition to that, there was a hope to withdraw or at least purchase 19 TU-160 remaining in Ukraine (ultimately these plans failed).

Accordingly, START II and the warranty periods of the then deployed weapons have determined the order of priorities: ICBMs first, then the naval component, and finally heavy bombers. It is a different matter that the initial plans are being stretched out because of insufficient funding.

The development of Topol-M, designed in the Moscow Institute of Thermotechnics, started in the 1980s, and in February of 1993, soon after signing of START II, President Yeltsin issued a decree, which determined the basic parameters of the work on a new missile system. In the last days of 1997 the first two silo-based missiles were put on a test combat duty.

A distinguishing feature of the work on Topol-M is an extremely short test series: the decision to commission it for the deployment was made only after four launches - the first launch was conducted in February 1993 and the fourth and the last one - in October of 1997[2]. Moreover, even the third launch was not quite successful. In essence, the missile system was put on combat duty after only one trouble-free launch (according to Vladimir Yakovlev, Chief of Russian Strategic Rocket Force (SRF), all the four launches were successful[3]). In the Soviet period, an average test series consisted of 15-20 launches[4]. Furthermore, according to START II, new ICBMs are subject to notifications only after the seventh launch (the treaty requires a notification about its throw-weight), and the total of 20 test launches is allowed before the side to the Treaty must either adopt the new missile or abandon it[5]. That is to say, in the in the end of 1980s no one in the USSR or in the United States could imagine a test series so short.

Of course, the continuing lack of founding explains for the radically reduced test series. But apparently there are also some other circumstances, which mitigate the potential shortcomings that result from the insufficient number of launches. First, Topol-M is

derived from an existing missile system, which, naturally, reduces the demands on the amount of work needed. Second, the number of flight tests can be considerably reduced simply by more meticulous work on each launch: it is no secret that in the Soviet period no one was saving on the launches[6]. More meticulous preparatory work allows to reduce the number of tests in and of itself; some suggest that a modification of traditional procedures has allowed to save 21 billion rubles and about two years of work[7].

The combination of mobile and silo-based ICBM provides a sufficiently high level of survivability of the ground-based leg of the triad because each class of weapons has its own, specific survivability features. Mobile systems can escape from the strike after receiving a warning or, in the case of systems on combat duty, remain in a place, which is difficult to monitor in real time and, consequently, to target. Topol-M has several advantages over its predecessor. In particular, it can be launched from anywhere in the deployment area (rather than from a limited number of predetermined launch positions) and has improved concealment capabilities against optical and other reconnaissance means[8]. As for stationary ICBM deployed in highly protected silos, they can be destroyed only in case of almost direct hit.

In both cases, the relationship between the number of warheads required to eliminate these ICBMs and the number of ICBMs will not be in favor of the attacker (for instance, the destruction of one silo-based single-warhead ICBM requires two or three warheads), which allows to preserve the retaliatory strike capability. This is the main difference of the land-based leg of the triad composed solely of single-warhead ICBMs compared to a traditional Soviet posture: for MIRVed ICBM, this relationship might be not in favor of the defending side, creating incentives to assume the strike on warning strategy.

The improved capability to penetrate an ABM system deserves special attention; it has been reportedly improved compared to Topol. The missile is more powerful, allowing to reduce the effectiveness of anti-missile defense at the boost stage[9]. In addition, according to some reports, Topol-M carries more penetration aids than the American MX with 10 warheads[10]. Finally, according to information from Western sources, Topol-M is equipped with a maneuverable front section[11] (Russian sources does not contain such information); if this is true, Topol-M marks a considerable breakthrough in the field of defense penetration capabilities.

However, Topol-M is not an ideal missile; its selection probably could be explained by the *absence of other alternatives*. In the time when START II was discussed numerous publications disclosed its shortcomings (paradoxically, this obviously secret information was first made public by *Pravda*[12]) According to this information, Topol's mobile launchers have comparatively *low speed* and *poor protection,* limiting its ability to escape from an incoming strike with short warning and making it vulnerable to effects of a nuclear explosion, in particular the blast wave. Though apparently designers succeeded in improving Topol-M, its weight and size parameters are too close to those of Topol[13], which creates unavoidable limits to avoiding these shortcomings. In any case, according to P. Belov, a breakthrough has not been achieved[14].

Full utilization of the advantages in terms of enhanced survivability offered by mobility would require the creation of a lighter and better protected missile system, meaning the creation of a missile lighter than Topol-M, whose weight and size would be similar to those of the American Midgetman, development of which was terminated in 1991. The Soviet Union was also moving in that direction and designed a Courier missile system[15], which reached the flight-test stage of R&D by 1991. President Gorbachev announced the cancellation of this program in his statement of October 5, 1991 in response to the termination of work on Midgetment announced by President Bush a week earlier.

It appears, however, that Russia can hardly avoid the replacement of Topol-M with a

new, better single-warhead missile with dual basing mode. This, of course, could be done only in a remote future because Russia is unlikely to find funds for that for a long time to come. Topol-M can remain operational for a long time and neither the international situation nor the dynamics of the nuclear balance call for its early replacement.

A return to MIRVed ICBM is another possible way of the development of the land-based leg of the triad. This option might become feasible in the case the United States approaches or, even more, begins to deploy an ABM system. A possible response to this step could be the equipment of Topol-M with three warheads[16].

There are also farther-reaching proposals. For example, Anton Surikov proposed to equip Topol-M with seven reentry vehicles[17]. His other suggestion is that the R-36M2 heavy ICBM should be resurrected based on a completely Russian production capability. According to his calculations, R&D will take four years and then it will be possible to deploy up to 50-70 heavy ICBM per year[18]. The implementation of proposals like this, however, is hampered by the shortage of funding and, even more important, by the absence of serious long-term rationale. Suppose that in two or three years we succeed in building up the R-36M2 force to match the level of the Soviet-time number of these missiles in the territory of Russia (154 missile systems) and, as he suggests, to subsequently deploy additional 180 such missiles. It is obvious that after five years of buildup it will be impossible to simply stop production; accordingly it will become necessary to modernize and replace R-36M2 with a new type. As a result, Russia will embark on the path similar to that of the USSR at the end of the 1980s. The question is whether we need this.

It appears more logical to respond to deployment of an ABM system in the United States by equipping Topol-M with three warheads, but one here has to exercise caution. Whether such is advisable will depend, first of all, on the efficiency of the future ABM system - it is not in every case that MIRVed ICBMs will be needed to penetrate it. According to quite a conservative estimate by *RAU-Corporation*, even under the conditions of START II, that is, if MIRVed ICBMs are prohibited, and even under the most unfavorable realistically possible circumstances (the first strike of the United States, the loss of 70-80% of the Russian strategic warheads, 50% effectiveness of the US ABM system) about 350-500 warheads could be delivered in a second strike[19]. This would be quite sufficient for deterrence, and the switch to MIRVed ICBM would not be required. It is a different matter that the events might be overtaken by the development of the political situation in Russia. In real life, any version of ABM system or even just steps in that direction can raise an extremely negative reaction of the Russian political elite, especially in the State Duma, and stimulate efforts to equip Topol-M with MIRVs.

Even as the situation with the land-based leg of the triad is clear enough, modernization of the naval component is only at the initial stage, and there is still much uncertainty, at least judging by the publicly available sources. At the end of 1996, keel was laid for a new strategic missile cruiser (SSBN), Yuri Dolgoruky, the first in the *Borei* (project 955[20]) series, which is intended to partially replace the existing types of SSBNs. *Borei* represents further development of 667 *BDRM* project (a.k.a. Delphin or Delta IV[21]) though in the West some speculate that *Borei* represents the follow-on to project 941 (a.k.a. Typhoon or Akula[22]).

Reportedly, Yuri Dolgoruky will carry the R-39UTTKh[23] SLBM (D-31 missile system; SS-N-20 in NATO classification) – a variant of solid fuel R-39 (D-19 missile system, a.k.a. SS-N-20 and RCM-52). This missile system was deployed at project 941 SSBNs, which probably accounts for the suggestion that *Borei* represented a follow-on to that project. The advanced version, according to certain data, is supposed to have increased range and better precision[24].

At the same time, there are several uncertainties. R-39UTTKh was created in the second half of the 1980s to replace SLBMs deployed at project 941. This process has

begun in 1991[25]. Naturally, a question arises if the submarine, which continues the series of projects 667, should indeed carry a missile system *borrowed* from another type. A follow-on to the R-29RM liquid fuel missile (D-9RM missile system, a.k.a. SS-N-23 or RSM-54) which is deployed at *BDRM* 667 SSBN type, would seem a more logical option. Indeed, the work on such new missile is being carried out in the design office of Miass city, which created all modern type of SLBMs[26]. However, the work proceeds slowly, with delays compared to the originally foreseen schedule[27].

One can reasonably suppose that the delay of the R-29RM modernization program could result in the decision to equip Yuri Dolgoruky with R-39UTTKh. Subsequently, events might take one of several directions. One cannot exclude that the whole series of the project 955 SSBNs will be equipped with solid fuel R-39UTTKh. Since Yuri Dolgoruky carries 12 missiles[28], the number of warheads may reach 120 (if the new version carries as many warheads as R-39), nearly doubling the capacity of the 667 *BDRM* project submarines (64). It is quite possible also that the number of warheads at R-39*UTTKh* will be reduced to five or six; in this case new SSBN will carry from 60 to 72 warheads.

Another possibility is to equip only the first submarine of the new type with R-39UTTKh, whereas the rest would be equipped with new liquid-fuel missiles, developed on the basis of R-29RM. In this case, Yuri Dolgoruky might become the only submarine in its class (at least, in legal terms, for the START I treaty purposes), while the remaining, similar submarines with missiles of a different type will be counted as a separate class.

Finally, one cannot exclude the possibility that the plan is to complete R&D on the new liquid fuel missile during the time when Yuri Dolgoruky is under construction. In the view of the recent failed flight-test of the new SLBM[29], one may imagine that effort would be ultimately concentrated on the liquid SLBM. In case the 955 project is equipped with this missile, each submarine will carry 48 RVs, if the number of RVs of the new missile equals that of R-29RM.

As for the third component of the nuclear triad, strategic bombers, modernization here is only at a very early stage. Moreover, a year or two ago it seemed that this component would not be subject to modernization at all: the production of new type of heavy bombers, TU-160, was terminated by Gorbachev, in part because of their high cost, and resumption of production seemed unlikely for financial problems. In any case, one could expect that R&D on a new heavy bomber would not resume any time soon because even the TU-95MS and TU160 heavy bombers produced in the 1980s could remain in service for up to 30 years. Bearing in mind that the majority of TU-160s remained in Ukraine and the negotiations on their transfer to Russia or even purchase failed, one could expect the extinction of the air leg of the triad.

In principle, Russia apparently could do even without heavy bombers because the vast majority of the tasks assigned to nuclear-weapons can be performed either by land-based or by sea-based legs of the triad or by medium bombers. Nevertheless, there is a problem, which the START I treaty creates: pursuant to its provisions, only heavy bombers are allowed to carry air-launched cruise missiles (ALCMs) with nuclear warheads. So the real question is not whether Russia needs heavy bombers or not, but rather whether Russia needs nuclear ALCMs.

The value of ALCMs is determined by their high efficiency in penetrating ABM systems; given the absence of MIRVed ICBM, this mission acquires even greater importance. Probability that the United States would abandoning the ABM Treaty remains high and apparently determines the need to have nuclear ALCMs within the triad. In any case, Vladimir Yakovlev, Chief of Russian SRF, unambiguously stated that a balanced triad requires the presence of the air component, positing direct connection between the need in heavy bombers and the need in nuclear ALCM[30].

The signs of renewed interest to heavy bombers appeared in 1997. In fall of 1997, a decision was adopted to complete the construction of six TU-160, which remained half-finished after Mikhail Gorbachev's decision[31]. There has been no decision on full-scale production of the bombers of this type, however, which can be attributed to the fact that TU-160s already represent outdated, to a certain extent, technology; in 10-15 years they will be an ever worse match to the modern technological level. The publicly available variants of the Russian strategic posture proceed from the notion of a more or less constant number of heavy bombers, approximately 80; the increase or decrease of the air leg as a share of the total number of warheads depended only on the possibility of downloading TU-95MS from 16 to six ALCM[32].

The work on creation of a new heavy bomber has been also started. In summer of 1997 Gen. Pyotr Deinekin, the then Chief of Russian Air Force, declared that new types of combat aircraft were being designed[33], and soon after that I. Shevchuk, chief designer of the *Tupolev* design bureau, announced that work was being performed to replace both the medium TU-22M3 bomber and the heavy TU-160[34]. We can only guess what the characteristics of the new bomber could be: this can be either a very simple bomber, serving only as a launch platform for ALCMs, or, on the other hand, a technically advanced aircraft capable of performing a wide range of tasks. According to some data, the new heavy bomber might already be commissioned in 2005[35], which seems quite questionable, though, because it is unlikely that required funding could be assured in coming years.

At the same time, the R&D on a new ALCM is in full swing[36]. The nuclear Kh-55 ALCM had been modified to carry conventional warhead (Kh-65) by 1992. In the end of the 1980s, development of a supersonic ALCM began, but after several flight tests, the program was suspended. Instead, by 1995 a supersonic Kh-101 ALCM had been created, with considerably enhanced precision (up to 12-20 meters).

Key Features of the Russian Strategic Nuclear Triad

Tentatively, by 2010 modernization of the Russian strategic weapons will reach its peak. Within the land-based component, the replacement of the Topol missiles with Topol-M will be close to completion; the second submarine of the project 955 class will be probably under construction; the production of a new type heavy bombers might also have been started. The advances and the pace of modernization will mostly depend on funding: if Russia succeeds to achieve economic growth, no matter how small initially, it will be probably feasible to provide funding at least at the level planned (but never implemented) in the recent years. In this case the rather optimistic forecast of this article may become reality.

The modernized Russian arsenal will have a reasonably balanced structure and possess features, favorably distinguishing it from the traditional Soviet strategic posture. This means, first of all, low concentration of warheads on delivery vehicles, which could be considered one of the primary aggregate indicators of survivability under a hypothetical first strike.

It has been mentioned above that in general terms the average number of warheads the attacking side needs to destroy a delivery vehicle of the attacked side is two or three. Naturally, in case of submarines this relationship is more complicated: a submarine in port can be damaged by one or two warheads, meaning the loss of 64 warheads carried by a project 667 *BDRM* SSBN or 200 in case of a project 941 SSBN. At the same time a submarine on combat duty is virtually invincible. Heavy bombers are extremely vulnerable on the ground, on airbases, but their vulnerability is sharply reduced if they leave the airbase in timely fashion.

Consequently in the case of two-to-one concentration of warheads on delivery vehicles (i.e. the number of warheads is twice the number of delivery vehicles) and approximate equality of the arsenals of the parties, strategic weapons can be considered sufficiently survivable in relation to a

hypothetical first strike, which ensures the ability to inflict unacceptable damage (no matter how it is determined) in a second strike, creating, in turn, the possibility to abandon the strategy of strike on warning and enhancing the level of strategic stability. In this case, the probability that a nuclear war would result from miscalculation or mistake will be small enough - if not reduced to zero at all - to consider it acceptable.

In contrast to the structure that is likely to emerge by about 2010, the Soviet arsenal even under the START I conditions was less survivable. On average, the number of delivery vehicles related to the number of warheads as approximately one to six: although the levels stipulated by the treaty allowed to somewhat reduce the pre-START I concentration (6,000 warheads and 1,600 carriers created the correlation about 3.75:1), in practice the Soviet Union would have had only 1,100-1,200 delivery vehicles, while, as a result of special accounting rules for warheads of heavy bombers, the number of warheads could apparently reach about 7,200. Strategic stability was mainly achieved not by better survivability, but by high number of warheads possessed by each of the parties, while all other characteristics of the posture were treated as secondary.

The way START II was planned in 1990-91, reduction in the concentration of warheads on delivery vehicles obviously would not have reached the level of two-to-one anyway. So, we potentially face a qualitative leap, whose importance should not be overshadowed by today's problems (primarily financial) of Russia or by its failure (also caused by economic problems) to implement the plans for a new structure of the strategic arsenal, which were developed in the early 1992 at the initial stage of the START II negotiations and were based on an assumption about a considerable size of the land-based leg, which currently is considered difficult to achieve because of financial difficulties.

Of course, survivability toward a first strike may be improved even further. For example, it could be achieved by increasing the number of submarines on the alert status. In the Soviet period, the share of combat-ready submarines was about 25%, less than the relevant US figure, and in the 1990s it dropped even more, to just 15%[37].

Qualitative advantages could also be achieved through higher combat readiness of the mobile road missile systems, especially by raising their speed and invincibility. One more traditional direction is the improvement of the command and control system. The higher reliability of the communications systems and command centers, the greater the general survivability of strategic weapons toward a hypothetical first strike.
The data cited about shows that even the problem of ABM system penetration can be resolved by placing the emphasis on the qualitative parameters. When each warhead has high penetration capacity, the number of warheads that could be sent against the defense in one launch could be decreased.

Greater importance of the qualitative parameters of strategic weapons draws attention to the fact that has never been a secret to experts: numerical parity of nuclear arsenals is a very rough and imprecise characteristic of the strategic nuclear balance. The efforts of the Soviet Union and the United States to legitimize approximate parity during all the negotiations on nuclear weapons reduction in the 1970s and 1980s were, to a certain extent, caused by the political requirements: leaders of the both countries tended to conceptualize balance in numerical estimates.

Naturally, no agreement signed in the 1970-1980s succeeded in establishing precise equality (nor was it achievable). However, under the conditions of high quantitative arms levels certain disparities were not decisive. At levels that high, the qualitative parameters were of secondary importance. In the 1990s the merits of the quantitative approach became rather questionable because the technical progress allows to look for different options. The choice should be made between a new, and rather considerable, numerical arms build-up, on the one hand, and a decisive switch to the

primacy of the qualitative characteristics, on the other.

The conclusion is obvious: improvement of quality of the Russian nuclear arsenal, especially the parameters, which deal with survivability under the first strike and guaranteed second-strike potential even under the most unfavorable circumstances, would increase the margin of parity and allow to disregard numerical equality. Of course, purely numerical factors will remain important, but greater attention to the qualitative aspects permits to broaden the acceptable limits of disparity.

Potential to gain advantage through stressing quality changes the framework of considering the proposals regarding a return to MIRVed ICBM as the backbone of strategic force. Without going into details of technical and financial possibilities of equipping Topol-M with three or even seven warheads[38], to say nothing of the creation of a new MIRVed ICBM, we should underline that this would be the return back to the quantitative methods of maintaining strategic parity associated with the 1970s and 1980s.

First, as mentioned above, elimination of MIRVed ICBM did not represent a break with the evolution of the Soviet strategic arsenal, but rather was a leap forward, over several intermediate stages. Since that this leap has already been made, it would hardly be logical to return back just to pass through the already rejected stages. Second, although the deployment of MIRVed ICBM might, in fact, yield certain benefits, these same benefits can be achieved by increasing survivability and other qualitative parameters of the arsenal. Third, the quantitative approach, which boils down to an increase in the number of warheads, could provoke the United States to take similar steps, which would be considerably easier for it to do because it would just need to maintain its arsenal at some intermediate level between START I and START II.

It seems that in the present international situation Russia could confidently choose the path toward optimization of its strategic weapons. As a result of well-known economic difficulties this process will be long enough (10-15 years instead of five to seven), which seems to be an acceptable price, however. This path appears even more justified because the process of nuclear weapons reduction is bound to continue, at the very least as a result of pressure by the international community and more or less obvious danger that threshold states might join the nuclear club.

There are other, no less interesting but more remote, consequences of radical changes in the structure and characteristics of the Russian strategic arsenal. The 2010-vintage strategic posture will be able to provide much greater flexibility at future negotiations on nuclear arms reduction than it had ever been the case during the Soviet period. Unquestionable domination of ICBMs in the Soviet triad and relatively small share of the air leg had always been a source of constraints for Soviet negotiators. The American triad was better balanced and, in addition, its warheads were mostly deployed at comparatively less vulnerable submarines. This gave the Americans greater flexibility and allowed them to fit within practically any reasonably feasible variant of the strategic weapons structure.

At issue is, of course, not making the life of negotiators easier. Rather, the defense of certain features of the Soviet arsenal demanded much time and unnecessary concessions.

In case Russia embarks on more difficult path of restructuring its strategic arsenal on following new principles, the situation at the negotiations might change significantly. The Russian triad would be substantially better balanced and would consist mostly of systems with low vulnerability. At the minimum, the traditional pressure of the US side will be less under these conditions.

It is also possible that the United States, on the contrary, might face certain difficulties at the negotiations, because their existing systems were originally intended to be part of a very large strategic arsenal: it was not accidental that the initial American proposals

on START II provided for levels in excess of 4,000 warheads. The reductions under START II are conducted mostly through downloading of SLBMs and exempting part of heavy bombers from account. START III will create additional problems, which, essentially, explains the relatively low interest of the United States to reductions so deep. Indeed, there are reasonable limits for downloading of *Ohio* class submarines, which were designed with an eye at a 6,000-9,000 warheads arsenal; the reduction in the number of warheads at each SSBN would contradict the criterion of cost-effectiveness, while the reduction in the number of submarines would undermine the survivability of the force as a whole. The United States could even face the necessity to switch to a *dyad*, i.e. eliminate one of the legs of the triad, most likely the land-based one, i.e. ICBMs. This idea has already been raised, but faced strong opposition within the US Air Force. Another option for the United States would be to remove nuclear weapons from heavy bombers; but this recent idea has yet not gained enough support in the upper echelons of the military.

However, irrespective of how the United States solves the problems of the strategic forces restructuring - and there is no doubt that they will be ultimately resolved with appropriate funding - the position of Russia at the negotiations will become stronger. In this case, new opportunities could emerge to resolve the issues of interest to Russia, such as, for example, the reduction of sea-launched cruise missiles.

If qualitative parameters are emphasized in the process of shaping the future structure of the Russian strategic arsenal, it will become also possible to look with greater confidence at yet deeper reductions, which will become inevitable with time at least as a result of the pressure on part of nuclear threshold states. As is well known, these countries, led by India, establish a direct linkage between their (formally) non-nuclear status and the nuclear weapons reduction process. A serious discussion of nuclear weapons elimination will hardly begin in a more or less near future, but in any case negotiations on START IV or some other agreement will have to be commenced. One can confidently predict that this discussion will focus on the reduction to the level of 1,000-1,500 warheads, often quoted as acceptable for Russia. The arsenal, based on qualitative rather than quantitative characteristics, will assure better flexibility and allow sufficient freedom of choice among different variants of reduction, as well as to decide if there is any need in such reductions at all.

According to Minister of Defense Marshal Sergeyev, START III will be the last bilateral agreement on nuclear arms reduction. Future agreements should involve all the five official nuclear powers. In this situation it will be difficult (if at all possible) to apply the standard principle of approximate parity, which was contained in all the Soviet-American treaties on strategic weapons, or in other agreements based on numerical balance of forces like, for example, the Washington Treaty of 1922[39].

If we consider nuclear weapons as an absolute weapon of sorts, numerical correlation becomes senseless because in practice it provides for deterrence irrespective of numbers. But if we adopt more traditional criteria of the balance, it would be rather difficult to create a stable five-party balance that would satisfy everyone: nuclear weapons are too powerful so that even small predominance or, what is more, alliance relations between several members of the *nuclear club* could undermine such an agreement. For example, at the initial stage of the negotiations on medium-range missiles the Soviet Union insisted that similar French and British weapons should be included; such an approach at multilateral negotiations could result in a deadlock, but at the same time is difficult to avoid. The US Congress and the Russian Duma will be likely to demand at least approximate parity with all the hypothetical adversaries. For Russia, this would mean parity with the United States, Great Britain and, maybe, France; and for the United States - parity with Russia and China.

A realistic way out of this *trap of parities* could be the establishment of an extremely high levels for warheads, because in this case

all formal parameters of the balance of forces would become senseless: the number of weapons will be so large that numerical limits cannot affect the capability to destroy the other party (or parties). But there are two additional traps here, one can easily fall into. First, this is the position of the nuclear threshold states and, in a more general sense, the political pressure in favor of nuclear weapons reduction. The country, which would take the initiative in returning to higher levels of weapons, risks becoming a pariah in the international community. Second, as it will be demonstrated below, the level of unacceptable damage is a variable, which depends on many factors. One simply does not have a capability to destroy the whole world: in today's situation, even the capacity to deliver one or two warheads, to say nothing of one hundred[40], is a sufficient deterrent.

In this situation, it is precisely solid qualitative characteristics, which assure a more flexible approach to numbers, that can help to solve the potential deadlock. The state, which has survivable strategic weapons, can disregard disparity - to a certain degree, of course - simply because even if it faces an alliance, which has a numerical superiority, it will still preserve the retaliatory capability and its second-strike forces cannot be destroyed under any possible circumstances.

An analysis of the evolution of Russian strategic arsenal brings us to a conclusion that it would be advisable to proceed in the direction of this evolution, which originated under the impact of START II and subsequent agreements, and, in general, became the result of economic and political crisis of the late 1980s – early 1990s, from which Russia will begin (as it seems) to recover.

Of course, the temptation to return to an earlier stage and take a smoother line of development, which was foreseen in the 1980s, is strong. In this case Russia could reject START II with all its well-known shortcomings and try to revise the present situation. In theory, Russia could quickly enough build up the number of warheads by returning to MIRVed ICBMs.

The temptation to renounce the limitations of the treaty is strong enough and, what is interesting, goes hand in hand with similar attitudes in the United States: many conservative politicians in that country are opposed to all or almost all treaty restrictions, which might limit the ability of the United States to do whatever it wants.

But the benefits of such an approach are far from self-evident. First of all, unilateral parallel reductions that many opponents of START II expect are only possible (though there is no any certainty) but far from inevitable. *Natural* reductions, which indeed will be undertaken by the United States, will reduce the US arsenal to the levels proposed by George Bush in the early 1992, i.e. about 4,500 warheads. So, the comparatively cheap build-up of the Russian arsenal up to, let us say, 3,000-3,500 warheads will not give Russia discernible benefits from the point of view of the traditional criterion of parity, creating, at the same time, domestic political pressure in favor of further build-up.

The last point is rarely taken into account by many experts who advocate the rejection of START II. Disparity cannot continue for long: politicians are not experts; they tend to compare numerical indicators and with time will inevitably raise the prospect of building up the Russian arsenal to match the American one in terms of numerical characteristics[41].

It is much more important that irrespective of the number of warheads the Russian arsenal will be vulnerable. Indeed, it is significantly cheaper to deploy 200 ICBM with five warheads each to acquire 1,000 warheads on ICBMs than to deploy 1,000 single-warhead missiles. But in the first case the total elimination of the land-based component would take 400 warheads, while in the second case – 2,000 warheads. Small number of delivery vehicles and associated vulnerability of the arsenal will continue to push towards increasing the number of missiles. Consequently, there will also remain a latent incentive (which will become

apparent only later) for a new round of strategic weapons deployment.

What Are Nuclear Weapons Needed for?

In the end, the choice of options for the evolution of strategic weapons must be determined by the realistic missions nuclear weapons can support. The proposal to continue along the line determined by the START II and START III treaties stems not only from the balance of the economic and political benefits, but also from the recognition that missions of nuclear weapons are objectively limited.

Nuclear weapons closely match the definition of an *absolute weapon*, if not by the effects of its use (after Hiroshima and Nagasaki, nobody has used it, and therefore the real consequences of a large-scale or even local nuclear war are not known), then at least by the established norm against its use. Any use of nuclear weapons is viewed by the public as a potential catastrophe. This weapon deters just by the simple fact of its existence almost irrespective of the numerical and qualitative characteristics. In essence, we deal with minimum deterrence, i.e. nuclear weapon can perform its deterrence function in any situation and in any numbers.

The deterrence itself first of all is a psychological phenomenon rather than a military one: the quantity and quality of weapons and troops affect the probability of a successful use of force and correlation of losses and gains. The status of nuclear weapons as an absolute or almost absolute weapon results from the perception, whether correct or not, that losses from attack on a nuclear state are assumed to be many times greater than any possible gains. This firmly established norm determines the stability of nuclear deterrence.

The size of losses expected to result from the use of nuclear weapons, which makes nuclear war irrational, is commonly known as unacceptable damage. The scale of damage, which should be classified as unacceptable, cannot be defined in principle, simply because it depends on too many factors. For example, it depends on the level of development of the society: the greater the complexity of the system and the higher the standard of living in a state, the easier to cause damage, which will be considered unacceptable. It also depends on the goal: if the survival of the state is at stake, its population will be prepared to suffer significant privations, but if the objective is not as far-reaching, the level of damage, perceived as unacceptable, correspondingly decreases (for example, the Americans, when they expected a military conflict with the Soviet Union, were psychologically better prepared for the possibility of the use of nuclear weapons than during the Gulf War in 1991, when they were much less predisposed to face that risk).

Under these circumstances it becomes clear why nuclear weapons in theory are capable of performing the function of deterrence nearly irrespective of their number and quality. If there is a possibility to deliver even a handful nuclear warheads to the territory of the aggressor in a retaliatory strike or strike on warning, the situation of deterrence can be considered ensured. This is, approximately, the current attitude of China and, to a certain extent, France.

The Russian-American nuclear balance is governed by somewhat different rules. Decades-long confrontation together with almost thirty year of negotiations on limitation and reduction of nuclear weapons produced a different mentality, which proceeds from the over-insured margin of security. This margin of security emerges as a result of two factors. The first is the level of unacceptable damage, which was guaranteed many times over with little regard to the psychological dimension. In other words, the Soviet military did not pay much attention to which level of damage would be perceived as unacceptable in the United States; instead, they proceeded in their calculations from the level that *even* Americans would, in their view, consider unacceptable, i.e. a level measured in hundreds of warheads. A similar approach was taken by the American side, and apparently it had emerged even earlier than the Soviet one; in addition, American analysts' expectation of the readiness of the Soviet people and especially leadership to endure destruction caused by

nuclear war was assessed as extremely high (even excessively high). Accordingly, neither side even considered the principle of minimal deterrence.

Attention was focused on the capability to deliver a certain pre-determined number of warheads to the territory of the other side. Since it was impossible to ascertain whether this capability exists, each side resorted to building various scenarios of a nuclear war and computer modeling of a nuclear exchange to test whether it does have this capability. The results of these tests allowed to determine the probability that a given number of warheads would be delivered. It is this data that served as an at least formal criterion for both the R&D programs and for determination whether particular drafts of arms control agreements were acceptable. Quite naturally, the real situation was far enough from the one pictured above: decision-making was also influenced by other factors, such as the interests of the companies involved in the arms research, development, and production (this was true not only for the United States, but also for the Soviet Union), institutional interests, broader political goals, biases and personal prejudices of politicians etc.

The emphasis on the models of strategic balance and the establishment of a margin of security as a component of its evaluation, leaves only one option for the enhancement of strategic stability, namely, a switch to the second-strike strategy, which is supposed to reduce the risk of accidental, unplanned or unauthorized nuclear strike. As it has been mentioned above, this strategy requires either an increase of the number of weapons or greater survivability of the arsenal through enhanced qualitative characteristics.

One can hardly expect that Russia or the United States would, in the near future, abandon the criteria of the balance, which have already become habitual. The discussion in Russia on the START II treaty testifies to this: it is mainly focused on the question whether the terms of the treaty assure the capability for a retaliatory strike under any circumstances. For the United States, this approach is even more natural because its financial resources allow it to give little thought to a change in the approach. It seems likely that in future the nuclear balance will still to be determined on the basis of models of a hypothetical nuclear war.

It should be however underlined that such an approach also has some benefits. To a certain extent, it is precisely because the nuclear balance is *over-guaranteed* that Russia could carry out economic and political reforms. At least, under any circumstances it was guaranteed against a direct aggression, which could threaten its existence as a state. It is conceivable that in the absence of a reliable deterrent the reduction of the overall level of security accompanied by an alarmist mood of a part of the political establishment, could have resulted in reallocation of considerable resources to defense. High degree of resource mobilization, which is an indispensable element of increased defense spending, could have resulted in a return to an authoritarian political system.

Apparently, this variable – the interrelationship of military and economic factors of security - should be always kept in mind; otherwise, striving for the first, one might overlook the second. In this regard it would be appropriate to quote Vyshinsky, a Minister of Finance of Russia, who in 1888 (110 years ago!) wrote in a report to the Emperor, 'I consider it my duty to express to Your Majesty my firm, clear, and strong belief that the well-being of the people, even if at the expense of some imperfection in the military posture, will yield a greater advantage in case of military conflict than the most complete readiness of the army for combat in the situation when the economic situation of the people is deficient.'[42]. This quote has two interesting aspects. First, it emphasizes the priority of the economic means of achieving security over the military ones. Second is the fact, that still more than a hundred years ago the Minister of Finance had to prove that this approach was consistent with patriotism.

Nonetheless, the use of nuclear war models for estimating and projecting the balance has significant negative consequences, which

apparently affect Russia more strongly than the United States because they objectively stimulate the perception of an increased role of nuclear weapons in security policy. The use of various, often highly complex models of nuclear war creates the situation when the nuclear weapons seem capable of performing a wide range of tasks, including in particular the prevention of limited (in terms of territory and goals) conflicts along the periphery of Russia and the CIS.

Some believe that the threat of use of nuclear weapons (most probably the tactical ones) can prevent such conflicts or contribute to their settlement on terms, acceptable for Russia. In practice, it seems hardly probable that nuclear weapons which, I repeat, are viewed as the absolute ones, could perform such limited tasks.

The author has already tackled this issue[43]. For the purposes of this article, it would be enough to point out that nuclear weapons, even the tactical ones, are hardly (if at all) usable in the situations of military or non-military *pressure* (as opposed to aggression) as well as in *conflicts with low stakes*. Nuclear weapon will neither renew canceled credits nor prevent the ousting of Russia from the world arms markets (avoiding the situations like, for example, the one around South Korea, when the US Secretary of Defense personally resisted the purchase of Russian S-300 systems); nor will it create a more favorable regime for the export to the European Union. Nuclear weapons can not guarantee that the oil and gas pipelines from South Caucasus and Central Asia would follow the routes preferable for Russia. Meanwhile, precisely these and other similar issues have key-importance for Russian foreign policy and economic development.

Nuclear weapons are similarly inapplicable in most issues of Russia's military and political relations with the surrounding countries. For example, the threat of their use will not prevent the Baltic States from joining NATO or the deployment of NATO infrastructure on the territory of new members of the Alliance. They will not help to stabilize the situation along the southern CIS borders either.

All these tasks should be tackled with the use of economic or political means. Damage that can result from the use of nuclear weapons, same as the damage from a retaliatory strike, is simply incompatible with the real extent of the threat or with the stakes of the international *games*. This is why even the threat of use of nuclear weapons will not be taken seriously and will not influence the policy of other countries: it is quite obvious to them that the threat would not be realized and therefore the psychological mechanism of deterrence would not work. It does not even matter whether the use of nuclear weapons would be planned directly in the area of conflict or outside it, even if it's a limited (single) strike.

The above suggests that the practically unlimited power of nuclear weapons and associated, deeply rooted standard perceptions make nuclear weapons a highly effective means for deterrence of a large-scale aggression, but they also determine low applicability of nuclear weapons for more limited goals, when at stake are maybe vitally important goals, but still short of survival of the state. Here we find a serious contradiction inherent to the nature of this weapon. Its high effectiveness in certain types of situations (it is clear that for prevention of a large-scale aggression it is much more effective than the most powerful conventional arms) makes it essentially inapplicable in others.

Furthermore, an attempt to threaten to use nuclear weapons in real international crisis can have only negative consequences. There are two possible variants here. Either Russia will corner itself into a situation when it will be compelled to use nuclear weapons because otherwise any future threats would lose credibility (a threat, which is not followed through, almost invariably leads to this, and next time even a serious intention to use nuclear weapons simply will not be taken seriously); or it will have to admit a defeat and withdraw without using the weapons.

From here it follows that the possession of nuclear weapons can not substitute for other political mechanisms, especially for effective conventional armed forces. The programs of development of non-nuclear ALCMs and their delivery vehicles (not only heavy but also medium bombers) show that this aspect receives attention. And since the international norm against the sue of nuclear weapons, same as armed force in general, is becoming stronger over time, the role of non-military instruments of influence is accordingly increasing, including political and economic leverages and in particular the

use of international regimes and organizations. An example is the relationship between Russia and NATO: deep integration of Russia into NATO decision-development mechanisms will ultimately prove much more effective than the attempts to influence NATO from the outside by means of external pressure.

To conclude, it is important to once again stress that the use of various options of nuclear weapons' use for the purpose of modeling the strategic balance does not mean, by the long shot, that all these options are usable in real life. Here we probably encounter a psychologically understandable, but nonetheless mistaken mixture of two different aspects. Accordingly, we must ask a logical question: do we need to use this sort of computer modeling at all, if it is fraught with overestimating of the capabilities of nuclear weapons?

Apparently we need to continue using the traditional methods of estimating the balance, at least in the foreseeable future, since the stability of the balance, which is repeatedly tested on models, assures stable political relations. And this even does not necessarily mean the relations between Russia and the United States or Russia and the West as a whole, but also the domestic political dynamics, the perception of the stability of relations by political elites of Russia and other countries. If the Russian establishment is certain that under any feasible circumstances Russia will be capable of a retaliatory strike, the feeling of stability and security correspondingly increases, at least, with respect to certain category of security threats.

In the light of the above, it becomes clear why the author has paid so much attention to the issue of survivability of the Russian strategic arsenal. Of course, this is not about acquiring the capability to use nuclear weapons to support a wide range of missions: this would be simply impossible irrespective of specific characteristics of the arsenal, but rather about guaranteed stability of the strategic balance among the five nuclear states with respect to any possible variants of the first nuclear strike against Russia. Provided that Russian nuclear forces are capable of the second strike, they could be, by definition, used first in response to a large-scale conventional aggression. That is to say, in any situation Russia will retain a capability to use nuclear weapons in the contingencies, which are provided for in the 1993 military doctrine, effective at the moment of this writing.

Conclusions: Variants of Evolution of Russian Strategic Posture

By the end of the 1990s, Russia has found itself in a rather paradoxical situation. In the circumstances of a continuing financial crisis it must choose between two options of developing its strategic arsenal. The first option is to continue along the lines determined by the START II treaty, and to seek a new treaty (START III) by all means. In this case, the strategic arsenal will be reduced to about 2,000 warheads in absolute numbers; within this number, the land-based component will constitute less than a half of the total number (apparently about 30-40%) and will consist solely of single-warhead ICBMs. The second option assumes that Russia must abandon the START II treaty and return to the traditional priority of the land-based component, consisting of MIRVed ICBM; this could be done through the development of a new type of ICBMs as well by equipping single-warhead ICBMs Topol-M with additional warheads.

The author is certain that the preferable option for Russia is the first one. Essentially, it represents the *completion of the leap over several stages in the development of strategic posture, which were planned in the Soviet period,* whereas the second option represents a return to one of the intermediate stages in the process, but will inevitably force Russia to return in the future to the problem of *de-MIRVing* ICBMs.

It is even more important that the first option will ultimately provide Russia with a qualitative advantage, first of all in terms of survivability of land-based component of the force. Since the composition and the survivability of the other components of the triad will remain more or less the same under any option, the improvement of the characteristics of the arsenal as a whole can be achieved precisely through ICBM.

The choice between the two options should depend on the missions, which can be assigned to the Russian nuclear arsenal. As demonstrated above, these missions are limited enough: it is first and foremost the prevention of a large-scale aggression against Russia, while the rest of the missions assigned to nuclear weapons are either difficult or impossible to achieve. Strictly speaking, in this situation Russia could even choose the minimum deterrence posture, but a more rigorous approach to calculating the balance together with guaranteed second strike capability under any feasible circumstances has its advantages. The principal advantage is political and psychological stability of the relations. Many temptations disappear or, at least, weaken when political leadership, political elite, and experts are all sure that the country is capable of withstanding the first strike and responding with a retaliatory one. In particular, this eliminates incentives to buildup the number of weapons, because the arsenal is already sufficiently survivable and the limitations provided by the treaties prevent the other side from building up its forces. The incentives to switch to the strategy of preemptive second strike (strike on warning) also weaken.

The international situation of Russia is stable enough to allow it to pay close attention to modernization of weapons with an eye on distant future. This, of course, does not mean that there are no security challenges today or that they are cannot appear in future: quite on the opposite, the situation is rather unstable and difficult to predict. But those challenges that could be predicted are not on the list of situations that require nuclear deterrence. Hence, they should not be taken as the basis for planning the nuclear weapons modernization.

Despite the well-known difficulties, the status of the Russian strategic arsenal is far from hopeless. Moreover, its longer-term prospects seem quite advantageous, if Russia succeeds in providing funding at least at the minimum level, which is contained in the recent budgets. The today's prevailing negative estimates of the situation reflect the current circumstances but not the prospect.

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[1] The warranty period of Topol is 10-15 years. See: V. Litovkin, Russia Created First Strategic Missile Topol-M. *Izvestia,* January 20, 1995. See also: *Nuclear Weapons Reduction: process and problems,* Moscow, 1997. The figure is confirmed by the late Lev Rokhlin, former Chairman of the Duma Defense Committee, according to whom the life period of even the latest Topol missiles expires in 2008. See: *Rabochaya Tribuna*, June 4, 1997.

[2] S. Krylov, The Main Weapon of the Country. *Aviatsia i Kosmonavtika - Tehnika i Oruzhie,* No. 22, 1996, (joint publication).

[3] *Nezavisimaya Gazeta*, February 12, 1998.

[4] About the history of Topol-M testing see: I. Safranchuk. *Topol-M Development Status and Flight Testing*, contained in the data base of the Center for Non-Proliferation of Monterey Institute of Foreign Studies: http://www.cns.miis.edu.

[5] START II. Protocol on Notifications, January 1993, Paragraph 1, Section III; Paragraph 4, Section VII.

[6] In his memoirs, one of outstanding Soviet designers Boris Chertok gives a detailed description of the tendency to conduct countless launches just to clarify the cause of a trouble. This is not the fault of the designers who were required to achieve quick results irrespective of the expenses. Analysis of his memoirs shows that the number of launches could be reduced almost by three times provided that each launch is meticulously planned. The interviews with the representatives of the design bureaus reveal that the methods of work, described by Chertok, had been in use at least until the mid-1980s.

[7] V. Litovkin, op. cit.

[8] *Nezavisimaya Gazeta*, February 6, 1998, February 12, 1998.

[9] *Nezavisimaya Gazeta*, February 12, 1998.

[10] S. Krylov, op. cit. Of course, it is not surprising that Topol-M carries numerous ABM penetration aids: its throw-weight, calculated according to the START I rules, is 1.2 tons; for comparison, the throw-weight of a three-warhead Minitman-3 calculated under the same rules is 1.15 tons.

[11] *Aviation Week and Space Technology*, January 19, 1998, p.30.

[12] *Pravda,* December 30, 1992, December 31, 1992. Similar information was later published in *Rossyiskaya Gazeta*, April 1, 1994, March 28, 1995, in *Krasnaya Zvezda*, April 15, 1995.

[13] See: Memorandum on Understanding to the START-I treaty, reviewed on April 1, 1997.

[14] *Nezavisimaya Gazeta*, February 20, 1998.

[15] Information on Courier and some its characteristics were disclosed in an interview with L. Solomonov. See: *Nezavisimaya Gazeta*, February 6, 1998.

[16] See: Interview with V. Yakovlev. *Nezavisimaya Gazeta*, February 12, 1998.
[17] A. Surikov, START II: contradictions remain. *Yaderny Kontrol*, No. 18-19, June-July, 1996.
[18] A. Surikov, The START II Treaty and the Future of the Russian Strategic Nuclear Forces. *Yadernoye Rasprostranenie*, November 1997, p.38.
[19] *START II Ratification: Decisions, Problems, Prospects,* Moscow, 1996, p. 40.
[20] See: *Nezavisimoe Voennoe Obozrenie*, January 30, 1998.
[21] See: *Nuclear Weapons and Security of Russia*, Moscow, 1997, pp. 25, 107.
[22] See, for example, a publication of the US Naval Intelligence: *Worldwide Submarine Challenges*, Office of Naval Intelligence, 1997. It should be, however noted that American authors are rather careful and avoid establishing direct link between *Borei* and 885 project (also known as *Severodvinsk*), the first submarine of which was laid keel in summer of 1986. See: S. Zaloga, The Thunder Inside Russia's Typhoons. *Jane's Intelligence Review*, December 1996, p. 536. This version, however, seems doubtful because 885 project is an attack submarine rather than a SSBN.
[23] Stands for *Uluchshennye Taktiko-Technicheskie Kharakteristiki* (Improved Tactical and Technical Parameters).
[24] S. Zaloga, op. cit., p. 536.
[25] *Nuclear Weapons and Security of Russia*, Moscow, 1997, p. 14; A. Shirokorad, Missiles Over the Sea. *Tehnika i Oruzhie*, No. 2, 1996, p. 10.
[26] *Missile Power of Russia: the Past and the Present,* Moscow, 1996, p. 53; *Nuclear Weapons and Security of Russia*, Moscow, 1997, p. 14.
[27] *Nuclear Weapons and Security of Russia*, Moscow, 1997, p. 25.
[28] Such a small number of launch tubes is one of the enigmas of the new series: project 941 has 20 tubes while project 667 *BDRM* has 16. It would have been be logical to speculate that the future *BDRM* series would continue to carry 12 missiles, but this did not happen. It is not clear if this decision is conditioned by the tendency to reduce the concentration of warheads on one carrier or by technical difficulties.
[29] See: RIA-Novosti, November 20, 1997.
[30] *Yaderny Kontrol*, No. 34-35, 1997, pp. 5, 6.
[31] Interfax, October 28, 1997.
[32] See, for example: *Nuclear Weapons and Security of Russia*, Moscow, 1997, pp. 107-112.
[33] RIA-Novosti, June 18, 1997.
[34] RIA-Novosti, August 22, 1997.
[35] *Nuclear Weapons and Security of Russia*, Moscow, 1997, p. 14. It is interesting that the chapter written by Dvorkin, Kaliadin and Pikaiev in the same volume proceeds from the assumption that the production of heavy bombers will not be restarted.
[36] Information on ALCMs is taken from the Jane's Weapons Systems, electronic version, reviewed in September 1997.
[37] *Nuclear Weapons and Security of Russia*, Moscow, 1997, p. 26; *Missile Power of Russia: the Past and the Present,* Moscow, 1996, p. 57.
[38] See, for example, the above article by A. Surikov, START II: Contradictions Remain. *Yaderny Kontrol*, No. 18-19, June-July, 1996.
[39] Signed in 1922, the five-party Washington Treaty established the correlation of the numbers of the navy battleships for the United States, Great Britain, Japan, France and Italy as 5:5:3:1.75:1.75
[40] The growing concern of the United States about international terrorism could illustrate the real level of unacceptable damage: even the probability of loss of a small city raises serious concern. It is not accidental that only now, when the Cold War is over, the United States has launched a *Civil Defense* program, only too resembling the program, which existed if the Soviet Union. And its main emphasis is upon the prevention or mitigation of effects of a terroristic act.
[41] The American experience, namely Jackson's amendment to SALT I in 1972, could serve as a sort of illustration here. As it is known, SALT I did not cover the air-based component of the triad because the sides failed to agree which types of aircraft should have been counted. The agreement therefore covered only ballistic missiles and because of the predominance of the United States in heavy bombers, the Soviet Union was given an edge in ballistic missiles, which was reflected in the agreement. Although the Senate ratified SALT I, ratification was accompanied by the adoption of Jackson's amendment, which required that the numerical equality of the parties should be assured in the forthcoming negotiations. The amendment did not affect the essence of the issue, but reflected purely domestic political trends and the peculiarities of public perception of the situation; by and large, parliaments tend towards a tougher line with respect to disarmament simply because the interests of lawmakers lie with domestic issues and often depend on oversimplified understanding of the issue which is proper for the public.
[42] See: P.N. Milyukov, *The Armed World and Arms Limitation*, St. Petersburg, 1911, pp. 45-46.
[43] See *Yaderny Kontrol*, No. 2, 1997.

Stories of the Past

HOW THE SOVIET UNION HELPED CHINA DEVELOP THE A-BOMB

by Roland Timerbaev, Ambassador Extraordinary and Plenipotentiary of the Russian Federation (retired)

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This is the first time we include in our English digest a rubric, which is well known to the Russian-speaking readers of Yaderny Kontrol Journal. It is devoted to the history of nuclear power development both in peaceful and military spheres. We hope that it will help to understand better many of the current problems in the light of the past.

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The Story
It is commonly believed that the leaders of the People's Republic of China began thinking about creating China's own nuclear weapon (though Mao Zedong called it a 'paper tiger') after PRC Vice-Chairman Chu Teh and Defense Minister P'eng Te-huai, accompanied by several Chinese military chiefs, had been invited together with the defense ministers of other socialist countries to attend a combined-arms exercise with the use of a 40 kiloton nuclear bomb at the Totsk test range (situated between Samara and Orenburg) on September 14, 1954. The exercise was commanded by Marshal G.K. Zhukov[1].

Yet, according to some evidence, one of the Chinese leaders, Liu Shao-tsi, who went to Moscow on a secret mission shortly before the PRC was formed on October 1, 1949, was briefed about the first Soviet nuclear test (carried out in August 1949) and probably became interested in nuclear weapons at that early date. During Mao's prolonged visit to Moscow in late 1949 and early 1950, which was crowned by the signing of the Sino-Soviet Treaty on Friendship and Mutual Assistance, the nuclear problem was discussed, especially the issue of Chinese uranium ore supplies, which the USSR badly needed at the time.

Documents and materials regarding assistance to China in the nuclear field have yet to be declassified, but the large scale of assistance, which covered the entire nuclear fuel cycle and included assistance in developing an atomic bomb, raises no doubts as shown by a good many published sources, most notably eyewitness accounts. In his memoirs published in 1988, the former head of the Second Ministry of Engineering (in charge of nuclear power), Liu Tse, wrote that Zhou Enlai, 'the main figure, around whom scientists, engineers and technicians involved in the development of nuclear weapons were grouped', ordered soon after the creation of the PRC in 1949 to allocate foreign currency to purchase foreign equipment, instruments and scientific and technical literature related to the issue of atomic energy. Chinese geologists discovered massive deposits of uranium ore in the autonomous region of Kwangsi Chuang[2].

D.T. Shepilov[3], who visited China soon after the Totsk exercise as a member of the government delegation to attend the celebration of the 5th anniversary of the PRC in late September and early October 1954, recalls that during a confidential meeting with Khrushchev in the presence of Soviet Ambassador P.F. Yudin, Mao Zedong directly asked Khrushchev to 'reveal to China the secret of the atomic bomb and to assist the PRC in launching the production of atomic bombs'. According to Yudin, the Soviet leader declined the Chinese request. 'As for the atomic bomb, Khrushchev motivated the refusal by saying that if we gave the bomb to the Chinese, the Americans would give their atomic bomb to the West Germans. Mao responded that there was

already a disparity between the two world camps in that respect. Not only the United States but also Britain possessed an atomic bomb. France was building (or had already built) its own bomb. In addition, it was common knowledge that the West Germans and the Japanese with their highly developed industrial systems had prepared all the components of the atomic bomb in their secret laboratories. Meanwhile, in the socialist camp only the Soviet Union had an atomic bomb. Khrushchev just laughed it off saying: 'Is it not enough that we have an atomic bomb? We are covering you as well. Should anything happen, we will deliver a strike on your behalf.'[4].
According to some other evidence, Soviet military leaders also tried to convince the Chinese that there was no need for them to have their own atomic weapon because Soviet nuclear weapons would provide all the necessary protection for the PRC[5].

According to Liu Tse quoted above, in the course of a meeting of the Secretariat of the CCP Central Committee on January 15, 1955 Mao Zedong made 'the strategic decision' to develop a Chinese atomic bomb, thus launching the Chinese nuclear industry. In the first half of the same year a *steering group* was set up which included Zhou Enlai, Vice-Premier and head of the State Planning Committee Li Fuchui, and Marshal Ne Junchen. The atomic bomb development project was given the code number 596[6].

According to Liu Tse, Zhou Enlai 'systematically, step by step, pressed for Soviet assistance in the field of nuclear technology, which enabled us to master it comparatively quickly and, to a certain degree, allowed us to gain time. At the same time, Zhou Enlai underlined that China had to possess the equipment, which would make it an independent nuclear power.'[7].
But it was the Soviet Union that provided the decisive assistance to China in developing an atomic bomb. On January 17, 1955, the Council of Ministers of the USSR adopted a decision on assisting socialist countries in research into peaceful use of nuclear energy.

Within days, a Soviet-Chinese agreement was signed on joint geological prospecting for uranium ore in China. Under the agreement China undertook to sell its surplus uranium to the Soviet Union. The agreement was mutually beneficial because during that period the USSR experienced a shortage of uranium.

According to Chinese data, between 1955 and 1958 the USSR and China concluded a total of six agreements on assistance in the development of Chinese nuclear science and industry and in the creation of atomic weapons: 1) Agreement of January 20, 1955 on joint prospecting of uranium deposits, including China's consent to sell surplus uranium to the Soviet Union; 2) Agreement of April 27, 1955 on assistance in nuclear research and peaceful use of nuclear energy, including the supply of a 10MW nuclear reactor and a cyclotron; 3) Agreement of August 17, 1956 on assistance in creation of nuclear industry; 4) Agreement of December 19, 1956 that transferred joint geological prospecting under Chinese jurisdiction while the Soviet Union was to continue assistance in its performance; 5) Agreement of October 15, 1957 on new military technologies, under which the Soviet Union undertook to provide China with a model of an atomic bomb and missile and the appropriate technical documentation; and 6) Agreement of September 29, 1958 on the schedule of supplies and on the amount of Soviet aid in the nuclear field[8].

In accordance with those agreements, hundreds of Soviet nuclear experts, including several designers of nuclear devices[9], were working in China in the late 1950s, while the Chinese were taught or trained in the USSR, notably at the Joint Nuclear Research Institute in Dubna. So, Mao's argument for the need to strengthen the nuclear potential of the socialist camp finally took effect.

N.S. Khrushchev writes in a fairly candid way about the assistance to China in his memoirs, 'I'd like to say that while we still had good contacts we signed an agreement on cooperation in the field of nuclear energy, including the transfer to China of the secrets of nuclear weapons production technology. Generally speaking, we were giving China everything. We had no secrets from it and its

scientists; engineers and designers dealing with atomic issues worked side by side with our nuclear experts. When China asked us for an atomic bomb, we told our scientists to receive its representatives and to teach them how to produce it. Our scientists proposed to make a model suitable for the Chinese. I cannot tell you here what the model was and why it was necessary to make it. There is such a thing as a state secret. A mere mention must suffice. And indeed a low-yield nuclear bomb was designed. Just as our relations took a dramatic turn for the worse, the training of corresponding Chinese experts had been completed and the model was ready for shipment. The minister of nuclear industry of the USSR (the position was called differently at the time) reported that everything was ready, including the model, just awaiting the order to ship. We held a meeting of the Presidium of the Central Committee of the CPSU. It was very difficult for us to decide what to do because we knew that China would do its best to spite us if we broke the agreement and did not send the A-bomb model. But on the other hand, the Chinese were berating us and making incredible territorial claims; in that situation we could not behave like obedient slaves and provide them with the atomic bomb. So, we decided not to send it.'[10].

Indeed, Academician E.A. Negin, former director and chief designer of Arzamas-16, and Y.N. Smirnov, who in 1960-1963 worked on A.D. Sakharov's team, say that our experts acquainted the Chinese with the nuclear weapon design in detail. In Arzamas-16 the prototype model of the bomb whose design had been explained to China[11], as well as all the instruction manuals not only for the bomb itself but also for beds, switchboards, various equipment, accessories, test devices, etc., were loaded onto railway cars. The cars stood idle for about half a year before orders came from the Central Committee of the CPSU to destroy everything - both the prototype bomb and the blueprints[12].

Academician Negin, recalling his first mission to China in 1958, writes, 'We were to tell the Chinese everything they needed to know to make a nuclear bomb. We traveled throughout China, examined factories, spoke to people, and suggested a scheme for cooperation that could be created among enterprises (a sort of *Chinese Minsredmash* or the Ministry of Medium Machine-Building Industry). We also told them what they lacked and what had to be done in the first place; in other words, we rendered them extensive scientific and technical assistance.'[13].

In 1958 111 Glavatom (main nuclear administration) experts and 43 geologists who specialized in prospecting for nuclear raw materials were sent to China. The industrial aspect of the work, including prospecting for and mining of uranium, was supervised in advisory capacity by A.A. Zadikian, chief engineer of one of the Ministry of Medium Machine-Building Industry chief directorates who worked in China in 1956-1960. Several prominent Soviet scientists dealing with nuclear issues (A.I. Alikhanov, A.P. Vinogradov, D.I. Blokhintsev and many others) also made regular short visits to China[14].

M.S. Kapitsa, who had long been in charge of Soviet China policy, wrote that a total of more than 10,000 Soviet experts were sent to the PRC in the 1950s and 1960s, while about 11,000 Chinese engineers, technicians, skilled workers and around 1,000 scientists received training, scientific instruction and practical experience in the Soviet Union[15].

The reminiscences of I.S. Glebov, retired Colonel-General, give some idea of the character and areas of Soviet assistance in the creation of the Chinese nuclear and military potential and the PLA training. In 1957-1958 Glebov was adviser to the chief of staff of the Chinese People's Liberation Army (PLA).

According to him, he participated in discussions on the issues related to the 'structure of new Armed Forces of the PRC'. It was planned to create 'more than 100 large units and, besides that, separate units of all the armed services'. An agreement was reached on transfer of surface-to-surface and surface-to-air missiles. As adviser, Glebov took part in an operational exercise where 'provisions were made for a possible use of nuclear weapons by an adversary'.

Consultations were given 'as to the construction of a test site for the new weapon testing. As for the transfer of aircraft-borne nuclear bombs, discussion of this issue was postponed by our leaders because of its key importance for relations with the United States,' as I.S. Glebov reported to Ambassador P.F. Yudin on his arrival to China in May of 1957[16].

Chinese experts visited the Soviet nuclear test site. Moreover, in late November 1958 two researchers of Ministry of Defense's CNII-12 (central research institute), Colonel F.K. Burlakov and Lieutenant-Colonel I.A. Razmyslovich, who had developed the security program against nuclear attack for the Army, arrived in Harbin as military experts of the Military Engineering Academy[17].

The son of N.S. Khrushchev, Sergei Khrushchev, says in his memoirs that the Chinese were promised the R-12 missile, capable of delivering nuclear warheads; 'production of this missile was to be launched in both countries simultaneously'. He writes that the prototypes of self-targeting cruise missiles, like the P-15 boat-launched missile and Kometa, a coastal defense missile, were sent to China. It was expected that they would be produced at new factories then being built with the help of the Soviet Union[18].

Apparently, Khrushchev decided to stop assisting China in developing nuclear weapons for fear that China's leadership would drag the Soviet Union into a conflict with the United States and the entire West in connection with the PRC's attempts to seize the islands of Quemoy and Matsu in the Taiwan Strait in 1958. It became known that in September of 1958 Eisenhower, in view of Chinese threats to bomb Quemoy, made a decision on the possible use of nuclear weapons and soon declared it in public[19].

Around the turn of July 1958 Khrushchev (accompanied by Minister of Defense Marshal Malinovsky, and acting Minister of Foreign Affairs V.V. Kuznetsov) met with Mao Zedong in Beijing. The atmosphere of the summit was strained, despite the joint communique on adherence to fraternal friendship. According to Sergei Khrushchev, the Chinese wanted an assurance of military support in their efforts to seize the islands in the Taiwan Strait, but N.S. Khrushchev evaded the issue, saying that 'joint coordinated efforts should be focused on repulsing the aggression and not provoking the Americans into a needless conflict'[20].

Nonetheless, Khrushchev proposed putting a separate Soviet anti-aircraft defense regiment at Mao's disposal and on September 7 in his message to President Eisenhower warned that 'an attack against the People's Republic of China, which is our great friend, ally and neighbor, will be viewed as an attack against the Soviet Union. Faithful to its duty, our country will do its best to preserve together with the People's China the security of both states, peaceful interests in the Far East and the interests of peace in the whole world.'[21]. The Soviet press fulminated against 'the American aggressors', but that was all. Neither Americans nor Chinese took the Soviet threat seriously, because, though the situation in the Taiwan Strait continued to be tense, the danger of using nuclear weapons had receded, writes McGeorge Bundy in his book *Danger and Survival*. Some time later, in 1963 when the Soviet-Chinese conflict was at its height, the Chinese insisted that the Soviet leadership declared its support for the PRC only when the threat of the American nuclear strike had already passed[22].

According to Sergei Khrushchev, by May of 1959 N.S. Khrushchev 'had made the final decision that in no case would nuclear secrets be transferred', and on June 20, 1959 'we unilaterally canceled the agreement providing for the transfer to China of the latest technical achievements, especially in the military field'[23]. Chinese sources also attest that the Central Committee of the CPC received an official letter of June 20, notifying that the atomic bomb prototype, blueprints and technical information on the bomb would not be supplied to China. According to the same data, the Soviet decision was motivated by the nuclear test ban negotiations with the United States and Britain being held in Geneva. Beijing, in its turn, saw that decision as a friendly gesture

to the United States made in connection with the Khrushchev's forthcoming first visit to America[24].

On July 18, 1960, the Soviet Embassy in Beijing in its note to the PRC's Ministry of Foreign Affairs notified of the recall of all Soviet experts, including military, in view of 'unfriendly' actions by the Chinese authorities against them[25]; in August all Soviet experts involved in the Chinese strategic program returned to the Soviet Union[26].

Mao Zedong's reaction was swift. He ordered development of the bomb within eight years, but it was designed even ahead of schedule, just five years after Soviet nuclear assistance was halted[27]. The scope of works was impressive: they involved 26 ministries and 900 factories and research centers. At the same time, the director of the Chinese nuclear project, Marshal Ne Jun-chen, in his memoirs does not deny that the basis of Chinese nuclear power was laid with the help of the USSR. He admits also that the Soviet Union transferred to China samples of arms that could be used as a means of delivery of nuclear weapons[28].

On the whole, however, Chinese and American literature underestimates the role of the Soviet Union in developing the PRC's nuclear weapons. According to estimates by some Russian experts, Soviet assistance enabled the PRC to reduce the period for creating its nuclear weapons (first tested in October 1964) by at least 10-15 years. The first Chinese hydrogen bomb was detonated on June 17, 1967.

The differences between Chinese and Soviet leaders remained unsettled for several years and the public polemics between them reached its peak during the signing of the Moscow Treaty Banning Nuclear Weapons Tests in the Atmosphere, Outer Space and Under Water in August of 1963. On September 1 the Chinese Government made a statement containing harsh criticism of the treaty and saying that it was aimed at 'tying the hands of the socialist countries and all the peace-loving states with the exception of the Soviet Union'. The Government of the USSR responded with a statement published on September 21 saying that 'the Chinese leaders [...] needed these speculations about "the monopoly" to justify their right to possess nuclear weapons'.

The Soviet statement also underlined that 'the desire to obtain a nuclear bomb at any price and by all means can only raise serious doubts about the objectives of the PRC leaders' foreign policy, for they are unable to prove that it is required in the interest of defense of China and all the socialist countries. It is well known that the nuclear might of the Soviet Union is sufficient to raze to the ground any state or a coalition of states which would encroach upon the revolutionary gains of the socialist countries. In this regard even the imperialists have no illusions. Is there any need in such a situation for Chinese bombs to defend the socialist countries? Of course, not.'[29].

Personal frictions between Soviet and Chinese leaders played a considerable role in bringing nuclear cooperation between the Soviet Union and China to a halt. But, of course, the main factors that led to the rift between the two states in the late 1950s were China's desire to gain status as a superpower not inferior in any respect to any of the other nuclear states and the increasing rivalry between both powers to attain hegemony and supremacy in the international labor and communist movement.

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[1] Information and materials on this exercise as well as the reminiscences of its participants were published in *Izvestia* on March 25, 1990; in *Bulletin of the Center of Public Information on Nuclear Energy,* Moscow, No. 9, 1993, pp. 60-72; and in the book *Nuclear Tests in the USSR,* Moscow, 1997, pp. 253-301.

[2] *Ekho Planety,* No. 24, September 10-16, 1998, p.26.

[3] Shepilov, Dmitry Trofimovich (1905-1995) - at that time was Chief Editor of *Pravda*, later became Secretary of the Central Committee of the CPSU, alternate member of the Presidium of the CPSU Central Committee, Minister of Foreign Affairs. In 1957 he was dismissed from all his posts together with Molotov, Malenkov and Kaganovich.

[4] *Nezavisimaya Gazeta,* November 11, 1997.

[5] David Holloway based this statement upon his interview with Lieutenant-General N.N.

Ostroumov who on the instructions of the Soviet Air Force Commander during the Totsk exercise had a conversation with the Chinese Air Force Commander. See: D. Holloway, *Stalin and the Bomb,* Yale University Press, New Haven & London, 1994, p.354.

[6] *Ekho Planety,* No. 24, 1988.

[7] Ibid., p.28.

[8] J.W. Lewis, Xue Litai, *China Builds the Bomb,* Stanford University Press, Stanford CA, 1988, p.41; *Ekho Planety*, No. 24, 1988, p.27.

[9] For example, E.D. Vorobyov, a close aide of I.V. Kurchatov in Chelyabinsk-40, worked in China from May 1957 till November 1959; and B.N. Ledenev, a nuclear weapons designer, Director of Gas Dynamics Department of Arzamas-16, was there in 1958-1960. See: E.A. Negin, Y.N. Smirnov, Did the USSR Reveal Its Nuclear Secrets To China? - Report at the international symposium in Dubna, May 14-18, 1996, in *Science and Society. History of Soviet Nuclear Project (1950-60-s)*. Moscow, 1997, Vol. 1, pp.306-309. An abridged version of the report by Negin and Smirnov was published in the *Itogi*, October 8, 1996.

[10] *Voprosy Istorii,* No. 3, 1993, pp.77-78.

[11] According to Y.N. Smirnov, it was one of the first Soviet-tested atomic bombs RSD-3, also known as Tatianka, and not later versions.

[12] E.A. Negin, Y.N. Smirnov, op. cit., pp. 311-312.

[13] *People of the Object*, Sarov - Moscow, 1996, p.150.

[14] E.A. Negin, Y.N. Smirnov, op. cit., pp.314, 306.

[15] M.S. Kapitsa, *On Different Parallels. Notes of a Diplomat*. Moscow, 1996, p.57.

[16] *Voyenno-Istoricheski Zhurnal,* No. 8, 1993, pp.49-53.

[17] E.A. Negin, Y.N. Smirnov, op. cit., p.312.

[18] S. Khrushchev, *Nikita Khrushchev: Crisis and Missiles. Inside View,* Moscow, 1994, Vol. 1, p. 347.

[19] M. Bundy, *Danger and Survival,* Random House, New York, 1988, pp.279-280.

[20] S. Khrushchev, op. cit., p.349.

[21] *Soviet-Chinese Relations 1917 - 1957. Collected Documents,* Moscow, 1959, p.411.

[22] M. Bundy, op. cit., p.281.

[23] S. Khrushchev, op. cit., p.353.

[24] J.W. Lewis, Xue Litai, op. cit., pp. 64-65.

[25] The full version of this *highly confidential* note was published in *Cold War International History Project Bulletin*, Woodrow Wilson International Center for Scholars, Washington D.C., Issues 8-9, Winter 1996/1997, pp. 249-250.

[26] J.W. Lewis, Xue Litai, op. cit., p.72.

[27] Mao repeatedly called the atomic bomb 'a paper tiger', but this was before China created its nuclear weapons. Nonetheless, some time later he himself admitted in private conversations that this was a figure of speech.

[28] *Izvestia,* November 11, 1994.

[29] *Collected Documents of the MFA of the USSR,* Vol. VI, pp.443-487. Here the words of Khrushchev (who usually himself dictated statements of the Government and then sent them to the MFA for proofreading and revision) sound rather contradictory: it was the Soviet Union that provided the initial assistance to China in the development of nuclear weapons.

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National Press Institute, Moscow, Russia

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Pogorely Mikhail, National Press Institute, Moscow, Russia

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Shmelyev Vladimir, Dr., The *Kurchatov* Institute, Moscow, Russia

Sokov Nikolai, Dr., Center for Nonproliferation Studies of the Monterey Institute of International studies, Monterey, United States

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Sukhoruchkin Vladimir, Dr., The *Kurchatov* Institute, Moscow, Russia

Svetozarov Vladimir, National Press Institute, Moscow, Russia

Tkachev Victor, Dr., Financial Academy of the Russian Federation, Moscow, Russia

Vinogradov Mikhail, Gen. (ret.), Committee of Scientists for Global Security, Moscow, Russia

Volodin Yury, Russian Nuclear Regulatory State Authority (Gosatomnadzor), Moscow, Russia

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Zhilin Alexander, Ph.D., *Moskovskiye Novosti*, Moscow, Russia

Zobov Andrey, Russian Nuclear Society, Moscow, Russia