

Russia's new SDI offer heralds scientific and strategic revolution

by Jonathan Tennenbaum

Leading western experts in strategic and military affairs privately admit they were caught completely offguard by reports of an official Russian proposal to the United States for joint development of a "global system of anti-missile defense" incorporating revolutionary "plasma weaponry." The surprise was so great that editors of the West's so-called free press, with one exception, decided not to publish a single word concerning the lead item on the front page of *Izvestia*, April 2, announcing the Russian offer.

The *Izvestia* article describes a proposed plan for a full-scale test of Russian plasma weapon technology, to be carried out jointly by the two countries. The article emphasizes that the relevant technology already exists, and has advanced beyond the laboratory stage to field tests. According to the proposal, the Russians would transport the components of their plasma weapon on an aircraft carrier and other ships to the American SDI testing area at the Kwajalein Atoll in the Pacific Ocean. There, full-scale tests would be conducted against missiles launched from either the United States or Russia. According to a Russian scientist quoted by *Izvestia*, plasma weapons would be devastatingly effective against missiles, warheads, and aircraft moving through the atmosphere.

Initial reports confirm that the offer described in *Izvestia* was actually presented to President Clinton by President Boris Yeltsin at the Vancouver summit. The *Izvestia* text is also known to have been dictated to *Izvestia* from the highest levels of the Russian military-industrial complex. Coming exactly ten years and ten days after President Reagan's announcement of what became the Strategic Defense Initiative, the Russians' offer represents a 180-degree shift in their official attitude toward the SDI, and potentially a far-reaching revolution in relations between the two military-scientific superpowers.

Voices have already begun to be heard, dismissing the proposal as an "April Fool's joke," as a "fishing expedition" to gain information about advanced western military research, or merely an attempt by starving Russian scientists to procure funds for their laboratories. But experts who have followed extensive Soviet research in the relevant areas of technology since the 1950s, emphasize that the offer is scientifically credible and should absolutely be taken seriously. The "plasmoid weapon" described in the April 2 *Izvestia* article clearly belongs to the first-generation beam weapon

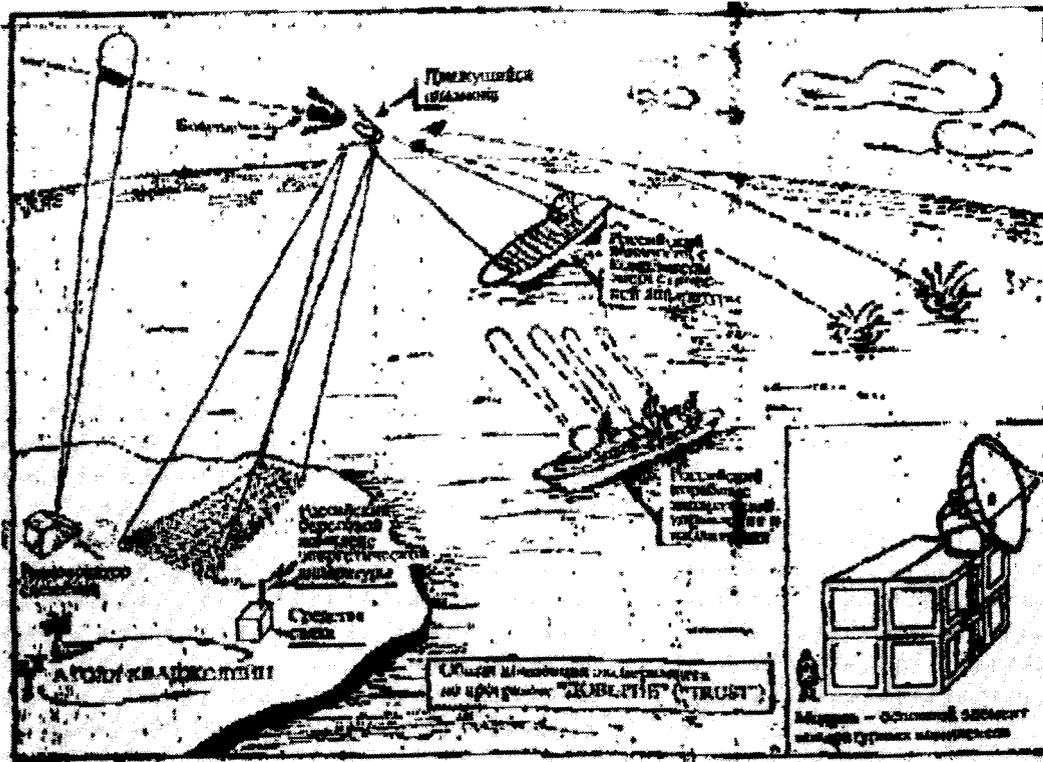
defense system known to constitute a crucial element of the Soviet war-winning strategy known as the "Ogarkov Plan," and originally projected to be completed in the late 1980s or early 1990s. Although the *Izvestia* announcement implies that some important breakthroughs have been accomplished by Russian scientists, key technological components of the plasma weapon have repeatedly been identified in western literature. Furthermore, Soviet work in several of the relevant research areas had been acknowledged to be considerably ahead of the West for some time.

In February 1988, for example, *Executive Intelligence Review* published a special report entitled "Electromagnetic-Effect Weapons: The Technology and the Strategic Implications," describing and documenting crucial aspects of the capability now revealed by the Russians themselves in the April 2 *Izvestia* article. The same capability had been the subject of a long series of conferences and seminars held all over western Europe and in the United States in 1987-88. These included events in Munich, Paris, and Rome at which *EIR* founder Lyndon LaRouche predicted a revolution in war-fighting based on nonlinear effects of electromagnetic pulses. LaRouche and *EIR* pointed at that time to Soviet breakthroughs in the generation and propagation of high-power microwaves—a crucial aspect of the plasma weapon described in *Izvestia*.

How the Russian plasma weapon works

It is important to emphasize that the plasma weapon described in *Izvestia* is only one of many possible weapons which could be put together on essentially the same technological basis. The heart of the capability is the means for generating an entity known as a "plasmoid" at any selected location in the atmosphere, by means of high-power microwave pulses emitted from a so-called phased array. The proposed experiment would involve an application of this technology for a ground-based terminal defense system, i.e., a system designed to destroy warheads in the last phase of their trajectory, as they descend through the atmosphere toward their targets. The same system would also provide a defense against aircraft.

In the diagram included in the *Izvestia* article we see two phased arrays: one installed on the deck of an aircraft carrier, the other on the Kwajalein Atoll. These arrays consist of a large number of individual modules, each several meters



The diagram printed in *Izvestia* on April 2, showing two phased arrays.

in diameter (see drawing in lower right-hand corner). Each module contains accumulator banks for storage and concentration of electrical energy, microwave generators, and an antenna element. The modules are arranged in a regular geometrical array and connected together with power sources and a complex electronic control system which “shapes” the total wave-form emitted by the system in space and time.

Electronically controlled arrays of antenna-elements, known as “phased arrays,” are a well-known technology in the West. Phased arrays are used for advanced radar systems capable of tracking many objects simultaneously. Electronic control of antenna-elements, shifting the relative phases of emission by those elements, makes it possible for an array without moving parts to generate highly directional beams and to change the direction and focus of those beams nearly instantaneously. Furthermore, a technique known as “synthetic aperture” permits such an array to simulate the effect of a single gigantic lens in the focussing of microwave energy.

In the mid-1980s the United States repeatedly complained of Soviet construction of very large phased array radars which violated the terms of the 1972 Anti-Ballistic Missile Treaty. Such radars, the U.S. alleged, had no plausible purpose but to provide precise tracking information for a territorial anti-missile defense system, forbidden by the 1972 Treaty. At the same time, however, concern was voiced in some western quarters, that the big arrays might be *more* than simply radars, i. e. tracking devices. What would happen, if instead of the relatively low emission power employed for tracking, such phased arrays were connected to gyrotrons and other devices generating microwave pulses of up to a

billion watts? At the very least, the resulting microwave weapon might knock out sensitive guidance systems and other electronic components of missiles and warheads. Subsequently, America’s Lawrence Livermore Laboratory initiated a series of laboratory tests of the effects of ultra-high-power microwave pulses on military hardware.

Izvestia describes exactly this sort of feared combination of phased arrays and high-power microwave generators, but with an additional feature based on advanced work in the domain of atmospheric and plasma physics. In *Izvestia*’s figure we see the high-power beams from the phased arrays focussed not mainly on the target itself, but rather on a region in the atmosphere directly ahead of the target. In that region the focussed microwave energy ionizes the air, causing a type of “structured” electrical discharge, known as a “plasmoid,” to be created. The plasmoid in turn creates a massive disturbance of the air flow around the target object, causing it to divert from its path and to break up under the influence of huge aerodynamic and mechanical forces.

To understand this type of effect of a plasmoid-caused atmospheric disturbance, one must bear in mind the tremendous energy which a ballistic missile warhead carries upon re-entering the atmosphere. The survival of the warhead and its ability to hit precisely a chosen target depend on achieving a stable, predictable aerodynamic behavior during re-entry at hypersonic speeds. For related reasons, meteors and other non-stabilized objects invariably break up and are partially or fully burned when they fall to Earth from space. *Izvestia*’s diagram specifies that the plasmoid is created in a state of motion, generating shock waves and other effects which de-

stabilize the target's aerodynamic configuration. At sufficiently high energy-densities, collision with a plasmoid could presumably destroy the target directly.

Background information on plasmoids

"Plasma" is a general term for an electrically conductive state of matter generated from a gas, for example, under the action of extreme heat, radiation or powerful electromagnetic fields. The term "plasmoid" refers to the fact, that under certain conditions a plasma can develop a self-contained, self-stabilizing structure based on the magnetic and other effects of internal configurations of electric currents within the plasma. This property of plasmas was discovered in the 1950s in early experiments in controlled nuclear fusion, and is crucial to some of the most promising schemes for advanced fusion reactors. Plasmoid structures have been proposed as the possible explanation for the strange and elusive phenomena of "ball lightning," which have been the subject of much scientific controversy, partly because of possible military applications. In July 1982, an *EIR Special Report* on "Beam Weapons: The Science to Prevent Nuclear War" included the following information on plasmoids and "plasma beam weapons":

The Soviet Union . . . has had a major research program in plasmoids since the middle 1950s when the first plasmoids were produced at Lawrence Livermore Laboratory in California. A review of Soviet research on ball lightning lists literally hundreds of experimental projects devoted to the subject. The Soviet research in this area has been well funded and has attracted the highest levels of Soviet scientific interest, including P. Kapitsa, the Soviet Nobel laureate. Recent intelligence reports indicate that the Soviet Union is now conducting large-scale propagation experiments involving the generation of high energy plasma beams. The appearance at regular intervals of a high frequency radio signature typical of plasmoid experiments has been interpreted by European intelligence agencies as striking confirmation of the practical application of the long-term Soviet interest in plasma beams.

The author of this article attended the 1978 Nobel Prize lecture by Pyotr Kapitsa, in the course of which the Soviet scientist described experiments on the generation of plasmoid-like structures by high-power microwaves. Since then, research has progressed a long way. As the *Izvestia* article emphasizes, Russian scientists have led the world in the relevant area of plasma dynamics. We would add to this their mastery of the complex interaction among plasma, electromagnetic radiation, and particle beams—an area where the "civilian" science and technology of controlled nuclear fusion intersects that of anti-missile beam weaponry, and one of the highest priority areas for Soviet research since the 1950s. It is the combination of plasma physics together

with mastery of the principles and technology of ultra-high-power microwave generation and propagation, together with advances in suitable electronic control and processing techniques, which provide the basis for the new plasma weapon.

High-power microwave generators

From the mid-1970s on, Russian laboratories have taken the world lead in development of technology for generation of high-power microwave pulses. The famous "gyrotron," which utilizes a relativistic electron beam to generate such pulses, was invented and perfected in the Soviet Union. Following 1975, western observers noted a curious decline in the number of publications in this domain, indicating that a major portion of research had gone "underground" into secret military programs. The 1988 *EIR* special report noted:

The Russian program to develop high peak power radio-frequency (and microwave) has involved scientists active in Russia's strategic defense program: Leonid Rudakov of the Kurchatov Atomic Energy Institute (who specializes in intense relativistic electron beams), A. A. Rukhadze and Y. A. Vinogradov of the Lebedev Physics Institute (who specialize in plasma electronics and X-ray lasers), and many others. A useful review of Russian work on radio-frequency devices is RAND Corp. Report R-3377, "Soviet Development of Gyrotrons" by Simon Kassel (May 1986). . . . How did it happen that the Russians developed high peak power gyrotrons that at some frequencies operate efficiently at peak powers three orders of magnitude greater than in the West? . . . The high peak power machines have no application to the area of interest in gyrotrons in the West (heating of magnetically confined plasmas). . . . The United States didn't start a serious program in high peak power short-pulse gyrotrons until 1984.

Besides gyrotrons, Russian laboratories produced many other important technologies in the domain of pulsed microwave generators, high-current electron beam generators, and pulsed power systems relevant to strategic defense. From a technological point of view, the plasma weapon described in *Izvestia* is based on a "favorite" area of Russian leadership and expertise.

Focussing and propagation problems

Several features of the diagram and short explanation provided by *Izvestia* will surely lead to interesting speculations among specialists in the West, at least until more detailed information is supplied. For example, the "moving plasmoid" shown in front of the target (a warhead) looks like a mirror image of the target itself. Is this achieved by an ingenious analog/digital data-processing technique, similar in effect to the "phase conjugation" methods pioneered by the Russians in laser optics? This technique might fulfill

the function of an otherwise extremely difficult computer analysis of the wave-form scattered back from the target and (possibly from the developing plasmoid), in order to precalculate, in real time, the complex effects of the atmospheric conditions and interactions on the propagation of the microwave pulses. The *Izvestia* article merely indicates that “it becomes possible for the first time to combine in a single complex, the system for radar tracking and the system for electronic delivery to the target, with the speed of light, of the means of destruction—the plasmoid.”

Related to this is another problem, often cited by western experts: how to deliver the large energy required to generate a localized plasma in the atmosphere, without dissipating most of that energy in heating and ionization of the air between the emitting array and the target area? An antenna emitting powerful microwaves will tend already to heat the air in its immediate vicinity. There are a number of ways known in principle for how to counteract this problem, but it is difficult to surmise from the short *Izvestia* article what specific solution the Russian scientists have found and perfected.

Based on known areas of concentration of Soviet fundamental and applied research, it is nearly certain that the chosen solution involves exploiting the nonlinear characteristics of propagation of powerful, “soliton-like” pulses in the atmospheric medium. In simplified terms, a “soliton” is a wave which transforms the medium as it propagates, in such a way as to self-focus its energy in a single, stable pulse which resists any disturbance. A rapid series or “packet” of such solitons might be emitted in such a way, that the solitons “condense” into a giant pulse only in the desired target region, without dissipating in the intervening medium. The corresponding area of fundamental research, which goes back to Bernhard Riemann’s 1859 paper on acoustical shock waves, and its implications for so-called “isentropic compression,” has long been a specialty of the most advanced Soviet research. It is key to advanced nuclear weapons design, to laser- and particle-beam fusion, and many other areas, including future industrial applications of beam technology and energy-dense plasmas.

Independently of this, western experts have long pointed to unique Russian expertise in radio and radar propagation in the Earth’s atmosphere—an area intersecting some far-reaching problems of geophysics. Over decades, bizarre radio-frequency signals have repeatedly been monitored from the Soviet Union, including emissions from huge transmitters whose purpose has never been clarified. Speculation was often voiced concerning Soviet development of exotic weapons capable of modifying the Earth’s ionosphere over large areas, and/or causing “over the horizon” disruption of telecommunications and computer systems, and perhaps even biological effects. Whatever the explanation, it is clear that the Soviet experiments involved areas of expertise which are broadly relevant to the newly revealed plasma weapon capability.

Will Russia help revive America’s SDI?

The pioneering breakthroughs embodied in Russia’s plasma weapon contrast rather favorably with the sluggish performance of America’s Strategic Defense Initiative—whose most promising areas of research have been crippled by the combined effects of savage budget cuts and “dirty tricks” from the SDI’s enemies inside and outside the United States. Indeed, the most revolutionary areas of “new physical principles” which were the focus of Lyndon LaRouche’s original design of the SDI policy initially adopted by Reagan in March 1983, came under strong attack, were soon cut back and finally virtually phased out, especially during the Bush administration. Symptomatic is the collapse in spending on “directed-energy” systems—including laser, particle-beam, microwave, and plasma weapons—which were initially the core of the SDI program, in favor of the relatively Stone Age technology of the so-called “smart rocks” (precision-guided anti-missile warheads based on advanced sensors and ultra-compact microcomputers). LaRouche emphasized that the latter sort of system could never provide the kind of global defense necessary to shift away from the doctrine of “Mutually Assured Destruction”—the original mission of the SDI.

The process of destruction of the SDI was of course inseparably connected with the persecution of LaRouche himself, leading eventually to LaRouche’s frame-up and final imprisonment, at the demand of the Soviet leadership, in January 1989. This underlines the irony of the present juncture. For, it was LaRouche himself who originated the idea of offering joint development of SDI technology to the Soviet Union, and who personally presented that offer on behalf of the U.S. government, in confidential “back-channel” discussions with Soviet representatives in the course of 1982. At that time the Soviets vigorously rejected the idea, on the grounds that a U.S. crash program of anti-missile technology based on “new physical principles” would cause the West to jump far ahead in economic and technological power. The Soviets opted to try to suppress the U.S. SDI by any means possible—while at the same time pressing ahead with their own, first-generation beam defense system!

Already back in 1982, LaRouche advised the Soviets that a common development of SDI provided the unique opportunity for solving the most devastating problems of the Soviet economy. Provided that the SDI effort were organized in accordance with LaRouche’s parameters for economic policy, the “spill-over” effects of SDI technology into the civilian economies of the United States and Russia would pay back the investment in beam weapons many times over. LaRouche warned that a Soviet refusal of the U.S. offer for joint development would make a collapse of Warsaw Pact economies during the ensuing approximately five years, virtually certain. That is exactly what happened! A decade after their initial, vigorous rejection of LaRouche’s proposals, the Russians now seem to have understood his point.

Meanwhile, the virtual dismantling of the U.S. SDI under the influence of George Bush and his friends guaranteed the

Senior Russian official confirms SDI proposal

Speaking in Rome on April 20 at the Assembly of the Western European Union conference on the subject, "Anti-missile Defense for Europe," Dr. Leonid Fituni, director of the Center for Strategic and Global Studies of the Russian Academy of Sciences in Moscow, stated: "Joint testing of a plasma weapon may be the first joint anti-missile program between the United States and Russia, as discussed during the Vancouver summit between Presidents Yeltsin and Clinton. The joint project called 'Trust' is based on plasmoids created by microwaves and optical laser-generating systems."

Dr. Fituni was asked by *EIR*'s correspondent to expand on his comments in his speech on the "plasmoid weapons" project. He responded that he could confirm that the matter was discussed between Presidents Clinton and Yeltsin. It was not yet a formal proposal and there was not yet a decision on it, he specified. He believed that it was in a state of stalemate and that there was opposition to it, perhaps also in the United States where there might be fear of competition.

The plasmoid project, he underlined, was designed to be Russia's secret answer to the U.S. Strategic Defense Initiative. You will remember, the Russian official continued in his public remarks, that the Russians said that there will be an unconventional response to the SDI. Russia's topmost secret research institutes were involved in it. He affirmed strongly that against this plasmoid design, there was no technologically possible countermeasure foreseeable. He said that there were also discussions in progress on the GPALs system, and that while everyone may assert publicly that the ABM Treaty was valid, it could be discounted in reality. The "Trust" project could become a major point on the agenda between the United States and Russia, Fituni added.

On the same day, Russian Science and Technology Minister Boris Saltykov also confirmed in Washington, where he was speaking on a forum on Russian science at Georgetown University, that the SDI joint-research proposal was discussed at the Vancouver summit. In answer to a question from *EIR*'s reporter, he stressed that the Russians are ahead in some areas in lasers and directed energy projects, citing work at Arzamas and at the Ogninsk Physics Institute where lasers are being used with nuclear energy to create a pulsed neutron reaction. "There is already collaboration on some projects apart from the military technology," he said.

downward slide of the U.S. economy into this century's worst depression. The only way out of the economic and political catastrophe now gripping both East and West is to combine a revival of LaRouche's original SDI policy, as a joint effort with Russia and other nations of the former Soviet Union, with a massive, global program of basic infrastructure development centered on the European "Productive Triangle." This means particularly: high-speed rail and magnetic levitation transport systems, "second-generation" nuclear energy, development of water infrastructure and communications, together with a complete reconstruction of health and education systems according to the requirements of the 21st century.

In this context, infrastructure and SDI development complement each other: On the one side, massive development of infrastructure provides the "transmission belt" for propagating the waves of new technologies, created in an all-out SDI effort, through the advanced machine-tool sectors into the entire economy; on the other hand, the effect of these new technologies is to greatly cheapen the *relative* cost of production for infrastructural and related capital goods. Thereby, as LaRouche emphasized, "we can spend all day long on SDI technology, and become richer all the time."

The science and technology behind the Russians' plasma weapon provides an excellent illustration of how this will

work. For example, microwave-driven plasmoids promise to become a crucial "working medium" for the production of new and old materials in tomorrow's industry. In the United States, a prototype plasma reduction using a plasmoid-like structure has been tested, which produces high-quality steel and other metals by direct reduction in a fraction of a second. A single unit the size of a garage would have the throughput of a present-day blast furnace! Such furnaces operate at temperatures of 10,000°C or more in a highly nonequilibrium, energy-dense regime which will make it possible to produce entirely new types of exotic materials. Using highly structured plasmoids permits us to run a material efficiently through a rapid series of phase changes, including "shock" heating and cooling and exposure to various radiation regimes. Plasmoid furnaces promise also to become the most efficient means for processing various forms of waste into useful materials. However, in order to exploit these advantages, we have to go to a much higher intensity of energy consumption in industry. That, in turn, is a question of infrastructure!

Will the Russian proposal for joint development of plasma weapons and a global defense system, turn the tide of history and revive LaRouche's original policies for peace and economic recovery? It is too early to tell, but *Izvestia*'s announcement is surely a step in the right direction.