

Debate on SALT II

W. K. H. Panofsky, in favor . . .



Wolfgang Panofsky is director of the Stanford Linear Accelerator Center.

SALT is a product of *negotiation* aimed at limiting strategic nuclear weapons spanning four administrations since 1967. Negotiations are not only across the table between the United States and the Soviet Union, but also involve resolutions of diverse positions at home on each side. Specifically, on the US side, SALT positions are the result of decisions by the President faced with inputs from the Defense Department, the Joint Chiefs of Staff, the Arms Control & Disarmament Agency, the CIA and the State Department. These decisions are also affected by consultation with Congressional leaders and with our Allies. One should be aware of this complex pattern to realize that the SALT outcome cannot make everyone happy. The negotiating history should be kept in mind when judging the sincerity of criticism that claims: "I support a SALT treaty but not this particular one." Little purpose is served in discussing an "ideal" treaty that would be optimal only to a particular set of interests.

Since SALT II is the product of negotiation, its very structure reflects the present status of agreement and disagreement between the two nations. The *Treaty*, running until 1985, represents agreement between the US and the Soviets on numerical limitations and minor qualitative constraints and on the means to assure verification. The *Protocol* (expiring by the end of 1981) represents items on which definitive agreement could not be reached on a long-range basis, but which are restrained for a shorter time while still preserving freedom of action after the expiration of the Protocol. For instance, the Protocol prohibits deployment (but not research, test and development) of ground-launched and sea-launched cruise missiles reaching beyond 600 kilometers. This provision offers no constraint as such, since development of

these weapons cannot have led to deployment before expiration of the Protocol. On the other hand, inclusion in the Protocol will automatically place these items on the agenda for discussion for the next round of SALT. The Protocol prohibits the test and deployment of mobile ICBM's. The Soviets have developed such systems while we have not, and the US could not possibly test or deploy these before the Protocol expires. Accordingly, this item constrains the Soviets but not the United States. Again, this subject will clearly be a matter for discussion in an ongoing SALT process.

Finally, there is a *Statement of Principles*, which promises more incisive arms control and touches on those subjects that were not seriously considered, let alone resolved, in SALT I and II, but which urgently need consideration if the strategic arms race is to be limited in its burdensome dangers.

Achievements

Let me list some of the achievements of SALT II that are both positive and important:

1. While SALT II will not limit the evolution of any of the US strategic weapons systems that are now under development or definitely planned for deployment, it does limit both US and USSR expansion in the next generation of strategic nuclear delivery systems. As a result, the projections that forecast US and Soviet future weapons systems under a variety of assumptions are facing a cap beyond which the numbers of weapons cannot grow. This, in turn, places a limit on the justifiable demands for new weapons that a "worst case" defense planner would make on the governments of each country.

2. In the past the pattern of buildup of strategic weapons has generally been

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At PHYSICS TODAY's invitation, two physicists with opposing views on the proposed Strategic Arms Limitation Talks discuss the arguments for and against US approval.

Edward Teller, opposed . . .



For many years the United States enjoyed unchallenged military superiority. This secure position was due to our wealth and to the high level of our technology.

Today our wealth is being dissipated. Many young people consider technology, and even science, irrelevant. The result is that our superiority disappeared and even turned into a position of inferiority vis-à-vis the Soviet Union.

To some this statement may appear exaggerated. However, hardly anybody will deny that the continuing trend is shifting the balance of power in favor of the Soviet Union.

The situation should be considered not only from the point of the interest of the United States. We should put the greatest emphasis on the question of how the best chances for peace can be achieved. I believe that stability depends on power being in the hands of those who are determined to prevent war.

The question of SALT II must be viewed in this context. Is it appropriate at this time to rely on an agreement? Let us remember that in 1961 the test moratorium was broken by Russia on a 48-hour notice.

If a SALT II agreement is signed and

ratified, this will constitute a signal to the American people that they need not worry—all's right with the world. Unfortunately, all will be right with the world only if we are prepared to defend such a happy condition. Events in Angola, Sudan, Yemen, Afghanistan indicate that "Pax Americana" no longer exists. What we have today is no longer Americana, and it is pax, at best, in a shaky manner.

It has been argued that, in the absence of a SALT treaty, an unlimited and disastrous arms race will result. Some fear the arms race because they believe that arms have a dynamism of their own; if they are produced they will be used. This view is supported by the history leading up to World War I. On the other hand, World War II was preceded by a race in disarmament—a race the western democracies won with ease. As a result, a single fanatic had a chance to initiate Armageddon. He almost succeeded in permanently subjugating all of Europe.

One should also note that we are involved not so much in an expensive arms race but rather in an intricate race of technology. The question is not primarily quantity and expenditure, but rather determination and ingenuity. As

far as military affairs and innovations are concerned, the Russians are beating us at our own game.

Alternatives to SALT

In the absence of a SALT agreement we could, and probably would, pursue some essential and not too expensive developments.

Civil defense. The Russians have made considerable progress in plans to evacuate if nuclear war is impending. Indeed, the Russians might disperse the population of their cities before giving us an ultimatum, with nuclear attack as an alternative. They have deployed shelters and food storage. Our affluent and motorized society has done next to nothing. We should, as a minimum, develop and implement plans for counter-evacuation.

Tightened alliances. We should and could tighten our alliance. The burden for defense and the responsibility for decisions could be divided in a more equal manner. For instance, cruise missiles might be jointly developed. The industrialized countries of the free world

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have a common interest in a secure peace. The issues that divided us are few and relatively unimportant.

Electronics and electronic computers is one area of technology in which our consumerist society enjoys a clear advantage. This capability has been applied to defense to a limited extent. The cruise missiles represent a small but significant step in this direction. One should note that the Russians are attempting to use SALT II for the purpose of limiting our cruise-missile development. In the end we might move toward highly sophisticated unmanned weapons with two-way communications using lasers and microwaves. These would be less expensive and more flexible than our present instruments and still could perform better than manned planes, tanks or small ships. They will not function without sophisticated electronics.

The Triad. At present we rely on the "Triad," a three-fold system of nuclear retaliation: bombers, nuclear submarines, and land-based missiles. None of these three are completely reliable. One of them, the land-based missiles, could be wiped out by a Russian first strike. Thorough modernization of this system is essential. In this connection, some mobility of the missiles is essential.

The list above is incomplete. The most urgent and least expensive items are mentioned first. This sketchy program may illustrate to the reader that if we become aware of the deficiency in our defenses soon enough, we shall be able to improve our situation at an acceptable cost.

A SALT agreement will be presented to the American public as a harbinger of peace between the two superpowers. In that case none of the programs mentioned above are apt to be pursued with vigor. By the time the danger of our situation is apparent it may be too late to catch up.

A position of inferiority

Previously treaties for arms limitation have been sought under conditions of American superiority. Today the United States negotiates from a position of inferiority. The attempt to agree with the Russians on restrictions of armaments is dangerous for two additional reasons: the US is an open society, while the USSR is not; and the US has no plans to dominate the world, while the USSR has a clearly stated program to extend their philosophy and their rule around the globe.

I believe that a SALT agreement is dangerous for the United States at this time under any conditions. There are even further dangers which are inherent in the plan that has been evolved for SALT II.

SALT II attempts to limit delivery vehicles while allowing nuclear weapons to proliferate. Under this arrangement the

Russians could build exceedingly great numbers of nuclear weapons and missiles to carry these weapons. These systems could be stored in warehouses and not deployed in silos we can see. Even at this time Russia has a four or five-fold advantage in "throw-weight,"—that is, the weight that their nuclear-tipped missiles can carry from Russia to the United States. The Russians could double or triple their advantage. A limit is not in sight. They could develop a superiority so great that resistance would become folly. All this could be done in complete secrecy and without violating the letter of SALT II. Indeed, they could not be limited in fabricating the missiles; the treaty would restrain them only from deployment in silos. Therefore, there does not seem to be any method by which the proliferation of nuclear weapons could be controlled in a society such as Russia's. However, in the open society of the US such proliferation could not occur.

The Russians consider their modern

Backfire bombers as non-strategic. Therefore, these are not included in the planned SALT treaty. Yet these bombers could take off from Russia, deliver their bombs on the US without the planes having refueled, and then land in Cuba.

The Russians count their SS-20 missiles as non-strategic. These missiles could wipe out all European defenses in a single blow. A signing of SALT II would, therefore, give rise to fully justified worries for our NATO allies. To weaken the NATO alliance is one of Russia's main near-term objectives.

The Russians consider our cruise missiles as strategic. SALT II would limit our cruise missiles, which represent a step toward sophisticated unmanned vehicles. Since we honor treaties, in the spirit as well as in the letter, the treaty would discourage the one development that we are now actively pursuing and that might lead to a more equal balance between the superpowers in the 1980's.

If we do not sign SALT II we have a

SALT II—the terms of the Treaty

The Strategic Arms Limitation Talks aim to limit the escalation both in numbers and in types of strategic nuclear delivery systems. Reflecting the view that SALT is an ongoing process, the proposed SALT II agreement is organized in three parts, each corresponding to a different duration of enforcement. The Treaty would remain in effect until 1986; the Protocol would last about three years and the Joint Statement of Principles would establish guidelines for future negotiations.

The SALT II Treaty would subject both parties equally to quantitative and qualitative

restrictions, including the following:

- ▶ A ceiling of 2400 on the aggregate number of strategic nuclear delivery vehicles, to be lowered to 2250 by 1982
- ▶ A limit of 1320 on launchers of ballistic missiles equipped with multiple, independently targetable reentry vehicles (MIRV's) and on heavy bombers equipped for long-range cruise missiles
- ▶ A lid of 1200 on the number of MIRV'd ballistic missiles alone
- ▶ A ceiling of 820 on MIRV'd, land-based intercontinental ballistic missile (ICBM) launchers
- ▶ A prohibition against any increase in the number of reentry vehicles (RV's) carried by existing types of ICBM's. The number of warheads on existing type of ICBM's will be frozen at the maximum with which that missile type has been tested. New types of ICBM's will be limited to 10 RV's and new types of SLBM's to 14.
- ▶ A ban on the construction of additional fixed ICBM launchers and on any increase in the number of heavy ICBM launchers, defined as those larger than the Soviet SS-19 missile
- ▶ A restriction to one new type of ICBM during the lifetime of the Treaty
- ▶ A ban on certain new types of strategic offensive systems such as ballistic missiles on surface ships
- ▶ A ban on the development of the Soviet SS-16 missile for the Treaty's duration
- ▶ An exchange of data on the weapons systems that are limited by the Treaty

The SALT II Treaty would continue the verification provisions of SALT I. (The SALT I Interim Agreement expired in October 1977, but the US and USSR have unilaterally stated their intents not to take any actions contrary to that accord as long as SALT II negotiations continue in good faith.) Under the verification arrangements of that earlier treaty, each side is to confirm by national

	US	Soviet Union
Strategic nuclear warheads	9000+	5000+
Land-based missiles (ICBM's)	1054	1400
Heavy bombers	350	150
SLBM launchers	656	950

chance to recover from the dangers of military inferiority. The power that we acquire would not be used for nuclear aggression but might well serve as a nuclear deterrent.

For more than two decades we have pursued a policy aimed at arms limitation. In this period we have gone from superiority to parity, from parity to essential equivalence and from equivalence to a situation that we hopefully call "sufficiency." SALT II may complete the process and introduce an obvious lack of balance. Such a situation would encourage Russian imperialism and is bound to endanger peace. This is why this is not the proper time to sign or to ratify SALT II.

Panofsky's rebuttal

Edward Teller's article clearly states his philosophy: The Soviets are now superior militarily, they are bent on world

domination while we are not, they are capable of very large-scale, high-technology, military undertakings that remain hidden from us over many years, the US is determined to avoid war, the USSR is not. Therefore we need a "pax Americana."

These are highly debatable assertions in their own right, but they are hardly related to SALT as drafted. *None* of the programs Teller strongly advocates for the United States—expanded civil defense, tightened alliances, increased emphasis on electronic warfare, cruise-missile development, strengthening of the strategic Triad—are inhibited by SALT. Teller states: "If a SALT II agreement is signed and ratified, this will constitute a signal to the American people that they need not worry—all's right with the world." Teller thus considers any SALT agreement with the Soviets dangerous to the United States. In other words, Teller suggests that under our democratic processes no arms-limitation agreement can

be signed without endangering our security through neglect of our defense. Only continuing superiority will do.

Not only is such a position destructive to the search for an alternative to the "race for oblivion," but it is also unsupported by history. Past arms-control agreements with the Soviets have not caused us to ignore our defense. The Limited Test Ban Treaty has actually accelerated our rate of testing nuclear weapons underground, as permitted by that Treaty. While SALT I has assured the penetration of each one of our missiles by restricting Soviet ABM's to militarily insignificant numbers, it has not reduced the number of missiles the US has deemed necessary. In the current budgetary debates I have heard no voices pleading that SALT I, the Nuclear Test Ban Treaties, or other arms-control agreements obviate the need for an adequate defense. On the contrary, there have been successful arguments that we should *accelerate* weapons acquisitions in order to "bargain from strength" at SALT; the price for support for Senate ratification of SALT II by military spokesmen may well be a commitment to *increased* military effort where not constrained by SALT. Despite these escalatory forces SALT II will achieve significant arms limitation on both sides. Moreover, basic technological innovation in military weapons, which Teller so strongly advocates, is much more hindered by institutional inertia than by arms control.

Teller hardly addresses himself to the actual provisions of SALT II. However, his references to the Treaty lead to misinterpretation of the provisions as drafted.

Teller states: "SALT II would limit our cruise missiles . . . the treaty would discourage the one development that we are now actively pursuing, and that might lead to a more equal balance . . ." In the strategic area this program is the ALCM (Air Launched Cruise Missile), *permitted and not limited* in range by either the SALT II Protocol or Treaty.

Teller states correctly that the Soviets could stockpile missiles and warheads *without violating the letter of the Treaty*. However, he states that these could be fired (presumably from transportable launchers) since the treaty would only restrain them from deployment in silos. This is incorrect; the Treaty limits launchers, not silos. Any such augmentation in throw weight would have to be clandestine, and I doubt that this is possible on a significant scale.

Teller states: "The Russians count their SS-20 missiles as non-strategic." These are intermediate-range missiles threatening Western Europe. It was the United States that refused to include the "Forward Based Systems" such as the US-manned, European-based aircraft as strategic weapons in SALT I and II.

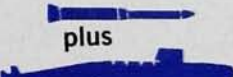
technical means (NTM)—that is, by observations not requiring the active cooperation of the other nation—that the other party is complying with the treaty. Interference with the NTM is forbidden, as is the use of deliberate concealment measures.

Adding to these verification measures, the proposed Treaty contains type rules to assist in counting MIRV'd launchers. For example, if an ICBM or SLBM of a certain type has ever been flight tested with MIRV's, it is considered to be MIRV'd, even if it has also been tested with a single RV. All missiles of that type are considered to be MIRV'd. The new Treaty would add the requirement for advance notification of certain ICBM test launches but would not limit their number.

The Protocol would allow testing, development and deployment of air-launched cruise missiles (ALCM's) of unlimited range. (A cruise missile is an unmanned, guided-weapon delivery vehicle that flies by means of aerodynamic lift in the manner of an airplane. They generally fly at low altitude to elude detection.) The Protocol forbids the deployment of land- and sea-based cruise missiles with ranges beyond 600 km but permits their development and testing. It would ban the deployment (but not the development) of mobile ICBM's, as well as the testing and deployment of long-range, air-launched strategic ballistic missiles. A separate package of constraints will deal with the Soviet Backfire bomber, an aircraft with capabilities somewhat less than those of heavy bombers. This aircraft can reach the US unrefueled, but only on high-altitude, one-way trips.

Under the Joint Statement of Principles, the US and USSR would commit themselves to pursue further reductions in the numerical ceilings, to extend the qualitative limitations, and to resolve the issues covered by Protocol.

Barbara G. Levi

Sublimit  ICBM's — MIRVed intercontinental ballistic missiles	820 maximum
Sublimit  plus SLBM's — the above plus MIRVed submarine-launched ballistic missiles	1200 maximum
Sublimit  plus bombers — both of the above plus long-range bombers carrying cruise missiles	1320 maximum
Overall ceiling  plus total delivery systems — all of the above plus unMIRVed missiles and bombers not carrying cruise missiles	2250 maximum

These can strike western Russia with nuclear weapons. As a result, the Soviets and the US agreed to omit consideration of these and other systems specifically affecting the European balance.

Teller states: "The signing of SALT II would, therefore, give rise to fully justified worries for our NATO allies." Ratification of SALT II has been supported by Chancellor Schmidt of Germany, Prime Minister Callaghan of England, President Giscard d'Estaing of France and other West European leaders.

Teller states correctly in his concluding paragraph that the US and USSR world situation has changed substantially for more than two decades, with the Soviets growing in military power. Yet this evolution can hardly be blamed on the ongoing arms-control effort. On the contrary, analyses of the actual provisions of SALT II lead to the conclusion that enactment of this treaty would increase US security.

Teller states: "... the agreement will be presented to the American Public as a harbinger of peace between the two superpowers." This I do not claim; all I maintain is that SALT II is a positive step in Man's efforts to limit the increasing dangers and burden of nuclear arms.

Panofsky

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that the US has led in a given technology (for example, nuclear weapons, ICBM's, SLBM's, ABM's, MIRV's and now strategic cruise missiles) and has proceeded to rapid buildup. The USSR then followed after a lag of several years while the US leveled off its own deployments. Thus, the Soviets often passed the US in terms of number and size of weapons deployed, but rarely in quality. We are currently in a phase where the US has leveled off its numbers of ICBM's and SLBM's, while the USSR is still building up. As a result, SALT does a great deal more to arrest Soviet strategic arms momentum than it does to impede planned US systems. SALT II actually requires the Soviets to destroy some, albeit older, strategic systems.

3. SALT II limits the number of warheads that can be placed on MIRV'd missiles. For instance, the SS-18 (the largest Soviet ICBM) will be constrained to carry no more than ten warheads, while its size theoretically permits carrying twice that many. As a result the US planner, in evaluating countermeasures to the emerging vulnerability of the land-based ICBM force, faces a threat with a specific upper limit.

4. The SALT process places the technical national surveillance systems (satellites, radars and so on) of each side under legal protection. In other words, short of actual war, we are assured of the continuity of information flow so neces-

"Strategic Arms." Clockwise from top: An airborne command post, ready to assume command of SAC missiles; a Titan-II ICBM launched from an underground silo; an FB-111 strategic bomber, a variation of the F-111 fighter that can carry nuclear or "conventional" weapons; the *Ohio*, a Trident-class submarine, at Groton, Conn.



sary for verifying compliance with SALT and for assessing the military status of other nations.

5. SALT II continues the Standing Consultative Commission that was created in SALT I to resolve controversial matters relating to SALT compliance. It thereby preserves the forum in which military matters (whose discussion had previously been taboo) can be aired. This Commission has been invaluable in clearing up suspicions of violations on both sides, resulting in the conclusion that no violations of significance of SALT I have occurred.

6. SALT is not an expression of mutual trust between the US and the USSR. Both parties must be persuaded that their intelligence apparatus is adequate to ensure that evasion of the SALT provisions to a militarily significant extent should not go undetected. Much has been written about the adequacy of US satellites, radar and other means to collect information in "verifying" Soviet compliance

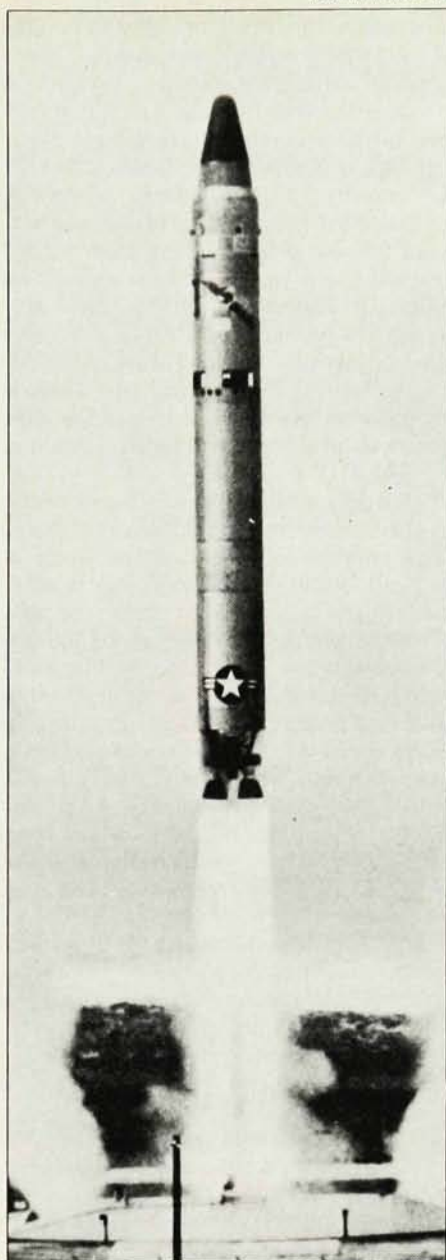
with SALT II. Let me simply state here that the numerical provisions of SALT II can indeed be very well policed. Checking the restraints on modernization is somewhat more difficult but still surprisingly good.

7. There are real economic benefits of SALT, at least in the long run, because purchases for strategic hardware need not be as large with SALT as without. However, the cost of such weapons is not a dominant factor in the overall economic burden of armaments.

Misconceptions

After having recited what SALT II will accomplish in dampening the US-USSR nuclear arms capabilities, let me list and discuss some frequent misconceptions:

1. SALT is not a major factor in shifting the relative defense posture of the United States versus the Soviet Union. Competition both in the military and economic arenas of both nations will not be diminished substantially by SALT II



that SALT II places on the fractionation of ICBM warheads, and thus on the total number of reentry vehicles carried by the Soviet ICBM force. The options now before the US Government in replacing Minuteman by a more survivable weapons system are not limited by SALT.

The problem of ICBM vulnerability should be put in proper perspective. It is indeed true that by early in the next decade the number and accuracy of Soviet warheads will be adequate to destroy a large fraction of US ICBM's in their silos; conversely, US weapons will be able to destroy not quite one-half of Soviet ICBM's. However, US land-based ICBM's carry only about 25% of US retaliatory power while Soviet ICBM's carry about 75% of the total weight of nuclear weapons. Thus the vulnerability of these land-based, fixed ICBM's, while certainly undesirable and contributing to instability, does not even approach giving a first-strike potential to either side. On the contrary, the ability to retaliate in a devastating manner after absorbing a first strike, which is a necessary consideration for stability, is preserved for the foreseeable future, and this stability is significantly enhanced by SALT.

Objections

If the achievements of SALT II are indeed positive, then why is there any criticism at all? The objections fall in three basic classes:

Criticism based on issues totally unrelated to SALT, objecting to military decisions taken either by this or prior administrations. Among such items, not constrained by SALT, are the cancellation of the B-1 Bomber, the deferred decision on the neutron bomb, the choice of small versus large missiles, the level of defense spending and so on. Generally such criticism focuses on areas of Soviet strength and US weakness, while omitting matching areas of US strength and Soviet weakness. Obviously, one should expect disagreement on the wisdom of past decisions in the strategic military arena. Yet blaming whatever dissatisfaction the critic may have on SALT is clearly wrong.

SALT II will generate an atmosphere of false security which will prevent the United States from providing adequately for its military needs. This argument in essence pleads that a move toward a more stable and peaceful world is dangerous. I have confidence that the wisdom of our institutions in providing for the needs of national security in the broadest sense will be preserved.

SALT II does not achieve enough. It is indeed true that many people interested in arms control would have wished that SALT II had achieved deeper cuts and more stringent controls. In fact, one can maintain that technological progress during the time in which the SALT treaties have been negotiated has outpaced the achievement of that process.

in itself, although certain limits are imposed. The United States must still establish defense policies to do whatever is believed necessary in its own security interest. Military procurements must still be gauged by the internal priorities as seen by government. In other words, the "guns vs. butter" debate will not be silenced by SALT.

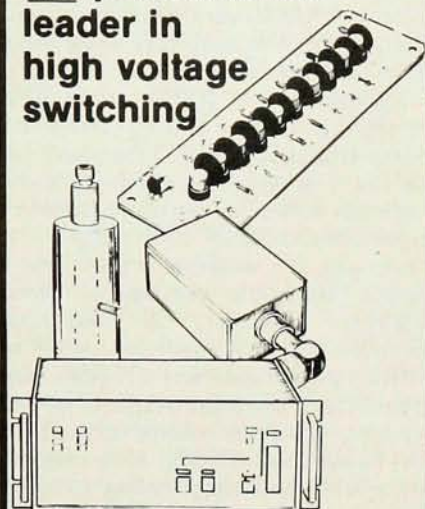
2. SALT is not a "zero sum game" in which one party's gain must be achieved at the expense of the other party's loss. Therefore, the frequently heard opinion that since the Soviets seem to want SALT so much it must be bad for the US, and that therefore we should be able to charge the Soviets a high price for our agreement, makes little sense. The SALT process does reflect the conviction of *both* parties that reducing the dangers and burdens of nuclear weapons is a matter of overriding interest, and that the security of both nations can be increased through a SALT agreement. As Andrei Sakharov said recently: "I believe that the problem of

lessening the danger of annihilating humanity in a nuclear war carries an absolute priority over all other considerations."

3. SALT is not a reward for good Soviet behavior. Although successful negotiation of a SALT agreement requires, of course, a minimum of civil relations between the United States and the Soviet Union, it does *not* signify approval of Soviet ideology, of Soviet moves in Africa, or of their conduct vis-à-vis internal human rights any more than it reflects Soviet approval of United States mediation in the Israeli-Egyptian treaty. In fact, SALT I negotiations continued while the US was bombing Haiphong harbor with Soviet ships in that port.

The much-discussed problem of the vulnerability of US land-based ICBM's (the Minuteman force) is real but is not significantly affected by SALT; as a matter of fact, with SALT II the problem is somewhat more tractable than without such a treaty. This is because of the limit

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Therefore, for SALT actually to reverse the growth of nuclear armaments, future treaties must achieve more. Yet there is no question that nuclear strategic weapons buildup on both sides projected for the future would be larger without SALT II than with SALT II in force. Moreover, defeat of SALT II would be a major setback towards attaining more incisive arms control in the future. The leaders of all Western European nations have expressed apprehensions about the security of their nations and the future of the Alliance if SALT II is not ratified. There is no question that US security and the hope for a peaceful world will be strengthened by SALT II.

It is important to keep the awesome reality of nuclear explosions in focus. The current inventory of the world is around 30 000 nuclear weapons, most of which are much larger than the two weapons which each killed about 100 000 Japanese when detonated over Nagasaki and Hiroshima. Many of the arguments swirling around SALT are couched in such terms as *perceptions* of strength, *perceptions* of resolve and national will, and other phrases that make nuclear weapons symbols of power rather than objects of physical reality. As physicists we must keep reminding ourselves and our fellow citizens of the real nature of these weapons and that any use of nuclear weapons for whatever purpose in war can cause dangers to our civilization that are impossible to quantify.

Teller's rebuttal

In a political debate such as the one on SALT II, there is not—and cannot be—a definitive answer. Some remarks on Wolfgang Panofsky's well-reasoned paper may, however, be in order.

Indeed, the "Protocol" will not be binding at all on the Soviet Union after expiration of a short period. In the United States, having raised hopes for more agreement, the Protocol will exercise great pressure, even after it has expired.

The Protocol may prohibit only deployment, but not research and development. But it is hard in the United States to appropriate money for research and development when deployment is not expected. It may also be hard to obtain the enthusiastic cooperation of scientists when the Protocol seems to have placed a military instrument outside the pale.

The Protocol prohibits the deployment of mobile ICBM's. This is apt to interfere with a viable option designed to ensure the survival of our Intercontinental Ballistic Missiles.

Panofsky lists six positive achievements of SALT II.

1. He expects a "cap" beyond which the numbers of weapons cannot go. The reality of such a cap depends on our surveillance, and also depends on the absence of future systems for which surveillance

is more difficult. It may have been a serious mistake that in SALT I we overemphasized limitations on silos for the obvious reason that for these, surveillance is possible.

2. Panofsky states "... the Soviets often passed the US in terms of number and size of weapons deployed, but rarely in quality." Of the quantities we might be aware; to check quality is almost impossible. It is an uncomfortable situation when we have to admit that the Russians are ahead of us in those respects that might be measured, but we claim to be ahead in those fields where guesses must suffice.

3. How shall we check that an SS-18 carries fewer than ten warheads? The usual answer is that we shall find out when a missile carrying 40 warheads is tested. But, could the Russians not fire a missile carrying 40 warheads, release only seven, and be confident that those not released would have worked as well as those released and observed?

4. SALT placed national surveillance systems under legal protection. These are words. Our foremost surveillance system consists of our satellites. We know that the Russians are perfecting satellite-killers.

5. The Standing Consultative Commission created in SALT I seemed to me, at the time, like real progress. In spite of its existence, bitter public debates ensued concerning violations—for instance, between Secretary Kissinger and Admiral Zumwalt. Due to secrecy, the public has no way to judge.

6. SALT tends to discourage proliferation of numbers. I agree with Panofsky that this may be advantageous to both sides. The United States should catch up by producing better quality, not by outdoing the Russians in quantity.

Concerning misconceptions related to SALT:

1. The "guns vs. butter" debate would, indeed, not be silenced. It would, however, be deeply influenced.

2. To avoid a nuclear war is truly the interest of everyone. However, to speak of annihilating humanity is an exaggeration.

3. Secretary Kissinger suggested that SALT should be linked to moderation in Russian expansionist policy. This seems to have some merit.

Panofsky mentions that only 25 percent of US retaliatory power is carried by ICBM's. But the great proportion of our weapons is carried by aircraft, and these aircraft are facing truly ample Russian air defenses.

In conclusion, Panofsky argues that we physicists must keep reminding everyone of the real nature of nuclear weapons. This point hardly needs more emphasis. Our proper role should be to point out the great and increasing role that new technologies play in national defense and survival. □