Panofsky said the forthcoming American Physical Society report on SDI technology would be useful. Keeny said his organization, the Arms Control Association, was dedicated to public education by means of educating the media who report on these issues.

Panofsky said it was time to discuss the last agenda item - chemical and biological weapons - and asked Lederberg to make some opening remarks. Lederberg said there were changing developments in the BW and CW fields that made it even more important to raise these issues. He cited specifically the issues of compliance and new complications raised by advances in technology - binary technology for chemical weapons and biotechnology for biological weapons. He said these weapons would become more significant in a world with fewer nuclear weapons.

Lederberg said chemical weapons were awesome tactical weapons which played an important role in WWI. He said biological weapons had not been tested in that way, but that they made entire populations vulnerable, much the way nuclear weapons did. Chemical, unlike biological, weapons do not multiply and are regulated by the Geneva protocol, essentially a no-first-use treaty. He noted ongoing efforts in the Committee on Disarmament to extend restrictions to chemical weapons, but that there were problems of definition and the fundamental issue of the dual uses of chemicals. Lederberg said there were problems of verification, which would affect the entire chemical industry, and that there were proposals for on-site inspections and challenge inspections. He noted that Keeny had been involved in the prior negotiating history.

Lederberg said the main military threat posed by CW was that of an adjunct to reduce the tactical efficiency of troops, or to add to high explosive loads to decrease ability to repair damage, as to airfields. Lederberg said the U.S. used to neglect CW defense, but that the problem was now at least half solved. He said that in view of deteriorating stockpiles, the U.S. was modernizing with binaries as a successor. He said one condition of this modernization was not to have full deployment, but that the ability to have a short lead time was an advantage. He said the Soviets had invested heavily in protective personnel systems.

Calogero said there needed to be greater concern about the proliferation problem, and that the Iraq situation might be a strong inducement to make progress toward a ban. Lederberg said the West had embargoed chemicals and equipment to the Middle East, but that the West Europeans had continued to export chemical intermediaries. He warned they could end up back on Western soil in the form of terrorist attacks.

Mason agreed with Lederberg on the assymmetry between NATO and the WTO in CW delivery systems and stockpiles. He said the only credible U.S. system was the 155 mm. shell, and eventually, the Big Eye, while the Soviet Union had several credible systems, and that

this could lead to chemical weapons use in close battle. Mason said it was hard to believe the Soviets could gain substantial advantage in close battles, that the chemical weapons would have to be deployed in significant amounts and that meant that the level of meaningful cheating on the tactical level was high. As to interdiction, Mason said 500 agent tons on 200 targets could interrupt capabilities, and that this put significant pressure on verification. He said verification would have to focus not just on stockpiles, but also on delivery vehicles, which represented a more robust set of observables.

In answer to a question from Haftendorn, Lederberg explained that binary technology complicated the verification problem because there were fewer signatures than for the storage of dangerous unitaries. He said the compounds produced, and their effects, were identical.

Doty said at the CW Treaty negotiations in Geneva movement toward agreement had advanced and that 90% of the text was agreed upon. He said the main problem was posed by the verification of undeclared stocks and of production facilities. He said the problem was that serious verification of the entire Soviet Union was unlikely and unaffordable. He said the administration may try to push this treaty through as a symbolic step toward the verification of undeclared stocks. He said that while total control was not possible, there was an advantage to be gained by a treaty that was not insignificant. He added that the Reagan-Kohl deal on chemical weapons in Germany might be the neutron bomb decision revisited.

Keeny asked how serious was the CW threat. Lederberg responded that its major danger was as a force multiplier and as an added complication. Calogero added the threat of proliferation as the greatest danger. Doty said this was under discussion in NATO, and they were thinking along the lines of the nuclear suppliers group or something less restrictive. Lederberg said there may be a coupling of non-proliferation with the U.S. withdrawal of chemical weapons from Germany.

Flax recalled that in the early 1960's, NATO emphasized chemical weapons, which at that time were seen as a more acceptable alternative to nuclear weapons, but that point of view did not last long. He said that Soviet Military Power says that many Soviet weapons systems are capable of being equipped to carry chemical weapons. Flax said, however, that the Soviets were worried about proliferation, and that this motivated them. He said this was a difficult problem deserving of international attention. He predicted it would be hard to write a strict treaty, and that it would require an SCC-like mechanism.

Steinbruner said that while the Soviets displayed a large chemical weapons defensive capability, their offensive capability was not known. Flax agreed, although he said some chemical weapons do seem to be available for a wide range of Soviet delivery systems.

Lederberg said the Soviet incentive for a CW ban was the knowledge that a CW race with the U.S. would not give them any advantage. He agreed that defining the boundaries of what was forbidden was difficult, and that the Soviets could feel that if they changed their mind, it would be easy to get out of it later. Lederberg said he would be skeptical if a treaty were signed. He said we should agree to destroy quantities, not percentages, and that it should be a treaty that declared residuals with some inspections to verify the declarations.

Schell asked how chemical weapons could be used defensively. Lederberg said chemical mines could protect a border, for instance, but that he was not so sure that an arms control regime could be built on this distinction.

Mason said any agreement would be multilateral, and that this was important for proliferation. He said we should keep trying for a negotiated abolition of an entire class of weapons, which he said would be a magnificent achievement for arms control. Lederberg said this could not be done because of the dual capability problem--the class was not that well defined.

Garwin said if there were not training in the use of and defense against CW, then there could be no use. Mason disagreed, saying research and training in CW defense was necessary as insurance. Mason noted this was a sticking point in Geneva.

Lederberg said a few words about biological weapons, which he said posed a serious threat to all people, not just the combatants. He said as an overhanging anxiety it also contaminates other efforts at world order.

Lederberg said the BW convention, signed in 1972, was a useful partial step towards controlling biological and toxin weapons, notwithstanding its well-understood limitations with respect to a) verification/compliance, b) enforcement, and c) its inability to deal with weapons-related R & D (as opposed to production and deployment). He said intrinsic to its utility was an expectation that it would foster a climate of mutually advantageous, cooperative verification and enforcement, meeting the deeper interests of all sides.

Lederberg said the convention has undoubtedly been helpful in forestalling a major technology race in BW, compared e.g. to recent history in cruise missiles. However, the limitations of the convention perhaps now contribute to other elements of international competition. He said the result today is a high degree of unmitigated suspicion about actions and intentions of 'the other sides,' with grave consequences for 1) the credibility of arms control agreements generally--especially those not manifestly verifiable by the grossest of national means; and 2) the potentiality for fueling a major technology race between the superpowers, within the letter if not the spirit of the 1972 BW convention. Lederberg

said that since agents could be manufactured in plants primarily designed for medical or industrial purposes, and since we have the prospect of still newer and more effective weapons-agents from biotechnology, anxieties about a threatening 'breakout' in violation of the 1972 convention further poison international harmony.

Lederberg said that international security was more likely to be threatened by the proliferation of BW capability to less responsible powers; the nuclear superpowers have a marginal need, at most, for BW atop their nuclear retaliatory capability. He said the possibility of regulating that proliferation is gravely impaired by the current lack of cooperation in the enforcement of the BW convention. The irresponsibility just mentioned is aggravated by the likelihood that biological weapons will spread infection from the targets under attack, with potentially unlimited collateral damage, even retroaction.

Lederberg said it would not be easy to design formal procedures for a more cooperative approach: the minimum that should be sought promptly is to enhance forums for candid discussion where questions can be raised and pressed on matters that elicit anxieties about compliance with the purposes of the BW convention. The still unanswered questions about the "Sverdlovsk case" are an example. The "answers" offered in print about the "foodborne epidemic of intestinal anthrax" at Sverdlovsk were so lacking in detail, they did not meet the minimum standards of a scientific or public health report.

Lederberg said in the long run, mutual confidence about the intentions and capabilities of BW-related research can be built up by more extensive international cooperation in the study of infectious disease. All responsible states will also have to be proactive in their reassurances to other states about their posture on BW and compliance with the spirit of the BW disarmament convention. The fabric of international control of BW development is tenuous indeed.

Lederberg concluded by noting that within the framework of the bilateral U.S.-USSR Academies of Science - CISAC discussions, we were organizing a subgroup of specialists to address the above challenges, with particular emphasis on proliferation.

Lederberg said the Soviets saw the value of BW vis-a-vis China, and that this could complicate BW arms control prospects.

Schell asked about terrorism and whether the technology needed to safely use BW against an aggressor was fairly sophisticated. Lederberg responded that if one side had a modern hospital, then it had that capability.

Zuckerman said he thought the U.K. and the U.S. conducted BW research in WWII, but that the Soviets did not. Flax said there was an ambiguity in the treaty because it allowed research on defensive measures, and that it was hard to make the distinction between research for offense and research for defense.

In answer to a question about how one calculates the effects of a BW attack, Lederberg said this was hard, and was one reason why biological weapons have not been used.

Panofsky adjourned the discussion for the day. The final session resumed at 9:00 a.m. on Monday, June 30. Panofsky first reviewed the substantive discussion of the previous day.

Panofsky summarized Zuckerman's presentation on the balance of forces in Europe, which questioned the relevance of the question of the balance of forces given the unpredictability of the outcome of conflict. Panofsky reviewed the following points made by Zuckerman: that the introduction of nuclear weapons into Europe occurred before NATO was formed; that they had no military utility in terms of actual use; and that the INF deployments reflected a political, rather than military, rationale. Panofsky review Doty's main points and those that emerged from the discussion on the same agenda item: that there was a great difficulty in predicting the outcome of conflict; that the Kaufmann estimate of 25% chance of holding back a WTO incursion for one month might be enough for deterrence; that the introduction of new technologies into Europe represented a mixed blessing; that NATO may be overly reliant on high technology and may be fueling a race in this area; that the new technology appears to threaten preemption; that surveillance from a large distance was vulnerable to countermeasures; that rapid pace of modernization may be artificially shortening the life spans of weapons and therefore unnecessarily costly; that the SDI program did not address the defense of Europe against ATBM and that Europeans did not see a way to afford ATBM.

On the INF discussions, Panofsky reviewed the paradox that emerged regarding linkage to strategic arms control, particularly in regard to the British position. He said the discussion revealed that there had been some disengagement of nuclear forces in Europe, despite some recent reversals. Finally, Panofsky said there was a concensus that deliberate nuclear confrontation in Europe was unlikely, and that inadvertent nuclear war was the main danger, emphasizing the need for greater study of crisis management.

Summarizing the deep cuts discussion, Panofsky said there was note of the common goal of 50% reductions, but that the two superpowers never appeared serious about this goal at the same time. Panofsky reviewed the discussion of the rationale for deep cuts, which included: a moral imperative to go down instead of up; positive impact on the political environment; non-proliferation treaty commitment to do so; and decreased inclination to use nuclear weapons