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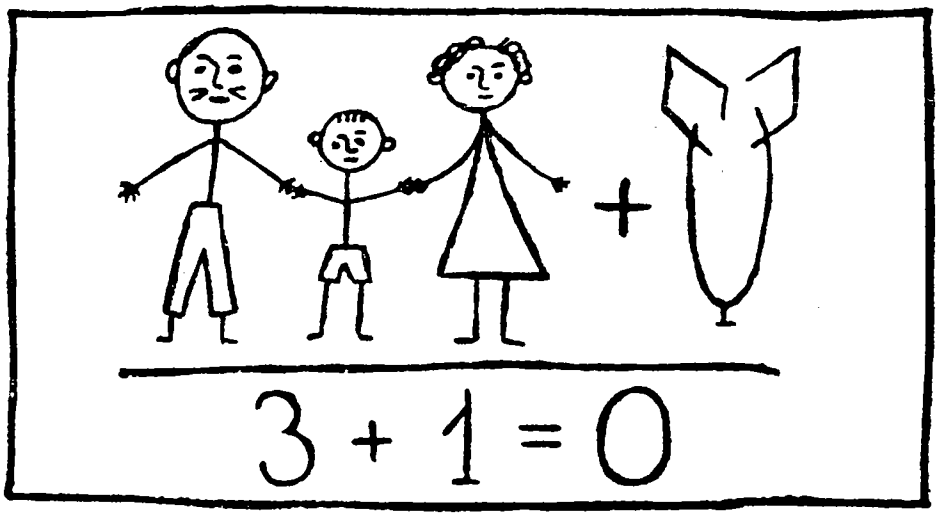

Of several minds: *John Garvey*

MURDEROUS EVIL

DOES NONVIOLENCE OFFER A SOLUTION?

Commonweal:
20 September 1985

IN HIS July 12 *Commonweal* article, "Appointment with Hitler," Peter Steinfels raises some difficult and necessary questions. The question of our response to Hitler is of supreme importance, and it has not been dealt with well by those of us who believe that Christianity demands nonviolence. Steinfels rightly points out that such statements as "War never solves anything" or the assertion that all wars are fought ultimately for reasons which are exploitative, racist, based on misunderstanding, or simple devices to benefit the military-industrial complex — all of these duck the question posed by Hitler: What are we to do when confronted by murderous evil? The fact that the Allies themselves were guilty of evil actions and that all motives were not pure does not change this central truth: Nazism was uniquely evil. At least some people who fought in that war did so, not because they did not understand the other side or the nature of the struggle being waged, but precisely because they did.

Much about World War II has become myth. Neville Chamberlain's attempt to appease Hitler, for example, is frequently cited by conservatives as similar to the attitude of liberals towards the Soviets: allow them a little leeway, and they'll settle down. Things aren't so simple as that, of course. Appeasement was, in fact, defended in part as an anti-Communist move. Hitler was a buffer against the Communists, the lesser of those two evils. Much about appeasement has more in common with the current conservative attitudes towards South Africa and the dictatorships of Latin America. According to this line of thinking, it makes sense to support, or at least not oppose, right-wing dictatorships, because the alternative is Communism. The right is correct to raise the question of liberal double standards: the assumption that left-wing tyranny is excusable while right-wing tyranny is reprehensible, so that Marcos, for example, — a terrible man, to be sure — gets a worse press than the leaders of China or the Soviet Union. (Poets in the Philippines, unlike China or the Soviet Union, are not in legal trouble for failing to write poems praising tractor production.) Still, the right has its own set of blind spots, which in some cases take over most of the field of vision.

Both right and left use the myths generated by a war which seems more justifiable than any in history. If the right waves appeasement around, the left does the same thing with fascism. Any oppression is compared to Nazism; any killing above the level of a fatal mugging is compared to the Holocaust. The problem with our use of the war and its myths is that it erodes our appreciation of the fact that there was, in Hitler, in Mengele, in the response to Hitler on the part of German people and on the part of many ugly Nazi-like groups in the countries Germany occupied, something uniquely evil.

Pacifists have argued that to respond to violence with violence makes us no better than those violent people we oppose. That looks neat on paper, but in fact what does it mean? I may choose to accept violence against myself rather than be violent — I mean this in theory, because I am not at all sure that confronted with such a choice I would be able to accept what I believe I should do — but would it be right for me to accept the violence done to another person? If someone mugs me and I hand over my wallet and allow him to slug me rather than resist him violently, that's one thing. I am hardly working from the same place, morally, if I allow him to rob and slug an old lady while I stand by. Abstract nonviolence could argue equally for both courses of action (or inaction), but real morality can't.

Violent actions can indeed reduce the people who are directly or indirectly involved in it, and it always implicates us in evil. But the heroes of the Resistance are not morally equivalent to the Nazis, nor were they, compared to the signers of the Oxford Union motion, naive.

Christians who believe in nonviolence face a number of dilemmas. I believe that we must hold on to the belief in nonviolence, and confront the dilemmas honestly without reducing them for rhetorical purposes.

Here is one dilemma: we believe that all human beings — not just those within our borders — are equally loved by God, made in God's image, and are, for that reason, to be revered. To kill anyone for reasons of state, or to allow any government to define other human beings as those we may kill (and this is something which happens in every war), would violate something central to our faith.

At the same time, it is right to ask what the Good Samaritan would have done if he had arrived on the scene a little earlier. Would he have stayed in the background while the robbers beat the stuffing out of the victim the Samaritan later tended? The victim would in that case have been a victim as much of the Samaritan's nonintervention as he was of the robbers' violence.

One answer to this is that resistance does not always have to mean murder. One can resist, even forcefully, without killing. But what if this isn't always the case? If a Japanese pacifist were, by some odd chance, seated at the controls of an anti-aircraft weapon; and if he spotted the *Enola Gay*; and if, knowing somehow that it was about to drop the bomb, he refrained from shooting it down on the reasonable grounds that doing so might kill someone, would he have done the right thing?

What I want to suggest is that the way we have done moral theology is often perverse, and it is further complicated these days by the desire of religious people to make secular sense. The perversity is this: we have tried to find ways through moral dilemmas which ignore the mystery of evil by saying, more or

less, that any necessity becomes good by virtue of the fact of necessity itself. If to kill the Nazis hidden in the basement I *must* bomb the orphanage, then I am not guilty of sin. If in order to save my family I *must* kill the madman with an ax because, given the situation I find myself in, there is no other real choice available, then I should not feel defiled. A good teacher once suggested that Oedipus was right to feel defiled for sleeping with his mother and murdering his father, even though he did not know that the man he killed was his father and the woman he slept with was his mother. Human beings can find themselves implicated in evil despite all of their best choices; they can find themselves confronted at times with only two paths, each of which leads to an evil end.

Any suggestion that evil is a presence in the world leads these days to the charge of Gnosticism or Manicheism. But it was Jesus, not Mani, who referred to "the Prince of this world." There is something present in the world, in the life of each of us, which does not love humanity and which distracts us from what has been revealed as our salvation. It is a vanishing, or at least a diminishing, of this understanding which allows us to think of a Hitler as sick, rather than evil. To suggest that evil is real is not to say that Hitler had nothing sick about him, or that he was so taken over by an evil and alien power that his own will was powerless, or his sickness irrelevant. The reality of evil means that a person — free, and at the same time perhaps blighted by sickness — can turn to the desire for power and manipulation rather than to compassion and, because this exposes us to the will of others, to weakness; in this turning, a choice is made which allows murder to be born. Something which affects us personally allows us to make this choice, and it is not wrong to call it satanic.

What about the dilemma facing the person who believes absolutely in the need for nonviolence, but who is confronted with occasions on which the only possible moral action seems to demand a violence which will lead to the evil of another's death? It may be that there are times when the only thing to do is accept violence and then repent. There were canons in the early church which demanded that those who had shed blood, even in self-defense, were required to refrain from the Eucharist for a period of years.

This makes sense to me, as does the possibility that someone might have to shed blood. On the one hand, it is important to bear witness to the fact that the life of any human being, even a bloodthirsty one, is sacred. On the other, there are occasions when there may be no alternative to killing another human being — unless the alternative of allowing yet another to be killed seems acceptable.

I am not, in saying this, defending the right of governments to conscript people into their wars, nor am I denying that not enough time has been spent in urging nonviolent alternatives to conflict at every level. The point is, rather, that there are times when nonviolence simply doesn't work. It isn't, I realize, always meant to. As Gandhi insisted, at its best nonviolence is not so much a strategy as a witness to truth — about yourself and about the life of the person who faces you as an enemy. But there may be circumstances when this does not seem morally possible, and at such times violence may seem — and may in fact be — the only moral alternative. Moral theology should not find ways to make these moments acceptable; they can be encountered only with fear, trembling, and profound repentance. The celebration of war, or of revolutionary violence, is obscene.

But another moral theology, one which simply denies the possibility that war and other forms of violence are ever anything other than exploitative or fearful responses to situations which could in every case be responded to nonviolently, is dangerously naive. I said above that the need felt by a lot of religious people to make secular sense complicates our view of this question. What I mean is that the pacifism of many people — the small fraction of French intellectuals to whom Steinfels refers, for example, and those who insist that only misunderstanding could cause the tensions between the West and the Soviets — is based less on the Gospel than on secular thinking. It is not Christian, but only silly, to think that Communism is not a repressive form of government in all of its historical incarnations. Christian nonviolence says that this is not reason enough to kill Communists. It does not say that all of our difficulties with Communism would disappear if only we better understood Communist nations. Christian nonviolence does not depend on solutions; its end is the cross. If a nonviolent response to evil works, that is nice, but it isn't the point. The point is that all human life has been revealed in Christ's incarnation as holy, even the lives of enemies and oppressors. This has nothing to do with the pacifism of those who think of Nazis or Communists as peace-loving sorts who would settle down and be good if only we didn't provoke them.

JOHN GARVEY

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Princeton Alumni Weekly
Sept 25, 1985

OPINION

The Case Against Star Wars

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PHILIP W. ANDERSON

The author in the lab

I AM NOT an expert on strategic weapons. I'm a theoretical physicist who has been involved in almost all of physics except atomic bombs. I have not done classified work since 1945, and that was on radar. My total contribution to the laser—a major technical component of the Strategic Defense Initiative, which is better known as Star Wars—was roughly that when one of the scientists at Bell Laboratories who originated the things asked me to predict whether a certain seminal version of it would work if they built it, I said, "Well, maybe."

Fortunately, most of the scientific issues that come up in discussing Star Wars are very simple ones which require neither specialized nor especially technical—and therefore classifiable—knowledge. One needs to know that it costs everyone about the same amount to put a ton of stuff into a given orbit and that this is a major portion of the cost of any space system; that signals can't travel faster than the speed of light; that it takes roughly as much chemical fuel to burn through a shield with a laser as the shield itself weighs; that Americans are not measurably smarter than Russians; and a few other simple, home truths. Given these, almost everyone comes to much the same conclusions.

If you go through the enormously detailed kinds of calculations on specific configurations which Richard Garwin and his fellow opponents of SDI felt necessary to convince the stubborn, you leave yourself open to the kind of errors of factors of 2 or 4 which Martin Muendel '86 found in his widely publicized junior paper last spring [PAW, May 8] and which then—to the lay person—seem to weaken the whole structure. This is a particularly tough game because Star Wars advocates do not themselves propose specific configurations and present specific calculations that can be shot down; their arguments are given in terms of emotional hopes and glossy presentations. This is why I think it is good for the argument against SDI to be made by a mentally lazy, non-expert person like myself who isn't particularly fascinated by the technical details.

The reasons for not building Star Wars are essentially identical to those which led both us and the Russians to abandon, for practical purposes, the antiballistic missile in 1972 and to sign a treaty restricting ABMs. It is important to understand that reasoning—and perhaps it is less emotionally charged than Star Wars since it is now history and not even controversial history anymore. Why would anyone feel that a defense against missiles was useless and, in fact, dangerous and destabilizing?

There are three stages, each more certain than the last: (1) It probably wouldn't work, even under ideal conditions. (2) It almost certainly wouldn't work under war conditions. This puts us in the dangerous and unstable situation of the gunfighter who doesn't know if his gun is loaded. (3) Most certain and conclusive of all, *each defensive system costs, inescapably, at least 10 times more than the offensive system it is supposed to shoot down.* Thus it pays the other side to increase its offensive arsenal until the defender is bankrupt, and the net result is an *increase* in armaments and a far more dangerous situation, without any increase in safety.

> "The reasons for not building Star Wars are similar to those that led us and the Russians to abandon the ABM in 1972."

The offense has, inescapably, enormous advantages: its missiles are sent at will, in any desired sequence and quantity, with any number of decoys and other deceptive countermeasures, preprogrammed at leisure to hit their targets; the defense has to find them, sort them out, get into space at a time not of its own choosing, and then kill the warheads it finds with nearly perfect accuracy. In the case of ABM, there were other problems, such as that the explosions were over the defending side and that the first few explosions probably blacked out the whole shooting match, but that was sufficient argument against.

As far as almost everyone in and out of the Defense Department was concerned, until March 1983 this situation was an accepted fact. No technical breakthrough had or has changed those realities. The change has been purely political and emotional, and hence now financial. President Reagan's March 1983 speech, as far as anyone can ascertain, was not preceded by any serious technical review, but quite the opposite: the most recent and urgent internal study of antimissile defenses had come out negative on all possible schemes.

Apparently, the President based his speech and his subsequent program on a collection of rather farfetched suggestions—farfetched but by no means secret and previously unknown—which, to the outside scientific observer, seem to deserve the oblivion that the last pre–Star Wars study consigned them to. These schemes amount to a way for the defense to spend more per missile and still let through a large fraction of the offensive missiles. The defensive hardware that has to be got up into space still has to have roughly the same mass as the offense; in many schemes it has to get there faster; and it still has to be much more sophisticated and therefore vulnerable and delicate. Key components, in most schemes, have to be left in space indefinitely, inviting the enemy to track them with space mines, perhaps the most dangerous tripwire mechanism for starting a war that one can possibly imagine.

Some Star Wars advocates will protest that I do not mention the one idea which

Philip W. Anderson, who won the Nobel Prize for Physics in 1977 and the National Medal of Science in 1982, is Joseph Henry Professor of Physics.

doesn't founder just on the problem of total mass in space. This is the scheme of exploding hydrogen bombs in space and directing the explosive energy of the bombs with lasers to kill very many missiles per bomb—several hundred to several thousand, if one is to kill an equivalent cost in missiles! If I could think of any way such a monstrosity could work, as opposed to the many ways it could not work or be frustrated, I would take it more seriously. Apparently there has been some good and interesting science done on these lasers, but unfortunately it is classified; no one, however, seems to claim that it helps much with the technical problem. I cannot, incidentally, see any way to do meaningful development on such a weapon without exploding H-bombs in space, a terrible pollution as well as a violation of what treaties we have.

"The large increment of research funds earmarked for SDI is a very bad thing for the research community and the country."

I think the above would represent reasonably well the views on the technical realities of most trustworthy physicists to whom I have spoken, in or out of academia and in or out of the Star Wars program. In academic physics departments, which receive relatively little support from the DOD, a pledge form has been circulating stating that the signer opposes SDI as unworkable and will not seek SDI funds; this has had a high percentage of signers everywhere it has been circulated and its preliminary circulation in Princeton over the summer encountered only a few holdouts. Those who do not sign feel, primarily, that research in any guise shouldn't be opposed, while agreeing personally that the systems proposed are unworkable and destabilizing.

PERHAPS it would be worthwhile, therefore, for me to explain why I feel the large increment of research funds earmarked by President Reagan for SDI is a very bad thing for the research community, as well as for the country as a whole. You will note that I said *increment*: every year before Star Wars, we spent $1 billion in ABM research and development. My main reason is that, on the whole, Star Wars will represent a further acceleration of three extremely disturbing trends in the direction of research funding in this country.

First, we are seeing a decrease in basic research relative to mission-oriented, applied research. The basic research agencies—National Science Foundation, Basic Energy Sciences in the DOE, and National Institutes of Health—have been maintained at level funding while their missions have been gently skewed toward applications and engineering by piling more applied responsibilities on them. At the same time, while the Administration has cut back on development in some civilian sectors, it has more than compensated by increasing the amount of applied work for the military.

Second, there is a trend away from scientific administration of federal research money—mostly done by the system of "peer review"—to micromanagement either by bureaucrats, or, increasingly, by Congress, with all the logrolling possibilities that entails. The three institutions mentioned above, especially NSF and NIH, operate by subjecting each grant to a jury of other scientists. Like most democratic procedures, this system is worse than everything except the alternatives; its effect has been reviewed repeatedly and there →

Princeton and the Bomb

I SUPPOSE Princeton can be given the dubious honor of being the birthplace of the Atomic Age: it was here that Einstein wrote the famous letter to President Roosevelt which, at least in a symbolic sense, set off the development of the bomb. The scientific and political history of the Ultimate Weapon is dotted with Princetonians: Eugene Wigner and Richard Feynman *42 both made major contributions to the development of the bomb; J. Robert Oppenheimer directed the Institute for Advanced Study during and after his period of power and influence; our Henry De Wolf Smyth '18 in 1945 wrote the report which summarized the Manhattan Project; John von Neumann midwifed the calculating machines which made modern weaponry possible; and there are many others.

What is less well known is that Princeton is, in this latter day, a center for the rational—and occasionally irrational—discussion of what to do with the damn things. Our two most famous philosophers of the strategic equation are at the Institute for Advanced Study: George F. Kennan '25, the patient and hard-headed advocate of living with the Russians instead of dying with them; and Freeman Dyson, whose book *Weapons and Hope* is a very personal but characteristically sane discussion of the entire spectrum of the problem of nuclear armanents.

On two other levels Princetonians concern themselves with these problems. For one, over several decades our scientists have worked within the many advisory bodies to the government which study strategic questions, such as—when it existed—the President's Science Advisory Committee (PSAC), and the still viable organization known as JASON, which brings the talents of the country's most brilliant scientists to give private (in fact classified) advice to the Secretary of Defense. As a member of PSAC, for instance, Marvin L. Goldberger (then a member of Princeton's Physics Department, later its chairman, and now president of Cal Tech) is known to have been an extremely influential advocate of the ABM treaty. Physicists at the university and the institute continue to work in JASON.

Second, on the level of open study and public discussion of arms, strategy, and arms control, and occasional advocacy of specific measures, we have a very active group in the Center for Energy and Environmental Studies of the Engineering School, with close contacts to the Wilson School. A regular, even busy, program of seminars and studies on arms control is maintained by this group, and the main topic of interest this fall will be the Strategic Defense Initiative (SDI), better known as Star Wars.

Senior personnel of this group are: Frank von Hippel, a Wilson School professor and past chairman of the Federation of American Scientists, the major scientists' lobbying group on arms control issues; Robert Socolow, director of CEES, and Hal Feiveson and Barbara Levi, members of the center; and Richard Ullman of the Wilson School. Many of us from other departments, notably physicist Jeff Kuhn, participate in such functions as the group's regular Thursday lunch seminars.

It was through Kuhn's interest in such issues that SDI first came to PAW's notice: he was the local supervisor and contact for the widely publicized junior paper by Martin Muendel '86, written under the instruction of Major Peter Worder of SDI. Last spring Martin was reported by PAW (and several other publications) to have "refuted" the calculations of Richard Garwin and his fellow opponents of SDI. When I objected that this story, while factually accurate in the narrow sense, did not properly represent the situation or the attitude of Princeton physicists toward Star Wars, I was invited by PAW to represent what I see as the majority attitude, which I attempt in the accompanying article.

—P.W.A.

is no serious doubt that it works. Military "research," on the other hand, has always operated on the arbitrary whim of the contracting officers. In the early days after World War II this administration was a benevolent despotism, but the adjective has long since lost its meaning. Most of the in-house DOD laboratories have been rather a scandal in the research community. The dominant motivation in this system seems to be the standard bureaucratic one of "empire building."

Third, from the point of view of the country as a whole, perhaps the most dangerous trend is the shift from civilian to military dominance of our federal research and development spending. Under the Reagan Administration, this has grown to 72 percent military, up from about 50 percent a decade ago. Everyone has been told—the DOD sees to that—of the great economic benefits of "spin-off" from military development, but if they exist (and I have never found an economist who believes in them), they are not evident in our recent economic performance vis-à-vis Japan and Germany. In fact, in a country like ours with a serious shortage of trained engineers and scientists, a shortage which would be crippling if we did not attract great numbers of them from overseas to staff our universities and research laboratories, the waste of our precious technical expertise on military hardware is a serious economic debit.

From Princeton's point of view, all of these trends are disturbing. As a top-flight research university, a heavy percentage of our funding is in individual support of independently functioning basic scientists, mainly peer-reviewed and to a large extent from the agencies mentioned above. We have not had to resort to logrolling political tactics, nor have we had to accept micromanagement, DOD control of publications, or limitations on citizenship of students to keep our research funded. SDI control of funding, and in general the shift of research funding to the military, is a serious danger to the independence of Princeton as a research university.

Of course, this is a narrow and slightly parochial view, but it is nonetheless serious. Certainly it is more important that the naïve emotional appeal of the Star Wars concept is being used so blatantly to defuse the country's strong desire for nuclear disarmanent, and to turn this emotional pressure into yet another excuse for enriching the arms manufacturers and building up a dangerous and worthless arsenal of nonsensical armaments. To paraphrase Murph Goldberger's testimony on the ABM: Star Wars is "spherically" senseless—that is, silly no matter how you look at it. □

• Princeton Alumni Weekly

The following is quoted from "Could 'Star Wars' Work?" by Hans-Peter Dürr, director of the Werner Heisenberg Institute for Physics, Munich. The article originally appeared in Der Spiegel and was excerpted in World Press Review, September 1985.pp.23-29:

"The SDI program follows the old pattern of 'the fallacy of the last move,' in which one seeks to solve a problem without considering the changes that the solution will unleash. SDI would set off a new, higher level arms race that might easily lead to the point of no return."

SCIENCE, Vol. 229, pp. 29-31, 5 July 1985. Reprinted with permission.

"Star Wars" Tests and the ABM Treaty

Arguing that planned tests of components of a missile defense system will violate the ABM treaty, critics are trying to cut the program's budget

The first experiment in space for the Pentagon's "Star Wars" program was modest and a little embarrassing. An off-the-shelf, low-power laser was fired at a mirror aboard the space shuttle Discovery as it passed over a military base in Hawaii on 19 June. The purpose of the experiment was to demonstrate a key bit of the technology needed for the development of much larger, ground-based lasers, which may someday be used in conjunction with space-based mirrors to destroy Soviet ballistic missiles at a great distance. Because of a navigation error, however, the shuttle was pointing in the wrong direction and the laser missed the mirror. A second attempt on 21 June was more successful.

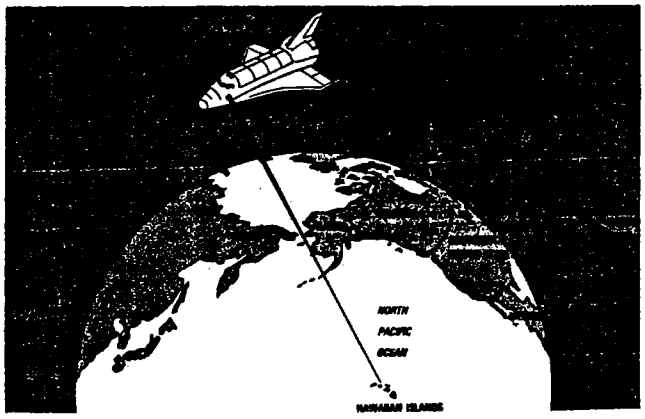
On the horizon are many more such experiments and demonstrations, each more elaborate than the one before. Between 1987 and 1992, for example, at least 12 flights of the space shuttle will be devoted in large part to "Star Wars" tests. Four major ground-based experiments are planned for the next 5 years; six more will occur within the earth's atmosphere; and four additional experiments are planned for space. They will incorporate a panoply of sophisticated, defensive weapons and sensors, including lasers, electromagnetic railguns, rockets, and infrared radars.

This list, a source of pride for the Pentagon, has recently provoked considerable anxiety within the Congress. Egged on by a substantial portion of the arms control community, a number of influential congressmen are worried that some of these experiments are illegal—banned by a prohibition in SALT I on development or testing of antiballistic missile (ABM) systems or components. Although the Administration has mounted a strenuous campaign to rebut this claim, it has not been entirely successful.

As a result, the proposed budget for the program in 1986 may be sharply cut, as critics attempt to force either a deferral or cancellation of the experiments through some drastic financial surgery. Recently, for example, it narrowly missed being slashed by 45 percent, from $3.7 billion to $2.1 billion, with most of the cuts in the long-lead items for major experiments. The proposal was made by Representative Norman Dicks (D–Wash.), who believes that "those who would call some of the activities contemplated . . . in line with the [SALT I] treaty would see a masked man at midnight stalking through an alley with a color TV under his arm as making a delivery." Dicks had the support, among others, of Representative Les Aspin (D–Wis.), who chairs the House Armed Services Committee. Along with a number of Senate supporters, including William Proxmire (D–Wis.), John Kerry (D–Mass.), and Albert Gore, Jr. (D–Tenn.), they intend to try again during appropriations votes later this summer.

Although the most controversial experiments are not scheduled until 1988, critics of the program are anxious to resolve the issue now, before major new contracts for test hardware are signed. "We are now moving into a time where the expenditures are building up quite rapidly because [we] are beginning to build experimental hardware, and that is where the costs are hard; they keep ramping up and will ramp up into the next year," Lieutenant General James Abrahamson, the program's director, told the House Republican Study Conference on 5 June. By early July, he will have selected four or five contractors to conduct detailed analyses of test requirements and schedules, out of ten who submitted proposals.

As many Administration officials recognize, the managers of the program face a difficult challenge. They must somehow conduct tests realistic enough to advance the technology and generate public support, yet remain within the treaty constraints, which were deliberately drafted to block such efforts. As Abrahamson told the study conference participants, "We have to be able to present . . . not esoteric laboratory data, but real demonstrations . . . the results of true experiments . . . so that it will be apparent not only to you but to your constituents, to our population and to the Western world and to the Soviet Union, as well, that this can be done." In a speech on 30 May, Arms Control and Disarmament Agency director Kenneth Adelman predicted openly that treaty modifications might be necessary for such experiments to proceed.



The first test

An attempt to bounce a laser beam off a mirror on the shuttle failed on the first try, but was successful on the second attempt.

For now, the Administration insists that everything on the books is legal. "The SDI [Strategic Defense Initiative] research program can be conducted in a fully compliant manner to reach a decision point in the early 1990's on whether to proceed to development and deployment of an SDI-related system," the Pentagon asserted in a special report on 18 April. Each of the proposed experiments has been formally reviewed and approved by the Pentagon's Office of Research and Engineering, which funds and directs the research, with legal advice from the Pentagon's general counsel.

Gerard Smith, the chief negotiator for the United States during the SALT I talks, is among those who have sharply criticized this review and its outcome. "When I read the Administration's report, I felt I was reading the work of expert tax lawyers, of people trying to evade the law," he says. "It seems to me →

[that] we are trying to prepare the ground for [treaty] breakout and as a lawyer, I would say that constitutes anticipatory breach of contract." He is joined in this view by John Rhinelander, who served as the chief legal adviser to the U.S. SALT I delegation.

Specifically, they are critical of the Administration's interpretation of a provision in the SALT I treaty that prohibits development of space-based or air-based missile defense components. As Rhinelander points out, the provision was not discussed in any depth during the negotiations, so the key terms are subject to varying interpretation. But the U.S. government has previously defined "development" as field testing on so-called breadboard models or prototypes of equipment, readily observable by the other side,* and "components" as devices capable of acting as missile interceptors, launchers, or defensive radars.

Smith and Rhinelander say that the managers of the "Star Wars" program have sought to circumvent the spirit, if not the letter, of these constraints through field tests of devices that are barely different from components. Beginning in 1988, for example, tests will be conducted on a Boeing 767 crammed with infrared missile detection and tracking equipment as it flies over the Pacific Ocean. Virtually everyone agrees that such tests would be illegal if the data collected during missile tests were passed along to ground-based interceptors; the plane would then be acting as a defensive radar. But the directors of the program intend to omit the transmission equipment, and record the data onboard instead. Therefore, they hold, the experiment is not proscribed.

Similarly, the Pentagon plans to launch two infrared satellites between 1991 and 1993 to detect and track Soviet missiles with great accuracy, beginning shortly after their launch. Again, the program managers hope to steer clear of the ban on radar tests by omitting the equipment needed for prompt transmission of the collected data, as well as most shielding against radiation. "They will operate in as close to a realistic environment as possible," says William Frederick, an assistant director for sensor technology in the SDI office, "but they will not be militarized satellites, and they will be incapable of providing a guidance vector to space- or ground-based interceptors in real time."

Sidney Drell, a physicist and co-director of the Stanford Center for International Security and Arms Control, calls this a cynical viewpoint. "If these devices are comparable in every way to components of air- or space-based systems, except for communications equipment, then in the court of world opinion, we lose." A similar argument is made in a forthcoming issue of *Daedalus* by Abram Chayes, a Harvard law professor and former State Department legal adviser, and Antonia Chayes, a former under secretary of the Air Force.

Two additional "Star Wars" experiments planned for the early 1990's have

*Even though he negotiated the treaty, Gerard Smith says that he is still unsure exactly what a "breadboard model" is. The term apparently comes from the laboratory practice of attaching electrical and mechanical equipment to a slab of wood for experimental tests.

Soviets Play Tit-for-Tat

Last February, the Soviet Union delivered a note to the State Department alleging that the United States had systematically violated five different nuclear arms agreements. The complaint, one of four such broadsides leveled by the Soviets at the Reagan Administration, was not made in isolation. It followed within a few days the release of a U.S. report about Soviet noncompliance, and Administration spokesmen noted accurately that it had a distinctive tit-for-tat quality about it.

Where the United States had declared that Soviet behavior increases "doubts about the reliability of the U.S.S.R. as a negotiating partner," for example, the Soviets asserted that U.S. behavior had put in doubt "its intentions with regard to the existing arms limitation agreements and to reaching such agreements in the future." Where the United States had charged the Soviets with violating the SALT I treaty by constructing a radar at Krasnoyarsk, the Soviets alleged U.S. violations of SALT I in the Strategic Defense Initiative. Where the United States alleged potential violations of the Threshold Test Ban Treaty, the Soviets did the same.

By virtually every account, this obvious attempt to equate U.S. and Soviet actions across the board failed.

The only complaints that have generated substantive debate in the West are those involving highly ambiguous provisions of the SALT I treaty. Specifically, the Soviets charged that Minuteman missiles had been illegally tested as defensive interceptors, that enormous radars have been constructed to prepare the ground for a territorial missile defense, and that an additional radar has illegally been constructed at Thule, Greenland.

The first of these complaints refers to a series of tests in 1983 and 1984, known as the Homing Overlay Experiment, in which a modified Minuteman I was used to attack a mock ballistic missile over the Pacific. The Soviets claim this violates a ban on tests of "non-ABM" missiles in an ABM mode, while the Administration claims that the Minuteman I was modified so greatly that it was not really a "non-ABM" missile.

The second complaint refers to construction of two immense early-warning radars in Georgia and Texas. Together with existing radars in Massachusetts and California, they provide coverage for a good portion of the continental United States. The Administration claims that the radars are intended for early warning of ballistic missile attack, however, not missile defense battle management. Unlike the Soviet radar at Krasnoyarsk, they are also clearly near national borders and facing outward, as the treaty demands.

The third complaint involves the construction of a new phased-array early warning radar at Thule, which the Soviets object to because it is nowhere near the U.S. border. The Administration maintains that it is exempt from this requirement because it replaces an older radar. Because the treaty is silent on such modernizations, the Pentagon asserts they are permitted.

SALT I negotiator Gerard Smith says with regard to the Administration's defense of the Homing Overlay Experiment that "if the Soviets used this argument, we would say, boy, that's cheating." And John Rhinelander, the SALT I legal adviser, says about both issues that "the U.S. position is the better of the two, but it is anything but an open and shut legal case."

The allegations have been discussed, without resolution, at meetings of the U.S.–Soviet Standing Consultative Commission, established by the treaty as a forum for compliance disputes.—R.J.S.

also aroused controversy. Each involves a defense against antisatellite weapons, or ASATs, which may someday be used to assault space-based components of a "Star Wars" system. In one, miniature projectiles will be fired at simulated ASATs by a railgun. (The projectiles are accelerated by a plasma arc that flows between two copper rails.) In the other, small homing rockets will be fired at ASAT targets from a large platform.

The Pentagon maintains that the tests are legal because the projectiles and homing rockets are aimed at ASATs, not ballistic missiles; thus, the weapons will be incapable of acting as missile interceptors. But a number of critics, including Representative George Brown (D–Calif.), Thomas Longstreth of the Arms Control Association, and John Pike of the Federation of American Scientists, maintain that this is a trivial distinction, because the difference between ASATs and ballistic missiles in this context is slight.

In addition, they say, the Soviets might lack the means to verify that either the radars or the space-based rockets and projectiles lack a true capability to kill ballistic missiles. Even Frederick concedes this uncertainty. "I'm not sure how the Soviets will know," he says. "Perhaps there can be some agreed-upon method." But others are less optimistic and fear that advocacy of essentially unverifiable experiments will ultimately come back to haunt the United States. Abram and Antonia Chayes suggest, for example, that "in the case of dual-purpose technologies that might achieve but do not yet have ABM [antiballistic missile] capability, the intention of the party conducting the development will always be in doubt. This is especially so for the U.S.S.R., where weapons decisions are not subject to the requirement of public evaluation and justification."

Rhinelander, like the other critics, is no less worried about recent actions by the Soviet Union, including the deployment of an illegal radar at Krasnoyarsk (*Science*, 22 March, p. 1442). The trouble, he says, is that each side "tends to interpret the treaty strictly with respect to programs of the other, but permissively for its own."

The critics have also urged that in the meantime treaty compliance issues be subjected to review by several agencies, not just the Pentagon. In a comprehensive report released last March, Rhinelander, Pike, and Longstreth recommended in particular that the general counsel's offices at the State Department and Arms Control and Disarmament Agency "should play important roles in the early review of U.S. research and development programs."

Barring this, they suggest that a panel of outside weapons and arms control experts be appointed to monitor continually the treaty implications of "Star Wars" work. Although this idea was endorsed in April by a group of defense experts that included John Foster, a vice president of TRW, and Sidney Graybeal, a vice president of the Systems Planning Corporation, it has been resisted by the Administration and has yet to win congressional endorsement. Its backers have vowed to try again before the budget deliberations have concluded.

—R. JEFFREY SMITH

The following is quoted from SCIENCE ON PARADE by Carl Sagan, Parade Magazine, Dec.8,1985, p.16:

"Let us suppose a [Star Wars] shield that is 90 percent effective...Many experts think that 90 percent is wildly optimistic, but even if we accept higher efficiencies than projected by SDI's advocates, it is entirely clear that Star Wars would be unable to protect the civilian population of the United States... After enormous expenditures of national treasure and the deflection of large numbers of first-rate scientists and engineers from useful research, the shield would not work. A contraceptive shield that deters 90 percent of 200 million sperm cells is generally considered worthless—20 million sperm cells penetrating the shield are more than enough. Such a shield is not better than nothing; it is worse than nothing, because it might well engender a false sense of security, bringing on the very event it was designed to prevent. The same is true for the leaky shield of Star Wars."

NOTICE
To Our Readers:

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