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THE GEORGE C. MARSHALL INSTITUTE
127 EAST 59 STREET, SUITE 201
NEW YORK, NEW YORK 10022

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Contents

*by Robert Jastrow, Little, Brown and Company, Boston, 1985

A New Strategic Vision

Not many people know that for thirteen years the official policy of the United States government has been to keep the American people defenseless against Soviet nuclear attacks. But this is the case. Thirteen years ago the United States and the Soviet Union signed a treaty — the so-called Anti-Ballistic Missile treaty or ABM treaty — which says that each country guarantees to keep its people undefended against a nuclear attack by the other side.

Most people are incredulous when they hear this. Yet the language of the treaty is plain. It states:

> "Each party [that is, the US or the USSR] undertakes not to deploy ABM systems for defense of the territory of its country and not to provide a base for such defense."

There is no quarreling with the intent of that statement. It says that the governments of the US and the USSR have entered into a solemn written agreement to keep their countries undefended against nuclear attacks. The agreement was ratified by the Congress in 1972 and has been the law of the land ever since.

Why did our government promise to keep its people naked before the threat of nuclear destruction? How could an American president sign away the right of self-defense of the American people? That makes no sense on the face of it. Yet there is a certain logic to the idea. According to the reasoning of the officials who worked out the ABM treaty, if both superpowers leave themselves undefended, the Soviets know that when they launch a missile attack against us, our own missiles will lay waste their homeland in reprisal. And, of course, we know that if we attack the Soviet Union, our nation will be destroyed by Soviet missiles. This knowledge deters both countries from starting a war, and makes for a very stable situation.

If, however, either side ever acquires an effective defense against enemy missiles, it can attack the other side with impunity, secure in the knowledge that its defense would protect it from retaliation.

The officials who devised this strategy called it Mutual Assured Destruction because it assures the destruction of both nations if either one makes a mistake. Sometimes the idea is known as the MAD strategy because of its initials. The defense of the US against Soviet missiles has rested on this strategy for two decades.

When President Reagan came into office, he was troubled by the inhumanity of the policy of Mutual Assured Destruction. Because of this doctrine, he could, if informed that Soviet missiles are on their way, be required to issue an order that would reduce millions of Soviet civilians to charred corpses. "To rely on the specter of retaliation," the President said, "is a sad commentary on the human condition."

That brief statement contains the essence of the moral dilemma posed by the doctrine of MAD. This doctrine, although invented by intellectuals who probably have never killed a fellow human, is, nonetheless, a cruel policy, because it leaves the American people open to incineration by Soviet nuclear weapons, and only offers the incineration of the Soviet people as a deterrent to that dreadful act.

President Reagan decided that there must be a better way to protect the United States from the danger of a nuclear attack. In his "Star Wars" speech of March 23, 1983, he offered a new strategic vision to the American people. The policy he had inherited from his predecessors depended on the threat of killing millions of Soviet civilians as the main deterrent to a Soviet nuclear attack on our country. President Reagan proposed to turn away from this policy. "The human spirit," he said, "must be capable of rising above dealing with other nations by threatening their existence." And the President called on our scientists to devise a means of intercepting and destroying the attacking missiles and their warheads in mid-flight. Let us go back to the old-fashioned, reliable kind of defense, he said — a defense that puts a shield between the United States and its enemies to protect us from their deadly weapons.

Some scientists objected to this proposal. They said that because of the great destructive power of nuclear weapons, a defense against missiles must be perfect to be useful, and a perfect defense is, of course, unattainable. But this reasoning is flawed. Suppose our defense is 80 percent effective — a very conservative estimate, according to defense experts. That means we can shoot down 4 out of 5 of Soviet warheads in a mass attack. With such a defense in place the Soviets will know that the bulk of our nuclear missile forces will survive their attack. They will know that if they attack us, we will be able to strike back with our nuclear weapons and reduce all the major Soviet cities to rubble in thirty minutes.

The Soviets will know this, and they will not attack us if we have an 80 percent defense against their missiles, or even a 60 or 70 percent defense. Our defense need only be good enough to guarantee the survival of most of our retaliatory forces — the key missile silos, Trident submarine pens, air bases — and, most important of all, the chain of command, beginning with the President, that would actually order a nuclear counterattack against the Soviet Union.

Such a defense, preserving the destructive power of our nuclear arsenal, will virtually foreclose the option of a first

strike by the Soviet leaders. Its deployment will serve notice on the Soviet leadership that it cannot hope to decapitate our political and military command and eliminate or greatly reduce our power of nuclear retaliation. In these circumstances, a nuclear first strike by the Soviet Union will necessarily seem to Soviet leaders to be a suicidal act.

That fact will deter the Soviet leaders from planning an attack. By deterring the Soviet leaders from an attack, our defense will protect the people of America from destruction.

Protection for the 1990s

A defense against Soviet missiles that uses advanced technologies, such as the laser and the neutral particle beam, may become a reality in the late 1990s. Americans will rest easier when that defense is in place, for it will mean that the prospect of a Soviet first strike is essentially nil.

Meanwhile, the technologies that are already in hand will allow us to put a simple but highly effective defense into place in the early 1990s. A conservative estimate of the effectiveness of this defense is 90 percent, which means that only one Soviet warhead in ten will reach its target. This is more than sufficient to guarantee devastating U.S. retaliation and discourage Soviet leaders from any thought of achieving a successful strike.

This limited defense will be based on the off-the-shelf technology of the "smart bullet". That technology is mature and unexotic and its deployment around the end of the decade involves no further research, but only a relatively modest degree of engineering development of existing hardware.

The key to the smart bullet is the miniaturized computer. Extraordinary developments in the miniaturization of computer circuits enable millions of transistors and other electronic components to be packed into a space the size of a thumbnail. As a result, defense technicians now have the means for building elaborate computer brains into a very small missile so that it can steer itself toward its target. This tiny missile with brains is often called "a smart bullet" or "a smart rock". Sensing the target either by its delicate emanation of heat waves, or by its radar reflections, the smart bullet analyzes the product of its senses within its highly capable computer brain, and directs a succession of messages to small rockets arranged around its circumference. Delicate thrusts of these rockets steer the defending missile into the path of the oncoming ICBM warhead. The result is either destruction of the warhead by a direct impact, or an explosion of the smart bullet on impact, releasing a cloud of flying metal fragments. The warhead, moving ten times faster than an artillery shell, tears into the cloud of fragments; the skin of the warhead is punctured in many places; its electronics are disabled; and the nuclear bomb inside it is disarmed.

In essence, the defense consists in tossing a keg of nails into the path of the speeding warhead. What makes this simple defense work is its computer brain.

The smart bullet does not have to destroy the warhead to be effective; it only has to prevent the nuclear weapon inside the warhead from exploding. That happens to be fairly easy, because nuclear weapons do not go off very readily; elaborate arrangements and a great deal of fragile electronics are needed to make one explode. Accordingly, a cluster of high-speed metal fragments will usually be sufficient to disarm the weapon's mechanism.

The defense will consist of two layers — a boost-phase defense that tackles the Soviet missiles as they rise above the atmosphere, and a terminal defense that intercepts the warheads at the end of their trajectories, as they descend toward their targets in the United States.

The boost-phase defense will necessarily be based in space because it depends on satellites for the surveillance of the Soviet missile fields and the tracking of the missiles as they rise from their silos. The satellites are also needed to store the smart bullets that will be fired at the Soviet missiles early in their flight. All these operations can only be carried out from space platforms orbiting over the Soviet Union.

Of the two layers in the defense, the boost phase is by far the more important. A boost-phase defense is essential because it prevents the Soviets from concentrating their warheads on high-priority targets such as our own missile silos or the Trident submarine bases. The Soviets cannot do this if we have a boost-phase defense, because they cannot tell beforehand which booster, and which warheads, will get through and which ones will be destroyed.

The technology suitable for an early 1990s boost-phase defense is the "smart bullet" — a projectile that homes in on its target using radar or heat waves, and destroys it on impact. That technology is available today; the boost-phase defense need not wait for the availability of the more devastating technologies of the laser, the neutral particle beam or the electromagnetic rail gun. The interceptor rocket for this early boost-phase defense would be an advanced version of the air defense interceptors that are in operational use in the Air Force today. The boost-phase interceptor rockets would weigh about 500 pounds; the interceptors themselves — the smart bullets — weigh 10 pounds; they are nonnuclear; and their speed is about 4 miles per second. The F-15-launched ASAT is another technology that could also be adapted to a boost-phase defense against missiles.

The rockets with their smart bullets would be stored in pods on satellites and fired from space. The tracking information needed to guide them would be acquired from satellites orbiting over the Soviet missile fields.

Satellites in high, geosynchronous orbits, 23,000 miles up, hover over the Eurasian land mass and scan the Soviet missile fields continuously for signs of an attack. Heat-sensitive

"eyes" on the satellites look for the telltale flames of the missile launch, follow the course of the missile as it rises, and pass their information on to computers which calculate the probable path of the missile over the oceans or the north pole.

Within seconds, the computers provide a picture of the entire attack: How many missiles are there? What kind? Headed toward which targets in the United States? The high-altitude satellites flash their information to the fleet of satellites at lower altitudes — the battle management satellites and the satellites that carry the weapons to be used against the Soviet missiles. These satellites begin to track the moving missiles. In a matter of a few more seconds, they fire. The boost-phase defense has begun.

The cost of an early 1990s, space-based boost-phase defense of this kind is about $45 billion. That ballpark figure includes 100 satellites, each holding 150 interceptors — sufficient to counter a mass Soviet attack from all 1400 silos; plus 4 "early-warning" satellites in geosynchronous orbits, and 10 lower-altitude satellites dedicated to surveillance, acquisition, tracking and kill assessment; plus the cost of the facilties for ground control communications and battle management.

After the booster has burned out and fallen away and the warheads arc up and over through space on their way to the United States, the second layer of the defense, called the terminal defense, comes into play. Interception of each warhead will occur as it descends to the earth near the end of its flight. If possible the interception will be at a considerable altitude, well above the atmosphere, to provide a "wide area" protection for the terrain below.

The cost of this terminal layer of the defense will be $15 billion. This includes $10 billion for 5000 interceptors at $2 million each, plus $5 billion for 10 aircraft carrying instruments for acquisition and tracking of the warheads, at $500 million each.

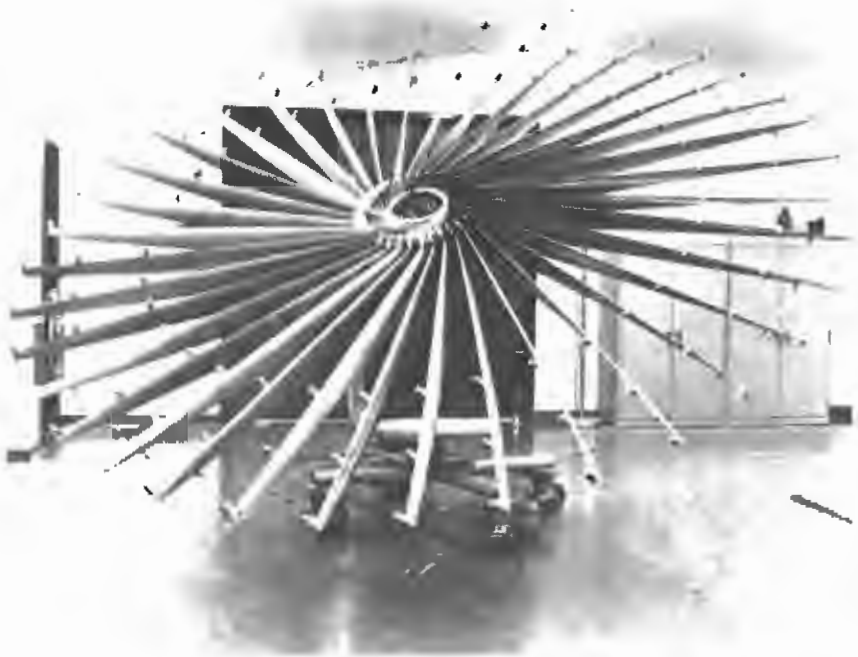
The total cost of the two-layer defense as described is estimated to be $60 billion. This cost estimate is preliminary

but believed to be good to 50 percent. Even with its uncertainty, it is certainly an affordable outlay for the protection of the American people from a nuclear attack.

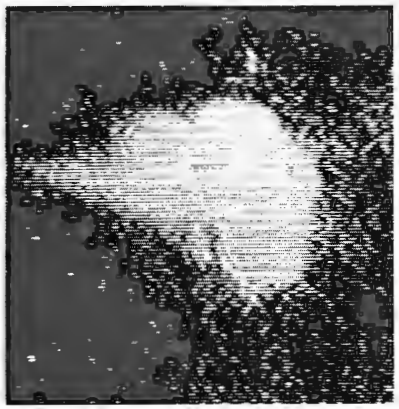
DESTRUCTION OF A WARHEAD
The photograph *(left)* shows the rocket used to destroy a warhead at an altitude of more than 100 miles, in a test of terminal defense on June 10, 1984.

The rocket carried a small heat-seeking missile which detected the relatively high temperature of the oncoming warhead against the cold background of space. The rocket was deliberately mis-aimed by 20 miles to test the capability of the interceptor. The interceptor recognized and corrected for the large miss distance and zeroed in for a bull's-eye collision.

Immediately before impact the heat-seeking projectile unfurled a 15-foot metal net *(below)*, resembling the frame of an umbrella, and studded with steel weights. The relative speed of the collision with the warhead was more than 10,000 miles per hour.



The impact "vaporized" the warhead and the intercepting projectile, spreading debris over an 80-mile area. The photograph *(right)* shows the cloud of debris, estimated to contain about a million fragments.



Ways to Counter the Defense

Several methods have been proposed for countering a defense against missiles. For example, if the defense uses a laser beam to melt the metal skin of the missile, the attacking nation could make the surface of its missiles very shiny, to reflect our beams of laser light. If 99 per cent of the beam were reflected, it would take the laser 100 times as long to melt or soften the missile's skin. That means each laser-equipped satellite would only have time to destroy a few Soviet missiles before the missiles burn out and release their warheads. That means, in turn, that a very large number of satellites would be needed to defend us against a massive attack by thousands of missiles at once. That would make our defense prohibitively expensive.

It is also possible to impart a spin to the missiles as they are launched, to spread the energy of the laser beam over the circumference of the missile and dilute its effect by a factor of π, or roughly three. Another promising countermeasure is a protective coating spread over the surface of the missile to absorb

the heat of the laser beam. Still others are the "balloon," the "space mine" and the "decoy."

The usefulness of these countermeasures depends partly on their inherent effectiveness, and partly on the penalty the attacker must pay to implement them. Consider the shine, for example. Putting a shine on a missile sounds like a useful suggestion, but would be ineffective in practice, because no shine is perfect; even if the shiny surface reflects 99 percent or more of the incident laser light, some laser energy is bound to get through and will heat the surface. The heating tends to dull the shine, so more heat gets through. This dulls the shine some more, and still more heat gets through . . . Very soon the shine is gone.

Another problem with shining up the missile is that during the launch it tends to get dirty, partly because of its own exhaust gases, and its luster is dulled. In addition, as the booster accelerates, it compresses and heats the air above it, and the plume of hot air sweeps downward around the side of the missile, oxidizing the surface, and also tending to take the shine away. Finally, the shine itself is obtained by applying a thin coat of reflective material to the missile, but the coating has a different coefficient of expansion from the metal skin underneath, and tends to buckle when the missile is heated by the laser beam. This leads to the catastrophic failure of the reflective layer. All in all, shiny missiles are not an effective countermeasure.

Another suggested countermeasure is a heavy coat of material, perhaps half an inch thick, spread over a missile to protect it from the laser beam. The heat of the laser beam vaporizes the protective coating but leaves the missile's surface beneath undamaged. The difficulty with this suggestion is that the weight of the protective coating is substantial. Since the missile must carry this extra burden upward against the pull of gravity, it must compensate for it by dropping some of its payload. If the coating were applied to an SS-18, for example, it would reduce the payload of that missile by four tons, which is approximately equal to the total weight of the 10 warheads

on the SS-18. In other words protecting SS-18s by this countermeasure would reduce the usefulness of that missile to zero.

The "space mine," still another method for foiling a defense against missiles, has received serious study by defense scientists. The space mine is a small, silent satellite, perhaps equipped with stealth technologies to make it invisible to radar, that shadows one of our laser-equipped satellites, ready to move in and blow it up on command.

The trouble with this idea, as with several other promising suggestions for countering a missile defense, is that it does not take into account the effect of atmospheric drag. Although the air through which a satellite moves is extremely thin, nonetheless, it exerts a resisting force on the satellite. This force, or atmospheric drag, varies from one satellite to another. As a result of differences in the amount of atmospheric drag, our laser-equipped satellite and the space mine will tend to draw apart over the course of many orbits, even if they were close together initially. To stay close to our satellite, the Soviet space mine must fire a small rocket now and then. But every time the space mine fires a rocket, it makes its presence known to the American satellite by the heat and light of the rocket flame. When that happens, our satellites, being armed to defend themselves against hostile objects, will fire at the space mine and destroy it. If our laser-equipped satellites do not carry suitable weapons for this purpose, other satellites in the defensive system, which have been assigned the task of armed escorts, will do the job.

It may be possible for the space mine to shield its rocket exhaust from the eyes of the satellite it is tracking. However, the plans for the missile defense call for a network of surveillance satellites that will be looking at the intruder from several directions. The space mine may be able to conceal the flame of its exhaust from some of the surveillance satellites, but it cannot conceal the flame from all simultaneously.

Of course, if the space mine stays at a respectful distance, our defense will have no reason to interfere with its activities. But if it makes an attempt to close in for the kill, we are bound to see it and can destroy it.

The balloon is another interesting proposal for defeating missile defenses. The idea here is that after the boost phase is over, and the booster rocket has fallen away, the bus that normally deploys the Soviet warheads will instead deploy a large number of "balloons." These balloons are light, metallized, hollow spheres. Some balloons will actually have warheads inside them, and some will not. Not knowing which balloons contain warheads, we will waste our midcourse defenses on killing every balloon in sight, empty or not. In effect, the Soviets will be playing a shell game.

Since the empty balloons are light in weight and many can be deployed, this Soviet countermeasure will greatly dilute the effectiveness of our midcourse defense. If the balloon is many-layered, so that when a burst from one of our laser breaks the outermost balloon another is revealed inside, then the dilution of our defenses is even greater.

The trouble with this idea is that we can tell quite easily which balloons have warheads and which do not. We need only tap the balloons, in effect, by directing a relatively weak pulse of laser energy at them and then observing their recoil. The empty balloons will recoil more rapidly than the loaded ones.

The Soviets could defeat our testing method by making their balloons heavy, so that they would all recoil in about the same way, whether or not they contained warheads. But if the balloons are heavy, they take up weight that would otherwise be allotted to warheads. In that case the Soviets may as well throw the balloons overboard and use warheads instead.

Still another potentially effective countermeasure to our defense would be to shoot down our satellites. It is sometimes said that these satellites are very vulnerable to attack, more so than the Soviet missiles they are designed to shoot down. However the reverse is true. A missile cannot be loaded with too much shielding, or it will not get off the ground; but a satellite in orbit is weightless and can be armored as heavily as necessary, within reason, without adverse effects on its per-

formance. A satellite can also be armed with its own weapons, to destroy any intruding satellite that approaches within lethal range. It can shoot down smart bullets with its own smart bullets. And it can be supplied with onboard rocket engines and a large supply of fuel, so that it can maneuver out of the path of an intruder.

An even greater measure of protection can be obtained by placing key satellites in orbits halfway to the moon, which could take the adversary's killer satellites 12 to 20 hours to reach.

A satellite could also be protected at any altitude by the methods bomber and fighter pilots use to foil the enemy in aerial combat. If a smart bullet homes in on the satellite with a heat-sensitive instrument, a warm decoy can be tossed out to the side to distract the instrument. If a satellite senses it is being probed by a radar beam — indicating that a killer satellite is stalking it — the satellite under attack can analyze the radar beam and send back spurious pulses that tell the killer satellite, "I'm not here, I'm over there."

Decoy warheads are another potentially valuable countermeasure. Each missile is likely to carry, in addition to its real warheads, a large number of lightweight decoys that are released at the same time as the warheads. The decoys look like warheads in almost every respect but they have no nuclear explosives inside. The purpose is to confuse our defenses and allow the real warheads to slip through unscathed.

There may be ten decoys for every warhead, and thousands or tens of thousands of decoys in all. The flock of warheads and decoys, coursing through space in a compact cluster, is called the "threat cloud." How do we see through its disguise to pick out the warheads?

One way to tell the decoys from the warheads is to tap both with a weak pulse of laser energy and then observe how they recoil. The decoys, being light in weight, will recoil from the tap more rapidly than the heavy warheads. Once the decoys are identified in this way, we can ignore them and attack the

true warheads with smart bullets and other weapons. Still another method for solving the decoy problem is to direct a moderately intense burst of laser energy at everything. The laser heat will burn up the thin-walled, fragile decoys, leaving the sturdy warheads undamaged. Then we go after those with our heavy guns.

Of course, the Soviets can always make their decoys robust enough to survive a laser attack. And they can design the insides of the decoys so elaborately that they are able to fool every kind of instrument in our defense. But then the decoys will have so much electronics and special equipment packed into them, that they will weigh nearly as much as the warheads. Once again, if a decoy weighs as much as a warhead the Soviets cannot release a flock of them, and they are of little value.

Soviet leaders have made it plain by their actions that they also think it will be difficult to defeat a well-designed missile defense. A CIA report released in 1985 indicates that Soviet expenditures on strategic defense are 10 times the SDI budget. If Soviet scientists thought countermeasures to a "Star Wars" defense were cheap, easy and effective, they would not be spending a very large sum of money on their own SDI.

Frequently Asked Questions About Strategic Defense

Q: DON'T SCIENTISTS SAY AN EFFECTIVE U.S. DEFENSE AGAINST SOVIET MISSILES IS IMPOSSIBLE?

A: Only four scientists in the entire country with full access to classified information on missile defense say that. (Drs. Bethe, Garwin, Drell and Panofsky.)

On the other side are Dr. Keyworth (the President's science advisor), 50 leading missile experts on Dr. Fletcher's panel, the brilliant weapons experts Lowell Wood at Livermore and Gregory Canavan at Los Alamos, and thousands of scientists and engineers actually working in missile defense.

Nature, the leading scientific journal in the world, wrote recently that "a substantial part of the technical community" agrees defense against missiles is feasible. *Nature* concluded about the objections from some scientists, "Critics of the project should look elsewhere for ammunition."

Fifty-four Nobel Laureates recently signed an appeal opposing space-based missile defenses or "Star Wars", but 53 of the 54 have no experience with missile defense work. One signer received his prize for studies on monkey vision, another for providing the astronomical proof of the creation of the Universe.

Q: HOW GOOD WILL THIS DEFENSE BE?

A: Hear what Dr. James Fletcher has to say. Dr. Fletcher is former head of NASA, a physicist with extensive experience in development of missiles. He is one of the most authoritative voices in the country on the subject of missile defense, respected by supporters and opponents of SDI alike.

Dr. Fletcher headed a panel of the country's leading missile defense experts which spent 36,000 man-hours on a study of the new technologies. He wrote in a National Academy of Sciences journal that his studies indicate that the basic two-layer defense, which could be operational in the early 1990s, could protect "90 to 99 percent of the nation's population . . . from a massive nuclear attack."

Note that Dr. Fletcher said "population," not "missile silos."

Dr. Fletcher said the advanced three- or four-layer defense proposed for the late 1990s or the end of the century could, in his view, protect "perhaps even greater than 99 percent of the nation's population against a nuclear attack." That is so close to perfection as to blur the difference.

Q: WHAT GOOD IS A 90 PERCENT OR EVEN A 99 PERCENT DEFENSE WHEN ONE WARHEAD CAN BLOW UP A CITY?

A: If a Soviet general knows that only one warhead in 10 will get through to its target — this is what a 90 percent defense means — he knows he cannot hope to knock out our retaliatory power in a surprise attack. He knows the bulk of our forces of nuclear destruction will survive intact, and less than sixty minutes after he gives the word to attack, his own homeland will lie in ruins.

To attack the United States, knowing that, will seem to the Soviet leaders to be suicidal. They will never order an attack under those circumstances.

In other words, a 90 percent defense against Soviet missiles gives 100 percent protection to the American people.

Q: CAN THE SOVIETS OVERWHELM OUR DEFENSE IF WE BUILD IT?

A: The Soviets have threatened to do this, but their threat is empty. Suppose we have a 90 percent effective defense. A 90 percent effective defense means 1 Soviet warhead in 10 gets through to its target. The Soviets spent about a half trillion dollars on the missile force they now have. To overwhelm our 90 percent defense and get as many warheads through to their targets as they would have if we had no defense, they would have to beef up their arsenal to 10 times its present size. That means spending 10 times a half trillion dollars, or $5 trillion. The Soviet Union would be very hard pressed to spend another $5 trillion on missiles in the next five to 10 years, on top of its present military outlays.

Ambassador Nitze has emphasized the importance of the

cost ratio "at the margin", i.e., how many dollars the Soviets have to spend on countering our defense for every dollar we spend on adding to it. These marginal cost ratios are also in our favor. Studies at Los Alamos and elsewhere show that to counter our defense, the Soviets must spend $3 for every dollar we spend on building it.

For some advanced kinds of defenses the ratios are even higher: ten to one or more in favor of our defense.

Q: HOW MUCH WILL IT COST?

A: For the basic two-layer defense using "smart bullets," the cost is $60 billion spread over about five years, or $12 billion a year. This defense could be available in the early 1990s. For the advanced three- or four-layer defense that might become available in the late 1990s the cost is roughly $200 billion spread over 10 years, or $20 billion a year.

These are approximate figures. However they come out of solid analyses by the Department of Defense on the cost of electronics, sensors, fuel and structures.

The figures of $1 trillion or more tossed around by Soviet spokesmen and domestic opponents of SDI are off the wall.

For comparison, note that we are spending more than $40 billion a year on nuclear weapons of destruction designed to keep the Soviets out of our backyard by the threat of retaliation.

Q: HOW DO YOU KNOW IT WILL WORK AND WILL COST THAT MUCH?

A: We won't be certain until we are farther along in the research, but all the calculations and experiments thus far are very encouraging.

- The "smart bullet" has been tested in flight against a Minuteman warhead and vaporized the warhead. The test was a complete success.
- High-power lasers are coming along faster than anyone expected. Livermore has tested a laser at a peak power of one billion watts with an average power of 100 million watts in sight. This is well above the level of 20 million watts considered necessary for a useful laser defense.
- There is amazing progress in building big mirrors cheaply, and also "rubber mirrors" that change shape to correct for air turbulence. Transmission of a laser beam from the earth to space was successfully tested in a recent Shuttle flight.
- Research on railguns, used for launching "smart bullets" at very high speeds, is making rapid progress.

Much of this research has major scientific and commercial spinoffs.

Q: CAN'T THE SOVIETS FOIL OUR DEFENSES WITH DECOYS AND OTHER COUNTERMEASURES?

A: The defenses we are designing will be probing Soviet decoys in many different ways with lasers, radars and heat-sensitive instruments. The Soviets can try to fool these instruments with decoys, but the decoys will have to be very elaborate to work. For example, we can tell a decoy from a warhead by tapping both with a weak pulse of laser energy and then observing how they recoil. The decoy, being light and flimsy, will recoil from the tap more readily than the heavy warhead.

If the Soviets made their decoys heavy enough to fool us in this test, they would weigh nearly as much as the warheads. But if the decoys weigh nearly as much as the warheads, the Soviets cannot release large numbers of them during their attack, and they will be of little value to them.

Q: AREN'T SATELLITES VERY VULNERABLE? CAN'T THE SOVIETS SHOOT DOWN OUR LASER SATELLITES MORE EASILY THAN WE CAN SHOOT DOWN THEIR MISSILES?

A: The opposite is true. Satellites can be made relatively invulnerable but missiles cannot.

The reason is that a satellite in orbit is weightless and we can plaster as much armor and shielding on it as we wish. For the same reason, a satellite can also carry heavy guns for its

own defense — lasers, smart bullets or particle beams.

A missile, on the other hand, has to fight its way upward against the backward pull of gravity. Gravity is its enemy. This makes it very vulnerable because if you try to put heavy shielding or armor on it it won't get off the ground. If the Soviets try to shield their SS-18 — the most powerful missile in the world — from our lasers by coating the skin with one inch of protective material, the payload of the missile will be reduced by four tons.

But four tons is the weight of all 10 warheads on the Soviet SS-18. If the Soviets protected their SS-18s in this way, they could not carry any warheads.

That would indeed make these terrible weapons impotent and obsolete.

Q: ISN'T THE COMPUTER PROGRAM FOR SDI IMPOSSIBLY COMPLICATED?

A: The software for SDI will require about 10 million lines of code. However, this has already been surpassed in length and complexity by the AT & T program which control's the nation's telephone network. That has 50 million lines of code. Also, the number of interconnections between "nodes", i.e., nerve centers, in the AT & T program is 14,000, whereas the number of interconnections in the SDI program is estimated to be about 4500.

In other words, the telephone program is more complex than SDI requirements, as well as being longer.

Q: HOW CAN YOU TEST THE SDI PROGRAM FULLY, SHORT OF TRYING IT IN BATTLE?

A: The one aspect of SDI that *can* be tested fully is the software. When signals are fed into the front end of the program, they look exactly the same to it regardless of whether they have been produced by a Soviet missile leaving its silo or by a piece of equipment that generates signals imitating the real battle. In fact, this equipment can create realistic "battles" that test the program more fully than a real attack. It can hurl

more "missiles," warheads" and "decoys" at us than the Soviets could ever build. And it can "launch" them more quickly than the Soviets could ever launch their missiles in an actual attack.

Well-developed techniques exist for testing programs that deal with emergencies too dangerous to allow them to happen for test purposes. These techniques were used in testing the AT & T program. When the AT & T program was put into operation, it worked immediately although it had never been tested completely "in battle."

Q: WHAT ABOUT THE FAST-BURN BOOSTER? SOME CRITICS OF SDI SAY IT COULD BE A LOW-COST AND HIGHLY EFFECTIVE SOVIET COUNTERMEASURE.

A: It took the Soviets about 15 years to build their present missile force. Fast-burn missiles — which burn out and release their warheads in less than a minute — are a much harder engineering problem. Experts on missile development agree that this very advanced kind of missile will not be available to the Soviets before the twenty-first century.

Cost is also a very serious problem for the Soviets in considering this countermeasure. Statements by Union of Concerned Scientists spokesmen that the Soviets could build a fast-burn Midgetman for $10 million each are not in accord with the facts. The real cost will be $200 million each, according to official Air Force figures for the cost of the Midgetman.

So, if the Soviets replaced their arsenal of approximately 8000 warheads with fast-burn Midgetmen, it would cost them $1.6 trillion.

Even spread over several years, this would be a very heavy burden for the Soviet Union, on top of its already massive military outlays.

Finally, the defenses recommended by the Fletcher panel on missile defense are designed to handle fast-burn missiles. So even if the Soviets go to the trouble and expense of scrapping their entire arsenal to replace it with first-burn ICBMS, at a

cost of more than a trillion dollars, it will avail them nothing.

Q: ISN'T IT A BAD IDEA TO PUT WEAPONS IN SPACE?

A: These devices — the smart bullet, the laser and particle beam — are defensive. They only go into action if the Soviets launch an attack to destroy us. It is much better to rely on them for protection than on the threat of using weapons of mass destruction.

If a mistake occurs today and a missile is fired by accident, cities can be destroyed and millions of people can be killed. If a laser in a satellite fires by accident, or misses its target and hits the ground, it might set a roof on fire, but it cannot blow up a city or kill millions of people. It is not a weapon of mass destruction.

Q: WILL OUR DEFENSE INVOLVE NUCLEAR WEAPONS IN SPACE?

A: The smart bullets planned for early deployment are non-nuclear. All the lasers under study are also non-nuclear with one exception — the x-ray laser. General Abrahamson has indicated that we are doing research on the x-ray laser mainly as a hedge against a Soviet breakthrough in this area. We know that the Soviets are working very hard on the x-ray laser themselves.

Q: IF OUR DEFENSE DESTROYS SOVIET NUCLEAR WARHEADS, WON'T THAT CAUSE NUCLEAR EXPLOSIONS IN SPACE?

A: No, because it is very difficult to make a nuclear weapon explode. Carefully timed steps and a great deal of electronics are needed to make one go off. If a smart bullet, for example, hits a warhead, it is likely to damage its electronics and the warhead won't explode.

If the bombs are "salvage fused" to explode on approach of an intruder, there will still be no clouds of radioactive dust and no damage on the ground provided the interception occurs

above 50,000 feet. Our interceptions will always be above that height.

Since our defense will prevent most bombs from exploding, it also greatly diminishes the "nuclear" winter effect.

The Union of Concerned Scientists has been irresponsible in placing newspaper ads and TV commercials which imply that SDI means fighting a nuclear war in space. This aspect of the UCS campaign directly supports Soviet propaganda against SDI.

Q: SOME PEOPLE SAY SDI WILL BRING THE WORLD CLOSER TO NUCLEAR WAR. WON'T THE SOVIETS FEEL THREATENED BY SDI AND LAUNCH A PREEMPTIVE ATTACK?

A: In the near term, they won't attack for the same reason they don't attack the United States today, namely, because we have a strong submarine deterrent.

In the long term, our government has announced that it will try to negotiate a parallel deployment of defenses with the Soviets so that neither side gains a military superiority through these defenses, and neither side can feel threatened. This is a cardinal point of our negotiating position in Geneva — perhaps the most important point of all.

Q: IF SDI WORKS AGAINST BALLISTIC MISSILES, AREN'T WE STILL VULNERABLE TO CRUISE MISSILES?

A: A laser defense sized to handle thousands of ballistic missile warheads and tens of thousands of decoys, traveling at 10,000 miles an hour, will have little trouble tracking and destroying cruise missiles lumbering along at the speed of a commercial airliner. A laser beam, being a beam of light, can penetrate to the ground from space and destroy a cruise missile even though it is flying at tree-top altitude.

Laser beams are blocked by clouds, but a cover of clouds is not likely to exist all the way to the target in the United States.

Even if the cruise missiles are protected by stealth technology, stealth will not work against radars beamed at them from space. Stealth is directional. It can conceal a bomber or cruise missile from radar coming from one direction but it is relatively useless against radars coming from several directions at once — as would be the case for radars mounted on a fleet of satellites.

Q: HOW ABOUT MISSILES LAUNCHED FROM SUBMARINES?

A: A defense that protects against the greatest Soviet threat — their land-based missiles — will be even more effective against submarine-launched missiles for several reasons.

First, only a fraction of the satellites in our defensive screen will be over the Soviet Union at any given time; the rest will be mostly over the world's oceans, watching for signs of missiles launched from Soviet submarines.

Second, a submarine cannot launch all its missiles at once; they have to be staggered, which makes it much easier for our defense because we can pick them off one by one.

Third, as soon as the submarine fires one missile, we know where it is and can probably destroy it before it launches the rest.

Fourth, submarine-launched missiles generally travel slower than ICBMs, which makes them easier to track and destroy.

Q: WILL OUR DEFENSE WORK AGAINST THE SS-20, AND OTHER SHORT- AND MEDIUM-RANGE MISSILES THAT THREATEN WESTERN EUROPE?

A: For several reasons, SS-20s and other medium- and short-range missiles pointed at Europe are easier to defend against than intercontinental missiles, contrary to statements emanating from some American scientists and Western European spokesmen.

First, and perhaps most important, because of their shorter range they spend a larger part of their trajectory in the atmosphere. This makes it much easier for our defense to discriminate the warheads from the decoys. (The decoys, being lightweight, are retarded more by air resistance.)

Second, they fly more slowly which makes them easier to track and destroy.

Third, they are smaller missiles with a smaller payload, and therefore carry fewer warheads and decoys, which again, makes the defense against them easier.

Q: WHAT ABOUT MISSILES LAUNCHED ON LOW TRAJECTORIES FROM SUBMARINES NEAR U.S. SHORES? WOULDN'T THESE SOVIET MISSILES REACH THEIR TARGETS — SAY, WASHINGTON — TOO QUICKLY FOR OUR DEFENSES TO WORK AGAINST THEM?

A: Our utility to track and destroy these "flat-trajectory" missiles will not be impaired by their short flight times.

First of all, like SS-20s, they fly lower and slower than ICBMs, which makes them easier to track and easier to intercept. Second, our surveillance satellites detect them within seconds after launch, and our laser beams catch up to them in a hundredth of a second or less. As a consequence, it doesn't matter appreciably to our defense whether the flight time is 5 minutes or 20 minutes.

Q: DOES SDI VIOLATE THE ABM TREATY?

A: SDI is a research program whose stated goal is research on ABM defenses. However, the ABM Treaty does not limit goals. It only limits certain activities.

The DoD experiment that successfully demonstrated the "smart bullet" concept at Kwajalein last June was in accord with the ABM Treaty because the Treaty allows ABM tests from areas specified as missile test ranges and so designated by the parties. (Article III.) The United States has designated Kwajalein as a missile test range.

We may bump up against the Treaty in three or four years — if, for example, we begin to test space-based components. But for the next several years there is no conflict between SDI and the ABM Treaty. The Soviet "Star Wars" program will also bump up against the ABM Treaty soon. Some experts say it has already done so.

Q: WHY DO WE NEED SDI IF NUCLEAR DETERRENCE HAS WORKED UP TO NOW?

A: Deterrence by the threat of retaliation has been effective, but there are signs of erosion of the U.S. position in this regard. Our ballistic-missile submarines are the principal U.S. deterrent at the present time, but their invulnerability is compromised by research into methods of detecting submerged submarines, as well as such developments as the recent Walker spy case. At some point in the 1990s we may find ourselves in a very dangerous position as a result of these developments.

The Reagan strategic modernization program has been valuable — especially in restoring the B-1B bomber — which, unlike the B-52, has a fair chance of penetrating Soviet air defenses — but an even stronger deterrent would be a combination of an effective force of nuclear retaliation *and* a defense that prevents the Soviet Union from destroying the bulk of that retaliatory force in a surprise blow.

As the defensive component of the American deterrent grows stronger, the deterrent by the threat of retaliation can be built down. The U.S. position is to achieve in this way a reversal of the buildup of the nuclear stockpile which has been going on for 15 years.

Q: AT WHAT POINT WILL THE UNITED STATES BE ABLE TO SCALE DOWN ITS OFFENSIVE CAPABILITY?

A: Ambassador Nitze has stated that in the next 10 years we will continue to rely on offensive weapons as our deterrent while "seeking a radical reduction in the number and power of offensive and defensive weapons." He went on to say that at that time "we should also be looking forward to a period of transition beginning 10 years from now, to effective non-nuclear defense forces. This period should lead to the eventual elimination of nuclear arms. A nuclear-free world is an ultimate objective."

In other words, our position is to maintain our present offensive capability threat for 10 years while we pursue "Star Wars" research and move toward deployment of a limited defense system. Then, in concert with the Soviets, we hope to carry out a carefully phased, simultaneous deployment of fully effective defenses on both sides, leading to a world in which the nuclear weapon is useless and its disappearance can be expected.

Q: WOULD SDI TRIGGER AN ARMS RACE IN SPACE?

A: No action-reaction phenomenon is at work here. The Soviets are already racing ahead on missile defense as fast as they can. Dr. Fletcher, who had full access to all intelligence reports on the Soviet ABM program, says, "The Soviet Union is pursuing their [Star Wars] program at the fastest pace their technology allows. It is unlikely that they could accelerate their effort more than they have, whatever we do."

The debate over "Star Wars" has been carried on in the United States as if it were up to us to decide whether any defense against missiles is going to be built on this planet. But that is not the case. The Soviets are building their missile defense regardless of whether we build ours or not.

It is clear that the United States has two options for the 1990s. Either we pursue missile defense vigorously, and then both the U.S. and USSR will have this defense by the late 1990s. Or we do not, in which case the Soviets will have a defense against our missiles and we will have no defense against their missiles. That would be an exceedingly perilous situation for this nation.

Q: WOULDN'T "STAR WARS" MAKE A FINE BARGAINING CHIP AT GENEVA SINCE THE SOVIETS WANT SO MUCH TO GET RID OF IT?

A: We cannot offer "Star Wars" as a bargaining chip, because if we do the Soviets are likely to have an effective defense against American missiles in the 1990s, while the U.S. has no defense against Soviet missiles.

The point is that intelligence reports indicate that the Soviets are working very hard on their own "Star Wars" effort. Dr. Fletcher, independent and highly respected expert on this subject, says there is "strong evidence" that Soviet scientists are working vigorously on all the missile defense technologies his panel looked at "and many which we do not even understand yet."

Faced with the prospect in the 1990s of a world in which the Soviets have a massive first-strike arsenal of more than 10,000 accurate warheads, and also have an effective defense against any American retaliatory blow, we must proceed with our "Star Wars" research or place America in a very vulnerable position.

SDI: The "Star Wars" Project

call Jeff

President Reagan

Current
Policy
No. 858

SDI: Progress and Promise

United States Department of State
Bureau of Public Affairs
Washington, D.C.

Following are remarks by President Reagan at a briefing on the Strategic Defense Initiative (SDI), Washington, D.C., August 6, 1986.

I'm grateful to have this opportunity to speak with you and to thank you for all you're doing to keep America in the forefront of scientific and technological change. Our country's security today relies as much on the genius and creativity of scientists as it does on the courage and dedication of those in the military services. It also relies on those with the wisdom to recognize innovation when they see it and to shepherd change over the obstacles and through the maze. It takes a special person, endowed with vision and tenacity, to overcome political and bureaucratic inertia; and many of you here today are just this kind of special people, and I want you to know that your President and your country are grateful. And, if I'm not being too presumptuous, I think history will remember you, too.

There are three stages of reaction to any new idea, as Arthur C. Clarke, a brilliant writer with a fine scientific mind, once noted. First, "It's crazy; don't waste my time." Second, "It's possible, but it's not worth doing." And, finally, "I always said it was a good idea."

When I notice how much support tax simplification seems to have attracted as of late, I can't help but think of Clarke's observation. Well, one sometimes has to live with opposition to proposals such as changing the tax code, but when the same kind of skepticism stands in the way of the national security of our country, it can be perilous.

Clearly, intelligent and well-meaning individuals can be trapped by a mindset, a way of thinking that prevents them from seeing beyond what has already been done and makes them uncomfortable with what is unfamiliar. And this mindset is perhaps our greatest obstacle in regard to SDI.

We're at a critical point now on national security issues, and we need your help. Many of our citizens are still unaware that today we are absolutely defenseless against the fastest, most destructive weapons man has ever created—ballistic missiles. Yet, there are still those who want to cut off, or severely cut back, our ability to investigate the feasibility of such defenses. Congressional action on the defense authorization bill is coinciding with increasing diplomatic activity with the Soviet Union. Yet, at the same time, we're in the midst of a budget fight which could take away the very leverage we need to deal with the Soviets successfully.

Back in 1983, I challenged America's scientific community to develop an alternative to our total reliance on the threat of nuclear retaliation, an alternative based on protecting innocent people rather than avenging them; an alternative that would be judged effective by how many lives it could save, rather than how many lives it could destroy.

All of you know that during the past three decades deterrence has been based on our ability to use offensive weapons to retaliate against any attack. Once an American President even had to make the excruciating decision to use such weapons in our defense. Isn't it time that we took steps that will permit us to do something about nuclear weapons, rather than simply continue to live with them in fear? And this is what our SDI research is all about, and there can be no better time than today, the 41st anniversary of Hiroshima, to rededicate ourselves to finding a safer way to keep the peace.

Many people believe the answer lies not in SDI but only in reaching arms control agreements. Trust and understanding alone, it is said, will lead to arms control. But let's not kid ourselves; it's realism, not just trust, that is going to make it possible for adversaries, like the Soviet Union and the United States, to reach effective arms reduction agreements. Our SDI program has provided a historic opportunity; one that enhances the prospects for reducing the number of nuclear weapons. Technology can make it possible for both sides, realistically, without compromising their own security, to reduce their arsenals. And the fear that one side might cheat—might have a number of missiles above the agreed upon limit—could be offset by effective defenses. Clearly, by making offensive nuclear missiles less reliable, we make agreements to reduce their number more attainable. Particularly is that true where one side now is an economic basket case because of the massive arms buildup that it's been conducting over the last few decades—the Soviet Union.

There has been progress. There's a serious prospect today for arms reductions, not just arms control; and that by itself is a great change, and it can be traced to our Strategic Defense Initiative. SDI can take the profit out of the Soviet buildup of offensive weapons and, in time, open new opportunities by building on today's and tomorrow's technologies.

I say this fully aware of the Soviet campaign to convince the world that terminating our SDI program is a prerequisite to any arms agreement. This clamoring is nothing new. It also has preceded steps we've taken to modernize our strategic forces. It was especially loud, for example, as we moved to offset the unprovoked and unacceptable Soviet buildup of intermediate-range missiles aimed at our allies by deploying our Pershing IIs and cruise missiles.

When I made it clear that we would no longer base our strategic force decisions on the flawed SALT [strategic arms limitation talks] Treaties—and, let me add, that action was taken when there was ample evidence that the Soviet Union was already in clear violation of key SALT provisions—the cry went up that it was the death knell of arms control and the beginning of a new, even more destructive nuclear arms race.

Well, let me just point out, in case no one noticed, the naysayers' predictions have been about as accurate as the time my old boss, Harry Warner of Warner Brothers' film company, said when sound films first came in: "Who the hell wants to hear an actor talk?"

Today, we continue to negotiate with the Soviets, and they are negotiating with us. In fact, their recent proposals—in stark contrast to those gloomy predictions—are somewhat more forthcoming than those of the past. We are giving serious consideration to what the Soviets have recently laid upon the table in response to our own concrete reduction proposals. Also, we are looking toward the next summit between General Secretary Gorbachev and me, as we agreed upon last November, where nuclear arms reduction will be one of several significant issues to be discussed.

Forecasting is not useful, but, let me just say again, I am optimistic. It is demonstrably in the interest of both our countries to reduce the resources that we commit to weapons. If the Soviet Union wants arms reduction—strategic, chemical, or conventional—the United States stands ready to commit itself to a fair and verifiable agreement.

As for SDI, let me again affirm, we are willing to explore how to share its benefits with the Soviet Union, which itself has long been involved in strategic defense programs. This will help to demonstrate what I have been emphasizing all along—that we seek no unilateral advantage through the SDI.

There's been some speculation that in my recent letter to General Secretary Gorbachev, I decided to seek some sort of "grand compromise" to trade away SDI in exchange for getting the Soviets to join with us in the offensive reductions. Now, to those who have been publicizing what is supposed to be in that letter, I hope they aren't offended to find out that they don't know what's in that letter because no one's really told them. I know. Let me reassure you right here and now that our response to demands that we cut off or delay research and testing and close shop is: no way. SDI is no bargaining chip; it is the path to a safer and more secure future. And the research is not, and never has been, negotiable. As I've said before, it's the number of offensive missiles that needs to be reduced, not efforts to find a way to defend mankind against these deadly weapons.

Many of the vocal opponents of SDI, some of them with impressive scientific credentials, claim our goal is impossible; it can't be done, they say. Well, I think it's becoming increasingly apparent to everyone that those claiming it can't be done have clouded vision. Sometimes smoke gets in your eyes. And sometimes politics gets in your eyes. If this project is as big a waste of time and money as some have claimed, why have the Soviets been involved in strategic defense themselves for so long, and why are they so anxious that we stop?

I understand that General Abrahamson [Director of the Strategic Defense Initiative Organization] has already briefed you on the progress we've made. I want to take this opportunity to congratulate the General and his team. They're all first string and doing a terrific job.

I'm more than happy with the strides made in our ability to track and intercept missiles before they reach their targets. The goal we seek is a system that can intercept deadly ballistic missiles in all phases of their flight, including and, in particular, the boost phase—right where they're coming out of the silos. Our research is aimed at finding a way of protecting people, not missiles. And that's my highest priority and will remain so.

And to accomplish this, we're proceeding as fast as we can toward developing a full range of promising technologies. I know there are those who are getting a bit antsy, but to deploy systems of limited effectiveness now would divert limited funds and delay our main research. It could well erode support for the program before it's permitted to reach its potential.

Jack Swigert, an astronaut, an American hero of the first order, once said: "I was privileged to be one of the few who viewed our earth from the moon, and that vision taught me that technology and commitment can overcome any challenge." Well, Jack tragically died of cancer and was cut short from the great contributions he would have made to his country and to mankind. He was the kind of individual who made this the great land of freedom and enterprise that it is. His can-do spirit is alive and well in America today.

We and the other free people of the world are on the edge of a giant leap into the next century. That turning point in 13½ years will not only mark the end of a century but the beginning of a new millennium. And the free people of the world are ready for it. Our research on effective defenses helps to point the way to a safer future. The best minds from some allied countries are already working with us in this noble endeavor, and we believe others will join this effort before too long. In SDI, as elsewhere, we've put technology that almost boggles the mind to work—increasing our productivity and expanding the limits of human potential. The relationship between freedom and human progress has never been more apparent.

But our freedom and security, as we are sorely aware, depend on more than technology. Both diplomacy and our internal debate are at a critical juncture, and your active support is imperative. Together, we must make it plain that this is the worst time to undermine vital defense programs and take away America's needed negotiating leverage.

If we cut back on our own forces unilaterally, we will leave our adversaries no incentive to reduce their own weapons. And we will leave the next generations not a safer, more stable world but a far more dangerous one. The future is literally in our hands. And it is SDI that is helping us to regain control over our own destiny.

Just one last little incident, if you aren't aware of it already, that might be helpful to you and some people that you might be discussing this subject with. Back when Fulton was inventing the steamboat and it came into reality, there was an effort made to sell it to Napoleon in France. And that great general, with all his wisdom, said: "Are you trying to tell me that you can have a boat that will sail against the tide and the currents and the winds without any sails?" He said: "Don't bother me with such foolishness." Well, we know where the foolishness lay, and let's not make the same mistakes.

I want to thank you all again for all you are doing to keep our country out in front, to keep her secure and free. Don't let up. ■

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U.S. Department of Justice

Federal Bureau of Investigation

Washington, D.C. 20535

July 31, 1986

WILLIAM HUBBS REHNQUIST

Incorporated herein are copies of the warranty and trust deeds for property in Vermont purchased by Associate Justice Rehnquist and his wife in July, 1979.

S ct

John Castellvi & Joan J. Castelvi — William H. Rehnquist & Natalie C. Rehnquist

KNOW ALL MEN BY THESE PRESENTS

Vermont Property Transfer Tax
32 V.S.A. Chap 231
—ACKNOWLEDGMENT—
Return Rec'd—Tax Paid—Board of Health Cert. Rec'd—
Vt. Land Use & Development Plans Act Cert. Rec'd.
Return No. 731840
Signed [illegible] Clerk
Date [illegible]

That We JOHN CASTELLVI of Burnsville, in the County of Dakota and State of Minnesota and JOAN J. CASTELLVI of Massapequa Park in the County of Nassau and State of New York Grantors, in the consideration of ONE DOLLAR AND OTHER GOOD AND VALUABLE CONSIDERATION paid to our full satisfaction by WILLIAM H. REHNQUIST and NATALIE C. REHNQUIST of McLean in the County of Fairfax and State of Virginia Grantees, by these presents do freely GIVE, GRANT, SELL, CONVEY AND CONFIRM unto the said Grantees, WILLIAM H. REHNQUIST and NATALIE C. REHNQUIST and their heirs and assigns forever, a certain piece of land in Greensboro in the County of Orleans and State of Vermont, described as follows, viz:

Being the land with dwelling thereon, together with rights of way and easements connected therewith, and being all and the same land and premises conveyed to the Grantors by Warranty Deed of Mildred Teasdale Rhodebeck dated May 4, 1966 and recorded in Book Y at Page 423 of Greensboro Land Records.

Mildred Teasdale Rhodebeck acquired the within-described premises in two parcels.

PARCEL ONE

The first parcel is more particularly described in a Warranty Deed from Vermont Summer Estates, Inc. to William J. Taylor and Blanche G. Taylor dated September 21, 1933 and recorded in Book P at Pages 727-29 of Greensboro Land Records. The premises and restrictions on the use thereof, are set forth in said deed as follows:

"Being a certain part of the same land and premises conveyed to the Vermont Summer Estates, Inc. by H. F. Cummings by his Warranty Deed executed September 25, A.D. 1926, and recorded in Book P, Page 131 of Greensboro Land Records bounded by a line running as follows: Beginning at a point located in the South Easterly edge of the old discontinued Town highway that once ran from the Greensboro-East Craftsbury highway, North Easterly by the North Westerly side of the so called Highland Lodge buildings and by the farm buildings now owned and now occupied by Geo. A. Allen, this point being four feet West of a Birch tree about one foot in diameter at the butt, standing in a group of Birch, Maple, and Ash trees; thence North forty six degrees and forth five minutes East following closely the South Easterly side of the above described old highway, three hundred ninety two feet to a point, marked by a stake and stones, in the lot line fence running between the North Easterly side of the Vermont Summer Estates Inc.'s lands and lands owned by James Black; thence approximately South forty seven degrees East, coinciding with the above described Black line fence, three hundred sixty five feet to a point marked by a stake and stones; thence South forty-six degrees and thrity minutes West, three hundred ninety feet to a point marked by an iron stake, (This point being South thirty two degrees East from the Easterly end of the ridgepole of James Black's house, seventy nine degrees East from the North Easterly end of the ridgepole of the ell of Geo. Wallace' new house, and North seventy one degrees East from the North Easterly end of the ridgepole of John Minor's house); thence North forty six degrees and forty five minutes West, three hundred sixty five feet to the point of beginning, this point being marked by an iron pin set eighteen inches from it and in the last above described line on account of ledge.

Also conveying herewith all springs of water now located on the herein conveyed property.

Also conveying herewith, as a right of way, not exceeding twenty feet wide, to and from the herein conveyed premises, the right to use in common with others for right of way purposes only, the following described roads: A section of a camp road located North Westerly of the so-called Highland Lodge buildings and running from the Greensboro-East Craftsbury highway, North Easterly to the Caspian View road on the Vermont Summer Estates Inc.'s land, until it intersects the old Town higway described above. From this intersection on, the right of way shall be over the old town highway described above North Easterly to the above described James Black line fence. The said Taylor's shall repair this old highway and put it into a useable condition at their own expense and shall maintain it there after at their own expense excepting that the Vermont Summer Estates, Inc. shall pay one half up to ten dollars, of the annual maintenance expense, beginning with 1934, but in no case shall it pay over ten dollars annually. In case that the Vermont Summer Estates, Inc. shall sell other lands and conveys therewith rights to use their right of way for right of way purposes, these users shall pay their proportional part of the expense of maintenance thereafter. Also conveying herewith the right to use in common with others for bathing, boating and recreational purposes, the section of Caspian Lake Shoare now used by the guests of Highland Lodge for similar purposes and the right of way thereto, in common with others, shall be over the established rights of ways as indicated on the Estates' plan of cottage lots. The said Taylors shall have a right to maintain a suitable R.F.D. mail box on the Greensboro-East Craftsbury highway adjacent to the property of the Vermont Summer Estates Inc.'s lands, the exact location to be designated by the said Corporation. The said Taylors shall have the rights to build and maintain a suitable electric line connecting with the upper cottage line to the herein conveyed premises following the right of way approximately, the exact location of which shall be designated by the VermontSummer Estates, Inc. The said Taylors shall have the right to charge future users of this line their proportionate share of the cost of installation expense subject to the approval of the Village of Hardwick. If the said Taylors wish the herein conveyed premises fenced they shall build and maintain a suitable fence at their own expense. The said Taylors shall dispose of their sewage by means of septic tanks located at least ten feet from the lot lines. No feet of the herein conveyed property shall be leased or sold to any member of the Hebrew race. Meaning hereby to convey approximately three and one fourth acres of land and the springs thereon and a right of way thereto including a right of way for an Electric light line. All directions are magnetic.

Reference is hereby made to the above described deeds and the records thereof, for more particular description of the premises."

The premises above-described were acquired by Mildred Teasdale Rhodebeck by Warranty Deed of Ovila Desjardins and Elvira Desjardins dated October 25, 1955 and recorded in Book V at Page 23.

PARCEL TWO

Being two acres of land, more or less, acquired by Mildred Teasdale Rhodebeck by Warranty Deed of Highland Lodge, Inc. dated July 31, 1961 and recorded in Book V at Page 510. The premises are described therein as follows:

"Being a portion of the land and premises described in a Quit-Claim Deed from David B. Smith, Carol C. Smith and Narcissa B. Cameron and Narcissa C. Boyd to Highland Lodge, Inc., said deed being dated December 27, 1960, and recorded in Book V, page 494 of the Greensboro Land Records, and the portion that is herein conveyed being described as follows:

Beginning at a point located in the southeasterly edge of the old discontinued Town highway that once ran from the Greensboro-East Craftsbury highway North Easterly by the North Westerly side of the so-called Highland Lodge buildings and by the farm buildings, this point being four feet (4') west of a birch tree, that is about one foot in diameter at the butt of said birch tree, and said tree standing in a group of birch, maple and ash trees; thence, proceeding N 47°-15'W, along the Southwesterly line of land of M.T. Rhodebeck, a distance of Three Hundred Feet (300') to an iron pipe driven in the ground on said Rhodebeck's property line which said iron pipe is further described as being located at the Northeasterly corner of the land herein conveyed; Thence, proceeding S 44°-24'W., at right angles with the first mentioned line, a distance of 290.50' to an iron post set in the ground at the southwesterly corner of the land herein conveyed; thence proceeding N 47°-15'W, at right angles with said last mentioned line, a distance of three hundred feet to an iron pipe driven in the ground; thence proceeding N 44°-24'E, in a straight line, to the point of beginning.

Meaning to hereby convey two acres of land contained within the above mentioned bounds, and all land described in the first above mentioned deed other than the within conveyed two acres, is reserved and excepted by Grantor.

Refer to the above mentioned deed and record, and to the deeds and records therein referred to, and to all former deeds and records, for a further and more particular description of the herein conveyed parcel of land.

As a further consideration for the giving of this deed, the grantees agrees that no residence or summer places shall be built on the land herein conveyed by the grantee, her heirs or assigns.

Also conveying a right of way at present location for purpose of gaining access to said conveyed land, said right of way to be used in common by the grantee and by the grantor, its successors, assigns, and its guest."

The first bound in line nine of the second paragraph above is set forth as being "N47°-15'W". This is an error and the bound is S 47° 15' E and the corrected designation is the proper description of the bound.

Reference is hereby made to the above deeds and their records and to all former deeds and their records for a more particular description of the premises hereby conveyed.

This deed shall be effective as a bill of sale of the contents of the cottage on the premises described herein as parcel one, including furniture, furnishings and appliances.

TO HAVE AND TO HOLD said granted premises, with all the privileges and appurtenances thereof, to the said Grantees, WILLIAM H. REHNQUIST and NATALIE C. REHNQUIST, husband and wife, and their heirs and assigns, to their own use and behoof forever; And we the said Grantors, JOHN CASTELLVI and JOAN J. CASTELLVI for ourselves and our heirs, executors and administrators, do covenant with the said Grantees, WILLIAM H. REHNQUIST and NATALIE C. REHNQUIST and their heirs and assigns, that until the ensealing of these presents we are the sole owners of the premises, and have good right and title to convey the same in manner aforesaid, that they are FREE FROM EVERY ENCUMBRANCE; and we hereby engage to WARRANTY AND DEFEND the same against all lawful claims whatever,

IN WITNESS WHEREOF, we hereunto set our hands and seals this 9th day of July A.D. 1974

IN PRESENCE of:

J. B. Maertz
Nancy L. Benson

John Castellvi L.S.
John Castellvi

Lorelle Herrmann
Ethel M. Thom

Joan J. Castellvi L.S.
Joan J. Castellvi

STATE OF NEW YORK

Nassau County, SS.

At Massapequa this 9th day of July, 1974 personally appeared before me Joan J. Castellvi and she acknowledged this instrument signed and sealed by her to be her free act and deed.

Before me Margaret Herrmann
Notary Public
My Commission expires March 30, 1976 (SEAL)

STATE OF MINNESOTA

County of Hennepin, SS.

At Mpls. Minn this 14th day of July 1974 personally appeared before me John Castellvi and he acknowledged this instrument signed and sealed by him to be his free act and deed.

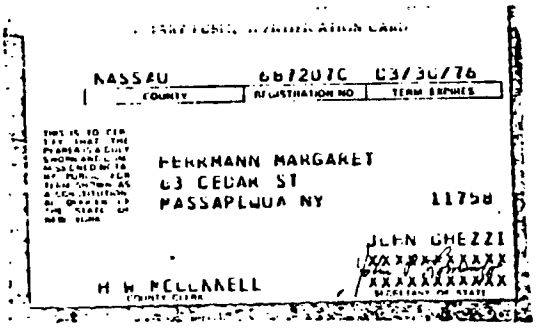
Before me J.B. Maertz
Notary Public

My Commission expires October 28, 1977
(SEAL)

Board of Health Regulations exempt. Reason: Not a subdivision Sale of the whole

Vermont Land Use and Development Plans Act exempt. Reason: Not a subdivision. Sale of the whole

Greensboro Town Clerk's Office. August 2, 1974 at 2:00 o'clock and 30 minutes P.M.
Received for record. Attest: Cleora I. Collier, Town Clerk



Book 2C
P. 132

MORTGAGE DEED

William H. & Natalie C. Rehnquist — Merchants National Bank of St. Johnsbury, Vt.

KNOW ALL MEN BY THESE PRESENTS

THAT WILLIAM H. REHNQUIST and NATALIE C. REHNQUIST of McLean in the County of Fairfax and State of Virginia Grantors, in the consideration of FORTY THOUSAND ($40,000.00) Dollars paid to our full satisfaction by Merchants National Bank of St. Johnsbury, with an office for the transaction of its business at St. Johnsbury in the County of Caledonia and State of Vermont Grantee, by these presents, do freely GIVE, GRANT, SELL, CONVEY AND CONFIRM unto the said Grantee Merchants National Bank of St. Johnsbury, and its successors and assigns forever, a certain piece of land in Greensboro in the County of Orleans and State of Vermont, described as follows, viz:

Being all and the same land and premises conveyed to the Mortgagors herein the said William H. Rehnquist and Natalie C. Rehnquist by John Castellvi and Joan J. Castellvi by their Warranty Deed dated 9th day of July 1974 and recorded in Book 2 B, Page 349-50-51 of the Greensboro Land Records.

Reference is hereby had to the aforementioned deeds and their records, and to all prior deeds and their records, for a more particular description of the premises herein conveyed.

TO HAVE AND TO HOLD said granted premises, with all the privileges and appurtenances thereof, to the said Grantee Merchants National Bank of St. Johnsbury its successors and assigns, to their own use and behoof forever; And we the said Grantors William H. Rehnquist and Natalie C. Rehnquist for ourselves and our heirs, executors and administrators, do covenant with the said Grantee Merchants National Bank of St. Johnsbury its successors and assigns, that until the ensealing of these presents we are the sole owners of the premises, and have good right and title to convey the same in manner aforesaid, that they are FREE FROM EVERY ENCUMBRANCE; and we hereby engage to WARRANT AND DEFEND the same against all lawful claims whatever, THE CONDITION OF THIS DEED IS SUCH, that if the said William H. Rehnquist and Natalie C. Rehnquist heirs, executors or administrators, shall well and truly pay or cause to be paid to the said Merchants National bank of St. Johnsbury, or its successor, a certain promissory note in the amount of $40,000.00 with interest at the rate of 9% per annum for a period of twenty years, and any other advances or loans made by the Merchants National Bank of St. Johnsbury to the said Mortgagors; and shall at all times keep the buildings on said land satisfactorily insured against loss by fire, for the benefit of the mortgagee herein, and also pay all taxes and assessments upon said premises, then this deed to be null and void, otherwise to remain in full force and virtue. And in case of failure to keep such buildings so insured, or to pay such taxes or assessments, the legal holder of this mortgage shall have the right to cause such buildings to be so insured in the owner's name and to pay such taxes and assessments, adding the proper expense thereof to the principal sum secured under this mortgage. It is also expressly agreed that in case this mortgage shall be forclosed and a decree obtained therein, there shall be included in such decree a reasonable solicitor's fee in addition to all sums and costs allowed in that behalf by law.

IN WITNESS WHEREOF, we hereunto set our hands and seals this 23 day of July A.D. 1974

IN PRESENCE OF

Lois R. Crawford
Witness #1

William C. Fawks
Witness #2

William H. Rehnquist
William H. Rehnquist

Lois R. Crawford
Witness #1

William C. Fawks
Witness #2

Natalie C. Rehnquist
Natalie C. Rehnquist

Washington, D.C. } ss. At this 23d day of July A.D. 1974

William H. Rehnquist and Natalie C. Rehnquist personally appeared, and they acknowledged this instrument, by them sealed and subscribed, to be their free act and deed.

Before me Virginia E. Crowder
Notary Public

(Seal)

My Commission expires Feb. 14, 1978

Greensboro Town Clerk's Office. August 2, 1974 at 2:00 o'clock thirty minutes P. M. Received for record. Attest: Cleora I. Collier, Town Clerk

National Security Record

A Report on the Congress and National Security Affairs

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NO. 95 OCTOBER 1986

In this issue . . .

The Near-Term Deployment of SDI

During the three years following President Reagan's March 1983 announcement of the Strategic Defense Initiative the debate centered on whether strategic defenses *could* be built. In the past six months, the issue has become *when* they will be built. This is substantial progress for a concept originally rejected out of hand by most "experts," but it also reflects serious problems for the program.

The other major SDI issue, whether U.S. defenses would be bargained away for an arms control agreement with Moscow, was answered by the president at a White House briefing on August 6. "When the time has come and the research is complete, yes, we're going to deploy." That categorical statement by the president of his intention to deploy strategic defenses was welcome, and it may have reassured some SDI supporters. But many rightly worry about the phrase, "when . . . the research is complete."

For the administration is presenting the SDI program as a long-term research effort, requiring up to ten years for a decision on whether to proceed with engineering development of defenses against ballistic missiles, and years more for actual deployment. Reagan has set a goal of a comprehensive, multi-layered defense of the whole American population against an end-of-the-world assault by thousands of nuclear weapons. There is no question that SDI, so defined, will take many years to develop, test and deploy.

It is, of course, important to protect the nation against Armageddon. But in the meantime, the American people have no protection against even an accidental or limited nuclear attack, and the U.S. strategic deterrent remains unacceptably vulnerable. The "window of vulnerability" is still wide open, and the long-term research program that SDI has become will not even begin to close it for another decade. So long as SDI appears to be only a research program, it will be subject to attack by friends and foes alike. Opponents see it as a waste of money and supporters as lacking a clear goal.

However, once contracts are let for full scale development of a specific weapon, the program will have a purpose and focus it now badly lacks. If President Reagan orders the Pentagon to develop and deploy *just one* SDI weapon, he will leave a legacy that no future president or congress can easily reverse. That is the kind of commitment the supporters of SDI want Reagan to make; to set a target date to begin protecting the American people.

The Technology Exists

The talk about research for ten years, and the reported offer in the president's letter to Gorbachev not to deploy SDI for 7½ years as part of an arms control agreement, are frustrating to supporters of the program. The technology now exists to build ground-based, non-nuclear defenses against ballistic missiles within five years. Such a step could provide substantial protection for the American people against an accidental or limited attack, possibilities that are far more likely than a massive, suicidal nuclear assault.

The option of a limited, ground-based defense has been put in abeyance too readily by the administration. The Soviet nuclear accident at Chernobyl occurred despite elaborate safeguards and backup safety systems. A series of unexpected human errors led to an "impossible" accident. And just last month a Soviet SSN-8 submarine-launched ballistic missile strayed 1,400 miles off course and its dummy warhead landed near the Soviet-Chinese border.

A similar error with just one of the thousands of ballistic missiles targeted on the United States with nuclear warheads could cause a national calamity of unprecedented proportions. SDI supporters are urging the president to deploy defenses against such a disaster as soon as possible. Years of research are not needed. What is needed is a political decision to proceed, and the allocation of the necessary resources to develop and produce defensive weapons.

Boost Phase Preferred

Eventually, SDI is to consist of three defensive layers: a space-based system of striking enemy missiles in the vulnerable boost phase, the first several minutes after launch; a space-based or land-based means of attacking the nuclear warheads as they traverse the 25 minute mid-course phase; and finally, land-based weapons that can destroy any surviving warheads in the terminal phase as they reenter the atmosphere and approach the target. The terminal phase may be further divided into high endoatmospheric defenses fifty miles or less above the earth and low endoatmospheric or point defenses, which would be a last ditch effort to stop warheads as they approach key targets.

Nuclear-armed terminal and point defenses of missile silos and other critical targets long have been available. It is now possible to build terminal defenses without nuclear warheads, and they could be deployed within a few years. But the administration is not planning to defend missile silos, at least not in the beginning of the SDI program. Instead, the administration promotes boost-phase defenses as the best and most important component of SDI. In an ideal world, that would be true. If successful, a boost-phase intercept would destroy an offensive missile with all of its warheads shortly after launch, avoiding the problems of distinguishing between warheads and dummies, and of leakage through the defenses.

The problem is that a boost-phase defense will require a large number of satellites in space. Since the destruction of the space shuttle Challenger last January and a series of other rocket failures, the U.S. has been facing a serious shortage of space-launch capability. This inability to put large numbers of objects into space, expected to last into the 1990's, is bound to have a serious impact on the SDI program. Until boost-phase systems are proven both technically possible and cost effective, it will not be known how many objects will have to be lifted into space for SDI, but estimates range from 400 to 3,400. Such launch requirements are far beyond U.S. capabilities well into the next decade.

Terminal Defenses

One alternative promoted by friends of SDI is to deploy point or terminal defenses first, using existing, tested technologies, while deferring the more complex and esoteric technologies such as lasers and particle beams until later. There are a number of ballistic missile defense systems in various stages of development which could be deployed in just a few years. These include the following point or terminal defenses:

- The *Patriot* guided surface-to-air missile is being built and deployed in large numbers to provide air defense of military targets, primarily for NATO forces in Europe. It is a hypersonic interceptor, deployed in pods of four on wheeled, mobile launchers. It uses a high explosive fragmentation warhead and has an intercept range of about 60 miles. Designed primarily to defend against bombers, Patriot could be upgraded with a rocket engine booster to increase speed and range, a new warhead, and improved radar, to enable it to track and intercept tactical ballistic missiles. In early September, the Pentagon announced a highly successful test of a Patriot intercepting a Lance battlefield missile.
- The *HEDI*, High Endoatmospheric Interceptor, would cover the upper end of a terminal defense from about 10 to 30 miles altitude. The HEDI is an experimental interceptor missile that would carry a high-explosive fragmentation warhead.
- The *FLAGE*, Flexible Lightweight Agile Guided Experiment, is an improved version of the Sprint interceptor that formed the low altitude segment of the U.S. ABM defense of the Grand Forks missile site in the early 1970's. But instead of Sprint's nuclear warhead, FLAGE uses a 9 inch wide kinetic energy weapon, guided by an optical system using infra-red guidance. It destroys its target by impact up to an altitude of about ten miles.
- The *LEDI*, Low Endoatmospheric Interceptor, is a concept for the interception of tactical ballistic missiles at high speed and short range. It follows a radar beam to its target, destroying it with high explosives at about four miles altitude. In April, the Army's Ballistic Missile Defense Command conducted a successful experiment with LEDI against a target suspended from a balloon.
- The *Swarmjet* is a hard point defense system originally designed to protect MX missile silos. It uses a large number of small, 2½ inch diameter rockets deployed on mobile launchers around a missile silo or other high-priority target. Fired in large numbers to defend a particular point, the rockets would destroy incoming warheads by impact at a range of up to 4,500 feet.
- The *Tround Gun* is a new technology machine gun that could be mounted in space on a satellite or on the ground as a last resort point defense. Firing a jam-free triangular round at a very high rate of speed, up to 24,000 rounds per minute, the Tround Gun creates a cloud of small projectiles over a wide area, destroying anything that enters the cloud.

While some of these non-nuclear defensive weapons could be deployed at reasonable cost within five years, the administration is not now moving toward deployment of any of them. Terminal or point defenses are designed to defend missiles or other high priority targets, while the Pentagon's SDI Organization is following orders to develop a system that can protect the whole U.S. population.

The Mid-Course Option

While most focus has been on boost phase defenses, something new has been happening. Weapons originally designed to defend missile sites with nuclear explosions have evolved into systems that can defend large geographical areas with non-nuclear kinetic energy weapons that destroy a target by striking it at very high speed. This technology now is feasible for ballistic missile defenses because of major advances in infra-red sensors, optics, computers and miniaturization, which together make it possible to identify, track, target and destroy incoming warheads at great distances.

Add these technological advances to a long-range interceptor and the result is a mid-course defense that could protect nearly all of North America against at least a limited or accidental attack by intercontinental ballistic missiles (ICBMs) and sea-launched ballistic missiles (SLBMs). Such a system is the Exoatmospheric Reentry Vehicle Interceptor Subsystem (ERIS).

In 1977 the Army began developing a non-explosive, kinetic energy warhead with advanced sensors. That work led to the Homing Overlay Experiment (HOE) conducted at Kwajalein Atoll in the Pacific in June 1984. A HOE interceptor was launched at Kwajalein to intercept a Minuteman ICBM launched 4,000 miles away at Vandenberg Air Force Base in California. The system worked perfectly. HOE's passive infra-

An ERIS mid-course defense, with upgraded radars and sensors, could protect the area covered by the circle against an accidental or limited nuclear attack.

red sensor-tracker proved much more effective at acquiring, tracking and distinguishing the target than had been expected. At a closing speed of over 20,000 feet per second, the HOE Interceptor scored a direct hit, demolishing a dummy warhead high over the Pacific.

In January 1986, the U.S. Army's Strategic Defense Command awarded Lockheed a five year, $460 million contract to develop the system called ERIS. This will involve more tests over the Pacific between 1989 and 1991, to validate a non-nuclear, low-cost weapon system. If a decision is made to go to full scale development on the present timetable an ERIS defense would be operational by the late 1990's.

The planned two-stage solid-fuel rocket interceptor is to be ground-launched and mobile. With a range of 2,500 miles, a site of ERIS interceptors located in the north central United States could provide some protection for the whole continent of North America, as indicated by the white circle on the map in the illustration. Using existing early warning radars and satellites for initial detection, and the PAR radar at Grand Forks for battle management, a single site of ERIS interceptors could protect against an accidental or limited launch over the large area covered by the circle.

Partial Defenses in Five Years

A single site of 100 ERIS interceptors, with modest radar improvements and airborne optical sensors to provide backup battle management regardless of the fate of ground-based radars, would provide at least a partial defense of the U.S. population against ICBMs at a very reasonable cost. If the president accelerates the ERIS program and allocates the necessary resources to it, the deployment of strategic defenses could begin in five years instead of ten or more.

Initial deployment might be 100 interceptors at the existing deactivated ABM site at Grand Forks, N.D., followed by the addition of sites on the East and West coasts. Such a three-site deployment would provide overlapping coverage of the whole North American continent against ICBMs and sea-launched ballistic missiles. Another site of ERIS interceptors in Western Europe could protect NATO against both Soviet ICBMs and SS-20 intermediate-range ballistic missiles. Similarly, a site in Japan or South Korea could provide comparable protection for our allies in Northeast Asia. Since these weapons are non-nuclear and strictly defensive, they should neither conflict with the Japanese constitution nor generate the kind of public opposition that has plagued nuclear-armed offensive missiles in Europe.

Additional ERIS missiles could be deployed if a future president decides to provide greater coverage against a heavier attack. Another future option could be to put multiple kinetic energy weapons on each interceptor, to be better able to intercept multiple warheads. A deployment consistent with Reagan's SDI goal for a layered system would make ERIS operational as a mid-course layer, followed by deployment of one of the more esoteric space-based boost phase defenses as soon as that technology is ready. Terminal defenses could be deployed separately.

At a conference in Copenhagen in September sponsored by the International Security Council, Dr. Kai-Uwe von Hassel, former defense minister of West Germany, called for the early upgrade of the Patriot battlefield missile as a non-nuclear defense of military targets in NATO against the threat of Soviet SS-21, 22 and 23 tactical ballistic missiles, which can carry conventional and chemical munitions as well as nuclear ones. Patriot could perform a similar role for the defense of Israel, Japan and South Korea. In the U.S., it could be used to defend command and control facilities against low-trajectory sea-launched ballistic missiles and cruise missiles.

An Affordable System

It is estimated that 100 ERIS interceptors could be built and deployed within five years of a decision to deploy at a cost of about $3 billion. Another $500 million would cover the desired upgrade of radars and sensors. The total for this initial mid-course defense against strategic missiles would be little more than one percent of the annual defense budget.

Today the United States is spending nearly $300 billion each year on defense and $3 billion on SDI, and there is *nothing* to protect the American people against the accidental launch of a nuclear missile against this country. In the wake of the Chernobyl fiasco and the SSN-8 accident, it would be foolhardy not to protect the public when the technology that can do so is available at reasonable cost.

The present long-term research program spreads the money far and wide. Senator Malcolm Wallop (R-Wyo) has called it a welfare program for the aerospace industry. The House has cut the 1987 budget request for SDI to $2.85 billion, and the final House-Senate figure is not likely to be much over $3 billion. If the program does not soon get focused on at least one affordable weapon that can be developed and deployed in the next half-dozen years, even SDI's most enthusiastic supporters will begin looking for another way of protecting the country, or for a presidential candidate who will promise to deploy defenses in the near-term. The early deployment of strategic defenses already is emerging as an issue for 1988.

Conclusion

SDI should not be viewed as a long-term research program to be followed by the rapid and complete deployment of a highly complex, multi-layered defensive system. Strategic defenses should be built one part at a time, as each technology proves feasible and cost effective. President Reagan has made the important decision to deploy SDI and not bargain it away. He now should instruct the Secretary of Defense to begin full scale development of ERIS and an upgraded Patriot, with target dates for initial deployment within five years.

The technology exists. It requires only a political decision to build it. President Kennedy set a target date to land a man on the moon; President Reagan should set a target date to begin protecting the American people.

Insiders Report

Tracking the Policy Process in Washington

News and Views from Washington

- Disenchantment is setting in at the White House just months after the decision was made to surrender to Capitol Hill pressure to reappoint **James Fletcher** as the Administrator of NASA. After a brief nod to the private sector, Fletcher now is lining up with the NASA bureaucracy to buck Reagan's decision to get the space agency out of the space launch business and open it to the private sector. Fletcher declined an invitation to appear at The Heritage Foundation to discuss the privatization of NASA's space launch monopoly, but he found time to speak at the Brookings Institution on a program highlighting ultra-liberal Rep. **George Brown** (D-Cal) and **John Pike** of the Federation of American Scientists.

  An ill omen for the future is Fletcher's choice of a deputy. He has picked **Dale Myers**, who was in charge of the Apollo program in 1967 when the fire broke out that killed three astronauts on the pad at Cape Canaveral. Myers later served as Under Secretary of Energy in the Carter Administration. Insiders claim that President Reagan approved Myers' nomination only with "great reluctance."

- The Soviet frame-up of *U.S. News and World Report* correspondent **Nicholas Daniloff** using the Soviet legal system reveals the absurdity of the "cooperative relationship" between the American Bar Association and the Association of Soviet Lawyers. The principal purpose of the Soviet lawyers' association, an arm of the government, is to legitimize the Soviet legal system, including its persecution of Jews and its practice of committing opponents of the regime to psychiatric hospitals. The ABA's effort to promote its own version of détente, including high visibility trips to Moscow, has brought discredit on a previously respected organization.

- The *New Republic* recently reported that President Reagan gets much of his information about the Soviet Union from **Suzanne Massie**, an author of popular books about Russia who has been invited to brief the President in the White House on several occasions. Yet Miss Massie is one of the few American writers popular with the Soviet regime. Moscow's *Literary Gazette* of August 20 carried an article highly critical of **William F. Buckley** and **Erica Jong**, describing them as American writers with "bad attitudes" toward the Soviet Union, then lavished praise on Miss Massie for her "good attitude" toward Moscow.

- A groundswell of conservative opposition is developing against **Paul H. Nitze**, President Reagan's top advisor on the sensitive arms control negotiations with the Soviet Union, in the wake of revelations that Nitze made two $500 contributions to the senate campaign of Rep. **Tim Wirth** (D-Col). The ultra-liberal Wirth is running a close campaign to fill the retiring **Gary Hart**'s senate seat in Colorado. Wirth has a zero rating on national security issues according to the tabulation of the American Security Council, while his opponent, Rep. **Ken Kramer** (R-Col), has a 100 percent favorable rating. Nitze confirmed the report, noting it is common knowledge that he is a Democrat. His office added that the contribution was based on his old school tie; it seems that Nitze and Wirth are both Harvard graduates and members of the college's exclusive Porcellian club. But conservatives calling on the president to replace Nitze say his support for Wirth should not be a surprise considering the major role Nitze played in negotiating the SALT I and ABM agreements, which he still supports.

- In a highly unusual appeal, Admiral **William J. Crowe**, Chairman of the Joint Chiefs of Staff, wrote to House Speaker **Tip O'Neill** on August 5 urging full funding of the Strategic Defense Initiative. The nation's top military officer told O'Neill there had been "excellent progress" in SDI research, which he called "a vital component" of the U.S. response to the Soviet strategic threat. The admiral added that if funding for SDI was held substantially below the 1987 budget request it would jeopardize the program. Ignoring the admiral's strong statement of concern, the liberal-led House voted a few days later to cut the president's SDI request by 40 percent.

- Senator **John Glenn** (D-Ohio), normally considered a Senate moderate, is being accused of doing more than any of his liberal colleagues to damage the Strategic Defense Initiative. Glenn introduced an amendment to the defense authorization bill banning foreign governments and companies from participating in SDI. The Senate passed the Glenn amendment to "buy research in America," disregarding the importance of allied support for SDI. Even though the authorization bill appears to be dead, and the Glenn amendment with it, Glenn's action was seen abroad as a direct slap at America's closest allies, the governments of Great Britain, West Germany, Israel, Japan and Italy, which have agreed to participate in the SDI program.

- Some of the pro-freedom fighter groups that helped force CIA deputy director **John McMahon** out of office earlier this year for failing to support adequately the Afghan resistance now are drawing a bead on **Arnold Raphel**, a career FSO and principal deputy assistant secretary of State for Near East and South Asian Affairs. Only 43, Raphel is considered a bright comer in the foreign service, and the State Department wants him appointed U.S. ambassador to Pakistan. The pro-Afghan groups have no objection to Raphel personally, but they consider him part of a State Department effort to arrange a compromise with Moscow that would end U.S. assistance to the resistance and guarantee a "neutral" communist government in Kabul in exchange for the withdrawal of Soviet troops. Supporters of the Afghan resistance want an ambassador to Pakistan whose goal will be getting effective aid to the freedom fighters, not cutting a deal with Moscow.

Negotiating with the Soviets by the House of Representatives: Unconstitutional and Improvident

by Bruce Fein

The House of Representatives recently acted both unconstitutionally and improvidently in yielding to Soviet blandishments on SALT II, a nuclear test ban, and a ban on anti-satellite testing against targets in space. In amending the Department of Defense authorization for fiscal year 1987, the House intruded on the constitutional authority of the president to make treaties, and foolishly undercut President Reagan's ability to negotiate constructively with the Soviet Union on arms control. This action exemplifies why the architects of our Constitution specifically excluded the House of Representatives from any role in the treaty-making process.

The Constitution empowers the president to make treaties, with the advice and consent of two-thirds of the senators voting. John Jay, in *Federalist 64*, explained that the important treaty-making power, especially as it relates to war or peace, was entrusted to the president and senators because they possessed a longevity of office, knowledge of foreign affairs, and a capacity for continuity of policy that is indispensable to success in making treaties. The president was endowed with *exclusive* negotiating authority to insure the secrecy and dispatch essential to exploiting opportunities in the negotiating process.

The House of Representatives, on the other hand, was denied any share in the formation of treaties. Its "fluctuating and multitudinous" composition, Alexander Hamilton observed in *Federalist 75*, was incompatible with the qualities necessary for exercising treaty-making responsibilities. And as Alexis de Tocqueville sagely noted 150 years ago, democratic institutions with numerous members are generally inept in foreign affairs because of a propensity to obey the passions of the moment, and to insist on immediate results.

Soviet leaders from Brezhnev to Gorbachev have importuned the United States to ratify the SALT II Treaty and two nuclear test ban agreements, especially the 1974 Threshold Test Ban Treaty limiting underground nuclear tests to a yield of 150 kilotons. And, since 1983 a series of Soviet leaders have been pressuring the U.S. to cease testing anti-satellite weapons (ASATs) in space.

President Reagan has resisted these Soviet entreaties for reasons of national security. The SALT accords were repeatedly violated by the Soviets, and they failed to accomplish their primary goal of limiting the increase of nuclear arsenals; the nuclear test ban agreements have been both unverifiable and violated by Moscow; and the proposed ASAT ban would leave the Soviets with a monopoly in the ability to attack satellites in space.

Despite these important national security considerations, on August 12 the liberal majority in the House approved a bill that accommodates three of Moscow's principal arms control demands. Generally speaking, the House bill prohibits the expenditure of funds in contravention of the terms of SALT II; it denies money to test nuclear weapons with a yield exceeding one kiloton (current testing is limited to 150 kilotons); and it prohibits the testing of ASAT weapons against a target in space. These actions reflect an effort by a majority in the House of Representatives to bypass the president and negotiate treaties directly with Moscow, disregarding the constitutional exclusion of the House from treaty-making.

Gorbachev immediately treated the House bill as a negotiating gambit, announcing his intention to continue an alleged Soviet moratorium on nuclear weapons testing until January 1, 1987. The Soviet leader's purpose seems to be to escalate world pressure on Reagan to stop testing the nuclear weapons being developed for the Trident D-5 missile and the small mobile ICBM, critical new elements of the U.S. strategic deterrent. And the House is playing into his hand.

The House bill epitomizes the reasons why the Founding Fathers denied that "fluctuating and multitudinous" body any role in the negotiation or ratification of treaties. It ignores the record of Soviet behavior, especially Moscow's congenital penchant for violating arms control agreements and for taking advantage of Western displays of good will.

Soviet violations of SALT II and other recent arms control agreements are just part of a long history of Soviet arms control duplicity. For instance, as early as 1921 the Soviet Union was breaking arms accords, helping Hitler to rearm in massive violation of the Versailles Treaty limitations on German armaments and military training. That Russia suffered mightily in World War II does not diminish Moscow's culpability for helping Hitler before the war.

The House bill also reflects naiveté regarding Soviet obduracy against effective verification of nuclear test ban accords. After all, what explains the Soviets' unwillingness to agree to effective test ban verification, the lack of which blocks an arms control goal that Moscow trumpets as pivotal to global survival, except to protect their ability to cheat?

The House bill carries earmarks of impetuosity born of political expediency. Many House liberals would like to campaign for reelection this fall by criticizing the failure of the president to conclude arms control treaties with the Soviet Union. They would exploit for political gain the natural desire of all citizens for a reduction in nuclear armaments and nuclear threats. This can readily be achieved, the House bill wrongly suggests, by the hasty acceptance of Soviet demands.

Several years ago, many argued that the Soviets would cease negotiating when the Western Allies refused to compromise on the deployment of Pershing II and ground-launched cruise missiles in Europe. The Soviets did walk out of the negotiations, but when the West stood fast they returned.

It should not be forgotten that the SALT I and ABM agreements of 1972 were signed by the Soviets on the heels of massive U.S. bombing and mining in North Vietnam, when many in the West were saying that strong U.S. action would ruin the chance of an accord with Moscow. And in 1963 the Nuclear Test Ban Treaty that outlawed atmospheric testing followed a firm U.S. stand in the Cuban missile crisis.

The Founding Fathers correctly understood that the nation's security would suffer if the House of Representatives intruded on the treaty-making process to score political points. The defense authorization bill may well die in the House-Senate conference, but the House also added its concessions to Gorbachev to the 1987 continuing resolution. The Senate should reject these restrictive House amendments, but if the Senate fails in its duty, the president should veto any bill that contains them.

Bruce Fein is a Visiting Fellow in Constitutional Studies at The Heritage Foundation.

Soviet Aid to "Special Friends"

While the United States provides some form of foreign aid to over two-thirds of the countries in the world, about 105 last year, the Soviet Union and its East-bloc allies carefully target their economic assistance to only eleven countries, all communist states unequivocally aligned with Moscow. A "background brief" issued by the British Foreign Office describes the selective nature of Soviet-bloc economic aid (in contrast to Soviet military assistance to over 30 countries).

Just three countries, Cuba, Vietnam and Mongolia, receive 78 percent of all Soviet-bloc economic aid. The eight other recipients are Afghanistan, Nicaragua, Ethiopia, South Yemen, Laos, Cambodia, Angola and Mozambique. No surprises here; all are communist countries tied politically to Moscow and run by Marxist-Leninist dictators.

Most Soviet-bloc aid is in long-term credits for specific development projects. Some short-term credits, commodity assistance and cash occasionally are provided, but very little Western-style humanitarian aid. Direct Soviet-bloc economic aid is estimated at $3.15 billion in 1984, compared to over $13 billion in U.S. economic assistance. However, the USSR also provides large hidden subsidies to some of its client states by buying their products at inflated prices while selling them Soviet-bloc products at discount prices. The shops in Managua, for example, reportedly carry little but Bulgarian and other East-bloc goods.

The principal recipients of Soviet-bloc economic aid are:

Cuba. Direct Soviet-bloc economic assistance to Cuba was about $680 million in 1984. Soviet subsidies were much higher; nearly $4.2 billion for sugar and $50 million for nickel. The sharp drop in the price of oil on the world market eliminated the subsidy Moscow previously provided by selling oil to Cuba at cut rate prices. The value to Cuba of the Soviet oil subsidy has been estimated at $1 billion in 1982 and zero in 1986. However, the USSR has offered Cuba nearly $3 billion in new credits.

Vietnam. Like Cuba, Vietnam is a client state of the USSR, totally dependent on the Soviet-bloc for oil, fertilizer and most equipment. Soviet-bloc economic aid was an estimated $1.18 billion in 1984. The Soviet oil subsidy has fallen to zero, but Moscow has offered new credits on easy terms.

Mongolia. The sparsely populated buffer state on the China border received a relatively high $620 million in Soviet economic aid in 1984. A new five-year agreement reportedly has further increased the volume of Soviet economic assistance by 50 percent.

Afghanistan. The Soviets have committed some $3 billion in "economic" aid to their puppet government in Kabul, although most is allocated to projects near the Soviet border and in areas where Soviet troops are located. Projects include mining and oil exploration, the products of which go to the USSR, and a railway linking Soviet bases with Kabul. Such assistance is more military than economic, and of little value to the Afghan people.

Nicaragua. The largest recipient of Soviet aid in Latin America after Cuba, Nicaragua has received Soviet-bloc economic aid offers in excess of $1 billion. During the visit of President Daniel Ortega in 1985, the Soviets pledged an additional $200 million and agreed to meet virtually all of Nicaragua's oil needs.

Africa. While Moscow has been willing to provide oil and send large amounts of military assistance to its African client states (an estimated $2 billion worth of arms to Angola alone, and more to Mozambique), its economic aid has been stingy. By far the largest Soviet-bloc economic commitment in Africa is the $860 million Moscow has promised Ethiopia. Hardly any of this has been the kind of humanitarian food aid provided by the West. Instead, Soviet-bloc aid has been for irrigation projects and industrial plants, while the population starves.

Soviet economic aid clearly has political purposes and is designed to further Moscow's interests rather than those of the recipient country. But the drop in the world price of oil, combined with falling Soviet oil production, has dealt a sharp blow to Moscow's efforts to sustain its global empire.

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DANIEL GRAHAM

Reagan's new SDI outlook

Unnoticed by the press were two profoundly important statements by President Ronald Reagan after his Iceland meeting with Soviet Secretary General Mikhail Gorbachev. For the first time in the Strategic Defense Initiative debate, Mr. Reagan referred to himself as a president who may make the decision to deploy defensive systems, and for the first time he mentioned the need to guard against accidental or Third Country attacks.

While still in Iceland, the president explained his refusal to agree to Soviet demands on SDI, saying, "The Soviet Union insisted that we sign an agreement that would deny to me and future presidents for 10 years the right to develop, test, and deploy a defense against nuclear missiles for the people of the Free World."

This certainly indicates that someone has at last told the president that SDI can be a reality in the short term and need not be an endless research program aimed at perfection, delivering no protection for a decade or so.

When the president suggests that *he*, not necessarily "some future president," can make such a deployment decision, there is reason to believe that he now knows what many of us have known for a long time: very robust SDI defenses based on mature and relatively cheap technology can be built long before the Soviet-proposed 10-year period of research-only would expire.

In his broadcast address following the Iceland meeting, President Reagan said, "As of today all free nations are utterly defenseless against Soviet missiles — fired either by accident or design." With that statement, he brought to public attention a critical aspect of the SDI debate. Without *any* defenses, we could lose millions of people to an accidental or "rogue" attack.

The possibilities of such an event are ominously real. Soviet missiles *have* gone astray, hitting China and Finland. The Soviets recently lost a nuclear missile submarine in the Atlantic because a missile malfunctioned. And there was Chernobyl. There could be — and the odds are heavily in favor of it — an accidental firing of a hydra-headed nuclear ballistic missile.

What would our president do? Without SDI, he can only order the devastation of the U.S.S.R. (the option favored by MAD-men) or simply warn the people in the target areas that their lives would last another 15 minutes.

These two statements by the president augur well for a deployment decision now. Certainly even the most committed opponents of SDI will admit that we can get defenses quickly which will defend against accidental or rogue attacks and reduce the dangers of unintended nuclear war. Such defenses can be built within five years at the remarkably low cost of $3 billion!

President Reagan can make that decision now, and it appears he knows it. In fact, he can order High Frontier's SD3 (Strategic Defense Development and Deployment) defenses deployed now. SD3 proposes mature technology for two ground-based and one space-based layer of SDI. Prepared in cooperation with the industry engineers who would carry out the programs, SD3 makes the case that with adequate priority, three layers can be in place in seven or eight years at a cost of $30 billion.

The result would be a non-nuclear system defending both our population *and* our military forces against deliberate or accidental attack, and it would create a deterrent to nuclear war far more powerful than the one we have now.

Once the decision to deploy is made, the false notion found in all the criticisms of the president's refusal to cave in at Reykjavik will disappear — that is, the notion that SDI is a futuristic, trillion-dollar vision that may or may not work — so why not trade it off?

It is in fact a strategic necessity, a strategic bargain, and a current reality held back only by politics.

Retired U.S. Army Lt. Gen. Daniel Graham is director of High Frontier.

WASH TIMES OCT 21

FEASIBILITY...Continued

ought to be done. But I think it can be cheaply set aside by the ICBMs that are already in existence. A thousand of them can come toward us even after we have 90 percent knocked down, before even inventing SDI. That could happen, and will happen, as a matter of fact.

Another thing is, how about the satellites? This program is entirely dependent upon satellites, and satellites can be shot down. It's a lot easier to shoot down a satellite than it is to shoot out an incoming weapon.

So, there are just lots of answers to the SDI, even as it's conceived.

I think it's worthwhile studying, but I think every indication is that it will cost a lot more than anything we've ever done before; and in addition to that, will not be anything but adding another great problem to mankind in the future.

MACNEIL: Do you have a final comment, Dr. Teller?

DR. TELLER: I have a couple of very short ones.

Let's not all it SDI. Let's call it SDR, strategic defense response. The Soviets have every reason to defend themselves, and so have we.

My other suggestion is, listen to Jack Kemp and vote for people in the fall, like Jack Kemp, who will be for defense.

MACNEIL: We have to leave it there.

NEW YORK TIMES 12 August 1986 Pg. 25

Perils of Deferring S.D.I.

By Malcolm Wallop and Jack Kemp

WASHINGTON

PRESIDENT Reagan's announcement last week that he remains committed to the eventual deployment of strategic defenses deserves applause. But there are some of us who fear that S.D.I. — the Strategic Defense Initiative — still won't happen. The reason we're worried is that Mr. Reagan has also reportedly offered to defer deployment of any American defenses against Soviet missiles for five to seven years.

This is a dangerous change in our arms control policies that invites strategic peril. A moratorium on S.D.I. deployments — at the very time the Russians are violating the ABM treaty and fielding the components for their own nationwide strategic defense system — would place the United States in a no-win position and the Russians in a no-lose position.

Every American should by now be aware that the Soviet Union, from the very first day of negotiations, has had one overriding objective at Geneva — to kill S.D.I. Talk to our negotiators, and they will tell you that their Soviet counterparts are obsessed with S.D.I. But now, astonishingly, we appear ready to accept a limit on American S.D.I. deployments as part of our official negotiating position. Once we've agreed on the principle, we'll be reduced to arguing over the price.

Negotiations can be expected to turn increasingly on what part of the "Star Wars" program we are willing to deliver to Moscow in exchange for offensive reductions on both sides. Soviet cheating — which should be the primary issue — will become a side issue, and the 20-year-old Soviet S.D.I. program a fait accompli. In Congress, meanwhile, support for S.D.I. funding will erode, once people come to believe that our money is being spent on a program we may well give away. Indeed, judging by last week's close votes in the Senate, this process may already have begun. And over time, S.D.I. will increasingly be portrayed as the major obstacle to a broader agreement.

All this is reminiscent of August 1970, when the United States offered Moscow an arms agreement based on a vastly scaled-down deployment of its "Safeguard" antiballistic missile system. Funding for the program fell immediately, and declined to less than one-fifth of its pre-agreement level by 1976. S.D.I. is vulnerable to the same fate.

It will also become much more difficult to conduct the tests necessary

CONTINUED NEXT PAGE

PERILS...Continued

to deploy either near-term defenses — which the Russians are already deploying — or more ambitious defenses. Opponents will argue, as they did after the ABM treaty signing, that such tests are inconsistent with the spirit of the new agreement. Without such tests (the Russians, based on past record, will observe no restraints), the United States will be even more vulnerable to a Soviet ABM "breakout" during or at the end of the seven years. This is the diplomacy of accommodation at its worst.

Some at the State Department and elsewhere will say the scenario we envision is exaggerated. But these are the same people who say we have nothing to lose by this new offer because there's nothing we can do by way of S.D.I. deployments over the next five to seven years anyway.

These people are wrong. We have the military capability today to do very useful things with our strategic defenses. These options are not limited to the defense of our missile silos, as some would have us believe. Initial deployments would include options to protect all military forces and disrupt a Soviet first strike. Such defenses would introduce significant uncertainty in the minds of Soviet planners, strengthen deterrence and provide an important level of defense against accidental or third-country attacks.

Just last month, the President rightly said that we would end our adherence to the terms of SALT II because Moscow long ago ceased to comply with that treaty. Yet his new offer makes no mention of the Russians' sweeping violations of the core provisions of the ABM treaty. How can we agree to extend a treaty we know the Russians are violating even as they put their name to paper? That's a sure way to lose all credibility and leverage in our efforts to put an end to Soviet cheating.

The purpose of the ABM treaty was to prohibit the things that Moscow is doing now. Signing yet another agreement would do nothing to stop them. It would only keep us from building the defenses we need to protect ourselves and our allies.

The great irony of the new approach is that we are jeopardizing S.D.I. in response to a basically worthless Soviet proposal. The Soviet offer to reduce offensive weapons is little more than a network of SALT II provisions at lower but less stable levels. It contains limits, as on so-called "forward-based systems," that previous Administrations have rejected. And it contains no offer to remedy Soviet treaty violations.

Yet for this we risk seeing S.D.I. reduced to a research program with virtually no promise of providing the strategic defense America so vitally needs. By the end of Mr. Reagan's term, the S.D.I. program could be reduced to a bargaining chip at the negotiating table, something the President has vowed would never happen. We do not believe that this is the legacy that the President wishes to leave the nation.

There is nothing to be gained from trading defensive limitations for offensive reductions. This is the clearest lesson of the past two decades, during which America fell further and further behind. The ABM treaty itself was sold on the basis that it would limit offensive weapons. Those limitations never materialized. The result has been a steady erosion of our deterrent in the wake of an unprecedented Soviet military buildup.

It's time we broke free of this destabilizing cycle. Let us deploy strategic defenses, and under protection of those defenses begin to reduce offensive forces. And let us insist that no arms control agreement is acceptable if it impedes near-term S.D.I. deployment or validates Soviet violations.

Mr. Reagan's magnificent vision of a strategic defense for America and our allies must not be compromised by the sort of bureaucratic equivocation that produced this new and ill-advised offer. □

Malcolm Wallop, Republican, is a U.S. Senator from Wyoming. Jack Kemp, also Republican, is a U.S. Representative from New York.

ALBANY TIMES UNION 26 August 1986 Pg. 11

Soviets' SDI fear

By GARRY WILLS

The argument that President Reagan's forces always fall back on, for their Star Wars scheme, is that it must be something good if the Russians are so palpably afraid of it. If they loathe it, we are obliged to love it.

The President rightly says that SDI brought the Russians back to the negotiating table — after his first skewed "offer" had driven them away. But what is the good of bringing them back if we do not mean to do any business with them, as on Star Wars we clearly don't?

In other times, in other moods, the President likes to say the Russian economy is collapsing, that it cannot keep up with the free-enterprise system. There is some truth to this — though Russia's recovery from World War II's ravages, its depopulation, its destruction of cities and industrial sites, was a miracle of its own sort. That miracle depended on making the Russian people work frenziedly on a few priority items, out of an unreasoning fear of America — a fear we helped to stoke and keep fueled.

But Star Wars takes Russia into a new and expensive competition, in fields where it has always lagged (staying at least five years behind us in computer technology, for instance). Russia keeps up, as its MIRVs show, but with increasing effort.

Well, then, why not make them spend themselves into debility? Because, long before that happens, they will be tempted to use what might they have, while they have it, to prevent us from getting finally beyond their reach.

The Russians' first response to Star Wars, for instance, will be to increase the known technology of IBMs, to "flood" our defense in its early stages — a process in which temptations to pre-empt will increase significantly. Their next step will be to find cheap ways of crippling parts of our system. Reagan's plan is to defend from all attack — a goal that is thwarted if even some major gap can be created in the rim of defenses. We will be spending more and getting less, since a large periphery of defending forces can always be pierced at some point by a concentration of lesser forces. Then we will be the ones tempted to sabotage the sabotage.

In any case, a dangerous world will be made intensely more dangerous for everyone and vastly more expensive for us and them. The Russians are afraid of the system because it is bad, unstable, tricky for both us and them. We can use that fear to prevent such a precarious development, or we can be the slaves of that fear by cultivating it whenever it appears.

Strategic Defenses Should Be Built Now

President Reagan's Strategic Defense Initiative is in trouble. Its main enemy: delay.

In 1983 the president made the right strategic decision, to build SDI to protect the American people against nuclear attack. But now his administration is making the wrong tactical decision—to delay deployment until a near perfect, high-tech system that can protect against an all-out Soviet assault has been designed and proven possible. This means a decade of research, while America remains undefended against intercontinental ballistic missiles (ICBMs).

If SDI continues to be just a long-term research program, it will not survive. Congress will not vote funds much longer for indefinite research, and pressure to make SDI an arms control bargaining chip will grow.

The first step in that direction already has been taken. The President's recent letter to General Secretary Mikhail Gorbachev puts SDI on the bargaining table. According to press accounts, the letter suggests that *if* defensive technologies are shown to be feasible by 1991 the United States and the USSR should then begin discussions on how to manage the transition from offensive to defensive weapons. These talks would have a two-year limit. If no agreement is reached in that time, the U.S. would begin unilaterally to deploy strategic defenses, after giving Moscow six months notice. That adds up to 7½ years before the U.S. even begins to deploy defenses against Soviet missiles.

There is nothing wrong with this scenario except the timing. It is based on the assumption that the government will not know until 1991, if then, whether ballistic missile defenses of the United States are technically feasible. The fact is that such defenses are *now* feasible. The technology has been demonstrated successfully. It is based on the Homing Overlay Experiment of June 1984, in which a non-nuclear, non-explosive missile scored a direct hit on an ICBM warhead high over the Pacific Ocean. That system has been under development for fifteen years, and it works.

The problem is that it is seen by many as a means of defending missiles instead of people. But this system could be developed to include the capability, if combined with advanced sensors and improved early warning radars, of providing at least some protection against ballistic missiles for most of North America.

The Soviet anti-ballistic missile (ABM) system around Moscow has a large "footprint," within which it protects both Soviet ICBM sites and a large segment of the Russian population. Similarly, a U.S. ABM system could be deployed with a "footprint" so large that it would protect both America's strategic deterrent *and* the American people from at least an accidental or limited attack. This, in itself, is worth the price of such a program, which is estimated at three to four billion dollars, or less than two percent of the annual defense budget. But such a ground-based limited defense of North America would be just phase one of the ultimate goal: a comprehensive, layered defense of the United States and its allies, employing both current and future technologies.

Research should continue on lasers, particle beams and other futuristic weapons, but conventional weapons can be built now that would provide considerable protection for the American people against ICBMs. Those weapons should be developed and deployed as soon as possible. It is not necessary to wait until 1991 to make that decision.

The President should direct the Secretary of Defense to begin immediately to develop and test, under the broad interpretation of the ABM Treaty, those technologies that can be deployed in the near term to protect America. If just 30 percent of the annual SDI budget (currently about $1 billion) is allocated each year for the next five years to near-term deployment options, a limited strategic defense could become reality, while leaving 70 percent of SDI funds for research into the technologies of the future. Unless progress toward the deployment of real weapons begins soon, the President's historic vision may well be lost.

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NSR #94: Solving the Space Launch Crisis.

COMMENTARY

OPINION • LETTERS

DRAWING BY MARGARET KING

INSIDE VIEW

SDI Does Not Aim for Perfection

Plan Is Not Leakproof, but Still a Deterrent to Nuclear War

By DANIEL O. GRAHAM

A red herring is being dragged across the trail in the Strategic Defense Initiative (SDI) debate: the notion that there is some kind of finite distinction between defense of missiles and defense of population. It posits this false dilemma: either we have a perfect leakproof defense that can protect people, or a porous defense that can only protect missiles. The anti-SDI lobby is fond of mocking the idea by displaying an umbrella with holes in the fabric. They never display the umbrella they prefer — one with no fabric at all.

This is all blatant nonsense. Any modern missile defense protects some of the population; no defense will protect all of the population. And any strategic defense deployment will start with a partial and porous defense no matter how much total protection it eventually will provide.

But even a porous initial defense is of enormous strategic value as a deterrent to nuclear war. A relatively porous defense presents stupefying problems for a first-strike planner. As Clarence Robinson states in *Policy Review* (summer 1986), even a two-layered defense system would force the Soviets to allocate 300 warheads to a single hard target to get a 50 percent kill probability. This "leaky" defense would put a first strike outside the realm of reason. (Incidentally, the tremendous strike capability reveals the fallacy of the notion that SDI would provoke a buildup in offensive missiles.)

But would such a porous defense protect population? The answer is yes. Intercepting any missile that would have killed people saves people. Certainly a defense that could stop only half of a salvo of all Soviet, nuclear missiles would provide near-perfect defense against one or a few missiles fired by accident or by some third country, a significant threat when one considers the accident-prone Soviet system — witness Chernobyl.

Lt. Gen. (Ret.) Daniel O. Graham is director of High Frontier and chairman of the Coalition for the Strategic Defense Initiative.

Of course, it is true that we cannot protect the bulk of our population if the Soviets should choose to fire all their missiles at our cities. Then every warhead that got through the defense would kill people. But a first strike against cities to inflict maximum slaughter upon our civil population is sheer insanity and we cannot deter madmen, either with our current threat of retaliation or with strategic defense. The only conceivable rationale for a strike against cities (and the one the MAD doctrine uses as a rationale) is as retaliation against an opponent's first strike. It is relatively simple to prevent that kind of attack — don't strike first.

The most important mission of our strategic forces is to prevent nuclear war from happening at all. Everyone (even many SDI critics) seems willing to agree that less-than-perfect defenses would strengthen our deterrent by creating uncertainty in the mind of the aggressor.

The question of protecting the population has been and will always be a question of what happens should deterrence fail or an accidental launch occur. As of now, there is absolutely no protection of the population in either event. With the deployment of the first elements of SDI, there would be some protection. Over time, the degree of protection would increase from "some" to "very effective," but would never reach "100 percent, leakproof."

Technology itself bears this out. The president could today order the deployment of the exoatmospheric reentry vehicle interception system (ERIS), a variant of the successfully tested "Homing Overlay" (HOE) system in the missile fields of North Dakota where it would provide light defenses against ICBMs for the entire country, all of populated Canada and a large part of Mexico. This one defensive installation could thus defend the population from at least the accidental launch of a few missiles. We could get such a system in place in five years for $3 billion. In addition to providing our people protection from the devastation of an accidental or third country attack, it would destroy the usefulness of the Soviet intercontinental and submarine-launched missile force for preemptive or first-strike attack, against our retaliatory force. And the same technology could be used to provide similar regional defenses for Europe, Israel and Japan. Unless we deliberately restrain technology so that ranges of intercept permit defense of only single points or small areas on the ground, we will be providing broad area and thus population defense no matter what the strategic intent.

The notion that only 100 percent perfect defenses can be considered protection for population is a false premise cultivated by the anti-SDI lobby. It is a polemical device for undermining broad popular and political support for protective systems. It allows anti-SDI spokesmen to support continuation of adherence to the MAD doctrine without saying so.

Another false impression often heard is that the president originally called for a "leakproof umbrella," but has changed his mind and now wants merely to protect missiles. Purveyors of this idea would have us believe that when Lt. Gen. James A. Abrahamson, the SDI Organization director, states that we cannot achieve a perfect defense, or when Assistant Secretary of Defense Richard Perle says that we will start with defenses that reinforce deterrence more than protect population, they are at odds with Secretary Caspar Weinberger, who stresses the goal of defending the people.

This is all quite erroneous. President Reagan never called for perfection in strategic defenses, and neither has anyone else who is for SDI. Abrahamson, Perle and Weinberger all know, and have often stated, that the defenses will progress in stages and that early stages will be more effective in the deterrent role than in the population protection role, but that the end goal of SDI is effective population protection — not perfect, but effective.

This is not to say that there are no differences of opinion in the pro-SDI camp, in and out of government. The prime difference is on the question of a deployment decision, moving SDI out of the "pure research" mode. A deployment decision can be made now without undue technical risk — with no more risk than that taken by the Eisenhower administration when it approved development and deployment of the Polaris submarine fleet. The technology for a two-layered defense — one on the ground and one in space — is either in hand now or confidently predictable. The ground-based system is the ERIS described above. The space-based system that can effectively filter an all-out missile attack in the early stage of trajectory (the boost, post-boost phase). This is a much improved version of the "mature technology" system first proposed by the High Frontier study group in 1981.

Thus the pressures against an SDI deployment decision are not technical, as Abrahamson has testified. The resistance is political and bureaucratic. On the political side, hesitancy is based on an unwillingness to face the ABM Treaty squarely. This has resulted in the courting of the greatest threat the SDI program has faced — making it a bargaining chip in arms-control negotiations via extension of the ABM Treaty. If this approach is successful, we certainly will not deploy available defenses for many years, and probably will never deploy anything.

On the bureaucratic side, the resistance to deployment is based on the chronic competition for dollars in the Defense Department budget. So long as SDI remains "research only," defensive systems will not become a serious rival for dollars demanded for offensive systems or other military procurement programs. This creates a strange alliance between some of the DoD bureaucracy and the antidefense lobby in support of continued adherence to the ABM Treaty. The only technical aspect of the opposition to near-term deployment is the usual urge to wait and see if "emerging technology" cannot make the system better. This adds another unit to the alliance against deployment — scientists and others who for parochial and fiscal reasons opt for "research forever, deployment never."

There is a large red herring in the SDI debate, and it behooves us all to know how and where it was spawned. The notion that "perfection" was ever President Reagan's demand for SDI or that only perfection can defend the population is a contrived weapon of anti-SDI proponents in and out of government. It is this false notion that SDI is merely a long-term search for the perfect solution that lies at the heart of the rationale for extending the SDI-crippling ABM Treaty for 7½ years.

HIGH FRONTIER

1010 Vermont Avenue, N.W. • Suite 1000 • Washington, D.C. 20005 • (202) 737-4979

Lt. Gen. Daniel O. Graham
USA (Ret.)
Director

S121

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FURTHER INFORMATION:
Terri Lukach
(202) 737-4979

HIGH FRONTIER STUDY SAYS SDI DEPLOYMENT POSSIBLE WITHIN 71/2 YEARS

At a press conference today on Capitol Hill, Lt. General Daniel O. Graham (USA-Ret.), Director of High Frontier and Chairman for the Coalition for the Strategic Defense Initiative (CSDI), announced the results of a study of near-term SDI deployment options which can be operational within the next 7 1/2 years. Graham, who first briefed candidate Ronald Reagan on the concepts strategic defense in early 1980, is often called the "father of SDI."

The High Frontier's study, dubbed "SD^3" for Strategic Defense Development and Deployment, states that the United States and its allies could start deploying highly effective strategic defenses in two years and have a thoroughly reliable shield against nuclear attack for both population and military forces within 7 1/2 years, that is, within the period of delay now being considered by the Administration in a bargaining ploy with the Soviets.

Graham announced that High Frontier and the Coalition for the Strategic Defense Initiative will launch a nation-wide campaign to inform the public that President Reagan, not some future president, can order the building of strategic defenses. The CSDI represents almost 200 umbrella organizations and more than 30 million Americans nationwide.

"The public is highly supportive of the proposition that we defend ourselves," Graham said. "They are not much interested in endless research. Nor are they much concerned with 'perfection' in defenses or the 'sanctity' of the ABM Treaty. They are not even greatly concerned with cost."

Graham said the SD^3 study showed conclusively that "The SDI research program has already produced the technology which would permit a deployment decision today on two or three layers of defense.

(more)

"The three layers, all based on mature and proven kinetic energy technology," he explained, "can provide for both population defense and a greatly strengthened deterrent to nuclear war in 7 1/2 years at a cost of less than $30 billion." Graham pointed out that the costs and timing of the SD^3 program assume a Manhattan Project-like priority.

SD^3 is the result of an intensive effort by High Frontier to address the growing strategic nuclear imbalance.

"The Strategic Defense Initiative as currently defined and implemented, can no longer be considered an adequate response to the nation's security needs or the the American people's demand for genuine, affordable defense," Graham said. "A reasonable and cost-effective plan for near-term deployment of strategic defenses is absolutely necessary to the continued safety and prosperity of the United States."

As to the technical risks involved, Graham said, "There are fewer technical risks in a decision to deploy these defenses now, than were involved in the Eisenhower decision to deploy the Polaris submarine in 1956."

Graham outlined other important implications of the study, such as lower costs of space transportation to orbit. "If the Administration accepts the SD^3 program," said Graham, "one tremendously important benefit would be the creation in four or five years of a capability to put large payloads of all types into space at sharply reduced costs."

On Capitol Hill, Senator Malcolm Wallop and Congressman Jack Kemp, both strong defense advocates, said they felt a program like SD^3 would receive very strong support in the Congress, certainly much stronger than the support for 7 1/2 more years of research only. Senator Fritz Hollings said that even if Graham's figures were "in the ball park", the program would save taxpayers' dollars, not add to the burden.

"If we can expect reasonably good defenses coming in over the next several years," Hollings said, "A lot of expensive DoD systems in the works probably wouldn't be needed." Hollings pointed to the MX Dense Pack idea where we were going to spend about $30 billion just in concrete to provide a degree of survivability.

"That sort of thing isn't needed if even a <u>fairly</u> good defense is in place," Hollings said.

Graham said a more completely detailed analysis of the systems discussed in the report would be forthcoming from High Frontier.

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STRATEGIC DEFENSE INITIATIVE

Insight 10 NOVEMBER 1986 Pg. 56

In the Realm of the Possible: The Work on Strategic Defense

SUMMARY: The Strategic Defense Initiative is progressing well, thank you, though it will be some years before scientists and a future president can fully analyze the program's effectiveness. SDI, the space-based defense system dear to President Reagan, features sensors to detect missiles, different proposed laser systems to neutralize enemy warheads and ground-based defense rockets — the last link in the system that might make nuclear missiles obsolete.

On a television screen in a secluded lab in Albuquerque, N.M., vividly hued concentric circles sway back and forth like a multicolored amoeba.

Working nearby are Air Force Weapons Laboratory engineers attempting to create a powerful laser as part of President Reagan's Strategic Defense Initiative, or SDI. On a long table, they divide a single laser beam into three, then harness the beams together into a more powerful laser. With the help of computers, the result is displayed on the screen, where each color symbolizes a level of energy from the laser's beam.

Someday, a similar laser might lurk on an orbiting spacecraft, awaiting instructions to destroy enemy nuclear missiles before they reach the United States.

This lab, at Kirtland Air Force Base, is one of hundreds nationwide where scientists and engineers are painstakingly pursuing the massive technical challenge behind Reagan's 1983 call for research into development of a shield capable of eliminating the threat of strategic nuclear weapons.

SDI has come under close scrutiny lately, due to the research operations' expanding budgets and a push from some quarters to deploy a defensive system within the decade. That scrutiny has quickened following the recent meeting in Iceland between Reagan and Soviet leader Mikhail Gorbachev, at which Soviet insistence that the United States abandon the Strategic Defense Initiative scuttled potential agreements on cutting nuclear arsenals.

The battle at Kirtland and elsewhere is a scientific one — a battle of volts, of microns, of kilometers per second — far removed from the war of words that rages in the offices of congressmen and lobby groups. From Livermore, Calif., to Huntsville, Ala., scientists and lab directors are quick to say that their work is going well. They add, just as quickly, that much remains to be done before SDI can bear its first fruit: enough data for a president in the early 1990s to decide whether to deploy a missile defense.

"There's been substantial progress," says Roger Hagengruber, director of systems studies at Albuquerque's Sandia National Laboratories, a Department of Energy lab that has become a center of SDI research. "There's also no doubt that when you go back and look at it, there's a lot of things that have been said for which the progress isn't quite as much as the statement might have been," he admits. "So there's a little hyping that's going on."

There are those who are less sanguine, arguing that while individual technological advances have been made, they can never be molded into a system that can withstand Soviet attempts to attack or outwit it.

Others say that scientific headway is not the issue. They contend that SDI, popularly known as "star wars," is in dire trouble, a victim of attack from within the administration itself. Several senior Pentagon and White House officials reportedly do not share the president's enthusiasm for the program and would like to see it killed.

As the initiative enters its third year as a unified program, its character is changing subtly. Research devices — atomic particle accelerators and the like — that were built for other purposes are now giving way to grander, more powerful machines tailored specifically to SDI research. Budget cuts are forcing officials to look away from theories and basic physics research to actual testing in an effort to prove that concepts work outside the lab — the crucial step before developing a prototype weapon.

When Reagan's budget request was cut last year, for example, the Pentagon shifted funds to three areas thought to hold near-term promise: the ground-based laser, the neutral particle beam and space-based projectile-firing vehicles.

The Pentagon's Strategic Defense Initiative Organization has begun studying weapons and sensors that could be used in quickly deploying a missile defense. Or, as Maj. Gen. Eugene Fox, manager of the Army's missile defense program, bluntly puts it: "We're rapidly coming upon the time where we're bending some metal."

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large constellation of space-based weapons and sensors that are being developed. Aside from lasers of many types, there are sensors to detect and analyze an attack, platforms bristling with tiny rockets that home in on enemy missiles and destroy them by impact, and highly polished mirrors to relay the beams of ground- or space-based lasers to a target. Also being researched is the controversial X-ray laser, which is pumped by a thermonuclear bomb.

But if a scientist working on strategic defense could design the perfect space-based weapon to destroy incoming nuclear missiles, it would probably be one capable of firing a beam, at the speed of light, that could penetrate anything in its path. It would help if the beam weapon could distinguish nuclear warheads from decoys released by enemy missiles after the first phase of flight.

Using the same technique to determine which must be destroyed and which can be ignored, the space-based weapon would also be able to defend itself. An electrically neutral beam would be a must, so it would not be bent in space by Earth's magnetic field. And it would be icing on the cake if the weapon had a tried-and-true technological base to evolve from, such as that of atomic particle accelerators.

Such a weapon is not a dream. It is, in fact, under development at Los Alamos, and it is called the neutral particle beam. Not surprisingly, it is high on the list of space-based technologies under study.

"Because of its wide range and versatility, I think it must be among the leading candidates, if not the leading candidate," says Michael Lavan, director of the Army Strategic Defense Command's directed-energy weapons program. "All in all, the neutral particle beam is awfully tough to beat."

According to Rockwood, the neutral particle beam and the free-electron laser are probably the most promising weapons of the moment. Last year, $70 million for particle beam development was allocated to scientists at Sandia National Laboratories. A lab brochure describes it as "the top-priority Los Alamos program." And this year's realization that passive sensors may not be powerful enough to discriminate between warheads and decoys is pushing work on the neutral particle beam to the fore, says Rockwood.

Passive sensors merely detect a target's heat or other radiation; active sensors such as the neutral particle beam send out waves of energy and analyze what is bounced back. But an active sensor "gives your position away," says Rockwood. Passive would therefore be desirable from the point of view of being a "Peeping Tom," he says, "but your eyes may not be good enough."

According to Stephen D. Rockwood, an associate director of Los Alamos National Laboratory until his retirement last month, SDI faces four main challenges in the technical arena: (1) making space assets, such as satellites and laser platforms, survivable against enemy attack; (2) discriminating real targets from decoys in the midcourse of an enemy missile's flight, after the separate nuclear warheads have been released; (3) understanding how to operate in a nuclear environment without the benefit of aboveground nuclear testing, which is banned; and (4) ensuring that it is cheaper to bolster the defense than the offense. "I believe there has to be some control that avoids just proliferation of offensive weapons as the natural response to deployment of a defensive system," Rockwood says.

Some potential weapons are dropping by the wayside — or at least lagging behind. Others — phasars, neutral particle beams, free-electron lasers and antimissile missiles — have been selected for special attention.

Much of the proposed technology hinges on a broadened understanding of lasers and how they can be manipulated. Here, already, great strides have been made. Scientists once thought that a single, immensely powerful laser could do the job of burning through the metal skin of a nuclear missile in flight thousands of miles away. But it soon became apparent that the huge mirrors needed to focus and reflect the beam are beyond the grasp of today's manufacturing technology.

"It would be the equivalent of building a road that ran from San Francisco to Washington, D.C., with less than 1 inch in height variation from coast to coast," says one Air Force lab spokesman. "That technology won't be there for another 20 years."

Phasars, phased-array lasers that couple many laser beams, potentially provide a solution. Along with smaller mirrors, phasars have another advantage: If one laser fails, the device keeps working.

The challenge posed by the phasar, like many posed by the new technology, is a difficult one, comparable to trying to squeeze small circles — the separate laser beams — into one big circle, with few empty spots left over. The beams must be adjusted constantly and kept in phase, the waves that make up their light rising and falling together. "It's awful hard to phase," says Richard Carreras, a high-energy laser engineer at the Air Force lab. "It's summed up in one word: It's complex."

Phasars represent just one option in a tion away," says Rockwood. Passive would

While significant — and perhaps insurmountable — engineering obstacles remain, the physics of the neutral particle beam are well understood. It begins with a stream of ions, negatively charged hydrogen atoms. The charge is necessary for electrical acceleration. The ions are speeded up and then squeezed into powerful pulses by a Soviet-invented device called a radio-frequency quadrapole. (The Soviets also invented the ion source being used.) A linear accelerator further speeds up the beam. Finally, each atom's extra electron is knocked off, and a neutral — uncharged — beam leaves the weapon.

"It's technology you can see, that you don't have to just wish for," Los Alamos scientist Richard Purser says of the lab's neutral particle beam research tool, the Accelerator Test Stand. Like many such devices in the initiative's evolution, the test stand — a project Purser directs — will be

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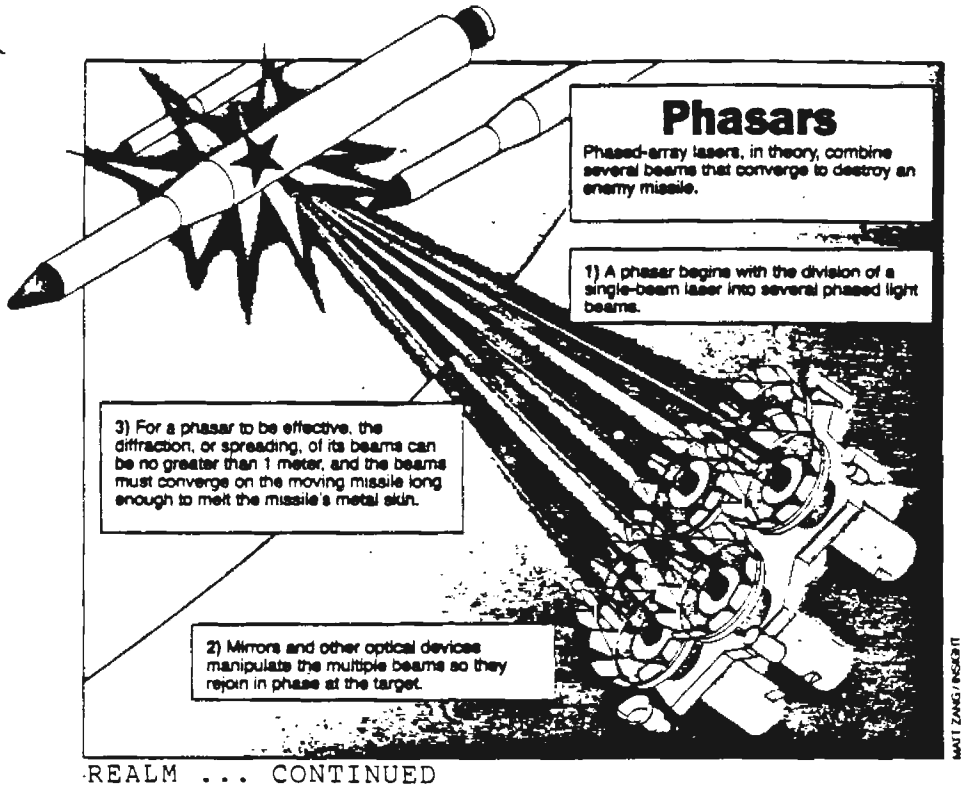

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replaced by a more powerful, $160 million accelerator in mid-1988, funding allowing. That accelerator will be joined in the early '90s by a third that officials say will have "weapons-level capability."

Preliminary designs for a space-based neutral particle beam prototype have been completed, and the Air Force plans to use the space shuttle in the early '90s to orbit a test integrating a particle beam weapon's components. The Challenger space shuttle disaster has left the date uncertain.

Still, for all its promise, the neutral particle beam faces several hurdles. These include scaling up to the needed power levels and tracking the invisible beam. At the Air Force Weapons Laboratory, engineers are studying how to track and control neutral particle beams.

At an accelerator surrounded by concrete blocks that shield against radiation, the engineers use magnets to steer a charged beam. Sensors, hooked to microcomputers, detect where it is. Later, the techniques will be applied to a neutral beam. "We're not the only ones addressing this and related problems," says beam control engineer Lt. Tony King. "Given the amount of effort that's being thrown at the problem, I think it can be solved."

Focusing is a related problem. Los Alamos's goal is a beam that will shine on a 1-meter spot on an enemy missile 1,000 kilometers away. In mid-September scientists produced a beam that exceeded the brightness — a measure of the energy in a slice of the beam — extracted from any other known accelerator. Rockwood calls that achievement "a very exciting milestone." Most important, the weapon's components must be made small and light enough to lift into space, a challenge common to most SDI research.

U.S. particle beam researchers got help with this aspect of the problem from the Soviet Union. Soviet scientists invented the radio frequency quadrapole, a table-sized device that replaced one the size of a three-story building. "I can think about putting one of these racks into space very easily," Los Alamos's Purser says, pointing to the quadrapole. "I can't think about putting [the component it replaced] into space without taking a big gulp."

More hazy still is the future of the X-ray laser, the most controversial and most classified of potential SDI weaponry. Since the X-ray laser is driven by a hydrogen bomb that provides power to start the lasing process, it is in conflict with Reagan's call for a nonnuclear defense. The laser also is a relatively new technology, unlikely to be part of any initial defensive shield.

Yet it is being pursued vigorously by government researchers, who say they are driven by fear of a Soviet surprise.

"It's important to understand . . . how technically difficult it is to do it," says David A. Nowak, head of Lawrence Livermore National Laboratory's X-ray laser program. That makes it necessary to determine, as best as possible, whether Soviet technology is up to the challenge. "Is it within the realm of Soviet capabilities?" asks Nowak. "Because that could put at risk a traditional SDI program."

Another Livermore scientist agrees but says that is a good reason to be wary of the weapon. "If the U.S. is really serious about this SDI defense of the nation against nuclear weapons, they better damn well hope this X-ray laser proves to be unfeasible," says senior physicist Ray Kidder.

An X-ray laser's attraction is the extremely short and powerful wavelengths — as small as five-billionths of a meter — of radiation it produces. Creating strong, coherent X rays requires a powerful energy source. Accelerators and conventional lasers used to make "soft" X rays — those bordering on the X-ray region of the electromagnetic spectrum — cannot be made small enough to launch into space.

One solution to the problem is a thermonuclear weapon. In the best-known scenario, the exploded nuclear bomb stimulates independently targeted lasing rods, which send laser beams toward missiles in flight.

A fraction of a second later, the entire device is consumed by the explosion.

Further details of the device are classified. Officials confirm that several weapons concepts exist but decline to elaborate. Says Nowak: "We haven't exhausted or explored all the possible options."

Officials once pondered placing X-ray lasers in permanent orbit but now are focused on a weapon that would be "popped up" from a submarine or a missile silo into space at the first sign of an attack. Such a weapon would be both less vulnerable to a surprise Soviet attack and easier to control.

Sandia's Hagengruber says, "If it were ever to be used in an SDI system, it has to show overwhelming capability in order to overcome our national hesitancy to use nuclear weapons." Several scientists agree the X-ray laser has not yet shown that cap-

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ability. "You can get wide diversity of opinion on the subject," Nowak says. "My own personal opinion is that . . . it has potential to play a very key role in SDI."

Another use of laser technology likely to play a key role in strategic defenses is the free-electron laser. Scientists hope that sometime in 1991, a laser orbiting above the New Mexico desert will send a beam tunneling through the atmosphere to Earth. A second beam from a ground-based laser will take the same path in reverse.

Researchers hope that the tunneling experiment and subsequent tests will tell them much about a weapon that has gone from being one of the Strategic Defense Initiative's dark horses to one of the favorites. To live up to its promise, though, the free-electron laser's powerful beam must pass the test of "atmospheric propagation," making its way through turbulent skies that normally weaken and bend it. In the New Mexico experiments, the second laser beam may be guided by a mirror that changes its face based on data received from the first beam's journey. In a war, the beam would strike two orbiting mirrors and ricochet thousands of miles across space toward attacking nuclear missiles.

Many factors are pushing the weapon forward, not the least of which are the rapid advances the free-electron laser has made since SDI's inception. And, say administration sources, political and budgetary pressures have forced policymakers to set their sights on technologies that can be recommended for initial deployment.

Many of those weapons are based on the ground rather than in space. They include two interceptor rockets being developed by the Army as a terminal-stage missile defense, as well as the free-electron laser.

That laser starts with a stream of electrons, negatively charged atomic particles, that are accelerated nearly to the speed of light. The beams then pass through an all-important series of magnets called a "wiggler." The magnetic fields bend the electrons' path, and as a result, they emit the lockstep waves of radiation that make up a laser beam. Not yet 10 years old, the free-electron laser has already displayed two key advantages over other, better-known lasers.

While the wavelength of most lasers is fixed, the free-electron laser can be tuned up and down the electromagnetic spectrum by varying the spacing of magnets in the wiggler or the speed of the electrons. More important, the laser's efficiency in converting energy from the speeding electrons into a beam — and toward an enemy missile — is unprecedented.

In experiments at Lawrence Livermore, the free-electron laser converted 40 percent of the electrons' energy into a laser beam, for a total efficiency from electric source to beam of about 20 percent. The comparable figure for a conventional laser is 2 percent or less.

"It was really the results of these experiments that got the Strategic Defense Initiative Organization very interested in the free-electron laser as a possible ground-based laser system," says Samuel F. Eccles of the lab's beam research program.

The free-electron laser has spawned a star wars of sorts between Lawrence Livermore and Los Alamos. The two labs, already frequent rivals, have free-electron lasers that begin with accelerators based on entirely different principles. "The kind of accelerators we build here have an easier time getting to the appropriate wavelength," said Charles Brau, head of Los Alamos's program. "The accelerators they [Livermore] build have an easier time getting to the appropriate power." Consequently, each research team is seeking results that come naturally with the other's design.

Livermore's biggest challenge is in the area of wavelength. The wavelength, often

Video Game Defense

One former government scientist calls it, in most unscientific terms, the "national Atari game." Like many arcade games, it involves fictional war.

The purpose of the Strategic Defense Initiative's National Testbed will be to simulate Soviet nuclear strikes on the United States to test how various strategic defense systems perform against them. The multimillion-dollar nationwide network will help determine whether a vital command can be sent in time and whether missile defense components can survive Soviet attack. It will also help conduct tests of SDI weaponry and sensors and share information about the program.

The project hinges on two of the most controversial questions about strategic defense: Can the various weapons, sensors and communication devices be molded into a working, defendable system? And can computer programs be designed that are capable of running the entire defense — sending data about decoys and actual nuclear warheads, deciding which weapons should shoot at which incoming missiles and when, and assessing the results?

SDI critics argue that the computer-controlled "battle management" is its Achilles' heel; even researchers say the challenge is enormous.

In one recent experiment at the Army Strategic Defense Command in Huntsville, Ala., computers simulated an attempted intercept by U.S. rockets of 252 Soviet objects — 216 of which were to be warheads, the rest decoys or debris. The warheads were depicted as red arcs, the interceptor rockets as white arcs rising to meet them. The continental United States was divided into 29 zones, each assigned a number indicating how important it was to defend.

It took six computers to generate the mock battle — a highly simplified version of a nuclear exchange. Officials estimate they will need eight times that number to simulate an engagement with 100,000 objects — a realistic estimate of the number of nuclear warheads, decoys and pieces of debris that might streak toward the United States in the middle phases of an actual attack. ■

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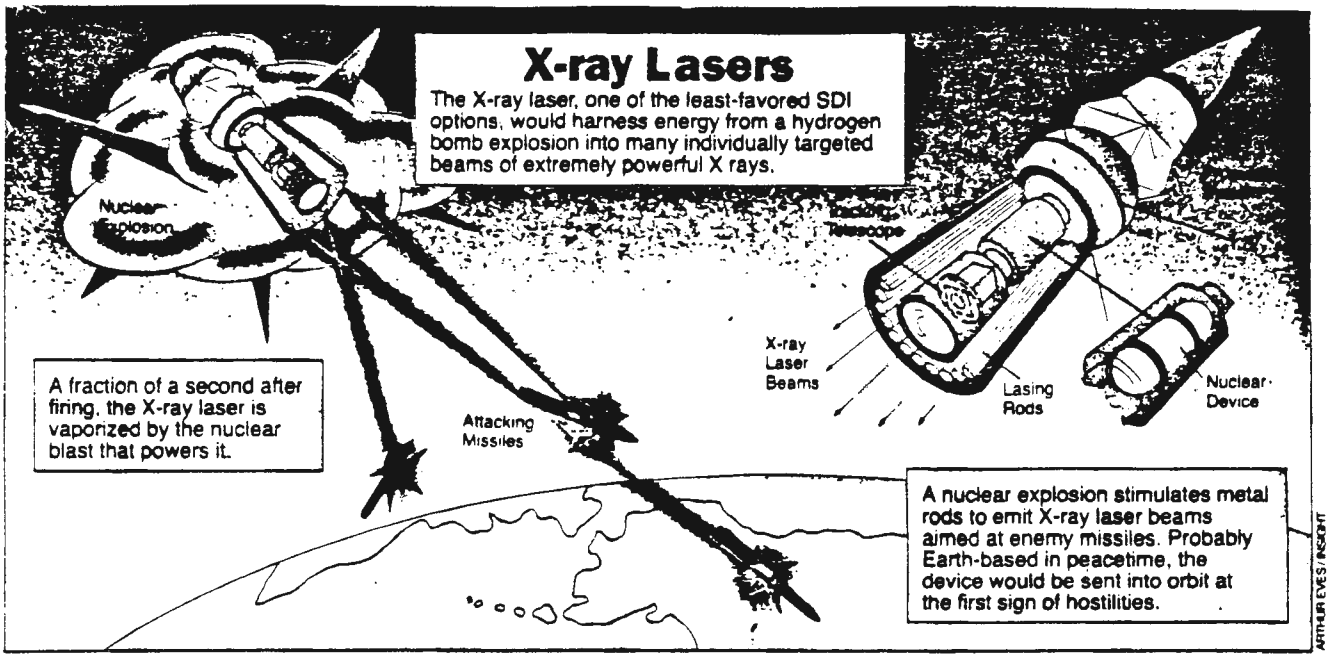

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measured in microns (millionths of a meter), determines where on the electromagnetic spectrum the beam falls. "The wavelength that is felt to be the most reasonable for strategic defense applications is somewhere between about a half and 1 micron" in the visible light range, Eccles says. "That is an opening in the atmosphere where light can pass through. . . . We're closing in on that."

The Livermore tests that achieved the extraordinary efficiency rates were conducted using relatively long wavelength microwaves. The experiments have been scaled down to 10.6 microns — infrared radiation. More tests must be done at that level, but plans already call for another test laser that will emit the needed 1-micron radiation and do it 1,000 times per second, compared with the current device's one pulse per second. "It might not be a weapon, but it'll be very close," says Eccles. "There's still a lot of unanswered questions."

"We certainly want to be at a shorter wavelength for weapons applications," says Brau. "But that in itself is not a problem." Unlike its Livermore counterpart, the Los Alamos machine passes the electron beam back and forth across the wiggler. The technique makes for a smaller machine, and one that perhaps could be lofted into space. "There's quite a few things we have to learn about how to make these things more efficient," admits Brau. The lab has converted 2 percent of the electron beam into laser energy; its goal is 10 percent.

The older, Los Alamos concept has been selected for use in the first experiments at New Mexico's White Sands Missile Range. The Livermore concept is being considered for use at a higher-power, $1 billion facility to be built at the remote range in 1993 or 1994. "We are now clearly in a competitive mode with the two technologies," says the Army's Carmichael. When it comes to scaling to high power, he says, "the [Livermore] induction machine has the lead."

Decision-makers, who have two working models of the free-electron laser to choose from, are not nearly so lucky when it comes to charged particle beams. Because the beam carries an electric charge, it is bent by Earth's magnetic field, making it useless as a space-based weapon. Even when earthbound, electron beams — the best-known type of charged particle beam — tend to whip around uncontrollably, mocking attempts to focus on a target.

A picture in a conference room at Sandia tells the story: a lightning-blue electron beam snaking chaotically during an early beam-stabilization test. "We've been working on ways to improve that," says Pace VanDevender, a top official at the lab, "but I can't comment on the status of that research." Several solutions have been proposed, including using a laser to burn a path through the atmosphere that the electron beam could follow.

Air Force engineers have managed to send an electron beam in a straight line, but they needed the nation's most powerful accelerator to do so. It remains unclear how much destructive power the beam can deliver to an enemy missile, and the Air Force project is slated for elimination.

After an enemy missile or warhead has been detected by sophisticated sensors in space, picked from a mass of decoys and then attacked by neutral particle beams, and finally fired on by lasers, most scenarios envision one last line of defense to prevent the missile from inflicting the destruction its owner intended.

For this last-ditch barrier, often called "terminal defense" in the SDI lexicon, the Pentagon is backing interceptor rockets.

The Huntsville unit, which spent 31 percent of the initiative's budget last year, is developing two such antimissile missiles. They are dubbed ERIS, or Exoatmospheric Reentry-vehicle Interceptor Subsystem, and HEDI, High Endoatmospheric Defense Interceptor. The former is designed to track and destroy a falling thermonuclear bomb just before it leaves the confines of space; the latter is truly the final line of defense, stopping the warhead seconds after it reenters Earth's atmosphere.

The technologies behind the interceptors play two other key roles. They are almost assured of having a part in an initial Strategic Defense system and in a separate program to defend against Soviet short-range ballistic missiles aimed at Western Europe.

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ERIS and HEDI are five-year projects intended to prove the technology works. Army officials have no doubt which of the two missiles has the more difficult job. "HEDI has a tough row to hoe," says Col. Thomas King, the command's deputy program manager for operations. Officials say a tough task has been made tougher by two facets of Reagan's vision: a nonnuclear defense and protection of what strategists call "soft targets" — people and cities. Because it has no nuclear weapon aboard, a HEDI-style rocket must get much closer to the incoming warhead than it otherwise would. Because cities are not hardened like military command posts, the warhead must be intercepted higher in the atmosphere.

HEDI must do its job well — and quickly. The entire flight takes less than a minute, meaning the rocket moves at extremely high speeds. Consequently, its nose becomes very hot. "We're into such velocity regimes that we have to look at everything," says Edward C. Wilkinson, director of the command's kinetic-energy weapons projects. "We're already getting very antsy about separating the second stage from the kill vehicle."

In building most rockets, separating the various stages is no longer considered a major issue. The extremely high temperatures on the nose of the vehicle — right where its guidance sensors are — create "aero-optical effects," a warping of the air that could throw the rocket off course if uncorrected. Pentagon officials, however, say they have already "hit a bullet with a bullet" in a much-touted 1984 experiment. A rocket launched from White Sands homed in on and destroyed a dummy nuclear warhead in space 4,300 miles away.

That experiment paved the way for ERIS, which is designed to hit warheads about 60 miles above Earth. Given enough warning of a missile attack and enough interceptors, officials say, the system could defend the entire continental United States.

But engineers have new challenges in designing a cheaper and smaller rocket that would cost $1 million to $2 million each to construct. "We've done intercepts," says King. "We haven't done it with the size vehicle we're talking about. . . . If you've got a relatively cheap interceptor you can afford to shoot some things that may not be targets. Obviously, we'd like to have more than one shot."

Despite the challenges that come with new ground, the engineers are confident the job can be done. "In the '90s, when the decision time comes," Wilkinson says, "we'll be there and ready."

Much of what can and will be accomplished depends on the levels of funding SDI will receive over the next decade. In fiscal 1986, the project accounted for about 1 percent of the Pentagon's budget. That may sound small, but the numbers reveal the program to be a massive one.

In the past two fiscal years, $4.8 billion has been spent on Strategic Defense research; as much as $26 billion may be spent by 1989. The House and Senate have agreed on a fiscal 1987 spending level of $3.5 billion, a tiny increase over last year's budget and far below Reagan's $5.4 billion request. The money, and the high profile Reagan gives SDI, have had a stunning impact on military and national laboratories.

This represents quite a turnaround from the situation that prevailed in the past two decades. In the '60s and '70s, the Army Ballistic Missile Defense Program Office in Huntsville and others churned out missile defense systems, only to see them canceled because of the 1972 Anti-Ballistic Missile Treaty, which generally bans such defenses, or because of official judgment that reliable defense was impossible.

"It wasn't sexy to work on ballistic missile defense," says Hagengruber. "Now there were some folks down in Huntsville who were still doing good work, but it just wasn't in vogue." Such was not the case, however, in the Soviet Union. "The Soviets," he says, "did not go through the oscillation that we went through after the ABM treaty." The Pentagon estimates that the Soviet high-energy laser program alone represents an annual investment of $1 billion.

Today, the Army unit, renamed the Army Strategic Defense Command, has control over many major SDI projects. The initiative accounts for 63.7 percent of the Air Force lab's budget and 7.3 percent of Sandia's. "Whether you support SDI or not, there's no question [it] will be the dominant strategic issue of the 1980s," says Hagengruber.

At Los Alamos, the program uses 20 percent of the oldest nuclear weapons lab's $800 million budget. That "is about as large as I would like it to be," says Rockwood.

The congressional appropriations process, in which arms control policies are mixed with budgets and White House funding requests are juggled endlessly, is disrupting the program, Rockwood says. "If you and I did our job the way Congress has the last four years, we would have been fired," he says. "We go into every fiscal year in essence totally blind: . . . SDI has become a political football. Every staffer and congressman you can talk to believes he's the program manager."

One other change has come to the SDI research effort. "The program's getting more classified," says Hagengruber. "Part of the reason for that is we are entering into technologies that are sensitive enough that they should be classified.

"The largest part of it is that one of the things we've been unable to do is maintain a research program in the face of the kind of competition of statements and hype and critiques that enter from the outside," he explains. "A decision was made to try to manage the information flow."

Hagengruber says it is possible that secretiveness will decrease in a few realms. "But I expect the policy to increase some in some areas," he says. "Because the fact is, we are making progress and it isn't the sort of thing that we want to talk to everybody about at this time."

— *Warren Strobel*

WALL STREET JOURNAL 19 May 1986

The U.S. Can Build a Pinpoint Strategic Defense Now

By Martin Anderson

Americans are among the most insured people in the world. We have medical insurance, auto-accident insurance, fire insurance, earthquake insurance, burglary insurance, libel insurance, and even life insurance. We are insured up to our chins against almost any calamity that could befall us, except one—accidental annihilation by a nuclear missile.

We all know that the massive and increasing nuclear-missile arsenals of the world have created the small but real possibility that there could be an unauthorized or an accidental launch of a nuclear missile. Adding to that risk is the growing concern that a ruthless radical of the Qadi variety will manage someday soon to get his hands on a nuclear bomb and a missile capable of delivering the bomb to a faraway target.

As the risk of a deliberately planned all-out nuclear war between the two superpowers has receded, we have almost totally disregarded the growing risk of a small nuclear attack on the U.S. Neglect of this danger is unconscionable. The consequences of even one nuclear warhead striking a heavily populated area of this country would be catastrophic. The loss of life would be appalling.

That we choose to live so dangerously is baffling. It is baffling because we could build a limited missile defense today, at low cost, in full accord with the current ABM treaty, that would insure against such a tragedy.

The U.S. Army has already demonstrated conclusively that we have the technology—on our scientific shelves—to build an interceptor missile that can stop and destroy an incoming nuclear missile high above the earth's surface. On June 10, 1984, the Army fired an old Minuteman missile toward a target 4,000 miles away. Once the incoming missile was detected, a new interceptor was launched, a 70-foot engineering marvel, cobbled up from old missile parts and topped with an ultrasecret, state-of-the-art sensing device. The interceptor flew flawlessly and homed in on the incoming Minuteman at a distance of more than 100 miles above the earth. In the brittle cold and near vacuum of outer space, the interceptor collided with the Minuteman missile at a speed of more than 20,000 miles per hour.

What happened was a collision of such power and intensity that both missiles were literally pulverized. We all have a pretty good idea of what happens when two automobiles, each traveling 60 miles per hour, hit head on. The interceptor missile hits its target at least 165 times harder.

And that was the old interceptor missile. By early 1986, the Army had completed plans for a better one. It's called ERIS, which stands for Exoatmospheric Reentry-vehicle Interceptor Subsystem. The new interceptor missile is extremely accurate, carries no explosives in its nose cone, and is only 20 inches in diameter and less than 14 feet long. Utilizing our existing radar system, with some upgrading, we could build a complete limited missile defense system (with 100 missiles) for about $150 million a year, or a total cost of $1.5 billion spread over 10 years. If we started today, the first missiles would be standing guard, ready to fire, in the early 1990s.

Under terms of the ABM treaty, both the U.S. and the Soviet Union have the right to deploy as many as 100 interceptor missiles at designated launch sites. The Soviet treaty site is near Moscow; ours is at Grand Forks, N.D., next to the Canadian border. The Soviet ABM missiles are in place, the only operational missile defense system in the world. We started to build such a system in the late 1960s, but stopped and tore it all down in 1975. So we have a nice building site ready and waiting.

The area of earth that can be effectively protected by an interceptor missile is called its "footprint." The size of the protection footprint is determined by how soon we can detect an incoming nuclear missile and the speed of the interceptor missile. Because of the "footprint" phenomenon, the Soviet missile defense site near Moscow actually can provide a limited defense for a large part of the Soviet Union.

The footprint of an interceptor missile based in Grand Forks, N.D., also would be enormous. It would cover the entire continental U.S., all of Mexico and most of Canada. A single site could provide a limited defense against nuclear missiles for virtually all of North America.

Just one interceptor missile could destroy an accidentally launched nuclear missile. One hundred interceptor missiles could effectively insure us against virtually anything but an all-out nuclear attack by the Soviet Union. And, in addition to protecting us from an errant ICBM, this new system also could protect us from an errant missile launched from a Soviet submarine lurking off our coast.

Last February, President Reagan talked of "pushing forward our highly promising Strategic Defense Initiative—a security shield that may one day protect us and our allies from nuclear attack, whether launched by deliberate calculation, freak accident, or the isolated impulse of a madman." And then he asked, "Isn't it better to use our talents and technology to build systems that destroy missiles, not people?"

Most people would answer yes. Missile defense is clearly morally superior to the doctrine of mutually assured destruction. But shouldn't we also ask why we don't now build and deploy what we know we can build, why we don't deploy live interceptor missiles while we press ahead with the futuristic research of SDI?

Or perhaps we should put it this way: What will we say to the people living in an American city who, someday in the future, learn that in 15 or 20 minutes they will be annihilated by a nuclear bomb and ask for help? Will we be able to say "no problem," and quickly fire some interceptor missiles, or will we have to say "sorry" and then live with the knowledge of what we could have done?

The full-scale Strategic Defense Initiative has been the subject of intense debate about its scientific feasibility and its complex implications for military strategy. A missile insurance system is not subject to scientific debate. We have already successfully tested a prototype. A missile insurance system does not complicate military strategy. It simply protects us from accidental annihilation.

We should begin immediately to build, and then deploy, the best interceptor missiles we can create. They could turn out to be the most important insurance program the American people ever had.

Mr. Anderson is a senior fellow at the Hoover Institution at Stanford University. He was President Reagan's assistant for policy development from 1981 to 1982.

Special
Report
No. 129

The Strategic Defense Initiative

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In his speech of March 23, 1983, President Reagan presented his vision of a future in which nations could live secure in the knowledge that their national security did not rest upon the threat of nuclear retaliation but rather on the ability to defend against potential attacks. The Strategic Defense Initiative (SDI) research program is designed to determine whether and, if so, how advanced defensive technologies could contribute to the realization of this vision.

The Strategic Context

The U.S. SDI research program is wholly compatible with the Anti-Ballistic Missile (ABM) Treaty, is comparable to research permitted by the ABM Treaty which the Soviets have been conducting for many years, and is a prudent hedge against Soviet breakout from ABM Treaty limitations through the deployment of a territorial ballistic missile defense. These important facts deserve emphasis. However, the basic intent behind the Strategic Defense Initiative is best explained and understood in terms of the strategic environment we face for the balance of this century and into the next.

The Challenges We Face. Our nation and those nations allied with us face a number of challenges to our security. Each of these challenges imposes its own demands and presents its own opportunities. Preserving peace and freedom is, and always will be, our fundamental goal. The essential purpose of our military forces, and our nuclear forces in particular, is to deter aggression and coercion based upon the threat of military aggression. The deterrence provided by U.S. and allied military forces has permitted us to enjoy peace and freedom. However, the nature of the military threat has changed and will continue to change in very fundamental ways in the next decade. Unless we adapt our response, deterrence will become much less stable and our susceptibility to coercion will increase dramatically.

Our Assumptions About Deterrence. For the past 20 years, we have based our assumptions on how deterrence can best be assured on the basic idea that if each side were able to maintain the ability to threaten retaliation against any attack and thereby impose on an aggressor costs that were clearly out of balance with any potential gains, this would suffice to prevent conflict. Our idea of what our forces had to hold at risk to deter aggression has changed over time. Nevertheless, our basic reliance on nuclear retaliation provided by offensive nuclear forces, as the essential means of deterring aggression, has not changed over this period.

This basic idea—that if each side maintained roughly equal forces and equal capability to retaliate against attack, stability and deterrence would be maintained—also served as the foundation for the U.S. approach to the strategic arms limitation talks (SALT) process of the 1970s. At the time that process began, the United States con-

cluded that deterrence based on the capability of offensive retaliatory forces was not only sensible but necessary, since we believed at the time that neither side could develop the technology for defensive systems which could effectively deter the other side.

Today, however, the situation is fundamentally different. Scientific developments and several emerging technologies now do offer the possibility of defenses that did not exist and could hardly have been conceived earlier. The state of the art of defense has now progressed to the point where it is reasonable to investigate whether new technologies can yield options, especially non-nuclear options, which could permit us to turn to defense not only to enhance deterrence but to allow us to move to a more secure and more stable long-term basis for deterrence.

Of equal importance, the Soviet Union has failed to show the type of restraint, in both strategic offensive and defensive forces, that was hoped for when the SALT process began. The trends in the development of Soviet strategic offensive and defensive forces, as well as the growing pattern of Soviet deception and of noncompliance with existing agreements, if permitted to continue unchecked over the long term, will undermine the essential military balance and the mutuality of vulnerability on which deterrence theory has rested.

Soviet Offensive Improvements. The Soviet Union remains the principal threat to our security and that of our allies. As a part of its wide-ranging effort further to increase its military capabilities, the Soviet Union's improvement of its ballistic missile force, providing increased prompt, hard-target kill capability, has increasingly threatened the survivability of forces we have deployed to deter aggression. It has posed an especially immediate challenge to our land-based retaliatory forces and to the leadership structure that commands them. It equally threatens many critical fixed installations in the United States and in allied nations that support the nuclear retaliatory and conventional forces which provide our collective ability to deter conflict and aggression.

Improvement of Soviet Active Defenses. At the same time, the Soviet Union has continued to pursue strategic advantage through the development and improvement of active defenses. These active defenses provide the Soviet Union a steadily increasing capability to counter U.S. retaliatory forces and those of our allies, especially if our forces were to be degraded by a Soviet first strike. Even today, Soviet active defenses are extensive. For example, the Soviet Union possesses the world's only currently deployed antiballistic missile system, deployed to protect Moscow. The Soviet Union is currently improving all elements of this system. It also has the world's only deployed antisatellite (ASAT) capability. It has an extensive air defense network, and it is aggressively improving the quality of its radars, interceptor aircraft, and surface-to-air missiles. It also has a very extensive network of ballistic missile early warning radars. All of these elements provide them an area of relative advantage in strategic defense today and, with logical evolutionary improvement, could provide the foundation of decisive advantage in the future.

Improvement in Soviet Passive Defenses. The Soviet Union is also spending significant resources on passive defensive measures aimed at improving the survivability of its own forces, military command structure, and national leadership. These efforts range from providing rail and road mobility for its latest generation of ICBMs [intercontinental ballistic missiles] to extensive hardening of various critical installations.

Soviet Research and Development on Advanced Defenses. For over two decades, the Soviet Union has pursued a wide range of strategic defensive efforts, integrating both active and passive elements. The resulting trends have shown steady improvement and expansion of Soviet defensive capability. Furthermore, current patterns of Soviet research and development, including a longstanding and intensive research program in many of the same basic technological areas which our SDI program will address, indicate that these trends will continue apace for the foreseeable future. If unanswered, continued Soviet defensive improvements will further erode the effectiveness of our own existing deterrent, based as it is now almost exclusively on the threat of nuclear retaliation by offensive forces. Therefore, this longstanding Soviet program of defensive improvements, in itself, poses a challenge to deterrence which we must address.

Soviet Noncompliance and Verification. Finally, the problem of Soviet noncompliance with arms control agreements in both the offensive and defensive areas, including the ABM Treaty, is a cause of very serious concern. Soviet activity in constructing either new phased-array radar near Krasnoyarsk, in central Siberia, has very immediate and ominous consequences. When operational, this radar, due to its location, will increase the Soviet Union's capability to deploy a territorial ballistic missile defense. Recognizing that such radars would make such a contribution, the ABM Treaty expressly banned the construction of such radars at such locations as one of the primary mechanisms for ensuring the effectiveness of the treaty. The Soviet Union's activity with respect to this radar is in direct violation of the ABM Treaty.

Against the backdrop of this Soviet pattern of noncompliance with existing arms control agreements, the Soviet Union is also taking other actions which affect our ability to verify Soviet compliance. Some Soviet actions, like their increased use of encryption during testing, are directly aimed at degrading our ability to monitor treaty compliance. Other Soviet actions, too, contribute to the problems we face in monitoring Soviet compliance. For example, Soviet increases in the number of their mobile ballistic missiles, especially those armed with multiple, independently-targetable reentry vehicles, and other mobile systems, will make verification less and less certain. If we fail to respond to these trends, we could reach a point in the foreseeable future where we would have little confidence in our assessment of the state of the military balance or imbalance, with all that implies for our ability to control escalation during crises.

Responding to the Challenge

In response to this long-term pattern of Soviet offensive and defensive improvements, the United States is compelled to take certain actions designed both to maintain security and stability in the near term and to ensure these conditions in the future. We must act in three main areas.

Retaliatory Force Modernization. First, we must modernize our offensive nuclear retaliatory forces. This is necessary to reestablish and maintain the offensive balance in the near term and to create the strategic conditions that will permit us to pursue complementary actions in the areas of arms reduction negotiations and defensive research. For our part, in 1981 we embarked on our strategic modernization program aimed at reversing a long period of decline. This modernization program was specifically designed to preserve stable deterrence and, at the same time, to provide the incentives necessary to cause the Soviet Union to

join us in negotiating significant reductions in the nuclear arsenals of both sides.

In addition to the U.S. strategic modernization program, NATO is modernizing its longer range intermediate-range nuclear forces (LRINF). Our British and French allies also have underway important programs to improve their own national strategic nuclear retaliatory forces. The U.S. SDI research program does not negate the necessity of these U.S. and allied programs. Rather, the SDI research program depends upon our collective and national modernization efforts to maintain peace and freedom today as we explore options for future decision on how we might enhance security and stability over the longer term.

New Deterrent Options. However, over the long run, the trends set in motion by the pattern of Soviet activity, and the Soviets' persistence in that pattern of activity, suggest that continued long-term dependence on offensive forces may not provide a stable basis for deterrence. In fact, should these trends be permitted to continue and the Soviet investment in both offensive and defensive capability proceed unrestrained and unanswered, the resultant condition could destroy the theoretical and empirical foundation on which deterrence has rested for a generation.

Therefore, we must now also take steps to provide future options for ensuring deterrence and stability over the long term, and we must do so in a way that allows us both to negate the destabilizing growth of Soviet offensive forces and to channel longstanding Soviet propensities for defenses toward more stabilizing and mutually beneficial ends. The Strategic Defense Initiative is specifically aimed toward these goals. In the near term, the SDI program also responds directly to the ongoing and extensive Soviet antiballistic missile effort, including the existing Soviet deployments permitted under the ABM Treaty. The SDI research program provides a necessary and powerful deterrent to any near-term Soviet decision to expand rapidly its antiballistic missile capability beyond that contemplated by the ABM Treaty. This, in itself, is a critical task. However, the overriding, long-term importance of SDI is that it offers the possibility of reversing the dangerous military trends cited above by moving to a better, more stable basis for deterrence and by providing new and compelling incentives to the Soviet Union for seriously negotiating reductions in existing offensive nuclear arsenals.

The Soviet Union recognizes the potential of advanced defense concepts—especially those involving boost, postboost, and mid-course defenses—to change the strategic situation. In our investigation of the potential these systems offer, we do not seek superiority or to establish a unilateral advantage. However, if the promise of SDI technologies is proven, the destabilizing Soviet advantage can be redressed. And, in the process, deterrence will be strengthened significantly and placed on a foundation made more stable by reducing the role of ballistic missile weapons and by placing greater reliance on defenses which threaten no one.

Negotiation and Diplomacy. During the next 10 years, the U.S. objective is a radical reduction in the power of existing and planned offensive nuclear arms, as well as the stabilization of the relationship between nuclear offensive and defensive arms, whether on earth or in space. We are even now looking forward to a period of transition to a more stable world, with greatly reduced levels of nuclear arms and an enhanced ability to deter war based upon the increasing contribution of non-nuclear defenses against offensive nuclear arms. A world free of the threat of military aggression and free of nuclear arms is an ultimate objective to which we, the Soviet Union, and all other nations can agree.

To support these goals, we will continue to pursue vigorously the negotiation of equitable and verifiable agreements leading to significant reductions of existing nuclear arsenals. As we do so, we will continue to exercise flexibility concerning the mechanisms used to achieve reductions but will judge these mechanisms on their ability to enhance the security of the United States and our allies, to strengthen strategic stability, and to reduce the risk of war.

At the same time, the SDI research program is and will be conducted in full compliance with the ABM Treaty. If the research yields positive results, we will consult with our allies about the potential next steps. We would then consult and negotiate, as appropriate, with the Soviet Union, pursuant to the terms of the ABM Treaty, which provide for such consultations, on how deterrence might be strengthened through the phased introduction of defensive systems into the force structures of both sides. This commitment does not mean that we would give the Soviets a veto over the outcome anymore than the Soviets have a veto over our current strategic and intermediate-range programs. Our commitment in this regard reflects our recognition that, if our research yields appropriate results, we should seek to move forward in a stable way. We have already begun the process of bilateral discussion in Geneva needed to lay the foundation for the stable integration of advanced defenses into the forces of both sides at such time as the state of the art and other considerations may make it desirable to do so.

The Soviet Union's View of SDI

As noted above, the U.S.S.R. has long had a vigorous research, development, and deployment program in defensive systems of all kinds. In fact, over the last two decades the Soviet Union has invested as much overall in its strategic defenses as it has in its massive strategic offensive buildup. As a result, today it enjoys certain important advantages in the area of active and passive defenses. The Soviet Union will certainly attempt to protect this massive, long-term investment.

Allied Views Concerning SDI

Our allies understand the military context in which the Strategic Defense Initiative was established and support the SDI research program. Our common understanding was reflected in the statement issued following President Reagan's meeting with Prime Minister Thatcher in December, to the effect that:

First, the U.S. and Western aim was not to achieve superiority but to maintain the balance, taking account of Soviet developments;

Second, that SDI-related deployment would, in view of treaty obligations, have to be a matter for negotiations;

Third, the overall aim is to enhance, and not to undermine, deterrence; and,

Fourth, East-West negotiations should aim to achieve security with reduced levels of offensive systems on both sides.

This common understanding is also reflected in other statements since then—for example, the principles suggested recently by the Federal Republic of Germany that:

- The existing NATO strategy of flexible response must remain fully valid for the alliance as long as there is no more effective alternative for preventing war; and,
- The alliance's political and strategic unity must be safeguarded. There must be no zones of different degrees of security in the alliance, and Europe's security must not be decoupled from that of North America.

SDI Key Points

Following are a dozen key points that capture the direction and scope of the program:

1. The aim of SDI is not to seek superiority but to maintain the strategic balance and thereby assure stable deterrence.

A central theme in Soviet propaganda is the charge that SDI is designed to secure military superiority for the United States. Put in the proper context of the strategic challenge that we and our allies face, our true goals become obvious and clear. Superiority is certainly not our purpose. Nor is the SDI program offensive in nature. The SDI program is a research program aimed at seeking better ways to ensure U.S. and allied security, using the increased contribution of defenses—defenses that threaten no one.

2. Research will last for some years. We intend to adhere strictly to ABM Treaty limitations and will insist that the Soviets do so as well.

We are conducting a broad-based research program in full compliance with the ABM Treaty and with no decision made to proceed beyond research. The SDI research program is a complex one that must be carried out on a broad front of technologies. It is not a program where all resource considerations are secondary to a schedule. Instead, it is a responsible, organized research program that is aggressively seeking cost-effective approaches for defending the United States and our allies against the threat of nuclear-armed and conventionally armed ballistic missiles of all ranges. We expect that the research will proceed so that initial development decisions could be made in the early 1990s.

3. We do not have any preconceived notions about the defensive options the research may generate. We will not proceed to development and deployment unless the research indicates that defenses meet strict criteria.

The United States is pursuing the broadly based SDI research program in an objective manner. We have no preconceived notions about the outcome of the research program. We do not anticipate that we will be in a position to approach any decision to proceed with development or deployment based on the results of this research for a number of years.

We have identified key criteria that will be applied to the results of this research whenever they become available. Some options which could provide interim capabilities may be available earlier than others, and prudent planning demands that we maintain options against a range of contingencies. However, the primary thrust of the SDI research program is not to focus on generating options for the earliest development/deployment decision but options which best meet our identified criteria.

4. Within the SDI research program, we will judge defenses to be desirable only if they are survivable and cost effective at the margin.

Two areas of concern expressed about SDI are that deployment of defensive systems would harm crisis stability and that it would fuel a runaway proliferation of Soviet offensive arms. We have identified specific criteria to address these fears appropriately and directly.

Our survivability criterion responds to the first concern. If a defensive system were not adequately survivable, an adversary could very well have an incentive in a crisis to strike first at vulnerable elements of the defense. Application of this criterion will ensure that such a vulnerable system would not be deployed and, consequently, that the Soviets would have no incentive or prospect of overwhelming it.

Our cost-effectiveness criterion will ensure that any deployed defensive system would create a powerful incentive not to respond with additional offensive arms, since those arms would cost more than the additional defensive capability needed to defeat them. This is much more than an economic argument, although it is couched in economic terms. We intend to consider, in our evaluation of options generated by SDI research, the degree to which certain types of defensive systems, by their nature, encourage an adversary to try simply to overwhelm them with additional offensive capability while other systems can discourage such a counter effort. We seek defensive options which provide clear disincentives to attempts to counter them with additional offensive forces.

In addition, we are pressing to reduce offensive nuclear arms through the negotiation of equitable and verifiable agreements. This effort includes reductions in the number of warheads on ballistic missiles to equal levels significantly lower than exist today.

5. It is too early in our research program to speculate on the kinds of defensive systems—whether ground-based or space-based and with what capabilities—that might prove feasible and desirable to develop and deploy.

Discussion of the various technologies under study is certainly needed to give concreteness to the understanding of the research program. However, speculation about various types of defensive systems that might be deployed is inappropriate at this time. The SDI is a broad-based research program investigating many technologies. We currently see real merit in the potential of advanced technologies providing for a layered defense, with the possibility of negating a ballistic missile at various points after launch. We feel that the possibility of a layered defense both enhances confidence in the overall system and compounds the problem of a potential aggressor in trying to defeat such a defense. However, the paths to such a defense are numerous.

Along the same lines, some have asked about the role of nuclear-related research in the context of our ultimate goal of non-nuclear defenses. While our current research program certainly emphasizes non-nuclear technologies, we will continue to explore the promising concepts which use nuclear energy to power devices which could destroy ballistic missiles at great distances. Further, it is useful to study these concepts to determine the feasibility and effectiveness of similar defensive systems that an adversary may develop for use against future U.S. surveillance and defensive or offensive systems.

6. The purpose of the defensive options we seek is clear—to find a means to destroy attacking ballistic missiles before they can reach any of their potential targets.

We ultimately seek a future in which nations can live in peace and freedom, secure in the knowledge that their national security does not rest upon the threat of nuclear retaliation. Therefore, the SDI research program will place its emphasis on options which provide the basis for eliminating the general threat posed by ballistic missiles. Thus, the goal of our research is not, and cannot be, simply to protect our retaliatory forces from attack.

If a future president elects to move toward a general defense against ballistic missiles, the technological options that we explore will certainly also increase the survivability of our retaliatory forces. This will require a stable concept and process to manage the transition to the future we seek. The

concept and process must be based upon a realistic treatment of not only U.S. but Soviet forces and out-year programs.

7. U.S. and allied security remains indivisible. The SDI program is designed to enhance allied security as well as U.S. security. We will continue to work closely with our allies to ensure that, as our research progresses, allied views are carefully considered.

This has been a fundamental part of U.S. policy since the inception of the Strategic Defense Initiative. We have made a serious commitment to consult, and such consultations will precede any steps taken relative to the SDI research program which may affect our allies.

8. If and when our research criteria are met, and following close consultation with our allies, we intend to consult and negotiate, as appropriate, with the Soviets pursuant to the terms of the ABM Treaty, which provide for such consultations, on how deterrence could be enhanced through a greater reliance by both sides on new defensive systems. This commitment should in no way be interpreted as according the Soviets a veto over possible future defensive deployments. And, in fact, we have already been trying to initiate a discussion of the offense-defense relationship and stability in the defense and space talks underway in Geneva to lay the foundation to support such future possible consultations.

If, at some future time, the United States, in close consultation with its allies, decides to proceed with deployment of defensive systems, we intend to utilize mechanisms for U.S.-Soviet consultations provided for in the ABM Treaty. Through such mechanisms, and taking full account of the Soviet Union's own expansive defensive system research program, we will seek to proceed in a stable fashion with the Soviet Union.

9. It is our intention and our hope that, if new defensive technologies prove feasible, we (in close and continuing consultation with our allies) and the Soviets will jointly manage a transition to a more defense-reliant balance.

Soviet propagandists have accused the United States of reneging on commitments to prevent an arms race in space. This is clearly not true. What we envision is not an arms race; rather, it is just the opposite—a jointly managed approach designed to maintain, at all times, control over the mix of offensive and defensive systems of both sides and thereby increase the confidence of all nations in the effectiveness and stability of the evolving strategic balance.

10. SDI represents no change in our commitment to deterring war and enhancing stability.

Successful SDI research and development of defense options would not lead to abandonment of deterrence but rather to an enhancement of deterrence and an evolution in the weapons of deterrence through the contribution of defensive systems that threaten no one. *We would deter a potential aggressor by making it clear that we could deny him the gains he might otherwise hope to achieve rather than merely threatening him with costs large enough to outweigh those gains.*

U.S. policy supports the basic principle that our existing method of deterrence and NATO's existing strategy of flexible response remain fully valid, and must be fully supported, as long as there is no more effective alternative for preventing war. It is in clear recognition of this obvious fact that the United States continues to pursue so vigorously its own strategic modernization program and so strongly supports the efforts of its allies to sustain their own commitments to maintain the forces, both nuclear and conventional, that provide today's deterrence.

11. For the foreseeable future, offensive nuclear forces and the prospect of nuclear retaliation will remain the key element of deterrence. Therefore, we must maintain modern, flexible, and credible strategic nuclear forces.

This point reflects the fact that we must simultaneously use a number of tools to achieve our goals today while looking for better ways to achieve our goals over the longer term. It expresses our basic rationale for sustaining the U.S. strategic modernization program and the rationale for the critically needed national modernization programs being conducted by the United Kingdom and France.

12. Our ultimate goal is to eliminate nuclear weapons entirely. By necessity, this is a very long-term goal, which requires, as we pursue our SDI research, equally energetic efforts to diminish the threat posed by conventional arms imbalances, both through conventional force improvements and the negotiation of arms reductions and confidence-building measures.

We fully recognize the contribution nuclear weapons make to deterring conventional aggression. We equally recognize the destructiveness of war by conventional and chemical means, and the need both to deter such conflict and to reduce the danger posed by the threat of aggression through such means. ■

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ROBERT JASTROW

Frequently asked questions on SDI

Q: Don't scientists say an effective U.S. defense against Soviet missiles is impossible?

A: Only four scientists in the entire country with full access to classified information on missile defense say that. [Drs. Bethe, Garwin, Drell and Panofsky.]

On the other side are Dr. G.A. Keyworth II [the president's science adviser], 50 leading missile experts on Dr. James Fletcher's panel, the brilliant weapons experts Lowell Wood at Livermore and Gregory Canavan at Los Alamos, and thousands of scientists and engineers actually working in missile defense.

Nature, the leading scientific journal in the world, wrote recently that "a substantial part of the technical community" agrees defense against missiles is feasible. *Nature* concluded about the objections from some scientists, "Critics for the project should look elsewhere for ammunition."

Fifty-four Nobel Laureates recently signed an appeal opposing space-based missile defenses, or Star Wars, but 53 of the 54 have no experience with missile defense work.

Q: How good will this defense be?

A: Dr. Fletcher, former head of NASA, a physicist with extensive experience in development of missiles, headed a panel of the country's leading missile defense experts which spent 36,000 man-hours on the study of the new technologies. He wrote in a National Academy of Sciences journal that his studies indicate that the basic two-layer defense, which could be operational in the early 1990s, could protect "90 to 99 percent of the nation's population... from a massive nuclear attack." He said the advanced three- or four-layer defense proposed for the late 1990s or the end of the century could protect "perhaps even greater than 99 percent of the nation's population against a nuclear attack."

Q: What good is a 90 percent or even a 99 percent defense when even one warhead can blow up a city?

A: If a Soviet general knows that only one warhead in 10 will get through to its target, he knows he cannot hope to knock out our retaliatory power in a surprise attack. [If] he gives the word to attack, his own homeland will lie in ruins. They will never order an attack under those circumstances. In other words, a 90 percent defense against Soviet missiles gives 100 percent protection.

The Soviets are already racing ahead on missile defense.

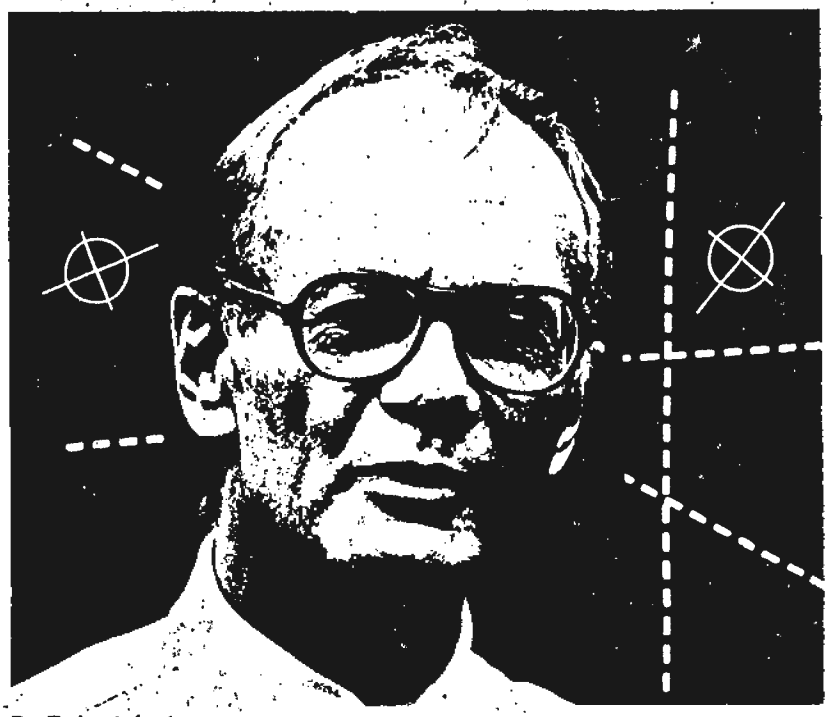
Q: Can the Soviets overwhelm our defense if we build it?

A: The Soviets have threatened to do this, but their threat is empty. The Soviets spent a half a trillion dollars on the missile force they now have. To overwhelm our 90 percent defense and get as many warheads through to their targets as they would have if we had no defense, they would have to beef up their arsenal to 10 times its present size. That means spending 10 times a half a trillion dollars, or $5 trillion.

The Soviet Union would be very hard-pressed to spend another $5 trillion on missiles in the next five to 10 years, on top of its present military outlays.

Ambassador [Paul] Nitze has emphasized the importance of the cost ratio "at the margin," i.e., how many dollars the Soviets have to spend on countering our defense for every dollar we spend on adding to it. These marginal cost ratios are also in our favor.

Studies at Los Alamos and elsewhere show that to counter our defense, the Soviets must spend $3 for



Dr. Robert Jastrow

Dr. Robert Jastrow, founder of NASA's Goddard Institute for Space Studies and author of How to Make Nuclear Weapons Obsolete, *prepared the pamphlet,* SDI: The Star Wars Project, *(© The George Marshall Institute), from which this article is excerpted.*

every dollar we spend on building it. For some advanced kinds of defenses the ratios are even higher: 10 to one or more in favor of our defense.

Q: How much will it cost?

A: For the basic two-layer defense using "smart bullets," the cost is $60 billion spread over about five years, or $12 billion a year. This defense could be available in the early 1990s. For the advanced three- or four-layer defense that might become available in the late 1990s, the cost is roughly $200 billion spread over 10 years, or $20 billion a year. The figures of $1 trillion or more tossed around by Soviet spokesmen and domestic opponents of SDI are off the wall.

For comparison, note that we are spending more than $40 billion a year on nuclear weapons of destruction designed to keep the Soviets out of our backyard by the threat of retaliation.

Q: How do you know it will work and will cost that much?

A: We won't be certain until we are farther along in the research, but all the calculations and experiments thus far are very encouraging.

The "smart bullet" has been tested in flight against a Minuteman warhead and vaporized the warhead.

High-powered lasers are coming along faster than anyone expected. Livermore has tested a laser at a peak power of one billion watts with an average power of 100 million watts in sight. This is well above the level of 20 million watts considered necessary for a useful laser defense.

There is amazing progress in building big mirrors cheaply, and also "rubber mirrors" that change shape to correct for air turbulence.

Transmission of a laser beam from the Earth to space was successfully tested in a recent shuttle flight.

Research on railguns, used for launching "smart bullets" at very high speeds, is making rapid progress.

Much of this research has major scientific and commercial spin-offs.

Q: Can't the Soviets foil our defenses with decoys and other countermeasures?

A: The defenses we are designing will be probing Soviet decoys in many different ways with lasers, radars and heat-sensitive instruments. The Soviets can try to fool these instruments with decoys, but the decoys will have to be very elaborate to work.

For example, we can tell a decoy from a warhead by tapping both with a weak pulse of laser energy and then observing how they recoil. The decoy, being light and flimsy, will recoil from the tap more readily than the heavy warhead.

If the Soviets made their decoys heavy enough to fool us in this test, they would weigh nearly as much as the warheads. But if the decoys weigh nearly as much as the warheads, the Soviets cannot release large numbers of them during their attack, and they will be of little value to them.

Q: Aren't satellites very vulnerable? Can't the Soviets shoot down our laser satellites more easily than we can shoot down their missiles?

A: The opposite is true. Satellites can be made relatively invulnerable; missiles cannot.

The reason is that a satellite in orbit is weightless and we can plaster as much armor and shielding on it as we wish. For the same reason, a satellite can also carry heavy guns for its own defense — lasers, smart bullets, or particle beams.

If the Soviets try to shield their SS-18 from our lasers by coating the skin with one inch of protective material, the payload of the missile will be reduced by four tons. But four tons is the weight of all 10 warheads on the Soviet SS-18s. Protected this way, they could not carry warheads.

That would make these terrible weapons impotent and obsolete.

We hope to carry out a carefully phased, simultaneous deployment of fully effective defenses on both sides, leading to a world in which the nuclear weapon is useless.

Q: Isn't the computer program for SDI impossibly complicated?

A: The software for SDI will require about 10 million lines of code. However, this has already been surpassed in length and complexity by the AT&T program which controls the nation's telephone network. That has 50 million lines of code. Also, the number of interconnections between "nodes", i.e., nerve centers, in the AT&T program is 14,000, whereas the number of interconnections in the SDI program is estimated to be about 4,500.

Q: How can you test the SDI program fully, short of trying it in battle?

A: The one aspect of SDI that can be tested fully is the software. When signals are fed into the front end of the program, they look exactly the same to it regardless of whether they have been produced by a Soviet missile leaving its silo or by a piece of equipment that generates signals imitating the real battle. In fact, this equipment can create realistic "battles" that test the program more fully than a real attack.

It can hurl more "missiles," warheads" and "decoys" at us than the Soviets could ever build. And it can "launch" them more quickly than the Soviets could ever launch their missiles in an actual attack.

Well-developed techniques exist for testing programs that deal with emergencies too dangerous to allow them to happen for test purposes. These techniques were used in testing the AT&T program. When the AT&T program was put into operation, it worked immediately although it had never been tested completely "in battle."

Q: What about the fast-burn booster? Some critics of SDI say it could be a low-cost and highly effective Soviet countermeasure.

A: It took the Soviets about 15 years to build their present missile force. Fast-burn missiles — which burn out and release their warheads in less than a minute — are a much harder engineering problem. Experts on missile development agree that this very advanced kind of missile will not be available to the Soviets before the 21st century.

Cost is also a very serious problem for the Soviets in considering this countermeasure. Statements by Union of Concerned Scientists spokesmen that the Soviets could build a fast-burn Midgetman for $10 million each are not in accord with the facts. The real cost will be $200 million each, according to official Air Force figures for the cost of the Midgetman.

So, if the Soviets replaced their arsenal of approximately 8,000 warheads with fast-burn Midgetmen, it would cost them $1.6 trillion.

Even spread over several years, this would be a very massive military burden for the Soviet Union, on top of its already massive military outlays.

Finally, the defenses recommended by the Fletcher panel on missile defense are designed to handle fast-burn missiles. So even if the Soviets go to the trouble and expense of scrapping their entire arsenal to replace it with first-burn ICBMs, at a cost of more than a trillion dollars, it will avail them nothing.

Q: Isn't it a bad idea to put weapons in space?

A: These devices — the smart bullet, the laser and particle beam — are defensive. They only go into action if the Soviets launch an attack to destroy us. It is much better ro rely on them for protection than on the threat of using weapons of mass destruction.

Q: Will our defense involve nuclear weapons in space?

A: The smart bullets planned for early deployment are non-nuclear. All the lasers under study are also non-nuclear with one exception — the X-ray laser, mainly a hedge against a Soviet breakthrough in this area. We know that the Soviets are working very hard on the X-ray laser.

Q: If our defense destroys Soviet nuclear warheads, won't that cause nuclear explosions in space?

A. No, because it is very difficult to make a nuclear weapon explode.

If the bombs are "salvage-fused" to explode on approach of an intruder, there will still be no clouds of radioactive dust and no damage on the ground, provided the interception occurs above 50,000 feet.

Since our defense will prevent most bombs from exploding, it also greatly diminishes the "nuclear winter" effect.

The Union of Concerned Scientists has been irresponsible in placing newspaper ads and TV commercials which imply that SDI means fighting a nuclear war in space. This aspect of the UCS campaign directly suppports Soviet propaganda against SDI.

Q: Some people say SDI will bring the world closer to nuclear war. Won't the Soviets feel threatened by SDI and launch a pre-emptive attack?

A: In the near term, they won't attack for the same reason they don't attack the United States today, namely, because we have a strong submarine deterrent.

In the long term, our government has announced that it will try to negotiate a parallel deployment of defenses with the Soviets so that neither side gains a military superiority through these defenses, and neither side can feel threatened. This is a cardinal point of our negotiating position in Geneva — perhaps the most important point of all.

Q: If SDI works against ballistic missiles, aren't we still vulnerable to cruise missiles?

A: A laser defense fixed to handle thousands of ballistic missile warheads and tens of thousands of decoys, traveling at 10,000 miles an hour, will have little trouble tracking and destroying cruise missiles lumbering along at the speed of a commercial airliner.

Q: How about missiles launched from submarines?

A: A defense that protects against the greatest Soviet threat — their land-based missiles — will be even more effective against submarine-launched missiles.

First, only a fraction of the satellites in our defensive screen will be over the Soviet Union at any given time; the rest will be mostly over the world's oceans, watching for signs of missiles launched from Soviet submarines.

Second, a submarine cannot launch all its missiles at once; they have to be staggered, which makes it much easier for our defense because we can pick them off one by one.

Third, as soon as the submarine fires one missile, we know where it is and can probably destroy it before it launches the rest.

Fourth, submarine-launched missiles generally travel slower than ICBMs, which makes them easier to track and destroy.

Q: Will our defense work against the SS-20, and other short- and medium-range missiles that threaten Western Europe?

A: For several reasons, SS-20s and other medium- and short-range missiles pointed at Europe are easier to defend against than intercontinental missiles, contrary to statements emanating from some American scientists and Western European spokesmen.

First, and perhaps most important, because of their shorter range, they spend a larger part of their trajectory in the atmosphere. This makes it much easier for our defense to discriminate the warheads from the decoys. [The decoys, being lightweight, are retarded more by air resistance.]

Second, they fly more slowly, which makes them easier to track and destroy.

Third, they are smaller missiles with a smaller payload, and therefore carry fewer warheads and decoys, which again, makes the defense against them easier.

Q: What about missiles launched on low trajectories from submarines near U.S. shores? Wouldn't these Soviet missiles reach their targets — say Washington — too quickly for our defenses to work against them?

A: Our utility to track and destroy these "flat trajectory" missiles will not be impaired by their short flight times.

First of all, like the SS-20s, they fly lower and slower than ICBMs, which makes them easier to track and easier to intercept.

Second, our surveillance satellites detect them within seconds after launch, and our laser beams catch up to them in a hundredth of a second or less. As a consequence, it doesn't matter appreciably to our defense whether the flight time is five minutes or 20 minutes.

Q: Does SDI violate the ABM Treaty?

A: SDI is a research program whose stated goal is research on ABM defenses. However, the ABM Treaty does not limit goals. It only limits certain activities.

We may bump up against the treaty in three or four years — if, for example, we begin to test space-based components. But for the next several years there is no conflict between SDI and the ABM Treaty. The Soviet Star Wars program will also bump up against the ABM Treaty soon. Some experts say it has already done so.

Q: Why do we need SDI if nuclear deterrence has worked up to now?

A: Deterrence by the threat of retaliation has been effective, but there are signs of erosion of the U.S. position in this regard. Our ballistic-missile submarines are the principal U.S. deterrent at the present time, but their invulnerability is compromised by research into methods of detecting submerged submarines, as well as such developments as the recent Walker spy case. At some point in the 1990s we may find ourselves in a very dangerous position as a result.

The Reagan strategic modernization program has been valuable — especially in restoring the B-1B bomber — which unlike the B-52, has a fair chance of penetrating Soviet air defenses — but an even stronger deterrent would be a combination of an effective force of nuclear retaliation and a defense that prevents the Soviet Union from destroying the bulk of that retaliatory force in a surprise blow.

Q: At what point will the United States be able to scale down its offensive capability?

A: Our position is to maintain our present offensive capability threat for 10 years while we pursue Star Wars research and move toward deployment of a limited defense system. Then, in concert with the Soviets, we hope to carry out a carefully phased, simultaneous deployment of fully effective defenses on both sides, leading to a world in which the nuclear weapon is useless and its disappearance can be expected.

Q: Would SDI trigger an arms race in space?

A: The Soviets are already racing ahead on missile defense as fast as they can.

Q: Wouldn't Star Wars make a fine bargaining chip at Genevea, since the Soviets want so much to get rid of it?

A: We cannot offer Star Wars as a bargaining chip, because if we do, the Soviets are likely to have an effective defense against American missiles in the 1990s, while the U.S. has no defense against Soviet missiles.

Faced with the prospect in the 1990s of a world in which the Soviets have a massive first-strike arsenal of more than 10,000 accurate warheads, and also have an effective defense against any American retaliatory blow, we must proceed with our Star Wars research or place America in a very vulnerable position.

The Washington Times

President skeptical on Soviet arms offer

By Jeremiah O'Leary
THE WASHINGTON TIMES

President Reagan is viewing the recent Soviet arms control proposal as a promising development that could mark the beginning of real progress, but the offer has six major problems that must be addressed, a senior administration official said yesterday.

The official, who spoke on condition he not be identified, said the problems are:

- U.S. concern that the Soviet capability to launch a first strike at the United States would be strengthened substantially.
- The Soviet proposal is highly unequal and would ensure that the U.S.S.R. would retain major advantages in the numbers of nuclear weapons, delivery vehicles and ballistic missile throw-weight.
- The proposal would prevent key areas of needed U.S. modernization while the Soviets could carry through to completion the modernization they started 10 years ago.
- The Soviet offer seems designed to fulfill the long-standing Soviet goal of totally removing the U.S. nuclear deterrent from allies in Europe and Asia while not inhibiting Soviet forces which threaten those allies.
- Key elements of the Soviet offer would not be verifiable in light of the Soviet record of non-compliance with existing arms control agreements.
- The Soviets have not dropped their precondition that reduction of offensive arsenals must be linked to stopping American research on the space-based Strategic Defense Initiative.

NEWS ANALYSIS

The official said the precondition on SDI presents a serious obstacle to the negotiations in Geneva and must be dropped. He said the need for offensive weapon reductions is self-evident and there are ample incentives on both sides to trade off and reduce offensive capabilities.

There also is a clear need for defensive research and testing which both the United States and the Soviet Union are pursuing, he said.

The six major problems described yesterday by the official mark the administration's most detailed evaluation of a Soviet proposal offered by Soviet leader Mikhail Gorbachev.

The Soviets in general have proposed mutual reductions of 50 percent in offensive weaponry along with termination of the U.S. "star wars" research program. But the senior official pointed out that the present ratio of warheads to targets shows the Soviets with an advantage of 6-1.

The Soviet proposal, he said would leave the Soviets with 3,600 warheads against 300 for the United States. If there were an agreement to ban modernization of existing forces, it could bar all new U.S. systems while not counting the Soviet systems as new.

He said the scale of the U.S. deployment of Pershing and cruise missiles in Europe is lopsided compared with the Soviet weapons of a similar intermediate-range type. It is not reasonable for the Soviets to threaten Europe but to stipulate that Europe not defend itself, he said.

However, the official said the Soviet proposal is a place to start and the United States will spend all the time that is needed at Geneva to attempt to achieve greater stability between the superpowers.

The Soviet position still has not been fully revealed, the official said, and the partial disclosures have caused widespread uninformed conjecture.

Even so, he said, the president finds the counter offer to be a promising development and said it proved that Mr. Reagan's firmness has started to pay off.

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DRAFT

SDI

THE STRATEGIC DEFENSE INITIATIVE: CRITICISMS & RESPONSES

BRIAN CHEVLIN

SDI: CRITICISMS AND RESPONSES

ARMS CONTROL

CHARGE - The deployment of a strategic defense system will create an incentive for the Soviets to strike first in a crisis situation.

ANSWER - It is not the intention of the U.S. to gain offensive superiority over the U.S.S.R. through the SDI. The Soviets would have nothing to gain by striking first in a crisis and, in fact, an effective SDI will help strengthen existing disincentives to strike first. SDI weapon architecture will raise an important measure of uncertainty in the minds of Soviet warplanners as to their ability to achieve a successful first-strike. As the military incentive to strike lessens, along with chances for military success, the political incentive will also lessen. Thus, uncertainty will certainly act as a deterrent to the Soviets.

CHARGE - The SDI will fuel the arms race and threaten strategic stability by inviting Soviet increases in offensive weapons.

ANSWER - An offensive arms race continues today. Therefore, anything the US attempts to do which would possibly alter that cycle, and which challenges the military integrity of Soviet war plans, will result in Soviet concern. The hope of the U.S. is that the SDI will shift the competition away from the accumulation of more threatening offensive forces and a shift to a defensive strategy of deterrence. The SDI will decrease the offensive arms race if the Soviets are able to see the mutual benefits of a deterrence based on defensive technology, thus rendering offensive forces increasingly unreliable military tools.

CHARGE - SDI poses a threat to the negotiations at Geneva and should instead be bargained away for reductions in Soviet offensive forces as the Soviets have been recently proposing.

ANSWER - The U.S. cannot offer to bargain away SDI, which is simply a research program, because left unchecked, the Soviets are likely to have an effective defense against U.S. strategic forces in the 1990's while the U.S. would be left with no such defense. At this point, there is no way to verify research in either country. This can be seen by the extensive Soviet developments in strategic defense over the past decade. Contrary to the above claim, the SDI has in fact brought the Soviet Union back to the bargaining table and for the first time we are seeing proposals for a genuine reduction in Soviet strategic offensive forces.

CHARGE - The SDI violates the ABM Treaty of 1972.

ANSWER - Despite Soviet research and development in anti-ballistic missile technology since the signing of the 1972 treaty, the U.S. has remained in strict accordance with the treaty. The Soviet Union not only has the only active ABM site in the world surrounding Moscow, but it has also violated the treaty with the installation of the Krasnoyarsk radar in Siberia. The problem that SDI poses for arms control today lies only in Soviet rhetoric as they attempt to discourage the West from pursuing this new approach to stability. The treaty allows the U.S. to pursue research, as the Soviets should be well aware, because the negotiators on both sides realized that there was no way they could verify research. It is clear that the treaty does allow certain types of testing, and all of the U.S. testing has been done in strict compliance with these allowances. At some point, we will have to move beyond the levels of the treaty so as to permit more focused testing and development of the program. Consequently, we could then discuss modification of the treaty with the Soviets to permit a mutual transition to a safer world.

TECHNICAL FEASIBILITY

CHARGE - The software necessary for such a system is impossible to attain at the current level of programming technology. In addition, programmers will undoubtedly make errors that will be unknown until the system is used in a realistic scenario. Thus, our destiny will be left at the hands of potentially unreliable computers and not in the hands of humans.

ANSWER - The history of the development of technology argues strongly against those who make premature statements that something is technologically impossible. Moreover, the SDI is only a research program to see if the technology for such a system is at all feasible. The U.S. government has great confidence in the ability of American and allied minds to focus their efforts toward overcoming the problems facing the demands of software and other areas of the program. Nevertheless, the problem is not whether we can build millions of lines of error-free codes and perfectly functioning hardware. Rather, we are trying to build fault-tolerant systems that will check on each other so that you can rely on those systems to be trustworthy, while human beings control them. If critics of the SDI really believe the software to be impossible, perhaps the most intelligient and responsible position they could take would be to work within the program to help utilize their claimed understanding to help prevent the mistakes they claim are inevitable.

CHARGE - Any defensive system could be easily countered by the Soviet Union with far less costly methods, thus eliminating the cost-effectiveness of the system.

ANSWER - One of the primary program goals of the SDI is the commitment to a system that will be "cost-effective at the margin". That is, we are looking to create a system in which it will be cheaper to deploy the defensive components than any offensive countermeasures. Judgements concerning offense-defense cost ratios are highly premature until we know the exact nature of the system which we would deploy. Nonetheless, many of the viable countermeasures will not only prove difficult in themselves, but will cost the Soviet Union a lot in terms of dollars and weapon performance.

* For instance, we are told that all the Soviets have to do is throw away all of their missiles and replace them with fast-burn missiles, thus decreasing our chances of hitting them in their vulnerable stage. For the Soviet Union to do that would be time consuming, extremely difficult, and very expensive. When we look at the possibility of being able to defeat a multi-tiered defensive system, it is not clear it would do them any good. For instance, if the Soviets were able to produce a missile that burned out in a very short time in the earth's atmosphere, it would make it difficult to have adequate time to attack that missile. However, when one looks at what that missile will have to accomplish --- namely deliver a large and complex set of objects into space, that could then travel through space and hit a particular target with precision, and in addition to that, be able to deploy many decoys to confuse the defenders in space and confuse interceptors launched from the ground. It is clear that it would be difficult to accomplish an adequate ability to carry out the entire mission.

* Another frequently mentioned countermeasure is to overwhelm the system with warhead decoys, thereby making it difficult for a system to discriminate from the real warheads. But to attract a sensor's attention, these decoys would have to be just as large and weigh almost as much as genuine warheads. Because of these necessities, such decoys would have to occupy valuable warhead space on the missiles. In addition, many decoys would have to be added before they had a significant effect on the number of warheads that would survive. The cost of such a method of defeating strategic defense would be enormous.

* Another mentioned countermeasure is to put a shine on Soviet missiles. Putting a shine on a missile sounds like a good idea, because it reflects part of the laser beam and weakens the beams effect. However, it would be a poor idea for the Soviets in

reality. They could not count on keeping their missiles shiny as the missile's own exhaust gas and smoke during launch would certainly do the trick. Some laser energy is bound to get through, heating the surface. This tends to dull the shine so more heat gets through, and so on until the shine is gone.

* With respect to a beam-type defense, some scientists have suggested that an effective Soviet countermeasure would be to coat their missiles with a shield of lead that would make them impervious to beam attack. Also, the "band-aid" idea calls for a metal skirt that would slide up and down the outside of the missile, automatically stopping to protect the spot that is receiving a laser beam. Next, the "window shade" is a flexible, metallized sheet that is rolled up and fastened to the outside of the missile, and then unrolled at altitudes above fifty miles. It is supposed to protect against the X-ray laser, one of the areas we are researching.

The trouble with these ideas is that they do not fit the realities of missile construction very well. The ratio of a missile's weight empty to its weight loaded is nearly the same as an eggshell. Attempts to put band-aids, window shades or similiar protective devices on the outside of the smooth surface of a missile would put stresses on the flimsy structure that would require major renovations and a whole new series of test flights. In addition, any such improvements would cause significant loss in payload capability for any missile, assuming it could be launched at all. In spite of all these visible problems with countermeasures, the SDIO has set up a team to identify these possible countermeasures so that we will be able to design our architecture to effectively deal with these threats. This will allow the system to not only be cost-effective, but also will ensure survivability of the system.

CHARGE - The pressure to have unencumbered progress in the program has turned the SDI into a slick public relations operation. Thus, the SDI is using supposedly "successful" experiments with questionable military value to hide failures in program technology. By not permitting close scrutiny of its claims, proponents of the SDI hope to keep damaging information from the Congress and the public.

ANSWER - The SDI is only a research program and there are undoubtedly going to be failures when one tries to experiment with new frontiers of technology. Since the President first announced his vision in March 1983, the Strategic Defense Initiative Organization has been as open as possible to the Congress and the public on matters concerning the program. Nevertheless, there are certain areas of research and other aspects of the program which must remain classified for national security reasons. Although the threat of Soviet technological breakthrough in the area of ballistic missile defense dictates a

very rigorous schedule, the experiments that have been carried out thus far have been done so in the most logical scientific sequence possible. It is unfortunate that the SDIO has found it necessary to overemphasize the more visable experiments in order to maintain congressional and public support for the program. However, this should not be interpreted to mean that these were not necessary and vital experiments toward achieving a decision in the early 1990's whether or not to proceed with deployment.

AWKWARD

CHARGE - Peace can only be realized through human factors, and the SDI is a futile attempt to provide an inappropriate "technological fix" to a human problem. Such a "quick fix" is not a guarantee and is capable of failure. For example, the tragic loss of the space shuttle Challenger should be ample proof that we cannot always rely on technology.

ANSWER - Peace is indeed dependent on the human factor. However, the aim of arms control is precisely to change human behavior. But given that no one, critic or proponent of the SDI, has any plausible theory today of how we proceed to effect a definitive political settlement with the Soviet Union, we have no choice other than to minimize those dangers to our security that can be minimized. Soviet long-range missiles pose a serious threat to American survival. It is entirely appropriate that, pending the political growth of U.S. - U.S.S.R. relations, a technological answer be sought to.that technological danger. No responsible person is claiming that SDI, itself, will solve our political problems. But, SDI may enable us to live more safely with the political problems that continue to evade effective political treatment. To link a human disaster like the Shuttle tragedy to support arguments against the SDI is absurd, because the technical aspects of the two programs, and the reasons behind the Shuttle tragedy, are completely different and not comparable.

"BRAIN - DRAIN"

CHARGE - The need to preserve an open academic enviroment is being undermined by government classification requirements once research projects reach military significant results.

ANSWER - Most of the research grant money given under the SDI program is for basic, fundamental unclassified research which facilitates scientists to communicate their results among colleagues. The SDIO believes it is necessary for university faculty to have the academic freedom to perform any research they desire, as long as it conforms to a given university's guidelines on such issues as safety, classification, and quality of the research project. Unfortunately, some research advances must be classified for reasons of national security and concerns for espionage. Thus, where there is a likelihood of disclosing operational capabilities and performance characteristics of planned or developing military systems, or technologies unique

and critical to defense programs, the contract will stipulate that the responsibility for realease of the information resulting from the research belongs to the sponsoring office at SDIO.

CHARGE - Professors fear the prospect of a vast diversion of talent away from basic and pure research projects that the U.S. needs to pursue if it is to maintain it s commercial and scientific strength.

ANSWER - Much of the SDI research is in fact at the forefront of a broad range of technology that covers many different fields and will provide countless spin-offs in the commercial arena. More advanced supercomputers and software could transform today's computers into actual "thinking machines" and open up a previously unknown area of advancement. Development of new types of directed energy technologies will allow for unprecedented gains in medical lasers, material modification and other laser sciences. Thus, it is clear that the research being conducted in the SDI is indeed basic research that will undoubtedly enhance the U.S. technological base.

CHARGE - The government is citing big university involvement in SDI-related research as evidence of their endorsement of the program. The infusion of SDI research money is an effort to "buy up" brains and create a silent or supportive constituency for the program.

ANSWER - The SDIO has no intention of using involvement of major universities as an instrument of support for the program. Ever since the IS&T (Innovative Science and Technology) Directorate of the SDIO began to accept research proposals for SDI projects, the office has received more proposals than it can possibly grant to the academic community. The SDIO does not expect nor wish to imply any political support from universities as institutions. The I.S.T. has engaged a consortia of university, government, laboratory and industrial researchers who are at the top of a particular area of technology we need to explore. Thus, we have not engaged a consortia of universities themselves in order to elicit approval of the program.

THE BUDGET

CHARGE - SDI budget requests are unprecedented and cannot possibly spend its money prudently.

ANSWER - The SDIO estimates that the SDI will cost about $26 billion between fiscal years 1985 and 1989. This amount represents only 2% of the defense budget and less than 15% of the defense research budget for this period, less than is proposed for strategic offensive research and development. Some have suggested freezing SDI funding at Fiscal 1986 levels.

Such an action would be a major setback for the program as past cuts have already shown. As multi-faceted research, reducing or freezing SDI funding will delay our program objectives, and therefore delay the time in which the nation will be able to make an informed decision on strategic defense.

Initially, going from $3.7 billion to $4.8 billion may seem to be an overly ambitious expansion, but that is not the case. The SDI is a multi-faceted research program, not an average weapons development effort. As a research program, resources are allocated and utilized more quickly than in a procurement procedure. In fact, in ~~fiscal year 19~~85, the SDI had obligated nearly 40% of its budgeted resources by the end of the first quarter and last year the SDIO committed 94% of its budget, more than the military services. This is unprecedented in a program of this magnitude and certainly shows that the program is on track, vigorously pursuing the objectives that have been set forth, and clearly able to to execute at the pace that has been programmed. As we continue to develop these technologies at a rapid pace, it is imperative that we build on the foundation we have established in a logical and timely manner. It is not a program that should be relaxed and extended to a more leisurely pace.

CHARGE - If the Congress approves the billions of dollars ~~funding~~ requested for the SDI, this could distinctly and adversely impact on programs dealing with assistance to the poor and other social development.

ANSWER - It is a primary responsibility of the national government to provide for the security needs and the protection of the its people first and foremost. The SDI could finally offer the American people and her allies safety from nuclear annihilation and offer a unique quality and quantity of protection. Given the fact that the Soviets have, over the last decade, been implementing their own civil and missile defense systems, we owe it to ourselves to at least do research into the feasibility of protecting ourselves.

CHARGE - The level of funding requested for SDI, if approved, will necessitate taking away resources needed to modernize conventional forces and negatively effect readiness capabilites. This will seriously weaken the ability of the U.S. and her allies to deal with more likely conventional military crises in the future.

ANSWER - There certainly are important resource problems and there needs to be a proper balance maintained which is in line with our military needs. Nonetheless, the SDI request is a very small fraction of the overall defense budget. The program received only 2.7 billion in fiscal year 1986 after 1 billion was cut from the department request for 3.7 billion, a level approved by the Fletcher Study Panel. As a result, difficult trade-offs

had to be made to meet this level. To catch up and explore as thoroughly and effectively as possible a wider range of options, the Administration is requesting 4.8 billion for fiscal year 1987. Given the fact that the President has called the SDI our number one priority for the nation's security, 2% of the entire defense budget, which the SDI represents, is a reasonable request. Nevertheless, these are huge sums of money and we have accounted for their expenditure in a most careful and diligient manner. Moreover, the program has always been aimed at ways in which SDI technology can be used with conventional applications and we are actively exploring this potential.

CHARGE - Even if the SDI were to prove feasible at some point, a successful development effort could create a dangerous period of instability. The program certainly does not warrant such a huge investment of money given limited prospects for success at such a large cost.

ANSWER - If the SDI were to prove feasible at some point, it could create the incentive for mutual reductions in offensive arms by both sides, one of the goals of the SDI. While we are searching for the defensive means to enhance deterrence, we are also seeing today, critical leverage in the negotiations at Geneva to reduce the numbers of Soviet offensive strategic missiles. In fact, it is clear that the SDI has had a lot to do with the kinds of breakthroughs that are potentially on the horizon in the area of arms reduction. For the first time in the whole history of arms control, we are seriously looking at the possibility of real reductions on the Soviet side.

ETHICAL QUESTIONS

CHARGE - There is no ethical case for the SDI, Mutual Assured Destruction (M.A.D.) has worked this long and there is no reason to change this effective deterrent.

ANSWER - This nation has the constitutional obligation to protect its people. Without such a guarantee, there is no need for citizens to participate in the collective nature of the state; by paying taxes, obeying laws, and observing everyday custom and coutesy. MAD has had the good fortune of deterring thus far, but its utility has been lost. The rapid advancement of technology has dramatically increased the power of nuclear weapons as well as their accuracy. In addition, along with advances in offensive capabilities has come new technologies which were not present when the negotiators of the 1972 ABM Treaty decided to rely on mutual annihilation to ensure the peace. With the increased sophistication and numbers of nuclear weapons has come an increased likelihood of their use, but an assured response is not the answer.

We have seen quite clearly since the 1972 treaty that the Soviets do not accept the concept of deterrence

envisioned in the treaty. They have vigorously pursued their own defenses against our retaliatory forces and have also greatly increased the lethality and accuracy of their offensive forces. Even if the Soviets were not pursuing their own defense measures, it would be prudent and moral for the U.S. to investigate how we might learn to kill weapons rather than people. Our desire for a strong and moral deterrence demands that we research the possibility of moving beyond this mutual suicide pact.

CHARGE - The SDI has shown a lack of coherence in its policy rationale as those involved in the program have shifted from population defense to point defenses. SDI will not be an effective population defense, and the system will only be capable of protecting our own land-based missiles and command centers.

ANSWER - It is much too premature for anyone to predict the defense capabilities of the SDI, but the SDI goal is not to provide for point defense alone. The SDI is, and it has been since its inception, an attempt to achieve a comprehensive defense of the United States and its allies through a multi-layered defensive system. At no time has the program's primary objective - research to determine the feasibility of protecting the U.S. and its allies from ballistic missiles - been less than that. Development of defenses with less complex technology could be used in a more limited defensive role to protect our nuclear forces and strengthen deterrence in the near term. Consequently, this more secure deterrence would serve as the basis for eventual deployment of defenses to meet our primary goal of protecting people.

EUROPEAN PARTICIPATION

CHARGE - The SDI will decouple the NATO alliance. It's objective is to establish a defensive umbrella or shield over the U.S. This would decrease the likelihood that the U.S. would respond with nuclear weapons to a Soviet attack in Europe.

ANSWER - President Reagan stated quite clearly in his speech in March, 1983 that the SDI was research program focused on advanced defensive technologies with the aim of destroying ballistic missiles before they reached U.S. or allied soil. Our commitment to the defense of our allies remains intact. Some of the SDI architecture studies are examining the potential of defensive options against Anti-Tactical Ballistic Missiles (ATBM'S). We are actively engaged with our allies in exploring potential tactical applications against medium and short range ballistic missiles which threaten our allies. Soviet military doctrine stresses the use of conventionally armed ballistic missiles to initiate rapid and wide-ranging attacks on crucial NATO military targets throughout Europe. Therefore, an effective defense against these shorter-range missiles could have a significant impact on deterring aggression in Europe. In

addition, over the next several years, we will continue to consult with our allies about various applications of an SDI as well as security ramifications it will have on the alliance.

CHARGE - Congressional critics specifically have argued that European participation is not necessary as the work could be better performed by U.S. companies and that potential commercial spin-offs in the hands of allies will hurt U.S. competitiveness.

ANSWER - There is considerable scientific and technical expertise among our allies that could certainly reduce both the research phase and the cost of the SDI. Many of the problems that the SDI needs to overcome can be solved better, faster and cheaper with the inclusion of allied technical skill. The U.S. has engaged in a number of agreements with allies designed to utilize the special capabilities and advancements which have been made in SDI-related technologies. For example, allied advanced programs involving very specific laser and particle beam research useful for directed energy defense have been ongoing for some time now, and could complement efforts under way in the U.S. As was shown in the MoU (Memorandum of Understanding) signed with the government of Great Britain, cooperation on SDI research is of benefit to all parties. The agreement clearly states that there will be a free exchange of information on technology and each government is prepared to make available the expertise of its research and development establishments in order to facilitate progress in the program. In addition, any agreement will require the participating government to take appropriate steps to prevent the unauthorized retransfer of SDI technology to the Soviet Union or its allies.

CHARGE - Europeans are worried about the possibility that the U.S. will not give its private industry a fair chance at research contracts and will ultimately dominate the research phase.

ANSWER - The U.S. has recognized since the inception of the SDI that we need to work together with our allies, and the U.S. could not go ahead with the SDI efficiently, cost-effectively or in a timely manner without allied participation on a full and equal basis. The MoU signed with Great Britain clearly permits British companies to compete for SDI contracts on an equal basis with U.S. companies and to participate in an information exchange program on a fully reciprocal basis for the mutual benefit of the U.S. and her allies. In addition, British industry will receive some sole source contracts and will not be limited to the subcontractor level. Direct allied involvement in SDI research will enhance and deepen allied understanding of the program and of the technological basis for future defenses against ballistic missiles.

CHARACTER AND PURPOSE OF SDI

CHARGE - The SDI risks becoming another "Maginot Line".

ANSWER - Such a comparison does no injustice to the SDI because in fact, the Maginot Line was very effective. It directed German axes of invasion away from Alsace-Lorraine, it was sufficiently formidable that the German elected not to assault it, and the fact that the French failed to make proper strategic-operational use of it proves nothing about the inutility of defense. The U.S. has no intention of abandoning its offensive missiles until the Soviet Union realizes the benefits of defensive deterrence. No one would argue that a defense can always be beaten if an attacker is able and willing to pay the compound price in time and in assets to be expended. The use of defensive weapons and tactics in doctrine and posture need say nothing specifically about the purpose of strategy. However, the strong criticism raised at the threat posed by the SDI to the current condition of offensive dominance is absurd, given the historical record of attempts to maximize military effect by incorporating offense and defense.

CHARGE - Many of the SDI technologies being researched (lasers, optics, supercomputers, guidance systems and navigation technologies) are a legitimate Soviet concern as they could be used more practically as improvements for existing medium-range missiles in Europe or, more importantly, conventional weapon application. Thus, SDI technology is really an extension of the offensive arms race in that any developments that could be used for defense could also and more likely be used as offensive systems.

ANSWER - For the foreseeable future, offensive nuclear forces and the prospect of nuclear retaliation will remain the key element of deterrence in the transition from offense to defense. Therefore the U.S. and her allies must modernize their offensive forces to make up for a period of neglect in the West. It is true of course that many of the SDI technologies being researched could be applied to other security applications in our conventional forces. However, the critics are well aware that these are fields where research would go on with or without the SDI, as the advancement of technology cannot be stopped. It is possible that not only could SDI make MAD an obsolete strategy, but its conventional spin-offs could conceivably obviate NATO's reliance on the early or first-use of nuclear weapons in the event of a Soviet attack in Europe. Until the U.S can make a peaceful transition to defensive deterrence, it is necessary that we use our technology in the most effective way possible to provide for the security of our allies.

CHARGE - An SDI "think-tank" is an unnecessary waste of money which would attempt to overwhelm the press and public with a constant campaign of self-serving propaganda about the merits of SDI, while being almost immune from Congressional scrutiny.

ANSWER - The establishment of the proposed Federally Funded Research and Development Center (FFRDC) to support the SDIO is extremely necessary. The purpose of this action is to make continuously available to the SDIO a relatively small but dedicated technical support unit that can facilitate the utilization, in a manner that is more timely, cost-effective and productive than currently possible, of the large national capability that must be applied to the Strategic Defense Initiative Program. This new think-tank would help insure over the long run that we make good choices and that we have technical support that would hold no allegiance to any particular sector or organization. This would avoid the inevitable conflicts of interest that arise when business interests, who have billions of dollars worth of contracts at stake, must make decisions on systems architecture for the system.

CHARGE - President Reagan has repeatedly said that the goal of SDI is to determine whether a "non-nuclear" system can be developed to destroy missiles. Despite this claim, the SDI is researching the "nuclear-powered" X-ray laser.

ANSWER - The U.S. is indeed doing research on a nuclear-powered X-ray laser, but only as a hedge against a breakthrough by the Soviets who have been working very hard on this concept. In fact, most of our preliminary data on this technology came out of what the Soviets have already done. Nevertheless, our preference would be to design a non-nuclear device, but we must also be capable of understanding the design of our adversaries weapons. The nuclear explosion that produces the X-ray laser is exceedingly small compared to the total destructiveness of the weapons it is putting out of action. According to calculations, one X-ray laser the size of a packing crate will be able to destroy the entire Soviet ICBM arsenal ---thousands of missiles--- if these missiles are launched against us at one time in a massive attack. Furthermore, the explosion that powers the X-ray laser takes place hundreds of miles above the earth, and does not cause damage or radioactive fall-out.

CHARGE - The SDI could be used offensively by the United States against the Soviet Union.

ANSWER - The U.S. has no intention of using the SDI as an offensive system and it is clear that most of the weapons that we are looking at have no rational potential to attack anything on the ground. For example, the neutral particle beam would be a very potent weapon in space. Essentially, it is a stream of hydrogen atoms that would travel at about half the speed of light, but we know that if you place it in a battle stage in orbit, it cannot penetrate down into the upper atmosphere, only just a few hundred feet. Thus, it can not hurt anybody or anything on the surface of the earth.

The current controversy is the use of the laser as an offensive weapon from the sky. If you are going to take a ground-based laser and project the energy up through the atmosphere, that requires a frequency which is able to be controlled and can correct for the atmosphere. It may be true that scientists will be able to take that same laser and make it in such a way that it can go down and strike the ground. But a laser is a weapon which is only effective if one wants to hit a specific target with great destructiveness. Thus, the laser is a very effective weapon only if you can point and track it accurately against a missile, particularly as its coming out of the atmosphere. It is true that eventually it may be possible to use it against airplanes as well. However, no one would claim that the U.S. government is spending billions of dollars to track and destroy airplanes. Consequently, to use a laser against a city is equally absurd considering that the beam is very thin in diameter, and that it could be stopped by just half an inch of stone, or just a cloud. To attempt to march through Soviet cities like Moscow, which is three-quarters covered by clouds at least two-thirds of the time, would be militarily absurd. So the idea that we would use, even lasers that could project to the ground, as an offensive weapon of the kind that would be used to destroy populations, just does not make any military sense.

Finally, one of the earliest types of defense that could be practically implemented is called high frontier. It is a very simple satellite that carries a series of very high speed rockets which would be able to fire from an orbital position and intercept a booster just as it is coming out of the atmosphere. We want to make these kinds of systems go at tremendous speeds, like between 5 and 8 kilometers per second. In addition, we're trying to make these interceptors smaller and lighter so it can reach these types of speeds. We obviously could not afford to put a very heavy thermal system on it so it could penetrate the atmosphere, as that would just slow it down and go against the very objective that we're seeking. Such a weapon would have a very different use and very different characteristics from what we are researching for the SDI.