HIGH FRONTIER NEWSLETTER

The Economic Benefits of High Frontier
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Is SDI Too Costly, or a Bargain?

As the Strategic Defense Initiative becomes more widely understood and discussed, the issue of its cost is becoming more prominent.

Cost is a major factor both in Congressional debates and in criticism by SDI opponents, who see high estimates, often wildly exaggerated, as one of their most effective anti-SDI arguments.

First, the entire issue of how expensive an SDI system might be ignores one basic question: How much is it worth to save millions of American and European lives? What cost do we place on survival?

Robert Jastrow, founder of the Goddard Space Institute, recently told the Senate Defense Appropriations Subcommittee that the U.S. could build a "two layer, smart bullet" defense in space which would be 90 percent effective against a Soviet missile attack for $60 billion. (See testimony, pages 4 and 5).

One of Jastrow's most important points was that the Soviets, confronted with such a system, would then have to launch five times as many missiles as they now have and spend $2 trillion on offense to overcome the 60 billion dollars expended on U.S. strategic defense.

A Los Alamos scientific team has concluded that the ratio of costs for U.S. defensive systems to Soviet increased offensive systems favors the defense by three to one.

Opponents of SDI keep saying that even with a 90% effective defense, the Soviets could simply overwhelm this defense with a huge number of new missiles. Knowing what we do about the Soviets' huge investment in strategic offenses, and the present state of their economy, this argument makes little, if any, sense.

More importantly, participants in the debate over SDI costs should remember several key points.

(Continued on page 3)

Soviet Cost to Overwhelm a U.S. Space Defense

Present Soviet ICBM arsenal ICBMs—all types	1,400
Estimated Cost	$500,000,000
Cost per nuclear missile (est.)	35,714,200 (average)
Additional Soviet ICBMs needed to maintain present strike force if SDI is 80% effective.	5,600
Cost, 1985 dollars	$1.99 Trillion
Present Soviet GNP (1980 est.)	$1.5 Trillion

Opponents of SDI claim that if a successful non-nuclear space defense is deployed by the U.S., the Soviets would overwhelm it by building more ICBMs and warheads. Prof. Drell at Stanford University (see story below) estimates they would build 100,000 warheads. This table shows the cost to the Soviets of building enough ICBMs to maintain their present strike force if a U.S. ballistic missile defense is only 80 percent effective. The cost is compared to the Soviet estimated gross national product (GNP). If spread over five years, this ICBM cost would be 26 percent of their estimated GNP per year.

The Liberal Alternatives to SDI

Opponents of the Strategic Defense Initiative continue their relentless and often ingenious propaganda and lobbying efforts to kill this non-nuclear defense program.

They keep this up without offering an alternative except clinging to the outmoded policy of Mutual Assured Destruction (MAD) and the sacred (to them) ABM Treaty, which, in fact, has already been abrogated by the Soviets by their ABM violations.

One old and two new tactics are in vogue. One is that SDI will cost too much. The other two, more ingenious, are: SDI will be a "pork barrel" for defense contractors, and, nuclear devices in space will be more effective than proposed High Frontier non-nuclear defense systems.

We can already hear the "freezeniks":—"No nuke spooks in the heavens!"

In the current budget season in Congress, liberals are fighting hard to cut the SDI research funding. The Administration requested $3.7 billion, but four senators introduced a bill to cut funds to $1.86 billion. They are Sen. Dale Bumpers (D-Ark.), Sen. John H. Chaffee (R-R.I.), Sen William Proxmire (D-Wisc.) and Sen. Charles McC. Mathias of Maryland, who is listed as a Republican.

They point out that this $1.86 billion is a 27 percent increase over 1985 funds, but these were drastically reduced by Congress in 1985 appropriations.

In the House, Reps. George E. Brown (D-Calif.), Joe Moakley (D-Mass.) and Norman Dicks (D-Wash.) introduced bills to halt or limit SDI programs.

The effects of this legislation, if passed, would hamper or delay SDI research and development for years. Aside from the fact that it would save some money for social programs and preserve U.S. adherence to the ABM Treaty (even restrict U.S. develop-

(Continued on page 3)

COMMENTARY

The Economic Benefits of High Frontier

In the very act of defending our country against a nuclear missile attack, we will be opening the doors to dramatic improvements in the way we live our lives.

The benefits derived from U.S. space and military programs provide clear evidence that dollars invested in space-based technologies have an expansionary affect on our economy. A 1976 study conducted by the Chase Econometrics Group revealed that for every billion dollars invested in space technology, over 800,000 new jobs are created, the inflation rate is reduced by two percent, and the Gross National Product is increased by $23 million.

Leaders of the Soviet Union as well as leaders of the Free World know that if their nations are to maintain major power status, they must pursue the benefits of the high frontier of space.

Conversely, the abandonment of previous space programs has had a negative impact on our economy. It has been estimated that when the Apollo program was killed, over 400,000 jobs were eliminated across the country. Since each direct engineering job produces from 3 to 6 service jobs—truck drivers, grocery clerks, school teachers—Apollo's demise put 1.2 million to 2.4 million people out of work.

The deployment of a space-based missile defense system will accelerate the commercial development of space. The construction of space-based defenses requires the development of a sophisticated space-based infrastructure—space stations, a space transportation system, an improved space communications system and mass production techniques for satellites and their components. It is the development of this infrastructure which will unleash the commercial development of space.

New Products in Space

In-space production of materials could revolutionize the manufacturing process and make possible the production of many new products. Because things mix well in space, about 500 combinations of materials can be produced including metal alloys that have never been formed before, and super-light, high-strength materials for use in airplanes, homes and cars. Perfectly rounded ball bearings for use in computers and perfectly rounded latex spheres for use in calibrating microscopes can be produced in the gravity-free environment of space.

Preventing and Curing Diseases

The pull of gravity greatly reduces the effectiveness of extracting and separating biological substances used in many medicines. The zero-gravity environment of space makes it possible to extract 500 times more material with much greater purity.

In addition, the manufacturing of rare and expensive drugs in space holds the promise of expedient production at greatly reduced costs. For example, a medicine called Urokinase used to treat victims of pulmonary embolism and heart attacks caused by blood clots, is very costly to produce on earth. In space, Urokinase could be manufactured at one-tenth the cost making it available to literally thousands of patients who depend upon it to survive, yet who cannot afford it at today's prices.

Revolutionizing the Computer Industry

Silicon has supported phenomenal advances in computer technology. But designs for supercomputers are already on the drawing board. In order to make them work, a replacement for silicon must be found.

In the near-perfect vacuum of space, scientists will be able to grow crystals which cannot be grown on earth. Compared to silicon, these space-produced crystals generate less heat, use less electricity, and are less susceptible to interference by radiation. Some experts believe the overall impact of these crystals on the electronics industry could rival that of the transistor.

Advancing Communications

Satellites have already created a revolution in the communications field. More than two-thirds of all overseas communications are relayed by satellite. Before long, satellites will serve as conduits for two-way wrist telephone conversations and paging systems able to locate an individual anywhere on the globe.

Drawing Energy From Space

Solar power satellites, capable of drawing and redirecting huge quantities of energy radiated by the sun are an integral part of the military and commercial development of space. Such satellites will serve as a source of power for space stations, satellites and other space craft. They may also serve as a source of power on earth, converting energy from the sun into electricity and transmitting it to earth via a microwave beam.

Competing for Dominance in Space

If the United States does not take the lead in pursuing the economic opportunities which flow from the military and commercial development of space, other countries will rush in to fill the void. The Soviet Union is aggressively pursuing the military development and exploration of outer space. Leaders of the Soviet Union as well as leaders of the Free World know that if their nations are to maintain major power status, they must pursue the benefits of the high frontier of space.

Clearly, if the United States does not explore, develop and conquer the High Frontier, other Nations stand ready to do so.

Excerpt from a paper by John Goodman, National Center for Policy Analysis

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Is SDI Costly?

(Continued from page 1)

First, a change from our present all-offense strategy of MAD to a strategy of balanced offense and defense will save dollars in the U.S. budget over the long run. Once we are sure we can put up a reasonably good defensive system, we can start cutting the scale and cost of U.S. offensive systems.

Second, SDI promises to be one military program likely to return to the civilian economy more money than it takes out.

Experts place the gain between 6 and 14 dollars returned to the economy for every taxpayer's dollar spent on space. Thus, the technology for a non-nuclear SDI system will be of enormous value to future commercial developments in space.

Finally, SDI proponents should realize that their strongest argument is still a moral one. MAD is simply unacceptable from any viewpoint. Cost should be no obstacle to building an SDI system, for the millions of lives it will save make any cost pale in comparison.

You don't scrimp on the cost of locks and home security systems to protect your loved ones from danger. In the same manner, we should not scrimp on the cost of systems which offer us the means to protect millions of innocent people from nuclear holocaust.

High Frontier is not only an absolute necessity for the security of our country, it is a tremendous strategic bargain.

Liberal Alternatives

(Continued from page 1)

ment beyond the requirements of this treaty) none of the Congressmen has suggested how their bills would aid U.S. defense.

However, if these bills were to pass, delaying and hamstringing SDI indefinitely, they would be of enormous benefit to the Soviets and their very active anti-ICBM and related defense programs.

The spector of "obscene profits" to be gained by the "Merchants of Death" through SDI—one of the oldest cliches in liberal doctrine—has been raised by the Council on Economic Priorities, whose board lists the princes of liberalism in America.

Richard Garwin, scientist and vigorous opponent of SDI, and Carter's arms control negotiator Paul Warnke, recently issued a study on how U.S. defense contractors would profit from SDI research contracts.

We are only partly enchanted by Mr. Warnke's rhetoric: "What we see happening today is the rapid conversion of the President's 'star wars' proposal from stardust and moonbeams to that great pork barrel in the sky."

We wonder how you get all that on a demonstrator's protest sign.

The main complaint of the Garwin—Warnke report is that research contracts will go to those companies already most experienced in space development. Who else? J.C. Penney's?

Antis were prominent in hearings before the Senate Defense Appropriations Committee. All said a non-nuclear space defense would not work and would be too costly. Garwin and Gerard Smith, former arms control negotiator, said SDI would violate the ABM Treaty.

But, they all said, limited SDI research should continue in case the Soviets achieve a "breakout" in anti-ICBM defenses (a view shared by a number of liberal congressmen).

Question: How long would it take from such a Soviet "breakout" until the U.S. could translate "limited" research into deployable defense systems? And would the Soviets let us?

One of the more far-out witnesses was Prof. Sidney Drell of the Stanford University Center for International Security and Arms Control.

While declaring that non-nuclear kinetic energy weapons involve "much more difficult and far-out technology" (they already have been proved), he favors nuclear driven X-ray lasers in space and ballistic missile defenses using nuclear warheads.

Anti-nukes, Arise!

Meanwhile, the Soviets relentlessly continue their efforts to kill SDI at Geneva, while continuing to build their own anti-missile defense systems.

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Letter from the Editor

Dear Readers:

The key question to be answered this month by Congress is: How much money is it worth to save millions of lives in the event of nuclear war?

Dr. Jastrow, in testimony on Capitol Hill, argued for the economic benefits of developing non-nuclear defenses. However, opponents of SDI continue to lobby against our only real hope for protection.

Rather than suggesting a more viable strategic solution to defending the U.S. and its allies, the Congressional alternative is to reduce funding for SDI. It seems odd that the keepers of our national security, whose first responsibility in Congress is to DEFEND citizens of the U.S., cannot offer more practical alternatives to weapons they oppose. Even Rep. Aspin knows that for every complaint, one must offer an alternative.

High Frontier proposed a defense alternative in 1982. The study took 6 months and cost a half million dollars. Congress has had more than two years to take action and will probably spend more money than necessary to decide what High Frontier already knows . . . that the U.S. can be defended using current technology (which will, in turn, benefit the total economy) for $26 billion in 5 years.

Get with it guys! We cannot afford to let Congress neglect its duty in providing for the common defense of its constitutents. We cannot afford to balk on the answer to the most important question of this decade: What cost do we place on our survival?

Barbara R. Wheeler

What Would it Cost the Soviets to Overwhelm U.S. Strategic Defenses?

Statement by Professor Robert Jastrow, Before the Defense Appropriations Subcommittee of the Senate Appropriations Committee, 22 April 1985

The proposal to conduct research into methods of defending the United States from a Soviet nuclear attack seems to me to be very sensible. Some of my scientific colleagues, however, have been critical of this proposal. They point out that nuclear weapons are very destructive, and no defense can be 100 percent effective—at least, not against a massive attack involving thousands of warheads. Therefore, they say, a defense against Soviet missiles cannot protect the American people from the threat of nuclear destruction.

However, further thought reveals that this reasoning is not valid. Suppose our defense is 80 percent effective—a very conservative estimate, according to defense experts. That means we can shoot down four out of five 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 30 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.

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. In the Soviet calculus of gains and losses from military action, the potential losses from such an attack are bound to outweigh any conceivable gain.

But, some of my scientist friends say (as well as other critics of the Strategic Defense Initiative) that that means we are only protecting missile silos, not the American people. This is a false dichotomy, because any defense that discourages the Soviet leadership from an attack will add to the protection of the American people.

But how much will it add to their protection? Here is what Dr. James Fletcher, who headed the Defense Technologies Study Team, had to say about that, in an article in the National Academy of Sciences Journal, *Issues in Science and Technology*. Dr. Fletcher said it was clear to him; as a result of his panel's study, that a two-layer system—of the general sort envisaged in my article with Dr. Brzezinski and Ambassador Kampelman in the *New York Times*—could be effective enough "to protect most—perhaps even 90 or 99 percent—of the nation's population and infrastructure . . . against a full-scale nuclear attack."

Note that Dr. Fletcher did not say "missile silos"; he said, "population and infrastructure."

Dr. Fletcher went on to say that a complete three- or four-layer defense of that kind that, he said, could be deployed incrementally beginning in the 1990s, would have the potential of "protecting nearly all of the population—*perhaps even greater than 99 percent* . . . against nuclear attacks." That would be a defense so close to perfection as to blur the difference.

I spoke with Dr. Fletcher in January and asked him whether anything had happened to make him change his mind. He told me this statement remained his best judgment and he stood by it.

The question then remains as to whether such a defense will be cost-effective. That is, can the Soviets overwhelm our defense at less cost to them than the cost to us of building it?

Soviet leaders have threatened to do this. A Soviet spokesman said a little while ago that if the U.S. puts up a shield against Soviet missiles, then the Soviet Union "will do its best to get a sharper and heavier sword." In other words, the USSR will build more missiles in an effort to overwhelm our defense. The result, he said, will be an acceleration of the arms race, and more nuclear weapons in the world.

But some thought and calculation indicate that this Soviet threat is empty. Suppose the United States puts up a two-layer defense using smart bullets—a relatively mature and unexotic technology. And suppose this defense can shoot down—as an extremely conservative estimate—80 percent, or four-fifths, of the Soviet missiles and warheads in a mass attack. That defense is not a nebulous possibility; it depends on technologies that already exist, and it could be in place today if we had started to work on it five years ago.

Suppose now that the Soviets decided they wanted to build enough missiles and warheads so the number getting through our two-layer defense would be the same as the number that would have reached the United States if we had no defense. This is what "overwhelming the defense" means. Now, the Soviets have 1400 missile silos and missiles that could be launched in a nuclear first-strike against the United States. **To overwhelm our defense, they would have to launch five times as many as they now have, or 7000 missiles.**

But to get their arsenal of missiles up to 7000, the Soviet Union will have to build an additional 5600 missiles. The USSR spent approximately half a trillion dollars in the last 20 years on building the 1400 land-based missiles it now has. To add 5600 more

missiles—four times as many—to its arsenal would cost 4 × $500 billion or *$2 trillion more*. The Soviet Union would be very hard pressed to spend another $2 trillion on missiles in the next five or six years, on top of its present military outlays.

Ambassador Nitze has said we must look at the question in another way. What is the ratio of *marginal costs*? For each extra dollar we spend on our defense, how many dollars will the Soviet Union have to spend on countering that dollar's worth.

The point here is that if we put our defenses in place incrementally, and it costs the Soviets less money to counter each addition to our defense than it costs us to build that addition, they win; they can outbuild us. But if their "marginal cost" is greater—if it costs them, say $2 to counter our defense for every dollar we spend on making that defense better, then we win, because if they try to outbuild us, they will go bankrupt before we do.

This question of marginal cost, or cost ratios, has been looked at by experts in the Department of Defense and scientists at Los Alamos and Livermore. The Los Alamos team found that for the kind of defense envisaged as the second layer of our two-layer, smart-bullet defense—that is, the defense that intercepts Soviet warheads in the final stages of their flight as they descend towards their targets—the ratio of costs favors our defense over their offense by at least *three to one*. In other words, if the Soviets want to overwhelm our defense, they must spend three dollars on adding missiles and warheads, for every dollar we spend on making our defense better. With a ratio like that, they would find it exceedingly costly to accelerate the arms race by building more missiles, as they have threatened to do.

What about the marginal costs for the first layer of the defense—the so-called space-based or satellite layer? If this space-based defense is of the off-the-shelf variety, using smart bullets, the satellites in the American defensive screen will cost approximately half a billion dollars each. One of these satellites can destroy, on the average, 14 Soviet SS-18 missiles. The Soviet missiles cost, very conservatively, $100 million each, or $1.4 billion for 14. Comparing this to the cost of our satellite, the ratio of costs favors the American defense over the Soviet offense by about three to one—the same as the ratio of costs for the first layer of the defense.

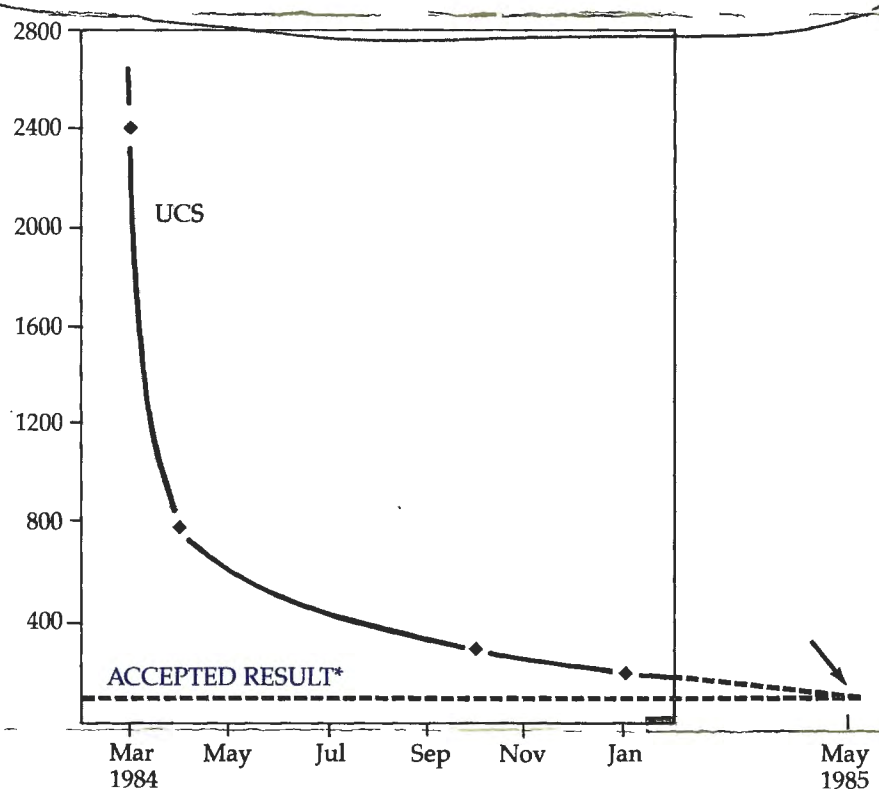
So the bottom line is that whether we look at the lump sum expenditures for the initial reaction to a defense, or at the marginal costs, the ratio of costs heavily favors the defense over the offense. This would be true for the Soviet response to an American "Star Wars" defense, or the American reaction to a Soviet "Star Wars" defense.

No development could be more favorable to the cause of ending the nuclear arms race and eliminating nuclear weapons from the world. For the meaning of these results is that if both the U.S. and USSR put a defense against missiles in place, neither country will be able to overwhelm the other's defense by building more missiles, and both nations must then recognize the futility of a continued competition in the building of offensive weapons of mass destruction.

Of course, we have not built this defense yet; the basic technology of the hit-to-kill kinetic energy weapon—unlike the laser or the neutral particle beam—is fairly mature, but we have not assembled and tested the whole system. Still, the technology seems to be very promising, and the cost ratio, as far as it can be worked out at this stage, is also very favorable.

Furthermore, the American people want this defense. According to a poll sponsored by an educational foundation with which I am associated, 90 percent of the American people want their government to defend them from Soviet nuclear attacks. In fact, 74 percent, according to the same poll, believe we should be spending as much as, or more than, the amount requested for research in the FY86 budget into a defense against Soviet missile attacks.

Number of Satellites Needed for Defense
History of Union of Concerned Scientists Estimates



*Los Alamos
Rand
General Research
Livermore

Technology Speeds SDI Progress

"Star wars" research is multiplying, almost on a monthly basis, the feasibility of using laser beams fired from space to intercept a nuclear missile in its most vulnerable, early-launch or boost stage over the Soviet Union said President Reagan's science advisor. George A. Keyworth II recently told reporters that proof of technological feasibility of ICBM boost-phase intercept could be cut to three years from the current five projected.

"The implications for boost-phase intercept for defense strategy are monumentally different . . . If you can destroy the missile while it is still over the Soviet Union—before it can be multiplied—you have effectively nullified the effectiveness of the ballistic missile as a delivery system," said Keyworth.

He said that the feasibility of achieving boost-phase intercept has become greater and greater by factors that multiply on the basis of just a few months.

"If we could apply the kind of vigor we're seeing in those industries successfully competing with the Japanese, which could be done within the budget proposed by the President for five years, I think we could cut two years off what I call the five-year proof," he added.

In its first annual report to Congress, the SDI Office reported that very promising progress has been made in laser technology.

Developments include small "excimer" lasers which, the report says, would be capable of being launched into orbit and shooting at enemy missiles just ascending from their launch pads.

Questioned about recent claims by critics that "star wars" research would involve testing of components in violation of the 1972 Anti-Ballistic Missile Treaty, which prohibits the testing of missile defense systems, Mr. Keyworth said these criticisms pertain mainly to ground interceptors, which are further along in development.

"The kinds of tests that I think are critically important to developing, to proving the principles required to intercept ballistic missiles in their boost phase, are not as now constrained by the treaty," he said.

Aspin Says Democrats Weak on Defense

Congressman Les Aspin (D-Wisc), chairman of the House Armed Services Committee, recently called on the Democratic party to shed its image as the "Doctor No of the defense debate."

Democrats must erase the perception of their being "soft on defense," Rep. Aspin told the Coalition for a Democratic Majority at a recent dinner.

"On specific weapons Democrats have stood for negatives," he said. "Democrats have been cast consistently in the role of chief anti. Anti-B-1 bomber. Anti-neutron bomb. Anti-MX [missile]. Anti-Strategic Defense Initiative. And thus, in the public mind: anti-defense."

He said Democrats should propose practical alternatives to weapons they oppose.

A major criticism of Democratic and liberal opponents of SDI is that they never suggest or support alternatives to SDI except continued reliance on the failed and enormously expensive policy of Mutual Assured Destruction (MAD) and trust in the Soviets through adherence to the ABM Treaty.

"The voters are not attracted to national security naysayers," he said. "Democrats long have been attacked as being weak on defense," he added, "and what is especially harmful (to Democrats) is that the same opinion is held by moderate voters."

Rep. Aspin recently stated that the President's SDI program "is full of holes." The committee he chairs, the House Armed Services Committee, voted to cut the Administration's request for an SDI appropriation of $3.7 billion to $2.4 billion.

Adelman Discusses ABM and SDI

"Our strategic defense research efforts are fully consistent with our ABM Treaty obligations," said Kenneth L. Adelman, Director of the U.S. Arms Control and Disarmament Agency, in a recently published statement.

But, he pointed out, the Soviet anti-ballistic missile defense programs suggest that they are moving toward a nationwide anti-ballistic missile capability—a violation of the letter and whole thrust of the ABM Treaty.

Moscow has an extensive air defense program and is continuing vigorous research on lasers and neutron particle beams, he said. "Overall, the Soviet Union spends some 10 times more than the U.S. on defense. Even more startling, in the years since the signing of the ABM Treaty, the Russians have spent roughly as much on strategic defense as on strategic offensive forces."

"To me, the main threat to the ABM Treaty lies elsewhere," he said. "The treaty was founded on an assumption that limits on defensive systems would be followed by limits on offensive systems. This assumption has not been borne out—largely because Moscow has been unwilling to agree to deep reductions."

In discussing SDI, he said, "A less than perfect defense could hold out hope against an unauthorized or unintended nuclear attack. Today, a President has the choice of accepting the destruction of a city or two or retaliating in kind, or both. It would not be a desirable alternative."

"A second factor is the ethical dimension," continued Adelman. "Surely, if we find that some defensive systems can reduce the risk of war, then morality should drive us hard in that direction."

"It Can't Be Done"

A favorite claim of SDI opponents is that it won't work—can't be done.

Mr. Leonard Weitz, a High Frontier supporter in New York, sends an interesting parallel.

On Jan. 12, 1920, in the New York Times, the famous space and rocket pioneer Dr. Robert H. Goddard, under auspices of the Smithsonian Institution, stated that it would be possible to send a rocket to the moon.

On its editorial page, the Times commented that this would be impossible, since once it left earth's atmosphere the rocket would have nothing to push against.

"Professor Goddard . . . does not know the relation of action to reaction . . . Of course he only seems to lack the knowledge ladled out daily in high schools."

HIGH FRONTIER FRONTLINES

High Frontier Expands its Speakers Bureau

Despite the negative campaign against "star wars," most Americans, once presented with the correct information, come on board the High Frontier.

The cutting edge of High Frontier's educational efforts continues to be the valuable work of our many supporters who have unselfishly volunteered their time and talent to speak publicly about the High Frontier defense.

As public interest in the issue continues to grow, so does the demand for High Frontier speakers.

In order to fulfill the increasing number of speaker requests which pour into the office each month, High Frontier recently brought in over 120 individuals from across the United States and Canada to participate in a speakers' training program.

The three-day seminar consisted of concentrated lectures by Gen. Graham and other nationally known political leaders on the technical, moral and political aspects of High Frontier.

These newly-trained and highly qualified speakers greatly increase the availablility of a speaker in your area. If you would like to arrange a High Frontier debate, seminar or lecture in your community, please contact Carol Hale or Kathleen Dietz in the High Frontier office. They will put you in touch with a speaker in your state or region.

Seminar Comment

Dear Danny,

To participate in such a major and long overdue revolution in thinking and strategy is a privilege that only a few people in any particular age ever come to know. To do so under your inspiring leadership is icing on the cake.

It is inspiring just to see so many competent people, young and old, do their thing with such enthusiasm and energy. This country will surely go on to even bigger and better things with a new generation like those you have assembled in High Frontier to take over soon.

Most sincerely,
John H. Morse

Get Your Youth Petitions In

Many of the High Frontier youth petitions, which were sent in the May newsletter, have not yet been returned to the High Frontier office.

It is our goal to collect 100,000 signatures from young people across the country to show America's leaders that young people not only want, but deserve a future free from the threat of nuclear war.

We need your help to insure that this vitally important project is a success. Mail your signed petitions to Lisa Desiderio in the High Frontier office.

High Frontier Receives Endorsements

High Frontier recently received endorsements from two distinguished organizations, the Daughters of the American Revolution and the Southeastern Idaho Chapter of the Reserve Officers Association.

The Daughters of the American Revolution passed a resolution calling for the development and deployment of President Reagan's Strategic Defense Initiative at its national meeting in Washington, D.C. last month.

The resolution stated that the National DAR will "Affirm that the Strategic Defense Initiative is a necessary strategy, and call for development and deployment of defensive technologies that can permit the nation to intercept deliberately or accidentally fired strategic ballistic missiles before they reach the boundries of the United States, and that this system not be negotiable in any arms control discussions."

At its May 4 meeting, the Idaho Reserve Officers' Association passed a similar resolution supporting the President's non-nuclear Strategic Defense Initiative.

These endorsements by the National DAR and the Idaho ROA are two of the many High Frontier resolutions passed by various service and patriotic organizations in the last year. Some of these organizations include the American Legion, the Veterans of Foreign Wars and the American Farm Bureau.

We encourage our supporters to work for the passage of High Frontier resolutions in their member organizations on the local, regional and national level.

High Frontier to Boost Commercial Space Uses

The Strategic Defense Initiative represents one of the most vital American initiatives of the nuclear age. Nevertheless, High Frontier has never forgotten that, where our national future is concerned, the military aspect represents only "the tip of the iceberg."

Today, High Frontier is taking a bold step toward reviving America's interest in the vast potential of outer space. Effective June 6, High Frontier will establish a new Commercial Space Division. The basic goals of this division will include:

—Educating the public on the vast potential of outer space, and the need to develop that potential.

—Establishing a broad-based constituency for a national "great leap forward" in space.

—Researching current and emerging proposals for space development.

—Encouraging innovative thinkers to develop new proposals for an American return to space.

This new division will be headed by High Frontier staff member Steven Adragna, who is currently responsible for a variety of research and analysis projects.

Concerned Scientists?

In our March newsletter we exposed the Union of Concerned Scientists for what they really are; mostly non-scientists and peace activists who oppose all U.S. strategic program proposals, including non-nuclear space defenses, who fraudently say they represent all or most credible U.S. scientists who oppose SDI.

The credibility of the UCS was questioned in an issue of Time, Inc.'s magazine "Discover," confirming what High Frontier has been saying about this group for years. Excerpts follow.

"The Union of Concerned Scientists. To those who follow the news, the name conjures up an image of masses of scientists, all looking concerned about nuclear energy. Indeed, few reporters complete their stories about the problems or progress of nuclear power plants without soliciting comments from the UCS.

"As a result, though the organization is also actively crusading against the nuclear arms race, it has become best known for its widely quoted views about nuclear power. Boiled down, the message conveyed by the UCS is clear: nuclear plants are inherently unsafe, and if they cannot be made safe, they should be shut down before a disaster occurs.

"That viewpoint, supposedly supported by a large number of scientists, has had a powerful impact on public opinion and on the future of the nuclear power industry. But what the public, and apparently most of the press, does not know is that the UCS represents neither science nor most scientists.

"Although five of the nine members of its board of directors are scientists, the directors have little to do with the day-to-day operations and nuclear energy pronouncements of the UCS. These are left to the energy staff, which consists of two lawyers, two non-scientist researchers, a policy analyst, two scientists, and a Navy-trained nuclear engineer.

"In fact, despite the UCS's claim to some 100,000 members, or sponsors, as it calls them, it is far from the voice of science. Its sponsors are people who have read the UCS mail solicitations and contributed an average of $17 each to support the cause. How are they recruited? "We trade mailing lists, just like everyone else," says Howard Ris, the UCS deputy director. But how many of the members are scientists?

"Not only does the UCS not know, but in 1981 it refused to cooperate when two political scientists—Stanley Rothman of Smith College and Robert Lichter of George Washington University—asked to poll UCS sponsors to determine their scientific backgrounds.

"Fear of nuclear energy is widespread among Americans. That is a tribute to the public relations skills of the UCS and the gullibility of reporters who accept its views as scientific gospel."

High Frontier supporters should know who this group is and be skeptical of their policies on SDI. They deserve the epithet, "Union of Confused Scientists."

Quotable Quotes

With the ABM Treaty—which tries to limit technology, an ambiguous and changing thing—nearly everything is a gray area. So under the double standard that arms controllers seek to apply, Soviet activity right up to the point of a nationwide ABM capability is "gray" and therefore allowable. But at the same time, U.S. research is also gray—but therefore not allowable. That there can even be a heated debate on whether this-or-that test is a violation point illustrates the inherent, abject flaw of the ABM Treaty.

Wall Street Journal
Review & Outlook
23 April 1985

UNION OF
CONCERNED
SCIENTISTS

ISSUE BACKGROUNDER

Date: 4 April 1986

Contact: Charles Monfort (202) 332-0900
Bobby Herman

STAR WARS: MYTH vs. REALITY

MYTH #1: SDI WILL PROTECT AMERICAN PUBLIC FROM NUCLEAR ATTACK

The Reagan administration has repeatedly implied that the purpose of its Strategic Defense Initiative (SDI) is to protect the American population from nuclear attack. That is not the goal of the program. The president may have initiated the SDI as a means of rendering nuclear weapons "impotent and obsolete," but SDI officials now speak of radically different objectives.

The SDI has steadily evolved into a program designed to enhance deterrence. The "new" SDI envisions a world in which both sides would continue to rely on the threat of nuclear retaliation to deter the other from launching an attack. Nuclear weapons and not missile defenses, therefore, will remain the "guarantors" of US and Soviet security. To this end, instead of protecting cities and citizens from nuclear attack, the SDI is now focused on the defense of missile silos and other military installations.

ASTRODOME DEFENSE REJECTED

The SDI is popularly perceived as an astrodome defense that would make the US invulnerable to Soviet nuclear attack. This image has been repeatedly encouraged by the president, who described

it as a "space shield" that would "set us free from the prison of nuclear weapons."[1] Others have called it a "peace shield."

Those people actually responsible for the program have said that no such shield is feasible. General James Abrahamson, Director of the Strategic Defense Initiative Organization, made clear the limits of the program when he said that "a perfect astrodome defense is not a realistic thing."[2] Abrahamson later clarified the less ambitious goals of the SDI on March 4, 1986 during testimony before the House Committee on Armed Services, when he stated:

> The goal of the Strategic Defense Initiative is to conduct a vigorous program of research on emerging technologies in search of a better basis for a credible deterrence [sic] and strengthen the stability of peace through strategic defense.[3]

Robert S. Cooper, Director of the Defense Advanced Research Projects Agency, has testified before Congress that "...in order to guarantee the population of the United States that they would be safe from the threat of ballistic missiles, we would have to build a perfect defense, no leakage. We do not see the combination of technology we have today guaranteeing that."[4]

These assessments by administration officials closest to the program were supported by a recent poll of more than 500 physicists conducted by Peter Hart Research Associates at the request of the Union of Concerned Scientists. Sixty-seven percent of those surveyed said it was improbable or very unlikely that SDI could defend the population as a whole.

In addition, 87% of those polled said it was very likely or somewhat likely that the Soviets would deploy countermeasures to render a US system ineffective. These countermeasures would be designed to overwhelm the system, fool radars and other sensors, avoid attack by flying under the SDI umbrella, disperse or dispel the force of attack, or directly attack vital components of the system.[5]

Without a leakproof defense there can be no population defense. The unprecedented destructive power of nuclear weapons means that only a perfect defense can protect the general population. A single nuclear bomb detonated on or above a city could destroy it entirely; a small number of nuclear explosions in the United States would be the most devasting event in American history. Even with a 95% effective defense, approximately 500 Soviet strategic warheads would land on American territory -- an average of ten per state.

Recent studies agree on the implication of such a defense. In one case, the Office of Technology Assessment, the US Congress's independent, non-partisan research arm, concluded that a 99% effective defense could result in 25 million casualties.[6] The US Arms Control and Disarmament Agency has reported that a 98% effective defense would cause 20 million to 40 million immediate deaths. A 90% effective defense would result in 75 million to 95 million immediate deaths.[7]

The President's dream of replacing Mutual Assured Destruction (MAD) with a policy of Assured Survival has vanished. The administration is now proceeding with the SDI as a way to bolster the existing strategic relationship. The SDI is designed to extend our reliance on the strategy of deterrence.

The enhancement of deterrence has become the central focus of the program. As stated in a White House document on the SDI, "providing a better, more stable basis for enhanced deterrence is the central purpose of the SDI program."[8]

In other words, the administration does not expect to make nuclear weapons "impotent and obsolete." Rather, it is working to develop more weapons to protect the weapons already in the US arsenal. In simple terms, the SDI will defend missiles, not people.

ENHANCING DETERRENCE

Before the United States embarks on a program to "enhance deterrence," we need to ask two questions: 1) Does deterrence need enhancement? 2) If so, what is the best way to do it?

Most analysts have concluded that the current strategic balance is stable, and that deterrence can effectively protect the United States against Soviet attack for some time to come. So long as both superpowers have confidence in the survivability of their strategic retaliatory forces, neither side has an incentive to initiate a nuclear strike. As a result of this "crisis stability," the use of nuclear weapons is unlikely since the costs and risks attending nuclear aggression far outweigh any anticipated political or military gains.

During the 1970s, there was concern that the US ICBM force would not survive a Soviet first strike -- the so called "window of vulnerability." The President's Commission on Strategic Forces, chaired by General Brent Scowcroft, examined this question in depth and cast doubt on the notion that the land-based leg of the triad was vulnerable to a Soviet attack. The Commission's final report concluded:

> The existence of several components of our strategic forces permits each to function as a hedge against possible Soviet successes in endangering any one of the others... [Each] component of the strategic forces... makes a major contribution to deterrence even if its survivability depends in substantial measure on the existence of one of the other components.../9

Nevertheless, the US should continue to ensure the retaliatory capability of its strategic forces. This may include certain steps to ensure the survivability of the triad's land-based leg. While the goal of SDI is to deter a Soviet attack by enhancing prospects for survival of the ICBM force, there are other less expensive and less destabilizing ways to achieve the same objective. New "superhardened" silos better able to protect

reliance on offensive deterrence

ICBMs against nuclear attack are being developed. Alternatively, a greater portion of the US deterrent force could be moved to sea. New programs would stress mobility and survivability much more than in the past.

One such program, the Midgetman mobile missile, is already well underway and could provide a more survivable ICBM force. According to Gen. Glenn Kent (USAF Ret.), "increasing the number of aim points has much the same effect as defense, except it's cheaper."[10] The 10-year costs for development, production, and operation of a 500 missile Midgetman force might exceed $40 billion. The 10-year SDI research and development program will cost $70 billion. Production, deployment, and operation of a Star Wars system would run into the hundreds of billions of dollars; according to James Schlesinger, former US Secretary of Defense, Star Wars could cost a trillion dollars.[11]

A negotiated arms control agreement banning flight tests of new missiles, or of new multiple warhead missiles, would place a cap on missile accuracy and thus the threat to silos. A treaty banning nuclear tests would likewise prevent the development of a new generation of more lethal warheads.

Seen in this light, the SDI is simply one of many options available for the goal of enhancing deterrence. If SDI is to be funded with that mission in mind, it must be compared with other systems designed to achieve the same purpose. Superhardened silos, mobile ICBMs, and arms control agreements all could contribute to enhanced deterrence, but would avoid the enormous expenditure of resources and threat to strategic stability associated with Star Wars.

Footnotes:

[1] National Television Speech (23 March 1986).
[2] "Star Wars Chief Takes Aim at Critics," Science (10 August 1984): 600.
[3] James A. Abrahamson, Statement on the Strategic Defense Initiative before the House Committee on Armed Services (4 March 1986): 1.
[4] US Senate, Committee on Armed Services, Hearings on the FY85 Defense Authorization Act (6 March 1984).
[5] For a general discussion of countermeasures, see Union of Concerned Scientists, Fallacy of Star Wars (October 1984); for an evaluation of the problems of discriminating warheads from decoys, see SDI: Progress and Challenges, Staff Report to Senators William Proxmire, J. Bennett Johnston, and Lawton Chiles (17 March 1986).
[6] Office of Technology Assessment, Ballistic Missile Defense Technologies (November 1985): 287.
[7] US Arms Control and Disarmament Agency, US Urban Population Vulnerability (August 1979).
[8] The White House, The President's Strategic Defense Initiative (January 1985): 3; see also US Department of Defense, Report on the Strategic Defense Initiative (March 1985).
[9] Report of the President's Commission on Strategic Forces (April 1983): 7-8.
[10] US Senate, Committee on Armed Services, Hearings on the FY85 Defense Authorization Act (6 March 1984): 12.
[11] James A. Schlesinger, Speech before the National Security Issues Symposium (25 October 1984): 4.

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UNION OF
CONCERNED
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ISSUE BACKGROUNDER

Date: 18 April 1986 Contact: Bobby Herman (202) 332-0900
Charles Monfort

STAR WARS: MYTH vs. REALITY

MYTH #2: SDI WILL LEAD TO REAL ARMS CONTROL

One of the principle arguments used in support of the Strategic Defense Initiative (SDI) program is that it will help bring about "real arms control". Through the introduction of highly effective defenses, it is asserted, offensive ballistic missiles would lose their utility and thus be readily bargained away. In this fashion, SDI proponents allege, the nuclear arms race finally could be brought under control. In reality, the opposite outcome almost certainly will occur: offensive forces will multiply greatly and arms control will become far more difficult. Star Wars will become the main obstacle to arms control, not a catalyst for progress.

DEFENSES STIMULATE OFFENSES

History has clearly demonstrated that defensive weapons stimulate offensive reactions. When the Soviet Union began construction of a ballistic missile defense (BMD) system around Moscow in the 1960s, the US did not respond by abandoning or bargaining away its ballistic missiles; on the contrary, the US introduced a dramatic new offensive measure -- the multiple, independently targetted reentry vehicle, or MIRV -- specifically designed to overwhelm the Moscow defense.

Through the MIRVing of land and sea-based missiles, the US offensive arsenal grew from 2000 to 7000 warheads over the course of nine years. Former Secretary of Defense James Schlesinger has explained that an even larger offensive response was contemplated: "We were talking about 50,000 warheads to overcome Soviet defenses. In other words, we were going to expand geometrically our offensive capabilities to deal with the defense."[1]

A similar US reaction met the improvement and expansion of Soviet anti-aircraft defenses through the 1970s. Rather than forego the strategic bomber leg of the nuclear triad in the face of upgraded Soviet air defenses, the US introduced two new bombers, the B-1 and Stealth, and the radar-defying cruise missile -- all specifically designed to penetrate the Soviet defense.

In yet another example, when the Soviets began to harden their missile silos against nearby nuclear bursts, the US countered with a highly accurate new warhead for the MX missile to enable it to strike closer to the target. We did not abandon our ICBM force in response to this new Soviet "defensive" measure. To the contrary, we beefed-up up our missile force to overcome it.

While recent history contains no instances in which the USSR acted to thwart an American defensive deployment, one can deduce from the pattern of previous US responses and from current Soviet pronouncements that Moscow can and will move to overcome a Star Wars missile defense system.

While claiming that the Soviets would disarm in response to the SDI, Pentagon officials are preparing to do just the opposite in the event of a comparable Soviet system. The Air Force is developing advanced "penetration aids", such as sophisticated decoys, zig-zagging warheads, and laser-hardened missiles, to ensure the ineffectiveness of any future Soviet defense.[2] Moreover, Secretary of Defense Weinberger has counseled the

president to "increase the number of our offensive forces and their ability to penetrate Soviet defenses," in the event that such defenses are ever deployed.[3]

The pattern is clear, advances in the defense merely spawn countervailing innovations in offensive strategy and weaponry. Neither side will allow its deterrent forces to be rendered obsolete by the other's defense. This has been the story of the arms race. That there is no precedent of defenses stimulating the abandonment of offenses is corroborated by the Pentagon's own plans for defeating any possible Soviet missile defense system.

THE SOVIET RESPONSE TO SDI

Within days after President Reagan's March 1983 Star Wars speech, then Soviet leader Yuri Andropov said, "Should this conception be translated into reality, it would in fact open up the floodgates to a runaway race of all types, both offensive and defensive."[4] Soviet commentators have since stated repeatedly that a US defense would be met by a determined and massive acceleration of Soviet weapons. There is little reason to doubt such warnings.

SDI officials have admitted that one of the most likely Soviet responses would be "increasing missiles, warheads, and penetration aids in an attempt to saturate the defense."[5] A 1985 report to Congress from the SDI agency concedes that "the number of Soviet ballistic missile warheads could increase to at least twice their current levels with only a modest increase in the number of ballistic missile boosters."[6]

Because Soviet land-based missiles are so large, Moscow is in a prime position to greatly expand the size of its offensive force in response to the SDI. The Soviets could double their offensive arsenal by simply increasing the number of warheads on their 308 SS-18s from 10 (the proscribed limit under the SALT II accord) to

30 (the number they are capable of carrying, according to the Joint Chiefs of Staff). The Soviets also could be expected to build more cruise and other missiles to thwart or overwhelm a US defense system.

Studies conducted by the Congressional Research Service and the Federation of American Scientists have shown that a threefold to fourfold increase in Soviet forces could occur between now and 1995 in the event of an unconstrained US-Soviet arms competition. Existing arms control treaties establishing numerical ceilings on various categories of offensive weapons, such as SALT II, clearly would be jettisoned if either side were to pursue the development of a missile defense system. This could hardly be considered "real arms control".

IMPACT ON THE ARMS CONTROL PROCESS

The development and testing of exotic new defensive weapons will make arms control increasingly difficult, if not altogether impossible. The 1972 Anti-Ballistic Missile (ABM) Treaty banning nationwide missile defense systems would be a sure casualty of such a course, yet without strict limits on defenses there would be no incentive for the Soviets to reduce their offensive nuclear forces. In the words of General Brent Scowcroft, head of the President's 1983 blue-ribbon Commission on Strategic Forces: "It would be very difficult to induce the Soviets to reduce their offensive forces if they faced the prospect of a strategic defense for which they might need those offensive forces to penetrate."[8]

The US Arms Control and Disarmament Agency affirmed the potentially disruptive effect of the SDI on arms negotiations in its 1986 arms control impact report: "The uncertainties regarding the potential results of ABM research could make negotiations on the constraint of offensive forces more complex, particularly if the Soviets calculate that they can counter the SDI with offensive deployments of their own."[9]

CONCLUSION

The notion that the SDI will produce progress on arms control is contradicted by past and present policies of both the US and the Soviet Union. Both superpowers will respond to defensive deployments by improving and expanding their offensive arsenals. US and Soviet military establishments are already engaged in research aimed at ensuring that no future defense succeeds in rendering nuclear weapons "impotent and obsolete." At the same time, development of defensive weapons by one side will be matched by the other.

A clear trade-off is now facing the nation: We can have Star Wars or arms control, but we cannot have both. Rather than spawning genuine arms control, Star Wars will become the paramount stumbling block to an agreement to reduce dramatically the superpowers' nuclear stockpiles. The goal of 50% reductions in strategic nuclear weapons agreed to by Reagan and Gorbachev at the Geneva summit cannot be realized if the development of missile defenses is allowed to proceed unconstrained.

Star Wars cannot be reconciled with the primary goal of arms control: enhancing strategic stability in order to reduce the risk of nuclear war. Collapse of the existing arms control regime precipitated by Star Wars will undermine US security by removing restraints on the deployment of both offensive and defensive weapons and by heightening US-Soviet tensions. The inevitable deterioration in superpower political relations resulting from an accelerating arms competition will further diminish the prospect of securing arms control agreements.

Footnotes:

1 MITRE Conference Speech, Bedford, Massachusetts, October 25, 1985.
2 "Confusion Over Star Wars," New York Times. (November 22, 1985): B-8.

3 "Air Force Seeking More Wily Missiles," New York Times. (February 11, 1985): A-2.
4 "What Moscow Might Be Doing in Replying to Star Wars," New York Times. (March 6, 1985): A-1.
5 Report to Congress on the Strategic Defense Initiative. (March 1985): 13.
6 Ibid.
7 US-Soviet Strategic Nuclear Forces: Potential Trends With or Without SALT, Congressional Research Service. (October 5, 1984).
8 Interview: Brent Scowcroft, New Perspectives Magazine (Fall-Winter 1984-85).
9 Fiscal Year 1986 Arms Control Impact Statement, Arms Control and Disarmament Agency. (April 1985): 42.

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The Union of Concerned Scientists is an independent, non-profit public policy organization based in Cambridge, MA. Founded in 1969 as an informal faculty group at the Massachusetts Institute of Technology, UCS now has over 100,000 sponsors nationwide. Its research, public policy and lobbying activities focus on national security and energy policy.

UNION OF
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ISSUE BACKGROUNDER

Date: 25 April 1986 Contact: Robert Herman (202) 332-0900
Charles Monfort

STAR WARS: MYTH vs. REALITY

MYTH #3: SDI IS STRICTLY A DEFENSIVE PROGRAM

Administration officials claim that the Strategic Defense Initiative (SDI) is strictly a defensive weapons program. President Reagan may earnestly believe this, but the technologies under development within the SDI could be used for a variety of offensive applications.

When paired with highly accurate strategic nuclear weapons, a system designed to destroy incoming ballistic missiles will necessarily be viewed by the other superpower as an effort to gain nuclear superiority and a first strike advantage. As President Reagan has stated, "....if someone was developing such a defensive system and going to couple it with their own nuclear weapons--yes, that could put them in a position where they might be more likely to dare a first strike."[1] A space-based defense also could be used to attack an adversary's satellites, including the opponent's orbiting defense.

Once these possible offensive missions are taken into account, the SDI assumes an entirely different character than the one popularly portrayed by program supporters. Rather than a bold departure from entrenched patterns of superpower arms rivalry, the research and development of missile defense technologies will spawn an intensified arms race as both sides move to counter the offensive threat posed by these new weapons.

PARTIAL DEFENSES AND FIRST STRIKE

The only form of defense within reach of either superpower is a partial defense, one capable of intercepting a portion -- but certainly not all -- of an opponent's attacking missiles. (The development of a leakproof defense has been widely rejected by SDI proponents and critics alike.[2]) If matched with a robust offensive force, a less than perfect defense would be most useful for destroying the relatively small number of surviving nuclear missiles with which an adversary could retaliate after having absorbed a first strike. In other words, a nation partially protected by a "shield" might be tempted to wield the "sword" against its adversary.

If both the US and USSR had a mix of offensive and defensive forces, the nation that launched first would have a clear advantage. The initiator hypothetically could destroy many of the opponent's nuclear forces before they left their silos, ports, and airfields, then use its limited defensive capabilities to intercept a significant portion of the diminished retaliation. (See the following section on the role of anti-satellite weapons in an attack on an opponent's missile defense system.)

While the missiles that leaked through certainly would result in millions of casualties, the attacking nation might still calculate that the damage was sufficiently "limited" to warrant such an action. A combination of offensive and defensive forces also could give rise to a pre-emptive attack by a nation fearing that its adversary was preparing to strike first. For these reasons, missile defenses would create a world in which the nuclear forces of the US and USSR would be poised on hair-trigger alert, further increasing the risk of nuclear war, especially in a crisis.

Given the current array of strategic forces, neither the US nor the Soviet Union has an incentive to launch a nuclear attack

because the costs and risks attending such a course far exceed any conceivable political or military benefits accruing to the aggressor. But this existing strategic stability will be dangerously undermined with the development of missile defenses. The mutual fear and suspicion that helps sustain the arms race would be exacerbated and both sides' security compromised. President Reagan recognized this eventuality when he said that defenses "if paired with offensive systems can be viewed as fostering an aggressive policy and no one wants that."[3]

Yet the Defense Department is already developing a plan to integrate offensive and defensive forces.[4] Soviet war planners are sure to be exploring parallel warfighting strategies. In a world of superpower ballistic missile defense (BMD) systems, both nations will live in perpetual fear of a disarming first strike.

THE ASAT-SDI LINK

Another potential offensive mission for the Star Wars program is attacks on an adversary's satellites (see **Figure 1**). Military planners have shown keen interest in the anti-satellite (ASAT) uses of SDI technologies. Compared to the daunting task of missile defense, the ASAT mission is fairly simple. Advanced ASAT weapons will emerge as early spin-offs of the SDI.[5]

The SDI is exploring an array of technologies that could be delivered from space or through space to intercept Soviet missiles in their early stages of flight. Any one of these exotic technologies could far more easily destroy vulnerable satellites than defend against a massive missile attack.

One of the SDI's main projects is the space-based laser. According to Robert Cooper, a leading SDI official, a space-based laser would be a "devastating ASAT."[6] "The firepower and flexibility of such a laser weapon," Cooper adds, "would be very difficult to defend against."[7] The same is also true of

THE ASAT/BMD OVERLAP

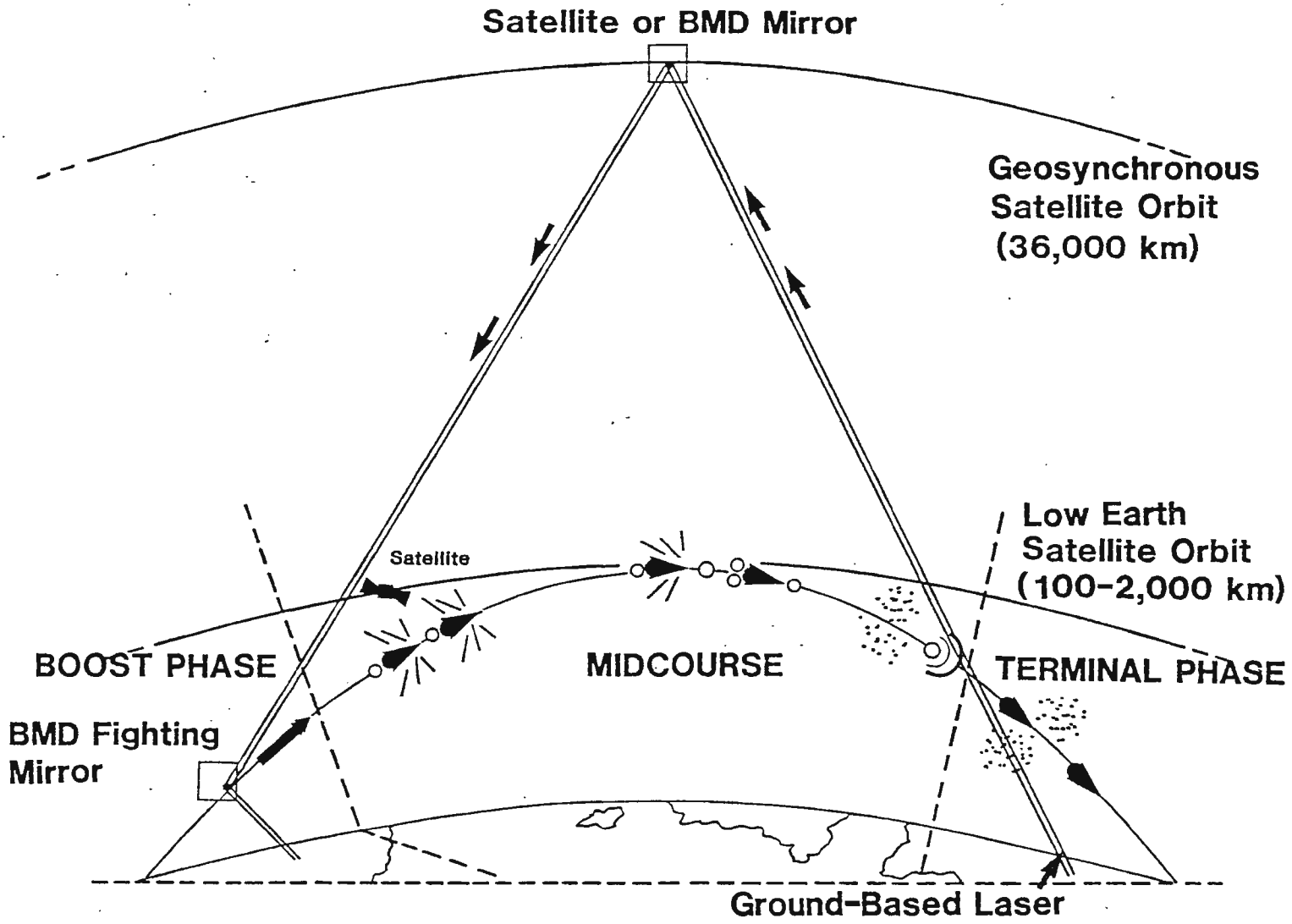

Figure 1. The overlap between ASAT and BMD technologies is the result of the similarity between the two missions. A weapon designed to attack a missile traveling through space could also be used to attack a satellite or a BMD battle station; these different targets would have similar flight characteristics. This similarity is most evident when considering a satellite in low earth orbit and a missile warhead during midcourse; the two objects have essentially the same altitude and velocity. Any midcourse BMD system, such as the Homing Overlay Experiment (HOE) tested in June 1984, could serve as a potent ASAT against low orbit satellites. The ASAT-BMD overlap extends to satellites in geosynchronous orbit as well. For example, a boost-phase defense system using ground-based lasers and orbiting mirrors could be used to attack spacecraft in low and high orbits.

ground-based short wavelength lasers using orbiting mirrors. The X-Ray laser, powered by a nuclear detonation in space, is another of the SDI technologies with ASAT weapon applications. Lawrence Livermore Laboratory's associate director for arms control has stated that "If the laser worked as predicted it would be overwhelming as an offensive weapon. It could wipe out all the other guy's lasers and satellites."[8]

The Soviet Union will undoubtedly match US development of advanced ASAT weapons. These weapons in turn will jeopardize US national security by threatening crucial military satellites on which the US relies for surveillance, monitoring Soviet compliance with arms control accords, early warning of attack, and command and control of nuclear forces. Moreover, Soviet ASATs would thwart the objective of developing a space-based defense by making all orbiting objects vulnerable to direct attack.

The SDI seems destined to give birth to lethal new ASAT weapons that will result in unprecedented threats to the superpower's ability to deter war and to command their military forces. Strategic stability again would be imperiled with each nation fearing the destruction of its vital early warning and communications satellites. In a crisis, both sides would have an incentive to neutralize enemy satellites. At the same time, possession of advanced ASAT weapons would frustrate the goals of a missile defense system because orbiting battle stations and their affiliated sensors and mirrors would be prime targets for attack.

CONCLUSION

Despite the President's assurances that SDI is a "defensive program that threatens no one," space-based missile defense systems have inherent offensive capabilities. Development of these weapons will increase the risk of nuclear war by enhancing a

nation's first strike capability and by threatening vital satellites that serve as the nerve chord for nuclear deterrence. It is therefore in America's national security interest to prevent a competition in missile defense and ASAT weapons that would undermine superpower strategic stability.

Footnotes:

1 Excepts from Reagan interview with Soviet journalists, Washington Post. (November 11, 1985).
2 See Myth #1: SDI Will Protect American Public From Nuclear Attack. (April 4, 1986).
3 President's nationally televised "Star Wars Speech," March 23, 1983.
4 Richard Holloran, "US Studies Plan To Integrate Nuclear Arms With A Missile Shield," New York Times. (May 29, 1985).
5 For a more in-depth discussion of this topic, see the UCS report, "The ASAT-SDI Link," available for $3.50 from the UCS Cambridge or Washington office.
6 Edward Ulsamer, "Military Imperatives in Space," Air Force Magazine. (January 1985).
7 Senate Appropriations Committee, Hearings Fiscal Year 1983, Part 2: 347.
8 R. Jeffrey Smith, "Experts Cast Doubts on X-Ray Laser," Science. (November 8, 1985): 648.

This is the third in a series of Issue Backgrounders on the myths and realities surrounding the Star Wars program. Myth #1 dealt with population defense and Myth #2 with SDI's impact on arms control. Forthcoming topics will include the cost of SDI, the fictitious BMD gap, and the dubious nature of "technological breakthroughs" claimed by SDI proponents.

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UNION OF
CONCERNED
SCIENTISTS

ISSUE BACKGROUNDER

Date: 2 May 1986

Contact: Charles Monfort (202) 332-0900
Robert Herman

No mention of ICBMs in yours!

STAR WARS: MYTH vs. REALITY

MYTH #4: THE SOVIETS ARE AHEAD OF US

One of the most dubious claims made in support of the Strategic Defense Initiative (SDI) is that the Soviet Union is ahead of the United States in developing a space-based missile defense. There is simply no evidence to support this claim. This alarmist projection mirrors the "bomber gap" of the 1950s and the "missile gap" of the 1960s. As was true with both those feared "gaps," the "Star Wars gap" is decidedly in the United States' favor. Congress and the American public should be aware that scare tactics are being used to generate support for the president's highly controversial proposal.

SOVIET SUPERIORITY REJECTED

Although Secretary of Defense Weinberger has charged that the Soviets are ahead of the US in the field of strategic defense, Pentagon officials in charge of the SDI program have stated publicly that the US holds a commanding lead. Said SDI director General James Abrahamson, "in the key areas needed for a broader defense -- such as data processing and computer software -- we are far, far ahead."[1] And Dr. Robert Cooper, director of the Defense

Table II-3. Relative U.S./USSR Standing in the Twenty Most Important Basic Technology Areas*

Basic Technologies	U.S. Superior	U.S./USSR Equal	USSR Superior
1. Aerodynamics/Fluid Dynamics		X	
2. Computers and Software	←X		
3. Conventional Warheads (Including all Chemical Explosives)		X	
4. Directed Energy (Laser)		X	
5. Electro-Optical Sensor (Including Infrared)	X		
6. Guidance and Navigation	X		
7. Life Sciences (Human Factors/Biotechnology)	X		
8. Materials (Lightweight, High Strength, High Temperature)	X→		
9. Micro-Electronic Materials and Integrated Circuit Manufacturing	X		
10. Nuclear Warheads		X	
11. Optics		X	
12. Power Sources (Mobile) (Includes Energy Storage)		X	
13. Production/Manufacturing (Includes Automated Control)	X		
14. Propulsion (Aerospace and Ground Vehicles)	X→		
15. Radar Sensor	X→		
16. Robotics and Machine Intelligence	X		
17. Signal Processing	X		
18. Signature Reduction	X		
19. Submarine Detection	X→		
20. Telecommunications (Includes Fiber Optics)	X		

* 1. The list is limited to 20 technologies, which were selected with the objective of providing a valid base for comparing overall U.S. and USSR basic technology. The list is in alphabetical order. These technologies are "on the shelf" and available for application. (The technologies are not intended to compare technology levels in currently deployed military systems.)

2. The technologies selected have the potential for significantly changing the military capability in the next 10 to 20 years. The technologies are not static; they are improving or have the potential for significant improvements; new technologies may appear on future lists.

3. The arrows denote that the relative technology level is changing significantly in the direction indicated.

4. Relative comparisons of technology levels shown depict overall average standing only; countries may be superior, equal or inferior in subcategories of a given technology.

5. These average assessments can incorporate a significant variance when the individual components of a technology are considered.

Advanced Research Projects Agency (DARPA), has told the Senate Armed Services Committee "I don't think that the Soviets are [as] far advanced as to where we are in many, if not most, of these technologies."[2]

According to a 1986 Pentagon report, the US is ahead of the Soviet Union in virtually every basic technology "critical to defense" over the next ten to twenty years -- including those being explored for space-based missile defense (see chart). The study rates the US superior to the USSR in 14 of the 20 key areas of military research, and equal to the USSR in the remaining six. The report's clearest message is that the Soviet Union does not lead the US in a single critical area of military technology.[3]

The US edge in ballistic missile defense (BMD) technologies is the result of a prudent, sustained research effort spanning more than a decade. Prior to the birth of the SDI, funding for missile defense research continued at a generally constant level. The state of the Soviet BMD program does not, by itself, provide any basis for the drastic acceleration of the American program planned by the current administration.

SOVIET MISSILE DEFENSE ACTIVITIES

SDI proponents are fond of pointing out that the USSR possesses "the only anti-ballistic missile (ABM) system in the world." What they fail to mention is that the Soviet Galosh system -- deployed around Moscow in conformity with the provisions of the ABM Treaty -- is essentially identical in technology and sophistication to the Safeguard ABM system that the US dismantled in 1975. Safeguard was scrapped owing to its great expense, marginal effectiveness and vulnerability to attack. Leading US military experts attribute the same weaknesses to Galosh.

According to Sayre Stevens, former Deputy Director of

Intelligence at the CIA and currently a member of the Pentagon's Defense Science Board, the Soviets' ABM system "cannot seriously hinder a US attack on Moscow."[4] Other experts have suggested that deployment of Galosh has turned Moscow into the biggest bull's-eye on the planet, since it has caused the US, France, Great Britain, and probably China, to increase the number of nuclear missiles targeted on the Soviet capital.

Whereas the Galosh and Safeguard systems are/were based on "second generation" technologies employing a two-tiered missile interceptor scheme, the US has been working on more advanced BMD technologies for over a decade. The USSR has lagged considerably behind in large part because the key components of these more advanced systems are highly capable battle management computers and discriminating sensors -- areas of demonstrated US superiority. Progress in air-based infrared sensors and "kinetic energy" (i.e. projectile) interceptors also place the US well ahead of the Soviets.

In the field of directed energy weapons such as lasers and particle beams, the Soviets have conducted a vigorous research program. But Soviet "breakthroughs" cited by SDI supporters have come in the areas of basic science; the transition from theoretical principle to working weapons continues to be a major Soviet weakness. Moreover, the Soviets have registered the most meaningful progress in technologies poorly suited for BMD missions.

One of these technologies involves development of a particle beam weapon. Assertions that the Soviets are dangerously outpacing the US prompted DARPA Director Cooper to say: "We have been down that alley."[5] While the Soviets have devoted significant resources to the pursuit of the particle beam, the US has explored its potential and has concluded it holds little promise as an effective BMD weapon. Accordingly, less than 5% of the SDI budget goes into particle beam research.

Sayre Stevens has concluded:

> "While the Soviet BMD program has momentum and has made significant technological progress over the past decade, it really has only now achieved the level of technology that was available to the United States ten years ago."[6]

Closely related to the debate over the status of Soviet and American strategic defense programs is the USSR's extensive anti-aircraft network. Purveyors of the "Star Wars gap" warn that the Soviet air-defense system comprised of some 10,000 surface-to-air missile (SAM) interceptors could be adapted for BMD purposes. In fact, Soviet SAMs cannot perform the BMD mission. They generally lack adequate acceleration and maneuverability, which in turn makes them susceptible to countermeasures accompanying attacking missiles such as decoy warheads and other penetration aids.

US military planners have said repeatedly that the Soviet defense network would be ineffective against a coordinated US attack. Robert Gates, the CIA's Deputy Director for Intelligence, testified before Congress that "against a combined attack of penetrating bombers and cruise missiles, Soviet air defenses during the next ten years probably would not be capable of inflicting sufficient losses to prevent large-scale damage to the USSR."[7]

"STAR WARS GAP" FICTITIOUS

The "Star Wars gap" resembles many other "gaps" that have punctuated the past forty years of Soviet-American military rivalry. Each alleged "gap" invariably surfaced when a major defense program faced stiff political opposition.

In the mid-1950s it was the "bomber gap." President Eisenhower accelerated the US B-52 bomber program amidst the

Defense Department's dire predictions of an impending imbalance between US and Soviet bomber forces. Pentagon estimates showed that the USSR would have as many as 600-700 strategic bombers by the early 1960s. As it turned out, the Soviets had fewer than 200 bombers in 1961, while the US had more than 1600 -- an overwhelming US advantage.

In the early 1960s Americans were treated to the "missile gap." Again Pentagon projections showed the US trailing the Soviets by up to 2000 ICBMs by mid-decade. Faced with such a frightening assessment, the US accelerated both the Minuteman ICBM and Polaris SLBM programs. By 1964, the Soviets actually had only one-tenth as many ICBMs as originally forecast, while the US possessed more than 800 -- again a huge American lead.

The late 1970s brought the "vulnerability gap." Proponents maintained that Soviet advances in missile accuracy had created a "window of vulnerability" that could tempt the Soviets to launch a pre-emptive first strike. Deployment of the highly accurate MX missile, it was argued, would solve the problem by making Soviet silos equally vulnerable to attack. The President appointed a blue-ribbon panel to study the issue. In 1983 the Scowcroft Commission published its findings and concluded that the "window of vulnerability" was a myth. US submarines, bombers and to a lesser extent land-based ICBMs, were survivable and provided a compelling deterrent to the Soviet Union.

And now we face the "Star Wars gap." Despite its mythical nature, the idea of a gap has garnered popular support as a rationale for accelerating the SDI program. History should have taught us to scrutinize closely self-serving claims of Soviet military advantages.

Exaggeration of Soviet capabilities is neither a firm foundation on which to construct a prudent and cost-effective military strategy, nor a legitimate way to sell a specific defense

program to the American people. It is very important to monitor Soviet BMD activities and to challenge Soviet actions which may constitute violations of arms control agreements -- such as construction of a large radar facility in central Siberia. But playing on public fears is no way to facilitate a responsible, informed debate on so crucial a national security issue as the Strategic Defense Initiative.

The US has maintained an overwhelming lead in missile defense technologies through an expenditure of less than $1 billion a year over the past decade. A robust research effort, consistent with ABM Treaty, and designed as a hedge against security-threatening Soviet breakthroughs, should continue. However, the President's proposal to spend $25-30 billion over the next four years goes far beyond that. It is a provocative program that likely will lead both nations into a dangerous and costly new arms race.

Footnotes:

1 Science (10 August 1984).
2 Senate Armed Services Committee, Hearings On Fiscal Year 1985 Defense Authorization Bill, Part 6: 2970.
3 Department of Defense, Fiscal Year 1987 Defense Program for Research, Development, and Acquisition (March 1986).
4 Sayre Stevens, "The Soviet BMD Program," Ballistic Missile Defense, Brookings Institution (1984): 214.
5 Senate Armed Services Committee, Hearings On Fiscal Year 1985 Defense Authorization Bill, Part 6.
6 Sayre Stevens, Ballistic Missile Defense, Brookings Institution (1984): 217.
7 Senate Armed Services Committee, Hearings on Soviet Strategic Force Developments, (26 June 1985): 6.

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This is the fourth in a series of Issue Backgrounders on the myths and realities surrounding the Star Wars program. Myth #1 dealt with population defense, Myth #2 with SDI's impact on arms control, and Myth #3 with the offensive applications of Star Wars.

Forthcoming topics will include the cost of SDI and the dubious claims advanced by SDI proponents of "technological breakthroughs."

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The Union of Concerned Scientists is an independent, non-profit public policy organization based in Cambridge, MA. Founded in 1969 as an informal faculty group at the Massachusetts Institute of Technology, UCS now has over 100,000 sponsors nationwide. Its research, public policy and lobbying activities focus on national security and energy policy.

UNION OF CONCERNED SCIENTISTS

ISSUE BACKGROUNDER

Date: 16 May 1986

Contact: Robert Herman (202) 332-0900
Charles Monfort

STAR WARS: MYTH vs. REALITY

MYTH #5: THE SDI PROGRAM HAS ACHIEVED "AMAZING BREAKTHROUGHS"

Claims by Administration officials that "monumental" or "amazing" breakthroughs have been achieved in the Strategic Defense Initiative (SDI) program are unsubstantiated and deceptive. These misleading claims -- challenged by several former Secretaries of Defense, computer experts and most recently, by a Senate staff study -- have hindered an informed and responsible debate on the SDI.

Before a decision to deploy a ballistic missile defense (BMD) system can be made, Congress and the American people need an objective assessment of SDI-related research, including the current Administration's criteria for judging alleged technical "breakthroughs." Only then can a prudent evaluation be made of this multi-billion dollar effort designed to transform the US-Soviet strategic environment.

ADMINISTRATION SUCCESS STORIES REFUTED

According to George Keyworth, former Science Advisor to the President, "there have been monumental breakthroughs that have made

us far more confident two and a half years later than we projected even in the optimistic tone that was evident in the original [SDI] speech."[1]

Such statements have been refuted in an in-depth Senate staff report, based on interviews with over 40 specialists in the SDI Office (SDIO), General Accounting Office (GAO), Defense Intelligence Agency (DIA) and four major laboratories now conducting missile defense research.[2] The study concludes that there have been "no major breakthroughs which make a mid- to late-1990s deployment of comprehensive missile defenses more feasible than it was three years ago."[3] "Contrary to public pronouncements, SDIO still does not have a firm idea of how a strategic defense system might be implemented."[4]

While recognizing that the program has made some progress in areas such as miniature gyroscopes and computer chip technology, the report reflects a more sober view of alleged breakthroughs:

> Success, however, in one small project -- or hundreds of projects, for that matter -- does not necessarily make for a successful strategic defense program. The task at hand and the hurdles it faces are so exacting that the sum of research cannot be judged solely by its parts."[5]

Determining the technical feasibility of a ballistic missile defense involves much more than developing a component or weapon -- it requires perfecting a single, integrated system. A Pentagon-convened panel of computer experts -- the Eastport Study Group -- cautioned that "SDIO must not assume that any architecture with sufficient sensors and weapons in the right place is also feasible architecture, i.e. one that can be implemented successfully."[6]

Exaggerated claims of program progress underscore a pre-occupation by SDI officials with missile defense hardware while crucial areas of overall program development such as systems management, maintenance, transportation, and computing have

received relatively little attention. "If anything," explains the Senate report, "the dramatic progress SDI has achieved....has been in identifying the operational problems a strategic defense system would face."[7]

SDI program director Lt. General James Abrahamson's assertion that there is no longer a significant question.... that "it can be done....we're past that point,"[8] contradicts more recent testimony before the Senate Armed Services Committee. There he stated that "success in nearly every element of the program is dependent on major advances in supporting technologies for space-based electric power, power conditioning low cost devices, space transportation and logistics."[9] The Senate study reached a similar conclusion: "It appears that the transportation-support-logistics system for a comprehensive strategic defense may well be as complex and unprecedented as the defense itself."[10]

The extraordinary emphasis placed on rapid development of individual weapon components also has prevented serious consideration of criteria widely regarded by national security experts as central to any decision to deploy a BMD system. Official Administration policy as set out by the State Department says, "Within the SDI research program, we will judge defenses to be desirable only if they are survivable and cost effective at the margin."[11]

Yet in this year's annual report to Congress (received almost two months late), the SDIO has conspicuously discarded the precise economic criterion of cost effectiveness and replaced it with the vague political criterion of affordability.[12] Secretary of Defense Weinberger had admitted that "I have problems with the concept of cost effectiveness."[13] With the report, the Administration has officially dropped its own previously established criteria. It is difficult to avoid the conclusion that the Administration now admits it would be cheaper for the Soviets to develop countermeasures than for the US to defend against them.

GOOD HEADLINES BUT BAD SCIENCE

Pronouncements about great breakthroughs frequently follow tests conducted within one of the SDI's many projects. Harold Brown, former director of the Lawrence Livermore National Laboratory and former Secretary of Defense, recently appeared before a Senate panel and warned that real technological achievements may be forfeited by SDI "spectaculars." Early demonstration projects may boost public support, he argued, but they are premature and don't reflect the very widespread caution voiced by a broad range of the scientific community.

Of those scientists actually participating in the SDI effort, many have expressed concerns that demonstration tests compromise the integrity of the program. "I'm very alarmed at the degree of hype, promises and failure to focus on what this national program really is -- a research program with lots of unanswered questions," lamented Dr. George H. Miller, head of defense programs at Lawrence Livermore.[14] Dr. Roger Hagengraber of Sandia National Laboratory believes that science will be "negatively affected by the fact that there's so much pressure for stunts and demonstrations."[15] A program of such magnitude and potential strategic consequences as the SDI must be free from pressures to produce "successes" regardless of their scientific value. Demonstration tests may produce favorable headlines or film footage on the evening news, but they do not constitute good science.

Another problem is that the Administration often has withheld or selectively released information concerning the SDI. The Pentagon, for example, has withheld a major study of the program that the GAO compiled completely from unclassified sources. Repeated requests to release the report from members of the Senate Appropriations Committee have been denied even though it was Congress that had originally asked for the study.[16]

Further restrictions on information are being encouraged by

Department of Energy (DOE) officials, one of whom wrote to the director of Lawrence Livermore that "involvement by the DOE and the nuclear weapons laboratories in the SDI program has received more media attention than we believe prudent....we believe a general lowering of the DOE program's visibility is appropriate."[17]

SCIENTISTS SKEPTICAL OF STAR WARS PROGRAM

The scientific community not only has expressed concern about premature demonstration tests, but has questioned the wisdom of the entire SDI program. Contrary to Abrahamson's claim that "there are only a few diehards left, sincere diehards, but only a very few, who still say this doesn't make sense," scientists have become more vocal and more visible in their opposition to Star Wars.[18]

A national boycott of Star Wars research funds already has garnered the support of more than 3,700 academic scientists and engineers, including 15 Nobel Laureates in Physics and Chemistry.[19] The pledge to turn down SDI- related research grants because a Star Wars system would be dangerous and destabilizing has been signed by 57% of the combined faculties at the 20 top Physics departments in the country.

In addition, a national poll of over 500 physicists revealed great skepticism of the SDI.[20] Two-thirds of those surveyed said it was improbable that a Star Wars defense could defend the population against nuclear attack, while 87% said the Soviets would deploy countermeasures that would render a US system ineffective. Despite the Administration's concerted effort to court the scientific community on the SDI, scientists across the country are speaking out and organizing against the Star Wars program.

CONCLUSION

Administration claims of "monumental breakthroughs" are without sound scientific foundation. Government spokespeople have been reluctant to discuss the criteria used to judge program progress. How can SDI officials talk about "breakthroughs" when key factors like system vulnerability to Soviet attack and program integration have been subtly downplayed or outright ignored? Self-congratulatory statements of success are no substitute for genuine scientific advances.

"The objective of research is not success, but increased knowledge," a chief researcher told the Senate study group. However, he cautioned, "The pressure to achieve success will ultimately result in a degradation of the research."[21] These comments raise a number of concerns: that SDIO is compromising long-term research for flashy near-term demonstrations, that Congress is not being given the tools with which it can evaluate the status of the program, that development of support technologies essential to a BMD system is not being addressed seriously, and that reasonable estimates of time and cost are being avoided deliberately. Most worrisome of all, at a cost of billions of dollars a year. Public support for the SDI is being courted to the detriment of serious scientific inquiry.

Footnotes:

1 "Scientist Assesses SDI As A '90s Reality," Washington Times (3 January 1986).
2 SDI: Progress and Challenges, Staff Report Submitted to Senators William Proxmire, J. Bennett Johnston, and Lawton Chiles, by Douglas Waller, James Bruce and Douglas Cook (17 March 1986).
3 Ibid., p. 1.
4 Ibid., p. 3.
5 Ibid., p. 7.
6 Ibid., p. 23.
7 Ibid., p. 23.

8 "From the Space Shuttle to the F-16 to Star Wars," Defense Week (12 November 1985).
9 Senate Armed Services Committee, Statement before the Subcommittee on Strategic and Theater Nuclear Forces (15 March 1986).
10 SDI: Progress and Challenges, p. 51.
11 U.S. Department of State, Special Report No. 129 (June 1985).
12 Strategic Defense Initiative Organization, FY86 Annual Report to Congress (May 1986), p. II-13.
13 "Cuts Imperil SDI Research, Congress Warned," Defense Week (4 November 1985).
14 "Science Showmanship: A Deep Star Wars Rift," New York Times (16 December 1985).
15 Ibid.
16 "Weinberger Resists Senate Pressure To Declassify GAO Report On SDI," Inside The Pentagon (11 April 1986).
17 "X-Ray Laser Budget Grows As Public Information Declines," Science (11 April 1986).
18 "'Star Wars' Chief Expecting Speed-up After Meeting," New York Times (21 November 1985).
19 A Status Report on the Boycott of Star Wars Research by Academic Scientists and Engineers, Lisbeth Gronlund (and others), Department of Physics, Cornell University (13 May 1986).
20 National poll of physicists conducted by Peter D. Hart Research Associates, at the request of the Union of Concerned Scientists (24 March 1986).
21 SDI: Progress and Challenges, p. 49.

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This is the fifth in a series of Issue Backgrounders on the myths and realities surrounding the Star Wars program. Past issues included population defense, impact on arms control, offensive applications of Star Wars, and the alleged Star Wars gap. Forthcoming topics will include the cost of the SDI program, SDI and the ABM Treaty, and the program's exploration of nuclear technologies for missile defense.

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UNION OF CONCERNED SCIENTISTS

BRIEFING PAPER

SPACE-BASED MISSILE DEFENSE

In March 1983, President Reagan offered the vision of a shield against nuclear attack so effective that it could replace deterrence as the basis of our security and render nuclear weapons "impotent and obsolete." He called for a major national effort to realize this vision through the development of new defensive weapons capable of intercepting and destroying Soviet ballistic missiles in flight. The administration's proposed Strategic Defense Initiative (SDI) is a five-year, $26 billion research, development, and testing program to lay the groundwork for construction and deployment of missile defenses.

The Problem of Missile Defense

The SDI raises a host of questions about the technical feasibility and strategic wisdom of missile defense and recalls the Anti-Ballistic Missile (ABM) debate of the late 1960s. Unlike the earlier ABM efforts, however, the new program focuses on futuristic weapons operating in space—hence the "Star Wars" label often applied to the SDI. The proposed shield would consist of several layers designed to intercept missiles during different phases of their flight (see Figure 1). The key to success is the first layer, which would attempt to destroy Soviet missiles in their "boost phase," within minutes after launching. Boost-phase interception is critical for three reasons: 1) the number of targets is much smaller than in later phases of the trajectory (since multiple warheads, decoys, and other penetration aids have not yet been released); 2) the booster rocket is a much "softer," more vulnerable target than the reentry vehicles it releases in the post-boost phase; and 3) the booster rocket flame offers a strong infrared signal that greatly facilitates target identification and tracking.

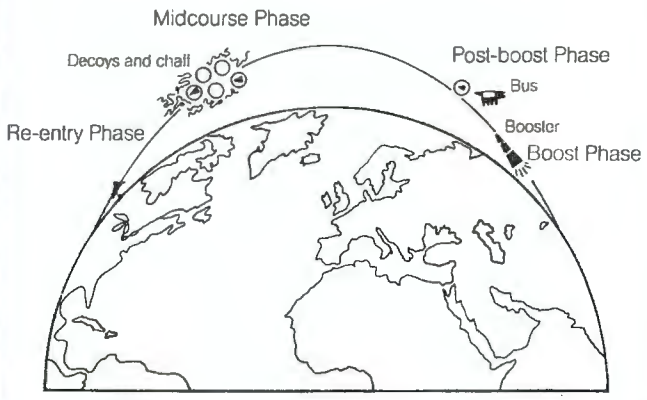
Failure to thin out an attack drastically in the boost phase would present the subsequent "midcourse" and "terminal" layers of the missile defense with an unmanageable problem. In midcourse, the defense could be confronted with hundreds of thousands of objects, all of which would have to be tracked and intercepted, since discrimination between warheads and decoys would be impossible in the vacuum of space. Terminal defense, while possibly a feasible means of protecting individual "hard" targets such as missile silos, is fundamentally unsuited to a comprehensive territorial defense.

The Union of Concerned Scientists has conducted a detailed technical analysis of the prospects for Star Wars defenses, emphasizing the principal technologies being considered for boost-phase interception—directed energy weapons such as lasers and particle beams, and "kill vehicles" that would home in on their target missiles. The UCS study concludes that there is no realistic hope of achieving the president's goal of an impermeable defense against nuclear attack. Moreover, the attempt to develop such a shield will have dire consequences for the arms race and for strategic stability, leaving both the United States and the Soviet Union less secure in the end.

The proposed defensive weapons of the SDI suffer from a combination of inherent technical limitations, intractable basing problems, and susceptibility to Soviet countermeasures. The Pentagon's own chief of research has conceded that the total missile defense called for by the president would require breakthroughs in eight separate technologies "equivalent to or greater than the Manhattan Project" that produced the first atomic bombs.

Even if individual technologies could be developed to the needed performance levels, fashioning them into a workable, deployable, and survivable system would pose insurmountable difficulties. The system would be immensely more complex than existing weapons and could never be tested under realistic conditions. In addition, it would have to be fully automated, responding instantly upon warning of attack without presidential involvement, given the very short reaction time available for boost-phase interception. Yet the defense would have to work with near 100 percent reliability. It would have almost no margin for error because

Fig. 1 Phases of Ballistic Flight



Once boost phase is over, warheads are dispersed on a "bus" along with decoys and "chaff" (metallic fragments and other materials) that can deceive and disrupt tracking and targeting functions of a missile defense. The post-boost offensive "threat cloud" could include more than 100,000 objects, all of which must be attacked by the defense.

even a minute "leakage" rate would mean hundreds of nuclear explosions on US territory—and millions of fatalities—in the event of a large Soviet attack (see Figure 2).

Basing Problems

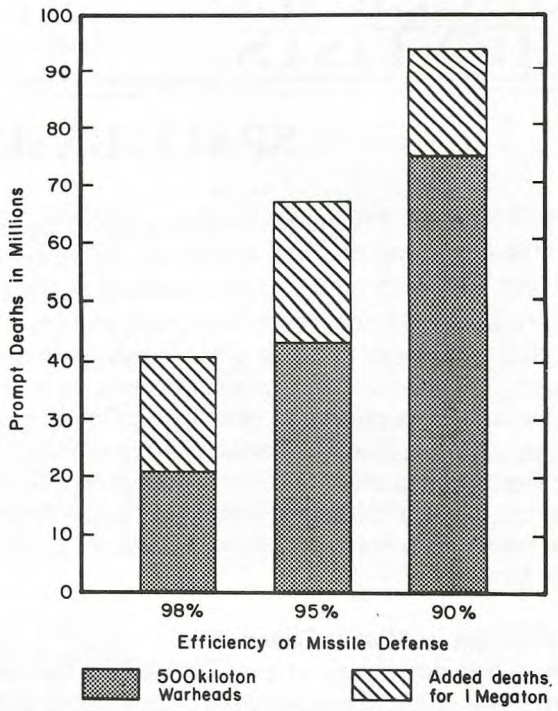
The problem of basing is particularly daunting. A boost-phase missile defense must operate in space, creating three deployment options. The system could be 1) based in space on orbiting battle stations; 2) based on the ground, with mirrors in orbit to reflect its laser beams to Soviet missiles rising from their launch sites; or 3) "popped up" into space when a warning of a Soviet attack is received. None of the three schemes appears workable.

— Orbiting battle stations could be placed into low orbits, at an altitude of several hundred miles, or in geosynchronous orbit at 22,500 miles. In the first case, a very large number of battle stations would be needed, since only a small fraction would be in position over Soviet missile silos at any given time. UCS has estimated that a low-orbit defense would require several hundred chemical laser weapons. Simply launching this system would cost tens of billions of dollars; more important, the weapons would be extremely vulnerable to Soviet attack. In geosynchronous orbit, fewer weapons would be needed, since they would remain in fixed positions relative to their targets on earth. But these weapons would have to operate at an enormous and quite infeasible range. An "excimer" laser in geosynchronous orbit, for example, would require a sighting telescope some 100 to 150 meters in diameter—twenty or thirty times larger than the Mt. Palomar telescope, the largest in the United States.

— A ground-based laser, favored by President Reagan's Science Advisor, George Keyworth, is no more promising. UCS has analyzed an excimer laser weapon whose beams would be reflected by a mirror in geosynchronous orbit to other mirrors in low orbit, and then to Soviet booster rockets. UCS estimates that the electric power bill alone for this implausible system would be $40–110 billion, even if the Soviets made no effort to counter it.

— The "pop-up" scheme has been proposed as a basing option for the x-ray laser weapon, favored by the physicist Edward Teller. Such a weapon could not be based in the United States, however, because of the curvature of the earth and the short time available for boost-phase interception. For example, a pop-up missile launched from Alaska would have to reach an altitude of 2000 miles before it could "see" missile fields in Siberia, and by then Soviet rockets would have completed their boost phase. As a result, the system would have to be based close to Soviet territory, probably on a new fleet of submarines created for this purpose. Even then, it is doubtful that sufficient reaction time would exist. Moreover, this basing scheme would be vulnerable to Soviet attack and would create major difficulties for command and control.

Fig. 2 Effect of Leakage in the Defense



A U.S. ballistic missile defense that prevents 90 percent of Soviet nuclear warheads (1 megaton each) from striking U.S. cities could still result in 90 million "prompt" fatalities. A defense that was 95 percent effective could result in 60 million deaths; and a 98 percent effective defense could cause 40 million deaths.
Source: U.S. URBAN POPULATION VULNERABILITY (U.S. Arms Control and Disarmament Agency, 1979).

Countermeasures

The slim hopes of overcoming such problems disappear altogether in light of the countermeasures available to the Soviets, who would certainly take any action necessary to defeat a US defense that would, if successful, disarm them. All of the proposed Star Wars defenses are susceptible to countermeasures that are cheaper and better understood than the defenses themselves. Soviet responses could include:

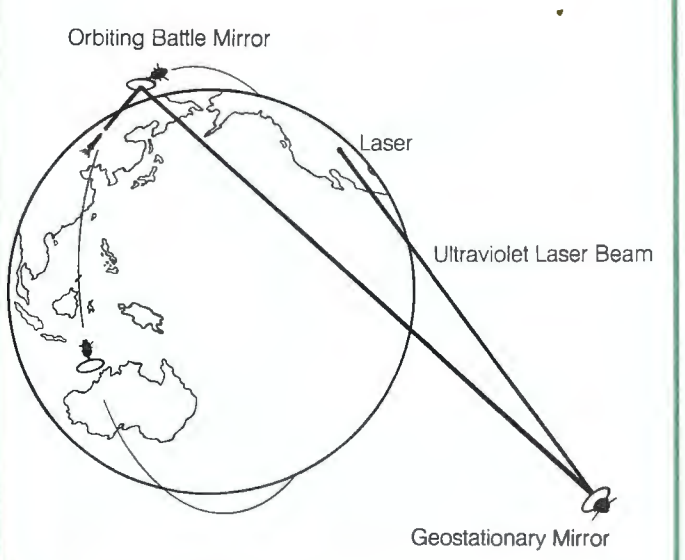
— An offensive nuclear buildup designed to saturate and overwhelm the US defensive system. This could include a proliferation of real or decoy missiles (decoys would lack warheads and guidance systems but would still have to be tracked and intercepted by the defense), or the placing of additional warheads on existing missiles (thus increasing the effectiveness of those that penetrate the defense).

— A buildup of warhead delivery systems, such as low-flying cruise missiles, that would circumvent space-based defenses.

— Shortening the boost phase of Soviet ICBMs by giving them more powerful engines. This would reduce the already short reaction time available to the defense, perhaps to as little as one minute. In addition, by designing their missiles to complete the boost phase while still inside the atmosphere, the Soviets could defeat those defensive weapons that are unable to penetrate the atmosphere. These include the x-ray laser and particle beam weapons.

— Protection of booster rockets from the effects of beam weapons through hardening, shielding, or rotation.
— Attacks on the defensive system itself. Space-based weapons and components (such as mirrors) would be highly vulnerable to attacks by "space mines" or inert objects such as sand or small pellets. Ground-based components would be subject to attacks from submarine-launched ballistic missiles and from cruise missiles. Targets could include ground facilities for battle management, rockets and basing facilities associated with pop-up weapons, and communications and control stations. Well-executed strikes of this sort, in advance of the main offensive missile launch, would probably disable the entire defense.

Fig. 3 Ground Based Laser System



Strategic Implications

The Strategic Defense Initiative will carry heavy political, strategic, and arms control costs. These costs would weigh against development of ballistic missile defenses even if the technical prospects for such systems were much brighter than they are.

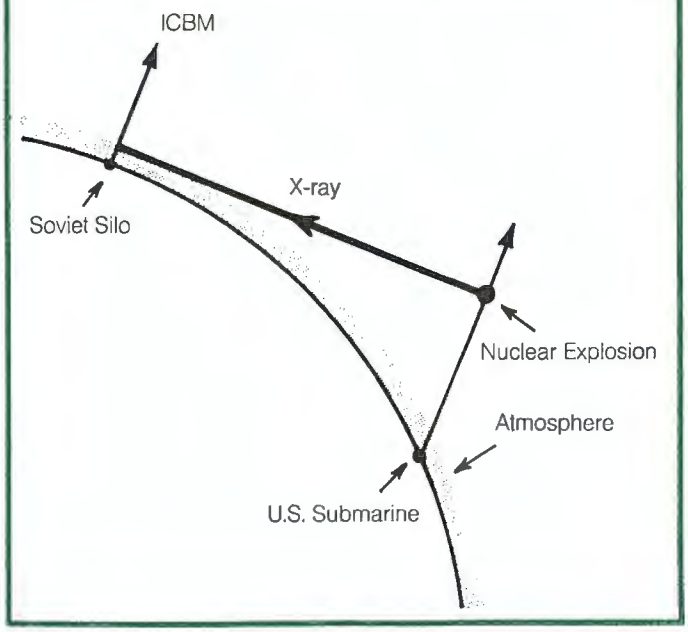
The most obvious casualty will be the 1972 Anti-Ballistic Missile Treaty, the most important arms control agreement to date and the foundation of all efforts to impose limits on offensive nuclear forces. The ABM Treaty flatly prohibits the development, testing, or deployment of space-based missile defenses or components. Although the administration claims that the SDI can initially be carried out within the terms of the treaty, planned technology demonstrations will at the very least push the United States to the edge of noncompliance. As such, the process of erosion that already threatens the ABM Treaty will be accelerated, precluding serious attempts to resolve issues of Soviet compliance that have been raised by the Reagan administration.

A major US missile defense program would also stimulate a new round of the arms race and undermine the already bleak prospects for new arms control agreements. Despite US rhetoric that missile defense might be in the mutual interest of the superpowers and compatible with negotiated arms reductions, the Soviet Union will certainly view the SDI as an attempt to achieve military superiority by negating the Soviet deterrent. The Soviets are no more likely than the United States to accept such a situation and can be expected to respond with a nuclear buildup that ensures their ability to penetrate US defenses. This fresh stimulus to the arms race would sweep aside existing constraints on offensive forces and doom future ones, including the administration's own "build-down" initiative in the Strategic Arms Reduction Talks (START). The President's Commission on Strategic Forces (the Scowcroft Commission) has recognized this danger and warns that the continued integrity of the ABM Treaty is critical to arms control.

Another danger of the SDI is the destabilizing impact of missile defenses in crisis situations. Given their limited effectiveness against all-out attack, defenses are likely to be perceived as part of a "first strike" strategy: They would be most effective in defending against the weakened retaliation that would follow an attack on the adversary's missile silos. As a result, defenses could increase pressures for preemptive strikes during periods of high tension, as each superpower fears that if it fails to strike first it may find itself disarmed.

Finally, pursuit of space-based missile defenses will foreclose any chance of restraining the development of anti-satellite (ASAT) weapons. The proposed Star Wars weapons would all have an inherent anti-satellite capability. Indeed, they might well function more effectively in the less demanding ASAT role than in their intended anti-missile role. Therefore, a commitment to

Fig. 4 Pop-up X-ray Laser System



Summary of Boost-Phase Ballistic Missile Defense Systems

System	Limitations	Countermeasures
• Chemical lasers on battle stations in low earth orbit (about 1000 km altitude)	• "Absenteeism" problem: for each laser in position over USSR at any time, about 10 must be in orbit • Vulnerability to ASAT attack	• ASAT attack: e.g., space mines • Hardening of booster rockets to resist laser effects
• Kill vehicles (e.g., homing projectiles) on "space trucks" in low earth orbit	• Limited range due to much lower velocity than beam weapons • "Absenteeism" problem: about 30 space trucks must be in orbit for every one in position over USSR • Vulnerability to ASAT attack • Can't penetrate atmosphere	• ASAT attack • Fast acceleration boosters able to complete boost phase within the atmosphere
• Ground-based excimer laser with mirrors in space to reflect beams to boosting Soviet missiles	• Vulnerability of orbiting mirrors • Huge electrical power requirements	• ASAT attacks on mirrors (e.g., pellets or sand) • Low-trajectory missile attacks on lasers
• X-ray laser, generated by nuclear explosion after being "popped up" into space at moment of Soviet attack	• Short reaction time and curvature of earth require basing close to USSR (e.g., on submarines) • Can't penetrate atmosphere • Automated system would mean relinquishing presidential control over use of nuclear weapons • X-ray delivers only a weak blow	• Fast acceleration boosters • Hardening of boosters
• Particle beam in orbit	• Can't penetrate atmosphere • Would weigh well over 500 tons	• Fast acceleration booster • ASAT attack
• All boost-phase systems	• Very short reaction time means system must be fully automated • Can't be realistically tested • At least some components must be space-based • Must be very effective or midcourse BMD will be overwhelmed	• ASAT attacks on space-based components • SLBM or cruise missile attacks on ground facilities • Proliferation of real or decoy booster rockets to overwhelm system • Cruise missiles or depressed-trajectory ballistic missiles to circumvent system • Disguise booster flame to foil aiming and tracking

Star Wars means an unconstrained US-Soviet ASAT competition—and the future vulnerability of satellites on which the United States depends for early warning of attack, control of nuclear forces, and military communications.

The Star Wars policy is ill-advised on both technical and strategic grounds. There is virtually no chance that an invincible shield envisioned by President Reagan can be developed. Yet the pursuit of this appealing mirage will, ironically, make us *less* rather than *more* secure: It will escalate the arms race, reduce stability, and feed a new cycle of mutual suspicion and fear between the superpowers.

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The most important arms agreement of the nuclear age is in danger...

National Campaign to Save the ABM Treaty

...From the Star Wars Illusion

The 1972 Anti-Ballistic Missile (ABM) Treaty is the cornerstone of efforts to reduce nuclear arms. It prevents an arms race in anti-missile weapons, strengthens deterrence, and is a precondition for reducing offensive nuclear weapons. Yet the looming race in ground- and space-based anti-missile weaponry threatens to destroy the ABM Treaty—the foundation for improving global security.

What Would an Anti-Ballistic Missile System Do?

In the event of a nuclear war, anti-ballistic missile systems would attempt to locate and destroy incoming nuclear warheads carried by BALLISTIC missiles—those that follow a flight path through space. An ABM system would not be capable of intercepting nuclear weapons delivered by AIRCRAFT or by low-flying CRUISE missiles. Such an anti-missile system could be directly attacked or overwhelmed and evaded by increases and improvements in offensive nuclear missiles. Therefore it would not provide a perfect defense of populations but would accelerate the race in nuclear weapons.

What is the Anti-Ballistic Missile Treaty?

The ABM Treaty between the US and the USSR was signed by President Nixon and ratified, 88-2, by the U.S. Senate in 1972. The agreement bans the deployment of *nationwide* systems to defend against strategic ballistic missile attack. It permits each side to build one site of up to 100 fixed, land-based ABM interceptor missiles and radars near either its national capital or an intercontinental ballistic missile (ICBM) base. While permitting some research, the Treaty bans the development, testing and deployment of sea-based, space-based, or mobile land-based ABM systems or their components. The Treaty also established the Standing Consultative Commission (SCC) as the forum for discussion of ABM Treaty issues.

Both nations signed this BALANCED and VERIFIABLE limitation on strategic weapons because it served their national as well as mutual security interests in avoiding nuclear war and a costly competition in anti-missile weapons. Joint US-USSR reviews of the ABM Treaty in 1977 and 1982 reaffirmed its contribution to the security of the two countries.

What Are the Threats to the ABM Treaty?

The US and USSR are now engaged in activities that endanger the ABM Treaty:

- The United States' multi-billion dollar "Star Wars" program—the Strategic Defense Initiative (SDI)—providing for development of a nationwide ABM system, precisely that which is banned by the Treaty. The initial aim will be protecting U.S. ICBMs and other military assets, not protecting people.
- Various planned demonstrations of air- and space-based ABM components planned in the next few years as part of the Star Wars program. These programs would be in direct violation of the Treaty's provisions against the advanced development and testing of certain types of ABM components.
- Soviet programs aimed at upgrading existing surface-to-air missiles (designed to shoot down aircraft) in order to make them capable of destroying ballistic missiles.
- Construction of large radars in both countries which might be utilized for ABM systems, though such use is banned by the Treaty.
- Unrestrained U.S. and Soviet development of weapons to destroy satellites. This same anti-satellite (ASAT) technology can be used to develop prohibited ABM systems.

These initiatives are not consistent with the goals and intent—and, in some cases, the letter—of the ABM Treaty. The US and USSR are circumventing restrictions, and thus gradually eroding the integrity of the Treaty. The superpowers are also exchanging hostile public accusations that make solutions difficult to reach in the SCC.

The advanced development and testing of anti-missile weapons will violate the ABM Treaty long before their effectiveness can be determined. Technical advances by both sides threaten to render the ABM accord a dead letter, ***yet hold no promise for developing an effective nationwide shield against incoming nuclear missiles.***

> *"A perfect astrodome defense is not a realistic thing."*
>
> —LT. GEN. JAMES ABRAHAMSON, manager of the Strategic Defense Initiative, August 10, 1984

How Does the ABM Treaty Enhance U.S. Security?

The ABM Treaty was a necessary condition for the limits on offensive nuclear missiles that were achieved in the SALT I and SALT II agreements and that have been further pursued in the START negotiations. The Treaty's ban on nationwide anti-missile weapons also deters each nation from launching a nuclear attack by assuring effective retaliation. The Treaty reflects and strengthens the conclusion that nuclear war is unwinnable.

"Against missiles there is no defense...the offense could always fool the defense....So anti-ballistic missiles for city defense are technically nonsense."

—HANS BETHE, Nobel Laureate in Physics, April 1982

Without an ABM Treaty:

- A dangerous and expensive superpower competition in ABM weapons will occur. This new arms race would prompt further increases in nuclear arms to overcome an adversary's ABM system. Costs of a nationwide ABM system are estimated to be as much as a trillion dollars.
- The risk of nuclear war would increase as each side feared that the other was developing ABMs as part of a first strike strategy.
- The arms race would be extended into outer space. New weapons would threaten early warning, communications, and intelligence-gathering satellites which provide information essential to protecting our national security.
- Relations between the U.S. and its allies would be strained; they would fear that we were abandoning our security commitments and taking refuge in "Fortress America."
- The achievement of agreements to constrain the nuclear arms race would be jeopardized by abandoning the single most successful arms control agreement to date.

Preserving the ABM Treaty Would:

- Maintain the foundation essential for further efforts to reduce the superpowers' nuclear weapons arsenals.
- Constrain future threats by prohibiting the development of new types of ABM systems.
- Save the U.S. hundreds of billions of dollars in both ABM systems and nuclear weapons to penetrate Soviet ABM systems.
- Keep outer space free of weaponry.
- Permit reliable satellite monitoring of the USSR.
- Enhance the Western alliance.

To Preserve the ABM Treaty the National Campaign Will:

- Continue to build a nonpartisan, broadly-based coalition to support the ABM Treaty.
- Conduct a vigorous campaign to educate the general public and government officials about the value of the ABM Treaty, threats to its continued integrity, and the consequences for U.S. security if it is destroyed.
- Provide technical advice to both Congress and the news media.
- Urge both the Soviet and American governments to abide by ABM Treaty obligations and to resolve outstanding Treaty compliance questions through the SCC.
- Work to ensure that U.S. and Soviet programs inconsistent with the Treaty are halted.

"One of the most successful arms control agreements is the Anti-Ballistic Missile Treaty of 1972....the strategic implications of ballistic missile defense and the criticality of the ABM Treaty to further arms control agreements dictate extreme caution in proceeding to engineering development in this sensitive area...."

—From the Final Report of the PRESIDENT'S COMMISSION ON STRATEGIC FORCES (the Scowcroft Commission), March 21, 1984

What is the National Campaign?

The National Campaign to Save the ABM Treaty is a non-partisan coalition of prominent national organizations and distinguished individuals with backgrounds in government, business and the natural and social sciences. We are dedicated to preserving and strengthening this crucial arms control agreement and the principles of national security it advances. The National Campaign seeks to educate government officials and the general public about the value of the Treaty, the United States and Soviet programs which endanger it, and the consequences for our security should the accord be terminated. The National Campaign is in favor of basic research and limited development programs consistent with the provisions of the ABM Treaty.

The ABM Treaty is our best defense against an all-out nuclear arms race. We need your help to preserve the foundation and future of arms control.

Support the National Campaign to Save the ABM Treaty.

For more information, please write to:

National Campaign to Save the ABM Treaty
1346 Connecticut Ave., N.W., Suite 903
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202/463-4213

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"[T]he ABM Treaty of 1972 is a major element in the stabilization of the arms balance and the relations between the two superpowers. It would be a very substantial step for us to renounce that treaty, and it would involve very significant political cost to the United States."

—JAMES R. SCHLESINGER, Secretary of Defense (1973-1975), testimony before the Senate Armed Services Committee, April 18, 1983

"There is simply no escape from the reality that Star Wars offers not the promise of greater safety, but the certainty of a large-scale expansion of both offensive and defensive systems on both sides....Star Wars, in sum, is a prescription not for ending or limiting the threat of nuclear weapons, but for a competition unlimited in expense, duration and danger....To lose the [ABM] Treaty in pursuit of the Star Wars mirage would be an act of folly."

—McGEORGE BUNDY, Special Assistant to the President for National Security Affairs (1961-1966)
GEORGE F. KENNAN, Ambassador to the Soviet Union (1952)
ROBERT S. McNAMARA, Secretary of Defense (1961-1968)
GERARD C. SMITH, Chief Negotiator, SALT I (1969-1972)
Foreign Affairs, Winter 1984-1985

"When the time comes that you deploy any of these technologies, you'll be staggered at the cost that they will involve."

—RICHARD DeLAUER, Under Secretary of Defense for Research and Engineering, testimony before the House Armed Services Committee, November 1983

UNION OF CONCERNED SCIENTISTS

BRIEFING PAPER

ANTISATELLITE WEAPONS

Until recently, outer space was free of weapons, despite the numerous military support activities performed there by the United States and the Soviet Union. The development of antisatellite weapons (ASATs), however, threatens to extend the arms race into space, with very serious consequences for peace and security.

Background

Satellites have become essential to military communications, reconnaissance, intelligence gathering, and navigation. They are a key part of the apparatus for warning of attack and controlling nuclear weapons, and they act as "force multipliers," increasing the effectiveness of the military forces they support. Satellites would therefore be very tempting targets in the event of conflict, and the emergence of antisatellite weapons might seem an inevitable step in the arms race.

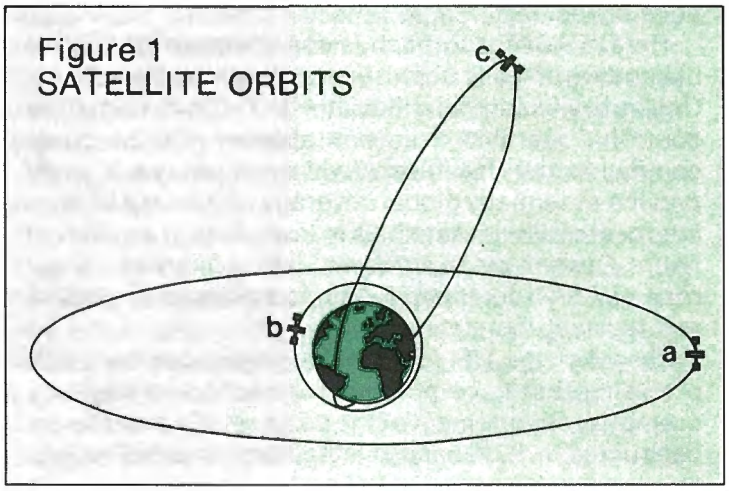
However, satellites also serve common US-Soviet interests in stability, arms control, and crisis management. They can provide mutual reassurance about the two countries' activities and capabilities, including compliance with arms control agreements. Early-warning satellites add to the deterrence of nuclear attack. If conflict were to break out, the chances of controlling it and bringing it to an early end would depend critically on satellite systems for the command and control of nuclear forces and on satellite communications between the two countries.

These stabilizing functions of satellites create a joint interest in giving them sanctuary from attack and thus in restraining the development of ASAT weapons. This interest is particularly strong for the United States, because it is more dependent on satellites for intelligence gathering and global communications.

Nevertheless, both superpowers began to explore antisatellite weapons in the 1960s. The United States developed two nuclear-armed ASAT weapons but discontinued this approach in the mid-1970s. Meanwhile, the Soviets began testing an orbiting, non-nuclear system in 1968. Testing of this ASAT was suspended in 1971 and resumed five years later, at which point the Ford administration approved the development of the current American ASAT system. President Carter continued this program but also entered into negotiations with the Soviets aimed at restraining or banning ASATs. The negotiations were suspended in 1979.

The Reagan administration has been committed to the testing and deployment of an ASAT system. It opposed a resumption of the ASAT arms control talks, despite overtures from the Soviet Union that included a draft treaty submitted to the United Nations and a self-imposed ASAT testing moratorium. In March 1984, the administration issued a report asserting that limitations on ASATs would be contrary to American military interests and virtually impossible to verify.

In March 1985, however, the two superpowers resumed arms control talks in Geneva under an umbrella formula covering three areas: long-range nuclear forces; intermediate-range nuclear forces; and space weapons, including ASATs as well as the "Star Wars" missile defenses being developed under the US Strategic Defense Initiative (SDI). The early rounds of these talks have been deadlocked by the American refusal to agree to restrictions on space weapons and the Soviet insistence that such restrictions are a precondition of agreements in the other two areas.



The US and Soviet ASATs

A satellite's vulnerability to attack is largely determined by the nature of its orbit (Figure 1). These fall into several categories, including geosynchronous (GEO) orbits, in which the satellite remains in a fixed position relative to the earth at an altitude of about 22,000 miles above the equator (a); low-earth orbits (LEO), at altitudes of about 100 to 1500 miles (b); and highly elliptical "Molniya" orbits (characteristic of many Soviet satellites) that dip as low as several hundred miles and rise as high as GEO orbits (c). Only satellites at low altitudes are vulnerable to current ASAT weapons.

The Soviet ASAT interceptor is launched by a ground-based SS-9 missile into an orbit close to that of its target, and uses a non-nuclear warhead to destroy its target with shrapnel (Figure 2). It is a rather clumsy and

inflexible system, and would require days or weeks to "sweep the skies" of the satellites within its range. This ASAT has been tested some 20 times; about half these tests were successful. Though characterized by the United States as an operational system, the Soviet ASAT is of questionable reliability and military utility. The highest altitude it can reach is reported to be about 1400 miles, threatening LEO space objects. About a third of all US satellites—used for photographic and electronic surveillance—are in such orbits, while the most critical US satellites—those responsible for early warning, nuclear attack assessment, and military communications—are in high orbits not vulnerable to the current Soviet ASAT. It does not appear that this ASAT could be easily modified to reach GEO orbits.

The US ASAT is based on quite different principles. The interceptor is a Miniature Homing Vehicle (MHV) carried into space on a two-stage rocket which in turn is launched from a high-altitude F-15 fighter plane (Figure 3). The MHV is a small cylinder, one foot in diameter, that seeks its target by a combination of infrared telescopes, a laser gyroscope, and a set of small jets that can alter its trajectory. It destroys by direct impact at very high velocity. The US system could not reach GEO satellites, but at present almost all Soviet satellites are in low or Molniya orbits that would bring them within range of the system. In the future, the F-15 ASAT could possibly be adapted to a GEO role by using a three-stage booster rocket.

The US ASAT approach is considerably more flexible and technically sophisticated than the Soviet one. Unlike the fixed-based Soviet ASAT, the F-15 system could be operated from any airbase with adequate communication facilities; if widely dispersed, it could provide essentially global coverage and a capability to intercept all Soviet satellites in low orbits in a matter of hours. Current plans, however, call for only two squadrons of ASAT-equipped F-15s, to be based in Virginia and Washington state.

Recently, the US ASAT has experienced technical problems that have put it behind schedule and may prompt a reassessment of the program. Two tests were conducted in 1984 against imaginary targets. The first was successful, while the second was characterized as only a "partial" success. The testing of the system against an actual object in space was delayed due to problems with the MHV and the test target vehicle. In August 1985 the administration announced that the first such test would occur soon, but that the target would be a nonfunctioning US satellite already in orbit. Meanwhile, the total development and procurement costs of the MHV project have risen to $4.1 billion, and the deployment date has slipped a year to 1988. It has been reported that the Air Force is considering cancelling the program in favor of developing a more advanced laser ASAT.

ASAT Arms Control

Neither the US nor the Soviet ASAT currently poses a threat to the most strategically significant satellites in high orbits. As a result, there is still an opportunity for meaningful ASAT arms control to forestall the emergence of advanced ASATs that would seriously undermine stability. A joint moratorium on ASAT testing would be an important first step, and could be followed by a more comprehensive ban on ASAT systems. Pending negotiation of such a ban, there would admittedly be a limited Soviet ASAT threat to US satellites in low orbits. However, this risk must be put in perspective. First, even with a complete ban on ASATs, satellites will be vulnerable to attack or disruption, for example by nuclear explosions or such electronic measures as jamming. Measures to protect and diversify satellites are therefore necessary with or without ASAT arms control. Second, without ASAT arms control the future

Figure 2
SOVIET ASAT APPROACHING AND DESTROYING ITS TARGET

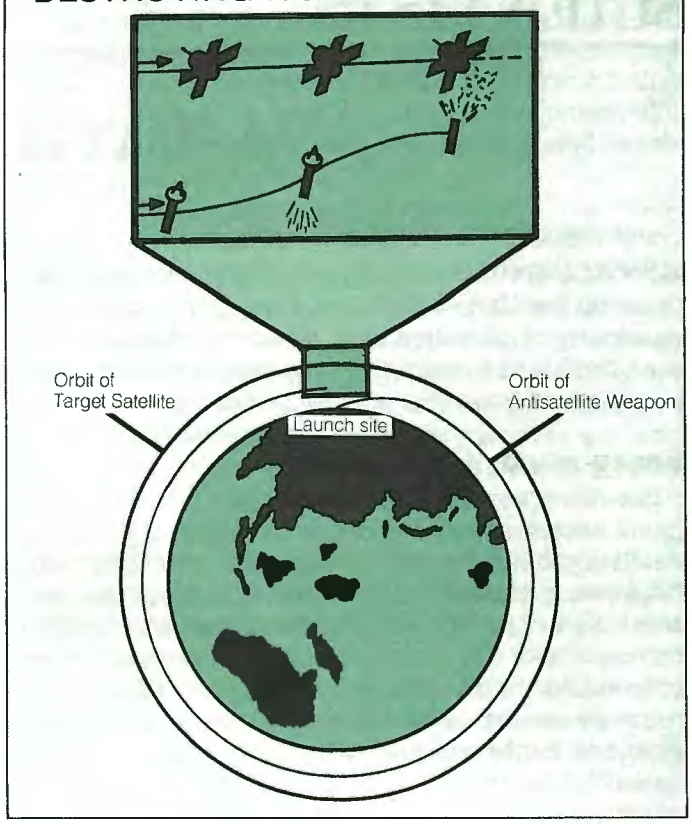
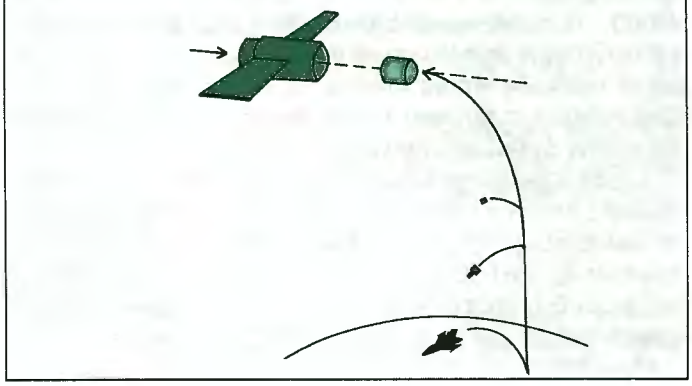


Figure 3
AMERICAN ASAT APPROACHING AND DESTROYING ITS TARGET



threat to American satellites will be far greater, and the measures necessary to protect them far more difficult and expensive.

The objective of ASAT arms control should be to prevent the development of advanced, reliable, dedicated ASAT weapons. This is an achievable goal, and should not be neglected simply because the total elimination of all threats to satellites is impossible.

The Reagan administration has made several arguments to justify its opposition to controls on antisatellite weapons. It asserts that the United States requires such weapons to attack hostile Soviet satellites in the event of conflict, and to deter Soviet attacks on US satellites. In addition, it argues that an ASAT treaty poses serious verification difficulties and thus a high risk of Soviet cheating or "breakout." However, these objections do not stand up to close analysis.

The first argument—the alleged need to deny the use of space to the Soviet Union during a conflict—is often supported by citing the threat to US naval vessels posed by Soviet Radar Ocean Reconnaissance Satellites (RORSATs). These satellites are reported to be able to locate ships at sea, and aid in providing targeting coordinates. But RORSATs are vulnerable to a wide variety of electronic countermeasures such as jamming and decoying, negating the need to destroy them. In addition, the Soviets have many alternative means for locating naval vessels. Finally, given its own dependence on satellite-based command, control, and communications systems, the Navy would very probably lose more than it would gain if both the United States and the Soviets develop effective ASAT weapons and use them in a conflict.

This last point underscores the weakness of the deterrence rationale for US ASAT development. If the United States is more dependent on satellites than the Soviets are, then the threat to attack Soviet satellites may not deter Soviet ASAT attacks. Moreover, the deterrence rationale conflicts with the first argument for a US ASAT: If the United States intends to destroy Soviet satellites during a conflict, then it cannot hope to use the threat of such attacks to forestall Soviet attacks on American satellites.

An additional, often unstated, reason for the Reagan administration's opposition to ASAT arms control—in particular an ASAT test ban—is the significant overlap between the technologies for antisatellite weapons and "Star Wars" ballistic missile defense (BMD). Because the ASAT mission is the easier one, ASATs are a logical step in a program to develop missile defenses. Constraints on ASATs could impede the SDI program significantly.

In addition, tests of space-based BMD systems or components are banned by the 1972 Anti-Ballistic Missile (ABM) Treaty. The administration plans to conduct several SDI tests under the guise of ASAT development, thus remaining nominally in compliance with the ABM Treaty. An ASAT treaty would close this loophole—strengthening the ABM Treaty but hindering the SDI.

Because of the close connection between the two technologies, serious attempts to develop space-based BMD systems by the superpowers will preclude effective ASAT arms control. Even a fairly rudimentary space-based missile defense system could function as a very capable antisatellite weapon. Moreover, as the United States proceeds with the SDI the Soviets may become less interested in ASAT arms control, since they will want to develop ASATs as a countermeasure to any space-based BMD that the United States might deploy.

Verification

It has been argued that an ASAT treaty would be difficult to verify: satellites are so few in number and their capabilities are so difficult to duplicate with ground-based alternatives that even a few ASAT weapons covertly deployed in violation of a treaty might reward the cheater with significant military advantage. It is also argued that any limitations on weapons or space programs that are broad enough to prevent cheating would preclude many civilian uses of outer space.

The United States is well equipped to verify a carefully drafted ASAT treaty, however. It possesses a diverse, sophisticated array of intelligence and space surveillance facilities to monitor Soviet activities, and this array is being expanded. Other electronic and optical sensors deployed around and over the Soviet Union add to the US ability to detect and classify Soviet missile and space launches. There is also great potential for surveying activities in outer space from space itself. The effectiveness of monitoring facilities would be enhanced by arms control provisions (as in the SALT agreements) that prohibit both interference with national technical means of verification and deliberate concealment that impedes verification.

Four main verification tasks face the United States in an ASAT accord:

1. Ensure that the Soviet ASAT is not being tested in space. The United States has monitored tests of the current Soviet interceptor since 1968. It is very unlikely that future tests of the system—including new ways of testing it, for example, on a booster capable of reaching high-altitude orbits—would go undetected.

2. Ensure that no new ASAT weapons are being developed and tested. If the Soviets hope to expand their ASAT capability covertly, they would probably attempt an entirely new ASAT, such as a laser weapon or a "space mine."

The technological challenges in building a space-based laser ASAT are formidable, even if unrestricted testing in space were permitted. Doing so covertly would be a protracted, high-risk task. To prevent the Soviets from testing ASATs in space under the pretense of developing, for example, a laser anti-aircraft system, an ASAT treaty should ban space weapons for damaging or destroying objects in the atmosphere or on the ground. This prohibition would reinforce the limitations on space weapons in the 1967 Outer Space Treaty and the 1972 ABM Treaty.

Ground- or air-based laser ASATs are far easier to build than space-based ones. In all these new ASATs, however, the very high accuracies in homing or aiming necessary would be hard to confirm without tests against space targets. Such tests can leave a host of telltale

signs: launch of the ASAT itself; data transmitted from the test vehicles; damage to the target that causes it to fragment or tumble; intense heating that can be detected by infrared sensors; and displacement of the target's orbit.

Space mines, placed in orbit near target satellites and detonated only when conflict begins, seem ingeniously simple. If covertly deployed, however, they might give themselves away either through direct detection or through interception of signal transmissions between the space mine and earth. If, to reduce the possibility of detection, only a limited number of space mines were deployed, this would correspondingly reduce the threat to US satellites.

3. Ensure that weapons designed for other missions are not used as ASATs. Long US experience at monitoring the characteristic patterns of Soviet missile tests would make it difficult for the Soviet Union to test its ICBMs or ABM missiles as antisatellite weapons without US knowledge. It is true that these weapons could be used to destroy US satellites with nuclear explosions even without testing; this is part of the residual threat that no ASAT treaty can eliminate. But nuclear detonations would be an extreme, last-resort method of destroying satellites—risking escalation to nuclear war and damage to Soviet space systems.

4. Ensure that non-weapon space vehicles (such as the Space Shuttle) are not used as ASATs. Some non-weapon space vehicles may also have inherent ASAT capabilities (e.g., resupply vehicles that can home in on other satellites), and both superpowers would want to verify that such vehicles were not being tested in an ASAT mode. Constraints on the characteristics and use of non-weapon space technologies may be prudent. It is difficult to propose specific constraints on future space technologies, but an ASAT treaty could provide for consideration of such questions, as needed, through the Standing Consultative Commission.

A final verification issue is that of "breakout," the risk that the Soviet Union might assemble a significant ASAT capability by running a sudden series of space tests. The issue here is how quickly an ASAT weapon could be brought to operational status if assembled and tested on the ground, or tested covertly in space as dismantled components (for example, by testing homing sensors for ASAT interceptors on a non-military space mission).

If the ASAT accord banned tests but allowed both sides to keep their present ASAT weapons, then both would have some breakout potential. Although the existing Soviet ASAT is a much more manageable threat than that posed by unrestrained ASAT competition, this potential would be of some concern for the United States. A combination of satellite survivability measures, the erosion of the Soviets' confidence in their ASAT in the absence of testing, and further negotiations aimed at the dismantling of current systems would address these concerns.

Breakout using an entirely new ASAT weapon tested only on the ground or covertly (component by component) in space would be very risky both technically and politically. To be confident of having a reliable weapon, the Soviets would need to do extensive tests simulating as closely as possible an actual satellite interception.

In sum, there are no insuperable obstacles to verifying an agreement to ban the testing and use of ASAT weapons. There may be some areas of uncertainty, but not so great as to permit the Soviets to pose a significant unanticipated threat to US security if prudent steps are taken to improve intelligence-gathering capabilities and to diversify and protect vital satellite functions.

As with any arms control agreement, the risks of militarily significant cheating by the Soviet Union must be weighed against the risks of an unrestrained space arms race if no agreement is reached. Such a race would be an immensely dangerous, expensive, and ultimately self-defeating prospect. If ASATs remain uncontrolled, both superpowers' security will be diminished. Any threat to satellites, whether real or potential, will reduce confidence in the ability to deter attack. By the same token, the knowledge that satellites are at risk will undermine stability during a crisis. Even in times of peace, a keen rivalry in the development and testing of ASATs can cause friction, increase suspicion, and perhaps inadvertently spark a conflict. Finally, such development and testing will inevitably erode the effectiveness of the ABM Treaty, whose integrity is critical to the prospects for agreements to limit offensive nuclear forces.

The hazards of an uninhibited competition in space weapons are far greater than those posed by the tightly constrained evolution of ASAT capabilities that may be possible because of verification ambiguities. On balance, US security will be much better served by a negotiated ban on the testing or use of antisatellite weapons.

Suggestions for Further Reading

Union of Concerned Scientists, *The Fallacy of Star Wars* (Random House, 1984).

American Academy of Arts and Sciences, *Weapons in Space,* in *Daedalus* spring 1985 (*Volume I: Concepts and Technologies*) and summer 1985 (*Volume II: Implications for Security*).

The Union of Concerned Scientists

The Union of Concerned Scientists is an independent nonprofit organization of scientists and other citizens concerned about the impact of advanced technology on society. UCS's efforts focus on nuclear arms control, nuclear power safety, and national energy policy. Established as an informal faculty group in the Boston area in 1969, UCS now has over 100,000 sponsors nationwide.

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UNION OF CONCERNED SCIENTISTS

BRIEFING PAPER

CONGRESSIONAL VOTING RECORD

99TH CONGRESS, FIRST SESSION

Once again, UCS is printing a Congressional voting record focusing on the major arms control/national security votes of the United States Congress. We have provided some basic information on each vote, including the number and title of the bill under consideration, the date, and a description of the issue under debate. Although UCS did not work extensively on each of these amendments, we have indicated for our sponsors the preferred outcome for each vote.

As you examine this information, remember that voting is only one of the many varied duties of a Member of Congress. Most spend long hours in committee and subcommittee hearings and mark-up sessions, where crucial legislative decisions are often made. Constituent service, leadership on major issues, and the degree to which Members influence, rather than follow, their colleagues, are other factors that should be considered when you judge the effectiveness of your Congressional representatives.

Finally, while the votes here represent important decision points in U.S. national security and nuclear weapons policy, they are only a few of the hundreds of votes that occur during each session of Congress. For additional information, you can write to your Senators or Representative, or you can refer to numerous information sources, including the *Congressional Record* and such commercial publications as *Congressional Quarterly* and *National Journal.*

KEY TO VOTES

+=Voted for arms control (with UCS position)
−=Voted against arms control (against UCS position)
v=Congressional seat vacant at the time of the vote
a=Absent, did not vote, or "paired" on the amendment

DESCRIPTION OF SENATE VOTES

1. MX MISSILE APPROVAL
S.J. Res. 71. MX Missile Authorization
Joint resolution required to reaffirm authorization of $1.5 billion for production of 21 additional MX missiles in FY (Fiscal Year) 1985. **UCS opposes production of the MX and opposed this joint resolution.** (Y=−)
March 19, 1985. Resolution accepted 55-45.

2. MX MISSILE PRODUCTION
S.1160. FY 86 Defense Authorization
Amendment offered by Senator Nunn (D-GA) to deploy no more than 50 MX missiles in existing missile silos and to authorize procurement of 12 MX missiles for FY86 (some of which are to be used for testing rather than actual deployment). **UCS opposes the MX and supported the Nunn amendment in order to limit total deployment.** (Y=+)
May 22, 1985. Amendment passed 78-20.

3. ANTI-SATELLITE (ASAT) TESTING MORATORIUM
S.1160. FY86 Defense Authorization
Amendment offered by Senators Kerry (D-MA), Chafee (R-RI) and Mathias (R-MD) for a moratorium on the testing of ASAT weapons against objects in space during FY85 and FY86, unless the Soviet Union tested an ASAT weapon. **UCS strongly opposes ASAT testing and supported the Kerry amendment.** (Y=+)
May 24, 1985. Amendment defeated 35-51.

4. STAR WARS SPENDING LIMITS
S.1160. FY86 Defense Authorization
Amendment offered by Senators Proxmire (D-WI), Bumpers (D-AR), Chafee (R-RI) and Mathias (R-MD) to reduce SDI spending from $2.96 billion to $1.9 billion. **UCS strongly opposes increased funding for SDI and supported the Proxmire-Bumpers amendment.** (Y=+)
June 4, 1985. Amendment rejected 38-57.

5. U.S./CHINA NUCLEAR TECHNOLOGY TRANSFER
H.J.Res.465. FY86 Continuing Appropriations
Motion by Senator Evans (R-WA) to table (kill) the Glenn (D-OH) amendment which prohibited the transfer of nuclear technology to China, unless Peking had agreed to accept international standards ensuring the peaceful use of the technology. **UCS supports strict limits on the spread of nuclear technology and opposed the Evans motion.** (Y=−)
December 9, 1985. Motion defeated 28-59.

6. FUNDING FOR X-RAY LASER PROGRAM
H.J.Res.465. FY86 Continuing Appropriations
Motion by Senator Stevens (R-AK) to table (kill) the Kerry (D-MA) amendment to bar the use of any nuclear materials in the development of strategic defenses. **UCS opposes the inclusion of research on nuclear devices within the SDI and opposed the Stevens motion.** (Y=−)
December 10, 1985. Motion accepted 64-32.

	1	2	3	4	5	6
ALABAMA						
Denton (R)	−	−	−	−	+	−
Heflin (D)	−	+	−	−	+	−
ALASKA						
Murkowski (R)	−	+	−	−	−	−
Stevens (R)	−	+	−	−	−	−
ARIZONA						
Goldwater (R)	−	+	−	−	+	a
DeConcini (D)	−	+	a	+	a	−
ARKANSAS						
Bumpers (D)	+	+	+	+	+	+
Pryor (D)	+	+	+	+	+	+
CALIFORNIA						
Wilson (R)	−	−	−	−	+	−
Cranston (D)	+	+	+	+	−	+
COLORADO						
Armstrong (R)	−	+	−	−	+	−
Hart (D)	+	+	+	+	+	+
CONNECTICUT						
Weicker (R)	+	−	+	+	+	−
Dodd (D)	+	+	+	+	−	+
DELAWARE						
Roth (R)	−	+	−	−	+	−
Biden (D)	+	+	+	a	+	+
FLORIDA						
Hawkins (R)	−	+	−	−	a	−
Chiles (D)	+	+	−	+	a	a
GEORGIA						
Mattingly (R)	−	+	−	−	+	−
Nunn (D)	−	+	−	−	+	−
HAWAII						
Inouye (D)	+	+	+	+	a	+
Matsunaga (D)	+	+	+	+	+	+
IDAHO						
McClure (R)	−	−	−	−	−	−
Symms (R)	−	−	−	−	−	−
ILLINOIS						
Dixon (D)	+	+	a	−	+	−
Simon (D)	+	+	+	+	a	+
INDIANA						
Lugar (R)	−	+	−	−	a	−
Quayle (R)	−	+	−	−	+	−
IOWA						
Grassley (R)	+	+	−	+	+	−
Harkin (D)	+	+	a	+	+	+
KANSAS						
Dole (R)	−	+	−	−	−	−
Kassebaum (R)	+	+	−	+	−	−
KENTUCKY						
McConnell (R)	−	+	−	−	−	−
Ford (D)	+	+	−	+	+	−

	1	2	3	4	5	6
LOUISIANA						
Johnston (D)	+	+	a	+	−	+
Long (D)	−	+	a	−	+	−
MAINE						
Cohen (R)	−	+	a	−	+	−
Mitchell (D)	+	+	+	+	+	+
MARYLAND						
Mathias (R)	−	+	+	+	−	+
Sarbanes (D)	+	+	+	+	+	+
MASSACHUSETTS						
Kennedy (D)	+	−	+	+	+	+
Kerry (D)	+	−	+	+	+	+
MICHIGAN						
Levin (D)	+	+	+	+	+	+
Riegle (D)	+	+	+	+	a	+
MINNESOTA						
Boschwitz (R)	−	+	−	−	+	−
Durenberger (R)	+	+	−	−	a	−
MISSISSIPPI						
Cochran (R)	−	−	−	−	−	−
Stennis (D)	−	+	−	a	a	a
MISSOURI						
Danforth (R)	−	+	a	−	+	−
Eagleton (D)	+	+	+	+	+	+
MONTANA						
Baucus (D)	+	+	+	+	+	+
Melcher (D)	+	+	a	+	+	+
NEBRASKA						
Exon (D)	+	+	−	−	+	−
Zorinsky (D)	−	+	−	−	−	−
NEVADA						
Hecht (R)	−	−	−	−	+	−
Laxalt (R)	−	+	−	−	a	−
NEW HAMPSHIRE						
Humphrey (R)	−	−	−	−	+	−
Rudman (R)	−	+	a	−	+	−
NEW JERSEY						
Bradley (D)	+	+	−	−	+	−
Lautenberg (D)	+	+	+	+	+	+
NEW MEXICO						
Domenici (R)	−	+	a	−	−	−
Bingaman (D)	+	+	+	−	+	−
NEW YORK						
D'Amato (R)	−	+	−	−	+	−
Moynihan (D)	+	+	+	+	+	+
NORTH CAROLINA						
East (R)	−	a	a	a	a	a
Helms (R)	−	−	−	−	+	−
NORTH DAKOTA						
Andrews (R)	+	+	−	−	−	−
Burdick (D)	+	−	+	+	+	+

	1	2	3	4	5	6
OHIO						
Glenn (D)	+	+	−	−	+	−
Metzenbaum (D)	+	+	+	+	+	+
OKLAHOMA						
Nickles (R)	−	−	−	−	+	−
Boren (D)	−	+	a	a	+	−
OREGON						
Hatfield (R)	+	−	+	+	−	−
Packwood (R)	−	+	a	−	+	−
PENNSYLVANIA						
Heinz (R)	−	+	+	−	−	−
Specter (R)	−	+	+	a	a	−
RHODE ISLAND						
Chafee (R)	−	+	+	+	−	+
Pell (D)	+	+	+	+	−	+
SOUTH CAROLINA						
Thurmond (R)	−	+	−	−	+	−
Hollings (D)	+	+	−	−	+	−
SOUTH DAKOTA						
Abdnor (R)	−	+	−	−	+	−
Pressler (R)	+	−	−	−	−	−
TENNESSEE						
Gore (D)	−	+	+	+	+	+
Sasser (D)	+	+	+	+	+	+
TEXAS						
Gramm (R)	−	−	−	−	−	−
Bentsen (D)	−	+	a	−	+	−
UTAH						
Garn (R)	−	−	−	−	−	−
Hatch (R)	−	−	−	−	−	−
VERMONT						
Stafford (R)	+	a	+	−	−	−
Leahy (D)	+	−	+	+	a	+
VIRGINIA						
Trible (R)	−	+	−	−	+	−
Warner (R)	−	+	−	−	+	−
WASHINGTON						
Evans (R)	−	+	−	−	−	−
Gorton (R)	−	+	−	−	−	−
WEST VIRGINIA						
Byrd (D)	−	+	−	−	+	−
Rockefeller (D)	+	+	+	+	+	+
WISCONSIN						
Kasten (R)	−	+	−	−	−	−
Proxmire (D)	+	+	+	+	+	+
WYOMING						
Simpson (R)	−	+	−	−	−	−
Wallop (R)	−	−	−	−	+	−

DESCRIPTION OF HOUSE VOTES

1. MX MISSILE APPROVAL

S.J.Res.71. MX Missile Authorization

Joint resolution required to reaffirm authorization of $1.5 billion for production of 21 additional MX missiles in FY85. **UCS opposes the MX and opposed this joint resolution.** (Y=−) *March 26, 1985. Resolution approved 219-213.*

2. MX MISSILE PRODUCTION

H.R.1872. FY86 Defense Authorization

Amendment offered by Representatives Mavroules (D-MA) and McCurdy (D-OK) to impose a permanent, statutory ceiling on the deployment of the MX at no more than 40 missiles. **UCS opposes the MX and supported the Mavroules-McCurdy "Cap."** (Y=+)

June 18, 1985. Amendment accepted 233-184.

3. CHEMICAL WEAPONS PRODUCTION

H.R.1872. FY86 Defense Authorization

Amendment offered by Representatives Skelton (D-MO) and Spratt (D-SC) to authorize the appropriation of $124 million for binary chemical weapons production subject to NATO's agreement to both the need for modernized chemical weapons and their placement in Europe. **UCS opposed the Skelton-Spratt amendment, as it detracted from the ban on chemical weapons production proposed by Representatives Fascell (D-FL) and Porter (R-IL).** (Y=−)

June 19, 1985. Amendment adopted 229-196.

4. STAR WARS SPENDING LIMITS

H.R.1872. FY86 Defense authorization

Amendment offered by Representatives Mavroules (D-MA) and Hertel (D-MI) to limit SDI spending to $1.4 billion, the FY85 funding level. **UCS opposes increased funding for SDI and supported the Mavroules-Hertel amendment.** (Y=+)

June 20, 1985. Amendment rejected 155-268.

5. STAR WARS SPENDING LIMITS

H.R.1872. FY86 Defense Authorization

Amendment offered by Representative Dicks (D-WA) to reduce SDI funding from $2.5 to $2.1 billion and to constrain research that would violate the ABM Treaty. **UCS opposes increased funding for SDI and supported the Dicks amendment.** (Y=+)

June 20, 1985. Amendment defeated 195-221.

6. ANTI-SATELLITE (ASAT) MORATORIUM

H.R.1872. FY86 Defense Athorization

Amendment offered by Representatives Brown (D-CA) and Coughlin (R-PA) for a US-Soviet moratorium on the testing of ASAT missiles against a target in space. **UCS supports the ASAT moratorium and supported the Brown-Coughlin amendment.** (Y=+)

June 26, 1985. Amendment adopted 229-193.

	1	2	3	4	5	6
ALABAMA						
1 Callahan (R)	–	–	–	–	–	–
2 Dickinson (R)	–	–	–	–	–	–
3 Nichols (D)	–	–	–	–	–	–
4 Bevill (D)	–	–	–	–	–	–
5 Flippo (D)	–	a	–	–	–	–
6 Erdreich (D)	–	–	+	–	–	–
7 Shelby (D)	–	–	–	–	–	–
ALASKA						
Young (R)	–	–	–	–	–	–
ARIZONA						
1 McCain (R)	–	–	–	–	–	–
2 Udall (D)	+	+	a	+	+	+
3 Stump (R)	–	–	–	–	–	–
4 Rudd (R)	–	–	–	–	–	–
5 Kolbe (R)	–	–	–	–	–	–
ARKANSAS						
1 Alexander (D)	+	+	–	–	–	a
2 Robinson (D)	–	–	–	–	–	–
3 Hammerschmidt (R)	–	–	–	–	–	–
4 Anthony (D)	+	+	–	+	+	+
CALIFORNIA						
1 Bosco (D)	+	+	–	–	+	+
2 Chappie (R)	–	–	–	–	–	–
3 Matsui (D)	+	+	+	+	+	+
4 Fazio (D)	–	+	–	+	+	+
5 Burton (D)	+	+	+	+	+	+
6 Boxer (D)	+	+	+	+	+	+
7 Miller (D)	+	+	+	+	+	+
8 Dellums (D)	+	+	+	+	+	+
9 Stark (D)	+	+	+	+	a	a
10 Edwards (D)	+	+	+	+	+	+
11 Lantos (D)	+	+	+	+	+	+
12 Zschau (R)	+	+	–	–	–	+
13 Mineta (D)	+	+	+	+	+	+
14 Shumway (R)	–	–	–	–	–	–
15 Coelho (D)	+	+	+	+	+	+
16 Panetta (D)	+	+	+	+	+	+
17 Pashayan (R)	–	–	–	–	–	–
18 Lehman (D)	+	+	+	+	+	+
19 Lagomarsino (R)	–	–	–	–	–	–
20 Thomas (R)	–	–	–	–	–	–
21 Fiedler (R)	–	–	–	–	–	–
22 Moorhead (R)	–	–	–	–	–	–
23 Beilenson (D)	+	+	+	+	+	+
24 Waxman (D)	+	+	+	+	+	+
25 Roybal (D)	+	+	+	+	+	+
26 Berman (D)	+	+	+	+	+	+
27 Levine (D)	+	+	+	+	+	+
28 Dixon (D)	+	+	a	a	a	+
29 Hawkins (D)	+	a	+	+	+	+
30 Martinez (D)	+	+	+	+	+	+
31 Dymally (D)	+	+	+	+	+	+
32 Anderson (D)	–	–	–	+	+	+
33 Dreier (R)	–	–	–	–	–	–
34 Torres (D)	+	a	+	+	+	+
35 Lewis (R)	–	–	–	–	–	–
36 Brown (D)	+	a	+	+	+	+
37 McCandless (R)	–	–	–	–	–	–
38 Dornan (R)	–	–	–	–	–	–
39 Dannemeyer (R)	–	–	–	–	–	–
40 Badham (R)	–	–	–	–	–	–
41 Lowery (R)	–	–	–	–	–	–
42 Lungren (R)	–	–	–	–	–	–
43 Packard (R)	–	–	–	–	–	–
44 Bates (D)	+	+	–	+	+	+
45 Hunter (R)	–	–	–	–	–	–
COLORADO						
1 Schroeder (D)	+	+	+	+	+	+
2 Wirth (D)	+	+	+	+	+	+
3 Strang (R)	–	a	a	a	a	–
4 Brown (R)	–	–	+	–	–	–
5 Kramer (R)	–	–	–	–	–	–
6 Schaefer (R)	–	–	a	–	–	–
CONNECTICUT						
1 Kennelly (D)	+	+	+	+	+	+
2 Gejdenson (D)	+	+	+	+	+	+
3 Morrison (D)	+	+	+	+	+	+
4 McKinney (R)	+	+	+	+	+	+
5 Rowland (R)	–	–	–	–	–	–
6 Johnson (R)	+	+	–	–	–	+
DELAWARE						
Carper (D)	+	+	+	–	+	+
FLORIDA						
1 Hutto (D)	–	–	–	–	–	–
2 Fuqua (D)	–	–	–	–	–	–
3 Bennett (D)	+	+	–	–	–	+
4 Chappell (D)	–	–	–	–	–	–

	1	2	3	4	5	6
5 McCollum (R)	–	–	–	–	–	–
6 MacKay (D)	+	+	+	+	+	+
7 Gibbons (D)	+	+	–	+	+	+
8 Young (R)	–	–	–	–	–	–
9 Bilirakis (R)	–	–	–	–	–	–
10 Ireland (R)	–	–	–	–	–	–
11 Nelson (D)	–	–	–	–	–	–
12 Lewis (R)	–	–	+	–	–	–
13 Mack (R)	–	–	–	–	–	–
14 Mica (D)	+	+	–	+	+	+
15 Shaw (R)	–	–	–	–	–	–
16 Smith (D)	+	+	+	a	a	+
17 Lehman (D)	+	+	+	+	+	+
18 Pepper (D)	–	a	a	a	a	+
19 Fascell (D)	+	+	+	–	+	+
GEORGIA						
1 Thomas (D)	–	–	–	–	–	–
2 Hatcher (D)	–	–	–	–	–	–
3 Ray (D)	–	–	–	–	–	–
4 Swindall (R)	–	–	–	–	–	–
5 Fowler (D)	+	+	+	–	–	+
6 Gingrich (R)	–	–	–	–	–	–
7 Darden (D)	–	–	–	–	–	–
8 Rowland (D)	–	–	–	–	–	–
9 Jenkins (D)	+	+	–	–	–	–
10 Barnard (D)	–	–	–	–	–	–
HAWAII						
1 Heftel (D)	+	+	–	–	+	+
2 Akaka (D)	+	+	–	+	+	+
IDAHO						
1 Craig (R)	–	–	–	–	–	–
2 Stallings (D)	+	+	+	–	+	+
ILLINOIS						
1 Hayes (D)	+	+	+	+	+	+
2 Savage (D)	+	+	+	+	a	+
3 Russo (D)	+	+	+	+	+	+
4 O'Brien (R)	–	–	a	–	a	–
5 Lipinski (D)	–	+	–	–	a	+
6 Hyde (R)	–	–	–	–	–	–
7 Collins (D)	+	+	+	+	+	+
8 Rostenkowski (D)	+	+	+	a	a	+
9 Yates (D)	+	+	+	+	+	+
10 Porter (R)	–	–	+	–	+	+
11 Annunzio (D)	+	+	+	+	–	+
12 Crane (R)	–	–	–	–	–	–
13 Fawell (R)	–	–	–	–	–	–
14 Grotberg (R)	–	–	–	–	–	–
15 Madigan (R)	–	–	–	–	–	–
16 Martin (R)	–	–	+	–	–	–
17 Evans (D)	+	+	+	+	+	+
18 Michel (R)	–	–	–	–	–	–
19 Bruce (D)	+	+	+	+	+	+
20 Durbin (D)	+	+	+	+	+	+
21 Price (D)	–	+	–	–	+	+
22 Gray (D)	+	+	–	–	–	+
INDIANA						
1 Visclosky (D)	+	+	+	–	+	+
2 Sharp (D)	+	+	+	–	+	+
3 Hiler (R)	–	–	–	–	–	–
4 Coats (R)	–	–	+	–	–	–
5 Hillis (R)	–	–	–	–	–	–
6 Burton (R)	–	–	–	–	–	–
7 Myers (R)	–	–	–	–	–	–
8 McCloskey (D)	v	+	+	+	+	+
9 Hamilton (D)	+	+	–	–	+	+
10 Jacobs (D)	+	+	+	+	+	+
IOWA						
1 Leach (R)	+	+	+	+	+	+
2 Tauke (R)	+	+	+	–	+	+
3 Evans (R)	+	+	–	–	–	+
4 Smith (D)	+	+	+	–	+	+
5 Lightfoot (R)	–	–	–	–	–	–
6 Bedell (D)	+	+	+	+	+	+
KANSAS						
1 Roberts (R)	+	+	–	–	–	+
2 Slattery (D)	+	+	–	–	+	+
3 Meyers (R)	–	+	–	–	–	+
4 Glickman (D)	+	+	–	+	+	+
5 Whittaker (R)	–	+	–	–	–	–
KENTUCKY						
1 Hubbard (D)	–	–	–	–	–	–
2 Natcher (D)	+	+	+	–	+	+
3 Mazzoli (D)	+	+	+	–	+	+
4 Snyder (R)	–	–	–	–	–	–
5 Rogers (R)	–	–	–	–	–	–
6 Hopkins (R)	–	+	–	–	–	+
7 Perkins (D)	+	+	+	+	+	+

	1	2	3	4	5	6
LOUISIANA						
1 Livingston (R)	–	–	–	–	–	–
2 Boggs (D)	+	+	+	–	+	+
3 Tauzin (D)	–	–	–	–	–	–
4 Roemer (D)	–	–	–	–	–	–
5 Huckaby (D)	–	–	+	–	–	–
6 Moore (R)	–	–	–	–	–	–
7 Breaux (D)	–	–	–	–	–	–
8 Long (D)	v	+	+	–	+	+
8 Long (D)	v	v	v	v	v	v
MAINE						
1 McKernan (R)	–	+	+	–	–	+
2 Snowe (R)	–	+	+	–	–	+
MARYLAND						
1 Dyson (D)	–	–	–	–	–	–
2 Bentley (R)	–	–	–	–	–	–
3 Mikulski (D)	+	+	+	+	+	+
4 Holt (R)	–	–	–	–	–	a
5 Hoyer (D)	–	+	–	–	+	+
6 Byron (D)	–	–	–	–	+	–
7 Mitchell (D)	+	a	+	+	+	+
8 Barnes (D)	+	+	+	+	+	+
MASSACHUSETTS						
1 Conte (R)	+	+	+	+	–	+
2 Boland (D)	+	+	+	–	+	+
3 Early (D)	+	+	+	+	+	+
4 Frank (D)	+	+	+	+	+	+
5 Atkins (D)	+	+	+	+	+	+
6 Mavroules (D)	+	+	+	+	+	+
7 Markey (D)	+	+	+	+	+	+
8 O'Neill (D)						
9 Moakley (D)	+	+	+	+	+	+
10 Studds (D)	+	+	+	+	+	+
11 Donnelly (D)	+	+	+	–	+	+
MICHIGAN						
1 Conyers (D)	+	+	+	+	+	–
2 Pursell (R)	–	+	–	–	+	+
3 Wolpe (D)	+	+	+	+	+	+
4 Siljander (R)	–	–	–	–	–	–
5 Henry (R)	+	+	+	–	–	–
6 Carr (D)	+	+	+	+	+	+
7 Kildee (D)	+	+	+	+	+	+
8 Traxler (D)	+	+	+	+	+	+
9 Vander Jagt (R)	–	–	–	–	–	–
10 Schuette (R)	–	–	–	–	–	–
11 Davis (R)	–	–	–	–	–	–
12 Bonior (D)	+	+	+	+	+	+
13 Crockett (D)	+	+	+	+	–	+
14 Hertel (D)	+	+	+	+	+	+
15 Ford (D)	+	+	+	+	+	+
16 Dingell (D)	+	+	–	+	+	+
17 Levin (D)	+	+	+	+	+	+
18 Broomfield (R)	–	–	–	–	–	–
MINNESOTA						
1 Penny (D)	+	+	+	+	+	+
2 Weber (R)	–	a	+	–	–	–
3 Frenzel (R)	–	+	–	–	+	+
4 Vento (D)	+	+	+	+	+	+
5 Sabo (D)	+	+	+	+	+	+
6 Sikorski (D)	+	+	+	+	+	+
7 Stangeland (R)	–	–	–	–	–	–
8 Oberstar (D)	+	+	+	+	+	+
MISSISSIPPI						
1 Whitten (D)	+	+	+	–	+	–
2 Franklin (R)	–	–	+	–	–	–
3 Montgomery (D)	–	–	–	–	–	–
4 Dowdy (D)	–	–	–	–	+	+
5 Lott (R)	–	–	–	–	–	–
MISSOURI						
1 Clay (D)	+	+	+	+	+	+
2 Young (D)	+	+	–	+	–	–
3 Gephardt (D)	+	+	–	–	+	+
4 Skelton (D)	–	–	–	–	+	–
5 Wheat (D)	+	+	+	+	+	+
6 Coleman (R)	–	–	–	–	–	–
7 Taylor (R)	–	–	–	–	–	–
9 Emerson (R)	–	–	a	–	–	–
9 Volkmer (D)	+	+	–	+	+	+
MONTANA						
1 Williams (D)	+	+	–	+	+	+
2 Marlenee (R)	–	a	–	–	–	–
NEBRASKA						
1 Bereuter (R)	+	+	–	–	–	–
2 Daub (R)	–	–	–	–	–	+
3 Smith (R)	+	+	–	–	–	–
NEVADA						
1 Reid (D)	–	–	+	–	–	+
2 Vucanovich (R)	–	–	–	–	–	–

	1	2	3	4	5	6
NEW HAMPSHIRE						
1 Smith (R)	–	–	–	–	–	–
2 Gregg (R)	–	–	+	–	–	–
NEW JERSEY						
1 Florio (D)	+	+	+	+	+	+
2 Hughes (D)	+	+	–	–	+	+
3 Howard (D)	+	+	+	+	+	+
4 Smith (R)	+	+	+	–	–	–
5 Roukema (R)	+	+	+	–	+	+
6 Dwyer (D)	+	+	+	+	+	+
7 Rinaldo (R)	–	–	+	–	–	–
8 Roe (D)	+	+	+	–	+	+
9 Torricelli (D)	+	+	+	+	+	+
10 Rodino (D)	+	+	+	+	+	+
11 Gallo (R)	–	–	–	–	–	–
12 Courter (R)	–	–	–	–	–	–
13 Saxton (R)	–	–	–	–	–	–
14 Guarini (D)	+	+	+	+	+	+
NEW MEXICO						
1 Lujan (R)	–	–	–	–	–	–
2 Skeen (R)	–	–	–	–	–	–
3 Richardson (D)	+	+	+	–	+	+
NEW YORK						
1 Carney (R)	–	–	–	–	–	–
2 Downey (D)	+	+	+	+	+	+
3 Mrazek (D)	+	+	+	+	+	+
4 Lent (R)	–	–	–	–	–	–
5 McGrath (R)	–	–	–	–	–	–
6 Addabbo (D)	+	a	+	+	+	+
7 Ackerman (D)	+	+	+	+	+	+
8 Scheuer (D)	+	+	+	+	a	+
9 Manton (D)	+	+	+	+	a	+
10 Schumer (D)	+	a	+	+	+	+
11 Towns (D)	+	+	+	a	a	+
12 Owens (D)	+	+	+	+	–	a
13 Solarz (D)	+	+	+	+	+	+
14 Molinari (R)	–	–	+	–	–	–
15 Green (R)	+	+	+	–	+	+
16 Rangel (D)	+	a	+	+	+	+
17 Weiss (D)	+	+	+	+	+	+
18 Garcia (D)	+	+	+	+	a	+
19 Biaggi (D)	+	+	–	–	–	+
20 DioGuardi (R)	+	+	–	–	–	–
21 Fish (R)	–	–	+	–	+	a
22 Gilman (R)	–	–	–	–	–	–
23 Stratton (D)	–	–	–	–	–	–
24 Solomon (R)	–	a	–	–	–	–
25 Boehlert (R)	–	+	–	–	–	+
26 Martin (R)	–	–	–	–	–	–
27 Wortley (R)	–	–	+	–	–	a
28 McHugh (D)	+	+	+	+	+	+
29 Horton (R)	–	–	+	–	–	+
30 Eckert (R)	–	–	–	–	–	–
31 Kemp (R)	–	–	–	–	–	–
32 LaFalce (D)	+	+	+	+	+	+
33 Nowak (D)	+	+	+	+	+	+
34 Lundine (D)	+	+	+	+	+	+
NORTH CAROLINA						
1 Jones (D)	+	+	+	+	+	+
2 Valentine (D)	–	–	–	–	–	–
3 Whitley (D)	–	–	–	–	–	+
4 Cobey (R)	–	–	–	–	–	–
5 Neal (D)	–	+	–	–	+	+
6 Coble (R)	–	+	–	–	–	–
7 Rose (D)	+	+	–	+	+	–
8 Hefner (D)	–	+	–	–	–	a
9 McMillan (R)	–	–	–	–	–	–
10 Broyhill (R)	–	–	–	–	–	–
11 Hendon (R)	–	–	–	–	–	–
NORTH DAKOTA						
Dorgan (D)	+	+	+	+	+	+
OHIO						
1 Luken (D)	+	+	+	a	a	a
2 Gradison (R)	+	+	+	–	–	+
3 Hall (D)	+	+	+	+	+	+
4 Oxley (R)	–	–	–	–	–	–
5 Latta (R)	–	–	–	–	–	–
6 McEwen (R)	–	–	–	–	–	–
7 DeWine (R)	–	–	–	–	–	–
8 Kindness (R)	–	–	–	–	–	–
9 Kaptur (D)	+	+	+	+	+	+
10 Miller (R)	–	–	–	–	–	–
11 Eckart (D)	+	+	+	+	+	+
12 Kasich (R)	–	–	–	–	–	–
13 Pease (D)	+	+	+	+	+	+
14 Seiberling (D)	+	+	+	+	+	+
15 Wylie (R)	–	–	–	–	–	–
16 Regula (R)	–	–	+	–	–	+
17 Traficant (D)	+	+	+	+	+	+
18 Applegate (D)	+	+	+	+	+	+
19 Feighan (D)	+	+	+	+	+	+
20 Oakar (D)	+	+	+	+	+	+
21 Stokes (D)	+	+	+	+	+	+
OKLAHOMA						
1 Jones (D)	+	+	–	–	+	+
2 Synar (D)	+	+	+	+	+	+
3 Watkins (D)	–	+	+	+	+	–
4 McCurdy (D)	–	+	–	–	–	+
5 Edwards (R)	–	–	–	–	–	–
6 English (D)	–	+	–	–	–	–
OREGON						
1 AuCoin (D)	+	+	+	+	+	+
2 Smith, R. (R)	–	–	+	–	–	–
3 Wyden (D)	+	+	+	+	+	+
4 Weaver (D)	+	+	+	+	+	+
5 Smith, D. (R)	–	–	–	–	–	–
PENNSYLVANIA						
1 Foglietta (D)	+	+	+	+	+	+
2 Gray (D)	+	+	+	+	+	a
3 Borski (D)	+	+	+	+	+	+
4 Kolter (D)	+	+	+	+	+	a
5 Schulze (R)	–	–	–	–	–	–
6 Yatron (D)	–	–	+	+	+	+
7 Edgar (D)	+	+	+	+	+	+
8 Kostmayer (D)	+	+	+	+	+	+
9 Shuster (R)	–	–	–	–	–	–
10 McDade (R)	–	–	–	–	–	–
11 Kanjorski (D)	+	+	+	–	+	+
12 Murtha (D)	–	–	–	–	–	–
13 Coughlin (R)	+	+	+	–	+	+
14 Coyne (D)	+	+	+	+	+	+
15 Ritter (R)	–	–	–	–	–	–
16 Walker (R)	–	–	+	–	–	–
17 Gekas (R)	–	–	–	–	–	–
18 Walgren (D)	+	+	–	+	+	+
19 Goodling (R)	+	–	–	–	–	+
20 Gaydos (D)	+	+	+	a	a	–
21 Ridge (R)	+	+	–	–	+	+
22 Murphy (D)	+	–	–	+	+	+
23 Clinger (R)	–	–	+	–	–	+
RHODE ISLAND						
1 St Germain (D)	+	+	+	+	+	+
2 Schneider (R)	+	+	+	+	+	+
SOUTH CAROLINA						
1 Hartnett (R)	–	–	–	–	–	–
2 Spence (R)	–	–	–	–	–	–
3 Derrick (D)	+	+	+	–	+	+
4 Campbell (R)	–	–	–	–	–	–
5 Spratt (D)	+	+	–	–	+	+
6 Tallon (D)	+	+	–	–	–	+
SOUTH DAKOTA						
Daschle (D)	+	+	+	a	a	+
TENNESSEE						
1 Quillen (R)	–	–	–	–	–	–
2 Duncan (R)	–	–	–	–	–	–
3 Lloyd (D)	–	–	–	–	–	–
4 Cooper (D)	–	+	+	+	+	+
5 Boner (D)	–	–	–	–	+	+
6 Gordon (D)	+	+	+	–	+	+
7 Sundquist (R)	–	–	–	–	–	–
8 Jones (D)	–	–	–	–	–	+
9 Ford (D)	+	+	+	+	+	+
TEXAS						
1 Hall (D)	–	v	v	v	v	v
1 Chapman (D)	v	v	v	v	v	v
2 Wilson (D)	–	a	–	–	–	a
3 Bartlett (R)	–	–	–	–	–	–
4 Hall, R. (D)	–	–	–	–	–	–
5 Bryant (D)	+	+	–	–	+	+
6 Barton (R)	–	–	–	–	–	–
7 Archer (R)	–	–	–	–	–	–
8 Fields (R)	–	–	–	–	–	–
9 Brooks (D)	+	+	–	+	+	+
10 Pickle (D)	+	+	+	–	–	+
11 Leath (D)	–	–	–	–	–	–
12 Wright (D)	+	+	–	–	+	+
13 Boulter (R)	–	–	–	–	–	–
14 Sweeney (R)	–	–	–	–	–	–
15 de la Garza (D)	–	+	–	+	–	+
16 Coleman (D)	+	+	–	–	+	–
17 Stenholm (D)	–	–	–	–	–	–
18 Leland (D)	+	+	+	+	+	+
19 Combest (R)	–	–	–	–	–	–
20 Gonzalez (D)	+	+	+	+	+	+
21 Loeffler (R)	–	a	–	–	–	–
22 DeLay (R)	–	–	–	–	–	–
23 Bustamante (D)	–	+	–	–	+	+
24 Frost (D)	–	+	–	–	+	–
25 Andrews (D)	–	+	–	–	+	–
26 Armey (R)	–	–	+	–	–	–
27 Ortiz (D)	–	+	–	–	+	+
UTAH						
1 Hansen (R)	–	–	–	–	–	–
2 Monson (R)	–	–	–	–	–	–
3 Nielson (R)	–	–	–	–	–	–
VERMONT						
Jeffords (R)	+	a	a	a	a	+
VIRGINIA						
1 Bateman (R)	–	–	–	–	–	–
2 Whitehurst (R)	–	–	–	–	–	–
3 Bliley (R)	–	–	–	–	–	–
4 Sisisky (D)	+	+	–	–	–	–
5 Daniel (D)	–	–	–	–	–	–
6 Olin (D)	+	+	+	–	–	+
7 Slaughter (R)	–	–	–	–	–	–
8 Parris (R)	–	–	–	–	–	–
9 Boucher (D)	+	+	–	+	+	+
10 Wolf (R)	–	–	–	–	–	–
WASHINGTON						
1 Miller (R)	+	+	–	–	–	+
2 Swift (D)	+	+	+	+	+	+
3 Bonker (D)	+	+	+	+	+	+
4 Morrison (R)	–	–	–	–	–	–
5 Foley (D)	+	+	+	+	+	+
6 Dicks (D)	–	+	–	–	+	+
7 Lowry (D)	+	+	+	+	+	+
8 Chandler (R)	–	–	–	–	–	+
WEST VIRGINIA						
1 Mollohan (D)	–	+	–	–	–	+
2 Staggers (D)	+	+	+	+	+	+
3 Wise (D)	+	+	+	+	+	+
4 Rahall (D)	+	+	+	+	+	+
WISCONSIN						
1 Aspin (D)	–	+	–	–	+	+
2 Kastenmeier (D)	+	+	+	+	+	+
3 Gunderson (R)	–	+	+	–	–	+
4 Kleczka (D)	+	+	+	+	+	+
5 Moody (D)	+	+	+	+	+	+
6 Petri (R)	+	+	–	–	–	–
7 Obey (D)	+	+	+	+	+	+
8 Roth (R)	–	–	+	–	–	–
9 Sensenbrenner (R)	+	+	+	–	–	–
WYOMING						
Cheney (R)	–	–	–	–	–	–

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UNION OF CONCERNED SCIENTISTS

BRIEFING PAPER

ARMS CONTROL VERIFICATION

Verification of treaty compliance is a critical issue for the future of arms control. Before entering into an agreement, each side must be confident that it can detect cheating by the other. Verification ensures that a treaty serves its intended purpose, and bolsters confidence in future negotiations.

Verification need not be perfect to be effective. Under an agreement that provides for adequate verification, cheating is deterred; any cheating that does occur is likely to be revealed, and cheating that is not detected is likely to result in only marginal changes in military capabilities. In a world where the United States and the Soviet Union already have about 20,000 strategic nuclear warheads between them, such changes will not have much military significance.

Some are concerned that the Soviet Union may be able to "break out" of a negotiated agreement—undertake militarily significant activities without detection—before the United States could respond. Theoretically, the Soviet leadership might plan to confront the United States with a sudden revelation of military capability covertly built up in order to bring pressure to bear on American political leaders. But, given the quantity and variety of weapons available to the United States, such a breakout would be ineffective if confined to incremental increases in a single weapons system; broader preparation would almost certainly be apparent to American intelligence agencies. Moreover, in considering whether to violate a treaty reached with the United States, the Soviets must weigh the potential gains of cheating against the costs of being caught—including the prospect of hostile relations and the possibility that America would take advantage of its superior technical skill to accelerate its own weapons programs.

Verification is a political process, not simply a matter of obtaining the most detailed technical information possible. Once information is gathered through various monitoring means, it must be analyzed and interpreted for consistency with treaty provisions. Arms control agreements are often ambiguously worded, and in the face of such ambiguity, each country tends to make unilateral interpretations and use them to judge the other's compliance. Ascertaining compliance becomes a matter of political judgment as well as the routine technical monitoring of military activities, and the process leaves a great deal of room for political discussion about "violations." Similarly, the interpretation of incomplete information calls for judgment—political, military, and technical—as to whether observed activities comply with arms control agreements.

A good arms control agreement strikes a balance between what can be verified and what needs to be verified to fulfill the purposes of a treaty. Verification is not a static process. In a situation of continuing technological change, ongoing communication among the parties to an agreement is necessary to ensure its proper application.

This briefing paper will first review the means by which compliance with arms control agreements can be verified, and then assess the feasibility of monitoring compliance with specific types of restrictions that may be included in arms control agreements.

Means of Verifying Compliance

Compliance with arms control agreements is monitored both through "national technical means" (NTM) and through cooperative efforts between the parties to a treaty.

National Technical Means

Most verification is accomplished using **national technical means** such as satellite surveillance. Both

Reconnaissance Satellite. *Artist's rendition—Pentagon has never released photographs of actual satellites.*

the United States and the Soviet Union utilize NTM to monitor compliance with arms control treaties from outside each other's national borders. The information available through NTM has increased continually with improved reconnaissance satellites and electronic detection devices. These ever-improving monitoring and detection capabilities provide increasingly sophisticated tools to ensure compliance with negotiated arms control agreements. Both the SALT agreement limiting offensive nuclear forces and the Anti-Ballistic Missile Treaty are verified by NTM, and provisions of these treaties prohibit interference with such verification.

Satellites, ground stations, aircraft, ships, and submarines all host a variety of remote sensing devices used to detect and identify military activities. Three types of US satellites provide images of the territory over which they fly. The KH-11, from an altitude of 250 to 500 kilometers, uses a multispectral scanner and both thermal and visible infrared sensors. The Big Bird satellite, operating at an altitude of 160 to 280 kilometers, uses a high-resolution film camera and multispectral and infrared scanners. The third satellite, Close Look, takes color photographs using visible light from an altitude of 130 to 300 kilometers.

Although specific figures are classified, the clarity and detail now being achieved by US reconnaissance satellites is reportedly approaching theoretical limits. Some US satellites are apparently able to distinguish objects as small as 5 to 15 centimeters in size, depending on the weather, pollution, movement of the object, and other factors. One former director of the CIA has said that US satellite surveillance capabilities are good enough to allow a skilled photo interpreter to distinguish between Guernsey and Hereford cows grazing in a meadow.

Other satellites collect intelligence from "telemetry"—electronic signals that transmit data. The United States' most important such satellite for verification purposes is the Rhyolite, which operates in a geosynchronous orbit at about 36,000 kilometers. It collects data on missile tests and probably monitors Soviet military communications as well. Still other satellites, including the Integrated Operational Nuclear Detection System (IONDS) and Defense Support Program (DSP) satellites, detect nuclear explosions and monitor missile flight tests. The satellite launched by the US space shuttle in early 1985 reportedly will also be used to monitor Soviet missile tests.

Cooperative Measures

Cooperative measures supplementing national technical means of verifying compliance have been an important part of arms control negotiations. The most intrusive cooperative measures are on-site inspections and monitoring devices installed within the borders of a party to a treaty.

On-site inspections would provide for the actual presence of human observers at military installations that fall within the purview of a treaty. Such on-site verification is useful, but can be overvalued. Although it can provide high confidence of compliance at individual sites just prior to, during, and immediately after a visit by observers, it cannot be relied upon to ensure compliance during the periods between visits or at other locations. Moreover, it is unlikely that either the United States or the Soviet Union would agree to unconditional or unlimited on-site inspections, since both nations fear that such openness would jeopardize their national security.

Permanent, unmanned devices can facilitate verification of such activities as underground weapons tests. A recent study has shown, for example, that with 15 unstaffed stations inside the Soviet Union and 15 stations outside the country, underground tests of nuclear explosions as low as one kiloton could be detected. Installation of such a system would provide high confidence in the verification of a comprehensive test ban, should such a ban be achieved.

Some of the more helpful cooperative measures established in past arms control treaties have been rules for counting weapon systems, rules for determining types of weapons, forums for discussion of potential violations, and agreements to give advance notification of certain military activities in order to prevent them from being misinterpreted.

Counting rules are used to simplify the verification of numerical limitations. For example, as part of the SALT II agreement, all missiles are counted as having the maximum number of warheads ever tested on that missile. This means that if a particular missile has been tested with ten warheads, *any* missile of the same type that is deployed is assumed to have ten warheads, even though some may actually be deployed with fewer.

Type rules reduce confusion by requiring that there be observable differences between nuclear and non-nuclear versions of the same system, or between different nuclear systems. For example, bombers carrying nuclear bombs must be distinguishable both from those carrying non-nuclear bombs and those carrying cruise missiles.

The SALT process established a forum—the Standing Consultative Commission (SCC)—to which each country could bring its concerns about potential violations by the other. The United States and the Soviet Union have brought several compliance issues to the SCC. It is important to note that, in the past, most such issues have been resolved satisfactorily. More recently, each country has publicly charged the other with a number of treaty violations, many of which apparently have not yet been resolved by the SCC.

Feasibility of Verifying Compliance

The feasibility of verifying arms control agreements is tied to the likelihood that a set of different activities related to developing or deploying a given weapons system could all be undertaken without being detected. For example, if there is an 80 percent chance that the United States can detect certain Soviet activities, the Soviets could, in theory, cheat on those activities 20 percent of the time. But if the development of a new weapons system involves a sequence of three separate activities, each of which has an 80 percent chance of

being detected, then the chance that the United States would fail to observe *any* of the activities within the sequence is less than one percent ($0.2 \times 0.2 \times 0.2 = 0.008$).

The likelihood of observing a violation to a treaty varies over time and also depends on the characteristics of the weapons system being monitored, especially its size and mobility. Systems that can be easily concealed or readily moved around from site to site are obviously more difficult to monitor, as are systems that are "dual-capable" (capable of launching either nuclear or conventional ordnance). We will consider in turn the feasibility of verifying restrictions related to ground- and sea-based delivery systems, the testing of nuclear explosives, the production of weapons-grade materials, and development of antisatellite systems.

Monitoring Ground- and Sea-Based Delivery Systems

With respect to restrictions on **deployment** of delivery systems, the United States has high confidence* in its ability to count fixed launchers for intercontinental ballistic missiles (ICBMs) and intermediate-range ballistic missiles (IRBMs), launchers for submarine-launched ballistic missiles (SLBMs), and strategic bombers and other primary nuclear missions aircraft. The United States has moderate to high confidence in its ability to count mobile systems such as nuclear-armed ships and submarines, nuclear artillery, and battlefield missile units.

It is more difficult to count mobile launchers for ICBMs, IRBMs, or ground-launched cruise missiles (GLCMs). Large-scale deployment of cruise missiles could threaten chances for future quantitative limitations on nuclear weapons, because the weapon is small, easily transported, and may be fitted with nuclear or non-nuclear explosives in a way that is not easily distinguished.

The **testing** of delivery systems is monitored principally by technical intelligence sources such as imaging reconnaissance satellites, electronic reconnaissance satellites, ground-based monitoring posts, test observation radars, aircraft, and ships, as well as nontechnical intelligence sources such as spies, defectors, and the foreign press. Through these means, we can determine with moderate-high to high confidence the number and weight of re-entry vehicles being tested, the number of stages, the type of propellant, and the limits on operational ballistic missile flight tests. We are moderately confident of our ability to determine whether the length, diameter, throw-weight, and launch-weight of a new missile are more than 5 percent different from those dimensions of an older missile—that is, whether the United States considers the missile to be new or a modification of an older system.

* Former Secretary of Defense Harold Brown has described confidence in the United States' ability to detect various activities using NTM as follows: **high** confidence is defined as a greater than 90 percent likelihood of detecting a given activity; **moderate-high,** 75–90 percent; **moderate,** 50–75 percent; **low,** 10–50 percent; **very low,** less than 10 percent.

USS Observation Island. *Equipped with the latest in electronic listening devices to monitor Soviet communications.*

Monitoring the **production** of missiles, bombers, and strategic nuclear submarines uses primarily imaging reconnaissance satellites, and nontechnical intelligence collection methods. We have high confidence in monitoring the total shutdown of shipyards or facilities for assembling weapons or making key components for nuclear weapons, because a complete halt in the flow of materials into and out of known manufacturing or storage facilities is readily observable by NTM. Monitoring a specific level of production at factories producing small weapons systems or components of larger systems is more difficult, however—satellites simply cannot see through walls to determine what is happening inside.

Monitoring the Testing of Nuclear Explosives

Nuclear explosions are monitored principally by early warning satellites, nuclear explosion detection satellites, and ground-based seismic sensors. The United States currently has high confidence of detecting tests with a yield greater than about ten kilotons, but somewhat less confidence in the ability to determine whether smaller explosions are nuclear tests or earthquakes. Confidence in the ability to detect nonseismic evidence of nuclear explosions (e.g., craters, radioactivity) and to monitor the activity and geography of potential test sites is also moderate to high. As noted above, installation of a system of unmanned seismic stations inside and around the perimeter of the Soviet Union could provide high confidence in confirming whether tests of nuclear explosions as small as one kiloton have been conducted.

Ratification of the Threshold Test Ban Treaty (TTBT), already signed by both the United States and the Soviet Union, would improve our ability to assess the yield of nuclear weapons tests. In addition to limiting testing to designated sites, the TTBT also provides for an exchange of data, including the yield, time, depth, and geographic coordinates for two tests from each geophysically distinct test area. These data would allow

further calibration of monitoring systems by establishing the relationship between seismic signals and stated yields of tests at particular sites.

Monitoring the Production of Weapons-Grade Nuclear Materials

Restrictions on production of weapons-grade nuclear materials would be verified primarily by imaging reconnaissance satellites and nontechnical intelligence sources. Production of weapons-grade nuclear materials takes place in only a few well-known locations in each country. We have high confidence in our ability to monitor activities at these facilities, and it would be very difficult for a country to develop new facilities without detection by satellite.

Monitoring Antisatellite Systems

Antisatellite (ASAT) systems are monitored by satellites, ground-based posts, test observation radars, aircraft and ships, and nontechnical intelligence sources. The United States has a global network of space tracking radars and telescopes that enable the Air Force to keep track of all Soviet space launches and space objects. We have good confidence in monitoring the **testing** of the current Soviet ASAT system, which uses a huge, easily observable booster rocket and has been monitored successfully for 15 years. Steady improvements in US surveillance facilities are likely to keep pace with advances in ASAT technology, providing long-term assurance that the space testing of new ASAT systems can be adequately verified if a test ban on ASAT systems should be achieved.

Verifying compliance with a ban on ground **deployment** or possession of ASAT systems is more difficult. The proposed US system, for example, will be carried under the wing of an F-15 fighter plane and could be deployed at US aircraft bases anywhere in the world. The weapon's small size will make it easy to conceal. However, an agreement by both superpowers banning the testing of ASAT weapons would preclude either nation from gaining confidence in the reliability of its system, creating a major disincentive for deployment.

Summary

In a perfect world, perfect verification would be possible. The world in which we live, however, is one of uncertainty and risk. As a result, monitoring and verification must be viewed within the context of potential benefits and costs of arms control agreements.

In this imperfect world, the United States has formidable, robust, and redundant monitoring and verification capabilities. Thus, even as we continue to press for improved verification and tighter formulation of obligations under arms control agreements, we should be able to strike a reasonable balance between the risks of potential noncompliance with a carefully verified agreement and the risks of uncontrolled competition without such an agreement. And we should also be aware that some outright opponents of arms control find it convenient to conceal their opposition behind calls for 100 percent verification.

Suggestions for Further Reading

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MARCH 1985

THE UNION OF CONCERNED SCIENTISTS

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Scientist's Declaration on Nuclear Power

From the Declaration presented to Congress and the President of the United States on the 30th anniversary of the atomic bombing of Hiroshima and signed by more than 2,000 biologists, chemists, engineers and other scientists. . .

". . . the country must recognize that it now appears imprudent to move forward with a rapidly expanding nuclear power plant construction program. The risks of doing so are altogether too great. We, therefore, urge a drastic reduction in new nuclear power plant construction starts before major progress is achieved in the required research and in resolving present controversies about safety, waste disposal, and plutonium safeguards. For similar reasons, we urge the nation to suspend its program of exporting nuclear plants to other countries pending resolution of the national security questions associated with the use by these countries of the by-product plutonium from United States nuclear reactors."

August 6, 1975

Since the proclamation of the scientists' declaration, some of our objectives have been achieved.

Since 1975, plans for 64 reactors have been cancelled, one-quarter of the total then planned.

A few of the signers of the declaration*:

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HANNES ALFVEN—Professor of Physics, University of California at San Diego; Nobel Laureate;

CHRISTIAN B. ANFINSEN—Chief, Laboratory for Chemical Biology, United States National Institutes of Health; Nobel Laureate;

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HARRIET BERNHEIMER, Ph.D.—State University of New York, Downstate Medical Center;

NINA BYERS—Professor of Physics, U.C.L.A.

EARL CALLEN—Professor of Physics, American University

RICHARD L. CASPERSON—Associate Scientist, Thermal Reactor Safety Division, Idaho National Engineering Laboratory (formerly known as Atomic Energy Commission National Reactor Testing Site);

SAUL COHEN—Professor and Head of Department of Chemistry, Brandeis University;

JAMES BRYANT CONANT—President Emeritus of Harvard University; Chairman, National Defense Research Committee during World War II; Member of Manhattan Project Steering Committee; United States High Commissioner in Germany; General Advisory Committee of the AEC; "Atomic Pioneer's Award" from President Nixon, among other honors; (deceased)

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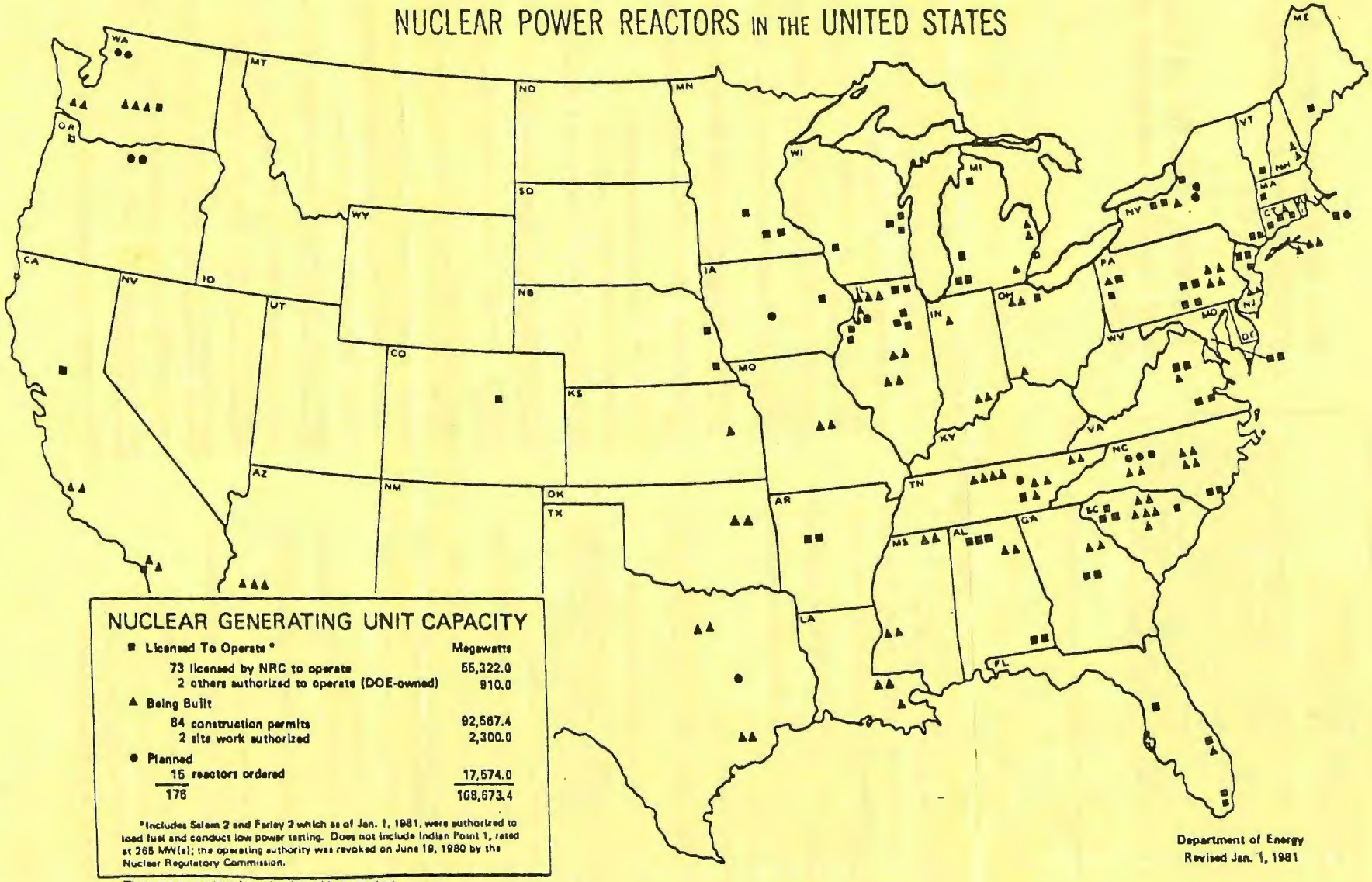
*Organizational affiliation is for identification only.

This Declaration was prepared August 1975 under the auspices of The Union Of Concerned Scientists

NUCLEAR POWER REACTORS IN THE UNITED STATES



NUCLEAR GENERATING UNIT CAPACITY

	Megawatts
■ Licensed To Operate *	
73 licensed by NRC to operate	55,322.0
2 others authorized to operate (DOE-owned)	910.0
▲ Being Built	
84 construction permits	92,567.4
2 site work authorized	2,300.0
● Planned	
15 reactors ordered	17,574.0
176	168,673.4

*Includes Salem 2 and Farley 2 which as of Jan. 1, 1981, were authorized to load fuel and conduct low power testing. Does not include Indian Point 1, rated at 265 MW(e); the operating authority was revoked on June 19, 1980 by the Nuclear Regulatory Commission.

There are no symbols for units planned but not sited.
Because of space limitations, symbols do not reflect precise locations.

Department of Energy
Revised Jan. 1, 1981

UNION OF CONCERNED SCIENTISTS

BRIEFING PAPER

SPACE-BASED MISSILE DEFENSE

In March 1983, President Reagan offered the vision of a shield against nuclear attack so effective that it could replace deterrence as the basis of our security and render nuclear weapons "impotent and obsolete." He called for a major national effort to realize this vision through the development of new defensive weapons capable of intercepting and destroying Soviet ballistic missiles in flight. The administration's proposed Strategic Defense Initiative (SDI) is a five-year, $26 billion research, development, and testing program to lay the groundwork for construction and deployment of missile defenses.

The Problem of Missile Defense

The SDI raises a host of questions about the technical feasibility and strategic wisdom of missile defense and recalls the Anti-Ballistic Missile (ABM) debate of the late 1960s. Unlike the earlier ABM efforts, however, the new program focuses on futuristic weapons operating in space—hence the "Star Wars" label often applied to the SDI. The proposed shield would consist of several layers designed to intercept missiles during different phases of their flight (see Figure 1). The key to success is the first layer, which would attempt to destroy Soviet missiles in their "boost phase," within minutes after launching. Boost-phase interception is critical for three reasons: 1) the number of targets is much smaller than in later phases of the trajectory (since multiple warheads, decoys, and other penetration aids have not yet been released); 2) the booster rocket is a much "softer," more vulnerable target than the reentry vehicles it releases in the post-boost phase; and 3) the booster rocket flame offers a strong infrared signal that greatly facilitates target identification and tracking.

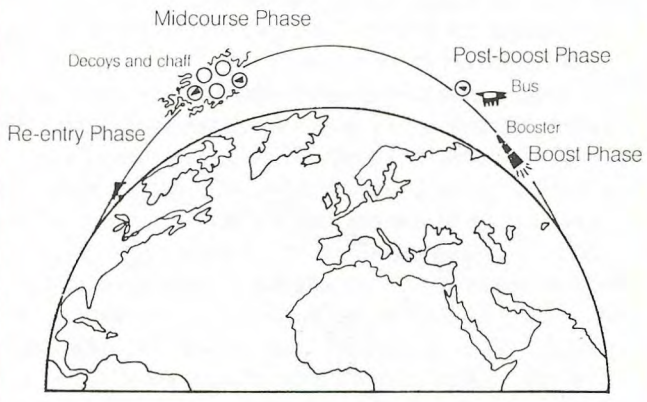
Failure to thin out an attack drastically in the boost phase would present the subsequent "midcourse" and "terminal" layers of the missile defense with an unmanageable problem. In midcourse, the defense could be confronted with hundreds of thousands of objects, all of which would have to be tracked and intercepted, since discrimination between warheads and decoys would be impossible in the vacuum of space. Terminal defense, while possibly a feasible means of protecting individual "hard" targets such as missile silos, is fundamentally unsuited to a comprehensive territorial defense.

The Union of Concerned Scientists has conducted a detailed technical analysis of the prospects for Star Wars defenses, emphasizing the principal technologies being considered for boost-phase interception—directed energy weapons such as lasers and particle beams, and "kill vehicles" that would home in on their target missiles. The UCS study concludes that there is no realistic hope of achieving the president's goal of an impermeable defense against nuclear attack. Moreover, the attempt to develop such a shield will have dire consequences for the arms race and for strategic stability, leaving both the United States and the Soviet Union less secure in the end.

The proposed defensive weapons of the SDI suffer from a combination of inherent technical limitations, intractable basing problems, and susceptibility to Soviet countermeasures. The Pentagon's own chief of research has conceded that the total missile defense called for by the president would require breakthroughs in eight separate technologies "equivalent to or greater than the Manhattan Project" that produced the first atomic bombs.

Even if individual technologies could be developed to the needed performance levels, fashioning them into a workable, deployable, and survivable system would pose insurmountable difficulties. The system would be immensely more complex than existing weapons and could never be tested under realistic conditions. In addition, it would have to be fully automated, responding instantly upon warning of attack without presidential involvement, given the very short reaction time available for boost-phase interception. Yet the defense would have to work with near 100 percent reliability. It would have almost no margin for error because

Fig. 1 Phases of Ballistic Flight



Once boost phase is over, warheads are dispersed on a "bus" along with decoys and "chaff" (metallic fragments and other materials) that can deceive and disrupt tracking and targeting functions of a missile defense. The post-boost offensive "threat cloud" could include more than 100,000 objects, all of which must be attacked by the defense.

even a minute "leakage" rate would mean hundreds of nuclear explosions on US territory—and millions of fatalities—in the event of a large Soviet attack (see Figure 2).

Basing Problems

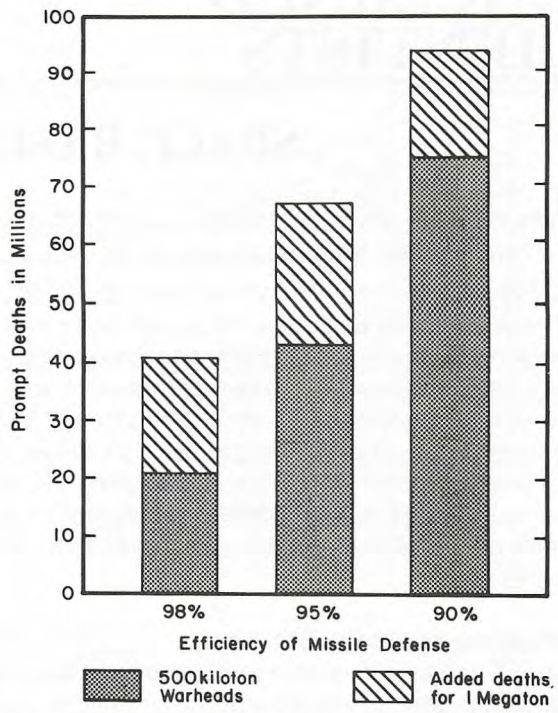
The problem of basing is particularly daunting. A boost-phase missile defense must operate in space, creating three deployment options. The system could be 1) based in space on orbiting battle stations; 2) based on the ground, with mirrors in orbit to reflect its laser beams to Soviet missiles rising from their launch sites; or 3) "popped up" into space when a warning of a Soviet attack is received. None of the three schemes appears workable.

— Orbiting battle stations could be placed into low orbits, at an altitude of several hundred miles, or in geosynchronous orbit at 22,500 miles. In the first case, a very large number of battle stations would be needed, since only a small fraction would be in position over Soviet missile silos at any given time. UCS has estimated that a low-orbit defense would require several hundred chemical laser weapons. Simply launching this system would cost tens of billions of dollars; more important, the weapons would be extremely vulnerable to Soviet attack. In geosynchronous orbit, fewer weapons would be needed, since they would remain in fixed positions relative to their targets on earth. But these weapons would have to operate at an enormous and quite infeasible range. An "excimer" laser in geosynchronous orbit, for example, would require a sighting telescope some 100 to 150 meters in diameter—twenty or thirty times larger than the Mt. Palomar telescope, the largest in the United States.

— A ground-based laser, favored by President Reagan's Science Advisor, George Keyworth, is no more promising. UCS has analyzed an excimer laser weapon whose beams would be reflected by a mirror in geosynchronous orbit to other mirrors in low orbit, and then to Soviet booster rockets. UCS estimates that the electric power bill alone for this implausible system would be $40–110 billion, even if the Soviets made no effort to counter it.

— The "pop-up" scheme has been proposed as a basing option for the x-ray laser weapon, favored by the physicist Edward Teller. Such a weapon could not be based in the United States, however, because of the curvature of the earth and the short time available for boost-phase interception. For example, a pop-up missile launched from Alaska would have to reach an altitude of 2000 miles before it could "see" missile fields in Siberia, and by then Soviet rockets would have completed their boost phase. As a result, the system would have to be based close to Soviet territory, probably on a new fleet of submarines created for this purpose. Even then, it is doubtful that sufficient reaction time would exist. Moreover, this basing scheme would be vulnerable to Soviet attack and would create major difficulties for command and control.

Fig. 2 Effect of Leakage in the Defense



A U.S. ballistic missile defense that prevents 90 percent of Soviet nuclear warheads (1 megaton each) from striking U.S. cities could still result in 90 million "prompt" fatalities. A defense that was 95 percent effective could result in 60 million deaths; and a 98 percent effective defense could cause 40 million deaths.
Source: U.S. URBAN POPULATION VULNERABILITY (U.S. Arms Control and Disarmament Agency, 1979).

Countermeasures

The slim hopes of overcoming such problems disappear altogether in light of the countermeasures available to the Soviets, who would certainly take any action necessary to defeat a US defense that would, if successful, disarm them. All of the proposed Star Wars defenses are susceptible to countermeasures that are cheaper and better understood than the defenses themselves. Soviet responses could include:

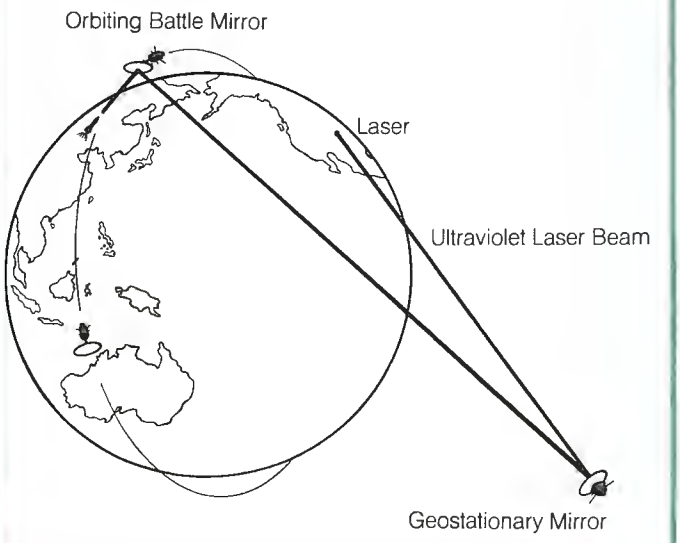
— An offensive nuclear buildup designed to saturate and overwhelm the US defensive system. This could include a proliferation of real or decoy missiles (decoys would lack warheads and guidance systems but would still have to be tracked and intercepted by the defense), or the placing of additional warheads on existing missiles (thus increasing the effectiveness of those that penetrate the defense).

— A buildup of warhead delivery systems, such as low-flying cruise missiles, that would circumvent space-based defenses.

— Shortening the boost phase of Soviet ICBMs by giving them more powerful engines. This would reduce the already short reaction time available to the defense, perhaps to as little as one minute. In addition, by designing their missiles to complete the boost phase while still inside the atmosphere, the Soviets could defeat those defensive weapons that are unable to penetrate the atmosphere. These include the x-ray laser and particle beam weapons.

— Protection of booster rockets from the effects of beam weapons through hardening, shielding, or rotation.
— Attacks on the defensive system itself. Space-based weapons and components (such as mirrors) would be highly vulnerable to attacks by "space mines" or inert objects such as sand or small pellets. Ground-based components would be subject to attacks from submarine-launched ballistic missiles and from cruise missiles. Targets could include ground facilities for battle management, rockets and basing facilities associated with pop-up weapons, and communications and control stations. Well-executed strikes of this sort, in advance of the main offensive missile launch, would probably disable the entire defense.

Fig. 3 Ground Based Laser System



Strategic Implications

The Strategic Defense Initiative will carry heavy political, strategic, and arms control costs. These costs would weigh against development of ballistic missile defenses even if the technical prospects for such systems were much brighter than they are.

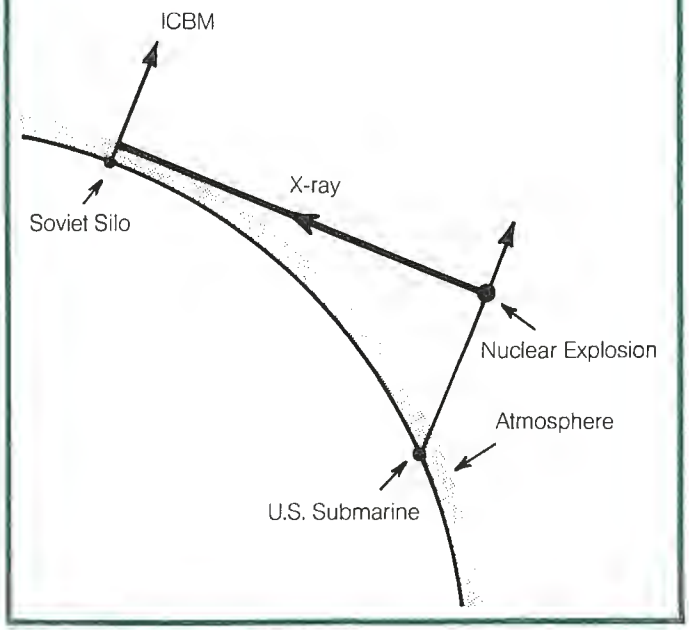
The most obvious casualty will be the 1972 Anti-Ballistic Missile Treaty, the most important arms control agreement to date and the foundation of all efforts to impose limits on offensive nuclear forces. The ABM Treaty flatly prohibits the development, testing, or deployment of space-based missile defenses or components. Although the administration claims that the SDI can initially be carried out within the terms of the treaty, planned technology demonstrations will at the very least push the United States to the edge of noncompliance. As such, the process of erosion that already threatens the ABM Treaty will be accelerated, precluding serious attempts to resolve issues of Soviet compliance that have been raised by the Reagan administration.

A major US missile defense program would also stimulate a new round of the arms race and undermine the already bleak prospects for new arms control agreements. Despite US rhetoric that missile defense might be in the mutual interest of the superpowers and compatible with negotiated arms reductions, the Soviet Union will certainly view the SDI as an attempt to achieve military superiority by negating the Soviet deterrent. The Soviets are no more likely than the United States to accept such a situation and can be expected to respond with a nuclear buildup that ensures their ability to penetrate US defenses. This fresh stimulus to the arms race would sweep aside existing constraints on offensive forces and doom future ones, including the administration's own "build-down" initiative in the Strategic Arms Reduction Talks (START). The President's Commission on Strategic Forces (the Scowcroft Commission) has recognized this danger and warns that the continued integrity of the ABM Treaty is critical to arms control.

Another danger of the SDI is the destabilizing impact of missile defenses in crisis situations. Given their limited effectiveness against all-out attack, defenses are likely to be perceived as part of a "first strike" strategy: They would be most effective in defending against the weakened retaliation that would follow an attack on the adversary's missile silos. As a result, defenses could increase pressures for preemptive strikes during periods of high tension, as each superpower fears that if it fails to strike first it may find itself disarmed.

Finally, pursuit of space-based missile defenses will foreclose any chance of restraining the development of anti-satellite (ASAT) weapons. The proposed Star Wars weapons would all have an inherent anti-satellite capability. Indeed, they might well function more effectively in the less demanding ASAT role than in their intended anti-missile role. Therefore, a commitment to

Fig. 4 Pop-up X-ray Laser System



Summary of Boost-Phase Ballistic Missile Defense Systems

System	Limitations	Countermeasures
• Chemical lasers on battle stations in low earth orbit (about 1000 km altitude)	• "Absenteeism" problem: for each laser in position over USSR at any time, about 10 must be in orbit • Vulnerability to ASAT attack	• ASAT attack: e.g., space mines • Hardening of booster rockets to resist laser effects
• Kill vehicles (e.g., homing projectiles) on "space trucks" in low earth orbit	• Limited range due to much lower velocity than beam weapons • "Absenteeism" problem: about 30 space trucks must be in orbit for every one in position over USSR • Vulnerability to ASAT attack • Can't penetrate atmosphere	• ASAT attack • Fast acceleration boosters able to complete boost phase within the atmosphere
• Ground-based excimer laser with mirrors in space to reflect beams to boosting Soviet missiles	• Vulnerability of orbiting mirrors • Huge electrical power requirements	• ASAT attacks on mirrors (e.g., pellets or sand) • Low-trajectory missile attacks on lasers
• X-ray laser, generated by nuclear explosion after being "popped up" into space at moment of Soviet attack	• Short reaction time and curvature of earth require basing close to USSR (e.g., on submarines) • Can't penetrate atmosphere • Automated system would mean relinquishing presidential control over use of nuclear weapons • X-ray delivers only a weak blow	• Fast acceleration boosters • Hardening of boosters
• Particle beam in orbit	• Can't penetrate atmosphere • Would weigh well over 500 tons	• Fast acceleration booster • ASAT attack
• All boost-phase systems	• Very short reaction time means system must be fully automated • Can't be realistically tested • At least some components must be space-based • Must be very effective or midcourse BMD will be overwhelmed	• ASAT attacks on space-based components • SLBM or cruise missile attacks on ground facilities • Proliferation of real or decoy booster rockets to overwhelm system • Cruise missiles or depressed-trajectory ballistic missiles to circumvent system • Disguise booster flame to foil aiming and tracking

Star Wars means an unconstrained US-Soviet ASAT competition—and the future vulnerability of satellites on which the United States depends for early warning of attack, control of nuclear forces, and military communications.

The Star Wars policy is ill-advised on both technical and strategic grounds. There is virtually no chance that an invincible shield envisioned by President Reagan can be developed. Yet the pursuit of this appealing mirage will, ironically, make us *less* rather than *more* secure: It will escalate the arms race, reduce stability, and feed a new cycle of mutual suspicion and fear between the superpowers.

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UNION OF CONCERNED SCIENTISTS

BRIEFING PAPER

A COMPREHENSIVE TEST BAN

Although a comprehensive test ban (CTB), prohibiting any explosive testing of nuclear weapons, has been high on arms control agendas since the atomic age began, no such agreement has yet been negotiated. Only partial agreements—most importantly the atmospheric test ban achieved in 1963—have been concluded. The Reagan administration has become the first to explicitly decide not to seek a CTB treaty with the Soviets, on the grounds that a halt to nuclear testing would be contrary to American interests and difficult to verify.

Advocates of a CTB believe that an end to nuclear testing would have a dramatic symbolic and practical impact that would enhance American and global security. It would help restrain the further development of advanced nuclear weapons technologies, improve the climate for negotiations to reduce US and Soviet nuclear arsenals, and act as a brake on the proliferation of nuclear weapons to additional countries. Moreover, advances in verification technologies make it possible to monitor compliance with a CTB with a high level of confidence.

History of Testing and Test Bans

In March 1954, the United States detonated a 15-megaton thermonuclear explosive device at Bikini Atoll in the Pacific. This test, code-named Bravo, was one of a series intended to study the effects of nuclear explosions and improve the technology of nuclear weapons. The resulting fallout was much more extensive than anticipated, and neighboring islands and fishermen on a nearby Japanese trawler suffered radioactive contamination. This incident first aroused public awareness of fallout and generated early interest in banning nuclear testing. Over the next few years, as testing by the United States, the Soviet Union, and Great Britain continued, strontium-90 concentrations in human bone and milk samples were found to be on the increase, as was the level of radioactive carbon in the atmosphere.

The idea of a CTB immediately attracted strong opposition from those who feared that it would erode US superiority in nuclear weapons, leaving the Soviet Union free to exploit its conventional force advantage in Europe. Both the Defense Department and the Atomic Energy Commission opposed a CTB on the grounds that Soviet compliance could not be verified. President Eisenhower's scientific advisory committee disagreed, however, as did an international conference of experts in Geneva in 1958. Eisenhower called for negotiations on a CTB and announced a one-year moratorium on testing; Soviet Premier Khrushchev replied that the Soviets would not test as long as the West did not.

Negotiations began in October 1958, and both sides refrained from testing, but the talks soon foundered on verification and other issues. Events in 1960–61 helped to turn the negotiations sour: the first French nuclear test, the crisis in Berlin, and the downing of an American U-2 over Soviet territory. In September 1961, the Soviets abruptly resumed testing with a long series of atmospheric tests. Within weeks, the United States began its own series of tests. The negotiations were adjourned indefinitely in January 1962.

New negotiations soon began, but made little progress. Although the Cuban missile crisis of October 1962 gave a new impetus to the talks for a time, disagreement remained on verification, in particular the problem of distinguishing underground nuclear explosions from earthquakes. The talks stalemated when the United States demanded seven on-site inspections per year and the Soviets would agree to only three.

The Partial Test Ban Treaty

In June 1963, President Kennedy announced in a speech at American University a unilateral US moratorium on testing as long as other nations also refrained, as well as new, high-level negotiations for a test ban. Unable to reach agreement on a comprehensive ban because of lingering questions about monitoring underground tests, the United States, Britain, and the Soviet Union quickly concluded the Partial Test Ban (PTB) Treaty in August 1963. The treaty, which is of unlimited duration and open to all signers, banned nuclear tests in the atmosphere, in space, and underwater. France, the only other nuclear weapons state at the time, refused to accede, and continued atmospheric testing through 1974. China, which conducted its first test in 1964, has likewise never signed. As of December 31, 1984, 112 nations had signed the treaty.

The PTB Treaty did much to control the health dangers posed by radioactive fallout from atmospheric testing, but it did little to curb the arms race. American and Soviet nuclear testing continued underground at a more rapid pace than it had aboveground. Moreover, public pressure to negotiate a total ban on nuclear testing subsided with the signing of the PTB Treaty.

The Threshold Test Ban Treaty

It was not until 1974 that test bans again made the headlines, when President Nixon and Premier Brezhnev signed the Threshold Test Ban (TTB) Treaty. The treaty limited underground explosions to 150 kilotons, a threshold high enough to guarantee detection and also to permit tests at magnitudes required by planned testing programs. The bilateral treaty also restricted tests to specific sites and provided for the exchange of data on yields and geological environments in order to calibrate seismic instruments—perhaps the most important contribution of the TTB.

In 1976, Ford and Brezhnev signed a companion treaty, the Peaceful Nuclear Explosion (PNE) Treaty, which maintains the 150-kiloton limit for individual ex-

plosions but permits series of underground nuclear explosions for peaceful purposes up to a total of 1.5 megatons. Neither the TTB Treaty nor the PNE Treaty has been ratified by the United States, although both nations have pledged to abide by their provisions.

Recent Initiatives

New negotiations on a CTB were started in Geneva during the Carter administration in 1977, but took a back seat to the SALT II talks. As US-Soviet relations worsened in 1980 with the Soviet invasion of Afghanistan and the suspension of SALT II ratification, the prospects for a CTB agreement withered. The negotiations were recessed after President Reagan's election and have not been resumed. Nevertheless, the draft framework that was achieved is noteworthy. Verification was to be accomplished through reciprocal placement of tamper-proof seismic detection devices within each nation's borders (first suggested by Premier Khrushchev in the early stages of test ban negotiations), exchanges of geophysical data, and limited voluntary on-site inspections to resolve ambiguous events.

Benefits of a CTB

A comprehensive test ban would have both symbolic and practical benefits. Symbolically, it would be a dramatic mark of commitment to arms control on the part of the United States and the Soviet Union, and would add legitimacy to their efforts to control the proliferation of nuclear weapons to new countries. In more concrete terms, a test ban would help curb the relentless process of nuclear weapons development and modernization, and would raise an important technical and political barrier to the acquisition of nuclear capabilities by additional nations.

Restraining the Development of New Weapons

Because sophisticated new weapons require extensive testing, a comprehensive test ban would be an important force in restraining their development. Indeed, the current administration's resistance to a CTB is attributable primarily to plans for new generations of advanced nuclear weapons whose development would require explosive testing. The impetus for such "modernization" comes in particular from the Strategic Defense Initiative (SDI) or "Star Wars" program and from the nuclear warfighting strategy that guides current US nuclear planning. For example, a potential key SDI technology is the x-ray laser, which uses the energy released by a nuclear explosion to create an intense beam of x-rays for destroying ICBMs soon after they are launched. Similarly, the United States is investigating directed-EMP (electromagnetic pulse) weapons that might be used to disable command, control, and communications systems during a nuclear conflict. Other objectives of the warhead modernization process are to produce varying combinations of blast and radiation effects (as in the "neutron bomb") and to improve yield-to-weight ratios, so as to adapt nuclear weapons to specific warfighting applications. Pursuit of these new directions in nuclear weaponry, far from enhancing the United States' security, is more likely to erode nuclear stability by fostering the illusion that a nuclear war could be fought, controlled, and "won."

Controlling the Spread of Nuclear Weapons

A CTB alone, of course, would not solve the difficult problem of spreading nuclear weapons capabilities. Although most nations probably would sign a CTB treaty, others—including France, China, and some of the most likely candidates for proliferation—probably would not. Even so, nonsigners would feel more pressure from the international community not to conduct testing—just as France, although not a party to the Partial Test Ban Treaty, nevertheless ceased atmospheric testing in 1974. While a nation with a relatively sophisticated military and scientific community might develop simple fission weapons without testing (as the United States did), most countries could not do so. It is highly unlikely that any nation would be able to develop thermonuclear weapons without testing.

A ban on nuclear testing would also work to redress the imbalance in the current nonproliferation regime between nuclear weapons haves and have-nots. The Nuclear Non-Proliferation Treaty (1968) requires non-nuclear states to refrain from acquiring nuclear weapons in exchange for a pledge from the nuclear weapons states to negotiate in good faith for an early end to the arms race. But as the non-nuclear states—both signatories to the treaty and nations that have refused to sign—have repeatedly pointed out, the superpowers have not lived up to this pledge, and nuclear testing is widely seen as a key symbol of their lack of commitment to arms control. India and Argentina, both nonsigners of the treaty, have often stated that a CTB is a precondition to their joining the international nonproliferation regime.

Alleged Drawbacks of a CTB

Opponents of a CTB, in addition to believing that explosive nuclear testing is needed so the United States can develop new weapons technologies, also cite two other justifications for continuing such tests. They argue that testing is needed to maintain the reliability of weapons already in the US stockpile, and to study the effects of nuclear explosions. However, neither of these arguments against a CTB is persuasive.

It is true that over time, stockpiled weapons may suffer reduced yield or may fail altogether due to corrosion or other effects of aging. But for proven weapons designs, reliability can be assured without a nuclear explosion by testing the non-nuclear components of a device, and by a policy of frequent replacement of components.

As for the evaluation of nuclear effects, nuclear explosive testing for this purpose is of limited utility since it must be done underground in compliance with the 1963 Partial Test Ban Treaty. Much work on the effects of nuclear explosions is already being done through simulation, simply because the information sought cannot be found out through underground nuclear explosions—or indeed, in any situation short of a real nuclear war. For example, the effects of multiple explosions or explosions at a considerable distance are difficult to mimic. Some effects, such as the EMP effects of nuclear explosions in space, cannot be studied even in principle underground.

Because actual nuclear explosions underground are of limited usefulness, the technology for simulating the effects of nuclear explosions is already highly developed. The effects of blasts on hardened missile silos and mobile launchers are simulated using conventional

high explosives; EMP effects are simulated with EMP generators that use non-nuclear technologies. A multimillion-dollar lab is currently being built at Sandia National Laboratory in Albuquerque to simulate radiation effects.

Verification of a CTB

As with other treaties, the ability to verify compliance has proved to be a sticking point in negotiating a comprehensive test ban. In light of current monitoring capabilities, however, the obstacles are more political than technical. Atmospheric tests are in general verifiable acoustically, optically, and by measuring radioactivity. Tests in space can be detected by satellites with x-ray and gamma-ray sensors. Very low-yield underwater tests can be detected using antisubmarine warfare sensors.

Monitoring of underground testing has historically been most difficult. To some extent it too can be monitored by satellite; photography can reveal unusual levels of activity required to prepare a test site, for example. (In 1977 the Soviet Union notified the United States that its spy satellites had detected such preparations in South Africa; the United States brought diplomatic pressure to bear, and the activities were terminated.) In addition, an underground test, unless it is very deep, produces a crater that can be observed from the air. On-site inspection can reveal radioactivity and other evidence, but its effectiveness is limited to the time and place of the visit, and may be circumvented by exploding the device far below the surface.

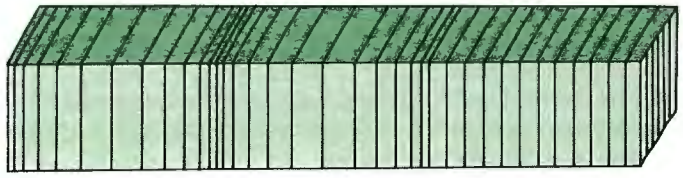
Detecting and Identifying Seismic Events

By far the most sensitive means of verifying compliance with a ban on underground testing is seismic monitoring. Like an earthquake, a nuclear explosion produces waves that propagate through the body and crust of the earth. The problem of verifying a test ban is twofold: to detect nuclear explosions, even when muffled, and to distinguish them from earthquakes.

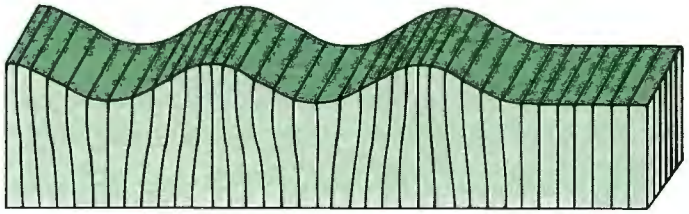
Both detection and identification are more difficult for events of lower magnitude. (The magnitude of an event is closely related to the amount of energy released.) To muffle an underground nuclear explosion, the "coupling" of the seismic wave with the surrounding rock can be reduced by testing in a very soft medium, or, more effectively, by detonating the device in a large underground cavity. For example, a 5-kiloton explosion in hard rock would be an event with magnitude of about 4.4, but the same device detonated as a cavity-decoupled explosion would have a magnitude of only about 2.8—significantly less likely to be detected, since the signal must be enough greater than the background noise (random vibrations caused by weather, tides, human activity, etc.) at a receiver site to be recognized.

Once detected, an event must be identified as an earthquake or an explosion. This can frequently be done on the basis of the event's location—about 90 percent of earthquakes can be unambiguously identified as such because they occur under deep ocean waters or more than 30 kilometers underground. In the remaining cases, an event must be identified as earthquake or explosion by examining its seismic signal. Scientists have developed numerous discriminants based on the relative amounts of energy in different types of waves produced by earthquakes and nuclear explosions, as well as the frequencies of the waves produced.

Compression Wave



Surface Wave



For example, two major types of waves propagate from the source of a seismic event through the earth's crust and mantle: compression waves, analogous to sound waves in air; and surface waves, analogous to the waves on a body of water (see figure). Because the source of a weapons test is an explosion at a point, whereas the source of an earthquake is scraping along a fault, weapons tests generate relatively more compression waves, and earthquakes relatively more surface waves. For the same reason, the waves generated by an explosion tend to be much more symmetrical than those generated by an earthquake. In addition, because an earthquake is a more widespread and longer-lasting source of seismic waves than an explosion, its energy is in low-frequency waves; an explosion generates much higher-frequency waves.

Seismic Monitoring Networks

For low-magnitude events—small earthquakes and small or decoupled nuclear explosions—both detection and identification would require the use of monitoring stations located within the borders of each party to the treaty ("in-country devices"). How many and how elaborate these would have to be is the subject of some debate.

Many seismologists believe that seismic verification of a comprehensive test ban is well within current technical capabilities. A view representative of that of the majority of the seismological community is expressed by Lynn Sykes of Columbia University and Jack Evernden of the US Geological Survey, who believe that a network of 15 monitoring stations outside the Soviet Union would suffice to detect explosions down to one kiloton if the Soviets made no attempt to conceal them; and that an additional 15 simple, unmanned stations inside the country would give high confidence that tests down to one kiloton could not be concealed through cavity-decoupling (*Scientific American,* October 1982).

A few seismologists sound a more pessimistic note. For example, W. J. Hannon of Lawrence Livermore Laboratory argues for more and better in-country devices: at least 30 small-aperture regional arrays (clusters of seismometers in a circle with diameter of a few kilometers), substituted for the simple stations of the Evernden/Sykes network, in order to approach the capability to detect one-kiloton cavity-decoupled explosions with 90 percent confidence in 90 percent of the Soviet Union (*Science,* January 18, 1985).

The Nature of Verification

Focusing on debate within a narrow technical domain may obscure the larger issues in the verification of a comprehensive test ban, which, like other arms control agreements, should strike a balance between what can be verified and what needs to be verified to fulfill the purposes of the treaty. Thus, one must ask not only what weapons tests can be detected and identified—of what kilotonnage, under what evasion scenarios, with what confidence levels—but other questions as well.

When is verification adequate? Verification need not be perfect in order to effectively deter cheating. A 30 percent confidence level—which to the cheater represents a one-in-three chance of being caught—would very likely be adequate to deter clandestine cheating. In considering whether to violate a treaty reached with the United States, the Soviets must weigh the potential gains of cheating against the costs of being caught—including the prospect of hostile relations and the possibility that the United States would take advantage of its superior technical skill to accelerate its own weapons programs. Similarly, verification need not be perfect in order to detect covert testing activities before they become militarily significant. A series of tests, rather than a single explosion, is required for any significant technological advance, and this greatly increases the probability of detection. In sum, it is essential to strike a reasonable balance between the risks of potential noncompliance with a carefully verified agreement and the risks of uncontrolled arms competition without such an agreement.

What evasion schemes are plausible? A testing program scheduled around unpredictable opportunities to hide explosions in earthquakes would be of doubtful utility to an evader, and its success would be uncertain because of the variability in the propagation of seismic waves. Many cavity-decoupling schemes are also implausible. If using a naturally occurring cavity, the evader faces the difficult task of certifying that all vents have been closed off. Manmade cavities pose different problems: huge expense, an engineering challenge, and the difficulty of concealing construction from watching satellites. To fully decouple a 5-kiloton explosion at a depth of 1000 meters would require a cavity 75 meters in diameter. To carry away the resulting volume of rock would require many thousands of truckloads.

What is negotiable? In the draft framework achieved in the CTB negotiations that ended in 1980, the Soviets agreed in principle to verification through reciprocal placement of tamper-proof, in-country seismic detection devices and exchanges of geophysical data. The negotiability of particular seismic monitoring networks —whether 15 stations or 30, simple stations or arrays, or any network required to adequately monitor compliance—can only be established by trying to negotiate a test ban.

The Reagan administration's resistance to a CTB, though often couched as concern over the verifiability of a test ban, is rooted in plans to develop more advanced nuclear weapons, as described above. Verification is a critical issue to be addressed in negotiating a satisfactory CTB; as a justification for refusing even to negotiate, however, it should be recognized as a red herring.

Conclusion

A comprehensive test ban would not end the arms race. Curtailing the development of new weapons would not inhibit the development of new and more threatening delivery systems for those weapons, nor that of non-nuclear "Star Wars" defenses. Nevertheless, a CTB would have substantial benefits both for US–Soviet arms control and for international nonproliferation efforts, would impose no security penalty on the United States, and could be verified with confidence. For these reasons, the conclusion of a CTB treaty is long overdue.

Suggestions for Further Reading

"Nuclear Test Bans," Chapter 7 in *Nuclear Arms Control: Background and Issues,* National Academy of Sciences (National Academy Press, 1984).

Lynn R. Sykes and Jack F. Evernden, "The Verification of a Comprehensive Nuclear Test Ban," *Scientific American,* October 1982.

W. J. Hannon, "Seismic Verification of a Comprehensive Test Ban," *Science,* 18 January 1985.

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AMERICA, ISRAEL & SDI

by Charles D. Brooks

Ed. Note: Mr. Brooks is Outreach Director for the National Jewish Coalition and Liaison Officer to the Jewish Community for High Frontier.

The arguments for the urgent necessity of deploying non-nuclear multi-tiered defensive weapon systems in an effort to prevent the spectre of a nuclear holocaust have been eloquently argued in public media by scholars, military experts and scientists on numerous occasions. The political, strategic, fiscal and moral case has and will continue to be made for the Strategic Defense Initiative (SDI). However, few analyses have centered on how this historic reformulation of American defense policy will affect the 18 allies invited to participate in the project. In particular, one ally has more to gain and contribute than any other nation, Israel.

For Israel, the historical challenge has and will continue to be ensuring self-survival. The geopolitical nature of the Middle East and the xenophobic nature of fanatical Arabs sworn to the destruction of Israel necessitates a determined, but economically costly vigilance. There are terrorists who engage in suicide car bombings and nations who send 12-year-olds to battle and would no doubt use nuclear weapons at the earliest opportunity against Israel. It is illogical and dangerously naive to assume that retaliatory policy would serve as a deterrence if these nations or groups ever obtained nuclear weaponry.

The Threat

In 1981, when Israeli intelligence discovered that the Iraqis were on the verge of constructing nuclear weapons, they made a decision to launch a preemptive attack on The weapons producing facility. the world condemned the surgical strike, but less than two years later failed to condemn the Iraqis on their use of poison gas against Iran. What would have prevented the Iraqis from deploying nuclear weapons if the reactor had not been destroyed?

Already vastly outnumbered, Israel will have difficulty in future years maintaining the qualitative advantage over the Arabs. The Strategic Defense Initiative will help enable them to counter Arab procurement of sophisticated weaponry.

Israel is confronted with a far more immediate threat — Soviet installed SS21 missiles in Syria capable of delivering nuclear warheads at Tel Aviv and Jerusalem. Israel would have only minutes of reaction time and pay a total price if Syria were to equip the SS2ls for a random strike. General Daniel Graham (USA, Ret.) a former Director of the Defense Intelligence Agency and a founder of High Frontier (the conceptual project from which SDI arose) has noted that one of the first technologies to emerge from SDI research may well be anti-tactical ballistic missiles. Such weapons could allow Israel to defend itself against Syria's Soviet supplied ballistic missiles without having to rely on the increasingly unreliable deterrent of retaliation.

Avram Schweitzer, an Israeli journalist with "Ha'Aretz" newspaper aptly described how Israeli defenses could benefit by being directly involved with the development of SDI technologies. "A system that can make out, identify, home-in-on, and destroy an object less than 100 feet long, moving at near Mach-1 speed at a distance of 10,000 miles, is essentially a system, the application of which could do to the foot soldier, the artillery piece, the tank or the helicopter what its space-progenitor is supposed to do to strategic missiles. To be in on this kind of technology,..could mean the purchase of peace for Israel, or more realistically, the imposition, by non-aggressive means, of a permanent state of non-belligerence along its borders."

The Potential

Israel will derive more than national security benefits from its participation in SDI. Israeli Prime Minister Shimon Peres called SDI, "A new dimension in the technological, scientific and strategic spheres...It is like joining a new era. Imagine if Columbus had invited an Israeli to join his ship. I, for one, would have supported this invitation, no matter what he was going to discover."

Indeed, no one really is quite certain of what we will discover. America landed a man on the moon in less than seven years: 10 years earlier the feat was beyond the wildest imagination of all but an intrepid few. Israel's industrial future will be greatly enhanced by being at the forefront of this technological revolution. Technological spinoffs could lead to production of new computer systems, energy sources, communication devices, medicines and thousands of consumer products. Moreover, SDI will heap research funds upon the troubled universities and will revitalize the Israeli scientific community. Israeli defense-related industries will receive lucrative contracts and strategic and economic cooperation between Israel and the United States will be strengthened.

For the drained Israeli economy, SDI will mean new jobs and revenue. Chase Econometric Group revealed that for every billion dollars invested in space technology, over 800,000 new jobs are created, the inflation rate reduced by two percent, and the GNP increased by $23 billion. Tadiran, Inc., an Israeli military electronics corporation, has already had discussions with American SDI officials about potential contracts for future projects.

Israel's Capability

America would also be the recipient of numerous benefits from Israeli involvement in SDI, especially in the area of research and development. Israel is a stable ally that has already worked closely with the American military/industrial complex.

Israel's high state of technological and scientific capability can be utilized in SDI research. The IDF has demonstrated an unforseen mastery over command, control and communication (C3) by downing over 80 Syrian jet fighters with no losses during the Lebanon conflict. Their expertise in battle-tested technologies would immensely enhance development of weapon systems. In addition, because of the precarious nature of the Middle East, the Israelis cannot afford to have long research and development time spans before weaponry is operational. Israeli involvement can serve to catalyze the entire SDI program by accelerating the pace of the effort.

Furthermore, U.S. technological secrets are often safer with Israel than with our European allies. The Israeli intelligence services are so competent that former chief of Air Force Intelligence Gen. George F. Keegan (USAF, Ret.) has remarked that Israeli has been worth five CIAs to the U.S. because of its intelligence-gathering capability and transfer of data on the performance of Soviet weaponry. This has included the direct transfer of captured Soviet weapons.

SDI constitutes a revolution not only in defensive strategy, but moves into a new world of technology that may ameliorate many of the world's problems. In a nuclear world, it is not good enough to be morally right, America and Israel must also be strong. The Strategic Defense Initiative can help ensure that Jews will never have to endure another Holocaust and could lead to a world where close democratic allies can allocate their efforts to socio-economic endeavors instead of preparations for war and defense. For America and Israel, SDI is another giant leap for mankind.

DON'T GET PERS-ENGULFED AGAIN

Low oil prices are a boon today and a threat for tomorrow. Today, they induce increased economic activity and lower inflation. Tomorrow they will lead to increasing dependence on the vulnerable supplies from the Persian Gulf. The U.S. has five to ten years to prevent a replay of the oil- shocks of the 1970s.

The strategies are clear: adopt policies that will decrease U.S. imports and that will increase exploration and development of oil resources in those parts of the world both outside the Persian Gulf and where oil is less expensive and more plentiful than within the continental United States.

The difficulty is that these strategies have to work in an environment of low oil prices.

A ten dollar oil tariff would limit U.S. consumption and maintain U.S. production, thereby maintaining imports at approximately today's level of 4.5 million barrels per day. If an equivalent tax were placed on domestic production, U.S. production would decrease and imports would rise to approximately 7.5 million barrels per day. If there were no tariff and domestic oil sold at the current world price, imports in five to ten years are likely to increase to 12 million barrels per day.

In approximately the same time frame, world demand will increase to such a level as to consume OPEC's excess capacity to produce. Therefore, the U.S. may well find itself in the same position as in the 1970s, no excess capacity in the world, peak U.S. imports and OPEC in the catbird's seat - again.

In addition to the tariff, the U.S. could use its market power to aid countries with undeveloped resources - such as Mexico, Argentina, West Africa and Norway - to obtain the funds needed for drilling even in a weak oil market. Once assured of a portion of the U.S. market, developmental drilling can be financed. In this way, the U.S. could maintain the proliferation of international suppliers - outside of OPEC. Production in non-OPEC countries has led to the current oil glut.

At what level of imports is there an unwanted economic dependence on a dangerous part of the world? Previous oil shocks occurred at the 8-million barrel/day import level. A forward looking energy policy could prevent a recurrence of Pers-engulfment.

Inside This Issue

- The Oil Glut is not Forever
- Reforming Through Reorganization
- From Central Asia to Afghanistan
- Moral Equivalence

EDITORIALS

Getting our Money's Worth in Foreign Policy

There was a time - it now seems long ago - when key elements of U.S. foreign policy were privately hammered out by the President and leading members of Congress. Privacy (though depriving the public of the clash of ideas through debate) was essential to prevent all parties from becoming hostage to statements made for public consumption. Later public discussion then became largely a process of educating the public. The result was a bipartisan foreign policy and a single voice for the U.S. government.

However, with the diffusion of leadership in Congress, foreign policy is more often an adversarial process whereby the President has to try to muscle programs through a hostile and polemical Congress. All too often, the chief question on controversial issues now is, "How much political capital will the President have to expend to get what he wants?" and "Is it worth that much fighting about?"

The result is an ineffective foreign policy policy in the area concerned.

Two recent examples of this unhealthy approach were the fights between Congress and the President over Contra aid and arms sales to Jordan and Saudi Arabia. Neither side distinguished itself by statesmanship.

Unasked were the questions, "What is it that the President hopes to achieve in this area of foreign policy?" and, "Is this particular action reasonably likely to help us get there?"

Applied to Nicaragua, the questions should have been, "What is the preferred outcome from the U.S. point of view?" and "Will the provision of $100 million to the Contras help us get there?"

1) If the threat from communist Nicaragua is as grave as the President and some Contra aid supporters claimed, their preferred outcome could only be the dissolution of the Sandinista government. In that case, a total of $100 million to the Contras is unlikely to achieve the intended result.

2) If there was, during the debate, still hope for the Contadora process, as opponents of aid claimed, their preferred outcome in Nicaragua is an opening of the regime to democratic principles and respect for human rights. While the Contra aid would certainly not be appropriate under those circumstances, there is no evidence that such a preferred outcome is possible. There was a time, after all, when the U.S. was the chief supplier of economic assistance to the Sandinista government. But even then, the Sandinistas were becoming more and more repressive.

3) Perhaps the most reasonable outcome the U.S. can expect is to continue to harass the Sandinistas, and keep our further options open. Part of the Marxist-Leninist Sandinista revolution is its internationalist character, and its commitment to worldwide revolution. This is what helps to unite the Sandinistas, the PLO, Libya, Bulgaria and North Korea. It is in our interest to make it difficult for them to export their revolution and to subvert their neighbors. It is a reasonable part of U.S. support for El Salvador, Honduras, Costa Rica and others to keep the Sandinistas busy at home. The Contras are a logical way to achieve this result and $100 million is not too much to spend to do it.

In the case of arms sales to Arab countries, beginning with the 1978 F-15 sale to Saudi Arabia, the argument has been that the Arabs need to see the U.S. as a reliable supplier and "evenhanded" in order to bring them into the "peace process". In effect, we could buy them in by selling them weapons. But invert the equation and ask how many U.S. arms it would take to purchase Saudi loyalty. The answer would be, "More than we have to sell."

But if buying Arab loyalty with weapons is not reasonable U.S. policy, should we stop selling them weapons completely? Presumably not, as there are other, more realistic reasons to sell some weapons at some times: we do not want to see the fall of the Saudi Royal family; we do not want the oil fields in radical hands; we do want the Saudis (and others) to defend themselves in the event of an Iranian attack; we don't want to use U.S. troops except as a last resort.

Far better cases for certain arms sales to Saudi Arabia can be made than the ones that have been put forth. But the realistic arguments would not have included sanctioning F-15s, conformal fuel tanks or bomb racks. Stingers would be included only under circumstances where their end use could be assured — and that can't be done.

Continuing to sell relatively indiscriminately under faulty assumptions will lead to pouring endless arms down a bottomless pit in hopes of achieving something that cannot be reasonably expected.

Consider Egypt. Since the Camp David Accords, the U.S. has been the chief supplier of weapons to Egypt. For this, we appear to have expected a certain quid pro quo - continued peace with Israel and political support when needed. By holding joint military exercises with Egypt as well, we appear to have assumed a certain level of military support. This is not a reasonable assumption.

As in the case of Saudi Arabia, the U.S. should have expected that Egyptian loyalty could not be bought with U.S. weapons. However, it appears that the U.S. on several occasions asked Egypt to join a U.S.-led expedition against Libya based on the joint exercises we have held in the past. The Egyptians declined because, as President Mubarak has stated often, Egypt will not attack any Arab country that has not attacked Egypt. That includes Libya.

What was the policy consideration that led the U.S. into these expensive joint exercises with Egypt in the first place? What had we hoped to achieve for our effort? If the exercises are solely to protect Egypt from an attack against Egyptian soil and Egyptian interests, we are getting very little. If they are to call a joint force into action to protect joint U.S.-Egyptian interests, the Egyptians failed their first real test. If they are only to be used when the two parties agree on the nature of the threat and the nature of the enemy, we may be pouring a lot of money down a hole. We might want to renegotiate our options.

In all three cases, losing sight of what we hope and plan to achieve has led us to skip too quickly over the part of the foreign policy debate that asks what we are getting for what we are giving away.

Yarmulkas in the Military: Part II

In an editorial a year ago, JINSA argued that the U.S. Supreme Court ought to refrain from deciding whether military personnel who desire to wear a yarmulka while on duty should be permitted to do so. The issue should be left to the armed forces, we felt, and military authorities ought to recognize that the wearing of yarmulkas as a matter of religious faith poses no threat to discipline.

The Supreme Court has, in the case of Orthodox Jewish Air Force Captain Simcha Goldman, sustained the priority of the military dress code over the right of the individual. While we had hoped they would not choose to rule at all, the way in which the Court majority articulated its decision — and the grounds on which the minority dissented — are both reassuring.

In effect, the Supreme Court ruled that permitting Jews to wear yarmulkas might result in discriminating IN FAVOR of Judaism as compared to other minority religions which also have distinctive requirements as to clothing or personal appearance.

The dissenting and concurring arguments are well summarized by Justice Brennan for the minority and Justice Stevens for the majority. Justice Brennan wrote:

> Although turbans, saffron robes and dreadlocks are not before us in this case, and must each be evaluated against the reasons a service branch offers for prohibiting personnel from wearing them while in uniform, a reviewing court could legitimately give deference to dress and grooming rules that have a REASONABLE basis in, for example, functional utility, health and safety considerations and the goal of a polished, professional appearance.

Justice Stevens wrote:

> The interest in uniformity, however, has a dimension that is of still greater importance for me. It is the interest in uniform treatment for the members of all religious faiths. The very strength of Captain Goldman's claim creates the danger that a similar claim on behalf of a Sikh or a Rastafarian might readily be dismissed. For the difference between a turban or a dreadlock on the one hand, and a yarmulka on the other, is not merely a difference in "appearance" - it is also the difference between a Sikh or a Rastafarian on the one hand, and an Orthodox Jew on the other.
>
> The Air Force has no business drawing distinctions between such persons when it is enforcing commands of universal application.

Jews are likely to receive this decision with mixed feelings — we do. It is extremely difficult to see how a yarmulka harms military discipline and easy, on the other hand, to apply the additional criteria Justice Brennan proposes. However, those rules would likely be perceived on all sides as distinguishing between mainline and fringe religions. For those of us who have been uncomfortable through the years with the "this is a Christian country" pronouncements that leave Jews on the outside, the prospect of being included in a "Judeo-Christian" majority that leaves others on the outside cannot be philosophically pleasing.

Moreover, even the majority opinion does not ban yarmulkas outright. The Court left room for the sort of informal compromise that had long governed the issue on military installations, and that we hope will continue to prevail.

Efforts to solve the problem by legislation will, we fear, be more divisive than constructive. Good will and pragmatic common sense by all concerned will yield better results in the long run. A fresh attempt to resolve this type of problem is called for by all branches of the military service.

The Oil Glut is Not Forever

by Lawrence Goldmuntz

Ed Note: Dr. Goldmuntz is a consultant in energy affairs and a member of the JINSA Board of Advisors.

At what level of oil imports is there a threat to the nation's economy and security? Is the level 4, 8, or 12 million barrels/day? Or is there no threat at any level? If there is deemed to be a threat at some level, what is it and what precautions should the Federal government adopt? In order to address these issues, consider the following background facts:

1. U.S. oil resources are being depleted more rapidly than those in the rest of the world. The U.S. reserve to production ratio is the lowest among significant producers. There are 1.2 wells/sq. mi. of sedimentary basin in the U.S., while only 0.02 well/sq. mi. of basin in the rest of the world.

2. Lower oil prices decrease exploitable U.S. resources and the incentive to discover and develop new resources. This will be reflected in decreased production during the next decade. Domestic exploration and development budgets have been cut at least 50%.

3. Lower oil prices increase U.S. consumption. This will be reflected more rapidly than the decrease in production. Utilities have stand-by generating capacity that could consume 2-million barrels/day.

4. Lower prices decrease incentives to develop foreign resources, leaving those significant producers with low production to reserve ratios — the Persian Gulf countries — as the most important producers. This will occur toward the end of the next decade.

5. Lower prices increase world consumption and will absorb OPEC's excess capacity before the end of the decade.

Applying long-term (5-10 year) production and consumption elasticities to decreases in oil prices from $28/barrel, one can predict the following:

1. At the price of $20/barrel, there is a possible 190% increase in imports to 9.3 million barrels/day.

2. At the price of $15/barrel, U.S. imports could increase 250% over present levels. This equals 12-million barrels/day.

3. At the same time, demand on OPEC production will increase by 9-million barrels/day if the world oil price settles at $20/barrel and will increase to 13-million barrels/day if the the oil price settles at $15/barrel. This will consume OPEC's present excess capacity.

This is the traditional double whammy made famous in the 1970s: U.S. production decreases, while increased world consumption tightens available world supply. The U.S. — and many others — then became dependent on the Persian Gulf. Mexico and Canada will not be able to supply the projected huge increase in U.S. needs. Furthermore, Mexico follows OPEC's pricing and production policies, Canada follows OPEC's pricing policies. So OPEC, being the supplier of last resort, will set prices. The oil shock of 1979 is estimated by the International Energy Agency to have cost the GNPs of OECD countries one trillion dollars in one year — as well as substantial unemployment and inflation. The future shock of 1995 could be worse.

This scenario is a threat to our national security and, at the very least, to the economic well-being of the country. The U.S. government does have a responsibility to alleviate this future shock. Free market economists will argue that if oil prices increase toward the end of the next decade, then the world energy infrastructure will react — as it has in the past. However, the lag time of such reactions is longer than the reaction time of market prices. It takes ten years to turn over the automotive fleet or build a coal or nuclear plant. Certainly a problem of this magnitude can be anticipated and, thereby, handled with less stress. Our trading partners in the OECD criticize us for being the largest oil importer with the lowest prices to our consumers.

At the price of $15/barrel, U.S. imports increase 250% over todays levels. This equals 12-million barrels/day . . . At the same time, demand on OPEC production . . . will increase to 13-million barrels/day.

What must the U.S. do over the next decade? Decrease oil consumption, maintain oil production, and promote the development of additional international oil resources.

There are a number of alternatives to meet each objective.

Import Taxes

One could decrease consumption by regulation, such as prescribing automotive fuel economy, the setting of thermostats, limiting the use of oil in utilities and industrial plants, etc. Or, one could increase the cost of oil by excise taxes on gasoline, fuel oil, and diesel or by an oil import tax. One could promote production by providing all sorts of tax incentives to oil drillers. Or broad incentives could be provided by imposing an oil import tax. The experience of the last few years recommends against detailed regulations and tax incentives, and suggests that objectives in the national interest be achieved by broad financial measures. A tax on gasoline influences less than 50% of oil-product consumption, and does not affect oil consumption in some sectors of the economy where there is substantial elasticity, such as utilities, industry and rail and river transportation.

With respect to utilities, one should keep in mind that they have oil-fueled generators on stand-by of sufficient capacity to use two-million barrels/day of oil. Utilities may not complete coal and nuclear plants if they can buy oil at $15/barrel, and furthermore, may elect to meet demand growth with these stand-by plants. So when analysts are skeptical about price elasticity — quipping that residents will not rip insulation out of their homes — it is appropriate to keep in mind some of the other elements of elasticity, such as utility stand-by capacity.

The development of additional international oil resources, in the face of temporarily declining prices, can be achieved by using U.S. market power.

Federal Help

For example, the Secretary of the Department of Energy could be entitled to allocate U.S. imports of petroleum in the national interest. His authority could extend up to some limit of total present and projected U.S. imports — perhaps 25% — and up to some limit in time, perhaps 20 years and at prices that reflect, hopefully, some concession with respect to world prices at U.S. ports based on the length of the contract, the proximity of the country to the U.S., and the relative economic status of the nation involved.

The Secretary of Energy could have the authority not only to enter into these long-term contracts with appropriate suppliers, he could have the authority to "lay off" his purchases on those companies that import oil. His leverage in this regard could derive from an authority that enables him to require oil importers to accept a pro-rata portion of his long-term purchases for their own imports before they could be allowed to import from other sources.

An advantage of such long-term Federal purchase agreements with an exporting country is that they are fungible instruments. A nation can finance oil field developments, ugrading facilities and pipelines with the commercial international banking community using the long-term purchase order of the U.S. government as the basis for loans. Thus, it is not necessary for the U.S. government to advance funds to underdeveloped countries for them to exploit their resources; the existence of long-term U.S. purchase orders should facilitate international loans to those countries with potential oil resources. This arrangement has the advantage of broadening the credit or investment in an underdeveloped country from a single company or country to the international banking community. A violation of the agreement becomes a more serious matter to the offender.

SPR

What role should the Strategic Petroleum Reserve play to help this threat to U.S. security? At a 500 or even 750 million barrel level, the SPR can be important to relieve a temporary interruption of supply or can be used for a short period of time to counter cartel-induced price hikes. It should be used as both an economic and strategic resource. It is not useful to counter the 300-billion barrel resource of the Middle East when that is deployed against the oil importing nations for a long period of time. Over a long time period only domestic conservation, fuel switching and continuing proliferation of international oil resource development are useful.

Does the economy need the boost provided by lower oil costs and would an oil import tariff damage the economy? The tariff can be made revenue neutral by decreasing some other regressive tax proportionally, for example, the Social Security tax. The geographical impacts of the oil tariff cannot and should not be alleviated. It is important for New England to utilize Canadian gas and hydropower and local coal and nuclear electric plants. Perhaps New England could follow the Swedish example and use coal-based district heating systems to lower their consumption of fuel oil.

Windfall Profits

Should the U.S. tax away the "windfall" profit s that domestic producers would experience if an import tax were enacted? This depends on the level of imports that is deemed a threat to the economy and national security. If the "windfall" is taxed away, domestic production, at a $15/barrel price level in a 5-10 year time frame, is likely to decrease by approximately 3-million barrels/day and imports are likely to increase by this amount from whatever level of imports is achieved by the import tax. The "Windfall" improves the nation's security by a substantial amount, particularly in a time frame when OPEC has no unused capacity. It is probably not in the security interest of the U.S. to tax away "windfall" profits.

No nation should be exempted from the tariff. It is a national security tariff not a bar to free trade. Our neighbors will supply as much oil as they now do — our security concern is that imports should not double. Mexico could make up some income by exporting gas — which they once refused to do even though the price was more than double today's price; Mexico could increase its oil production; Mexico could use its oil in the U.S. strategic reserve as collateral for their bank loans, thus loweing the interest rate on their loans.

In the long term the U.S. should develop a strategy that would induce conservation and fuel switching at the lowest cost to the U.S. consumer. It would seem that some combination of an oil import tax and Federal policies to stimulate proliferation of international oil production, would be helpful to forestall the next oil shock. The oil import tax should be maintained until such time as considerable fuel switching had occurred. With further fuel switching and conservation in the utility, transportation and heating sectors, it should be possible to reduce domestic oil consumption to approximately two-thirds of the present 15-million barrel/day level. Without an oil import tax and some Federal stimulation of additional oil development, OPEC is likely to be back in the saddle just when U.S. imports peak. Not only will the U.S. consumer suffer once again, but U.S. national security will be gravely impaired.

FROM CENTRAL ASIA TO AFGHANISTAN

by Yossef Bodansky

Ed. Note: Mr. Bodansky is a frequent contributor to "Security Affairs".

The Soviet occupation of Afghanistan is directly evolved from the age-old Russian drive toward Central Asia and the warm water of the Indian Ocean. This relentless advance into Asia emerged from the struggle of the Slavic population for fertile land, and has become the focal point of Russian (and Soviet) expansionism. Russians (and Soviets) have historically perceived their advance into Central Asia as the only means by which their land-based military might could translate into strategic gains short of a major confrontation in Europe. Since the mid-1820s, the Russians have believed that the European Powers would acquiesce to the occupation of a Central Asian country because such a country would not be worthy fighting over. This is a major determining factor in Soviet Afghan policy.

Even prior to that, Muslim Turks and Russians had been in contact for a thousand, mostly hostle, years. As a bitter legacy of the Mongol invasion, the Great Russians have always perceived their struggle with the Turkic population of Central Asia in terms of "KTO-KOGO" (who gets whom), in which struggle there can be no compromises, or even pauses. The legacy of the "Tatar Yoke" constitutes a second major impetus for Soviet policy in Central Asia, including Afghanistan.

The Baluchi Revolt

The Soviets compare their position in Afghanistan to the suppression of the Basmachi revolt in the Soviet Union, revealing the Soviet understanding of, and expectations from, their current military operations in Afghanistan. The Basmachi revolt is divided into three stages, the most dangerous of which started soon after the 1917 Revolution, when Central Asian nationalities sought to assert their independence from Russian colonialism. Enver Pasha, a Turkish general committed to pan-Turkism, ceased cooperating with the Soviets and assumed leadership of the Basmachi forces. Special detachments of the Central Asia CHEKA (CHON) assassinated Enver Pasha in August 1922, starting the second stage of the revolt.

The rebels still enjoyed strong military forces and major engagements took place over the next decade. However, the Soviets believed that in the absence of credible leadership capable of uniting the Basmachi, it was only a question of time before they were fractured and submitted to Soviet control. Indeed, in the wake of a series of raids on Basmachi sanctuaries in northern Afghanistan in 1929-30, external support to the Basmachi ceased, and the revolt subsided within a year.

A very few zealots continued to conduct small-scale and infrequent skirmishes until the massive exiles of the late 1940s.

Afghanistan Today

The Soviets point out that the Afghan resistance today does not have capable leadership and that it is widely split among diversified organizations. Therefore, they believe, it is only a question of time before it collapses. They compare the current situation in the more volatile parts of Afghanistan to that of the Basmachi revolt in the mid-1920s, and compare other parts of Afghanistan to Central Asia in the late-1930s. The Soviets acknowledge that clashes with resistance will likely continue for the forseeable future. However, from an historical point of view, the fate of the resistance has already been decided, and it is doomed. Combat operations in Afghanistan might influence the time and price of suppressing the resistance, but not the outcome.

While suppressing the Basmachi revolt, the Soviet Armed Forces chose for long periods not to enter areas of Central Asia, leaving them to the control of the Basmachi. The areas were strategically insignificant and armed penetration would have cost the Soviets high casualties without changing the rate of suppression. Such a policy is currently pursued in Afghanistan.

The Soviets claim to control 25% of Afghan territory, say the resistance controls 10%, with the remaining 65% a noman's land.

Where the Soviets Are

The Soviets claim 25% of the history, concede that the resistance controls 10%, and define the rest (65%) as no-mansland, reflecting the situation fairly accurately. Since midl 980, the Soviets have been able to do whatever they wanted in Afghanistan, provided they were willing to pay the price. Professor Rabbani, the leader of Jamiat-i-Islami, admitted that "the Soviets feel comfortable in Afghanistan". At the height of their routine military operations, only 15% of Soviet troops in Afghanistan were committed to fighting the resistance. Currently, as a result of growing emphasis on special operations and improvement in the performance of the DRA (Democratic Republic of Afghanistan) Armed Forces, an even smaller number of Soviet troops (about 5%) is actually involved in conducting combat operations.

The Afghan resistance is incapable of inflicting substantial damage on Soviet strategic assets and infrastructure in Afghanistan. The Soviet casualty ratio, from, all causes, is below the casualty ratio caused during exercises and routine activities of the most active Soviet Fronts (The Far East Military District and the Group of Soviet Forces in Germany). In other words, the Soviet casualty ratio is acceptable to Soviet authorities.

Soviet Goals

Russian/Soviet military strategy has been the rapid consolidation of control over local strategic objectives, and only then, beginning the long and gradual submission of the local Muslim population. The Russians have always adhered to the Kazakh proverb: "It takes 50 years to remold a people," and Soviet activities in Afghanistan clearly indicate that their goals and priorities have not changed.

On the basis of accumulated Russian/Soviet experience since the early 18th century, preconditions for the occupation of Muslim territories and the suppression of local insurrection and resistance are threefold:

1. destruction of the local leadership, and especially its ability to achieve unity;
2. erosion of the population base through destruction of the local social and economic infrastructure; and
3. effective isolation of the region.

The primary Soviet goals in Afghanistan are maintaining a secure power-projection strategic infrastructure, a safe "show-case" Kabul, and preventing escalation of resistance activities from Pakistan. Since Russian military strategy has been formulated to deny assets to the enemy rather than to control the entire territory and pacify the population - in Afghanistan, the Soviets have been doing well.

Since 1978, there have been three major Soviet decision making events in which their Afghan policy was determined. In the spring of 1978, the Soviets recognized Afghanistan as a Socialist State and extended the Brezhnev Doctrine to it. (Once a Soviet-type client state, always a Soviet-type client state.) Consequently, the Soviets had to escalate their involvement, leading to the Invasion of 1979. In the spring of 1980, the Soviets realized their forces would be in Afghanistan indefinitely, and decided the object of their deployment would be to further Soviet strategic and global interests. This determined the nature and organization of the Soviet deployment. In the winter of 1983-1984, the Soviets recognized the intensity of Afghanistan's traditional Muslim society, and that insurrection might become a threat to the stability of the Muslim population of the USSR. This has determined the nature and ferocity of the current campaign against the resistance. These perceptions of Afghanistan are the key to understanding the Soviet approach to Afghanistan and to Central and South-West Asia as a whole.

The Afghan People

The Soviets believe the Afghan population did not undergo that monumental event that can transform nationalities from one status to another - a Revolution. The Afghan nationalities perceive and define their identity in accordance with similar expressions of everyday life religion, language and cultural behavior. This makes it very difficult to establish a Socialist State within the boundaries of present-day Afghanistan. Furthermore, the nationalities of northern Afghanistan have more in common with their brethern north of the Amu-Daraya (in the Soviet Union) than with these south of the Hindu-Kush (Southern Afghanistan).

This has led to an intense campaign of "Sovietization" in the northern provinces of Afghanistan; a "creeping annexation" to the Soviet Union. The Soviets emphasize that the boundaries of ethnic territories correspond to the communication potential of the society at each stage of its social and economic history. It is those boundaries that count, for them, not tribal "artificial borders". Consequently, they believe that long-range stability will be achieved only in the wake of a "regional solution". What does that entail? Large-scale changes in the map of Central Asia.

Redrawing the Map

By September 1985, the Soviets had escalated their campaign to and foment exacerbate nationalist sentiments, focusing on the most turbulent nationalities of the region: Baluchis, Pushtuns and Nuristanis. Their tribal territories were divided among Afghanistan, Pakistan and Iran by the colonial superpowers, and their self-identity and culture have been suppressed (at times with extreme violence) since independence in the course of "nation building" efforts.

After decades of covert exacerbation of these nationalities, the Soviets have made them the primary objective of the DRA regional policy. As with other successful Russian activities with Muslim nationalities and ethnic groups over the last 200 years, this campaign is based on indiginous rifts exacerbated for Soviet gain. In a series of fierce speeches in the Assembly of Border Tribes, Afghan president Babrak Karmal called for the revival of a unified and autonomous Baluchistan, Pushtunistan and Nuristan. He emphasized that "The unity of Pushtuns and Baluchis is also the guarantor of freedom, progress, unification and national maturity for the Pushtuns and Baluchis." This unity, of course, would require the dismemberment of Afghanistan, Pakistan, and portions of Iran. There has been a very favorable reaction to the DRA initiative among wide segments of the three nationalities. In mid-November a series of tribal uprisings in Pushtunistan culminated a month later in a major clash with the Pakistani Army and the closing of the Khyber Pass.

Military Policy

Long-term Soviet regional should not be confused with military policy to address specific challenges in Afghanistan. The Soviet military strategy is designed to facilitate the eventual attainment of the long-term strategy.

The Soviet approach to the Afghan resistance is identical to the classic solutions

(Continued on page 6)

YES THERE IS A "MORAL EQUIVALENCE" BUT NOT NECESSARILY WHERE YOU THINK

by Jim Guirard, Jr.

Ed. Note: Mr. Guirard is a governmental affairs consultant and a frequent contributor to "Security Affairs".

The Reagan administration is much concerned about people who speak and act as though there were a "moral equivalence" between the United States and the Soviet Union. The President, Secretary of State George Schultz and Defense Secretary Caspar Weinberger have all addressed the subject in recent months.

Unfortunately, their worry is not farfetched. Last year, when the question *"Do you or do you not hold that the USSR and the United States are morally equivalent?"* was put to the Oxford (England) Student Union, the "nays" carried by only a slender margin.

The same would probably result from a poll of the leadership of certain radicalized churches, certain university faculties and certain elements of the media in this country — those who former US Ambassador Jeane Kirkpatrick has labeled the "Blame America First" crowd.

In fact, one prominent journalist refused last year even to participate in a conference co-sponsored by the state Department and the Shavano Institute, because he did not wish to lend his presence to a debate whose conclusion might be that such a moral equivalence did NOT exist between the US and the USSR.

In the minds and pronouncements of such people, the American and Soviet armed forces are equally militaristic and warmongering. Our nuclear stockpiles are equally threatening. The CIA and KGB are equally sinister. The American liberation of Grenada is equated to the Soviet so-called "liberation" of Afghanistan. Any evil the Soviets do, America is alleged to have done as bad, or worse.

More than a few of these strange people go even one step farther. They speak of President Reagan as a "fascist" and of Fidel Castro as a "progressive leader" — which suggests that Castroite tyranny is morally SUPERIOR to American multiparty democracy.

Even the language of politics has turned to value-free terms — the "superpowers," the "East-West conflict", Such labels imply that there is minimal moral distinction betwe en the defenders and the repressors of human rights and civil liberties in the world. Virtually forgotten are such powerful phrases as President John F. Kennedy used repeatedly to make the proper distinction — "the Free World versus the Communist World". Kennedy knew (and cared) what the Berlin Wall was all about. He knew (and cared) about what Fidel Castro had in mind for Central and Latin America.

Of course, there is a powerful moral equivalence afoot in the world of geopolitics. But it most certainly is not between communist tyranny and civil-libertarian democracy. It is between the mirror-image tyrannies of the "ultra-left" (Leninis m, Stalinism, Castroism) and the "ultra-right" (Nazism, fascism).

Many prominent liberal-intellectuals would (and do!) strongly protest the drawing of an equation between communism and fascism. Some have even branded President Reagan as evil for having dared to call the Soviet Empire "evil". Such people prefer to take comfort in the naive notion that the rulers of the Empire (Gorbachev, Castro, Mengistu, Qaddafi, Ortega, et al) really do go around promoting "liberation" and "social justice" and "people's democracy" in the world.

But there are other, more objective experts who have drawn precisely such an equation between the so-called "extremes" of the imagined left-right "political spectrum". Here is a sampling of their conclusions as to where the real moral equivalence in today's world lies:

SUSAN SONTAG (liberal-intellectual author and literary critic): "Not only is fascism (and overt military rule) the probable destiny of all communist societies — especially when their populations are moved to revolt — but communism is itself a variant, the most successful variant, of fascism."

ADOLF HITLER (National Socialist dictator of Germany): "The petit bourgeois Social Democrat and trade union boss will never make a National Socialist, but the communist always will...There is more that unites us than divides us from Bolshevism...above all the genuine revolutionary spirit."

SENATOR DANIEL MOYNIHAN (Democratic Senator from New York): "The most brutal totalitarian regimes in the world call themselves 'liberation movements'...Yuri Andropov is 'a terrorist in a system sustained by terror'."

JOSEPH SOBRAN (conservative columnist): "On the subject of communism, history has spoken in a shrill monotone. Never mind the ideology: communism is as communism does. Like every other system, it deserves to be judged on its record, not its promises. That record is bloodier even than Nazism's."

ANDREI SAKHAROV (Russian dissident and Nobel Peace Prize winner, to Soviet officials at 1978 trial of fellow dissident Anatoly Scharansky): "You are not humans. You are fascists. Hear me, a member of the Academy of Sciences. You are FASCISTS."

BERNARD-HENRI LEVY (French intellectual of the "New Philosophers" movement): "I am the bastard child of an unholy union between fascism and Stalinism...The only revolution I know, the one which may grant notoriety to this century, is the Nazi plague and red fascism."

PROF. A. JAMES GREGOR (author of The Fascist Persuasion in Radical Politics, Princeton Univ. Press, 1974): "...fascist and communist regimes are subspecies of one and the same species...In substance, whatever distinctions there are between 'fascist' and 'communist' movements in terms of ideological commitments — they are singularly superficial."

HARRY S. TRUMAN (Former President of the United States): "There is no difference in totalitarian or police states, call them what you will: Nazi, fascist, communist or Argentine Republics."

There are, indeed, many "moral equivalents" in the world of international politics. But these are AMONG the various democratic systems, on the one hand, and AMONG the various despotisms, on the other.

Hitler and Stalin demonstrate the point to perfection. Following their infamous Friendship Pact of 1939-41 (which had been preceded by several years of secret collaboration) those two socialist monsters came to blows not because they were different but because they were inherently the same. The moral equivalence they shared was the brutal AMORALITY of tyrants bent on world domination. Finally, they fought each other to the death for the same reasons mad dogs or Mafia bosses do — for power, for total control.

As Susan Sontag has observed, "Communism is it self a variant, the most successful variant, of fascism." The sooner true liberals and true progressives recognize this fact, the sooner they will cease holding hands with the Gestapo-left.

REFORMING THROUGH REORGANIZATION:

SOLUTIONS TO MILITARY PROCUREMENT PROBLEMS

by Rep. Jim Courter (R-NJ)

America's defense procurement problems have made our noble military institutions the objects of scorn and ridicule. Tongue-in-cheek television commericals depict unscrupulous supply officers substituting inexpensive beer for the high-priced variety and absconding with the difference; editorial cartoonists render the Secretary of Defense laboring under the yoke of a $700 toilet seat. Fat-cat contractors and bloated burcaucrats are now among our dominant national stereotypes.

Unfortunately, all stereotypes have at their core a kernel of truth. We do face a grave crisis in confidence in our military procurement system, but in order to restore credibility, the system must undergo fundamental changes, not merely cosmetic cover-ups. And in order to make these changes, we must recognize that all three major elements of the "Military-Industrial Congressional Complex"—The Pentagon, the defense contractors and the Congress—contribute their fair share to procurement abuses.

Most reform efforts have been focused upon the defense industry, but the Pentagon and the Congress are sorely in need of reform, as well. Much of the Pentagon procurement activity ($15 billion per year) is conducted by the Defense Logistics Agency, a 50,000-man omnibus buying bureaucracy which was responsible for the $700 toilet seat and other overpriced spare parts.

The DLA was originally created to buy items like cornflakes and horseblankets which all the military services needed. That was 20 years ago. Now, 70% of DLA's purchases are made for only one service. What's more, three-fourths of DLA's annual budget goes to pay personnel costs, and the Agency is headed by a high ranking military officer who is not accountable to any elected officials. Now you begin to see where some of our military procurement abuses arise. The DLA, quite simply, should be abolished.

The other major source of concern is the Congress itself. Forty Congressional Committees and Subcommittees oversee the Pentagon, holding hundreds of hearings, demanding countless reports, and making thousands of requests. Every Pentagon procurement decision, from the momentous to the mundane, is exhaustively scrutinized by the Congress. Recently, when Defense Secretary Weinberger pleaded for some relief from this oversight burden, he was told to prepare four more reports on precisely how much and what kind of relief he was seeking. Congress, quite simply, must curb its appetite for "over-oversight" and put its bloated Committee structure on a strict diet.

The slowly grinding operations of the "MilitaryCon gressional Complex" serve toconfirm what is knownin Washington as Augustine's Law of Propagation and Misery: "If a sufficient number of management layers are superimposed on top of each other, it can be assured that disaster is not left to chance."

Rep. Jim Courter

In this era of tight Federal budgets and a burgeoning Soviet military threat, America's defenses can ill afford any more disasters. The streamlining of our Pentagon and Congressional defense bureaucracies will help ensure that we once again receive the greatest possible "bang for the buck."

AFGHAN (Continued from page 4)

to Central Asian problems over the last 150 years. The most interesting modern development is the Soviet realization of the futility of a socialist solution. They have confronted the Muslim Afghan realities, and have proven their willing to adopt and pursue not only classic Russian goals and aspirations, but also classic Russian socio-military solutions. The Soviets are devastatingly effective against the Afghan resistance, and in 1985-86, are closer than ever to total victory.

The Soviets define the following military preconditions as the keys to success in suppressing a Muslim insurgency:

1. deep intelligence penetration and manipulation of the hostile population;

2. deep raiding capabilities and the ability to conduct surgical strikes against priority objectives; and

3. the ability to rapidly inflict massive collateral damage on the civilian infrastructure to erode popular support for the resistance.

Russian/Soviet conduct of military operations in Central Asia since the emergence of their modern Armed Forces (at the end of the 18th century) can be divided into three major periods. The formulation of the operational art took place between the 1780s and 1916. The integration of mechanization (aircraft, armoured-cars and chemical weapons) into the operational art took place between 1917 and 1945. In 1980, the Soviets introducted flexible and automated troop-control and autonomous small unit combat operations into their operational art and tactics - in other words, the growth of counterinsurgency warfare. The most significant development in the Soviet operational art has been the complete integration of the troop-control of the combined arms subunits with a diversified array of weapons, resulting in their growing sophistication and effectiveness.

The goal of these operations is to put the subversive organization constantly on the defensive through a series of devastating surprise strikes on its very deep sanctuaries. Such operations have three key requirements:

1) operational flexibility and autonomy in the small unit;

2) the availability of superior and flexible fire power (including chemical weapons); and

3) a complete intelligence picture.

Soviet Successes

The moment the Soviets succeeded in integrating these three elements, the Afghan resistance started to suffer serious defeats.

As mentioned above, Soviet forces in Afghanistan do not attempt to pacify areas in which they encounter resistance. When a village is known to be cooperating with the resistance, the Soviets use special forces to destroy the entire village so as not to give away intelligence assets, and to demonstrate to the resistance that Soviet special forces can get them everywhere - and by surprise.

The Soviets have made a special effort to penetrate the most conservative, traditional sectors of the population, and compile an accurate picture of the situation of the resistance at any given moment. They also rely on their excellent intelligence penetration of the resistance to conduct deep raids into their sanctuaries. Raids are usually conducted to seize newly arrived weapons and supplies before they are disseminated, and to capture or assassinate resistance commanders. The most significant special operations are these conducted by SPETSNAZ 3-man teams in the deep rear of the enemy. There are also quite a few cases where a resistance commander, who was a KhAD agent, deliberately led his force into a devastatingly effective Soviet DRA ambush.

History shows that the turning point in the Russian/Soviet struggle for the control of Muslim territories has been when they succeeded in isolating the population and severing external support to the local resistance. Soviet special operations have brought the population to the breaking point, while logistical hardships prevent the effective dissemination of aid to the resistance, resulting in their virtual isolation.

Together, these two trends constitute the key to Soviet success. If they continue, Afghanistan can be written off by the West and the Soviets will be encouraged to continue their persistant advance toward warm waters and toward the Near East.

The Soviet Union is winning in Afghanistan. On the other hand, escalation of the struggle in Afghanistan is bound to have long term influence on the Soviet Empire. Although the decision to pursue regional rather than socialist solutions led Soviets to be more pragmatic and effective, it has also exposed the Soviet Muslim population to outside influence and subversion, because northern Afghanistan is now closer to the USSR. The Central Asian population has learned that a Socialist Revolution can be reversed in favor of nationalist, tribal policies.

The tenets of Islam have been the source of the commitment and ferocity of the resistance to Soviet occupation in Central Asia and Afghanistan. However, the same adherance has been the prime reason for the inability of the resistance to effectively confront the Soviet forces, ultimately leading to its collapse and the subjugation of the Muslim population by the USSR. The Soviets are correct when they identify the current situation in Afghanistan as a component of a historical process leading to a regional solution. The West cannot alter historical realities. Western countries should understand and capitalize on historical developments to help bring about favourable results for the entire region.

NEWSBRIEFS

THE VERDICT ON GENERAL 'UMAR: ON 30 MARCH, THE STATE SECURITY COURT OF SUDAN SENTENCED GENERAL 'UMAR MUHAMMAD AL-TAYYIB TO 20 YEARS IN PRISON. In the March issue of "Security Affairs", JINSA presented the case of General 'Umar, who was the Sudanese connection to the rescue of Ethiopian Jews. Although the trial focused almost entirely on the General's role in Operation Moses, nowhere was it mentioned in the sentence. It appears that General 'Umar received 10 years for "Article 136/misuse of authority", and 10 years for "Article 136-84/incitement".

The next day, the official Sudanese news agency SUNA carried a commentary reading in part, "The United States expressed its displeasure with the Khartoum trials that revealed its complicity with the previous dictatorial regime in transferring the Falasha Jews to Israel...The trials revealed aggressive U.S. plots which eventually serve U.S. monopoly interests and the Israeli enemy."

Another Sudanese paper notes, "The U.S. stand is not surprising. The United States, a superpower, continues to topple the Nicaraguan Government by mining ports and allocating millions of dollars to topple the government of that country."

BRITS STILL TRAINING LIBYAN PILOTS: The British Oxford Air Training School has continued to train three Libyan civilian pilots, even after one student's voice was picked up by the BBC in a Tripoli Radio broadcast saying, "The Revolutionary Force at Oxford Aerodrome, Britain...prepared to become suicide squads against America and its arrogance."

The Oxford Training School is less than five minutes flying from the U.S. F-111 nuclear air base at Upper Heyford, and near several other major U.S. bases. Colin Beckwith, principal of the school said, "I am satisfied our Libyans are not a danger to anybody."

SOVIETS NEAR ISRAEL: According to a U.S. source, the Israeli Defense Ministry reported two Soviet destroyers and a Russian spy ship were positioned some 30-80 miles off the Israeli coast during the U.S.-Libyan confrontation. In addition, since January the Soviets have had their Mediterranean flagship patrolling along the coast of Libya.

Yuval Ne'eman, former chief of planning for the IDF, said the Soviets "are monitoring all Israeli signals, every (international) telephone conversation...and certainly messages going in and out of the country are being 'captured' by the (Soviet) spy ship which has enough electronic equipment to 'capture' even most (telephone) conversations within Israel itself."

FRENCH WITHDRAW FROM BEIRUT: Withdrawal of the 45-member ceasefire observer force came two weeks after the kidnappers of four Frenchmen demanded the withdrawal.

STINGERS TO AFGHANS & ANGOLANS: The Reagan Administration has decided to ship Stinger anti-aircraft missiles to anticommunist rebels in Afghanistan and Angola. Previously, the rebels had only been supplied with recycled weapons that could not be traced to the U.S., according to one source.

YELLOW RAIN CONFIRMED: A Canadian research team is prepared to release the most conclusive proof to date that yellow rain is a man-made weapon. The study, conducted by the Ottawa-based Defense Research Establishment, found positive yellow-rain sampled from an attack site and what appears to be part of a weapon.

LIBYAN SQUADRON IN GEORGIA: A squadron of Libyan C-130s, purchased 13 years ago, is still sitting on a field at the Lockheed Georgia plant. The Libyans contracted for the planes in 1973, and paid for them, but when they were ready, the State Department embargoed them. Lockheed applies annually for a license to ship the planes to Libya, but is annually denied. A Lockheed spokesman said, "Libya apparently doesn't blame Lockheed for the no-show, or at least it isn't making a fuss. We haven't talked to those people since '78 or '79", although Libya paid $42 million for the planes.

DRYDOCKING SUBS? The Administration is apparently considering drydocking two Poseidon nuclear submarines rather than having them dismantled in May as required by the SALT II treaty. This would be the first action under what the Administration has proposed as "proportional responses" to Soviet violations of SALT II and other arms-control agreements.

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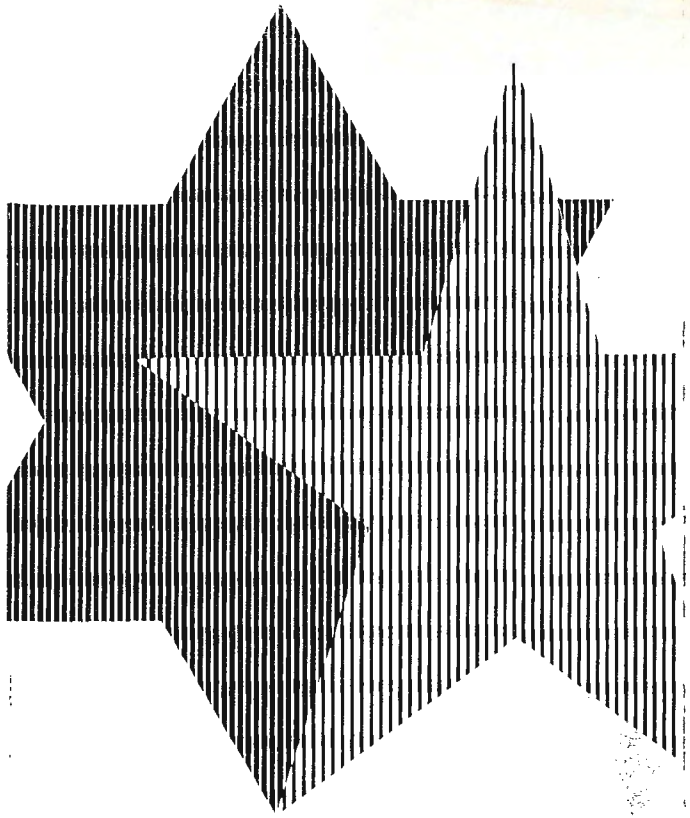

JINSA

WHY WAS JINSA CREATED?

Israel faced a life-threatening impasse during the 1973 Yom Kippur war: without military resupply she could not defend herself against the Arab nations.

The event jarred the Jewish community, and underscored the need to generate support for Israel in government and defense circles. To do this, American Jews realized that they must acquire a deeper understanding of defense issues. To meet both these needs, a unique organization was created: The Jewish Institute for National Security Affairs.

WHAT IS JINSA'S PURPOSE?

JINSA's purpose is twofold: to inform the Jewish community of security issues affecting the U.S. and Israel and to maintain communication with government and military leaders to stress the strategic importance of Israel.

HOW DOES JINSA ACHIEVE ITS GOALS?

JINSA has developed programs and publications that work to inform and educate.

JINSA publishes a newsletter so noteworthy that its articles have been reprinted in the Department of Defense *Current News* and entered into the *Congressional Record.* The *Newsletter* has a history of reporting strategic developments months—and in some cases years—before popular media.

JINSA sponsors a unique seminar series—the Pentagon Fly-In. Bringing leading members of the American Jewish community to meet military officers and civilian defense officials, the Fly-In allows for intensive discussion of U.S security programs and policy, and an open exchange of views.

JINSA holds meetings and seminars around the country. The Secretary of the Navy, the U.S. Army Chief of Staff, Senators, and Congressmen have spoken at these events.

JINSA travels to Israel with retired U.S. military officers. These retired officers return to the U.S. with a deeper understanding of Israel's capabilities and needs, which they can share with their colleagues.

IS JINSA EFFECTIVE?

Just look at what key figures in Washington say about JINSA:

... the Jewish Institute for National Security Affairs is helping to inform the American people.... It is doing pioneering work in explaining how Israel is an important asset....

the late Senator Henry M. Jackson

The Jewish Institute for National Security Affairs plays a unique and vital role in Washington that is particularly relevant today. With the current emphasis on the military and strategic aspects of foreign policy, support for JINSA's activities takes on new meaning.

Morris J. Amitay,
former Executive Director, AIPAC

JINSA has won the respect of senior U.S. defense officials for its enlightened, candid, and unemotional approach to issues that impact on the security of the U.S. and Israel. Your involvement in JINSA can directly contribute to the strength of this critical relationship and do much to insure the continued security of Israel and the U.S.

Lt. Gen. Devol Brett (Ret.)

WHY SHOULD I JOIN JINSA?

To be effective, JINSA must continue to grow. Each new JINSA member shows our government and military leaders that concern for America's security and a strong bond with Israel exists in the Jewish community. JINSA's programs provide important interaction with members of the U.S. military, and is often the only opportunity for many of them to hear this particular message.

WHAT ARE THE BENEFITS OF JINSA MEMBERSHIP?

As a JINSA member, you will:

- expand your knowledge and understanding of global news developments through your *Newsletter* subscription.
- become eligible to participate in JINSA Pentagon Fly-Ins.
- enhance U.S. concern for the security of Israel and appreciation of her strategic value to our national security.
- be invited to travel to Israel with the JINSA delegation.

THE JINSA NEWSLETTER

The best testimonial to the impact of the JINSA *Newsletter* in government circles is the number of its articles that have appeared in the Department of Defense *Current News.*

Virtually unknown to the public, this Pentagon publication reaches 15,000 government and military personnel daily and asserts a considerable influence on national policy by providing a cross section of press coverage on a wide range of national security issues.

*(*Current News *editor) "Our problem is one of selectivity. We can use less than 10% of the stories that make it through our screening process, so our choices are based on what we think are the most important stories and who covered them best."*

(reprinted from the *New York Times*)

We find it gratifying that *Current News* has included material from every JINSA *Newsletter* since 1981.

Some JINSA Newsletter firsts:

- Reported the PLO build-up of heavy weapons in Lebanon in 1981. Confirmed June 1982.
- Predicted Soviet involvement and weapon provision for Syria. Confirmed six months later.
- Reported the PLO back in Lebanon and warned of Syrian intransigence over withdrawal in late 1982. Became a national concern one year later.
- First story on government massacres in the Syrian city of Hama. Reached national news one year later.
- Reported an agreement between the PLO and El Salvadorian guerillas. Became a national news story two years later.
- Wrote of PLO involvement in Cuba and Nicaragua, as well as El Salvador in 1983. Article received national attention throughout the summer and autumn.
- Wrote of impending crisis in Afghanistan, predicted Soviet involvement. Soviet invasion occurred five months later.