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STRATEGIC DEFENSE INITIATIVE

by

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FRANCE

Thank you very much. I am glad to be here for the first time. I expect to talk for about 30 minutes and then to answer questions about things that may interest you more than those I happen to have touched upon.

First I want to discuss whether the SDI-- which is what I will call the Strategic Defense Initiative-- will provide defense against strategic ballistic missiles. The answer to that is it will not in any significant sense. Three goals have been advanced for the SDI-- the dream of President Reagan, as he calls it, of March 23, 1983 in which we would have a defense so good that we could abandon our strategic retaliatory force. So, no more nuclear weapons in the United States because we don't need them-- the Soviet Union could do whatever they wanted with their nuclear weapons, throw them at us and our allies and we wouldn't care because we would be protected. But the President recognized that the combination of defenses and offenses would be very dangerous and could be imagined as supporting an aggressive posture, to the extent that he said-- and he is the only one I have found in the United States or the Soviet Union or Europe who believes this-- that we would share our defenses with the Soviet Union so that they could protect themselves against Western nuclear weapons at the same time.

The reason that one cannot have so good a defense is, first of all, all of the problems with making anything work well-- particularly something that has to work extremely well-- because if there is any way in which the Soviet Union can threaten the destruction of a significant part of Western society whether with strategic ballistic missiles, aircraft cruise missiles, or smuggled weapons, we will have to retain a capability for retaliation. That is very simply why we cannot achieve the President's goal.

So we're talking not about that but a lesser capability and asking whether it is feasible and whether it is useful. Here the problem enters of a great technical, a great management problem. The systems imagined by scientists-- or for that matter by science fictionists,-- built by engineers, will be operated by military people. There is nothing wrong with the intelligence of any of these groups but things do not work perfectly in the real world, particularly when some powerful force, the Soviet Union in this case, has a great desire to make sure that it doesn't work.

Even when nobody is trying to make things not work we have failures. The four sequential failures-- the Titan II launch in the United States, the Challenger disaster, another unmanned Titan II launch, the Delta launch and then Ariane-- it has not been a good 6 months for space launches. But things will be much worse. Unlike the hydrogen bomb program, the atomic bomb program, the Apollo program to put a man on the moon and bring him back safely, where no one was fighting back; no one was trying to bypass the defense as in the case of the Maginot line; nobody was trying to overcome the defense by building more weapons to do so; no one was trying to attack the defense which will be a serious problem.

So not only I but, for instance, Edward Teller, a strong supporter of strategic defense in general, says that you can't base a defense in space. He says that the satellites are very costly to put up and can be shot down in advance of an attack. The problem is threefold. The problem is space mines. Each of the large satellites and costly which

are put up for defense will be accompanied from the day it is launched by a small less expensive enemy satellite carrying a nuclear weapon or other explosive and maintained always within lethal range. It awaits just the command to explode and to destroy the quarry satellite, the target satellite. Lest you think this fanciful and not to be tolerated, I remind you that we have tolerated for years within our carrier task forces of the United States, small Soviet ships which for all we know carry a nuclear weapon ready to explode at a moment's notice at the outbreak of large-scale war between the United States and the Soviet Union. We wish those ships weren't there, but we are unwilling to do as we could do in peacetime-- to destroy them-- because we want to travel freely on the oceans of the world, to use them for military purposes and for commerce; and the only way to allow travel on the oceans is to allow travel for everyone. So a regime in which defensive satellites arrogate to themselves the privilege of not being accompanied by space mines is a regime in which nobody uses space, or a regime in which one fights for dominance of space during peacetime.

Consider two other approaches to the defeating of a high-capability defensive system, one which, as you know, is supposed to attack the missiles in their boost phase because they are fewer than the warheads they will eventually liberate, they are more fragile and they are more visible.

Boost-phase intercept is widely regarded by those in the SDI program and supporting the SDI program as essential to the success of the SDI. But that can be done only from space. It's the only place where with the round earth you can see the launch sites in Siberia. Whether or not you can destroy the missiles when you see them is another story, but you must first be able to see them with the weapons. There are two possibilities-- one to have the defenses permanently based in space and able to reach out in the short time of the boost of the missile (something from 3 minutes to 5 minutes at present), or the defenses must be held on the ground and (immediately on warning of launch of the offensive weapons) popped-up and dispose of a form of energy which can destroy the enemy missiles in boost phase.

This first (space basing) has the problem of vulnerability that I have indicated, the space mine problem. The second (pop-up) has a different problem-- a problem which was not recognized in my opinion by the people who advocated pop-up weapons and is still not understood by many of them even though it is a very simple problem. It is that the ICBM during the time of boost, now 3 minutes perhaps, achieves a speed of 7 kilometers per second and rises to an altitude of about 200 kilometers. But a quarter world away at the target, in order to see over the curve of the earth, an interceptor has to rise to 5000 kilometer altitude in order to see the missile still in boost phase. You can move closer than 10,000 kilometers; in a submarine one should be able to approach to 4000 kilometers of the launch site. But even under those circumstances the interceptor missile must rise to 1000-km altitude in the time that the booster rises to only 200-km altitude.

The interceptor missile must start after the booster itself if it is not be a first-strike weapon, and it must go faster. It must achieve a higher speed. Therefore from the physics of the rocket equation, an ICBM may have 10 times the launch weight of its payload, or more practically for instance in the case of the SS-18 missile which has a

4-ton payload and a 200-ton launch weight (50 times the launch weight of its payload); but the interceptor may have to have 1000 times the launch weight of its payload. One problem. This becomes a very big interceptor which has to fit into a submarine, be talked to within seconds rather than within hours or days as is the case of retaliation.

Second problem. What kind of payload can this carry which can reach out from seeing the booster 3000 to 5000 kilometers and destroy the booster? The only one proposed thus far is the x-ray laser. Whether or not one can make an x-ray laser weapon powered by a nuclear explosion is questionable. Assume that you can. Assume that we will not use defense as a complement to a first strike against the Soviet Union. The Soviet Union will eventually have x-ray laser weapons also then. If they want to destroy our defense, they can launch their x-ray laser weapons on small missiles vertically near their ICBM launch sites and destroy our defensive weapons as they come over the horizon. So we face this combination of space mines; and of fast-burn boosters to render the x-ray lasers totally ineffective-- so that the boost can end within the atmosphere at 90 kilometer altitude, thereby giving neither time nor allowing the x-rays to come in; and finally the use of antisimulation. The idea that in midcourse, rather than build expensive decoys which look exactly in all respects like the warheads themselves (100 times as many decoys as warheads) one instead makes the warheads more readily decoyable. One can dress them in rags, in lumpy balloons to look like decoys, which are easy to build ...

According to a study presented July 1983 for the Fletcher Committee which devised the SDI, the Soviets could build for about \$10 M each 10,000 single-warhead fast-burn boosters located in a region about the size of France and that will make it very much more expensive to achieve even a 50% destructive capability against them.

People in fact do not sell the SDI anymore as a replacement for deterrence but as a strengthening of deterrence. They call attention to the vulnerability of the Minuteman silos in central United States and say it is essential to do something about this. The Scowcroft Committee was appointed in January of 1983 by President Reagan. Every one of its members by Presidential appointment-- two former Secretaries of Defense, one in a Republican administration, James Schlesinger a member of the Committee on the Present Danger; one a Democrat, Harold Brown; a former Undersecretary of the Navy; various people, all kinds of people. One of the best kept non-secrets of the Reagan Administration is the report of the Scowcroft Commission in April 1983 one month after the President's SDI speech and again in March 1984, a year after the President's speech, where they did not advocate strategic defense but said that the future security of the West could be assured as far as nuclear destruction is concerned eventually by the development and deployment of a small single-warhead ICBM for the land-based force and smaller submarines each with fewer warheads for the sea-based force. Not only did they not urge strategic defenses, but they advised the most extreme caution in going beyond what is clearly permitted by the ABM Treaty-- which is no effective defense at all. So we do not need the SDI for defending the Minuteman. If we did need to defend the Minuteman we already know how to do it by means that were perfected in the 1960s and 1970s including the low-altitude defense systems and other things.

I published in May 1985 "15 Agreed Propositions" with Ed Gerry who was in charge of boost-phase systems for the Fletcher Committee, which studied these things for President Reagan after his speech in 1983. We agreed that defense of silos could be achieved sooner and at less cost with means that we have already developed than via a layered defense using space components. This may not be true, but I just want you to understand that it is technical agreement between a person who works on the SDI, is a contractor for it and was a key person in the Fletcher Committee discussions.

Now people say, "Well let's be realistic. Of course this won't work against the large Soviet force, but perhaps we need it against the Libyan ICBM. Suppose Colonel Kadaffi buys an ICBM from Germany and he steals a nuclear warhead and he holds New York or Washington hostage." Right now what could we do? Well right now we could certainly use the CIA or for that matter overt military force to destroy that missile on its launch pad. But if we wanted to live dangerously and wait until it was launched, we have 450 Minuteman II missiles in silos, each with a single warhead, each capable of destroying an enemy silo a quarter-world away within a fraction of a second of the assigned time. It could clearly make an intercept in space of the incoming missile on its ballistic trajectory. So if you care about the Kadaffi threat don't waste 10 years of research on SDI and another 10 years of development and deployment; solve the problem now. But silo vulnerability is a problem not meant for solving, this is a problem meant for scaring.

The other quasi-military threat against which the SDI is supposed to serve is the accidental launch. One reads articles occasionally in the U.S. literature that right now the United States is "naked against the nuclear threat." If the Soviet Union launched a squadron of ICBMs by accident all they could do is call up on the telephone and say, "We're very sorry; this was an accident. After you figure out how much the destruction cost, please send us the bill. We'll do what we can to help." General Graham, Danny Graham, thinks something should be done about this. Well if he thinks something should be done about this, I have suggested to him that I have the solution. It won't cost much; it can be done within a year, you've seen it operating twice within the last 4 months-- once on Ariane and twice on the Challenger-- and this is to put on the operational missiles themselves the command destruct link. This is a little radio receiver and package of explosives which is used in every test of a missile by every nation that I know.

On Ariane, when the third stage did not work there was a command sent to destroy the rocket so that it would not cause trouble. When the Challenger broke up and the two solid rocket boosters were going off in different directions, even under those circumstances the individual packages on the solid rocket boosters were able to receive the message to destroy the solid rocket booster so it wouldn't pose a threat to populated areas. So if you worry about accidental launch, mount these command-destruct boxes on the operational missiles-- the Minuteman, the submarine-launched missiles,-- encourage the Soviet Union to put them on theirs. If necessary, pay them to put them on theirs; it'll be a lot cheaper and sooner than waiting for the conclusion of the SDI, during which time we will be exposed to the threat of accidental launch. The secret word which would be sent can be held secret in a safe; if the Soviet Union would launch accidentally they would call up and say, "Never fear, this is an accidental launch, and we are sending

the destruct word to our missile; but just in case it doesn't work, here it is and you can send it as well. And if all that doesn't work, then send us the bill."

So neither the terrorist ICBM, nor the silo defense, nor the accidental launch is a reason for building SDI. What is? Well it has been said that this is a secret weapon of the United States to make U.S. industry more competitive and that if European industry does not want to be left behind it has to join in this effort. This is joining in an effort like the lemmings' march to the sea. Before you believe that this is going to improve U.S. industrial competitiveness you ought to look at the facts, at who says this, and what our experience has been. I find it amazing that people who have never in their lives supported science or technology, and have no brief for doing so, use as their chief argument these days for the SDI the benefit it will have on the nation's industrial capacity.

Somebody who has been very much involved with this is Professor John Bardeen of the University of Illinois, a physicist with two Nobel Prizes-- one for the invention of the transistor; one for the theory of superconductivity. In a remarkable two-page statement published September 13, 1985, Professor Bardeen said first of all he was a member of the White House Science Council at the time of the President's speech. The President did not consult the White House Science Council or the panel which it had looking at the relevant technologies; nor did the President consult with the experts in the Defense Department. And you well know the story of how Caspar Weinberger, Richard Perle and such worthies were surprised by the President's speech. Furthermore, Bardeen says that rather than help science and technology and industrial competitiveness in the United States, the SDI will impair it, will hurt it. He says that the Apollo program in the 1960s to send a man to the moon and bring him home safely within the decade was a great technical success; but we put our best people and our best thought into that program at a time when the Japanese instead were studying industrial technology and consumer technology and manufacturing. Bardeen dates the Japanese supremacy in these fields now to the inattention and malfocus of the United States during the 1960s-- to the concentration on spectaculairs rather than on bread and butter, on things that could be of wide use throughout industry.

I have the same opinion; I advised President Nixon in 1969 against the pursuit of the supersonic transport development and I advised the French and the British also against the pursuit of the Concorde which, of course, is a great technical success. But to have built 16 aircraft of which only 9 have ever flown in commercial service is hardly an economic benefit to anybody. You could have had the Airbus a decade sooner had you not had the Concorde. It was not good for the countries.

Let's look at protection against tactical ballistic missiles, and I think that is the last thing I'm going to say in my semi-prepared remarks. If the SDI is not good against the long-range strategic ballistic missiles, perhaps it is better against the shorter range missiles. For various reasons the SDI and the organized civilian pentagon in the United States have been proposing to our European allies that they think hard about the benefits of defense against tactical ballistic missiles. About that I say, "nonsense." The Soviet

Union of course does not need tactical ballistic missiles to hold European capitals hostage. It has some 10,000 strategic warheads and it could spare a few of those on the variable range SS-11s or their modern equivalent to threaten \*\*JAH: Trouble again. Your voice is low and far, cannot hear at location just after the 5th line from the right on plastic cassette. Lasts about 3 minutes.\*\* shielding or rocks and destroy them before they strike you. \*\*JAH: Cannot hear at 6th line from the right on cassette. Lasts about 3 more minutes.\*\* by the elimination of defense and by the elimination of the possibility of effective counterforce. That is the retaliatory weapons will be destroyed neither after launch nor before launch. The lack of defense is something that must be negotiated??... \*\*JAH: Trouble again. Voice picks up near the end of tape 483-B. It is a male voice speaking in French. Tape 483-B ends and French question continues on side 483-A.\*\*

RLG: Thank you. Well I find it bizarre to see people, leaders of nations, revel in their lack of power and then announce that they are powerless to stop this juggernaut-- that the SDI is irreversible. But I am not surprised. I have seen it before. It is a standard argument for programs which have lost all other justification. One says it has gone too far, one cannot stop it. It is a very useful argument, as you can see. But in fact if the European nations would get together they could of course have a very major influence on their big ally. We have in this regard a divide-and-conquer policy whereby we negotiate secret agreements with the individual European nations. We do not do that to your advantage, we it to-- what our government thinks is-- the U.S. advantage, which is not advantage at all in my opinion.

I think that the Gramm-Rudman limit on the budget is a good thing. It is mindless, but we were even more without mind before we had this mindless limit. It demonstrates to everyone who might have had the fantasy that we can do things which are additional effort, additional funds, that we cannot. And we could not in any case, because the SDI-- usually portrayed as a research program of \$26 billion over 5 years-- was really outlined in the Fletcher Committee report as a 10-year research program of \$70 billion. The reason that you hear this 5-year number is that in the United States we have a requirement for a 5 year defense plan, a "FYDP", and the number that went with that is \$26 billion. But you may have noticed that from 1984 to 1993 is 10 years, not 5 years, and you have never heard a price for the last 5 years of that program, which is about \$44 billion more.

I think that the military is not supportive of the SDI. They are good soldiers. Caspar Weinberger issued an order last September designating the SDI as the highest priority program in the Department of Defense, and all defense personnel military and civilian should give it their support. What that really means is that no defense person, military or civilian, should criticize it; and they have been doing their job very well.

Now on the computer hardware and software, here too there is a lot of misinformation, disinformation, and unfortunately just plain lies. Dr. Fletcher not only in his report said that 10 million lines of error-free high level code programming would be required. In a paper which he published in the Fall of 1984 in the National Academy journal Issues in Science and Technology he repeated this statement. He said that 10

million lines of error-free code would be required and it would be difficult, but he was confident we could achieve it.

More recently David Parnas, a Professor of Computer Science at the University of Victoria in British Columbia, the only person on the Software Advisory Committee to the SDI who had any experience in military programming-- he had worked for the Naval Research Laboratory and actually for IBM-- resigned after the first meeting saying that there was no sense taking seriously this problem they had been given, because it could not be done. He wrote 8 two-page papers explaining why. Well SDI of course now maintains that their critics of software and hardware are wrong, that they do not understand the problem. In fact, last November I debated General Abrahamson's Special Assistant-- at that time, Major Worden-- who said the critics wrongly say that 10 million lines of error-free code are necessary and can't be made to work. He said that of course you don't need error-free code.

I pointed out that it wasn't the critics who said that 10 million lines of error-free code were required. And at that time Worden turned around and he said, "Yes I admit it. I am guilty. I wrote that paper for Fletcher and some of the software engineers took me to task. They said that I, Worden, was either drunk or crazy when I wrote it and I have to admit it." So it cannot be done; it probably is not necessary but in order to have a system which can be done, the whole architecture of the SDI has changed from the one which was advised and assessed by the Fletcher Committee in which everything was centrally managed, battle management, each interceptor was assigned to its target. Now they are talking rather wildly about layers which are independent. And they say wrongly that if the interceptors are assigned at random to the decoys and warheads they are only 10 or 15% less efficient than if they were assigned specifically. They do not understand that that's so only for defenses of low performance. If you have a defense with high performance in which a million interceptors would have destroyed a million targets specifically assigned, it would take 5 million interceptors and still leave 10,000 targets even if they could be assigned randomly-- which is not easy. In wartime they tend to attack the first of the targets or the brightest of the targets.

We would like to have software which is without error. We would like to have software which can accommodate new phenomena because the other side is going to be very careful to reserve tricks which will never be observed until the time of war, and the system will certainly not be able to accommodate those. But it's very difficult to design the system, very difficult to provide test cases because no particular architecture has been chosen.

Male Voice: \*\*JAH: Difficult to interpret because of accent and distance. Will try.\*\* I also have two questions. One will be a very simple question as to whether....Russia keeps a relationship between offensive and defensive weapon... Possible that you were saying .... and conversely one says that one of the worries of the Soviets is that ..... that some of the weapons which are supposed to be for defense will in fact increase the offensive capacity of the United States and be actually directed at silos rather than to intercept their missiles. And to broaden that question from a technological point of view many people say that-- I heard many ?? from San?? Laboratory say that-- he thinks that the main results of SDI will be..... give a great boost

to new technologies in .... I want to know your opinion of that. Now the other question is maybe I misunderstood because you were going quickly but in your system you are proposing why should your 400 warheads, or whatever the number is, be ordinary not particularly hardened or protected silos. ....where you have no population??.... very important that they should be invulnerable even against an attack on which ....

RLG: Yes, I wanted to mention that second first. My single-warhead missiles are self protecting against a comparable force of Soviet missiles, no matter how based. The Soviets have to use one warhead striking the silo in order to destroy one warhead. Now ordinarily one figures that under the best of circumstances they will have to use two warheads against each silo to make sure of having one destroy it. And so no matter how many of these 400 they destroy, they will be worse off, they will have a more unfavorable situation relative to our force afterwards than before. So from that point of view they are self-protecting. This makes a much cheaper deployment than what is proposed, the \$44 billion for 500 mobile Midgetman which is the only number you hear from the Defense Department in the United States. The small silo-based single-warhead missile was studied for the Fletcher Committee by two contractors, and a force of 1000 warheads in these silos and missiles was to cost a total of \$10 billion for 1000 warheads. Very cheap, very affordable. If the Soviet Union does not agree to a limitation of 1000 warheads altogether, then if I want to run an arms race with the Soviet Union I will do it by putting many of these-- 10,000, 20,000, 30,000-- of these silos (they can be accommodated on one mile spacing, about 30,000 of them in the fields now occupied by Minuteman).

Now the question of whether SDI will boost conventional technologies. This reminds me of the cock who boasted to the hens of his power, because every time he crowed the sun rose. Of course if we spend 10 years while civilian technology is expanding at the rate at which it does-- with the Minolta camera that I have and the video recorders and the Polaroid Spectrum camera-- of course conventional technologies will improve very much. But it is the passage of time; it is not the work being done in the SDI which will do that. If we are interested in improving conventional technologies (and I am, and I'll be glad to give you an article from Issues in Science and Technology as to how to do European defense with conventional weapons which are theater-range ballistic missiles for air defense and artillery attack) if we want to do that, we know how to do it right now, and we should get on doing it. But we can't because we don't agree on whose product to buy, who will do the manufacturing, the usual NATO problems; we cannot agree on replacing aircraft by other means, because the air forces don't want that and those are the problems we will have if we ever prove SDI has any feasibility at all.

I think the offensive use of the SDI is really in conjunction with first strike. This is certainly Caspar Weinberger's worry about a Soviet defense. In his letter to President Reagan, Weinberger has said that even a possible Soviet ballistic missile defense will force us to expand our offensive weapons and to ensure their ability to penetrate to their target.

There are some little things that you could do offensively-- set a million fires on the ground with space-based lasers (which will never be deployed because they are so vulnerable). But I've looked at this and believe we could do better more cheaply with orbiting magnesium incendiary bombs, the kind that were used in World War II. Finally, if you believe people who say that we will develop a totally new kind of lift capability to orbit-- the transatmospheric vehicle or something like that-- which because it can be reused many times (echoes of the space-shuttle propaganda of the 1970s) will make it very cheap to harden the satellites so that they cannot be destroyed by enemy action. That same transatmospheric vehicle (or whatever you imagine which is cheap lift to orbit) could more simply be used to deploy nuclear weapons into orbit and harden them against the enemy forces the way our satellites are expected to be hardened, and then you will have nuclear weapons in orbit. Stupid place to put them. They're more vulnerable there than on the ground. But if you stipulate that satellites are made invulnerable, then these bombs are made invulnerable in the same way. So, there is really no logic in this. It is the latest desperate argument of people who, having lost sight of their goal redouble their effort.

Male Voice (English?? accent): My first question is about the Soviet effort in that field for which we know little but we fear a good deal. But what can be noticed is that the Soviets now when they speak of the problem say that they are against SDI, but they mention space-based attack. Does that mean that they are ready to go ahead with land-based defenses, and if that's so is it based on new technology or is it simply the development of the old Galosh system? It certainly seems that now they want to qualify their opposition in focusing it on the space-based weapons and exempting land-based weapons from that interdiction. Then I'd like to make two comments which are questions also in a way but perhaps more of a political nature than technical ones. If your analysis of SDI being bound to failure is correct-- and I must say I have no reason to challenge it, I'm not a technician and I cannot-- when I hear through those who are in favor of it they say that it will not 100% but enough would work so that it would present the aggressor with a problem, but I don't know leaving that apart. But if your reasoning is correct, why do the Soviets raise such hell about it? They ought to be pleased to see the United States embarking on a program that will lead nowhere. Spending money on absurd expenses and add the cost also, the political cost, of can??raising?? the pignities?? with their allies and I really don't see why the Soviets should be so perturbed at seeing the United States actually weakening and focusing their defense effort on wrong lines.

The second comment is related to that. Now they agree, or rather they propose to omission?? of about 50% of the delivery system of the super powers and the limitation of the warheads to 6000 as a first move reaching in the 90s, before the year 2000, the complete elimination of nuclear weapons. Do you think that this is entirely for propaganda purposes with the result that it would strongsent?? new??pake?? in the tight spot as you mention, or is it that they are really interested in anything that would stop SDI and they think that this is the move by working on public opinion both in the United States and in Europe in saying suddenly that either?? contrurer?? we've got the solution and within 13 and a half years we can be free of nuclear weapons. It

doesn't really seem to be quite clear and with the extraordinary negative interpretation of rather judgementary?? you gave on SDI.

RLG: Why should you believe the Russians?

Male: But we've got to take them into account.

RLG: I agree with that. The Russians are no more a unitary force than is the United States. The Soviet Union has its political leaders, it has its military, it has its people who have careers and power in industry. And it has, I suppose, hawks and doves. But a dove over there is something like an eagle I suppose. The spectrum of doves doesn't go very far.

Let me answer the first question about which I know more. It is very difficult to look inside the minds of the Soviets, but it's a lot easier to look inside and see what they're doing in the ballistic missile defense problem. They have long had, for more than 20 years, an effort on improving ballistic missile defense. There is no new technology which they are able to use on defense against ballistic missiles. They have some long-term efforts on lasers-- about \$1 billion a year according to CIA estimates. They spend about 10% of their military budget on strategic offense, about 10% of their military budget on strategic defense, again according to unclassified CIA testimony of June 26, 1985. So the kind of technology that they would be using is not Galosh technology but upgraded Galosh technology-- probably not so good as the Sprint missiles that we deployed in 1975, which we developed and tested in 1965 and of which we had built more than 100 and have them operating.

Now I don't believe that when the Soviets particularly criticize space-strike weapons they are in any way opening the door to ground-based ballistic missile defense. They insist on respecting the ABM Treaty. They are not going to allow any U.S. or Western defense against strategic ballistic missiles whether ground-based or space-based. I think that the space-strike weapon is a very largely propaganda effort to show that the United States is insincere that they are proposing this defense... "instead of this defense what it really is is weapons which can strike the Soviet Union." And I think it plays on people's fears. The Soviets do not really believe that the SDI would provide any offensive capability, except that very major offensive capability of repressing a retaliatory strike. That's my judgment. I've talked to a lot of Soviets about this, some of whom have one line some of whom have another line. But that's my judgment.

But more interestingly if my analysis is correct why are the Soviets so concerned about the SDI? It's because they don't want to have an arms race. If they expand their offensive forces in order to counter the SDI-- that is make more silos with single warhead missiles on it, things that are quite cheap to do-- this will not fit within the SALT agreement; they will no doubt be forced to build defenses simply because they have a very large special interest group in their country which is used to building defenses and then the United States will be freed from the limitations of the ABM Treaty and the SALT limitations and probably the Outer Space Treaty. The last thing that the Soviets want is unpredictability. They hate things that cannot be predicted and they don't know where that arms race will lead. They do not

believe that they will come out ahead in an arms race with the United States. In fact, my judgment is that both will come out behind. That although the United States will have weapons which at any time are more advanced, more technologically exciting, the Soviet Union will have those eventually and we end up with more powerful weapons and more of them on both sides which will be to nobody's advantage.

Now the Soviet 50% reduction in delivery systems, that was agreed more or less between President Reagan and General Secretary Gorbachev and I think that is fairly serious on the Soviet side, I don't know whether we're serious about it on our side. I don't believe that they have any understanding of how they would approach zero nuclear weapons or what kind of world that would be. The problem with zero nuclear weapons is that it is so easy either to hide some small numbers or to make them anew. In the 1940s the United States in about 3 years made nuclear weapons when we didn't even know that could be made and we had no material from which to make them-- either uranium 235 or plutonium. Now with vast stocks of these materials in the so called civil economy, and with the development of technology, it would take 6 months perhaps. We have the drawings. Very hard to ensure that every microfilm of how to make a nuclear weapon has been eliminated. So I don't think that's serious. I think Mr. Gorbachev saw the political benefits that Mr. Reagan was achieving by his dream, as he calls it, of rendering nuclear weapons impotent and obsolete, and Mr. Gorbachev couldn't resist getting a little bit of that propaganda benefit for himself.

Henry Kissinger asked at a meeting in Atlanta about a year ago in which we participated (as did President Ford and Carter and Ambassador Dobrynin and a cast of hundreds) a question, "For the life of me" he said "I can't understand how the critics of the SDI can say at the same time that it is ineffective and destabilizing". What can Kissinger mean? He means a general theorem, that things cannot be both ineffective and destabilizing. So I gave the example of going to the toy store and buying a plastic handgun and putting in my pocket and going down the street, walking up to a couple of these police officers armed with submachine guns, pulling out the gun and pointing it at one of them. And of course I will be shot. My gun is ineffective, but it is terribly destabilizing because there are some people who think it might work. It is not the best judgment, but if there are some people who think it might work out of unwarranted respect for U.S. technology then it is both ineffective and destabilizing.

Male Voice (in French):

RLG: I don't think our submarines are becoming more vulnerable. In fact I published a paper in 1983 about "Will the submarine force become vulnerable?" And the answer is no. The more we know about the oceans, of course the better we can detect objects in the ocean. But these are not objects. These are submarines, which are operated by people with all of the information available to the commander of the submarine as to the local environment, the sound velocity profile. The ocean is not like the atmosphere. Radar waves go direct through the atmosphere without either being absorbed or significantly deviated. But in the ocean a sound wave (which is the only thing which goes for a long distance) initially horizontal near the surface ends up down at 3 kilometers depth some 20 kilometers away and then comes back again to the surface. A submarine in that environment can understand where it

is, hide in a zone which cannot be seen by long range sound. There are two kinds of long-range detection-- one is active sonar, the other passive sonar. Submarines can easily avoid active sonar because they can turn toward it, they can jam. Passive sonar, as the Soviet capabilities improve, we will eventually have to operate as we do our aircraft. We will eventually have to provide countermeasures against these listening devices which will raise the noise level in the ocean so that the submarines will become less and less visible or audible.

Our submarines are getting quieter and quieter. So as Navy Admiral McGee who has been in charge of such things has said, the more we learn about the oceans the more opaque they become. Not that they will become transparent.

So it is wrong to imagine that submarines will inevitably become more vulnerable. Quite the opposite. An independent authority Walter Munk, Professor of Oceanography at Scripps Institute of Oceanography in California has spent the last 20 years working for the U.S. Navy both in reducing the vulnerability of submarines and in helping to perfect antisubmarine warfare techniques against the other sides submarines. In a rare public statement in December 1984, he judged that we have no means for detecting submarines effectively at long range other than listening to them. All of the non-acoustic methods so far have failed to be effective.

If one has only two submarines or five submarines, another method comes in. One could look at an article which I published in 1972 in the Scientific American on strategic submarines to see that we have long known how to trail submarines actively. If there are few submarines one can have another submarine stay a few hundred meters away under all circumstances. Now you cannot do that with in the territorial waters or in harbors, at least you can't legally do it in harbors. You trail actively, that is you send out pulses so that the quarry submarine knows that it is being trailed. If he doesn't like this than he can take measures which are perfectly legal unlike \*\*JAH:End of tape.\*\*