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Emergency Planning for the Persian Gulf

LOS ALAMOS SCIENTIFIC LABORATORY
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Emergency Planning for the Persian Gulf

Edward Teller*

*Lawrence Livermore Laboratory, Livermore, CA 94550.

EMERGENCY PLANNING FOR THE PERSIAN GULF

by

Edward Teller
Lawrence Livermore Laboratory
Livermore, California

ABSTRACT

This was a talk given by Edward Teller for the LAMPF Users Group, Inc., (LUGI) Young Scientists' Lecture on Friday, February 1, 1980, at the LAMPF Auditorium.

Louis Rosen:

I didn't realize there were so many graduate students at LAMPF, but you all are very welcome. This talk is sponsored by the Young Scientists working group here. Normally the chairman of that group would introduce the speaker. In view of the late hour and the fact that Dr. Teller has to leave rather early this afternoon, five o'clock or so, we will dispense with introductions. I feel this is justified because almost everybody at Los Alamos has seen the one-hour television series a week or so ago describing Dr. Teller's life and times, his philosophies, and some of the discussions he has had with colleagues through the years (NOVA). Now, I listened to that television series in Chicago. I happened to be there for the APS meetings and I felt that it was incomplete, and I cannot discharge my responsibilities at this podium without saying about twenty words which, to me, would complete to some extent the series that I heard.

I don't want Dr. Teller to think that I have contrived these words just because he was good enough to come here at this time and address this audience. So, I am going to quote from a letter which I wrote to him, and which he has forgotten, maybe a year or so ago on the occasion of his seventieth birthday. There was a great celebration on this occasion. Unfortunately Mary and I could not be there

so I wrote him a letter, and I will quote just one paragraph from that. It says,

> "Although I have known you for more than thirty years, I still marvel when I look back on your colorful, eventful, and marvelously productive career as a working scientist and as an advisor to scientists, laboratories, presidents and governments. Many of us, I among them, have profited enormously from not only your keen intellect, encyclopedic knowledge, and masterful reasoning, but also on occasions from your powers as a prophet."

Now, having said that, I will be able, with a clear conscience, to take issue with things which Dr. Teller may say with which I might disagree.

That brings me to what I think is the real reason why Dr. Teller chose this moment--he has had this invitation to come here for a long time. I think, and he may correct me if I'm wrong, the reason he chose this moment to be here with us is because of international events. He has recently been charged by the governor of one of the great western states to advise that governor, him or her as the case may be, on what steps that governor should take in the event of catastrophic occurrences in the Persian Gulf region. Well, with that supposition, I introduce to you my very good friend, Dr. Edward Teller.

Edward Teller:

I always try to disagree with whomever introduces me. This time I have only one point. I had one very good reason to come here which you failed to mention, and that is, I always like to come here. In case anyone else has seen this remarkable film, I should not have any comments on it, and I don't. However, my wife did; she had one comment. You know, it so happens that she is interested in me, but she's interested in some things at least as much. She is interested in things that interest all of us, and must. It was a little peculiar that in this film there was no mention whatsoever of the fact that the Soviets worked on the hydrogen bomb at the same time and finished it practically at the same time. I think that one cannot deny that the film was not really made about me, but about the hydrogen bomb. We felt that the omission was remarkable.

I am very happy about another point that Louis made; the point that we are in a very difficult situation. What should we do about it? I will attempt to talk quite briefly, and I hope that when I'm through, you will have questions or suggestions. The more the better, and please don't be restricted to topics I have mentioned.

The first substantial point I have to make is this: in the last year or so, ever since the SALT discussions came up, there has been an increasing awareness

in the American public that a balance of military power no longer exists. Of course the defenders of the SALT agreement deny that Russia is the strongest military power. But if you read, for instance, the statement of our Secretary of Defense at all carefully, you will find that he supports the statement of that kind in such a flimsy way that a highly intelligent person like him cannot possibly believe it. And I believe that yesterday he was on television again and his positive statements were only slightly positive for the present and dubious for the future. As a result, there is now a consensus that one thing we must do is to increase our military budget.

I claim that this is not sufficient, and possibly not necessary. There is no question that the Russians have been ahead of us, quantitatively, for a long time, and to catch up quantitatively will be very difficult, and impossible in a short time. We always said, "but we are ahead in a qualitative way." Unfortunately, there is all kinds of evidence that today in qualitative military technology, the Soviets are ahead of us. Therefore they can beat us on practically every level, whatever level of warfare we should choose.

I cannot prove that to you for two reasons--it is a secret, and I am not allowed to tell you. I'm not even allowed to tell it in a Q-cleared area because it is secret intelligence--it is, therefore, more highly secret. And, I have an even stronger reason not to tell you--I don't know. After all, the Russians did not tell me. We can make inferences which should be known to the American public, and it is a scandalous fact that we keep Russian secrets more vigorously than our own secrets, that we really cover up our military inferiority. This is a most dangerous thing to do, but these are the facts.

Therefore, I claim that in military regards, the greatest need is for scientists to become interested in national defense as they did in the Second World War, but with a difference--these days time scales are compressed. We must be in a hurry about it. Even so, a lot can be done. And when I talk about defense, I don't mean just atomic weapons. Well, I do mean atomic weapons, among others, but I equally mean defense against atomic weapons, civil defense, entirely new methods of warfare. The laser beam is only one example, and it is remarkable that our Nobel Prize winner, Charlie Townes, is now interested in astrophysics. But, the Russian Nobel Prize winners, Basov and Prochorov, are working full time on lasers, and are working with the military. We are much better no doubt than anybody else, but to be good is not enough; one also has to work. In regard to

the military aspects, the amount of work done by the few laboratories interested in defense is good, but clearly insufficient. So, that is the first point I want to make. I want to say that what you are doing here at LAMPF (Los Alamos Meson Physics Facility), creating the interface between military work and the best scientists in the country, is something of very great importance, which may turn out to be the saving of the United States and the saving of the free world.

Now let me come more concretely to recent events which I will mention only to the extent that you may not have thought about it. Troubles in Iran really were preceded by an intensive effort coming from Russia which took the form of Persian language broadcasts from Baku into Iran inciting the Iranians to anti-American actions. That is amply documented. The direct result of this was the capture of a number of Americans in our embassy. The number today is forty-four. What Iranians did, or the Iranian so-called students did, in the embassy was brought up in the United Nations, and even the Russians voted to condemn it. The Soviets have a considerable capability to be flexible in regard to these issues and to take actions on both sides. Of course, when the more real issue came up--not to condemn the action, but to take economic counter-measures, the Russians came down on the side of the Iranians.

The other remarkable event is Afghanistan. Now the evidence that Afghanistan was dangerous to the Soviet Union is not something that I think I need to explain to you. That has been sufficiently explained by the Soviets themselves and by the fact that in the recent couple of years the Afghans had three successive puppet governments, all of them strongly under the influence of the Kremlin--strongly, but not sufficiently. The last Afghan ruler who invited in the Russians according to the Kremlin, was also shot by the Kremlin on the next day. To explain that? Well, I will explain it.

I think that the Soviets felt the need to have strong military forces of their own in Afghanistan, forces which can be used toward the east, toward the west, or toward the south. I cannot predict whether they will move or whether they will be satisfied with their presence, or in which direction they will move. But while I told you that I cannot predict it, I will. And of course, Louis has discouraged me from doing so. He, having praised me as a prophet, I should now not put my reputation at stake. I have been told never to make any predictions, particularly not about the future, and most particularly not about the near future. Because then you run the risk that people will remember your wrong

predictions at the time they don't come true. But, for that reason, not as a prediction but as a possibility, as a worry, I want to mention to you some geography.

In Afghanistan the Soviets are not far from the Strait of Hormuz, the inlet into the Gulf of Persia. There are also very many Russian tanks in South Yemen, which farther west is at a somewhat greater distance from the same Gulf. Also, the Soviets have conducted, not long ago, a parachute exercise of airlifting a lot of Soviet troops into Ethiopia and then bringing them back. What they could do there, they could do in South Yemen. It is entirely possible if the Kremlin so decides for the Soviets to take control of the Strait of Hormuz in as short a time as a few days, in a shorter time than any time scale on which we could react.

Now the President has talked about drawing lines, and this alarms me. First of all, I don't want war. But, more particularly, I certainly don't want war that we cannot possibly win. And I don't want war unless there is a firm resolution and a clear understanding in the American public that there is no other way.

The Second World War was fought on the American side with an unprecedented unanimity and with great effectiveness, but that was because Roosevelt waited until any doubt about the necessity of war had disappeared. To talk about drawing lines, is not as responsible an action as I would like to see from the highest quarters. It is therefore quite necessary for us to give most serious thought to the question of what happens when--and if--the Soviets get hold of the oil spigot.

Of course if they do so, they may close it. They may bring about a depression the like of which has never been seen. Maybe they won't do that. It may be wiser on their part to use the oil spigot as an instrument of pressure, of influence, something that will not bring about a reaction quite as violent as the cutoff of oil would generate. In this situation it seems to me absolutely clear that what we need are contingency plans--not just contingency plans for the United States--contingency plans for the entire free world, including the third world. How should we behave in a number of possible emergencies that could arise?

The most remarkable fact is that our government has no such plans; our corporations have no such plans; our press has not written a line as far as I know, demanding that we need such plans. We really imagine that we can go on with

business as usual, forgetting the fact that if we should be prepared, the Soviets would proceed more carefully. And, whatever the result will be, it will be less catastrophic.

I said nobody did anything and Louis, quite correctly, said that there is one exception. He was a little ambiguous on the State on the West Coast. I suspect him of being ambiguous on purpose. Perhaps it will not come as a surprise to you if I tell you that it was not Governor Brown who asked me for advice, but rather Governor Dixy Lee Ray. I will go there within the next week and will try to suggest anything that people in the State of Washington can do.

I want to mention first, because it is most important, the question of gasoline for automobiles. It is a national question. Governor Ray connot introduce rationing in one state. She cannot put a high tax on gasoline in one state. This must be a nation-wide decision. There is, however, one very small contribution that she can make, or for which she can prepare, and I do not know how good that possibility is, or how quickly it will act, but I propose to find out.

In LBL (the Lawrence Berkeley Laboratory) we have a Turk, whose name I don't remember, but he is a most excellent Turk who has found a way that seems to be feasible and seems to be an answer--and I hope an effective answer--to an old problem: to boil wood and make oil out of it. As I understand, the process is that you chop up the wood into very small chips. You don't dry it out; you don't make sawdust out of it; rather you add a little water and make a weakly acid solution with sulfuric acid, about pH2, which is not at all concentrated. Boil it for 45 minutes at maybe 130 psi at 180° C with agitation. You get a pumpable slurry. Now inject it into a pressure vessel at 350° C, 3000 psi, with some synthesis gas and a little sodium carbonate, boil it again for 45 minutes, and you get an oil-like fraction.*

It is not clear to me whether this can be done more rapidly than extracting methanol from wood. It seems to me highly likely that it uses a much higher proportion of the energy that is in wood than methanol, in whose production I believe, micro-organisms chew up the cellulose and break it down--but probably not quite completely. To use wood, either for methanol or for this "Turkish" oil, I think might be a small, but worthwhile contribution.

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*See Sabri Ergum, "Biomass Liquefaction Efforts in the United States," LBL-10456, February 1980.

And furthermore, it fits, because if we are hit by a depression, one of the obvious consequences will be that housing starts will rapidly decline--maybe vanish. That will, in turn, hit the lumber industry in the Pacific Northwest. We will have excess wood and excess capacity to produce wood. Also, in getting lumber, we are rather wasteful of wood because we leave the small wood, the small pieces, lying around.

This brings me to another point which is not really energy saving. It is something else about which we have to think. If that depression hits, the demand for automobiles will drop even more than the demand for housing. Detroit will be destroyed without an atomic bomb. But it will not be really destroyed. We will have a lot of people out of work, and there are no plans for what to do with them. There will be a lot of machinery out of work. We have no plans for what to do with it.

Maybe one should convert Detroit at top speed into a moped factory. I don't know whether I could ride a moped myself, and I wish on some of them they would put a third wheel. Whether that is possible or reasonable or not, I do not know, but questions of this kind have to be asked all across the board.

Let me return to the State of Washington. Not in Washington, and not near Washington, but nevertheless available to Washington, there is a remarkable coal field of which you may or may not have heard. It is the Beluga coal field in the Cook Inlet in Alaska. First of all, the coal is quite close to the surface. Secondly, the coal has probably the lowest sulfur content that is found anywhere, at least the lowest I ever heard of. It is uniformly below 0.2%. You know that low sulfur content usually means less than 0.6%, and high sulfur content is between 3 and 6 percent sulfur. The Beluga coal has 0.2% or less. It is also coal which is not particularly good. The BTUs per ton are low. It comes with a lot of dirt in it, with a lot of silicates or whatever else lies around.

How to bring it down to Washington? There exists a great surplus of oil tankers. Oil tankers today are cheap. We have to suspend that coal in some fluid and bring it down in the tankers. The fluid may be water--even sea water; then we may have to get rid of that water. There is a second possibility, a little more adventurous and quite possibly not feasible. There is a proposed product; it is called metha-coal. That is coal suspended in methanol, in wood alcohol. Now it is a fact that methanol has a particular affinity to practically every kind of coal. As a small molecule of the right kind of structure, it

penetrates into the smallest pores of coal. Probably it won't act in that manner for anthracite, but in every other kind of coal it will happen. The methanol penetrates and effectively disintegrates the coal into smaller particles. A mixture of 50-50 coal and methanol, or perhaps even more coal than methanol, with certainly considerably more heating value in the coal than in the methanol, flows. It can be loaded on the ships, or can be sent through pipelines. More than that, this solution can now be centrifuged, and by centrifuging you get rid of all the unnecessary silicates or whatever else came with the coal, all of which is heavier than the coal. Therefore you have to transport less, and you are left with very much less dirt in the place where you use the metha-coal. From the lumbering industry in Washington you can get the methanol. You may take it up to Alaska and return with metha-coal. Again, a small contribution, and perhaps an alternative one to the first mentioned use of wood.

Let me continue with coal for a moment. The State of Washington is full of coal. It has many coal deposits, in general, small ones, but really varied coalbed deposits. Some of them high sulfur and some of them low sulfur; some of them in nice horizontal layers; some of them tilted; some of them all jumbled up. And this is interesting because there is a program, the *in-situ* coal gasification. This program, incidently, had been originally started earlier than anyone else by Comrade Lenin, and furthermore, he started it for a very respectable reason. I am very glad that I can mention this to you because this is the only point on which I agree with Comrade Lenin, but I try to make a point of it to find one common cause between me and any other individual.

I agree with Linus Pauling about Vitamin "C", at least partly. With Lenin I agree about *in-situ* coal gasification. The Russians did have some success in it. We have done almost nothing. The State of Washington is an excellent laboratory in which we can try out coal gasification under various circumstances. Livermore has put in as big an effort as the somewhat unimaginative Department of Energy would tolerate, and we did manage to produce gas out of coal fields in the West--we did manage to produce 400 BTU per cubic foot. This is not good enough because if you try to put this into a pipeline, transportation by pipeline will become too expensive. Pipeline quality means 1000 BTU per cubic foot. One can transform low-grade gas into high-grade gas. It is quite expensive, quite a bit more expensive than the production of the original gas. But the state of Washington is not so big. Seattle and Portland are not far from some

of the coal fields, and over these short distances the original kind of *in-situ* gas could be used without any further transformation. To do this may be economically sensible even if there is no emergency. It would be particularly sensible for the original reasons that Lenin gave, i.e., to save coal miners from accidents in the coal mines and from the black lung disease, for this is a chronic effect of the deposition of coal in the lungs of the miners.

My third point--wind energy. You know wind energy is really wonderful, with only one provision; you ought to have wind! And furthermore, the wind velocity makes a little difference. Do you know how the wind velocity influences the power of the windmill? It's the cube. Twice as fast, twice as much air and four times as much kinetic energy in a certain volume. So, twice as fast, eight times the power.

Windmills in general will not make a big contribution to the energy economy. However, there are special places, for instance Hawaii, where the trade winds--which are quite steady--get deflected by the hills of the islands and give very strong winds. The State of Washington is not as good as Hawaii, but in the State of Washington or at the border, the Columbia River has put an opening into the chain of mountains on the Pacific Coast and this opening and these mountains confine the westerly winds. The average wind velocity at the place in Hawaii which has been now accepted as the first place to put windmills in Hawaii--there, the average wind velocity is 22 mph. In the Goodnoe Hills, a specially selected point in this opening on the Columbia River gauge, the average wind velocity is 19 mph. The difference is significant. You know there is a 50% difference in the efficiency and, therefore, out of the same windmill you get only half as much energy as in Hawaii, and furthermore, in Hawaii the windmill will work 80% of the time and in Washington only 60% of the time. So the Hawaiian windmill is almost three times as good as the Washington windmill.

But, even the Washington windmill in an emergency would be quite acceptable. There is a further point. The biggest firm, the biggest manufacturing facility for windmills today in the country, is the Boeing airplane factory in Washington. And, perhaps we will need less planes and more windmills. I understand that they can turn out a hundred windmills in a relatively short time. Each of them is expected to produce 2.5 MW; so, a hundred of them together will be as good as one quarter of a nuclear plant. It is not much, but perhaps they could begin to make plans now to expand their windmill producing capacity ten-fold, and I am

sure that we shall find the right kinds of sites for windmills, at least a few thousand. Again, not very much, but something. However, we must find ways to locate these windmills. Today the best way is an anemometer: a little toy windmill. To carry them around is boring and takes too much time and you are not interested in what the wind velocity is near the surface of the earth. A windmill is a high structure. You want to know the wind velocity 300 feet aloft. So, they put anemometers on kites and that works much better. What works even better is to use lasers. Wind usually carries some dust or spray that scatters laser light, and you can measure the doppler effect and thereby get the wind velocity as far as you can see in a very short time, and the equipment is small enough to be put on trucks--a point that DOE has not yet recognized.

I have talked a lot. I will come to my last point, and it is an anticlimax because you expected it all along--nuclear reactors. The question is, can these nuclear reactors help us if nuclear reactors take twelve years to be built?

Well, a short time ago I came back from Taiwan. They are building nuclear reactors as fast as they can, and they build them on a rigorous schedule of five years and three months. That can be done in Taiwan. What can we do under pressure? Well, first of all, we have six reactors ready, but since Three Mile Island, the Nuclear Regulatory Commission is slightly disturbed and, considering their performance, they have reason to be slightly disturbed. This led, however, to the result that they dare not license any reactor--they dare not even consider any reactor for licensing! We have in the United States six unlicensed reactors that NRC won't touch!

I also want to inform you that I am a member of an organization called SE_2 (Scientists and Engineers for Secure Energy), and we are concerned (but don't make the connection that we are Concerned Scientists!). Instead one of the actions that we have taken recently is to bring suit against the NRC because they are not doing their job. They are there to license, and they are not licensing. If they want to consider a reactor for licensing and they refuse a license, that's all right. They should then give the reasons for the refusal, and those reasons can be debated. But, not to consider the reactors, which is their present practice, is clearly illegal.* I wonder how many of you would like to join us? I will try to look to it that the Director's office here, at any rate I hope Louis, will be informed on how to apply for membership in SE_2.

*In the meanwhile NRC resumed licensing, but SE_2 has many additional important activities.

A year ago we had 300 members, and today we have more than 1000. Incidently, only scientists or engineers need apply; movie actresses are excluded![*]

That last proposal I want to make is that nuclear reactors be standardized and deployed on barges. Actually, for me to take this idea to the State of Washington is rather absurd because it is a favorite proposal of Dixy Lee Ray, which she made when she was Chairman of the Atomic Energy Commission. The great advantage of such a reactor is that it can be built in shipyards and, therefore, it can be built really in a completely standardized fashion, with a work force that is steadily there, does not have to be reassembled for each new project, and if we want to build reactors according to all safety regulations, and fast, that is probably the way to do it.

Also, I happen to be in California. I happen to work at Livermore, I am, therefore, a little interested in earthquakes. Now, according to Livermore experience, reactors are safe; libraries are not! A reactor can be made even safer if it is put on a barge, provided the barge is put in a place where there is no expectation whatsoever of a tsunami. Fortunately we know where tsunamis will hit. That depends on the distribution of land and water and the distribution of depths of water and, therefore, the occurrence of tsunamis is not a happenstance. We understand it, and we can therefore construct these barges and reactors more quickly and as safely as any other reactor.

Now, I apologize for having talked too long, a full microcentury. You can figure out how long that was, and please ask a lot of questions and make a lot of suggestions. I will try to take as many of your good suggestions to Dixy Lee Ray as I possibly can. Thank you.

Question: It is known from what you say, and I think most of us have observed the same thing, that the problem is not a technical one--it is a bureaucratic and political one. Do you have any solutions for that?

Answer: Yes. Go to the State of Washington. Dixy Lee Ray can solve any bureaucratic or political problem. And, you know, if it is solved in one place, she might conceivably have imitators. I will tell you of some boasts she made to me, just to show you what impossible things she is willing to undertake. She

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[*] Scientists and Engineers for Secure Energy
570 7th Avenue, Ste 1007
New York, NY 10018
(212) 840-6595

told me the other day that if she had stayed in office only one month longer, as head of the AEC, she would have gotten rid of Admiral Rickover. Now I like Rickover a lot, or rather, I liked Captain Rickover a lot. Admiral Rickover, I like less. And whoever can fire him can do anything.

Question: You complained about the effect that Three Mile Island has had on reactor licensing in the United States, but would you comment on what seems to be the main conclusion of the Kemény Report and the problems of nuclear power in this country? Is it management structure and the way the nuclear power is organized right now?

Answer: Well, I think that I have understood the Kemény Report better than you did. I'm not sure of that. I make this claim only because Kemény is a Hungarian! The Kemény Report said the trouble was with the operators and with the NRC. Of course to immobilize the NRC does not solve the problem. As for the operators, the fact is this; the event that triggered Three Mile Island was a common-mode failure of a pump, which occurred at 4:00 a.m. If, at that time, the four operators who were on the shift had walked away from the site and maybe notified the authorities that there is trouble, you never would have heard of Harrisburg. The reactor behaved in a manner that would have led to no damage. The damage was done by the operators who misunderstood the situation and shut off the emergency core cooling system, which came on when it should have--on time. Furthermore, a similar occurrence and chain of events had occurred approximately a year before Three Mile Island at the Besse-Davis reactor. The main trouble, a valve was stuck open, was the same. In the case of the Besse-Davis reactor, which was not operating at full power, the operators realized in 20 minutes what was wrong, closed the block valve, and nothing happened. A report of that event went to the NRC and was buried, even though that report pointed out that if wongly handled, this situation could become quite dangerous, and that report essentially predicted Three Mile Island. The NRC did nothing. The operators did recognize that they should close the block valve, not after 20 minutes, but after 140 minutes. There were more mistakes that they made. If they had left the reactor alone, and if after hours an engineer had arrived, there would have been no trouble. But lest I attack these poor operators too much, I should say that they are paid one-third or one-quarter as much as a pilot of a big airplane. And, for no money, you don't get good people. And to that extent, it was indeed a failure of the management. But this failure is now

recognized. Three Mile Island did not hurt anybody. The direct damage to the company was a billion dollars. Since these horrible capitalists are greedy, they don't want to lose another billion dollars. And, I see clear signs that they are looking for better educated operators. They will have to pay higher salaries to get them. The lesson is quite clear, and the lesson has been learned.

Question: You started out this presentation by suggesting the possibility that the Soviets might move up from Afghanistan to possibly Yemen and to other strategic areas. Could you comment on the fact that in all instances the Soviet aggression in the last 40 or so odd years, maybe 50 or 60 years, they have tended to move into areas where they either had stooges or cohorts or some pretext that was obvious--Czechoslovakia, Afghanistan, those countries. . .(Dr. Teller: Hungary--they had stooges, but all their stooges were in jail by the time they moved in.) Hungary, thank you. Do you feel that the Soviets would change their *modus operandi* and move into countries where they don't have a clear brother socialist?

Answer: Well, they have moved into a country where they did not have stooges, and they were beaten, or almost beaten--Finland. And that was a bitter lesson to them. I just make that point--not as an answer, but to make the discussion more complete. I do not know the answer--of course, I don't, but I do know that they position themselves at the end of two pincers which could be closed very rapidly. The Tudeh Party, the Communist Party, is quite strong in Iran. The distance to be crossed is a few hundred miles. The prize to be gained is exceedingly high. They may do it. On the other hand, they may prefer to use the salami tactics. Now, I am an expert on that too you know, because salami is the national food in Hungary, and you eat it by cutting off exceedingly thin slices. It is very tasty and furthermore, the great advantage is to slice it so thin that there is as much salami left as there was before. But, because of some strange and unexplained law, after some time the salami is gone anyway. I wouldn't be surprised if in this particularly inviting situation--two thirds of the free world's oil flows through the Straits of Hormuz--perhaps in this case, they will take a big chunk of salami which is not their usual mode of operation. The heavy armament deployed in Afghanistan and South Yemen suggests that this is a possibility. The President's words suggest that the President has this possibility in mind. It is possible that if this does not happen, then they may move into Iran where they have lots of stooges, where the Tudeh Party, the Communist

Party is very strong. Their first act may be to liberate the American hostages, send them back on Aeroflot to New York. We are going to say thank you, and the Russian tanks will be on the Gulf of Hormuz anyway. Failing that, they may not move in a dramatic fashion at all, but look for more opportunities by which more small slices of the salami can be taken. I don't know, but if we are prepared, the less the invitation to Russia to make a move. In other words, I am trying to make a self-unfulfilling prophecy. If this prophecy is taken seriously, then it may turn out to be false.

Question: Along the same line, are you saying that the reason the United States should prepare these alternatives is because they cannot win a war in that region?

Answer: I think that we cannot win a war in that region, and I am afraid American public opinion will not support such a war after the first great and terrible reverses, and that we therefore must prepare for war in the long run in order to decrease the appetite for expansion of the Russians--not to undo the damage that already has been done, but to forestall further damage. At the same time we should be prepared with economic counter-measures, and I very much on purpose mention to you big possibilities and small possibilities because every individual contribution will help. I have a son-in-law, Alan, who is a very nice man and an excellent mathematician. I never understand his mathematics. It is something he calls topology, but is not concerned with donuts, which to me symbolize topology. We don't always see eye-to-eye in politics. And he has been in the habit, in a tactful manner, in a respectful manner, to call me a warmonger. Now, in the present situation, I ask him what will happen if the Russians close the Straits? Alan says that means war. I said we can't go to war; we'd better do it in a peaceful way, and we'd better give some thought to the question of what we can accomplish with sweat and tears, but with no blood.

Question: What about helping the Chinese to increase their strengths to such an extent that the Russians will think twice before moving in any direction?

Answer: I am grateful for the question. I think one of the measures we absolutely have to take is to strengthen our alliances, but I claim we have two kinds of allies--strategic allies and tactical allies. And, I call a country a strategic ally if you can be confident that it will remain an ally for the next half century, if our traditions and interests are sufficiently similar. Western

Europe consists of such allies. Japan, I think, has been by now converted into such an ally, as long as we treat them as an ally.

The Chinese Communists, who since their takeover have killed something between 30 and 50 million Chinese and who have changed their political behavior (internally at least) several times, who have recently stopped their freedom wall for advertisements, I am not sure that they are strategic allies. We need them. In the Second World War we needed Francisco Franco. I would not call the Chinese more reliable allies than the government of Francisco Franco.

On the other hand, the Israelis, who did perform miracles, I would call allies. I would call them strategic allies. I would like to see as much help from other countries in the Mid-east as possible, but I think their strength is unproven, and I am almost ready to say that their strengths have been disproved and their reliability is doubtful.

That does not mean that we should not try to work with the Chinese. It does not mean that we should not try to work with the Egyptians, or with the Saudis. We should try, but we should give first priority to work really closely with those allies where there is no question that our alliance will be maintained if we behave decently and if we live up to it.

Now, one special case I want to add to China, and I am in favor of working with the Chinese--but watching them. Another similar case is Egypt. You see, Egypt has now 40 million people, most of them starving. In Livermore we are just finishing a little project of digging a nuclear canal from the Mediterranean to the Qattara depression to provide hydroelectric energy to the Egyptians. And the evaporating water will give all kinds of salts on which a chemical industry can be based. I like anything that will alleviate the situation in Egypt, particularly because by the year 2000, there will be a hundred million of them, and how they can survive is a very difficult question. Now, if we can bring about a situation where their interests become so closely interwoven that we can depend on the alliance, let's go ahead with it, but in an emotionally unstable region, we must be a little careful how we do it.

Question: I don't see that the defense structure of our country gives us any hope right now of getting any technical advantage on the Russians. How should that be changed; how can that be changed to improve our situation?
Answer: I'm very glad that you asked the question, and I'm very glad that this is the last question. Because I want to tell you a story, and that story I will

tell about myself, and so you can rely on it. You see in 1939, January, a few weeks after the discovery of fission, I heard about it. Some of my friends, for instance, Eugene Wigner, Leo Szilard, pushed very hard for going ahead with the atomic project in order to make an atomic bomb. That was a few months before the outbreak of the Second World War. What was coming was pretty clear by that time. My friends were in it. They asked me in minor matters for help. I saw their reasons, and of course I helped. Also, and equally naturally, I asked myself the question, "Should I stop being a physicist and devote myself 100% to national defense?" And that was a question which was very disagreeable, very hard. I was really happy with what I was doing. My whole background was the same as that of most scientists, a background which does not predispose any one of us to work on weapons. At the same time, I saw what Hitler meant, I knew what he meant, I knew something had to be done. I could not make up my mind.

Now I can tell you to the minute when I made up my mind. On the day after Hitler invaded Belgium and Holland, Roosevelt was scheduled to talk to a Pan American Scientific Congress in Washington. I was a professor at the George Washington University. I was invited. A scientific congress from all American countries with 5,000 participants--a clear case that there would be no science discussed. I was not going, but one day before the Congress it was announced that Roosevelt would give a speech and would mention the invasion by Hitler. So I went.

Toward the end of the talk Roosevelt said, "You scientists are accused of having provided these weapons which have caused and will cause an ever greater amount of suffering. But, I tell you, if the scientists in the free countries won't work on weapons, freedom will cease to exist." I had a very strange feeling that Roosevelt was talking to me personally. You may call it charisma, you may call it a number of other nonsensical names. But I have a reason to feel that way, because I happened to be there when Einstein signed a letter to Roosevelt suggesting the atomic bomb. And, I happened to be there at the conference that was urgently called at Roosevelt's request after he read this letter. And therefore, I have good reason to believe that Roosevelt, at least in part, had the same object in mind as I did. And at the same time it was just entirely impossible for me to act differently from the way I acted, and I never regretted it.

Your question boils down to this: how scientists can be persuaded. I have

told you how one scientist had been persuaded and when and by whom. Until we have people in the highest places putting the best reasons before all of us, I am afraid there will be trouble. But in the meantime I will do what I can, and each of us will do and should do what each of us can do. And when a little of it can be accomplished in the State of Washington--in Olympia, I am going to Olympia and will contribute. There are very many ways, in a peaceful way, in a defensive way, in producing deterrent weapons, by working on intelligence; in many ways each of us can help. How each of us can best help, each one of us can best judge. That is the inherent advantage of a democracy.

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