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**DEFENSE INDUSTRIAL BASE:
INDUSTRIAL PREPAREDNESS AND
NUCLEAR WAR SURVIVAL**

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HEARINGS

BEFORE THE

**JOINT COMMITTEE ON
DEFENSE PRODUCTION**

CONGRESS OF THE UNITED STATES

NINETY-FOURTH CONGRESS

SECOND SESSION

NOVEMBER 17, 1976

PART I

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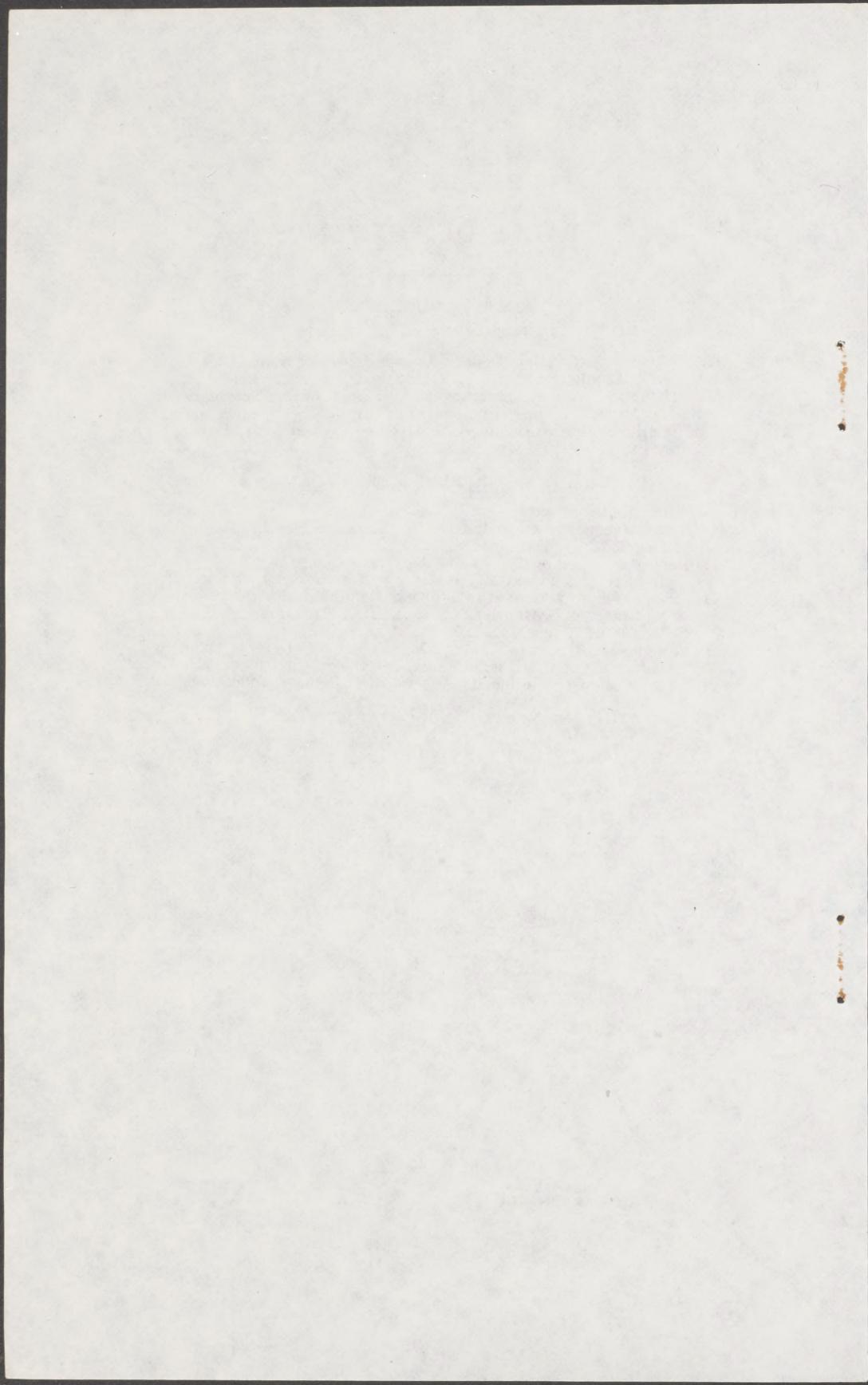
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INDUSTRIAL PREPAREDNESS AND NUCLEAR WAR SURVIVAL

WEDNESDAY, NOVEMBER 17, 1976

U.S. CONGRESS,
JOINT COMMITTEE ON DEFENSE PRODUCTION,
Washington, D.C.

The committee met, pursuant to notice, at 10:06 a.m., in room 5302, Dirksen Senate Office Building, Hon. William Proxmire (vice chairman of the committee) presiding.

Present: Senators Proxmire and Tower and Representative Mitchell.

Senator PROXMIRE. The committee will come to order. We expect to have Senator Tower here a little later. He is delayed, and when he comes in I am going to ask him to make a statement. He has a statement he would like to make at the beginning of the hearings, but because he is late and because we have a couple of witnesses, I think it is best for us to go ahead, and perhaps when you finish your statement Senator Tower can make his.

Today the Joint Committee begins 3 days of hearings on the defense industrial base. They are part of the committee's year-long review of plans and programs that affect our preparedness for wartime contingencies or other national crises. In this week's hearings, we will be examining the current condition of the defense industry, its costs, and its mobilization potential. Next week we will look at a new program for the strategic stockpiles of critical materials.

These are vital matters that have been neglected for some time. I am glad to say that this neglect appears to be ending. Over the last few months, studies have been completed on several aspects of the defense industrial base.

The Defense Science Board has recently completed its study of industrial preparedness plans and programs. On its own initiative, the Boeing Aerospace Co. has been examining the feasibility of hardening industrial facilities against nuclear attack, and they have been kind enough to provide the Joint Committee with the first results of their tests. [See appendix II, p. 55]. And we will have a witness from the Boeing Co. testifying a little later this morning.

This year the Defense Department finished its "Profit 76" study and promulgated a new investment-based profit policy, which will certainly influence the nature of defense industry. Also, the Federal Preparedness Agency has developed an entirely new method for managing the strategic stockpiles.

Now, these initiatives are timely. The committee has expressed its concern in the 94th Congress that our mobilization and industrial

base programs have not kept pace with changes in military strategy and technology, or with changes in economic and political conditions. Most of the programs in the Defense Production Act are geared to preparing for lengthy wars, such as World War II or the Korean war. Yet most military planning today is for short conflicts.

We want to know what kinds of economic and industrial preparations we need to make for such conflicts and what the likely costs will be. We want to know what policies we can adopt to enable the defense industry to produce more economically with as limited as possible a burden on the civilian economy. We want to know whether the premium we pay for preparedness insurance is consistent with the risk and whether it is buying maximum protection for each dollar invested.

This morning we will hear first from Deputy Assistant Secretary of Defense Jacques Gansler about erosion in the industrial base and the recommendations of the Defense Science Board. He will be followed by Mr. T. K. Jones and two of his colleagues from Boeing who will present their findings on the feasibility and costs of protecting the industrial base from nuclear attack.

And Senator Tower, the ranking minority member of the committee is present, and he has a statement.

Senator TOWER. Thank you, Mr. Chairman.

The subject of today's hearing, industrial preparedness and war survival, deserves far more attention from the Congress than it has received.

The issues are complex and inextricably bind together our willingness to consider that our quality of life might not survive a nuclear attack unless we take some measures now, while at the same time, insuring the ability of American defense industry to provide material to support a more conventional war. Both of these problems may appear remote during the present time of peace.

But the peace we now enjoy will not be preserved for long if we allow this country to become so unprepared for a nuclear attack or more conventional conflict that a weakness exists which the Soviets can exploit.

Although it is probably beyond the scope of today's hearing or this committee, the Congress and the Executive should renew their examination of whether the reliance on the Soviet-United States ability to mutually assure the destruction of one another still retains the vitality that it once did.

This examination of this and other issues must proceed cautiously for fear of renewing the disconsolation that accompanied the shelter building of the early sixties. But as John Collins, in a recently released Congressional Research study, notes: "Speculation that the Soviets could soon survive a general nuclear war appears premature, but the balance is starting to shift."¹

It is this beginning of an imbalance that can bring us to the brink of world instability. We are now looking at a great void, a void caused by uncertainty in the days ahead and an ambiguity as to what American, Soviet, and Chinese relations might portend for the future.

¹ Library of Congress, Congressional Research Service. "United States and Soviet City Defense Considerations for Congress." Senate Document 94-268, 94th Congress, 2nd Session, Washington, U.S. Govt. Off., September 30, 1976, p. 26.

With these thoughts in mind, let us put today's topic, industrial preparedness and war survival, in perspective.

Since the dawn of the atomic age increasingly infrequent attention has been given to the ability of this country's defense industries to mobilize in support of a conventional war. Whether this capability, often referred to as the defense industrial base, has dwindled to the point where we can say it is decaying is not clear. But a continuing watchfulness for any signs of erosion of the base deserves the priority that it has received in the Ford Administration.

The question of this Nation's ability to survive a nuclear attack also bears continuing watchfulness. The evidence, although not conclusive, shows that the Soviets are at least giving greater attention and devoting substantial resources to improving their ability not only to withstand a retaliatory nuclear attack but have their people and industry survive it. The concern here should not be with just the event of an unthinkable nuclear exchange, but, rather the strategic and diplomatic leverage that the Soviets might enjoy by having such an advantage over the United States.

We are then once again at the crossroads of peace and continued world stabilization. Hollow defenses and unpreparedness will not deter any enemy which has proven time and time again that it will exploit every weakness.

It is my hope that the next administration will give both our war survival and industrial preparedness a priority which will steer us from the brink of uncertainty and carry on and expand the concern that I have discussed here today. No less than the continuation of the American quality of life is at stake.

Thank you, Mr. Chairman.

Senator PROXMIRE. Thank you, Senator Tower.

Mr. Gansler, welcome back to the committee. It has been, I think, 18 months since you told us about the defense priority system.

If you would briefly summarize—well, as a matter of fact, your written statement is very concise. If you want to read your written statement, you may do so. So handle it anyway you wish and then we will ask you questions.

Mr. GANSLER. I would like to read the statement.

Senator PROXMIRE. Fine.

STATEMENT OF THE HONORABLE JACQUES S. GANSLER, DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR MATERIEL ACQUISITION

Mr. GANSLER. Senator Proxmire, members of the committee, I appreciate this opportunity to appear before you and to participate in your continuing review of the Federal preparedness effort. I consider this series of hearings to be particularly timely and important to the interests of national defense. My comments this morning will address the defense industrial base and its viability to supply military needs in both peacetime and during a variety of potential conflicts.

When we speak of the defense industrial base, we refer to that industrial capacity, both in the private and public sector, necessary to produce and support the military materiel required for our defense forces. Under the Defense Production Act of 1950, the Secretary of

Defense is tasked to insure the existence of a viable defense industrial base. The Defense Industrial Reserve Act of 1973 further stipulates that, to the extent possible, maximum reliance will be placed on the private sector of the base to support our defense needs. The act further charges the Secretary of Defense with the responsibility to maintain an essential nucleus of government-owned plants and equipment to support defense needs in a national emergency. Thus, the defense industrial base considerations encompass both the public and private sectors, and mixtures thereof. The incentives and the degree of control exercised by the Defense Department over the base varies, of course, for each of the sectors. Since the greatest share of the base is represented by the private sector, we must look to profit and long-term business stability as the primary incentives for a viable base. Unfortunately, defense procurement programs do not always offer these incentives. The long-term growth of the commercial market when compared with the long-term cyclical nature of defense business, and more recently, the post-Vietnam era of decreasing defense procurement expenditures has made defense business unattractive to many suppliers. Additionally, the myriad of government procurement policies, and the restrictions of government procurement practices, act as disincentives to many potential suppliers.

About 2 years ago, we began to perceive problems developing in the industrial base. Difficulties were being encountered by prime contractors and the Government in obtaining adequate competition for parts and components. Subcontractors were declining to bid on defense business and, to keep their share of the defense market, some large prime contractors, through acquisitions and expansion, began entering the subcontract field. As a result, competition decreased and, in some cases, inordinately high prices were being paid for parts and components of defense systems. Also, at the prime contractor level, indications of extra capacity were becoming evident, for example, in the aircraft sector because of decreasing commercial and defense business. In the shipbuilding sector, the DOD was finding it increasingly difficult to obtain contractor interest in Navy ship construction programs. We also observed an aging of plants and equipment with little investment being made to increase productivity. Innovations in engineering and particularly, manufacturing technology appeared to be sagging because of the lack of business. We became concerned that our needs for a viable defense industrial base, capable of responding to emergency demands, were becoming threatened.

With these indicators of potential problems, we began a reassessment of the defense industrial base, using as our guidelines the following five peacetime and wartime objectives:

First: To obtain the maximum deterrent and defense capability from the base for each dollar allocated.

Second: To ensure maximum economic efficiency for both the long and short term, within our given resources of money, manpower, plant, and equipment.

Third: To provide for a rapid transition from peacetime production to meet the military requirements of a surge or a mobilization situation.

Fourth: To encourage the maximum technological advancement for military advancement.

Fifth: To create a minimum of social and political impact.

We initiated a series of studies about a year ago to determine whether problems in fact did exist, and if so, what caused them, and what impact were they having upon the economic efficiency of the base and also upon its ability to surge to meet an emergency or mobilization situation. For those problems identified, we are seeking implementable solutions consistent with our peacetime and wartime objectives.

For example, sectoral studies of the aircraft and shipbuilding industries are being conducted to ascertain the degree of capacity utilization of the plants in these industries and what actions may be required to adjust the overall capacity in response to the military and commercial markets. Closely related to these sectoral studies is the question of the optimum mix of Government-owned and industrially-owned facilities for defense production. Additionally, we are studying the lower tier subcontractor and supplier segments of the industrial base to determine whether the critical support to the prime contractors has in any way deteriorated and, if so, to what degree. As each is completed, actions will be recommended, and, if the impact of the actions is assessed as positive, they will then be implemented.

Most of our studies are still in process. Preliminary data indicate that problems do, in fact, exist in some areas and actions need to be initiated to resolve them. For example, we have found that our weapons system acquisition management policies and practices are generally oriented toward the large prime contractors and may need to be modified for the smaller suppliers and subcontractors. In response to this problem we are providing for more flexibility in our military specifications and we are encouraging greater use of commercial parts as well as multiple sources of supply in our subcontract procurement practices. These initiatives will help to broaden our competitive base, to reduce our procurement costs and improve our surge capability at this "bottleneck" level of the base. Additionally, we are encouraging increased use of the multiyear contracting technique as an approach to provide stability to our procurement programs. Finally, we are actively pursuing our manufacturing technology program as a combined government and industry effort to diffuse our advanced technology throughout the industrial base and to achieve real success in cost cutting.

During the period that we began perceiving problems in the industrial base, we recognized that an assist was being received from the foreign military sales program. This assist, coming as it did during the period of decreased defense expenditures, helped to maintain the viability of the declining base, reduced procurement costs to the Defense Department, and improved our international balance of payments. Although we welcomed the benefits of foreign military sales in maintaining the base, we became seriously concerned about certain long-term implications of the program. The present tendency toward engineering and manufacturing technology transfer, exporting of turnkey factories and providing training for foreign production operations raises concern about the long-term economic and strategic effects of such practices. Competition from foreign production sources in the defense market is becoming increasingly significant. We welcome this increase in competition to secure more economies in our peacetime procurements. However, we recognize the danger of becoming solely dependent

upon foreign production sources, particularly with regard to meeting Defense requirements in an emergency situation.

In addition to the series of studies initiated to explore the problems in our peacetime industrial base, we asked the Defense Science Board to assess our industrial readiness plans and programs for the transition of the industrial base from a peacetime to a wartime environment. The key to conceptualizing this transition period is in identifying the contributions of a responsive industrial base to alternative forms of conflict, principally defined in terms of the duration of the conflict and the degree of interference with the peacetime civil production base.

The objectives of our industrial readiness plans and programs of the future must be based on our continuing perceptions of the most likely forms of conflict. For the short, high-intensity war, we must be prepared to rely on prestocked war materiel reserves to sustain the in-being forces for some initial period of time. This obviously requires a significant production investment through our peacetime budgets. Then, for longer duration conflicts or periods of increased world tensions, we will rely on increases in production output from existing production lines during the first year, to support our military effort. This production increase would permit us to meet two prime objectives:

First: Ensure that U.S. production output can support the wartime materiel requirements by the time the prestocked war reserves are exhausted.

Second: Ensure that U.S. production capability for such systems as aircraft, tanks, helicopters, and tactical missiles is adequate to make a significant contribution to the military effort during the transition from peacetime to full mobilization, or during a continuing peacetime "guns and butter" mode—as has been the case over the last 30 years.

The ability to meet these two objectives has been defined as a surge production capability. We feel implementation of this planning concept will provide a credible element in support of our national defense policy of deterrence.

Of critical importance to this surge response is the preplanning and the resolve necessary for its success. Here we are looking at reduced production lead times through the prestocking of long-lead time parts and components, the elimination of manufacturing bottlenecks and the modernization of plant and equipment. As an element of assuring success in this endeavor, we are considering holding each defense system program manager responsible for incorporating surge production planning into his individual program.

Our industrial readiness plans and programs, having been oriented toward the full mobilization concept of war, are not sufficiently inclusive to react to the concepts of a short war or a surge situation. Therefore, we are taking steps to update our plans and programs to cover the full spectrum of potential conflicts while continuing to provide for an extended duration conflict. It is in the latter case that the national stockpile of strategic and critical materials is of key importance.

In summary, we believe that we have identified some significant issues which, if not acted upon, could become serious problems in our

industrial preparedness efforts. We are aggressively pursuing solutions to these issues in close coordination with industry, academia, other agencies of the executive branch of Government as well as the Congress. The year-long review by this committee of the Federal preparedness effort and your interest today in the condition of the defense industrial base is indicative of your concern over these issues. We appreciate the support of the committee and through mutual endeavor, we believe that we will be able to strengthen the viability of this base.

That concludes my statement.

[Prepared statement of Mr. Gansler follows:]

STATEMENT BY JACQUES S. GANSLER, DEPUTY ASSISTANT SECRETARY OF DEFENSE
FOR MATERIEL ACQUISITION, DEPARTMENT OF DEFENSE

Mr. Vice Chairman and Members of the Committee, I appreciate this opportunity to appear before you and to participate in your continuing review of the Federal Preparedness Effort. I consider this series of hearings to be particularly timely and important to the interests of National Defense. My comments this morning will address the Defense Industrial Base and its viability to supply military needs in peacetime and during a variety of potential conflicts.

When we speak of the Defense Industrial Base, we refer to that industrial capacity, both in the private and public sector, necessary to produce and support the military materiel required for our Defense forces. Under the Defense Production Act of 1950, the Secretary of Defense is tasked to ensure the existence of a viable Defense Industrial Base. The Defense Industrial Reserve Act of 1973 further stipulates that, to the extent possible, maximum reliance will be placed on the private sector of the base to support our Defense needs. The Act further charges the Secretary of Defense with the responsibility to maintain an essential nucleus of government-owned plants and equipment to support Defense needs in a national emergency. Thus, the Defense Industrial Base considerations encompass both the public and private sectors, and mixtures thereof. The incentives and degree of control exercised by the Defense Department over the base varies, of course, for each of the sectors. Since the greatest share of the base is represented by the private sector, we must look to profit and long-term business stability as the primary incentives for a viable base. Unfortunately, Defense procurement programs do not always offer these incentives. The long-term growth of the commercial market when compared with the long-term cyclical nature of Defense business, and more recently, the post-Vietnam era of decreasing Defense procurement expenditures has made Defense business unattractive to many suppliers. Additionally, the myriad of government procurement policies, and the restrictions of government procurement practices, act as disincentives to many potential suppliers.

About two years ago, we began to perceive problems developing in the industrial base. Difficulties were being encountered by prime contractors and the government in obtaining adequate competition for parts and components. Subcontractors were declining to bid on Defense business and, to keep their share of the Defense market, some large prime contractors, through acquisitions and expansion, began entering the subcontract field. As a result, competition decreased and, in some cases, inordinately high prices were being paid for parts and components of Defense systems. Also, at the prime level, indications of extra capacity were becoming evident in the aircraft sector because of decreasing commercial and Defense business. In the shipbuilding sector, the DoD was finding it increasingly difficult to obtain contractor interest in Navy ship construction programs. We also observed an aging of plants and equipment with little investment being made to increase productivity. Innovations in engineering and manufacturing technology appeared to be sagging because of the lack of business. We became concerned that our needs for a viable Defense Industrial Base, capable of responding to emergency demands, were becoming threatened.

With these indicators of potential problems, we began a reassessment of the Defense Industrial Base, using as our guidelines the following five peacetime and wartime objectives:

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(4) To encourage the maximum technological advancement for military advancement.

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For example, sectoral studies of the aircraft and shipbuilding industries are being conducted to ascertain the degree of capacity utilization of the plants in these industries and what actions may be required to adjust the overall capacity in response to the military and commercial markets. Closely related to these sectoral studies is the question of the optimum mix of Government-owned and industry-owned facilities for Defense production. Additionally, we are studying the lower tier subcontractor and supplier segments of the industrial base to determine whether the critical support to the prime contractors has deteriorated and, if so, to what degree. As each is completed, actions will be recommended, and, if the impact of the actions is assessed as positive, they will be implemented.

Most of our studies are still in process. Preliminary data indicate that problems do, in fact, exist and actions need to be initiated to resolve them. For example, we have found that our weapons system acquisition management policies and practices are generally oriented toward the large prime contractors and may need to be modified for the smaller suppliers and subcontractors. In response to this problem we are providing for more flexibility in our military specifications and encouraging greater use of commercial parts, and multiple sources of supply in our subcontract procurement practices. These initiatives will help to broaden our competitive base, reduce procurement costs and improve our surge capability at this "bottleneck" level of the base. Additionally, we are encouraging increased use of the multi-year contracting technique as an approach to provide stability to our procurement programs. Finally, we are actively pursuing our Manufacturing Technology Program as a combined government and industry effort to diffuse our advanced technology throughout the industrial base and achieve real success in cost-cutting.

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The objectives of our industrial readiness plans and programs of the future must be based on our continuing perceptions of the most likely forms of con-

flict. For the short, high intensity war, we must be prepared to rely on prestocked war materiel reserves to sustain the in-being forces for some initial period of time. This obviously requires a significant production investment through our peacetime budgets. Then, for longer duration conflicts or periods of increased world tensions, we will rely on increases in production output from existing production lines during the first year, to support our military effort. This production increase would permit us to meet two prime objectives:

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Our industrial readiness plans and programs, having been oriented toward the full mobilization concept of war, are not sufficiently inclusive to react to the concepts of a short war or a surge situation. Therefore, we are taking steps to update our plans and programs to cover the full spectrum of potential conflicts while continuing to provide for an extended duration conflict. It is here that the National Stockpile of Strategic and Critical Materials is of key importance.

In summary, we believe that we have identified some significant issues which, if not acted upon, could become serious problems in our industrial preparedness efforts. We are aggressively pursuing solutions to these issues in close coordination with industry, academia, other agencies of the Executive Branch of Government and the Congress. The year-long review by this Committee of the Federal Preparedness effort and your interest today in the condition of the Defense Industrial Base is indicative of your concern over these issues. We appreciate the support of the Committee and through mutual endeavor, we believe that we will be able to strengthen the viability of the base.

That concludes my statement. I will be pleased to respond to any questions the Committee may ask.

Senator PROXMIRE. Well, thank you very much, Mr. Gansler.

Mr. Gansler, you paint a dreary picture here. Maybe you're right, maybe you're not. We have been briefed by the CIA on another committee. The briefing was sanitized so that what I am going to say is, of course, completely unclassified, but we were informed by the head of the CIA that in their judgment we are ahead of the Soviet Union in every technological respect with regard to our weapons, and to our research. They may be spending more money in some areas. They may have a greater megatonnage. They may have more ships. They may have other advantages, I am not saying that, but in terms of the technological capability, in terms of the excellence of our weapons systems, they couldn't find any in which the Soviet Union was ahead of us.

I think we have to put that to some extent into the picture you paint here. After all, in 1976 we are now 7 or 8 years from the peak of the Vietnam war when we were spending as much as we were, and in spite of that, we are told by our principal intelligence agency that we are doing well in terms of capability.

Now, you indicate that defense procurement expenditures have been cut back since the Vietnam war. Can you give us some notion of how

much, and be specific, how much has aircraft been cut back, how much have tanks been cut back, how much have ships been cut back and so forth, so we have something precise and definite to talk about instead of the generalities.

Mr. GANSLER. Yes. Let me make two comments.

Senator PROXMIRE. In real terms, because obviously there has been—it has been confused by the inflationary aspect of it.

Mr. GANSLER. My comments were specifically addressed to the procurement account which we use to buy things with, and that is the thing, of course, that is most important in terms of supplying the forces.

In 1976 dollars, in other words, in the real dollars that you asked for, since the Vietnam peak, the procurement account has dropped from about \$44 billion down to about \$17 billion in outlays, that is, expenditures per year from fiscal year 1978 or 1979 down to fiscal year 1976.

Senator PROXMIRE. You said 1978. You mean 1968?

Mr. GANSLER. Yes, 1968 or 1969, I forget which it was, down to fiscal year 1976. It sort of peaked at the top in Vietnam in 1968 and 1969, and has since dropped down in terms of outlays to about \$17 billion.

So it is about a reduction of more than a half in that time period. Now, what that has done to us in terms of your initial statement—

Senator PROXMIRE. What you were giving to me was in real terms, I think.

Mr. GANSLER. Yes, in fiscal year 1976 dollars, that is in real dollars.

Now, in terms of what that does to us, we have to also realize that during that time period and the years before, the unit cost of our equipment has continued to rise, not only because of inflation but also, because of increased performance costs.

Senator PROXMIRE. Well, I take it you were correcting for that when you gave me the diminution in real terms.

Mr. GANSLER. I am giving you the total in real terms. What I am pointing out is the combination of the expenditure reduction where the rising cost of equipment has resulted in a drastic reduction in the quantities of systems procured.

In your introductory statement you made to the question, you pointed out the statements that had been made relative to the quality of the systems, the technological position of the U.S. versus the Soviet. I think there are two considerations that one must consider in terms of war planning. The first pertains to the quantity of systems, Soviet versus United States. When the systems become relatively equal, say, in terms of technological capability, then quantity becomes even more important.

The other area that is of considerable concern to us is the trends. The statement you made about the relative technological position of the Soviets vis-a-vis the United States are current statements. I think that it is generally agreed that there has been a very rapid trend of catching up in technology between the Soviets and the United States. One of the things of concern to us and throughout, in fact, my position statement, is not so much as addressing today's issues as addressing the future. What do these trends mean in terms of projections in quantity and in quality, and in terms of—

Senator PROXMIRE. Well, again, these are so general—I am not criticizing you for that. After all, you have to speak on a basis of everything. Can you give us examples, one or two examples, are they catching up a great deal in aircraft, in tanks, and missiles? In what way?

Mr. GANSLER. Well, let me speak of aircraft. For example, I guess in about 1950, we used to buy on the order of 3,000 airplanes a year. In the 1960's we used to buy on the order of 1,000 airplanes a year. The last few years we have been buying on the order of 300 fixed wing aircraft a year. The quantity reduction is very significant.

Senator PROXMIRE. But a colossal difference in quality and performance.

Mr. GANSLER. Well, that's the point I was making, that the unit cost is going up. The performance is also going up. But their (U.S.S.R.) system performance in terms of their new aircraft is also high performance. Therefore, when one compares the United States and the Soviets, if the performance is about the same, then in a tactical environment particularly, the quantity is very important. That is where the great reductions in procurement account dollars hurt us.

Senator PROXMIRE. Now, you make a distinction between the prime contractors and subcontractors. It is a little difficult for me to understand what the difficulty is other than excess capacity that you would expect, and I don't see what we can do about it for prime contractors, and nobody is advocating, including the Defense Department, that we prepare as if we were moving into war right now. We produce a great deal more than the Defense Department procures.

So we are not going to do much about diminishing that excess capacity. Furthermore, in the economy we are in right now, excess capacity is the name of the game. The Federal Reserve Board's index shows that industry generally is operating about 70 or 73 percent of capacity, far below the capacity industry would like to be operating at.

Furthermore, most of our defense contractors, not all but most of them, are primarily operating in the private sector, as you know. They are not exclusively defense contractors. Defense is a part of their operation, anything from 1 to 10 percent on the average, sometimes a little bigger than that, but that is a rare situation, Lockheed being the exception.

So one of the principal difficulties you pose for us is the difficulty of the subcontractors. It is hard for me to understand why this is. Can you explain that? Why would the subcontractors be dropping out, and why should the increase in price be as great as it is, particularly since the subcontractors too, are primarily and always have been, including during the Vietnam war, principally operating in the private sector.

Mr. GANSLER. Yes. As you properly point out, I said the vast majority of the subcontract work is exclusively in the private sector. The fact that there is very little government plant and equipment or any government money is a prime problem.

The problems at the subcontractor base are numerous. Let me just go through a few of them. They have a choice, more usually than the large prime contractors do, of operating in the civil sector versus the defense sector. These are people who are operating, for example, at the component level, or at the subcontractor level. The civil market is a

growing market and the defense market, which is at best cyclical, and at the present happens to be a shrinking market, so given the choice, they would naturally put themselves, and any resources they have into the civil market.

We do find that their profit is considerably less than the prime contractor's and also less than their profit in the civil sector, so that again, from an attractiveness viewpoint, it is less appealing to them.

In addition, as the total dollars shrink, as they have been in terms of procurement, some of that is being absorbed by the prime contractor. So, to the subcontractor there are even fewer procurement dollars available. So, the subcontractor base is even more rapidly shrinking in terms of dollars.

Senator PROXMIRE. Well, the data I have seen on the profit study indicates that there is a rough comparability between profits on sales and profits on investment, between the profits made in the defense sector and the private sector, but that there is not a great advantage. It is something like 4, 5, or 6 percent profit on sales, which is typical or average in the private sector.

Is the experience in the defense sector in the return on investment of 12, 15, 18 percent, which is fairly typical in the private sector, is also about what they get on investment in the defense sector?

Mr. GANSLER. Well, let me—as you know, tomorrow Secretary Clements will discuss the profit study.

Senator PROXMIRE. Of course, I am talking about primes.

Mr. GANSLER. Well, of course, as I said, Secretary Clements is going to be talking about the whole profit and so forth, so I can't go into it in detail, but I can point out that the data does show that in return on sales, the defense business is significantly less profitable than in terms of return on investment.

What we also find is that the smaller companies—and this is where you get into the subcontractor and supplier levels—that their profit is less, even more so both in terms of sales and in terms of investment relative to the primes. I was just pointing out that that makes even that much less attractive for the subcontractors entering the defense business.

There are a few other things that I should list in that regard. It is difficult for these smaller companies to do business with the Department of Defense in terms of the large amount of regulations, large amount of data requirements, and the military specifications, which are very special in the sense that the work they do for the Defense Department is not very applicable to the civil sector. These things also tend to discourage them.

I might also point out that the technological evolution that you pointed out earlier, the rapid changes due to increased technology, are felt even more by these small companies in terms of the need for capital equipment and in terms of the need for very specialized talents. And so you get down to the point where it requires a large capital investment. Only a few of them, perhaps, can afford to make that investment. So it leads basically toward more of a sole source situation down at the subcontractor level, which is something we don't want, and why we are trying to encourage more multiple sources.

And I also think there is a problem in the way in which our prime contractors deal with their subcontractors, which is perhaps not as

consistent as we do with our primes. For example, we might give a prime contractor, on a high risk contract, a cost plus development contract. He may pass on to the critical component subcontractor a fixed price contract. In other words, he is not sharing the risk with that subcontractor. So we do find that at the subcontractor level, there is in fact a higher risk being taken. Something should be done about that. And it is something we are trying to address.

Senator PROXMIRE. My time is up. Senator Tower.

Senator TOWER. I note that you refer to sectoral studies of the aircraft and shipbuilding industries. As a member of the Armed Services Committee, I am particularly concerned with our shipbuilding program, the pressing, almost urgent need for us to modernize our Navy. We are embarking on an expansion program in shipbuilding, but we are concerned that we have not the capacity to get these projected ships into the fleet when we should have them in the fleet. As a matter of fact, there is some doubt that we can really begin construction on the ships that we have authorized for the next fiscal year.

Can you comment any further on that? I am not quite so concerned about our aircraft building capability. I think we have got more capacity than we can utilize at the moment, but I am very seriously concerned about our shipbuilding capacity.

Mr. GANSLER. Yes, Senator, that was exactly the point that I made in my introductory statement, that in fact the problems are not typical across the board. They vary considerably, as you point out.

In the aircraft case, we perhaps have extra capacity. In the ship case, we are clearly under in terms of capacity, in terms of our ability to even be able to build the ships that Congress has authorized in both the public and private yards. That is the focus of the current capacity study in the ship area—the ability to increase the capacity, either public or private yards, so that we can in fact build the ships. We agree with you that more ships are required and that more capacity to build the ships is probably going to be required.

At the same time, we are looking, as you well know, at the problems of doing business in that sector of our economy. We have had lots of problems with claims and other things in that area, and that may also be a part of the problem. We have people actually not accepting invitations to bid on very, very large shipbuilding contracts, and in fact, some shipbuilders hesitate to continue on current contracts. So, we do have very clearly a problem in the shipbuilding area, and a major part of that is, as you pointed out, a lack of capacity right now.

Senator TOWER. I am concerned that we will even be able to get a new carrier started.

Mr. GANSLER. We are very concerned also.

Senator TOWER. The yard that is building the current one apparently would like to shift that burden to somebody else. Do you have any kind of prognosis or resolution to that problem?

Mr. GANSLER. I would rather not comment on that. As you know, we are now in negotiations with the shipbuilders.

Senator TOWER. I can appreciate that.

That's all I have, Mr. Chairman.

Senator PROXMIRE. Congressman Mitchell.

Representative MITCHELL. Thank you, Mr. Chairman.

Indeed, you did lay out a number of significant issues in your testimony. You laid out a myriad of problems for us as you have indicated, but as I listen to you, it seems to me that you were at least inferring something that I want to clear up.

The defense industry is relatively new in America. We really didn't have it until World War II. Before that we relied primarily on Navy yards and so forth. That was our defense industry.

Now, it seems to me that you are suggesting, at least inferentially, in your testimony a return to the pre-World War II kind of operation, where we had arsenals, not with the defense industry but with the Defense Department itself?

Now, is that conclusion correct or partly correct?

Mr. GANSLER. No, that is not correct.

The reason for my discussion pointing out that we view the defense industrial base as a combination of the public and private sector is just because as you point out properly, historically, that has been the case. It has been in evolution through war and peacetime cycles for 200 years, where the initial focus was almost all in the public sector. Since World War II, particularly in the aerospace industry, we have primarily focused on the private sector, but with considerable government involvement in terms of plant, equipment and progress payments of money. We still have basically a mixed base between the public and private sector, and we feel that probably that is what we are going to end up with.

On the other hand, very clearly, it is the intent of Congress, and it is the intent of the Department of Defense that wherever possible, the maximum share of business should go into the private sector. And it is our intent; that is the direction we are moving.

I will give you some examples.

Representative MITCHELL. May I interrupt you for just a moment?

That is indeed the intent of Congress. On the other hand, I think maybe we might want to reconsider that intent. Isn't it possible that certain kinds of defense productions are better handled by government than by the private sector, and if I may continue, isn't it possible that we are supporting a defense industry structure that is just totally inappropriate for several reasons? One, it is a regulated industry right now. You have indicated that in your testimony.

No. 2, there is only one buyer.

No. 3, we deal with the problem of the fluctuations that occur such as after the Vietnam period.

So it may well be that we are supporting what is essentially an inappropriate defense structure.

Mr. GANSLER. Well, one of the points that I made in my testimony was that a critical portion of the studies, looking at the defense industry, is what is the proper mix between the public and private sector.

The answer is not obvious. People have given very good arguments from both sides, as you well know. When so much of it is regulated, and when you have the monopoly buyers and oligopoly sellers, some say that maybe it ought to in fact be incorporated into the public sector. We do not take that position.

On the other hand, very clearly there are some areas, such as munitions, where it just doesn't make much sense to put it all into the private sector. There is just not a civil market in that area. And so a good share of the munitions work, at least in terms of the final assembly areas and storage of munitions are now in the public sector.

What we are trying to do is to say that we have a very large existing resource in terms of plant, equipment and manpower that already is there. To treat it as an academic problem would not be very practical. But, given the resources that do exist in both the private and the public sector, how can we try to achieve improved economic efficiency and improved surge response when, in fact, the total levels of expenditures are relatively low? It is not an environment in which you can easily solve the problem just with a lot more money. That is not what we feel should be the right solution.

We do, however, feel that it should be within the context of the American economy and therefore within more of the private sector wherever possible. And so we are stressing to the extent possible, the use of the private sector.

For example, rather than have the Government buy equipment to put into a company's plant, have that company, if possible, make the investment itself. To do that you have to incentivize him to make the investment, and we have to look at ways to do that. Otherwise, the Government will have to buy the plant and equipment.

Representative MITCHELL. You made your point very clear. I am not at all sure that you have sold me, but you have made your point very clearly.

Let me get into another area, if I may. When I first came to the Congress there was a great deal of discussion about developing a comprehensive industrial preparedness plan to be put into operation when the conflict in Vietnam ended.

Well, apparently that did not happen, and apparently much of the difficulty that we are now experiencing in the defense industry is related to the fact that really there was no comprehensive plan developed for the transition from Vietnam to peacetime, or to at least a cold war kind of status in this country.

Would you agree or disagree with this statement? I think we could have avoided a lot of the hassle that we are now confronting in the defense industry had there been such a comprehensive preparedness plan for the transition.

Do you generally agree with that?

Mr. GANSLER. Well, in general I think that perhaps we have been doing a better job of planning than implementing the plan. I am not sure that a comprehensive plan that wasn't implemented would have been of much use. I am not being facetious, I am being very serious. I think we do, to a certain extent, a great deal of planning in terms of preparedness in terms of what we would do if we were to turn the switch again and go to full mobilization or even go to a Vietnam-type environment with the very heavy expenditures and heavy flow of dollars into defense and the economy.

What I don't think we have done in the past is in terms of addressing the preparedness case by really saying that the industrial base is as important in a peacetime-wartime or short response case as we should have. We have treated it in the long-term response case—

Representative MITCHELL. Where does the responsibility for that failure rest?

Mr. GANSLER. Well, I would say it is a combination of our not having done sufficient planning in this area, which is what we recognize and are now starting to do far more of, and the fact that I think we have probably been underfunded in this area, and there I would place the blame on both the executive branch and the Congress.

In other words, the preparedness funding has to be balanced against the in-force funding, in other words, funding of current equipment for the forces. If you have limited resources, you make the choice between funding of current equipment versus funding preparedness, and I think in terms of that trade, clearly preparedness has not gotten its share, and that I think that the ball is on both sides.

Representative MITCHELL. Let me follow up on that.

You indicated in your testimony that you were prepared for surge efforts, now, that could be mobilized very quickly.

Now, you are doing planning in that area, obviously. At the same time, it seems to me that you ought to be doing some planning to immediately move away from that surge thrust to an essential peacetime or cold war period in the country.

Is that being done now?

May I just point out, Mr. Gansler, it seems to me we made a ghastly mistake by not having a plan ready to go into operation at the end of the Vietnam conflict, and if you are planning now a new capability to move toward a surge very quickly, I think that same mistake is going to be repeated unless simultaneously with your planning for the desurging, a plan is being developed.

Mr. GANSLER. I think, Congressman, you have hit on a very critical point that we have become more and more aware of, that our previous planning was more in terms of first just normal peacetime procurement, and then second, all-out mobilization with total impact, in fact, on the civil sector. It is the part in between which, as you properly point out, has not been properly planned for in the past. We are now starting to go in that direction. We are now giving guidance to the services in terms of planning for rapid increase in terms of surge in a peacetime environment such as, for example, Herman Kahn's talk about a mobilization war environment—that sort of thing, even in peacetime conditions.

We are starting to plan now more for a variety of possible scenarios rather than exclusively the one case of the all out, full mobilization, long war. We are trying to look at the variety of possibilities in terms of our planning, and clearly we haven't done enough of that in the past. We are starting to do more of it now.

Representative MITCHELL. Thank you.

My time is up, Mr. Chairman.

Senator PROXMIRE. Mr. Gansler, one of the issues in the Presidential campaign was foreign military sales. As you know, President-elect Carter made that issue very emphatically, and talked about our being arms merchant of the world and so forth.

You say in your statement that you recognize an assist, as you say, was being received from the foreign military sales program. You point out some of the problems involved in the foreign military sales program.

Let me ask you how important is the foreign military sales program really? Have you made any precise estimate of what this really does in reducing our own costs, and what it really does in maintaining our defense base?

Mr. GANSLER. I think if you put it into perspective, what you see is that foreign military sales over the past few years, and this is, of course, since 1973 being increased over the \$10 billion level in terms of foreign military sales and direct sales by the companies. It is over the \$10 billion level in the last couple of years. Now, if you put the number I mentioned earlier of current defense expenditures, internal expenditures of about \$17 billion, you see that in fact, foreign military sales are a very major share of the procurements taking place in the military in the United States.

The U.S. Army last year, for example, bought more for foreign military sales than for domestic procurements.

Well, now, if you are going to have in effect an almost doubling of the demand on the base, that is going to have a very positive impact in terms of the reduction of cost of equipment. It is just a learning curve, it is a simple learning curve.

Senator PROXMIRE. That is what I am asking about. What does that curve show? What is the effect? Does it save us \$1 billion a year, does it save us \$2 billion a year? Roughly what is the benefit from that?

Mr. GANSLER. I don't know that.

Senator PROXMIRE. Can you work that out and give us the best figure you can? I'd like to know that. Also, I would like to have it broken down, if possible, for tanks, planes, for missiles, for the other major procurement items.

[Additional information submitted by Mr. Gansler follows:]

Cost savings resulting from foreign military sales are identified in Table 4 on page 18 from the Congressional Budget Office Staff Working Paper, CBO-1107, entitled, "Budgetary Cost Savings to the Department of Defense Resulting from Foreign Military Sales." This table identifies cost savings for five major defense systems which include the M60 Tank, the F14 Aircraft and the Harpoon and Maverick Missiles. Additionally, the CBO-1107 study concludes that:

"For those sales which can generate savings, the study estimates that on the average one dollar of sales results in fourteen cents in savings to the U.S., of which four cents represents R&D recoupments. These estimates are based on analysis of the data for the 35 major weapon systems."

TABLE 4

SAVINGS AND SALES IN CURRENT AND CONSTANT DOLLARS FISCAL YEARS 1972-81

System	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	Total
<u>MGO TANK</u>											
Savings (current)	16.1	22.5	3.1	5.9	106.6	68.7	65.8	60.6	56.6	53.9	459.8
Savings (constant)	24.6	32.8	4.2	6.8	115.7	68.7	62.0	54.3	48.6	44.5	462.2
Sales (current)	40.8	50.0	8.5	13.7	213.6	212.6	106.3	174.3	167.9	165.0	1,232.7
Sales (constant)	62.3	72.9	11.4	15.9	231.9	212.6	175.6	156.0	144.1	136.4	1,219.1
<u>MILITARY</u>											
Savings (current)	10.8	6.6	5.6	1.1	.8	9.7	14.6	16.9	16.6	24.0	106.7
Savings (constant)	16.4	9.6	7.5	1.3	.9	9.7	13.8	15.1	14.2	19.8	108.3
Sales (current)	48.1	37.9	375.3	81.8	333.2	141.6	253.0	75.0	0	0	1,345.9
Sales (constant)	73.4	55.2	505.1	94.7	361.8	141.6	238.5	67.1	0	0	1,537.4
<u>HARDOOD</u>											
Savings (current)	0	0	0	0	22.0	27.0	20.1	15.1	14.1	18.2	116.5
Savings (constant)	0	0	0	0	23.9	27.0	18.9	13.5	12.1	15.0	110.4
Sales (current)	0	0	0	0	86.2	109.4	60.2	39.2	37.1	63.3	395.4
Sales (constant)	0	0	0	0	93.6	109.4	56.7	35.1	31.8	52.3	378.9
<u>F14</u>											
Savings (current)	0	0	168.6	22.8	38.0	0	0	0	0	0	229.4
Savings (constant)	0	0	226.9	26.4	41.3	0	0	0	0	0	294.6
Sales (current)	0	0	1,412.2	0	0	0	0	0	0	0	1,412.2
Sales (constant)	0	0	1,900.7	0	0	0	0	0	0	0	1,900.7
<u>MAVERICK</u>											
Savings (current)	0	0	0	5.6	13.0	37.4	29.0	20.5	10.1	4.8	120.4
Savings (constant)	0	0	0	6.5	14.1	37.4	27.3	18.4	8.7	4.0	116.4
Sales (current)	0	0	0	69.5	4.3	83.6	84.1	0	0	0	241.5
Sales (constant)	0	0	0	80.4	4.7	83.6	79.3	0	0	0	248.0

Source: Department of Defense

Senator TOWER. Would you yield at that point?

Senator PROXMIRE. Certainly.

Senator TOWER. I think that would probably fluctuate, wouldn't it?

Senator PROXMIRE. Sure it would fluctuate. I just wanted to get a general idea.

Mr. GANSLER. Actually by individual systems.

Senator TOWER. The individual system is what I am talking about.

Mr. GANSLER. You don't determine what is the overall impact on, say, ships or what is the total impact on planes, but you take the individual systems being sold and simply apply the learning curve to those. There are some systems where we are building at extremely low rates, and it is basically the foreign sales, in fact, making the difference to our costs.

Senator PROXMIRE. It would affect some aircraft, not others; it would affect some ships and missiles and not others. That is what I want to get, though, your best estimate as to what benefit this has in this regard. Frankly, I think it is a program that is one of the most tragic mistakes this country has ever made, to get this deeply involved. We ought to be working exactly the other way, using our greatest possible influence to develop arms free zones and to negotiate with other nations to reduce arms sales as much as possible.

I realize it would have an adverse effect on our ability to produce, but the long-term effect on war in the world, and death and destruction is just so conspicuous and obvious if we keep loading up the world with our enormously lethal systems.

Senator TOWER. Would you yield at that point?

Most of these sales go to our allies, though, those with whom we have treaty agreements or unilateral agreements.

Mr. GANSLER. The rationale, of course, is that part of the overall defense policy—

Senator PROXMIRE. We sell them to anybody, though. We sell them to the rich, the poor, the dictatorships, the democracies. We sell them to Israel, and to Iran, and to Saudi Arabia, in huge amounts, and our allies, it is true, we sell them for some reasonable foreign policy purpose, I'm sure, in every case, but I just don't think you can justify it.

Well, let me go on.

Representative MITCHELL. Would the chairman yield for just a moment?

Senator PROXMIRE. Yes.

Representative MITCHELL. We don't sell just to our allies. We also sell to those nations that we seek to coerce or bludgeon into becoming our allies. That is just common knowledge. I am not at all sure that Zaire is an ally of America today. I know there has been a great deal of talk about arms shipments to Zaire, to bring it under our sphere of influence. So I think the record ought to show that those sales really become a method of maintaining American supremacy in terms of international influence.

Mr. GANSLER. Yes; I think, Congressman, if I could comment, let me say that as you are well aware, the Defense Department doesn't decide on which countries the sales go to. It is State Department policy and, of course, not one that we comment on.

Senator PROXMIRE. Yes, but only the Defense Department, particularly you, Mr. Gansler, can give us the data that I think is essential

so that we understand all of the dimensions of this, including the effect this has on our own defense establishment, its readiness, its cost and so forth.

Mr. GANSLER. That is the point I tried to address in my testimony. One of the concerns we have is that in the event that this suddenly does drop for some reason, either because of buyers or because of legislation or whatever, that a drastic reduction in the demand on the industrial base could have even more significant impact if not properly planned for.

The other area that we talked about earlier is the technological advances on the Soviet side. We are equally concerned about the manufacturing advances that are taking place, and I am personally quite concerned about our technology transfer programs taking place, where we are in fact selling manufacturing factories and that sort of thing overseas as well.

Senator PROXMIRE. Now, Mr. Gansler, the committee understands that there is currently no overview of mobilization planning within the Defense Department. I understand that each of the military services, the defense agencies and other Federal agencies involved have their own mobilization plans, so there is no meaningful assessment of our total industrial mobilization posture.

I just wonder about that, that lack of coordination doesn't make any sense.

Isn't it the responsibility of the Defense Department to make such a comprehensive assessment? Does the Defense Department have any plans for trying to get an overall assessment of our defense mobilization posture?

Mr. GANSLER. Well, let me point out, we do have a coordination within the Office of the Secretary of Defense in the Department of Defense. The Federal Preparedness Agency, as you know, is responsible for the national coordination function.

Now, whether or not it is adequate and whether or not the current plan is well integrated, and whether or not the plan, in fact, covers all of the contingencies is the very real question I think you are addressing.

Senator PROXMIRE. Well, what I am addressing is the fact that our staff, which has been very diligent in exploring this, and I am very proud of the ability of our staff, tells me that we don't have a full picture of where we stand at all, and that the Defense Department has not given us that. They have not pulled it together, and only the Defense Department can do it.

Mr. GANSLER. Well, I think you are right, and that is why we chartered the Defense Science Board task force this summer to address that exact question. In fact, we had your staff minority and majority representatives address that group because we also felt that they had been doing a good job looking at this subject and we wanted their views as well.

The purpose of that task force was to try to get some kind of an independent assessment of whether or not our plans are adequate, and in general I would say the conclusions were with yours, Senator, that they are not adequate.

Senator PROXMIRE. When do you expect to get some kind of a comprehensive picture so we will have some kind of an adequate—

Mr. GANSLER. Well, we have gotten some initial actions that we should take and have already started to take. The initial comments that I made to Congressman Mitchell in terms of trying to start doing more planning for the surge, for the shorter term response, comes from some of the looks that we have taken and recognize the deficiencies—

Senator PROXMIRE. I am not talking about just the surge. I am talking about an overall picture of what our total mobilization capability is under all the circumstances.

Mr. GANSLER. We are now in the process of doing a broad study of that, trying to define both.

Senator PROXMIRE. When will that be ready?

Mr. GANSLER. We don't have a firm commitment on that, but it is in next year's time period. It is not in the next weeks and months.

The sort of thing we are trying to get is some idea of the cost of implementation. Having a plan is not of too much use unless we can afford to implement it, or if it is too expensive, then we should cut back on the plan.

So one of the more important parts now is to determine what the cost of implementation of such a plan would be.

Senator PROXMIRE. Now, there have been other studies going on, as you know, including a study by the Arms Control and Disarmament Agency of industrial mobilization that was done over 2 years ago. The study was done by Arthur Little, I understand.²

Mr. GANSLER. Yes, sir.

Senator PROXMIRE. Were you aware that the study arrived at many of the same conclusions that you are still in the process of reaching?

Mr. GANSLER. Yes; I did review that study and I thought it was a good initial look, and that was one of the earlier things that caused us to start looking more seriously, as you said, about 1 year or 2 ago. I thought that it was a rather generalized study, but I thought it was good in terms of the general conclusion.

Senator PROXMIRE. Well, you see, the reason I am raising this point is you said that we need to expand stockpiling, include long leadtime items needed to maintain a war production basis in product lines, need a critical review of procurement practices, need to improve the effectiveness of demand incentives to producers. But it also said, and this is the crux of it, that the principal difficulty is the cost. We are complaining now about the cost of government in every respect, including the Defense Department, and we should, but the cost here—your proposals add that—would add a very substantial cost, would they not?

Can you give us some notion of what the cost increase might be?

Mr. GANSLER. It depends entirely upon which programs you apply.

Senator PROXMIRE. I understand that.

Can you give us a range?

Mr. GANSLER. Yes; I would think that one of the things, that if one were to try to get a more responsive base in terms of trying to order long-lead material costs, that this would probably involve picking the individual materials that are the longest lead items, and ordering 1 year ahead.

² "Industrial Preparedness in an Arms Control Environment: A Study of the Potential Impact of Sharp Increases in Military Procurement." Prepared by Arthur D. Little, Inc. for Arms Control and Disarmament Agency, ACDA/MEA-246, December, 1974.

Now, to do that there would be effectively no net cost increase, because you would order next year's long-lead parts earlier. But it would certainly increase this year's costs because of the fact that you are taking money from next year and moving it forward. In effect, you would be almost stockpiling forgings and castings and things like that.

Senator PROXMIRE. But isn't it true that if we make defense contracting more attractive for subcontractors by increasing their incentive, their profit, if we make it more attractive for prime contractors, if we try to do something about reducing their undercapacity—or overcapacity, I should say, the fact that they can't utilize their capacity, whatever we do is going to be extremely expensive.

Mr. GANSLER. I don't believe that.

Senator PROXMIRE. Well, what can we do that would not be costly?

Mr. GANSLER. Well, let me give you an example. To have multiple sources at the subcontractor level, clearly the initial impact of that is almost doubling your cost for that particular part. In other words, instead of buying from one supplier, you buy from two, you have cut your quantity in half and your costs significantly increase, but for the follow-on buy, you now have two people competing for the buy, and so in general we find competition lowers cost.

While you look at an individual case, it isn't clear whether or not the net effect would be more or less.

Senator PROXMIRE. Mr. Gansler, I have been hearing that for almost the entire 20 years that I have been in the Senate. I have been hearing over and over again that they are going to work in the direction of competition. I remember years ago we were at the pitiful level of 10 percent advertised competitive bidding. Now it is at 8 percent. We just can't seem to make any progress at all.

Every Secretary of Defense says they are going to move in that direction. Members of Congress responsible in this area call for it. We never do. Obviously it seems to me if we are going to make any substantial improvement in this area, it is going to be costly, and we ought to confront that and recognize it, face it, and try to see exactly what it is and how much we can do and how much we cannot afford.

One more question.

Many people have been very concerned about the almost total lack of civil defense in this country now, and the much greater activity and efficiency, probably, in the Soviet Union with respect to civil defense, in the event of a nuclear catastrophe, that we are just counting on deterrent to prevent it, that once it occurs, that seems to be the end of the world for us.

Is there any proposal in the Defense Department to come forward with a substantial civil defense program that would save substantial numbers of lives, and if so, what would it cost?

Mr. GANSLER. As with the prior case, in terms of the cost of improving the base responsiveness of the civil sector, these areas are under study right now. That is why I didn't commit to how much increased dollars it would be for that area or how much increased dollars it would be for the civil preparedness. I can't give you a number in either of those cases because the studies are currently in process.

On the other hand there is currently, I would say, greatly increased attention being paid of course. Mr. Jones, the next speaker, is going to address that specifically.

Senator PROXMIRE. That is exactly what I wanted you to bring out, the industrial protection and hardening. That is where the Soviet Union claims they have done something useful, and incidentally, I suppose, we ought to try to appraise that, whether they can do anything.

Mr. GANSLER. Well, I think two points. I don't think the Soviet Union has said they have done something useful. There are people who have said they have done it, and in fact, there are growing intelligence estimates that indicate this, and Mr. Jones is going to cover some of the studies that were done in the unclassified areas as well.

Now, the things that appear to be practical, some of which he is going to cover, like dispersing of our industry, very clearly in terms of the Government-owned facilities, we can do that. In terms of the private sector, as you know, we have not been doing that. We have not been forcing them to put plants in certain areas. That is certainly getting very heavily into the private sector. In terms of being able to, in fact, shelter equipment, I think he will indicate that the cost of doing that is expensive, but it appears as though it can be done.

Yet we are talking about billions of dollars to have that protection, and I might add that that involves more than just the defense sector. You are talking about the civil and defense critical economy that you have to protect. You have to have power sources, for example, in order to run the equipment, and so you have to look at the whole economy, not just the defense portion thereof.

Senator PROXMIRE. Can you give us something a little more solid? We are looking forward to Mr. Jones' testimony, but it would be helpful for you as a government official, which Mr. Jones is not, to give us your appraisal, if you can, of the limits of the cost—\$10 billion, \$20 billion, \$30 billion?

Mr. GANSLER. Well, I have seen two studies. I have seen his and I have seen another one. The first one that I saw was on the order of about \$1.3 billion. His study was on the order of about \$2 billion to \$3 billion. So in terms of billions, that is the kind of numbers you are talking about to harden the industrial structure to reasonable levels for a relatively rapid recovery.

Now, whether those are the right numbers is something I am not in a position to tell you because that is, as you know, what the studies are about.

But in terms of the levels, that is the sort of numbers that we come out with.

Senator PROXMIRE. How can you make that kind of an assumption unless you make an assumption of the kind of nuclear attack we face?

Mr. GANSLER. Well, that is what these studies do. They take a particular set of scenarios and go through calculations. What they are trying, I think is one of the things making people more interested in this whole area. As you pointed out in some of your statements, it is the more controlled nuclear exchange environment. If that becomes a realistic scenario, and it is certainly one that we do have to consider, then under those conditions, nuclear hardening of some of the instal-

lations would make a much more credible thing to study. Those conditions, I think, are why we should study it.

Whether or not we should make the investment, I am not in a position to say, but we do feel the studies should be done.

Senator PROXMIRE. Congressman Mitchell?

Representative MITCHELL. Just one more question, Mr. Chairman.

Since I serve on the House committee I am becoming very cost conscious, and I realize there is a potential \$16 billion savings floating around somewhere in the Defense Department, or some such astronomical sum.

I want to talk about the roughly \$5.4 billion worth of industrial plant equipment that we now have in the Defense Department. There was a General Accounting Office study done recently, and it revealed that not all of this equipment is needed for current peacetime production, but more importantly, the study also revealed that this excess equipment is not needed for mobilization, since the Defense Department already has another industrial equipment reserve for mobilization use.

Now, it seems to me \$5.4 billion is a lot of money to be invested in equipment, if some of that equipment is nonproductive.

Is there any way that we can exploit savings on this, which really represents an idle asset?

It seems to me that \$5.4 billion sitting there, not needed for our present status in peacetime, and not to be used for mobilization is just a God awful waste. We have to try to get rid of it in some way, to save some money.

Have you given it some thought?

Mr. GANSLER. Yes, very serious thought. It is an area that we have been addressing quite a bit.

Let me comment on it. First of all, a large share of that equipment is quite old. In fact, I think something like 62 percent of the metal cutting equipment is over 20 years old. We looked at that recently. So it is equipment that to a large extent is World War II, and then it was increased again in the Korean time period. To a certain extent, most equipment is already being used. A certain amount of that is being used in the private sector and a large share—

Representative MITCHELL. What amount and what percent?

Mr. GANSLER. Right now \$1.2 billion out of the total.

Representative MITCHELL. Well, roughly 20 percent.

Mr. GANSLER. Roughly 20 percent. Now, that is on the industry side. In addition, there is a considerable amount of it being used, in the munitions plants and in the public sector.

Representative MITCHELL. What percent?

Mr. GANSLER. Well, let's see, the last time we looked at that, out of the total, it was about 30 percent, so a total of about 50 combined, of the two, that are now in use.

Representative MITCHELL. Which means, then, that you have got roughly a total of \$2.2 billion sitting there.

Mr. GANSLER. It is old equipment that is available in the event of need from a surge viewpoint.

Now, there are things that we are looking at. One is to try to sell off more. The current legislation requires that we can only sell if it is considered excess, and it is hard to justify that it is excess if it is

either in use or part of the industrial reserve. So it is hard to then sell it off.

In addition, some very small percentage of it is used by universities on a loan basis. We have tried making more use of it for rent, you know, renting it out, for civil—in fact, we charge for it on foreign military sales as well.

What we would like to do is actually be able to sell it off, and then have the private sector invest in more modern equipment. You have to distinguish between the problem of the extra capacity or the extra equipment that is around versus modern equipment that you could use, to produce the things for much lower cost.

What we would like to do is stimulate industry to make investments in new modern plant equipment and thereby reduce our costs. We have all this government equipment around and people like you are saying: Why don't we use it? If you would put this old stuff out into the field and start to use it, you may be saving a few dollars on buying new production equipment. But the cost of the end items that you are buying is much more expensive. That is the trade that we are going through.

Representative MITCHELL. Mr. Gansler, it seems to me that you simply reemphasized what I alluded to earlier. Had there been a comprehensive plan for conversion into peacetime following World War II, that equipment wouldn't be sitting there because the disposal of it would have been a part of the comprehensive plan. Had such a plan existed following the Korean war and the war in Vietnam, we wouldn't be sitting on a stockpile of nonproductive equipment.

I know my time is up, but I simply wanted to make that comment to stress the importance of developing, right now, a comprehensive plan for conversion from peacetime to wartime, to a kind of in-between time. We don't have it, and each year that passes that we don't have it, we create a monster like this.

MR. GANSLER. Your point is correct, sir. We have been selling it off. We have disposed of, since the peak of the Vietnam period, something—well, we had then about \$2½ billion worth out in the private sector, and we are down now to on the order of \$1.2 billion. So we have actually gotten rid of about half of it during that time period just since Vietnam. This is the stuff that is in the private sector. The majority of the rest of it is at government installations or is part of the reserve for war. I personally agree with you that we would rather have that segment modernized, or be new equipment in use, than simply sitting ready. In terms of being able to get it rapidly on stream, it will be more difficult if it is sitting in storage. So we would much prefer to have it in use than sitting idly. It is just hard to use it all, in terms of the reduced amount of things that we are buying.

Representative MITCHELL. Thank you very much.

Senator PROXMIRE. Thank you very much, Mr. Gansler, for most responsive and helpful testimony. We appreciate it.

[See Additional Questions for the Record, appendix III, pp. 135-148.]

Our next witness, is Mr. Thomas K. Jones, program and product evaluation manager of the Boeing Aerospace Co.

Mr. Jones, we are happy to have you here.

Accompanying Mr. Jones are Mr. John Potter, director of facilities for Boeing, and Mr. Edwin York, a specialist in nuclear effects.

STATEMENT OF MR. THOMAS K. JONES, PROGRAM AND PRODUCT EVALUATION MANAGER, BOEING AEROSPACE COMPANY, ACCOMPANIED BY MR. JOHN R. POTTER, DIRECTOR OF FACILITIES, BOEING COMMERCIAL AIRPLANE COMPANY; AND MR. EDWIN N. YORK, NUCLEAR EFFECTS SPECIALIST

Senator PROXMIRE. You are Mr. Jones, is that correct?

Mr. JONES. Yes, sir.

Senator PROXMIRE. And on your right is?

Mr. JONES. On my right is Mr. Potter, and on my left is Mr. York.

Senator PROXMIRE. Go right ahead, sir, we are happy to have you. We have a copy of your statement, and we are very interested in hearing it, and I might also say that your very helpful exhibits which you attached to your statement will be printed in full in the record.

Mr. JONES. Thank you very much, Mr. Chairman and members of the committee.

Senator PROXMIRE. Would you pull the microphone a little closer, Mr. Jones, because it is hard to hear.

Mr. JONES. On behalf of the Boeing Co. I want to thank you very much for the opportunity to present our views on industrial survival and the findings of the study we have conducted on this subject. We have prepared for your committee a detailed study report that we hope will be useful to you.

[See appendix II, page 55.]

It is most timely that your committee has taken an interest in this matter. The growing emphasis on industrial survival in the Soviet Union, coupled with the present lack of such emphasis in this country, could have far-reaching consequences with respect to the future security of the United States.

I recognize, of course, that Americans find it difficult to believe that civil defenses could provide effective protection against nuclear weapons. In our country there is widespread belief that nuclear war inevitably would destroy both the United States and the Soviet Union, and that it might bring the end of mankind itself.

The avoidance of war, however, does not necessarily depend upon what Americans believe. It depends upon what the leaders of the Soviet Union believe, even if their belief should be ill-founded. We have only to look back at World War II, and perhaps even Korea, to recognize that a set of invalid assumptions can lead an aggressor into a war he neither wanted nor expected.

The threat of mutual assured destruction will provide an effective deterrent only if the Soviet rulers believe that the threat is indeed mutual. Examination of Soviet literature reveals, however, that the Soviets do not subscribe to the West's concept of assured destruction. On the contrary, there is a growing body of evidence that the Soviet Union is preparing to survive and to recover from nuclear war should such a war occur.

The most important ingredient in industrial recovery is the survival of the work force. The Soviet Union's published plans and observed preparations make it clear that the Soviets intend the bulk of their work force to survive should a nuclear war occur. The best defense against nuclear weapons is to be somewhere else when they go off.

Therefore, the Russian attempt is to employ a combination of evacuation and shelters. Although about half of America's nuclear arsenal should survive a first strike by the Soviet Union, the surviving weapons could destroy people unprotected against blast, thermal, and prompt radiation effects, in, at most, 3 percent of Soviet territory. Evacuation, because it distributes people over a comparatively large area, allow them to survive. The United States could, by foregoing half the effectiveness of its arsenal against industrial facilities, spread a lethal level of radioactive fallout over 15 percent of the Soviet Union. However, the evacuees will dig simple shelters to protect against this possibility. The decay rate of that radiation intensity would, within a week, permit the Russians to be out of their shelters for at least an 8-hour workday in 97 percent of their territory. [See page 203.]

Our own analyses, results of which are shown in figure 6 of the report [see page 64], confirm the validity of Russian estimates of population survival. Even if their city dwellers merely walked out of town for 1 day and then dug shelters, they would be very, very well protected.

With an established plan, Americans could also survive a nuclear attack, although they would face a more severe radiation problem. However, about half of this radiation problem is due to the capability of the Soviet backfire bomber force, a potential that could be largely eliminated by air defenses.

The Soviets also appear to have planned well for the survival of their industrial facilities. Again, dispersing over a large area is the most effective form of protection. During the past decade, the Soviet Union has located more than three-fourths of its new industry outside of its large cities. Furthermore, confirmed observations show that adjacent factories are separated to insure that a single U.S. warhead cannot destroy more than one, and even the buildings in a single complex have been rather widely separated. We have estimated that destruction of an entire Soviet complex would require eight times the megatonnage needed to destroy a typical U.S. complex with the same building area.

The Soviet civil defense manuals also provide for a number of ways to protect the critical production machinery within the factories. A book written by A. A. Gromov, hero of Socialist labor and director of the First State Ball Bearing Plant, outlines how these protective methods are being applied to his factory. It was this aspect of the Russian industrial survival program that was the least amenable to evaluation through purely statistical analysis. It was also this which seemed to hold the most practical potential for application by U.S. industry. Therefore, in an internal planning study which we initiated in 1975, we concerned ourselves principally with protection of the tools of industry.

As I have implied, our objective was twofold: First, to evaluate the effectiveness of Soviet preparations and second, to determine the feasibility of such measures applied to U.S. industry. Our research method was to duplicate the Russian planning processes and protective methods as outlined in their manuals and in the factory manager's books. This task was assigned to Mr. Gromov's U.S. counterpart, Mr. Jack Potter. We then selected Boeing's high-technology manufacturing

complex at Auburn, Wash., as a model, and set out to determine whether we could insure the survival of its large and costly machines. As an additional step, we considered the application of these measures to an urbanized industrial region, using the Seattle-Tacoma-Everett area as a model.

The study team considered all of the protection methods spelled out in Soviet literature, and determined that the easiest way was a uniquely Russian one: simply packing the machinery in sandbags or earth. Figure 24 in the document we have provided you [See p. 88] shows how they would go about this. That figure was excerpted from an unclassified report of a training exercise in a Soviet factory, and because most of the U.S. weapons are relatively small, this method would be fully adequate for Russian factories. It would protect against fire, debris, and blast pressures up to about 80 pounds per square inch. However, since American factories would need protection against high-yield 1 megaton weapons, our study team looked for something better. We determined, finally, that the most effective yet practicable way to protect a machine is to surround it completely with a layer of crushable material, such as foamed plastic or the metal chips that are a readily available byproduct of machining operations. This shock-insulating layer would then be overlaid with soil or sandbags to protect the machines from fire and debris. Moreover, the soil layer would form an arch or a natural bridge that would protect the machine against the blast pressure. Time studies indicate that work crews could protect all vital equipment at the Auburn facility within a few days, by using another Russian method: shovels and wheelbarrows.

To confirm the validity of our calculations, we have conducted a number of tests. In a series of static tests, starting with some simple tests conducted in a farmyard, and concluding with burial of a precision machine, we checked out the principle of earth arching and the effects of earth settling and corrosion on machine components. Next we were permitted to emplace a variety of small industrial components in the vicinity of a 5-ton high-explosive blast conducted by the Defense Nuclear Agency at Holloman Air Force Base. None of the tested components failed.

A more conclusive test, which was sponsored by the Defense Nuclear Agency at White Sands missile range on October 6th, subjected larger machines to a high-explosive shot equivalent to 500 tons of TNT. This shot produced the kind of shock and blast effects that we would get from a nuclear explosion. We tested six different sets of components, each representative of machinery with different structural characteristics. We set them on styrene blocks, packed them in bags of aluminum chips, and covered them with varying depths of soil. These test articles were placed around the explosives so that they experienced various overpressures ranging from 80 to 600 pounds per square inch.

We have assessed the damage to each of these items. As expected, the amount of damage varied with the type of equipment represented and the amount of protection provided and, of course, with the blast pressure to which each was subjected. The results are noted briefly in the document prepared for the committee. It is interesting to note, however, that a large grinding machine survived 200 pounds per square inch with only a slight dent; all working parts appeared un-

damaged. A gas-powered minibike was successfully protected against a blast pressure of 600 pounds per square inch, and a soil heave of 1½ feet; after the test, it was dug out, started and driven away.

In brief, the results of this test indicate that industrial machines, if properly protected, can survive within a few hundred feet from a 40 kiloton nuclear blast, or 2,000 feet from a 1 megaton. [Our printed statement, sir, was in error. That should have been 1 megaton, not 2.] These protective measures, if applied to the Seattle-Tacoma-Everett metropolitan area, could permit resumption of some production operations as early as 4 to 12 weeks after a nuclear attack, depending on the level of radiation intensity.

From our study we have concluded that the Soviet civil defense program can effectively protect the industrial base of the Soviet Union and could facilitate a relatively swift recovery from a nuclear war. Further, if the observed examples of Soviet industrial dispersal and separation of their industrial buildings represent the pattern for Russia's future capital expansion, Soviet industry would require little or no preattack hardening in order to survive and recover quickly. By quickly, I mean 2 to 4 years compared with about 12 years for the United States.

We believe that the Soviet preparations substantially undermine the strength of the concept of deterrence that forms the cornerstone of U.S. security. We believe further that they have effectively circumvented the protection the United States thought it had obtained through the ABM Treaty. It seems logical to conclude, then, that these defensive preparations, when combined with the increasing power of Soviet strategic offensive forces, have in fact destabilized the strategic relationship between the two nations.

Under such a condition, the so-called balance of terror tilts significantly in favor of the Soviet Union. In any future confrontation, should the Soviet execute their civil defense plans, the consequence of further escalation would be disastrous to the United States, while it might well be tolerable to the Soviets. The most probable outcome of such a situation is not nuclear war; it is more likely to involve increasingly costly concessions by the United States in order to avoid such a war.

In my personal view, these Soviet war survival capabilities make it imperative that the United States make some critically important policy decisions. We can choose to try to make nuclear war as unthinkable for Russia as it now is for the United States, or we can try to make it as survivable for the United States as it now is for Russia.

Addressing the second option, we see no technical or economic reason why the United States cannot build an effective civil defense or survival capability. It is therefore recommended that the Congress give strong consideration to a program for the protection of both American citizens and the industrial capacity that provides the quality of life enjoyed by Americans. This course could permit the United States to maintain its security for less cost and with less nuclear weaponry than would otherwise be required. It could also reduce the temptation for Soviet adventurism.

Thank you very much.

[Prepared statement of Mr. Thomas K. Jones follows:]

INDUSTRIAL SURVIVAL AND RECOVERY AFTER NUCLEAR ATTACK—A REPORT TO THE JOINT COMMITTEE ON DEFENSE PRODUCTION, U.S. CONGRESS—NOVEMBER 17, 1976

Mr. Chairman and Members of the Committee: I am Thomas K. Jones, Program and Product Evaluation Manager of the Boeing Aerospace Company. With me are Mr. John R. Potter, Director of Facilities for Boeing Commercial Airplane Company, and Mr. Edwin N. York, a specialist in nuclear effects. On behalf of The Boeing Company, I want to thank you for the opportunity to present our views on industrial survival and the findings of the study we have conducted on this subject. We have prepared for the committee a detailed study report that I would like to have placed in the record, and, with your permission, I will summarize for you some of the highlights of that report.

It is most timely that your committee has taken an interest in this matter. The growing emphasis on industrial survival in the Soviet Union, coupled with the present lack of such emphasis in this country, could have far-reaching consequences with respect to the future security of the United States.

I recognize, of course, that Americans find it difficult to believe that civil defenses could provide effective protection against nuclear weapons. There is widespread belief that nuclear war inevitably would destroy both the United States and the Soviet Union, and that it might bring the end of mankind itself.

The avoidance of war, however, does not necessarily depend upon what Americans believe. It depends upon what the leaders of the Soviet Union believe, even if their belief should be ill-founded. We have only to look back at World War II, and perhaps even Korea, to recognize that a set of invalid assumptions can lead an aggressor into a war he neither wanted nor expected.

The threat of mutual assured destruction will provide an effective deterrent only if the Soviet rulers believe that the threat is indeed *mutual*. Examination of Soviet literature reveals, however, that the Soviets do not subscribe to the West's concept of assured destruction. On the contrary, there is a growing body of evidence that the Soviet Union is preparing to survive and to recover from nuclear war should such a war occur.

The most important factor affecting industrial recovery is the survival of the work force. The Soviet Union's published plans and observed preparations make it clear that it intends the bulk of its work force to survive should a nuclear war occur. Its concept is to employ a combination of evacuation and shelters. Although about half of America's nuclear arsenal should survive a first strike by the Soviet Union, the surviving weapons could destroy people unprotected against blast, thermal, and prompt radiation effects in, at most, 3 percent of Soviet territory. Evacuation, by distributing people over a comparatively large area, allows them to survive. The U.S. could, by foregoing half the effectiveness of its arsenal against industrial facilities, spread lethal radioactive fallout over about 15 percent of the Soviet Union. However, the evacuees will dig simple shelters to protect against this possibility, and the decay rate of radiation intensity would, within a week, permit the Russians to be out of their shelters for an 8-hour workday in 97 percent of Soviet territory. Our analyses confirm the validity of published Russian estimates of population survival and show that even if their city dwellers merely walked for one day and dug shelters, they would be well protected (Fig. 6).

With an established plan, Americans also could survive a nuclear attack, although they would face a more severe radiation problem (Fig. 9). About half of this radiation problem is due to the capability of the Soviet Backfire bomber force, a potential that could be largely eliminated by air defenses.

The Soviets also appear to have planned well for the survival of their industrial facilities. Again, dispersing over a large area is the most effective form of protection. During the past decade, Russia has located more than three-fourths of its new industry outside of its large cities. Furthermore, confirmed observations show that adjacent factories are separated to ensure that a single U.S. warhead cannot destroy more than one. And even the buildings in a single complex have been rather widely separated (Fig. 10). It has been estimated that destruction of an entire complex would require eight times the megatonnage needed to destroy a typical U.S. complex with the same building area (Fig. 11).

Soviet civil defense manuals provide also for a number of ways to protect the critical production machinery within the factories. A book written by A. A.

Gromov, Hero of Socialist Labor and Director of the First State Ball Bearing Plant, outlines how these protective methods are being applied to his factory. It was this aspect of the Russian industrial survival program that was the least amenable to evaluation through purely statistical analysis. It also was this which seemed to hold the most practical potential for application by U.S. industry. Therefore, in the internal planning study initiated by Boeing in 1975, we concerned ourselves principally with the protection of the *tools* of industry.

As I have implied, our objective was twofold: to evaluate the effectiveness of Soviet preparations and to determine the feasibility of applying such measures in U.S. industry. Our research method was to duplicate the Russian planning processes and protective methods as outlined in the Soviet manuals and Comrade Gromov's book. This task was assigned to Gromov's U.S. counterpart, Mr. Jack Potter. We then selected Boeing's high-technology manufacturing complex at Auburn, Washington, as a model and set out to determine whether we could ensure the survival of its large and costly machines. In an additional step, we considered the application of these measures to an urbanized industrial region, using the Seattle-Tacoma-Everett area as a model.

The study team considered all of the machine protection methods spelled out in Soviet literature and determined that the easiest technique was a uniquely Russian one: to pack the machines in sandbags or earth (Fig. 24). Because most U.S. weapons are relatively small, this method would be fully adequate for Russian factories since it would protect against fire, debris, and blast pressures up to 80 pounds per square inch. Since American factories would need protection against high yield 1-megaton weapons, however, our study team looked for something better. We determined, finally, that the most effective yet practicable way to protect a machine is to surround it completely with a layer of crushable material such as foamed plastic or the metal chips that are readily available as a byproduct of machining operations (Fig. 26). This shock-insulating layer would then be overlaid with soil or sandbags to protect the machines from fire and debris. Moreover, the soil would form an arch or natural bridge that would protect against even extremely high blast pressures. Time studies indicate that work crews could harden all vital equipment at the Auburn facility within a few days.

To confirm the validity of our calculations, we conducted a number of tests. In a series of static tests, starting with simple tests conducted in a farmyard and concluding with burial of a precision machine, we checked out the principle of earth arching and the effects of earth settling and corrosion (Fig. 30). Next, we were permitted to emplace a variety of small industrial components in the vicinity of a 5-ton high-explosive blast conducted by the Defense Nuclear Agency at Holloman Air Force Base. None of the components failed.

A more conclusive test, sponsored by the Defense Nuclear Agency at White Sands Missile Range, subjected larger machines to a high-explosive shot equivalent to 500 tons of TNT (Fig. 40). This shot produced the kind of shock and blast effects we would get from a nuclear explosion. We tested six sets of components, each representative of machinery with different characteristics. We set them on styrene blocks, packed them in bags of aluminum chips and covered them with varying depths of soil, placing them around the explosives so they experienced overpressures ranging from 80 to 600 psi.

We have assessed the damage to each of these items. As expected, the amount of damage varied with the type of equipment represented, the amount of protection provided and, of course, with the blast pressure to which each was subjected. The results are noted briefly in the document I am leaving with you. It is interesting to note, however, that a large grinding machine survived 200 psi with only a slight dent; all working parts appeared undamaged. A gas-powered mini-bike was successfully protected against a blast pressure of 600 psi and soil heave of 1-1/2 feet; after the test it was started and driven away (Fig. 41).

In brief, the results of this test indicate that industrial machines, if properly protected, can survive within a few hundred feet from a 40-kiloton nuclear blast—or 2,000 feet from a 1-megaton blast. These protective measures, if applied to the Seattle-Tacoma-Everett metropolitan area, could permit resumption of some production operations as early as 4 to 12 weeks after a nuclear attack.

From our study, we have concluded that the Soviet civil defense program can effectively protect the industrial base of the USSR and could facilitate a relatively swift recovery from a nuclear war. Further, if the observed examples of industrial dispersal and separation represent the pattern of Russia's future capital expansion, Soviet industry would require little or no preattack hardening in order

to survive and recover quickly. By quickly, I mean within 2 to 4 years, contrasted with an estimated 12-year recovery period for the United States.

We believe these Soviet preparations substantially undermine the concept of deterrence that forms the cornerstone of U.S. security. We believe further that they have effectively circumvented the protection the United States thought it had obtained through the ABM Treaty. It seems logical to conclude, then, that these defensive preparations, combined with the increasing power of Soviet strategic *offensive* forces, have in fact destabilized the strategic relationship between the two nations.

Under such a condition, the so-called balance of terror tilts significantly in favor of the Soviet Union. In any future confrontation, should the Soviet execute its civil defense plans, the consequence of further escalation would be disastrous to the United States. It might well be tolerable to the Soviets. The most probable outcome, then, is not nuclear war; it is more likely to involve increasingly costly concessions by the U.S. in order to avoid nuclear war.

In my personal view, these Soviet war survival capabilities make it imperative that the United States make some critically important policy decisions. We can choose to try to make nuclear war as unthinkable for Russia as it now is for the U.S. or we can try to make it as survivable for the U.S. as it now is for Russia.

Addressing this second option, there is no technical or economic reason why the United States cannot build an effective civil defense, or survival, capability. It is therefore recommended that the Congress give strong consideration to a program for the protection both of American citizens and of the industrial capacity that provides the quality of life enjoyed by Americans. This course could permit the United States to maintain its security for less cost and with less nuclear weaponry than otherwise will be required. It could reduce the temptation for Soviet adventurism.

Thank you, gentlemen.

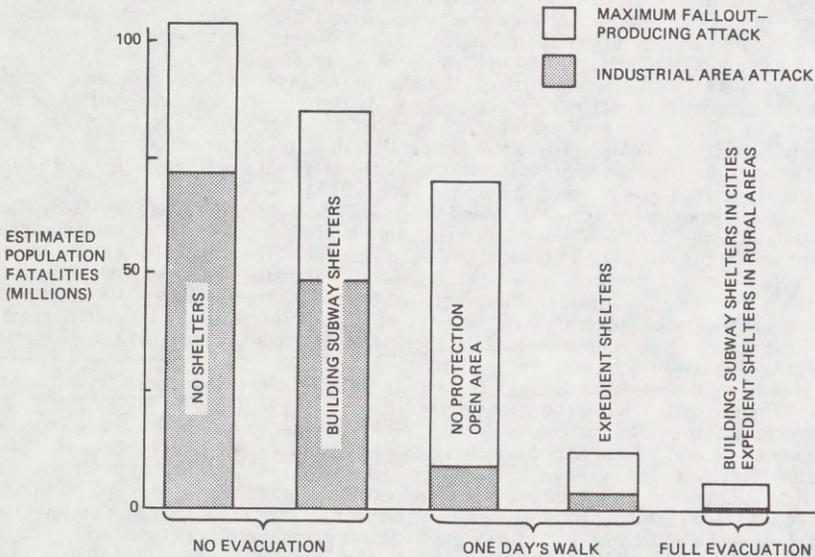


FIGURE 6.—Soviet population fatalities (surviving U.S. Strategic Forces).

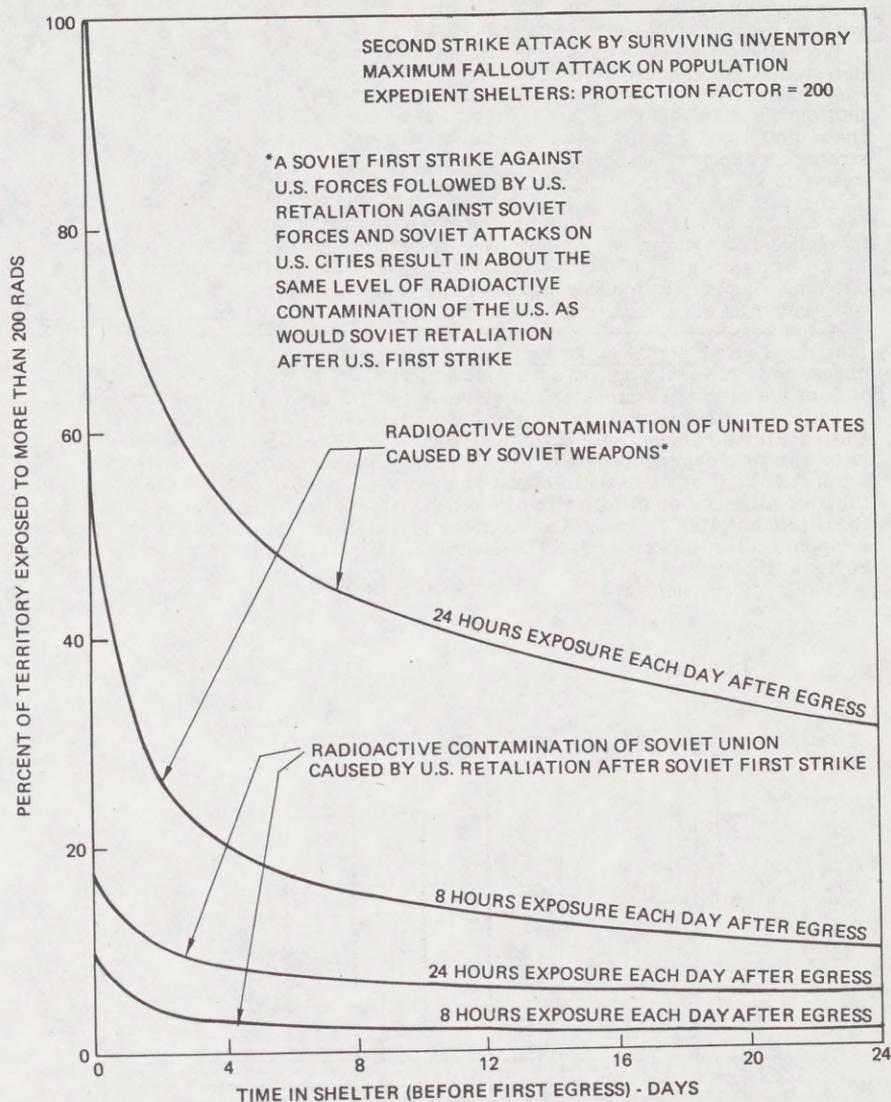


FIGURE 9.—Worst case comparative effects of surviving nuclear arsenal.

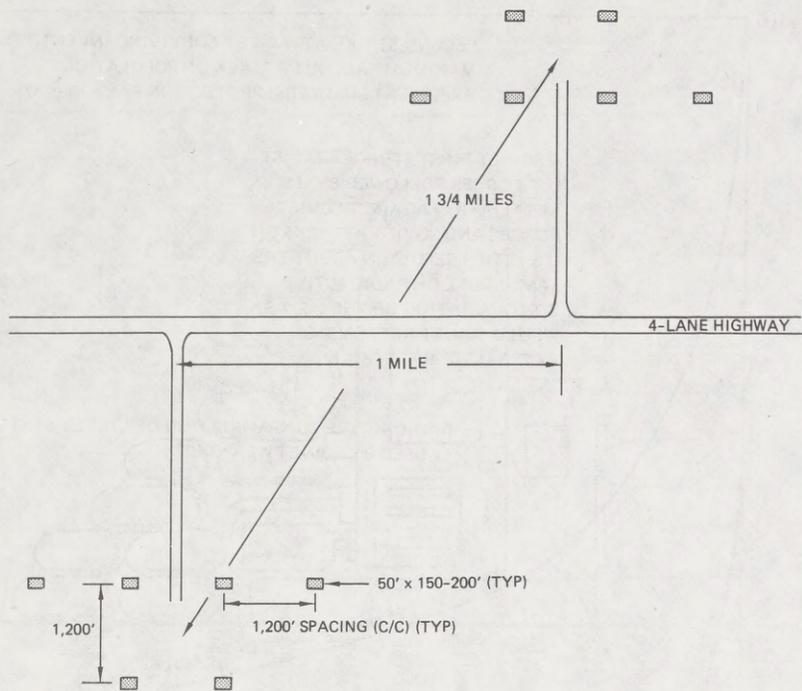


FIGURE 10.—Soviet industrial dispersal.

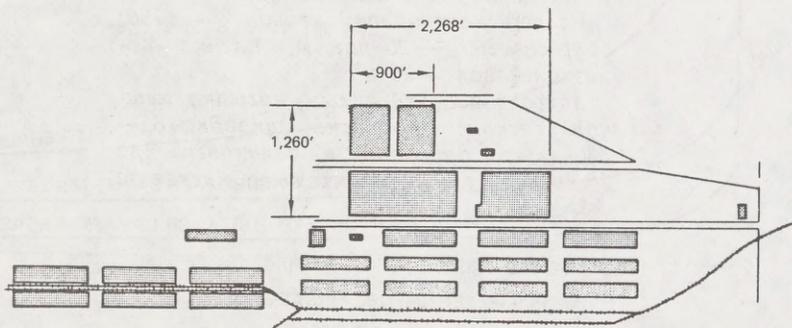


FIGURE 11.—Auburn complex.

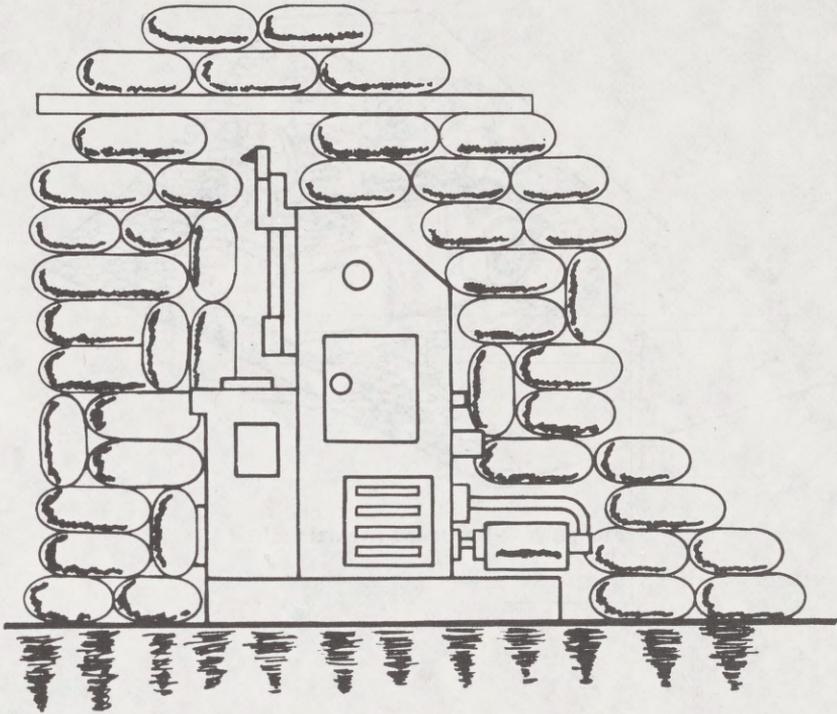


Figure 24. *Рис. 2. Вариант консервации*
Расход материалов: мешки — 180;
брус 60×200 — 20 пог. м; пленка полиэтиленовая — 25 м².
Затрата рабочей силы: насыпка меш-
ков песком, подноска, укладка —
58 чел./час; бригадой в 8 человек при
10-часовой смене работа выполняется за
5,3 числ

FIGURE 24.—Machines packed in sandbags or earth.

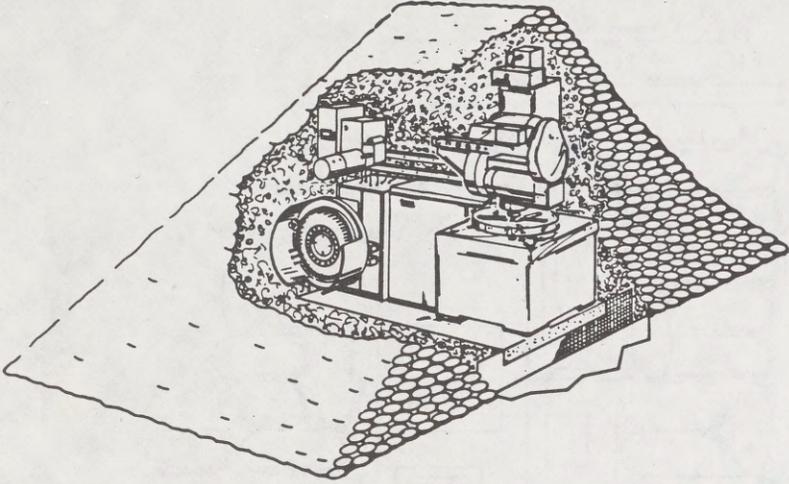


FIGURE 26.—Hardened five-axis mill.

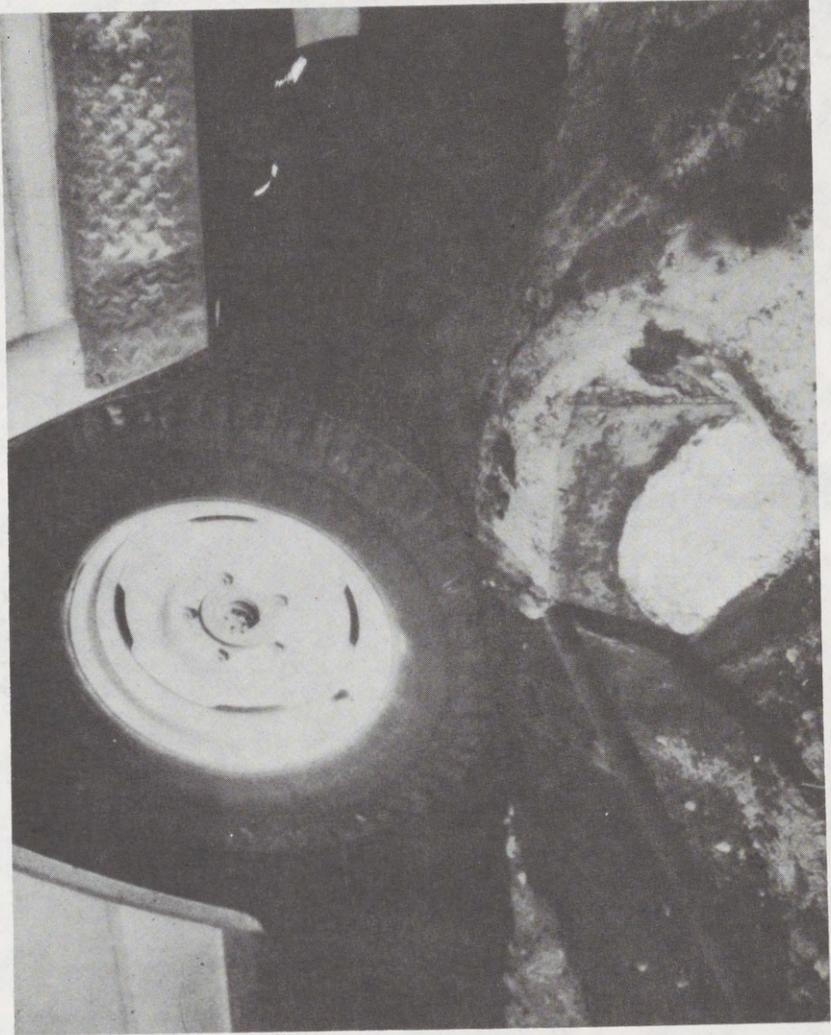


FIGURE 30.—Static test of Earth arching principle.

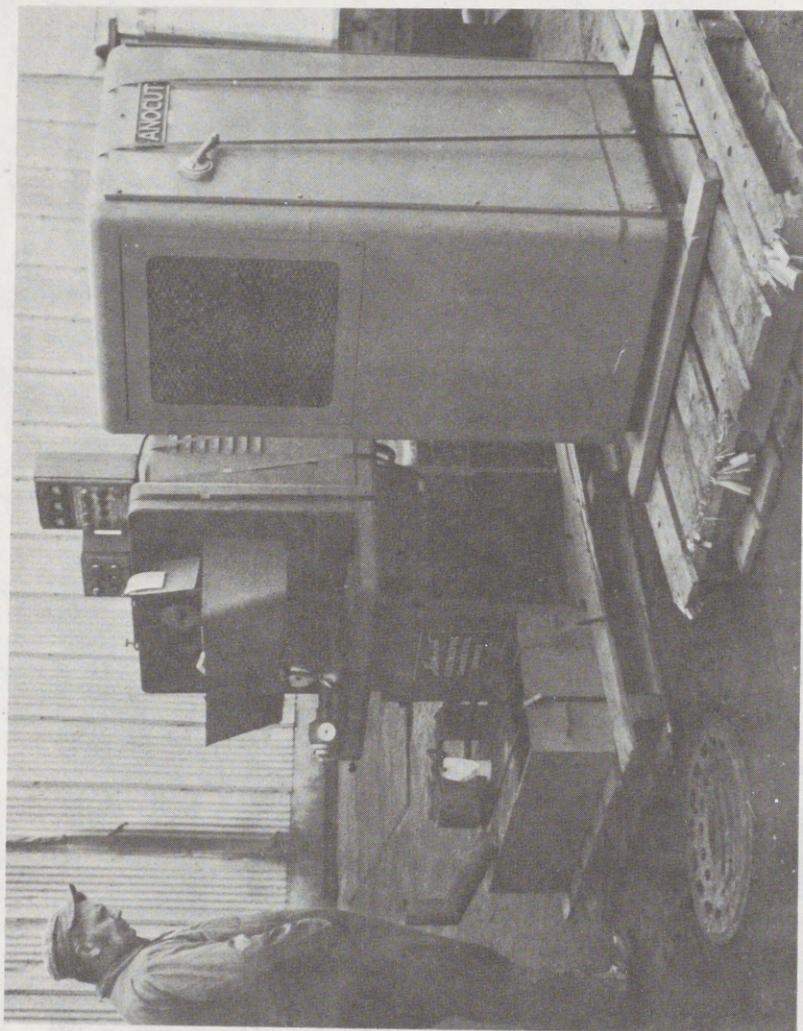


FIGURE 40.—Electrolytic grinder and power supply used in 500-ton high-explosive test.

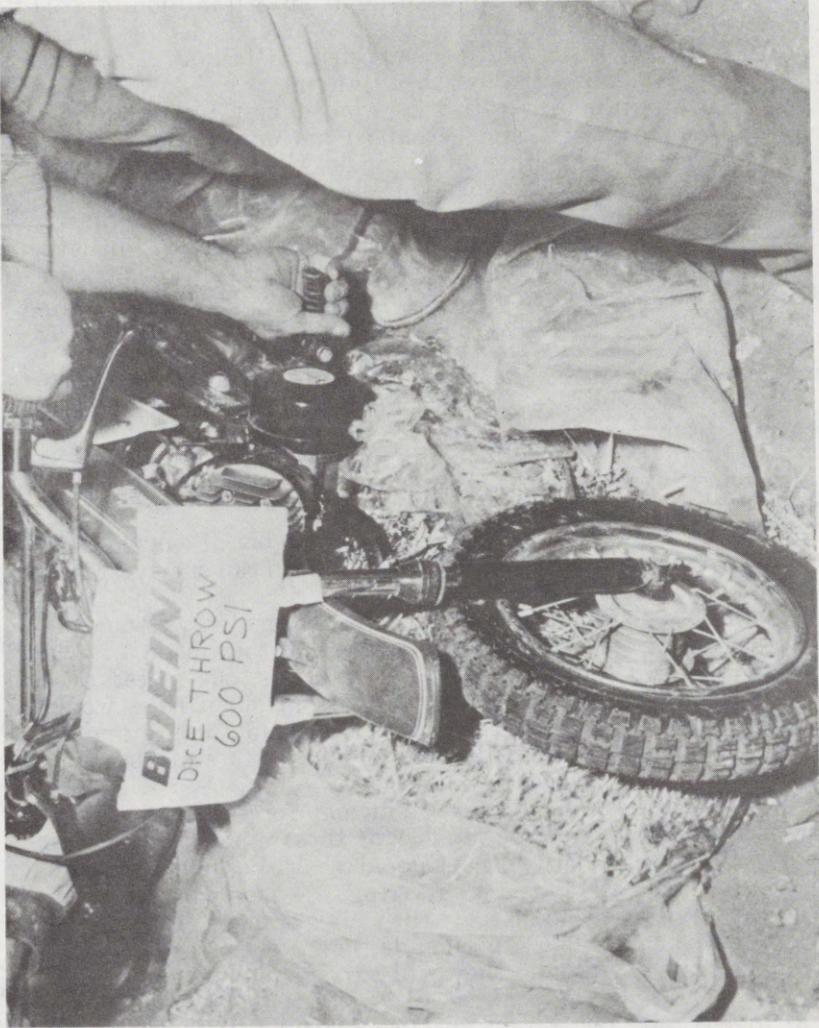


FIGURE 41.—Minitbike being removed from test location after 500-ton high-explosive blast. Test specimen was in an area subject to over 600-psi blast pressure and 1½-foot soil heave. Note misaligned front fender.

Senator PROXMIRE. Thank you Mr. Jones. I think that is something we ought to think about and talk about. We don't. This is a terrible situation. It is hard to face it and confront it and discuss it. I want to commend you and your company for engaging in this kind of investigation.

There is a quality of unrealism that I am sure you can understand when you are suddenly confronted with this, and maybe it is unfair to say that. I understand that we now spend about \$80 million to \$120 million, depending on what you include, in our civil defense effort, and the Russians are estimated to spend what, \$1 billion, something like that—a great deal more than we spend, anyway.

There are several problems with what you suggest. One, of course, is that you seem to imply—and perhaps I am unfair to you—that there would be one attack, either on the Soviet Union or on this country, lasting perhaps a day or two. Supposing the attack comes every day, every week, every month for a long time. We have a fantastic amount, as you know, of nuclear warheads, what is it, 10,000 I believe, strategic nuclear warheads, plus tactical warheads, just an immense amount. We have been told that a fraction of this will destroy Russia as an organized society. You dispute that, and you may well be correct, but it would seem to me that whether you are correct or not, that with the colossal amount of offensive power we have and the Soviets have, too, any defense just seems to be out of the question if one country or the other decides it is going to retaliate. I can't imagine this country sustaining a nuclear attack and then not going absolutely all out. I think any President of the United States would have to do that and would do it.

Under those circumstances, if we used every bit of our nuclear potential, are you contending that the Soviet Union can survive, could accept that kind of an unacceptable prospect?

Mr. JONES. Yes, Senator, the assumptions we made in estimating the effectiveness of Soviet protection assumed that they made a fairly light attack on the United States forces and, that our forces were on fully generated alert. Therefore, most of our submarines would be at sea, and we assumed that all of those would survive and be usable, and our bombers would be in a very high state of alert and most of those would survive.

We assumed that the attack on our Minuteman force was quite light, which would allow a very large number of those missiles to survive and be used. Our calculations considered that the United States would in fact dump all of those surviving weapons on the Soviet Union. If the Soviets did not execute their civil defense preparations and evacuate their people, sure enough they would be destroyed, but if they execute their plan, they will survive and recover rather promptly.

The 2- to 4-year recovery time that we project for their recovery does include recovery from a full-scale total United States response, where we disarmed ourselves in throwing everything we had at the Soviet Union.

You did, however, bring up a fact—

Senator PROXMIRE. Let me just interrupt to say that in your figure 6 that you have at the back, which indicates the fatalities under various

scenarios, do I misinterpret this as indicating that if they had a full evacuation, that they would be able to save 99 percent, plus, of their people? [See additional questions for the record, appendix III, p. 167.]

Mr. JONES. Yes, sir, it is I believe about 98 percent of their people.

Senator PROXMIRE. This is an all-out attack by this country with everything we have.

Mr. JONES. Yes, sir, and moreover, it was an attack where we actually tried as best we could to destroy their people by targeting the evacuation areas.

Senator PROXMIRE. Well, now, as you may recall, one of the big arguments in finally defeating the ABM was the argument that you could always overcome any defensive measure, at least with respect to the ABM, with a far less expensive offense, in other words, \$10 spent in offense would overcome \$100 spent in defense, or something like that, roughly in that area.

Are you contending that civil defense wouldn't have anything like that, that it would be cheaper to provide defense in relationship to the offensive cost of overcoming it?

Mr. JONES. Yes, Senator. That is a very important question because it is true, as you have indicated, that the cost leverages against ABM are such that they can be cheaply overcome with offensive forces. Moreover, certain types of civil defenses are also not cost effective. For example, if the United States invested heavily in large population shelters within the cities, we believe it likely that the Soviet Union could overcome those at less cost than it took us to build them. Moreover, in-city shelters would be relatively ineffective, because the people would still be concentrated in relatively small easily destroyable bunches. Evacuation, because it is cheaper and it spreads the people out, puts the cost leverage in favor of the defense.

Senator PROXMIRE. Are you making a realistic assumption in terms of the time that you have to evacuate, however?

Mr. JONES. The Russian assumption is that it would take them about 3 days to evacuate, and if they—

Senator PROXMIRE. Well, why would we, with any kind of realistic action on our part, give them 3 days?

You are assuming that they would strike first, take 3 days to evacuate, and meanwhile we wouldn't be aware of it or at least be in a position to act until they acted, is that it?

Mr. JONES. Our assumption—and the Soviet published plan—is that they would first evacuate before they even considered a strike.

Senator PROXMIRE. I see.

Mr. JONES. And as the preemptor, they do have the planning flexibility that would allow them some time. I believe that the United States would know almost immediately if the Soviets started an evacuation, but from our present posture, we have very little recourse to do anything about it.

Some people have brought up the possibility that we would attack the evacuees before they could get away, but the whole deterrence theory is based on the hostage idea. If you blow up the hostage before he gets away, you have no more hostage. Moreover, your adversary is twice as angry at you. Therefore, for the United States to preemptively attack the Soviet evacuees when they start evacuating would be a very suicidal thing to do.

Senator PROXMIRE. Of course, the same hostage scenario applies to the Soviets attacking the United States. They would lose their hostage if they destroyed our people.

Mr. JONES. That's true; but they don't need a hostage because by the time they get to that point in the confrontation exchange, their people would be very well protected. That, Senator, points to the problem of the imbalance that is caused by the Soviets being protected from the consequences of a nuclear war while the United States is totally exposed.

Senator PROXMIRE. In view of the enormous cost to both countries—and as you say, we could engage in this and match the Soviet Union, perhaps surpass them, perhaps not—at least we could provide a very effective defense at enormous cost to ourselves, provoking on their part, I presume, an equally strong attempt to protect their people even further. Wouldn't it be wise to put this on the SALT agenda as a matter for negotiations, to try to forestall this kind of activity, especially in view of the fact that this seems to me would be something we could be appraised about, know about—that they couldn't very well do it without our being aware of their activity?

Mr. JONES. As you know, Senator, I spent 3 years on the SALT delegation trying to negotiate deals with the Soviet Union to limit strategic arms, and it is my belief that the Soviets would not be amenable to any kind of arrangement that would limit their civil defenses. During the course of the SALT negotiations, for example, the U.S. delegation tried very hard to get the Soviets to limit their air defenses along with the limitations that we successfully obtained on ABM defense. The Soviets were very adamant against that. They said not only will they not even consider the subject, but please don't bring it up again.

Moreover, the experience in the SALT negotiations so far has been such that the Soviets have not given up any advantages that they had without the United States giving up a comparable advantage in return. So I don't see them giving up civil defenses which their leadership, in print, has outlined as a major advantage favoring them.

There is a technical problem involved as well, and that is that while we were able to limit ABM systems because it would take many years after abrogation to construct the necessary ABM radars for heavy defense, it is difficult to try and negotiate and then rely on a deal which can be abrogated in 3 days.

Senator PROXMIRE. But if we assume that they are going to make a preemptive strike, how expensive would it be for us to provide for effective civil defense under those circumstances for our people so that we can save most of our people as well as save our industrial facilities?

Mr. JONES. Senator, we did not estimate what it would cost to actually execute such a program in a situation where we were facing an attack by the Russians.

Senator PROXMIRE. But that is what you were assuming in the rest of the scenario.

Mr. JONES. We have estimated what it would cost to prepare for such a program so that if we did see the Russians moving out, then we could respond in kind and do so quickly and efficiently.

Senator PROXMIRE. You mean if they started to evacuate their people, we hit?

Mr. JONES. No; we could evacuate our people and protect our industry.

Senator PROXMIRE. I see.

Mr. JONES. The Soviets would then not have any major coercive bargaining advantage against the United States. Basically the kinds of things that need to be done involve planning and stockpiling, of rather pedestrian things like grease and plastic film and shovels and wheelbarrows—the things which would be used in preparation for an attack.

Senator PROXMIRE. Mr. Gansler preceded you, as you know, and made some kind of an estimate of cost. What was he talking about?

Mr. JONES. Well, Mr. Gansler, I think, was citing some of our figures which estimated that to get a very, very high level of protection, like 200 to 300 pounds per square inch, it would cost the United States something like \$2½ billion to \$3 billion. That is a one-time cost.

Senator PROXMIRE. So a lower level of protection would cost less?

Mr. JONES. Yes, sir, to protect against pressures in the vicinity of 40 to 80 pounds per square inch, we would estimate something on the order of \$200 million to \$300 million for the United States.

Senator PROXMIRE. What would that do with respect to our casualties?

Mr. JONES. The casualties could be reduced by evacuation. Once again, that is a planning cost which I would guess to be less than \$100 million to \$200 million for the whole United States. When you evacuate people, you incur some loss of time costs.

Senator PROXMIRE. You are assuming that we are going to have a day or two of notice before they act.

Mr. JONES. Yes, sir.

Senator PROXMIRE. A day or two is so crucial, I just wonder.

Mr. JONES. That is a very good point, sir, because I believe that the United States clearly has enough military capability that we could enforce the warning time. The Soviets would not dare to attack the United States without having first evacuated their people, and therefore we would have warning time; at least as much warning time as it took them to evacuate, which is about 3 days.

Senator PROXMIRE. No question in your mind, there is no way they could evacuate without our knowing it at once?

Mr. JONES. There is no question at all, we have very, very reliable means of doing that, and it is not just one way. There are at least three or four different ways that would provide us with very reliable warning.

Senator PROXMIRE. Congressman Mitchell?

Representative MITCHELL. This is one of the more grim moments for a Member of Congress, your testimony and the problem we are wrestling with. I must confess to you, Mr. Jones, I could not help but think about the closing lines in the movie, *The Bridge Over the River Kwai*—madness, just madness—that we have reached a condition where we can sit here and talk matter of factly about the possibility of destroying literally millions of human beings.

You didn't create that condition, but it is rather grim for me.

In the current controversy over whether the Soviets are ahead in terms of military superiority, or whether we are, there are several schools of thought, as you know. One school of thought maintains that

what is occurring is that the Soviets are spending more rubles and at a more rapid rate than we are spending dollars but the end result does not necessarily give them a military superiority over this Nation.

When we come down to the matter of civil and industrial defense, is it possible that that same kind of thinking could be applied? It may well be that the Soviets are spending more money, more rubles, but does it necessarily follow that their civil and industrial defense is really far superior to ours?

I know the state of disrepair of ours. I know General Bray testified before this committee, and others have testified before this committee on the rather horrible state of our civil defense preparedness, but would you address the question that I put to you, please? Is there a possibility, that maybe the money is really not producing the kind of protection which you suggested?

Mr. JONES. That is a very important point, Mr. Mitchell, and I think the preambular point that you made is also a very important one. The idea of talking about destroying millions of people is really madness, but it illustrates the difference in thinking between the Soviet Union and the United States. While we here in the United States have focused on destroying people, the Russians have focused on protecting them, making sure that they survive. And this Soviet perspective is a lot less mad than the way we Americans have been looking at it.

Now, as you know, this business of spending dollars and rubles and so on is really a difficult matter to assess. Moreover it is probably not really indicative of what is actually accomplished. Since we could not trust a rubles-dollar comparison as a method of assessing things, we looked not at what they were spending, but instead at what the Russians were actually accomplishing. We believe we have reasonably reliable indicators as to what they are actually accomplishing in terms of preparations that allow them to protect themselves. Our assessment of their protection is based on what we have seen them accomplish, not on what someone has said that they have spent.

Representative MITCHELL. Let me pursue this just a little bit more, and believe me, no way, do I seek to depreciate your research. You are the expert, but I think this has got to be made meaningful to the American people and that is what I am trying to do in my own way.

I can understand how your research would reveal or indicate that the Soviets are prepared to effectively protect their industry. It does seem to me to become rather speculative to suggest that their present state of preparedness would facilitate a rapid recovery, even after an all-out nuclear war. It is just difficult for me to comprehend—it strains credulity, Mr. Jones, to assume that we throw everything we have, and not only are the people protected, but there is this rapid recovery after a total, all-out nuclear war. Now, this is from the layman's point of view.

Isn't that somewhat speculative to assume that?

Mr. JONES. Mr. Mitchell, I must confess that as an expert, my original view, and the view I held during the time I was on the SALT delegation, was that there was no defense against nuclear war and that there was no realistic recovery from it. It was not until we started looking at what the Soviets were doing, and then went back and tried to correlate this with the recovery of Europe in World War II, the

recovery of the Japanese cities—Hiroshima and Nagasaki—for example, that we began to realize that recovery is feasible.

Mr. MITCHELL. They are not comparable situations, Mr. Jones. Hiroshima is not comparable to an all-out, total nuclear offensive on America's part.

Mr. JONES. We are aware of that, and as a result—in order to make an adequate assessment, we considered the consequences of a full-scale nuclear war in terms of a large scale model of the total Soviet economy and the total U.S. economy. We used the recovery factors demonstrated in World War II, and some of the wisdom that U.S. economists generated in studies of the European and Japanese recovery.

For examples, American impressions, which formerly included my own beliefs, are that Hiroshima was put out of business for a very long time. It turns out, however, that the day after the blast, bridges in downtown Hiroshima were open to traffic. Two days later, the trains started to run again, and 3 days later, some of the streetcar lines were back in operation.

The U.S. survey team came into the area 2 months after the bomb, and the surviving residents were back on their original homesites, starting to erect shelter out of whatever materials they could find. It is also very relevant to note, sir, that the U.S. team that surveyed Japanese cities prepared a list of very detailed recommendations as to how you should posture society to survive a nuclear war, and that all of those recommendations are contained in the Soviet civil defense documents, with improvements of their own added.

Most important is the fact that Hiroshima was very concentrated as a city—things were packed in pretty tight. If the Soviet Union had continued to keep all of their industry packed into the central cities, there is no way they could recover rapidly from a nuclear war. But, we have seen in major Soviet cities a pattern of dispersal where the industry is spread out as far as 60 to 80 miles from town. Furthermore, separation distances between factories are about 2 to 5 miles. With that kind of dispersal, industry becomes survivable.

So the point you made is well taken. If we follow the Hiroshima model—of keeping things packed together—you cannot recover; it is not possible. If industry is dispersed, however, recovery is possible.

Representative MITCHELL. Mr. Jones, you are suggesting then spread out and the immediate evacuation of American cities if there is a potential threat from the Soviets.

How do you answer the argument that is raised based upon experiences during World War II, and indeed, in Vietnam, that during the time of evacuation, that is when a nation is perhaps most vulnerable.

What is to prevent the Soviets from knowing that we are evacuating? Will not they know that there is indeed a wholesale evacuation from Washington—arteries clogged with equipment and human beings.

Isn't that when there is a possibility of maximum vulnerability?

Mr. JONES. Yes, sir, you have about 10 percent more vulnerability during the peak of an evacuation. The point you raise is that if the Soviets complete their evacuation to the point where they are in a well-protected posture before we start ours, then we are really in terrible shape. If we can start ours before they complete theirs, then there is still mutual vulnerability and they would be highly inadvised to initiate an attack at that point in time.

Representative MITCHELL. One last question.

Did I understand you correctly when you indicated that we can, through various methods, predict pretty accurately when that evacuation is going to take place and when it was going on in the Soviet Union?

Mr. JONES. Yes, sir, I believe—

Representative MITCHELL. And then would they not have the same capability with regard to evacuation of Americans from our cities?

Mr. JONES. Yes, sir, they would.

Representative MITCHELL. Then it seems to me, even in terms of your new survival pattern, we are still at a standoff with the Soviets.

Mr. JONES. Yes, sir, we would be. That is better than being in a situation where they are protected and we are vulnerable. When we are in a confrontation with them, it is better to push it to a standoff than to a situation where the United States has to give in.

Representative MITCHELL. Frankly, I think the story of America's neglect of civil preparedness and industrial preparedness has to be gotten out to the people who have got to do something about it. There is no question about that. Yet, if we get on par with the Soviet defense, once again we simply face a new standoff position, right?

Mr. JONES. Yes, sir.

Representative MITCHELL. You are suggesting that there is no remote possibility that the Soviets would in any way discuss civil-military-industrial defense as we revive détente and rapprochement. They would not consider listing defense as part of the SALT agreement.

Mr. JONES. Sir, I sincerely believe that they would not. There is no indication in any of the Soviet writings that they have ever accepted the mutual assured destruction theory of deterrence. They believe that their people should be protected. They believe that their society should survive. It is a value judgment to decide whether mutual destruction or mutual survival is the better approach, but clearly they are oriented toward survival, and I believe that they will stick with that. Certainly they have stuck with it very steadfastly through the 6 or 7 years that we have been negotiating with them on SALT.

Representative MITCHELL. Thank you, Mr. Jones. Thank you, Mr. Chairman.

Senator PROXMIRE. Isn't it true, Mr. Jones, that the Soviet Union has always had a very strong conviction that defense is essential, and stressed defense far more than we and most other very powerful countries have—that defense is of very great importance to them. And, isn't it also very true that they are concerned with the possibility, however remote it may be, that the rudimentary nuclear power that the Chinese have is one reason for their civil defense?

Isn't it conceivable that they may be spending the relatively modest amount that they spend on civil defense because they are concerned about a Chinese attack rather than an American attack?

Mr. JONES. Sir, it is indeed true that they have always stressed civil defense, and we can point out some of their writings that date back to 1932. The Chinese are also a factor in both their civil defense preparations as well as in their insistence on maintaining a very heavy level of air defenses.

Senator PROXMIRE. Well, let me just say, what makes me hesitate on this—and I think Congressman Mitchell, too—is that our nuclear arsenal is so colossal, we are told that we have about 15 tons of TNT for every man, woman and child in the world, the equivalent in our nuclear power. The Administration has cut back the budget for civil defense. They haven't increased it; they have cut it back.

I don't know of anybody in the Defense Department—heaven knows they are concerned with the defense of our country; that is their responsibility—who is calling for a big, vigorous civil defense effort.

Is there anyone in the Defense Department that supports your view, any group? Or any defense experts outside the Defense Department who feels that we should consider engaging in this kind of ambitious and very expensive civil defense effort?

Mr. JONES. Yes, sir, I believe that there are a number of people who are concerned in the Department of Defense. They are concerned because they see an imbalance in vulnerability that could lead to a serious problem—despite the size of our nuclear arsenal. Regardless of how many tons of TNT we have for each man, woman and child, we nonetheless, if you look at how much of the Soviet territory our surviving weapons could damage, it is not much. It is only about 3 percent.

Going back to the previous point, I think a large amount of the Soviet civil defense preparation is multipurpose. It certainly can protect against the Chinese. It certainly can also protect against the United States.

I thought it was significant that the Soviets accelerated their civil defense preparations at about the time that we were signing the ABM treaty in 1972.

Senator PROXMIRE. Have you discussed your proposal with Mr. Gansler or anybody on the Defense Science Board?

Mr. JONES. The Defense Science Board, sir, is reviewing the subject. They started a little over a year ago to look into the Soviet defense.

Senator PROXMIRE. Did you talk to them about it?

Mr. JONES. Yes, sir, we did.

Senator PROXMIRE. Have you talked to anybody on the National Security Council?

Mr. JONES. Yes, sir, we have.

Senator PROXMIRE. What reaction did they have?

Mr. JONES. The National Security Council people did not have much reaction. They had not, at that time, done any of their own studies, and their reaction was therefore to initiate a study within the Government to see if they could not confirm the findings that we had.

Senator PROXMIRE. Can you tell us whether the U.S. intelligence supports your estimate of the Soviet civil defense capabilities and strengths, or do they dispute it?

Mr. JONES. We get our data from them, sir. So we are essentially basing our findings on the results that their research has produced.

Senator PROXMIRE. So your estimate of the Soviet civil defense capabilities clears with theirs.

Mr. JONES. Yes, and if I might also point out, the Joint Strategic Planning Staff at Omaha has also done a very impressive amount of work on this subject, and our results are reasonably consistent with theirs.

Senator PROXMIRE. Well, in a nuclear confrontation, what gains do you see for the Soviet Union that would outweigh the terrible risks that they have, the certainty that their cities would be leveled, that hundreds of thousands, probably millions of their people would be killed? What would be the reason for it?

Mr. JONES. Well, Senator, if I could reiterate, I don't believe the Soviets want a nuclear war. They will try to avoid one. I don't believe they will try to attack the United States unless they are quite sure that there is no other alternative. However, I believe that the Russian intent is to try to get the fruits of war without having to fight a war. With their excessive military strength they can get what they want without having to fight for it. My fear is that we are going to get into confrontations with the Russians that will cost us—and they will cost us heavily in terms of the American life style, in terms of the resources that we need from overseas in order to run our industry and maintain our quality of life.

An additional concern is that I cannot think of any world war that started intentionally. I think they have all started by accident. Somebody got into a box in a confrontation, they were trying to get something and they didn't really think the opponent was going to fight too hard for it—but they were wrong. They miscalculated.

Senator PROXMIRE. Well, you see, in our staff briefing in August by the CIA and the DIA, they told the committee that the evidence isn't in on the Soviet civil and industrial defense, and they don't expect a full picture until later, 1977, and even then they won't know whether or not it means anything dangerous. That is what they told our staff in August.

Mr. JONES. Well, I submit, Senator, that there are some disagreements internally in the administration on that subject. There are two views on it, and I would suggest that it would be best for the committee and the committee staff to look over the intelligence personally rather than take any one person's word—mine or anyone else's.

Senator PROXMIRE. Our staff has done that.

Even if the Soviets harden a lot of their industrial capacity, which would entail, incidentally, a tremendous expense if they did it, wouldn't it be possible to cripple their production by targeting a few critical choke points, such as rail and communication centers, powerplants and essential basic industries like ball bearings and so forth?

Mr. JONES. Sir, we did look at that question. As a matter of fact, we felt that a good way to achieve deterrence might be to try to find the Achilles heel in the Soviet economy and attack that. So far the search for an Achilles heel has been unsuccessful. A very detailed study has been made, for example, on Soviet transportation, and the determination was that there is no way to target transportation so that it would delay Soviet recovery.

Senator PROXMIRE. Well, why couldn't we target, for example, the Soviet troops on the Soviet border, leaving the USSR vulnerable, targeting Soviet bunkers around Moscow, leaving them leaderless, and of course, destroying some of the incentives for some of the leaders to make decisions.

Mr. JONES. Well, sir, as to the Chinese border question, if the Soviet troops are so cooperative as to stay in their barrack areas, we surely

could blow them up. On the other hand, if they moved those troops out, which seems to be the normal mode when they are in a period of crisis, there is no way we could cover enough area along that border to destroy a significant fraction of those troops.

The matter of targeting Soviet leaders in Moscow bunkers perhaps is in reference to some remarks that were made on the floor of the House a month or so ago. It was alleged that the Soviets had four hardened bunkers around Moscow and the leaders would go there, and we could have a 99 percent probability of destroying those leaders.

It seems a little unreal to begin with that the Soviet leaders would go to bunkers where they have a 99 percent chance of being killed when they can simply march out with the rest of the peasants and have a 98 percent chance of living.

[General laughter.]

Mr. JONES. And the other thing, of course, is that it is in fact incorrect to imply that there are only four hardened bunkers around Moscow. There is an extremely large number of such bunkers and I believe that—well, I know, in fact, that the answer is available from the intelligence community. If you look at the protection afforded by the extremely large number of bunkers in Moscow, it is very impressive.

Senator PROXMIRE. Well, now, the cost of the proposal that you have troubles me.

When you talk on page 69 of the Boeing study [see appendix II, p. 122] about not being able to disperse plants or machines without industrywide regulation, doesn't that mean the Government will have to subsidize whole industries in order to force them to build uneconomical but less damageable plants? The cost to the Government may be a couple of billion dollars, but the cost to industry would be considerable if they have to build plants from now on that were safe or safer from nuclear attack.

Mr. JONES. That is a good point, sir. We are trying to figure out if there isn't some reasonable way or some cheaper way to solve that problem.

I think Government might be able to work that problem through regulation, building codes and zoning codes and so on. It is true that there would be a cost to society. But it turns out that the urban sprawl, which many of us have condemned here in the United States, has already given us a fairly effective amount of dispersal. The only difficulty for a company like Boeing is that we have almost all of our unique machine tools in a complex of four buildings. If we could find some way to tow those tools out in a period of crisis, and essentially duplicate the performance of the Soviets in World War II—when they relocated their entire aircraft industry in a fairly short period of time—we could probably wind up having a form of protection that would not incur large peacetime costs.

Senator PROXMIRE. Now, when you estimate on page 70 [see appendix II, p. 123], \$2½ to \$3 billion for nationwide hardening to protect against blasts of 200 to 300 pounds per square inch, including the cost of industrial dispersal from damages in construction, is that estimate for machinery only?

Does it include all industry or just essential defense plants?

Mr. JONES. It included all U.S. industry, and it was industrial protection only. It did not include protection of population.

Senator PROXMIRE. What would that be, the additional protection of population?

Mr. JONES. Our guess, and it is a guess, not an estimate, would be that the protection of the population would primarily be a planning operation, and the cost of that would be on the order of, say, \$200 million to \$300 million.

Senator PROXMIRE. Your idea is simply that the population evacuates the cities and spreads out on the countryside, and does their best to get underground somewhere—I think that is what you said—for a day or two.

Mr. JONES. Yes, sir, and it is a very important point, sir, because it does characterize the difference between the U.S. civil defense approach of the 1960s and the Russian approach. The U.S. approach was to build backyard shelters. This approach would have left the people concentrated in easily destroyable bunches. Moreover, it represents incurs an unacceptable peacetime cost.

The Russian approach is to make sure that they have lots of shovels. Their people walk out to avoid concentration in destroyable bunches. The kind of shelters that they tell their people to build after they have evacuated can be built in about 10 hours with hand labor.

Senator PROXMIRE. Mr. Jones, I don't mean to be critical, because I think you performed a very, very useful service in looking forward, as you have on this, and making a very substantial investigation you made of this, and very thoughtful recommendations, but it seems that the cost would be very great. On the basis of all my experience, the cost of every Federal program I have ever seen, where they say it will only cost \$2 billion or \$3 billion, is that you are lucky if it costs 10 times that much.

When you come to something like civil defense affecting this country, I would be surprised if your scenario didn't cost \$20 billion, \$30 billion, \$40 billion, \$50 billion, if we were going to provide the kind of protection which you indicate, and I wonder if that kind of colossal burden, tremendous expense, sterile in terms of any kind of economic benefit, is worth the price.

Mr. JONES. Well, if you look at what the country is worth, I think—

Senator PROXMIRE. Well, the risk seems so remote.

Mr. JONES. The risk of war may be remote but the risk of confrontation is not. If you look at what we could lose in a confrontation where we are bargaining at a disadvantage, even if it does not lead to warfare, we could easily lose that amount of money.

I recognize that a bureaucracy could cause a civil defense program to cost a huge amount but if there were a dedicated effort to try to keep the cost down it could be kept down.

Senator PROXMIRE. Well, I think there is something to that, but the difficulty is that it is not a static situation. We build up our defense, they build up theirs. We try to surpass them, they try to surpass us. It is another race, and it is a race in which we can get all kinds of refinements and complications and additional costs with—I just wonder what kind of a security any kind of an arms race, even a defensive arms race, really gives us.

Mr. JONES. Well, I think the security of a defensive arms race is better than the security of an offensive arms race, and that tends to be the issue, here. If we go for civil defenses, we could probably get by with less offense than would otherwise be required in trying to maintain a comparable level of security.

Senator PROXMIRE. Well, of course, if they built up their defense, we have to build a bigger offense to overcome their defense, they have to build up a bigger offense to overcome our defense.

So there is a reciprocal competition here that would escalate it, no matter how good our intentions are.

On what do you base your guesstimate on page 74 [of the Boeing Report, see appendix II, p. 126] that the Soviet Union could recover from a nuclear attack in 2 to 4 years while it would take the United States 12 years?

You said yourself that there are several unknowns in the Soviet program.

Mr. JONES. There are some unknowns, but what we did was get a large amount of data, from several studies, including several that we did not do. The data was pulled together and correlated to obtain consistent estimates of recovery time. We discovered that the survival of the work force was the most important ingredient in recovery, and to that extent, the Soviets have a very large leverage because of their population-evacuation capability.

If you lose half the work force and none of the capital, there is about an 8- or 9-year minimum for recovery. This assessment is based on the experience of postwar recovery of several countries.

Senator PROXMIRE. But there has been nothing remotely like this, and that Hiroshima experience is far, far, far different. That was one relatively small, little explosion compared to the kind of colossal power that is just beyond imagination.

We are told that the Hiroshima bomb is a tiny fraction, one-tenth of 1 percent of the power that we have, or that the Soviet Union has now.

Mr. JONES. That is correct, Senator, and we did not use the Hiroshima recovery model as the sole basis for this study. A large part of the surrounding economy at Hiroshima was not destroyed, and therefore, as you correctly point out, that city alone does not provide a sufficiently comprehensive illustration.

Senator PROXMIRE. Exactly.

Mr. JONES. We had to do what is, essentially a modeling of the entire Soviet economy, and the total level of destruction that would occur there in order to arrive at these answers.

Senator PROXMIRE. Congressman Mitchell?

Representative MITCHELL. Mr. Jones, one more question. Am I right in assuming that a number of variables will determine the decay rate of radiation—climatic conditions and megatonnage involved and that sort of thing?

Mr. JONES. Yes, sir.

Representative MITCHELL. To the extent that we have an array of variables that will affect the decay rate of radiation, would there not be a great latitude in terms of the timespan in which the decay rate might take place, within 48 hours in some instances, in other instances it might be as much as 3 weeks?

Mr. JONES. That is a good point, Mr. Mitchell.

Representative MITCHELL. The point I am trying to get to is you very clearly and specifically indicated a Russian recovery within 8 days with 97 percent of the work force back at work.

Did you assume the maximum best conditions for all of those variables falling into place?

Mr. JONES. We assumed, sir, what would be, from the Russian point of view, the worst case. We assumed that we detonated our weapons at the minimum altitude that the fuse will permit them to detonate, therefore creating the maximum amount of fallout. We assumed wind conditions which distribute fallout in the worst possible manner. We patterned these weapons in a pattern that would create the worst possible fallout conditions, and we assumed a survival level in U.S. forces that would give us the maximum amount of such weapons targeted against the Soviet Union.

And so the data which you have in your report is based on that kind of a worst case assumption. In any other case it would be better.

Moreover, we did credit the Russians with possible use of radio-protective pills or other things like that which the Soviets mention in their literature and which we frankly know very little about.

We also assumed, when we talk about a lethal level, 200 rads, which is not a lethal level but it is a level where about half the people become temporarily ill.

So when we gave these figures, we gave what was the worst case on radiation.

Representative MITCHELL. Thank you. I have no further questions, Mr. Chairman.

Senator PROXMIRE. Let me just say in conclusion that I think it has been most interesting testimony this morning. Mr. Gansler told us about what is the unfortunate condition of our prime contractors, and even worse condition of subcontractors. We have not made the kind of realistic assessment of our mobilization capacity of where we are short and what we should do to improve it, and we certainly have to do that, and this committee will certainly do its best to persist in trying to secure that from the Defense Department.

We have had a very enlightening and helpful presentation from you, Mr. Jones—most impressive. I think that although I, as you must have been able to tell from my questions, tend to disagree with many of your assumptions, I think that you have certainly made it clear that we have to take a far closer look at this than we have, recognizing the grim possibilities here. It appears that the Department of Defense has not come up with answers to the kind of challenge that you have made here this morning.

So we certainly will persist in trying to get some clear answers from them on what our civil defense posture ought to be.

Thank you very much.

[See Additional Questions for the Record, appendix III, pp. 167-220.]

The committee will stand in recess until tomorrow morning at 10 a.m.

[Whereupon, at 12:15 p.m., the committee recessed to reconvene at 10 a.m., Thursday, November 18, 1976.]

APPENDIX I

JACQUES S. GANSLER

Mr. Gansler is Deputy Assistant Secretary of Defense responsible for Materiel Acquisition. Prior to this, he was Assistant Director of Defense Research and Engineering, first responsible for Electronics and later for R&D Planning.

Before joining the Office of the Secretary of Defense, Mr. Gansler was Vice President and Director of Business Development at the Avionics Division of International Telephone and Telegraph Corporation (ITT).

He previously held management positions with both Singer Company and Raytheon Corporation.

Mr. Gansler has a B.E. from Yale University, an M.S. from Northeastern University (both in Electrical Engineering) and an M.A. in Political Economy from the New School for Social Research. He has completed his course work for a PhD in Economics at American University. He has been an instructor in Servomechanism, and has published numerous professional papers.

MR. THOMAS K. JONES

Mr. Jones is the Program and Product Evaluation Manager for the Boeing Aerospace Company. In this capacity he directs analyses and studies of national requirements, evaluates the capabilities of present and potential product lines to satisfy national requirements, and determines the allocation of research budgets to product programs.

From June 1971 thru August 1974, Mr. Jones was employed by the Office of the Secretary of Defense (DDR&E) in support of the Strategic Arms Limitations Talks (SALT). In this assignment, he served as Deputy Director, OSD SALT support group and as Senior Adviser to the OSD member of the U.S. SALT delegation. Through his appointment as a consultant to the Defense Science Board, he is continuing to support the SALT activities.

From 1954 until his employment by the Department of Defense, Mr. Jones was employed by Boeing in a number of design engineering, system engineering, and management assignments. These assignments included work on options to extend the viability of the Minuteman ICBM system, study of strategic tanker systems, analysis of ABM systems, system engineering of manned space systems, and design of strategic bomber systems.

APPENDIX II

D180-20236-1

**INDUSTRIAL SURVIVAL AND RECOVERY
AFTER NUCLEAR ATTACK**

**A REPORT TO THE JOINT COMMITTEE
ON DEFENSE PRODUCTION
U.S. CONGRESS**

November 18, 1976

Prepared by:
The Boeing Aerospace Company
A Division of The Boeing Company
Seattle, Washington

D180-20236-1

INTRODUCTION

The United States and the Soviet Union both recognize and adhere to a policy of nuclear deterrence. The U.S. approach to deterrence, recently reaffirmed by Secretary of Defense Donald H. Rumsfeld, is to "have some minimum force which can survive even a well executed surprise attack in adequate numbers to strike back with devastating force at an enemy's economic and political assets."¹ This doctrine, which is the foundation of U.S. national security, is more commonly referred to as assured destruction. The U.S. sought in the Strategic Arms Limitations Talks (SALT) with the USSR to ensure continued viability and to gain mutual acceptance of the assured destruction doctrine. These efforts culminated in signing of a treaty limiting antiballistic missile (ABM) deployments to low levels, the premise being that such deployments undermined deterrence by protecting an aggressor's economic and political assets against retaliation.

Civil defenses have much the same effect on deterrence that an extensive ABM deployment would have, for civil defense undermines deterrence by protecting an aggressor's economic and political assets against retaliation. Paul H. Nitze recently noted that the Soviet Union has adopted a program of civil defense preparation and concluded that "the ability of U.S. nuclear power to destroy without question the bulk of Soviet industry and a large proportion of the Soviet population is by no means as clear as it once was, even if one assumes most of U.S. striking power to be available and directed to this end."²

Many Americans find it difficult to believe that civil defenses could provide effective protection against nuclear weapons. The whole idea is contrary to the widespread notion that nuclear war would be the end of all mankind and that the U.S. possesses a vast "overkill" capability. However, the national security of the United States depends not on what Americans believe but on what the Soviet leaders believe. Examination of Soviet literature reveals that they have no equivalent of the West's concept of assured destruction. On the contrary, the Soviet literature speaks of their capability to survive and recover from a nuclear war; and some spokesmen even hold out the possibility of victory from such a war.

The existence of even very effective civil defenses is not likely to alter the Soviet's present objective of avoiding war, particularly nuclear war. However, the Soviets view civil defense as a force complementing their growing offensive power. The Soviet civil defense chief, Colonel-General A. T. Altunin, wrote in 1974 of the relationship of civil defenses to the first-strike counterforce mission of the Soviet offensive forces:

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While the Armed Forces take as their objectives to prevent the use of destructive means against the rear of a country by the destruction of the attack weapons or the interception of the weapons on their way to their target, Civil Defense, by carrying out protective measures and the thorough preparation of the population seeks to achieve the maximum weakening of the destructive effects of modern weapons.³

Given the double advantage of offensive power, which, according to some estimates⁴ constitutes a war-winning capability, and civil defenses to mitigate the consequences of what the Russians characterize as possible desperation moves by the United States, the Russians could become much more aggressive in future confrontations. Consider the situation that would be faced by a U.S. President if in some future confrontation the Soviets evacuated their population and executed the final actions to protect their industry. The consequences of further escalation would be much more disastrous to the United States than to the Soviet Union. Hence, the "balance of terror" would no longer be balanced; it would favor the Soviet Union. It would also create great pressures for the United States to make concessions to avoid war. For these reasons, the matter of civil defense is crucially important to the future security of the United States as well as to its political and economic future.

The purpose of this report is to address two questions regarding civil defenses:

1. Can Soviet industry be effectively protected by the methods described in Soviet literature?
2. Is it feasible to apply similar concepts to protect and ensure postwar recovery of U.S. industry?

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FACTORS INFLUENCING INDUSTRIAL RECOVERY

After World War II, public attention was focused almost exclusively on the awesome destructive power of nuclear weapons. As a result, the industrial recovery of bombed cities such as Hiroshima went unnoticed. However, the fact that industry can and will recover from even nuclear devastation is evident from the published findings of the U.S. Strategic Bombing Survey of Hiroshima. The day after the explosion, bridges into downtown Hiroshima were open to traffic, and electric service was restored in some areas. On the second day, trains were again operating. By the third day, some streetcar lines resumed service. Within 9 days, telephone service was restored to the city center. In the outlying areas of the city, water, sewer, and gas services were never interrupted. When the U.S. survey team arrived 2 months after the explosion, the survivors were starting to erect dwellings on their original homesites.⁵

A number of studies done in the U.S. have examined the factors influencing industrial recovery of a nation following a nuclear attack. Taken collectively, the results indicate that survival of the work force is by far the most important factor in industrial recovery. Figure 1, which was derived from the results of several of these studies, compares the relative importance of the work force and of capital assets to recovery time. As can be seen, if one-half the work force were destroyed, recovery would take three times as long as it would take if half the capital assets were destroyed. The importance of the work force was dramatically demonstrated in Hiroshima, Japan. Within days of the attack, manual labor alone was able to reopen the bridge that was the target of the atomic bomb (Figure 2). The restoration of streetcar service in Hiroshima also resulted from a concentrated effort by the work force. They replaced trolley wires and realigned rails, as shown in Figure 3, and were the major contributors to the early restoration of services.

Second in importance to survival of the work force is survival of the capital assets of a country. In this regard, the machinery of production is more important to prompt recovery than the buildings. The main Messerschmitt plant at Augsburg was destroyed by over 500 tons of bombs. Thirty buildings and 70% of stored material were destroyed, but only one-third of the machine tools were damaged. Hence, production capacity was reduced by only 35%, and the plant was back in full production in little over 1 month.⁶ It was also demonstrated in Hiroshima that industrial functions do not depend on survival of the buildings. Figure 4 shows a power converter station that was returned to operation with only a weather cover constructed of canvas, lumber, and ropes.

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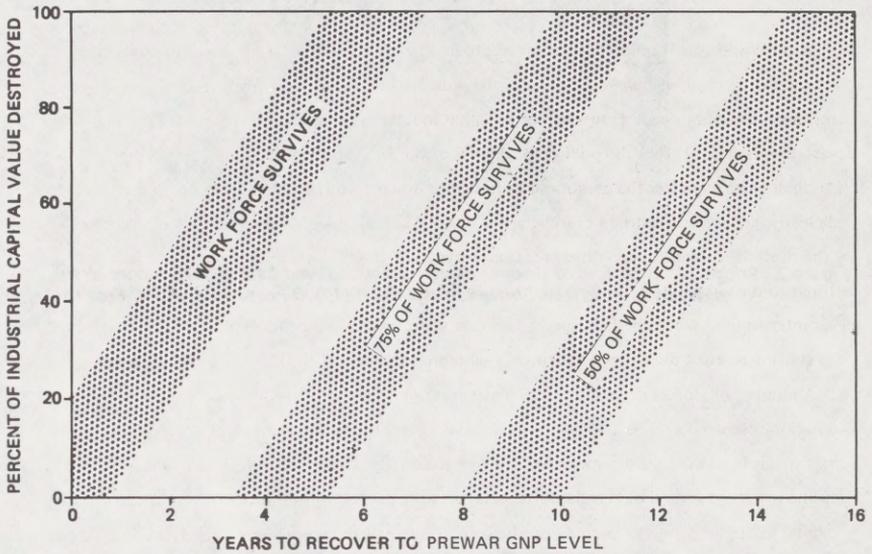


Figure 1. Postwar Recovery (1985 Time Period)



Figure 2. Intersection of Bridge 23 (Left) and Bridge 24 (Right). All Damage From Blast Effects. Bridge 23 (860 Feet to Gz, 2,170 Feet to Az). Bridge 24 (1,000 Feet to Gz, 2,230 Feet to Az).

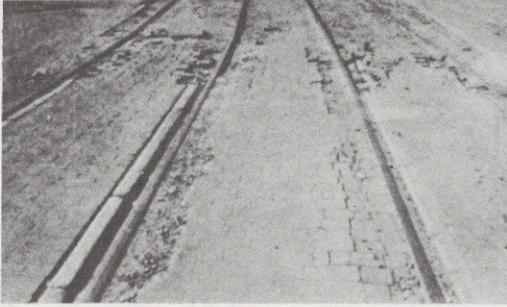


Figure 3. Bridge 24. West End of Bridge. Streetcar Rails Moved Laterally 15 Inches to the North When Blast Effects Shifted Bridge Deck (1,000 Feet to Gz, 2,230 Feet to Az).

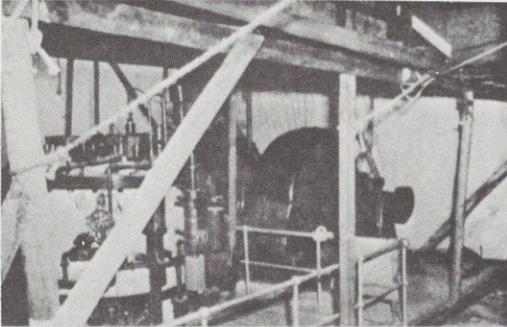


Figure 4. Building 35B. Rectifier and Rotary Converter in Operation Under Temporary Canvas Shelter.

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The Russians have themselves demonstrated that industrial buildings are not essential to continued production. To protect their aviation industry from German bomber attacks, the Soviets in 1941 used railroad cars to relocate approximately 1,523 industrial enterprises, including 1,360 large war plants, to the Trans-Volga, Urals, Eastern Siberia, and to Kazakhstan and Central Asia. This relocation involved 85% of the entire aviation industry. At many sites, resumption of production began even before temporary facilities were constructed. Machines were set up on temporary platforms in the open, and work was accomplished in weather that reached -40 degrees. Within a year, production rates exceeded the highest rates that had been achieved prior to the relocation.⁷

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PROTECTION OF THE INDUSTRIAL WORK FORCE

In the United States, public perceptions of nuclear war are oriented mainly toward population fatalities. Many Americans believe that the nuclear arsenal of the U.S. is sufficient to destroy the entire Soviet population several times over, a capability commonly referred to as "overkill." However, "overkill" is a myth rather than a real capability possessed by either the U.S. or the USSR. More important, Soviet authors point out the fallacy in the "overkill" argument, stating that such a theory is based on an "over-simplified, one-sided approach."*

In order for Americans to judge the true position of the U.S. in a future nuclear confrontation, it is first necessary to establish some perspective as to how damaging a U.S. nuclear retaliatory strike might be to Soviet targets. Briefly summarized, the U.S./USSR survival capabilities are as follows. Given a first strike by the USSR, the U.S. would have on the order of half of its nuclear arsenal (ICBMs, SLBMs, and bombers) surviving. If these weapons were programmed to achieve maximum destruction of industrial targets, the entire U.S. surviving inventory could destroy unprotected people in, at most, 3% of Soviet territory. If the people were protected by simple, foxhole-type shelters, the lethal area that could be imposed by the U.S. surviving arsenal would be reduced to one-third of 1% of the Soviet land mass.† People in the remaining 99-2/3% of the Soviet Union would survive. There would be no lingering lethal fallout.

If the U.S. were to program all its weapons to detonate at ground level, a lethal level of fallout might be spread over a wider area, but such an action would cut in half the lethality of the weapon against industrial targets. With favorable weather conditions, a lethal level of fallout could be spread over up to about 15% of Soviet territory. However, simple shelters can be constructed in a few hours to protect people against fallout until the radiation intensity decays to a nonlethal level. Figure 5 shows that within a week after a worst case U.S. retaliatory attack, the Russians could be out of their shelters for at least an 8-hour work day in 97% of Soviet territory.

The above figures clearly indicate that survival from nuclear war is a matter of dispersal. If the Soviet population remained concentrated in a small area (the top 200 cities total about one-fourth of 1% of Soviet land area), their population losses would be heavy. Conversely, if the population is spread out and sheltered, losses will be reduced to a low level. Figure 6 illustrates this point. If the Soviet urban population remains in the cities, the Soviet Union would lose most of

*For a more complete discussion of the Soviet views on "overkill," see *The Role of Nuclear Forces in Current Soviet Strategy* by Leon Goure, Foy D. Kohler, and Mose L. Harvey, Center for Advanced International Studies, University of Miami, 1974, p. 60.

†The calculations from which these figures are extracted have been furnished to the Committee at a higher classification.

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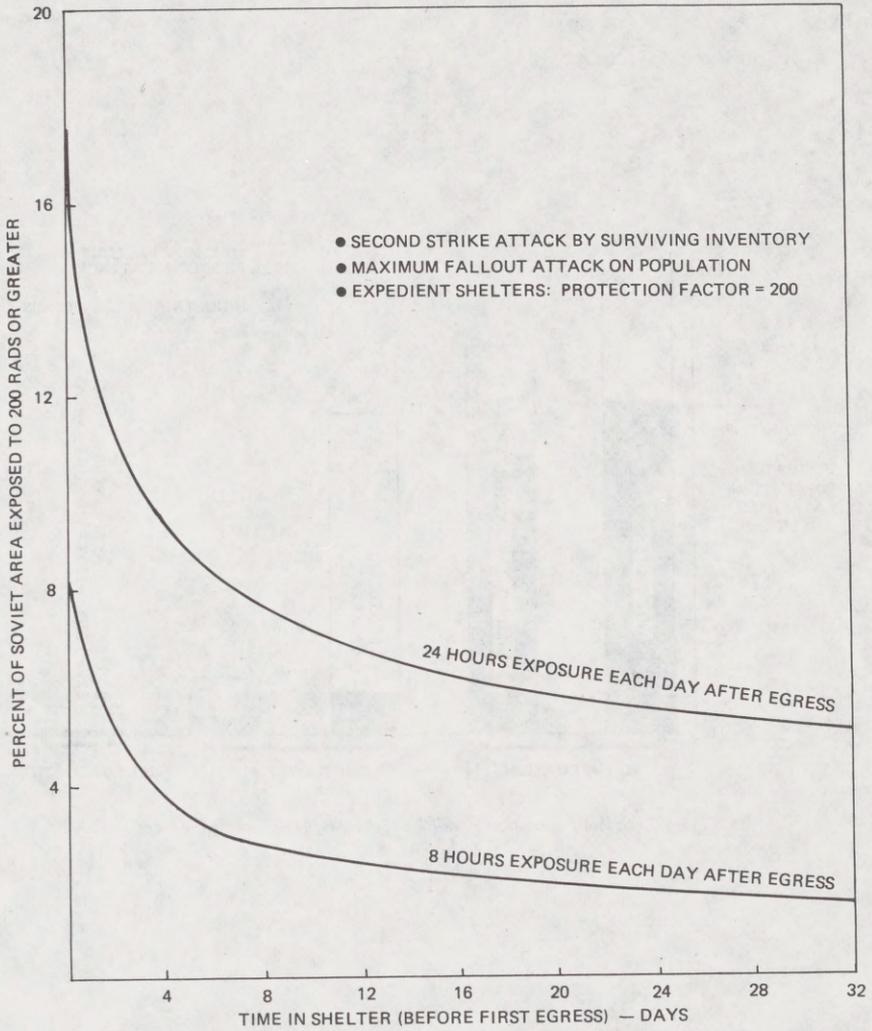


Figure 5. Worst Case Effects of U.S. Surviving Nuclear Arsenal

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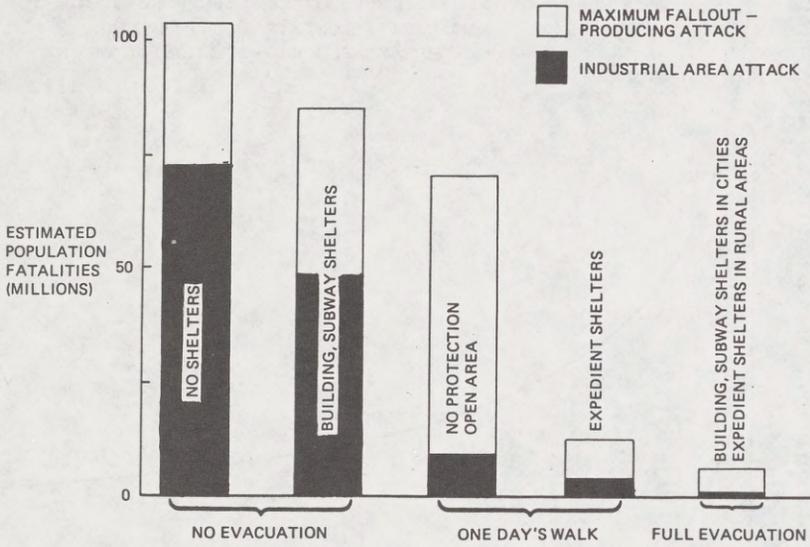


Figure 6. Soviet Population Fatalities (Surviving U.S. Strategic Forces)

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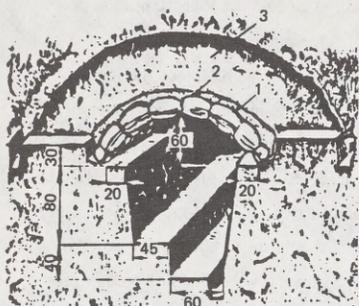
its industrial work force. Even use of urban shelters would not help much against a U.S. attack designed to destroy population. However, using only minimal dispersal—such as could be obtained by ordering the population to walk for one day away from the cities—fatalities could be significantly reduced if simple shelters of the type shown in Soviet manuals (Figure 7) were constructed or if the U.S. followed a policy of retaliating against industrial targets. A full 3-day evacuation of the type called for in Soviet plans would reduce their fatalities to no more than 10 million people. This latter figure approximates that given by a Soviet civil defense text.⁸

The conclusion is that the Soviets can, during the early stages of a crisis, take the steps necessary to ensure a very high level of survival for their work force. The most important prerequisite to such protection is first, planning, and second, the existence of a trained cadre. Soviet literature and textbooks provide extensive detail on their plans and preparations. These preparations, in addition to comprehensive planning for evacuation, include provisions to protect food supplies and manage crops and livestock, to ensure medical care, and to maintain the means of government and party control. A very comprehensive analysis of the Soviet preparations is published in *War Survival in Soviet Strategy* by Leon Goure.

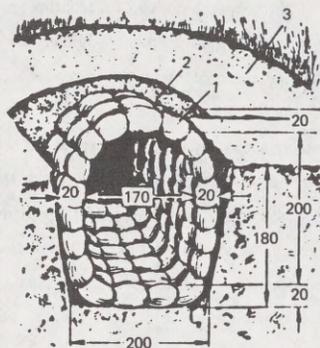
The U.S. work force could be protected nearly as well as their Soviet counterparts if the U.S. initiated a basic civil defense program. The United States does, however, need to overcome some disadvantages; first, the U.S. has less territory over which to disperse its people; second, after attacking U.S. forces, the Soviets would have more weapons with which to attack the U.S. cities and evacuation areas (the amount of Soviet superiority is shown in Figure 8.) The net effect of these factors is illustrated in Figure 9.

The Soviets could cover the entire continental U.S. with a level of fallout so high that for at least a few days shelter would be required, while the U.S. could cover only 15% of Soviet territory with lethal fallout. More of the U.S. population would have to stay in the shelters for a longer period of time than their Soviet counterparts. After one week, Americans in 15% of the U.S. would still be unable to leave the shelters for an 8-hour work day—compared to about 3% for the Soviet Union. The higher level of radioactive contamination received by the U.S. would demand greater reliance on radiation monitoring, rescue activities, and on area decontamination work. (Soviet procedures for these activities are noted in their manuals and described in training exercise reports.) It should be noted that almost half of the potential radioactive contamination of the U.S. would result because the U.S. has at present largely abandoned its air defenses, and the Soviet Backfire bombers could penetrate unopposed to U.S. targets. Restoration of even rudimentary air defenses would eliminate most of the potential contamination of the U.S. by the Backfire force.

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SHELTER IN CLAY GROUND WITH A COVERING OF CANE-REED ARCHED FASCINES: (1) FASCINES; (2) LAYER OF COMPACTED CLAY 3-5 cm THICK; (3) SOIL LAYER 70-80 cm THICK



SHELTER IN SANDY SOIL MADE OF ANNULAR BRUSHWOOD FASCINES: (1) FASCINES; (2) LAYER OF COMPACTED CLAY 3-5 cm THICK; (3) SOIL LAYER 70-80 cm THICK

Name of materials and designation	Shelter for 10 persons				Shelter for 20 persons		Shelter of hooped framework	
	Single row		Double row		Double row		10 persons	20 persons
	Without covering of the sloping part	With covering of the sloping part	Without covering of the sloping part	With covering of the sloping part	Without covering of the sloping part	With covering of the sloping part		
Cane reeds (brushwood), m ³	12	13	11	10	17	15	15	23
Poles, m ³	0.04	0.6	0.04	0.5	0.04	0.6		
1 mm wire, kg	4	4	3.5	3	5.5	4	7.5	13
Canvas, m ²	17	10	17	10	17	10	16	16
No. of persons in brigade	12	12	12	12	14	14	12	16
Preparation of basic components for cover, hours of labor	40	35	30	25	50	40	75	105
Building the shelter, hours of labor	80	85	75	80	110	105	95	150
General construction time, hours	11	11	9	9	12	11	15	16

Figure 7. Soviet Shelter Concepts

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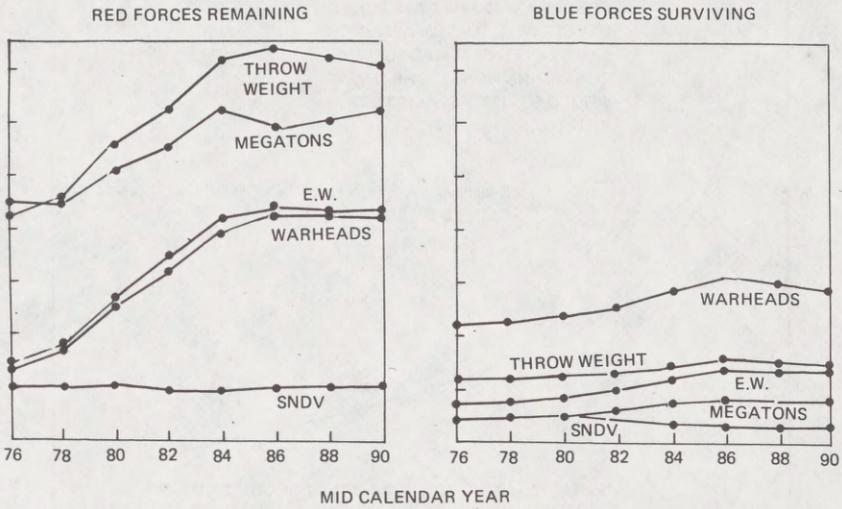


Figure 8. Capabilities After Soviet Union First Strike

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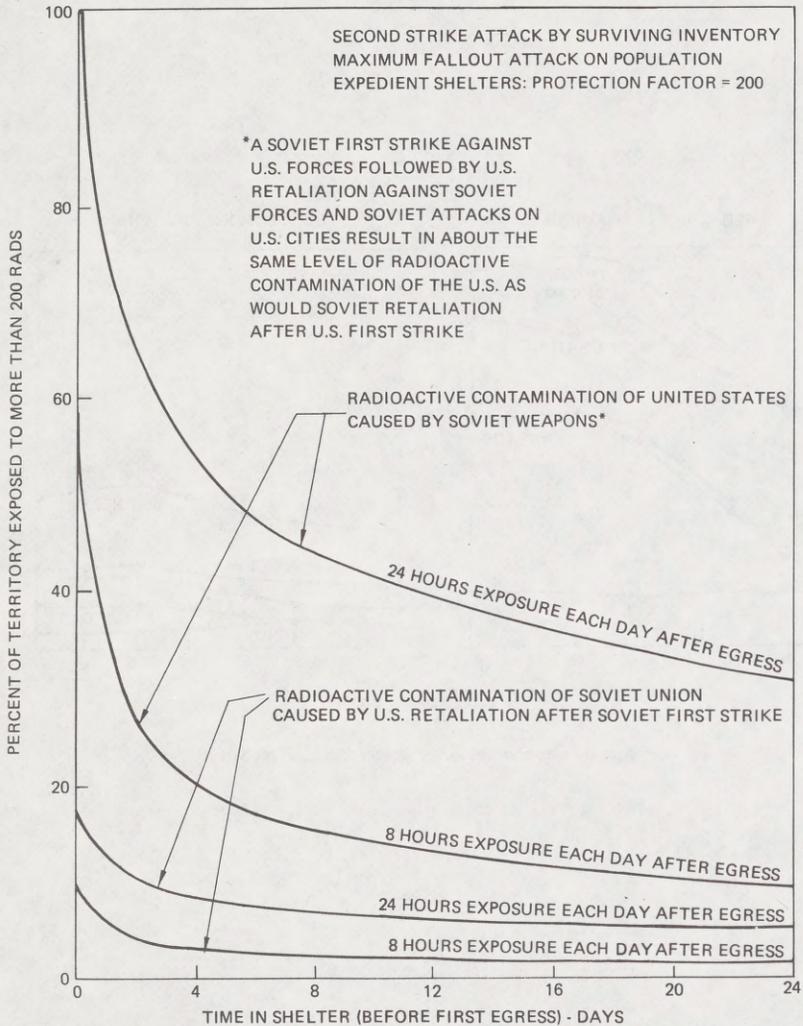


Figure 9. Worst Case Comparative Effects of Surviving Nuclear Arsenal

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PROTECTION OF INDUSTRIAL CAPITAL ASSETS

The findings of the U.S. Strategic Bombing Survey gave strong indications to the world community that survival of a country's population and recovery of its economy was possible. The recommendations of this survey team were of even greater importance in establishing what measures were necessary to protect against the effects of nuclear warfare. The major recommendations are listed below:

1. Dispersal of critical industry into small communities. It was noted specifically that Hiroshima, from an industrial point of view, was not a good target for a nuclear weapon because of the remoteness of the industrial concentration from the center of the city.
2. Bomb-resistant construction, either underground for highly critical and compact industries or earthquake-resistant construction
3. Passive measures, including:
 - Low building density
 - Natural and man-made firebreaks
 - Protection of fire departments, pumping, stations, power systems, and communication centers

Although the U.S. chose to ignore the findings, the Soviets were attentive to such requirements and implemented a civil defense plan that incorporated the U.S. team's recommendations together with some valuable innovations of their own. Of the U.S. recommendations, dispersal is by far the most effective form of protection against nuclear weapons. The U.S. retaliatory arsenal, even if devoted entirely to industrial target destruction, could cover no more than 2% to 3% of the Soviet Union and no more than a few thousand aim points. Hence, industrial installations in the USSR will survive if they are dispersed over more area or more aim points than the U.S. can cover.

Since its implementation in 1932, the Soviet civil defense program has established effective procedures for industrial dispersal. These can be divided into four types. The first type is to disperse new industry away from the major cities. During the last decade, the Soviets have located more than three-fourths of their new industry in small and medium-sized towns. A second type of dispersal is to separate all new industrial sites by a distance adequate to ensure that a single U.S. warhead cannot destroy two adjacent factories. A third type of dispersal is accomplished by separating the individual factory buildings within a complex; this would reduce the effectiveness of smaller weapons; i.e., more than one weapon would be required to destroy a single factory. Figure 10 illustrates these types of dispersal as practiced by the Soviets. The two factories shown are

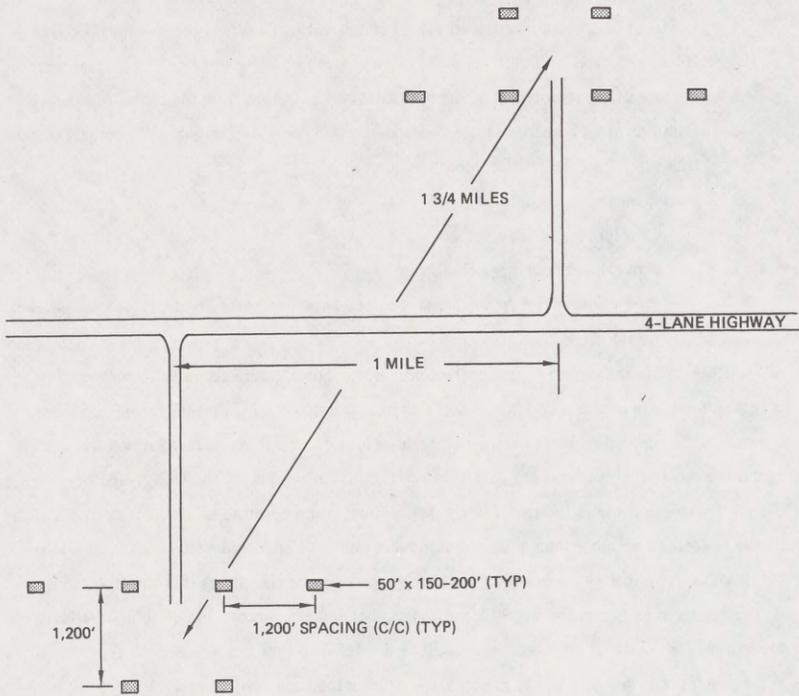


Figure 10. Industrial Dispersal

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located many miles from the nearest large city and are separated by nearly 2 miles. Instead of using a single large building, the factory is comprised of several small buildings separated by nearly a quarter of a mile; the intervening space is typically plowed ground or greenbelts that form a natural firebreak. For comparison, Figure 11 shows to the same scale, a relatively new U.S. industrial complex near a small town. Two different companies share this complex, and the buildings of each company are large and close together. As can be seen, the U.S. industrial complex is more vulnerable to nuclear attack than the dispersed Soviet site. To destroy the Soviet complex would require eight times more megatonnage per square foot of the roof area than would be needed to destroy the U.S. complex.

A fourth type of dispersal is termed "crisis relocation" and involves establishment of relocation facilities for the more critical enterprises. Some of these facilities are fully equipped and maintained on a standby basis. Others are partially equipped and can be put into operation in a short time. During an emergency, equipment as well as the temporary structures in which to house it would be moved from the peacetime factory to the relocation facility. Reports indicate that during World War II, the Russians were able to move all equipment, stockpiles, and documents out of a factory in about 10 days.⁹

Another type of protection recommended by the U.S. Bombing Survey team was the construction of blast-resistant structures. Apparently the Soviets have also paid serious attention to this recommendation. In 1969, Marshal Chuikov, then chief of civil defense in the USSR, said that:

There are tested techniques and measures to be used in industrial construction that can lessen the destruction and reduce the likelihood of secondary explosions and fires. Preliminary calculations show that they can lessen the effects of a nuclear attack by approximately 80 to 90 percent without great money and materiel expenditures.¹⁰

The extent to which the Soviets may have implemented such measures is not known; neither do we know of the specifics of the construction techniques referred to. However, even very small improvements in hardness and fire resistance, if employed in conjunction with wide separation of buildings, would substantially reduce the retaliatory effectiveness of the highly survivable U.S. SLBM force.

One of the major causes of loss of industrial capital assets in Hiroshima was fire. One way to prevent fire damage is to reduce the quantity of combustible materials in the area. The Hiroshima survey noted that the external structure and contents of a few of the buildings were generally non-combustible. These buildings suffered much less damage than neighboring structures. In the building shown in Figure 12, the wing facing the blast was burned, but suffered negligible

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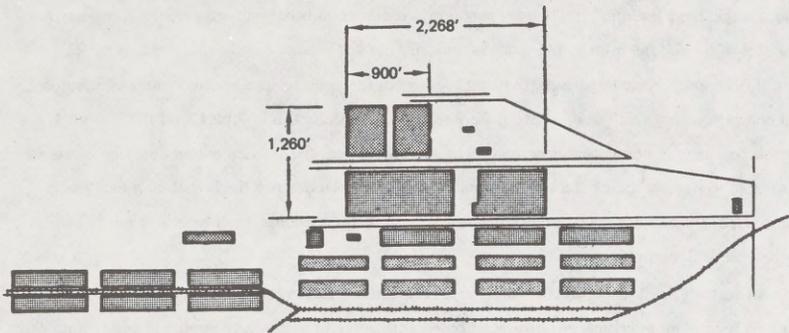


Figure 11. Auburn Complex

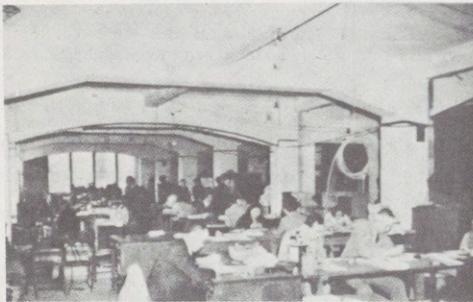


Figure 12. Building 65. Interior Third Story West Wing Showing Condition in Portion Not Burned Out. Note scarring of plaster on beams and ceiling by flying glass. Also note congestion and combustibility of contents.

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structural damage. The adjacent wing was not burned and is shown back in operation soon after the blast. Much of the USSR's new industrial construction is highly fireproof; concrete and steel are used almost exclusively. Moreover, reports indicate that even existing factories are taking steps to reduce the combustible material in and around the plant facilities. The book coauthored by the director and civil defense chief of the First State Ball Bearing Plant in Moscow, A. A. Gromov, provides a classic example of the use of fire prevention techniques. Fire protection improvements extended to the fence line; a wooden fence was replaced with a masonry fence. Wooden cooling towers in the plant area were replaced, and artesian wells were constructed to ensure an uninterruptible supply of water for firefighting.

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PROTECTION OF PRODUCTION MACHINERY

In Hiroshima, Japan, most of the damage to machinery was caused by fire rather than by blast or other nuclear effects. The second major cause of machine damage was due to debris from collapsing buildings striking the machines.

Figure 13 shows a burned out electrical generating station. This station could have survived in operational condition except for the fire that started from combustible material in front of the building. Figure 14 shows the interiors of small machine shops just outside the fire zone. The building in the lower photo suffered extensive structural damage. It has been braced with poles and "guy-wired" with a chain to keep it from falling over. Sheet metal covers have been placed over the machines to protect them from the rain. The machine shop shown in Figure 15 collapsed, but someone had crawled through the debris to apply a coat of protective grease to the machinery. All of these machine shops could have returned to nearly full operation within a few days or a couple of weeks.

The Soviet civil defense manuals provide for a number of possible ways to protect critical production machinery from nuclear damage. Protective means (illustrated in Figure 16) include structures, enclosures, hoods and housings, and canopies. Perhaps the simplest and most effective protective method described in Soviet literature is to cover vital equipment with sandbags or water. In *Civil Defense of an Industrial Installation*, A. A. Gromov described the actions taken to ensure continuity of utilities (electrical, gas, etc.). Other Soviet literature describing civil defense exercises in industrial plants also leave the impression that protective measures are taken prior to final evacuation of the work force. However, these descriptions are not sufficiently explicit to establish the practicality and effectiveness of protection measures for industrial machinery.

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Figure 13a. Building 131A and B. Looking Northeast. Showing Destruction of Roofing. All Combustible Debris Burned. Note Burned-Over Area in Foreground From Which Fire Spread.

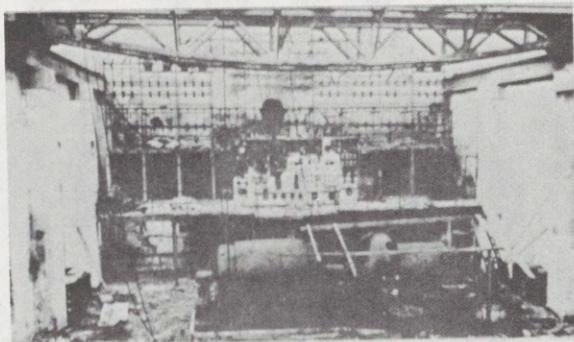


Figure 13b. Building 131A. Looking North Showing Turbo-Generator and Burned Out Electrical Panels at North End of Building

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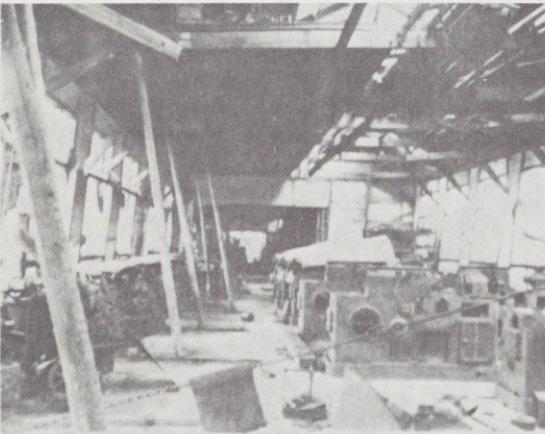
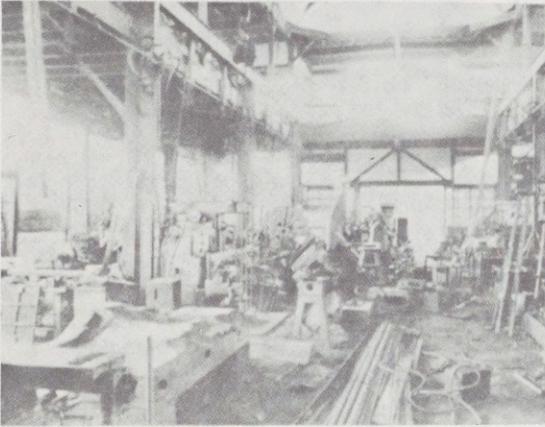


Figure 14. Interior of Small Machine Shops About 7,500 Feet South of Gz Showing Typical Combustible Construction and Arrangement of Machinery. Congestion is no Greater Than in Small American Shops.

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Figure 15. Building G, 6,000 Feet South of Gz, Looking West. A Wood-Frame, Light-Engineering Shop Collapsed as a Unit by Blast. No Fire.

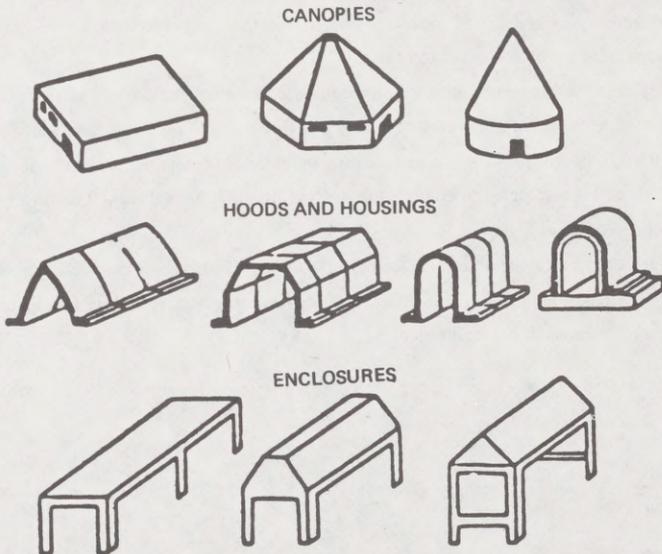


Figure 16. Protective Structures for Valuable Equipment

23 (REVERSE IS BLANK)

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CIVIL DEFENSE PLANNING STUDY

In 1975, The Boeing Company initiated an internal civil defense planning study to estimate the effectiveness of the Soviet civil defense preparations and to determine the feasibility of applying such measures to U.S. industry. The approach used was to duplicate the planning and preparation processes being used in the Soviet Union. The study was assigned to Mr. John R. Potter, Boeing's facilities manager. Mr. Potter is, in effect, the U.S. counterpart of A. A. Gromov, the director and civil defense chief of the First State Ball Bearing Plant in Moscow.

Mr. Potter was given the same technical materials that were probably given to Gromov by the Soviet civil defense organization; these included manuals and various publications on planning for the civil defense of industrial facilities. Finally, Mr. Potter was given a copy of the book written by Gromov describing the specific protection measures he had instituted to protect his ball bearing plant. Mr. Potter was asked to study the Soviet literature and follow its step-by-step instructions to the extent of preparing a plan showing in specific detail how the Soviet protection concepts would be applied to the Boeing industrial facilities. The principal steps called for and accomplished in the planning study were as follows:

1. Determine which machines are critical to continued production.
2. Determine the strengths and weaknesses of each critical machine and develop methods to protect it.
3. Determine cost, time, and technical feasibility of implementing expedient protection for postattack recovery.
4. Determine the capability of the surrounding region to assist in recovery, assuming the surrounding region is also attacked.

The study began with a review of various weapons effects studies and Soviet civil defense literature. A representative Boeing industrial facility was then selected for evaluation, and studies were conducted to determine how to ensure the survivability of the equipment in that facility. Finally, an analysis was conducted to evaluate the survivability of industrial capabilities in an urbanized industrial region.

The Boeing Company's manufacturing facility in Auburn, Washington, was selected for analysis. Aside from its ready accessibility to the Boeing study team, the Auburn facility (see Figure 17) appears to be a good choice for several reasons:

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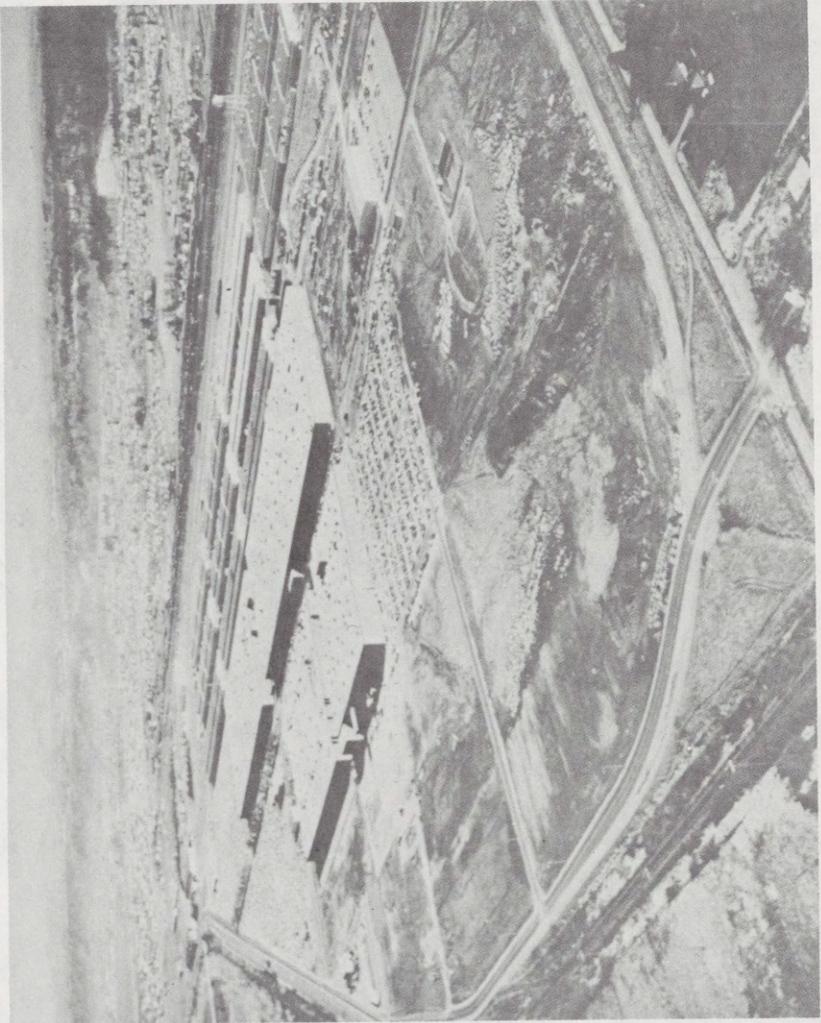


Figure 17. Aerial View of Boeing's Auburn Facility

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1. It is a high-technology facility.
2. It is the basic machine shop on which Boeing aircraft production depends. (Most other Boeing facilities assemble high-tolerance parts machined at Auburn. Recovery of these assembly plants would be a less difficult task since few high-tolerance machines are involved).
3. Auburn machines are large, varied, and complex, giving a good cross section of machines throughout industry. (Auburn is one of the largest machine shops in the world.)

It was assumed that if protective measures work for Auburn, they should work for other industries employing similar machinery.

The types of machines examined in the study were selected because they are large, expensive, crucial to aircraft production, difficult to replace, and generally difficult to repair.

1. Five-axis milling machines (Figure 18)
2. Spar mills (Figure 19)
3. Skin mills (Figure 20)
4. Autoclaves (Figure 21). These are used to provide a controlled heat/temperature environment for curing of structural adhesives.
5. Heat treat facility (Figure 22)
6. Process tank lines (Figure 23). These are used for such functions as cleaning and corrosion-proofing large parts.

Several different types of protective measures were considered in the course of the study.

The investigation first centered on canopies; i.e., relatively light protective structures that could be moved over the machines prior to evacuation of the work force. In general, typical industrial buildings suffer significant damage at about 2 to 5 psi and complete destruction at about 10 psi. Canopy-type structures could provide some protection from the debris of a collapsing building as well as from the free-field nuclear blast environments. An unprotected industrial machine, although it might survive greater overpressures in an open field, would suffer major damage if the building collapsed on top of it. It was considered that the use of canopies might also work well for the newer Soviet factories since the buildings are separated by a greater distance than in the U.S. and most of the U.S. retaliatory weapons are much smaller than the Soviet weapons. However, the 10-psi protection limit afforded by the steel canopies was considered inadequate to protect either the U.S. facilities or the older Soviet facilities.

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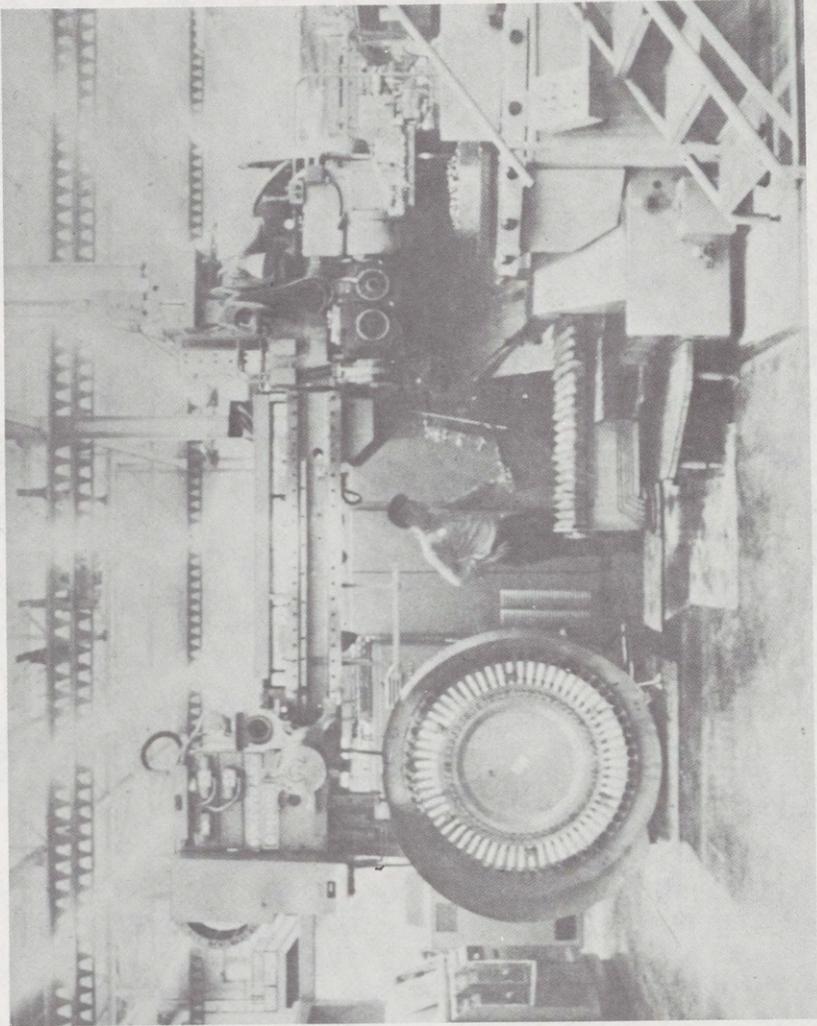


Figure 18. Five-Axis Milling Machine

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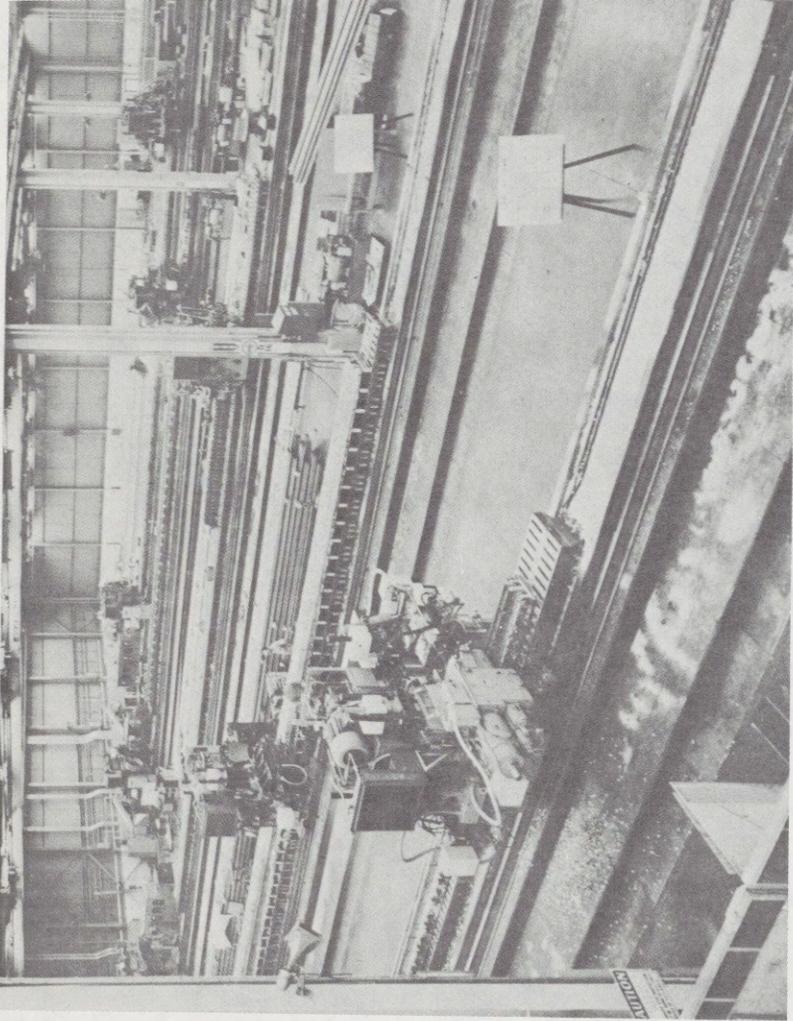


Figure 19. Spar Mills

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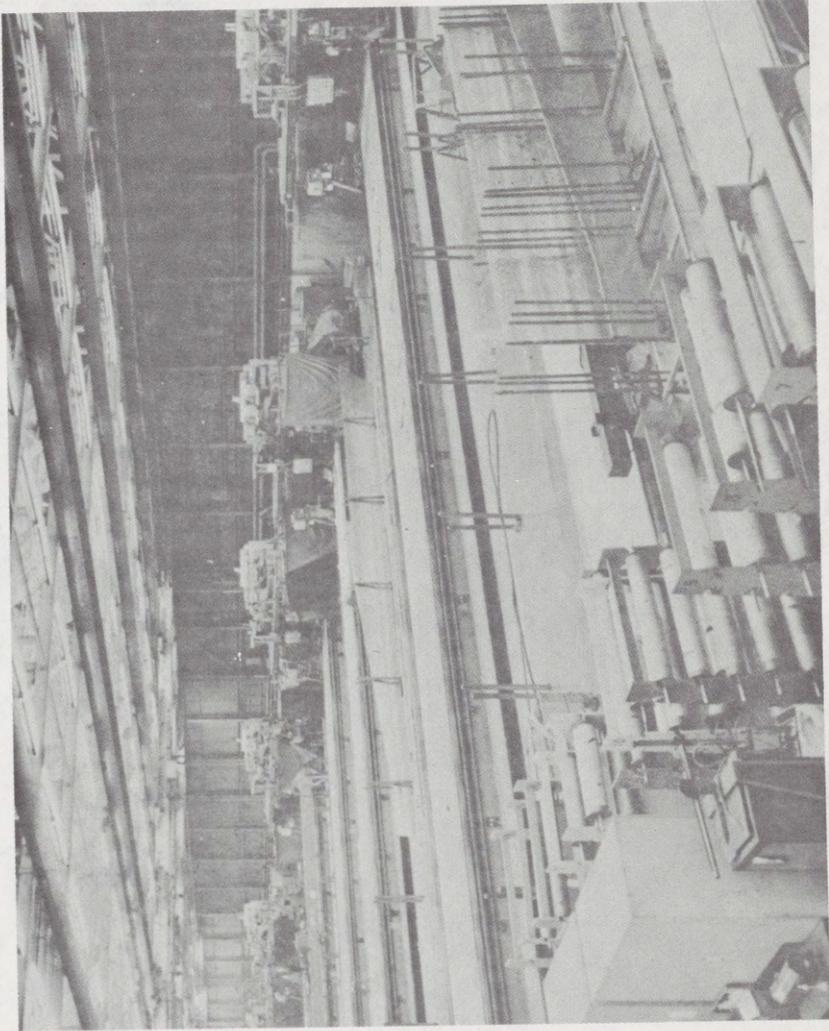


Figure 20. Skin Mills

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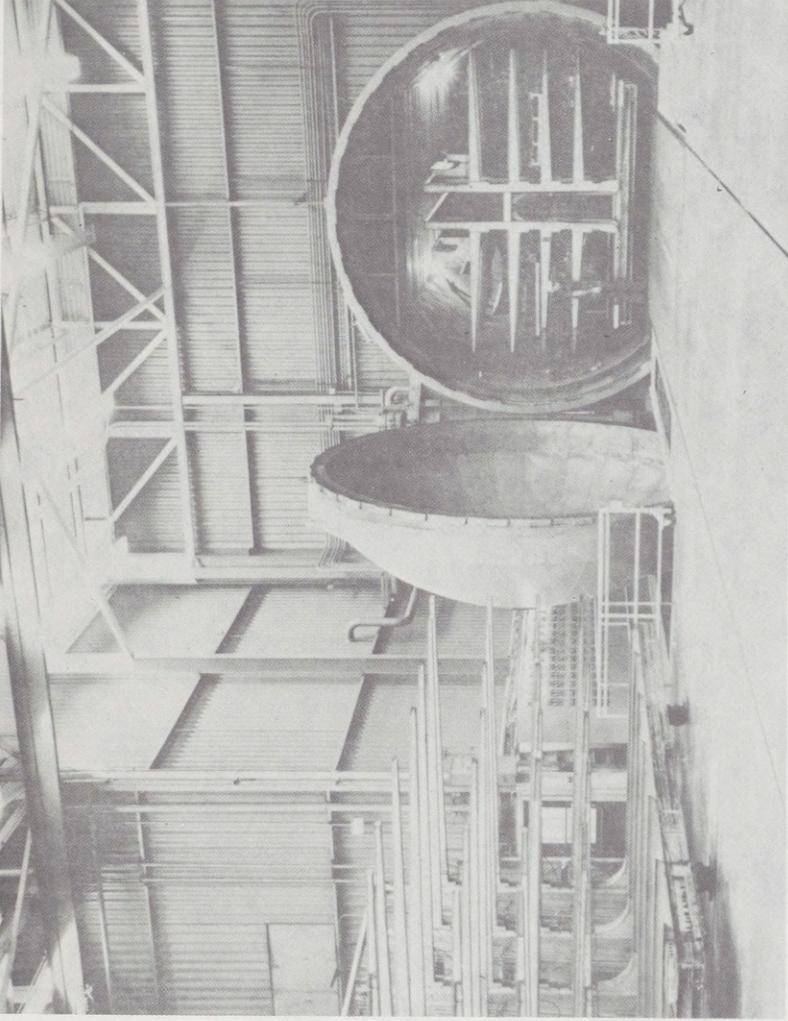


Figure 21. Autoclave

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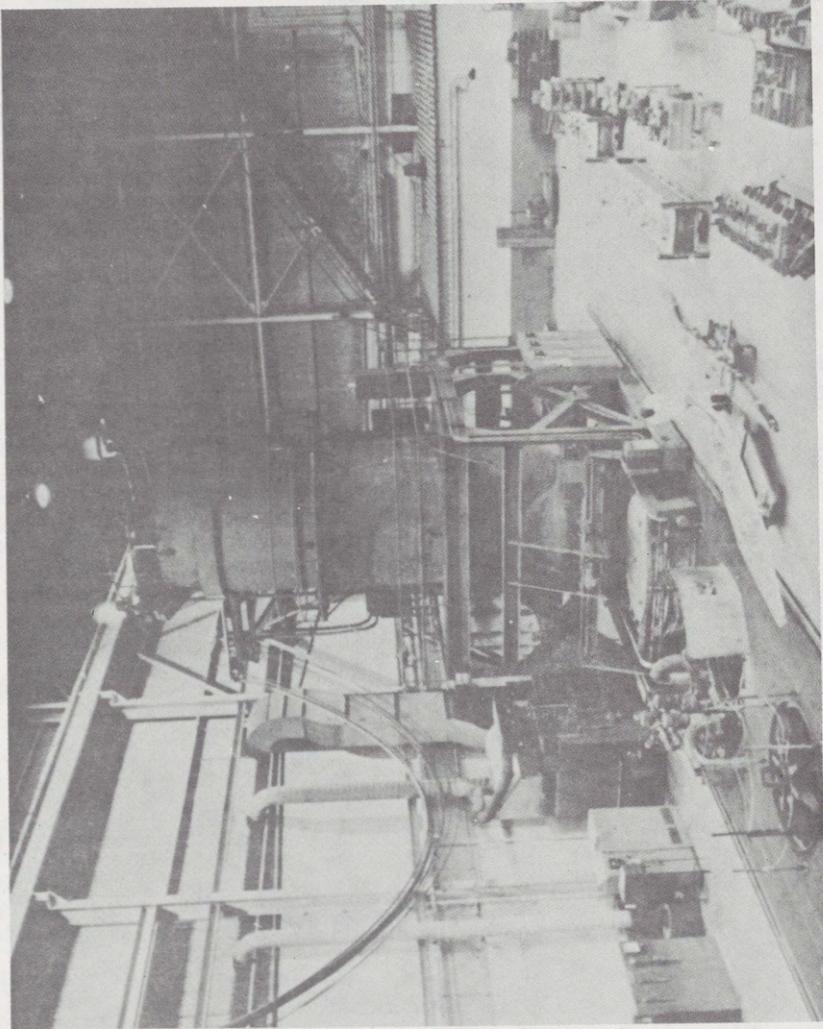


Figure 22. Heat-Treat Furnace

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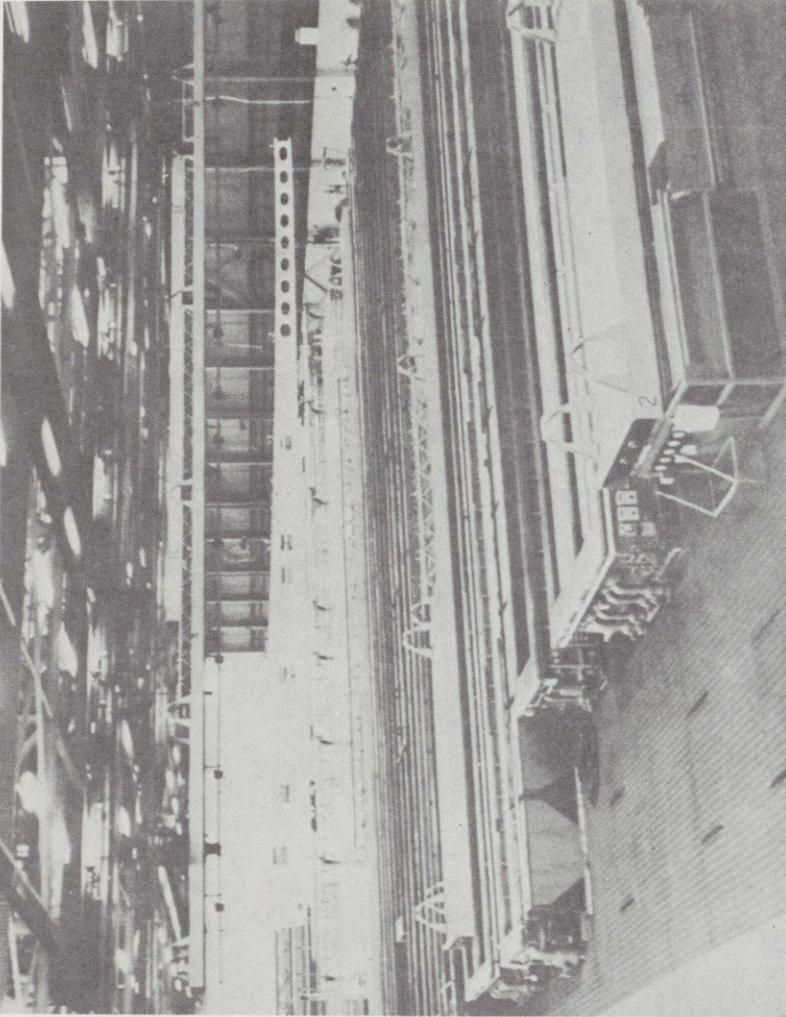


Figure 23. Process Tank Line

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As overpressure levels increase above 10 psi, the size (and cost) of protective arches or canopies increases. In addition to resisting vertical loads from blast and from falling roof structure, the protective structure must resist side loads from the blast wave overpressure and dynamic pressure. Some method of tie-downs or massive foundations thus are necessary to resist the sideward translation and overturning forces. As design work progressed on several potential candidate protective structures, it became apparent that the overturning loads were predominant and required prohibitively massive tie-downs and foundations at overpressures of 20 to 30 psi. Forty psi was about the technical limit at which foundations and tie-downs were adequate to resist overturning loads. At this overpressure level, the size and mass of the protective structures made them prohibitively expensive and cumbersome. In addition, permanently in-place structures would require extensive modification to the original factory layouts and even then would interfere with work flow. The study team concluded that the use of canopies was unacceptable from the standpoint of cost, interference with machine power and chip removal systems, and productivity impact. The expense of implementing this scheme in an existing plant would be enormous. It would probably be unacceptable even in a new plant designed for hardness.

At this point, the study team began to "think Russian." The cheapest protective method shown in the Soviet literature is to pack the machinery in sandbags or earth (Figure 24). This, in addition to protecting against structural debris, would protect against blast pressures up to 80 psi. Moreover, unlike the canopies, the soil cover would protect against fire. The disadvantage of this method is that the equipment is out of operation until the soil is removed and is subject to corrosion unless care is taken in greasing or painting all surfaces that might corrode.

Preliminary examination of typical industrial areas indicated that the level of protection obtainable from earth cover (40 psi minimum, 80 psi maximum) would be generally adequate to protect machinery in all but high-density industrial areas. However, to ensure survival of unique machinery such as skin mills, the 40-psi to 80-psi protection level would not be adequate if the machinery was located in a single building such as is the case at the Boeing Auburn facility. In theory, such a problem could be solved by distributing the machines among the several Boeing plants in the metropolitan area. Such distribution would provide adequate protection against low-yield weapons. The increase in production costs resulting from such a move, however, would be intolerable in the high competitive environment of the aerospace industry. Alternatively, higher levels of hardness could be used to protect nondispersed facilities (U.S. and older Russian factories) against high-yield (1-megaton) weapons. Having considered these factors, the study team began to search for protective methods that would provide higher levels of protection.

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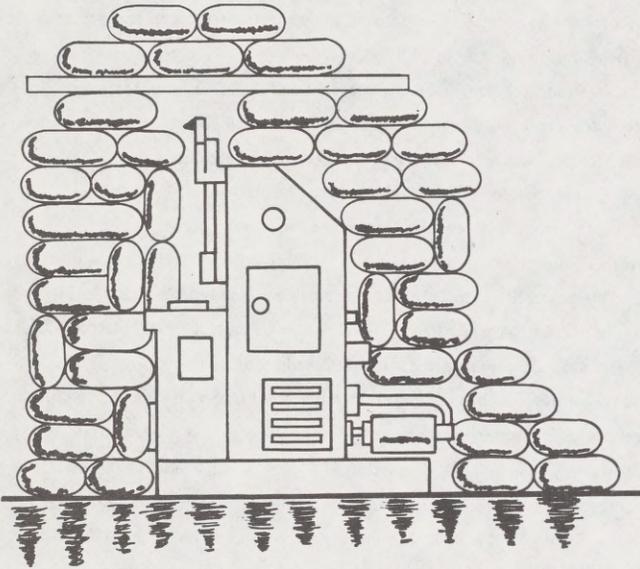


Figure 24. Рис. 2. Вариант консервации
 Расход материалов: мешки — 180;
 брус 60×200 — 20 пог. м; пленка полиэтиленовая — 25 м².
 Затрата рабочей силы: насыпка мешков песком, подноска, укладка — 58 чел./час; бригада в 8 человек при 10-часовой смене работа выполняется за 5,3 числ

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One of the factors that limits the protective capability of the earth cover method is the soil motion that would be induced by a nuclear blast. At about 80-psi air overpressure, shock from the soil motion is sufficient to damage even massive machines. To prevent ground shock damage at higher overpressures, some method of shock isolation or shock mitigation is required. Of the several methods investigated, the cheapest and easiest way of protecting a machine was to completely surround it with a layer of crushable material such as foamed plastic or the metal chips from machining operations. (This protection method is exactly analogous to packing sensitive instruments in plastic foam for shipment.) In practice, during construction or relocation of machines, the foundation of each individual machine would be supported on a crushable pad such as styrene or polyurethane foam. (In the event of a crisis, machines that had not previously been shored up with crushable material would have to be jacked up and supported on wooden cribbing.) Prior to an attack, each machine would be covered with crushable material such as plastic foam, balsa wood, or metal chips. Since metal chips are a byproduct of normal machining operations, there would be no supply problem; Figure 25 illustrates the quantities of such chips produced in a couple of hours by one of the large skin mills at the Auburn facility. The crushable material would then be covered by a layer of soil or sandbags to protect the machine from fire, air blast, and debris. Figure 26 illustrates the application of this protective method to a five-axis milling machine; this protective treatment is also suitable for the spar mills. The autoclaves are somewhat easier to protect as they can be strengthened by internal pressurization and hence would not need a cushion of chips.

A few machines do not lend themselves to the hardening techniques described above. Thin-walled vessels such as the process line tanks would be crushed, and wide unsupported plates such as the skin mill beds could collapse. For these devices, some method is necessary that would permit equalization of the explosive pressures on all sides of the structural elements. To provide this protection, the study team used a technique extracted from the Russian literature whereby the machines are covered with grease to prevent corrosion and then submerged or flooded in water. Using this method, sandbags supported by cribbing could be placed immediately above the surface of the water to protect the machine from debris and limit displacement of the water by the blast wave. The application of this protection technique to the process tank line and to the skin mill is shown in Figures 27 and 28.

The vertical heat treat furnace required yet a different type of protection approach. This furnace is very large and relatively fragile. The furnace itself could be protected by either turning it on its side, packing it with sand, and then surrounding it with sandbags or earth, or by moving it

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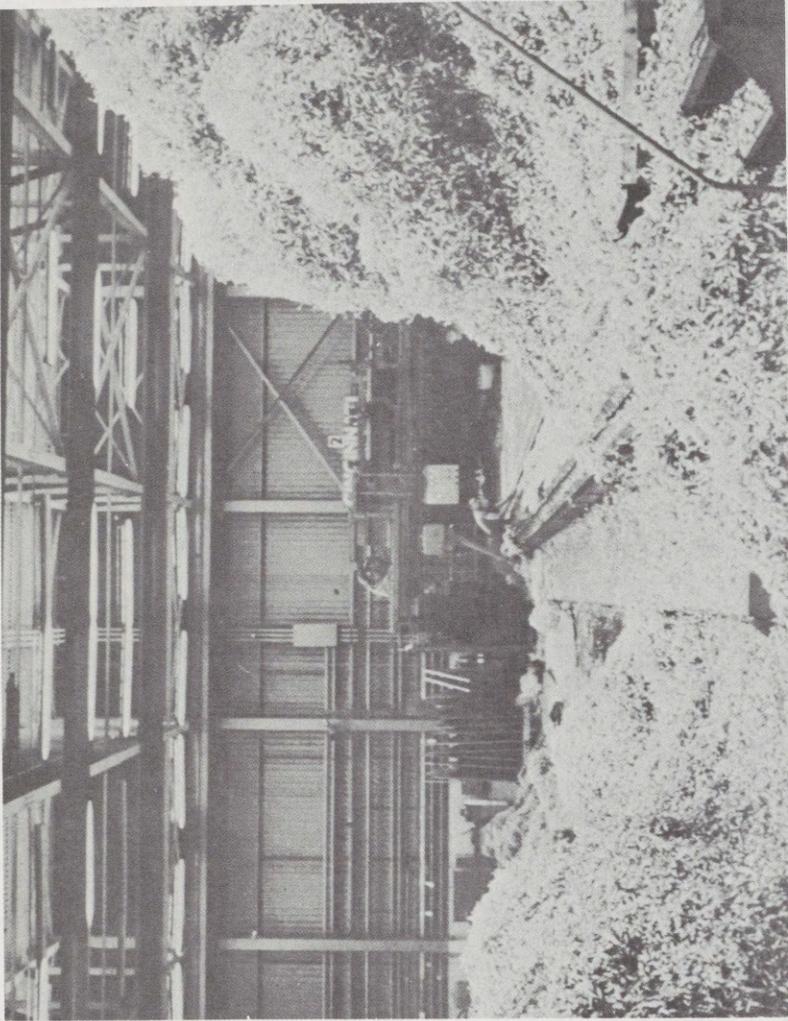


Figure 25. Chips Produced as a Byproduct of Milling Operations

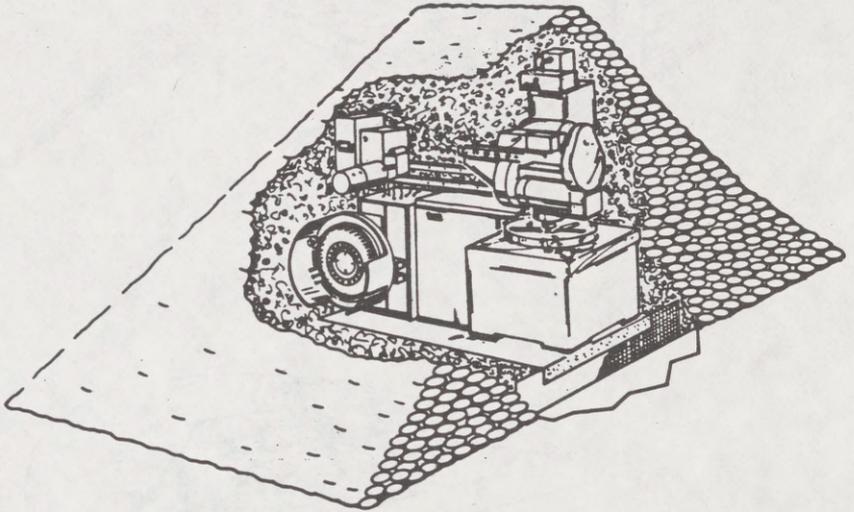


Figure 26. Hardened Five-Axis Mill

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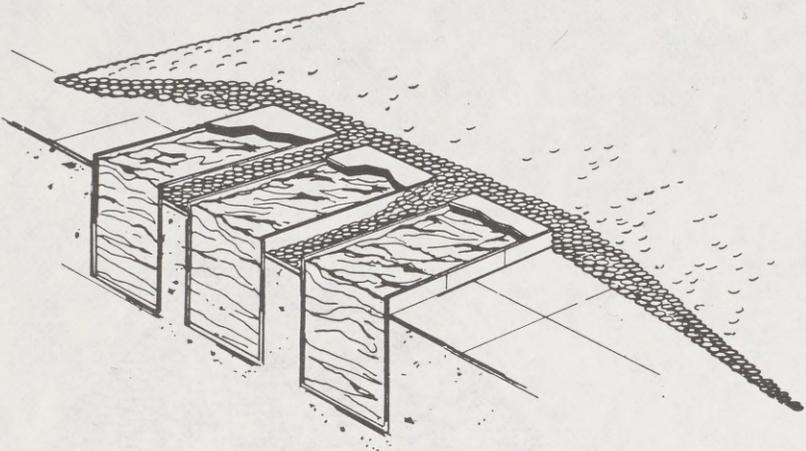


Figure 27. Hardened Tank Line

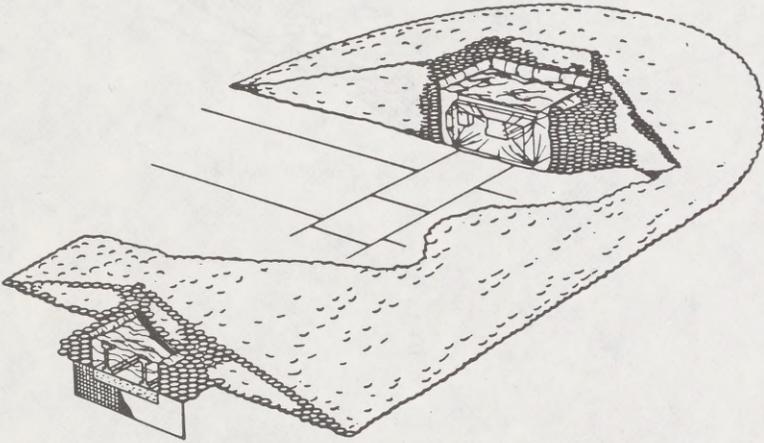


Figure 28. Hardened Skin Mill

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into a pit and packing it with sand. The quench tanks would be filled with water after being emptied of their corrosive contents. Application of this technique is illustrated in Figure 29. In practice, the collocation of machines in the shop would permit merging of the earth mounds from adjacent machines. This results in an essentially flat soil surface throughout the factory area and greatly reduces the amount of soil per machine that must be moved. Preliminary estimates indicated that the machines could be protected against 200- to 300-psi blasts by the means described.

The next step in the study involved a test program to confirm the validity of the protective methods considered. The technical principle involved in the proposed methods of protection is known as "earth arching." The metal chips used to pack the machines also serve to support the lower surface of the soil layer covering the machinery. If the soil layer is properly supported from below, the soil itself will form a natural bridge that will carry the blast loads across the cavity in which the machine is located, thus preventing the blast forces from reaching the machine itself. The principles of earth arching are well understood in highway construction and tunnel building technologies, where culverts and tunnel liners are not of themselves structurally adequate to carry the full weight of the earth above the tunnel itself.

Static Tests

A series of static tests was initiated to test machine survivability concepts. These were designed to provide information at an absolute minimum cost. Simple static tests were first conducted to determine whether or not chips were adequate to support earth arching and also provide the "rattle space" needed to protect against ground shock. In the most convincing of these tests, a shoebox was surrounded by several inches of chips, covered with soil, and subjected to static overpressure by driving a pickup truck wheel onto the mound of soil. The static overpressure at the surface was about 30 psi. After the test, the shoebox was somewhat dished in on top but not flattened. A second test involved only chips and soil (Figure 30). A glass plate was set up against the chips to permit observation of soil motion and crushing of the chips. These tests clearly established that the chips would support soil arching.

The next test in the static test series was conducted using a full-scale precision grinding machine. The purposes of this test were to (1) provide a larger scale static load test, (2) determine the effect of soil settling during a prolonged period of burial, and (3) determine whether or not corrosion would be a problem during prolonged burial in an area exposed to weather. This latter

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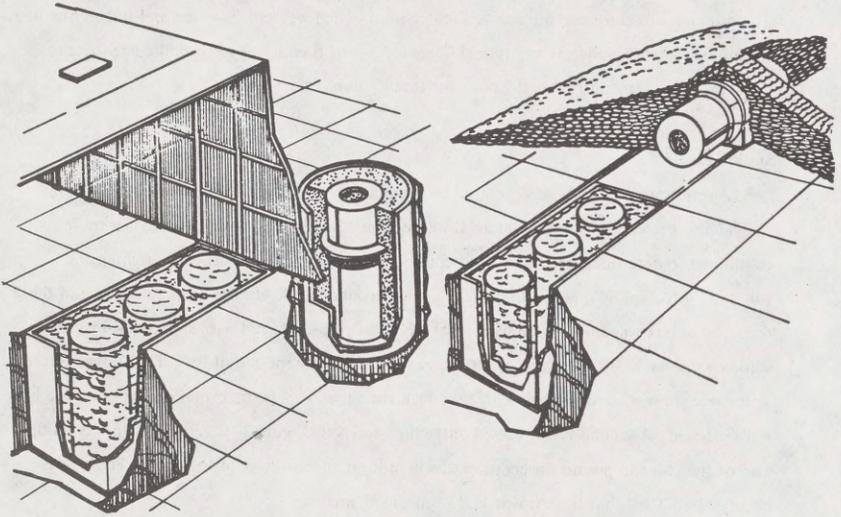


Figure 29. Hardened Heat Treat Facility

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Figure 30. Static Test of Earth Arching Principle

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point is important because buildings and roof cover would probably be destroyed in a nuclear attack. The test involved placing the grinder wrapped with plastic on a crushable styrene base (Figure 31). and then surrounding it with bags of metal chips (Figure 32). Several very simple types of gauges were used to record the motion of the chips and the covering soil (Figure 33). The area above and around the machine was then covered with soil. Mr. Jack Potter, the facilities manager, personally conducted the static load test (Figure 34). The machine was left in the buried condition for approximately 6 weeks; in this interval, a rainfall of about 3 inches was recorded. During excavation of the machine, the soil motion gauges were checked (Figure 35). The protective chips compressed less than 5%, an amount that would cause no damage even to fragile items. Afterwards, the grinder was moved back into the shop and functionally tested (Figure 36). The machine sustained only slight, easily repairable damage, much of which was probably due to handling during the burial and excavation processes. Also, there was a very slight layer of surface corrosion that could probably have been prevented by the use of an antirust coating prior to burial.

Five-Ton Test

The next step in the test program was to investigate whether or not the earth arching technique would withstand the dynamics of a high explosive blast. The Defense Nuclear Agency had scheduled a test involving detonation of 5 tons of TNT at Holloman Air Force Base on August 25, 1976, as part of a scale-model B-1 bomber test. Boeing was allowed to emplace test specimens in the vicinity of the explosive. Test components, together with very simple crush gauges, were emplaced at levels where they would receive 20-, 40-, 80-, 200-, and 300-psi blast pressures. Because of the relatively small yield of the explosion, small components such as electromechanical calculators, chain hoists, and vacuum pumps of the types shown in Figures 37, 38, and 39 were used. Gallon-size cans were included to represent processing tanks. The results are summarized in Table 1. The chain hoists and the vacuum pumps were completely undamaged. At the 200-psi level, the tanks were bent, but the bending was sufficiently light that they could have been repaired and returned to service. The electromechanical adding machines were the most complicated and fragile mechanisms tested. There was no damage visible to any of these machines at the lower overpressure levels. At 200 psi and 300 psi, the movable parts appeared to be slightly loosened, but the machine operated correctly during checkout. A test report giving further details on the test specimens, emplacement, gauge readings, and other results is in preparation. When completed, it will be available upon request from The Boeing Company.

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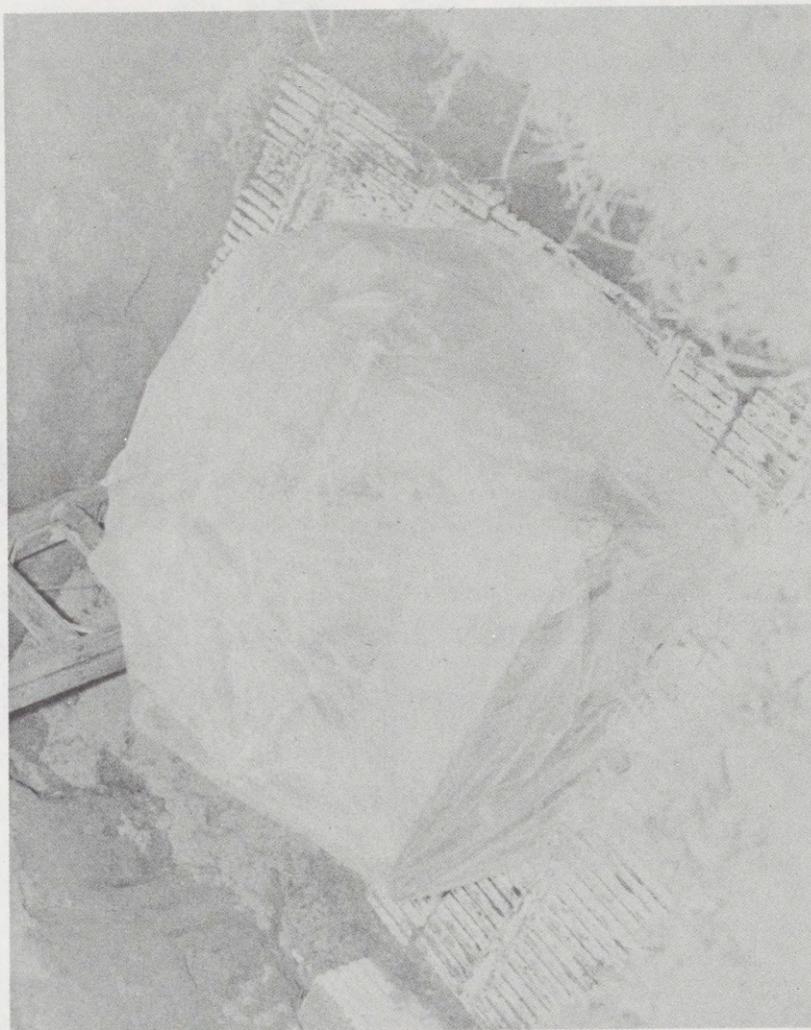


Figure 31. Burial Test (Machine Is Wrapped in Plastic and Placed on Styrofoam Blocks)

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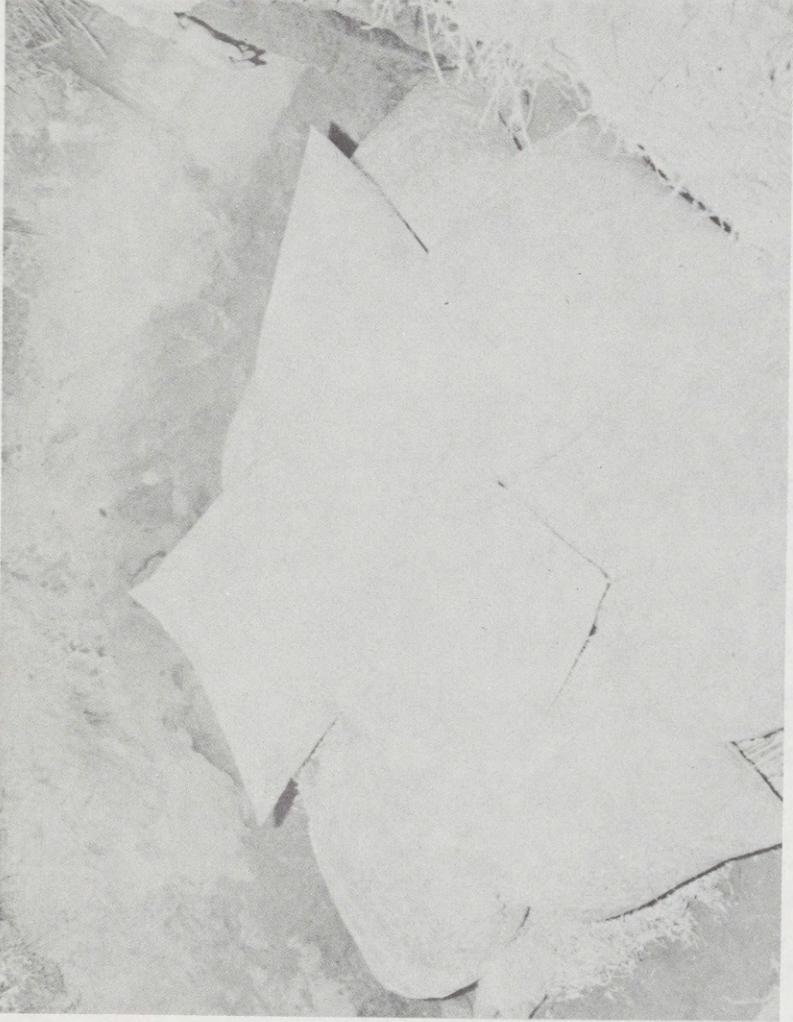


Figure 32. Machine Packed in Bags of Metal Chips

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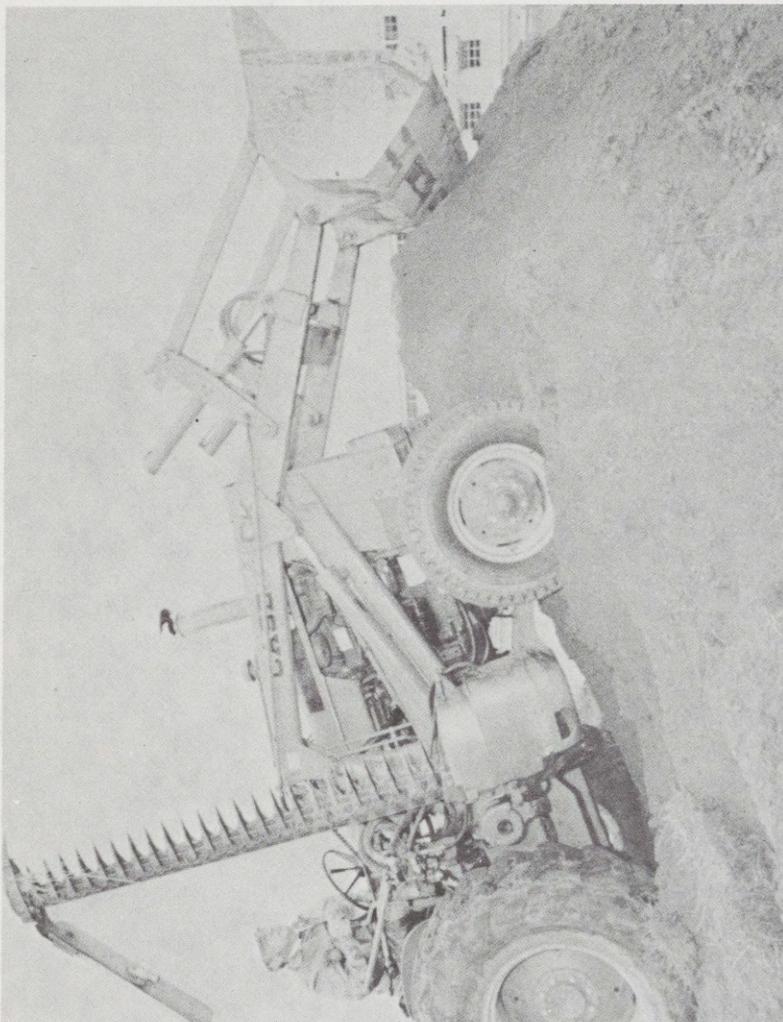


Figure 34. Static Load Being Applied to Buried Machine

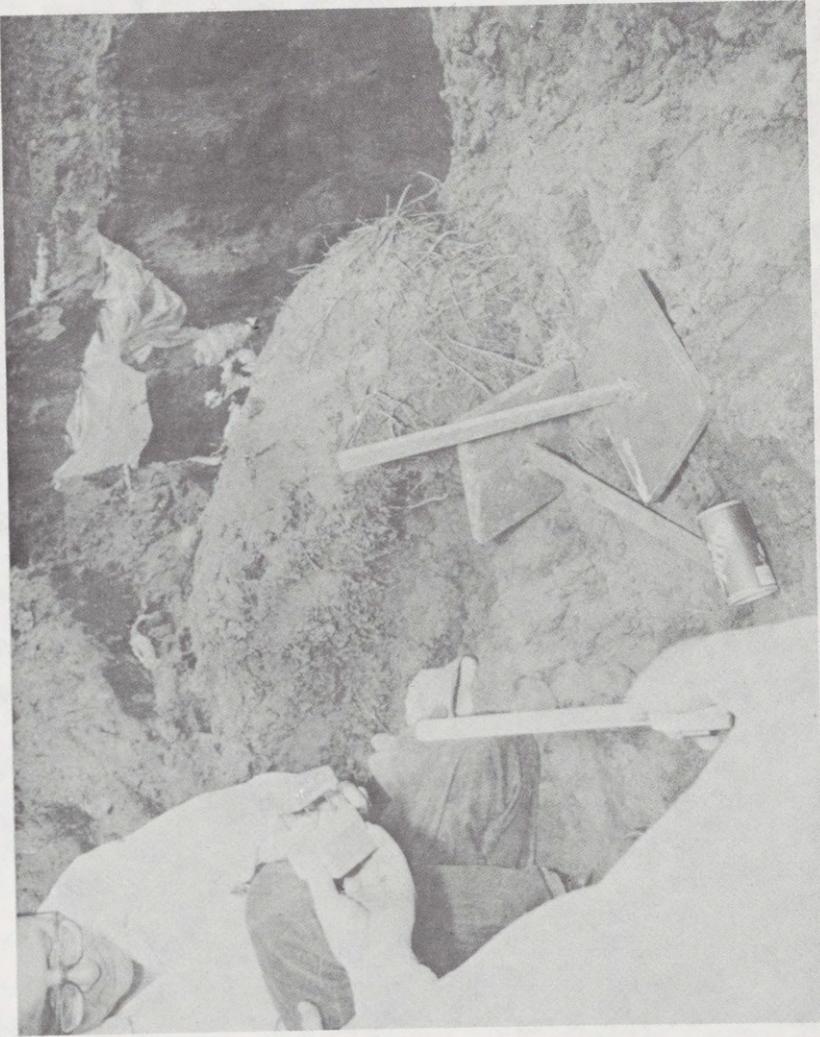


Figure 35. Excavation (Measuring the Soil Movement Gauges)

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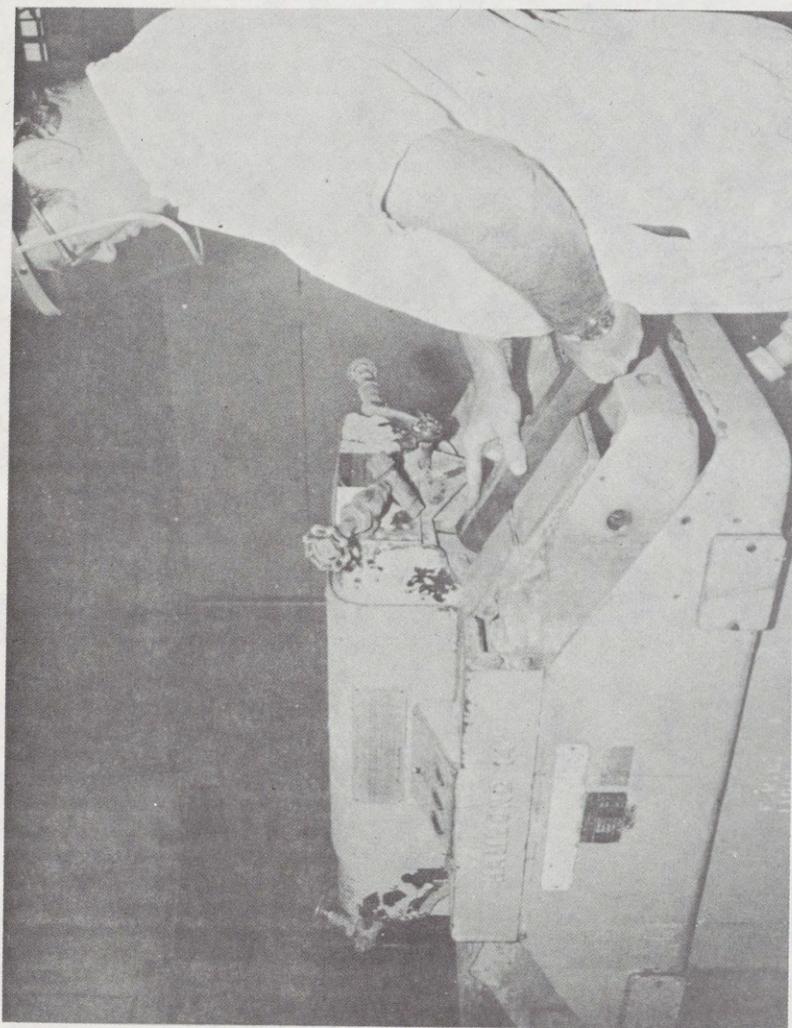


Figure 36. Functional Test of Machine After Burial Test

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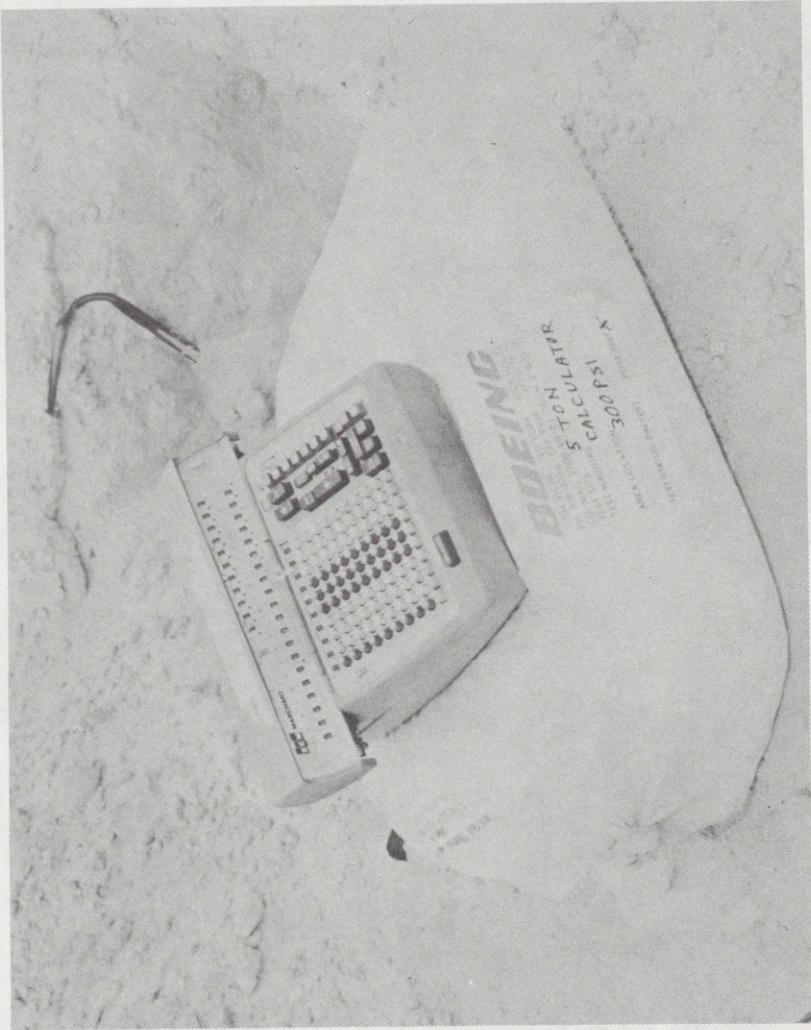


Figure 37. Electromechanical Calculator After 5-Ton High-Explosive Test
(Calculator Survived in Area Exposed to 300-psi Blast Pressure)

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Figure 38. Chain Hoist After 5-Ton High-Explosive Test (200-psi Level)

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Figure 39. Vacuum Pump After 5-Ton High-Explosive Test (200-psi Level)

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Table 1. Five Ton Test Results

	300	200	80	40	20
Chain hoists	←	Undamaged	→	#	#
Pumps	#	← Undamaged →			#
Adding machines	← Operable →		← Undamaged →		
Tanks	#	** Repairable	← Undamaged →		

Not tested

* Movable parts were loosened but machine operated correctly during post shot checkout.

** Tank walls slightly dented.

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Five-Hundred-Ton Test

The final test conducted by Boeing was at the invitation of the Defense Nuclear Agency. They had scheduled a test equivalent to more than 500 tons of TNT for October 6, 1976. Because of their interest in, and potential importance of, industrial hardening measures, they asked Boeing to participate on a contract basis (Contract DNA-001-76-C-0350). Since no failures occurred to specimens during the 5-ton tests at Holloman at overpressures of up to 300 psi, the DNA requested that specimens be included in the large-scale test at the 600-psi level.

The first set of test specimens included four large machines—a drill grinder located at 200 psi (similar to the machine buried in the static test at Auburn, Washington); an electrolytic chip breaker grinder at 80 psi; a power supply device at 40 psi (the grinder and its power supply are shown in Figure 40); and a minibike at 600 psi. The bike, in addition to being a functional component, was available locally in time to meet the schedule and represented several different types of structure, including hollow tanks, tubular structure, and the relatively damage-resistant castings of the motor.

The second set of test specimens was comprised of aluminum pipes. These were tested at the 600-psi overpressure level to permit analytical correlation of observed damage with predicted failure mechanisms. The third set was made up of portable electric hoists. These were included to represent very rugged machinery. Small electric pumps and varidrive units were included in the fourth set of specimens to represent medium-hard machines. The fifth set was made up of the electro-mechanical calculators and adding machines. These represented soft, relatively fragile machinery. The sixth and last set of the test specimens included waterfilled electronic cabinet racks. These represented tanks such as those found in chemical processing lines.

The test specimens were placed on styrene blocks to permit protection against ground shock and then packed in chips and covered with soil. Most of the test specimens were placed so that the depth of soil above the protective chips would ensure reliable earth arching. The soil cover calculations were based on the assumption that the angle of failure of the soil under dynamic blast loading would be the same as the angle of failure previously demonstrated under static load conditions. To learn more about the minimum effective depth of cover for soil arching, several of the mechanical calculators buried at the 200-psi location were placed in 1-foot increments of depth from 5 feet to only 1 foot to ensure that some specimens would be damaged because of insufficient soil cover.

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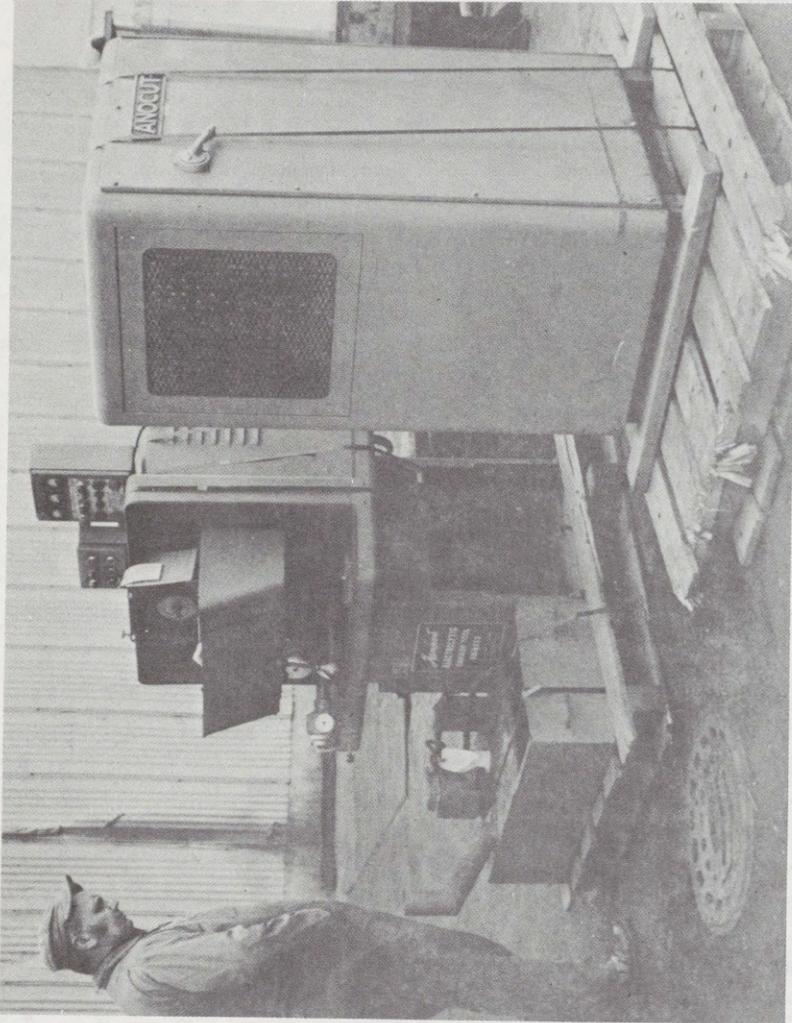


Figure 40. Electrolytic Grinder and Power Supply Used in 500-Ton High-Explosive Test

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The principal results of the test were as follows. The large grinder located at the 200-psi level incurred only a slight dent on the operator's adjustable light. All of the working parts appeared to be undamaged. The grinder at the 80-psi location suffered some damage to sheet metal collars and guards. There was no visual damage to any working parts. Similarly, the power supply located at the 40-psi point suffered only sheet metal damage with no apparent damage to any working parts. The minibike withstood 600 psi. It was so close to the 200-foot-diameter crater that it was subjected to 1-1/2-foot soil heave. The only damage was that the front fender was bent sideways about 5 degrees and the handlebars and fork were misaligned (Figure 41). The minibike started after perhaps 5 minutes of cranking and was driven away.

Figure 42 shows aluminum tubing located immediately adjacent to the minibike. This area also received 600 psi of blast pressure. Because the depth of soil cover was not sufficient to provide earth arching, the tubing was totally destroyed by the blast pressures. Similarly, one of the calculators at the 600-psi location (Figure 43) was severely damaged because, again, insufficient earth cover had been placed over the metal chips. The importance of the metal chips is shown by the two calculators in Figure 44. The calculator on the left, surrounded by an adequate layer of chips, was undamaged. The calculator on the right, which was covered only with earth, was crushed by the blast pressures that forced the earth downward into the machine case. Figure 45 shows the tanks after the explosion. Some of the tanks were slightly bent but still serviceable. The main difficulty experienced with the tanks in the test was that the water tended to leak out, thus exposing the tanks to a greater amount of damage than would otherwise occur. A detailed report on the test setup, gauging, and data derived from this test is being prepared for the Defense Nuclear Agency.

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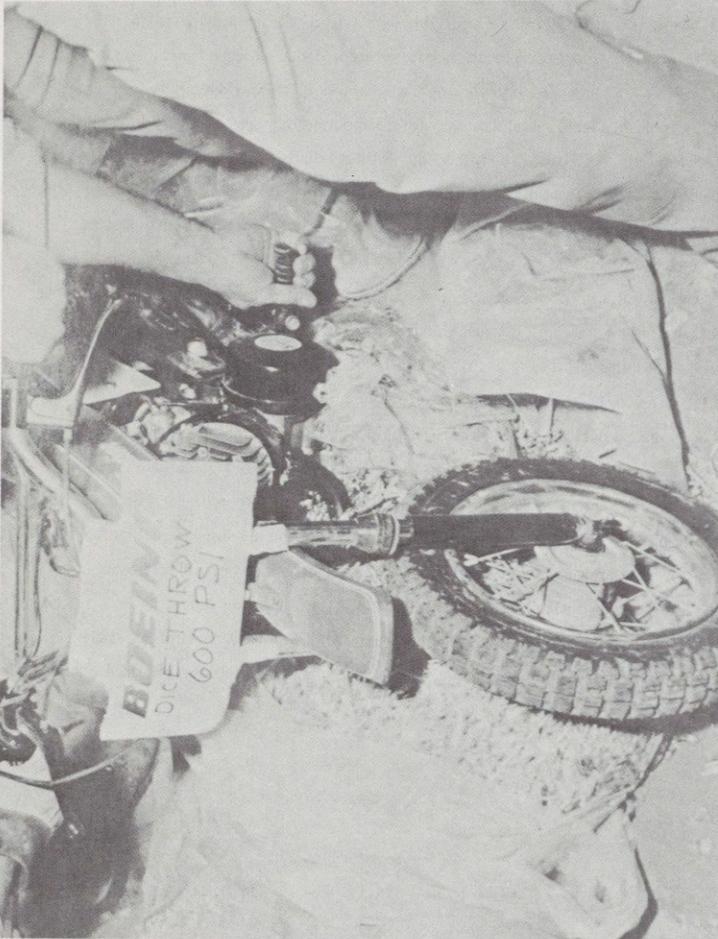


Figure 41. Minibike Being Removed From Test Location After 500-Ton High-Explosive Blast. Test specimen was in an area subject to over 600-psi blast pressure and 1-1/2-foot soil heave. Note misaligned front fender.

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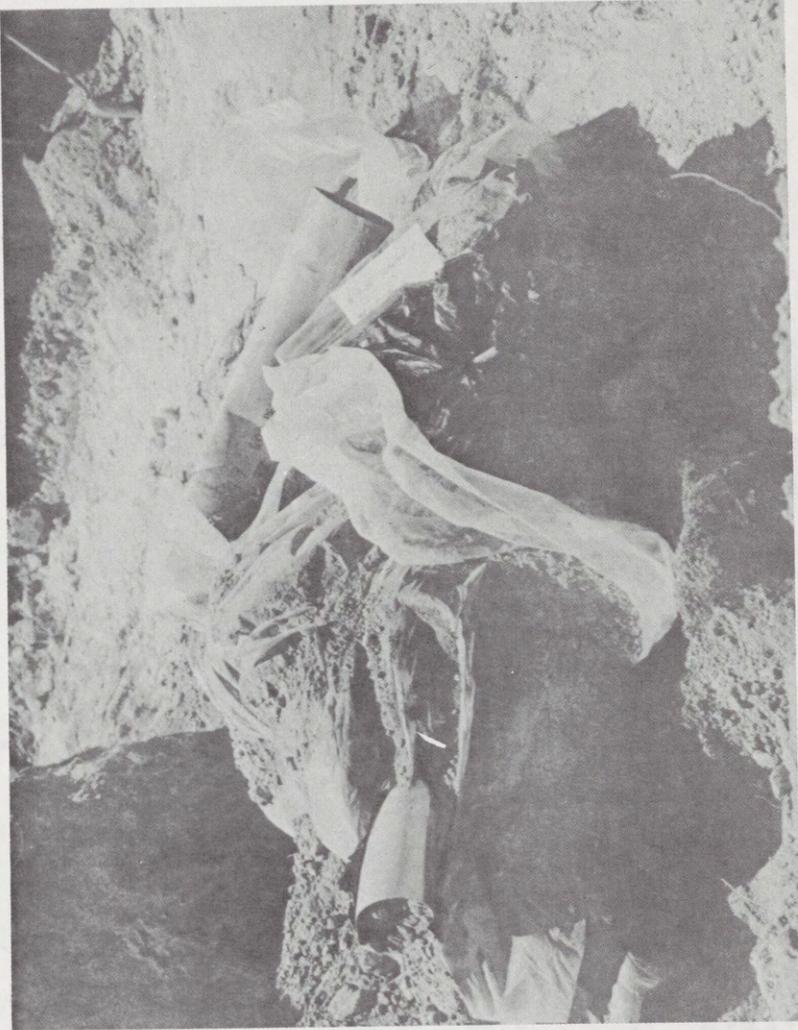


Figure 42. Tubing From 600-psi Location. Because of insufficient earth cover, the tubing was crushed by blast forces.

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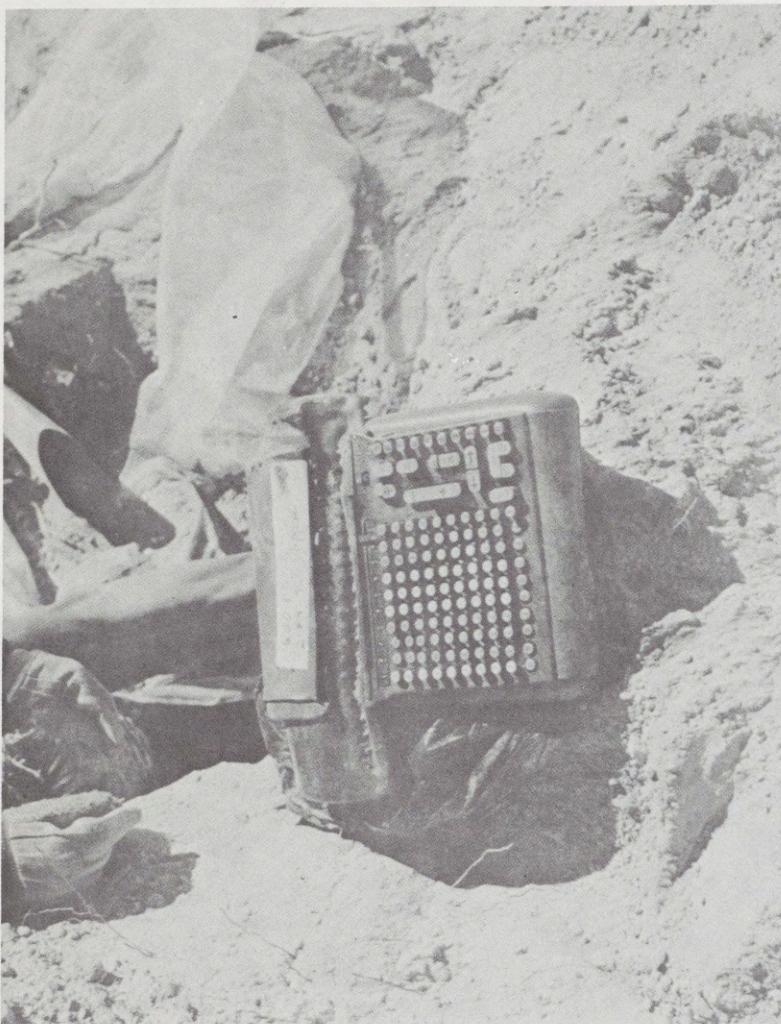


Figure 43. Calculator From 600-psi Location. Damage resulted from insufficient earth cover.

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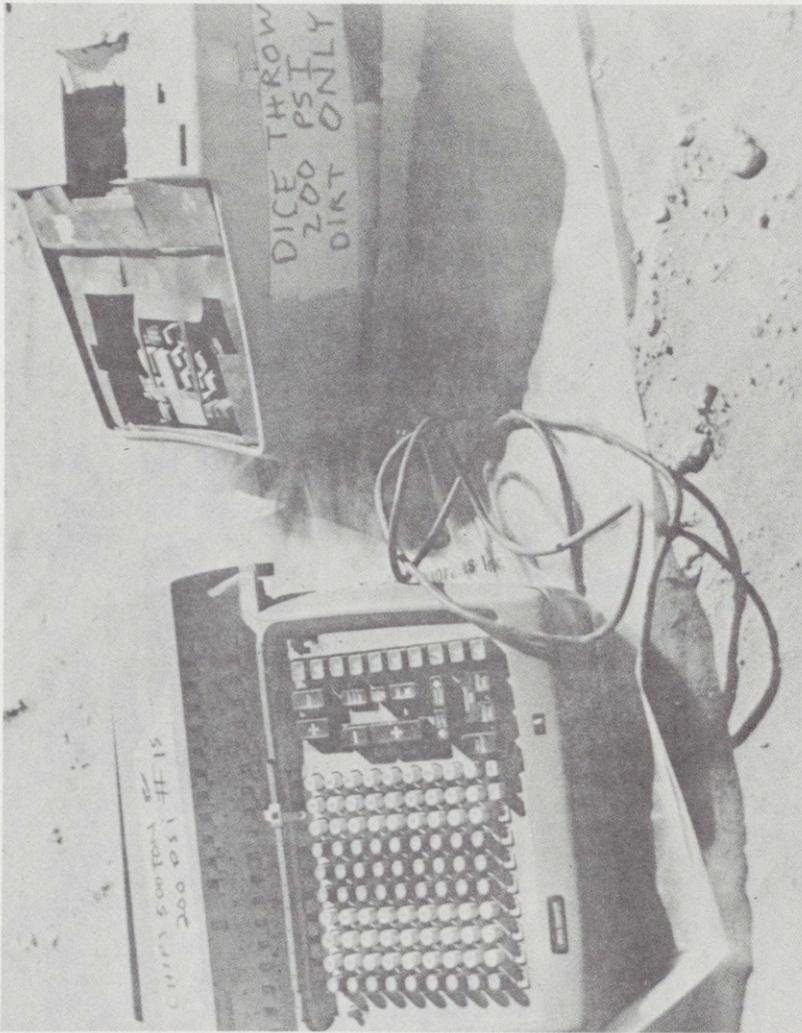


Figure 44. Protective Effects of Using Metal Chips. Calculator on left was protected with chips, calculator on right was not.

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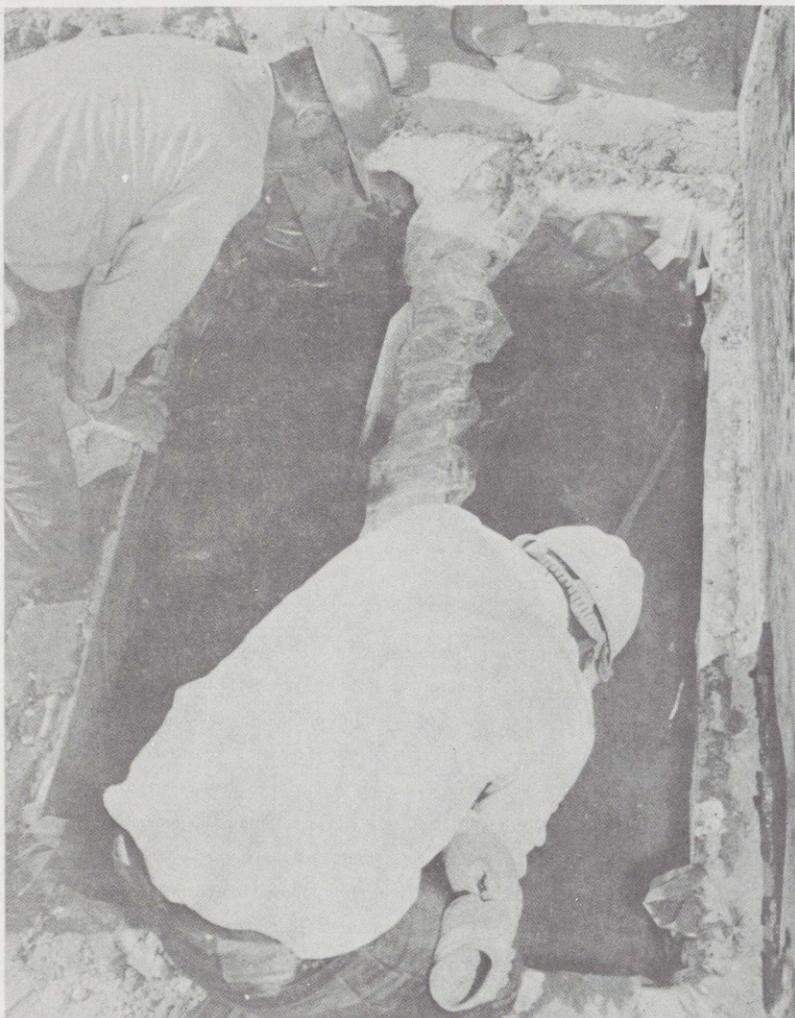


Figure 45. Tanks After 500-Ton Blast

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Protection of the Seattle-Tacoma-Everett Area

To obtain an accurate appraisal of the effectiveness of industrial protection measures, it was necessary to consider how these measures would be applied to a large metropolitan area. A major nuclear conflict would, in addition to damaging industries that were directly targeted, cause damage to some supporting industries, services, and utilities. The damage to these secondary industries would further delay recovery time. Also, although the U.S. has had no plan to disperse its industry for civil defense reasons, the "urban sprawl" phenomenon has resulted in a degree of dispersal that could improve U.S. industrial prospects.

The Seattle-Tacoma-Everett metropolitan area was used as a model for this portion of the study because it permitted consideration of detail information not obtainable from Soviet industrial areas. The number of weapons that would probably be targeted against this area was based on the relationship of the gross product of this industrial area to the total gross national product. Primary targets for this number of allocated weapons were selected based on size and apparent output of each industry and also to ensure that several critical sectors of the local economy would be damaged. The location of the primary targets in the central section of this area is shown in Figure 46. For perspective, the large circles show the area of destruction that would be caused by the relatively large weapons (≈ 1 megaton) of the Soviet arsenal, assuming no protective measures were applied. The small circles show the area of destruction of U.S. sea-based weapons, assuming the minimum protection of simple earth cover (40 psi).

The location of supporting industry is shown in Figure 47. The separation of this industry from the primary target areas is important since, for example, the "small" machine shops distributed through the metropolitan area comprise about two-thirds of the total machining capacity. The effect of protective measures in improving the survivability of the basic industrial functions is illustrated by Figures 48 and 49. Two warhead sizes are shown; Figure 48 assumes a relatively low-yield warhead that is representative of those which are most numerous in the U.S. retaliatory forces; Figure 49 assumes a higher yield warhead such as would be found in the Soviet inventory. A very high level of protection against the low-yield warheads is provided by the most simple protective measures; the 20- to 40-psi hardness needed is easily provided by a light covering of earth. Against the high-yield warheads, the minimum protection is significantly less effective but still improves survivability by a very important margin. Hardness levels of 60 psi to 150 psi, which could be obtained by packing in crushable material, would be needed to obtain a high level of survival against the high-yield weapons. For perspective, it is noted that present levels of production in most of the area's industry could be obtained by splitting the work force into three shifts

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Figure 46. Seattle-Tacoma-Everett Primary Target Areas

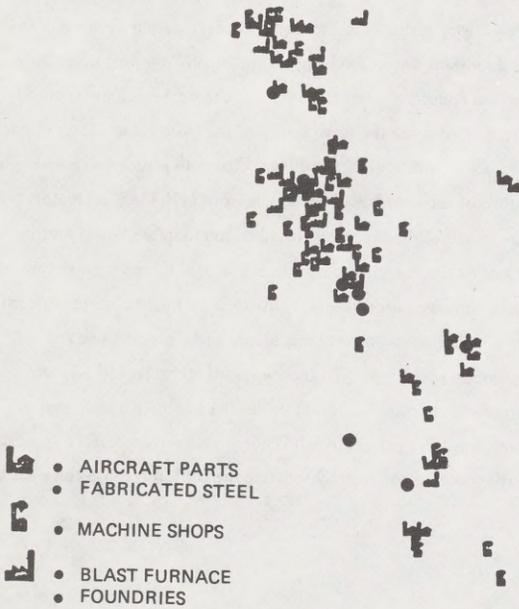


Figure 47. Supporting Industry

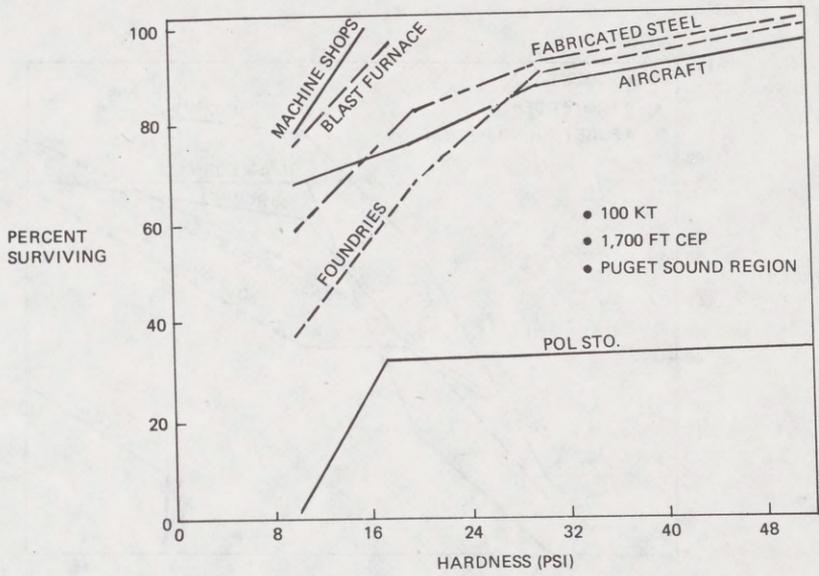


Figure 48. Effect of Hardness in Reducing Industrial Damage (Seattle-Tacoma-Everett Area) (100-Kiloton Blast)

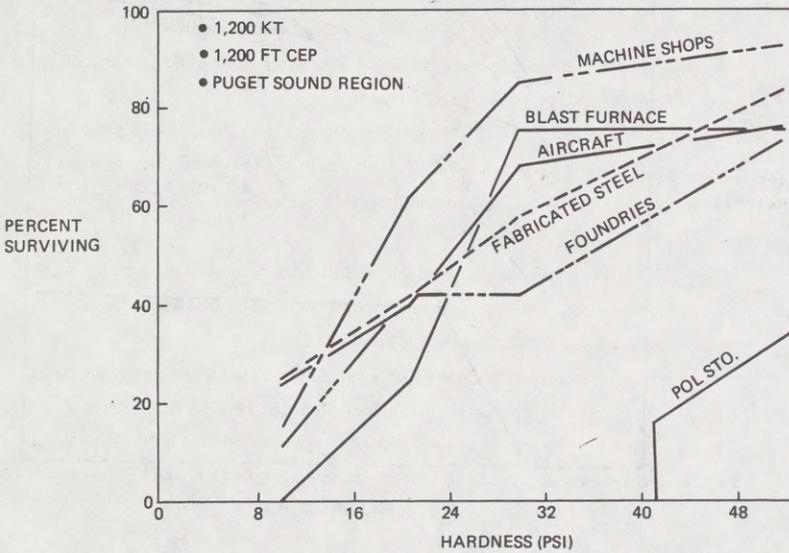


Figure 49. Effect of Hardness in Reducing Industrial Damage (Seattle-Tacoma-Everett Area) (1,200-Kiloton Blast)

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per day; this assumes that 30% of the machinery is operable. In order for this level of recovery to occur, however, it is necessary to protect petroleum, oil, and lubricant (POL) supplies. All POL facilities in the metropolitan area studied are collocated with primary target areas. Further dispersal or hardened underground storage would be required to ensure survival of POL stocks.

The study also examined the question of whether some sector of the economy represents an "Achilles heel" which, if destroyed, would prolong recovery for many years. Electrical power was investigated as a possible weak link because of the availability of low-cost hydroelectric power in this particular area and the resulting dependence on electrical energy. It was found that the distribution of capacity among the 2,700 generating plants in the U.S. is not dissimilar from that within the State of Washington (Figure 50); about half of the plants produce 90% of the power. There are several reasons why it is not feasible for an adversary to target electrical powerplants:

1. To target all U.S. powerplants would require a major expenditure of Soviet warheads and would leave 20% to 30% of the capacity intact.
2. It would be impossible to prevent the surviving capacity from being used by those industries critical to rapid recovery efforts. (Attempting to isolate key economic regions would mean attacking the major substations in the distribution network—about 24,000 aim points in the U.S.)
3. Emergency power systems appear adequate to operate all or most of the industry initially needed for recovery, even if all commercial sources were destroyed. The emergency power sources in the Seattle area are listed in Table 2.
4. Given survival of the machinery needed to repair powerplants and the emergency power required to operate that machinery, the primary production facilities can be rebuilt early in the recovery program. This recovery capability was demonstrated in North Vietnam, where powerplants destroyed by bombing were returned to operation in less than a year.

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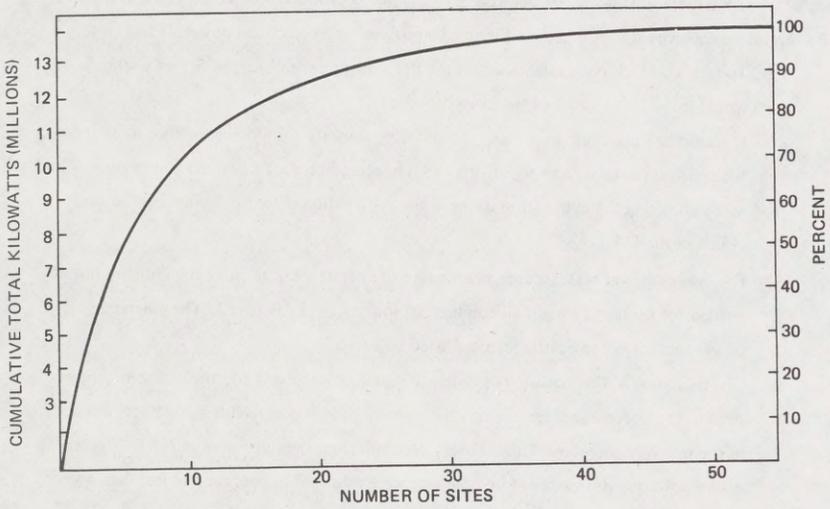


Figure 50. Electrical Power Generation Capacity for Washington State (1974)

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Table 2. Electrical Power System Emergency Power in Seattle Area

Private emergency generators	44 identified	29,285 kW
Diesel electric ferries	16	58,400 kW (600 volt DC)
Diesel electric locomotives	130 (typically)	93,500 kW (600 volt DC)
Mothballed ships	15 (typically)	75,000 kW
	205	265,185 kW

Recovery Time Considerations

A number of studies done in the U.S. have addressed various aspects of recovery from nuclear war. However, it appears that all such studies pertaining to industry have focused on the time needed to restore things to their prewar conditions and prewar production priorities and further have assumed no protection of the industrial components essential to recovery. For an industry such as Boeing, the criterion of full restoration would imply a capability to produce airframes at prewar manhours and costs per pound and to achieve present payload/gross weight performance while maintaining the guarantee of a 60,000-hour airframe life. This degree of restoration would require the capability to produce prewar designs using prewar materials and production processes.

Without protection of machinery, Boeing could achieve full restoration only after restoration of the machine tool industry. Hence, recovery time would be very long. With the maximum obtainable protection of machinery *plus* distribution of unique machines among Boeing's metropolitan area facilities (e.g., skin mills, which are not found in supporting machine shops), full restoration of production processes is estimated to be achievable in 12 to 18 months, but the maximum production capacity would be reduced by about half.

The criterion of full restoration examined above is not considered to be a realistic approach to recovery. The German, Japanese, and Russian experience during World War II is a more appropriate guideline for U.S. postwar recovery. Their approach was to substitute materials and processes where needed and substitute labor for destroyed capital equipment. The difference between full restoration and the substitution concept can be illustrated by an example from a study of postwar restoration of refineries. The item pacing the "full restoration" schedule was the availability of process instrumentation essential to prewar efficiency (gallons of gasoline per barrel of crude) and production cost per gallon. However, after widespread bombing, there would be massive unemployment and extreme shortages of gasoline. The forces of supply and demand would tend to reduce

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labor cost per hour and increase gasoline prices. Hence, it would be feasible to substitute people for the process instrumentation, thus allowing refining to start earlier on a more labor-intensive basis. The same technique could be used in the Seattle-Tacoma-Everett metropolitan area. If aircraft production is needed, parts could be redesigned so that they could be built on the surviving machines. Corrosion proofing could be done with paint brushes if processing tanks did not survive. Strong backs or primitive lifting methods could be used until overhead cranes were restored. Using this approach, some production operations could start within 4 to 12 weeks (depending on the absence or presence of heavy fallout) and reach half of present maximum capacity within about a year.

Planning Factors for a U.S. Industrial Civil Defense Program

A number of factors that should be considered in any U.S. plans for industrial survival can be extracted from the results of the Boeing study. These planning considerations are outlined below.

1. Dispersal

Separation of industrial plants and industrial buildings is the most effective form of protection against nuclear weapons. The pattern of urban development that has occurred in the U.S. has provided substantial dispersal of existing industry. However, current zoning codes and practices tend to group industrial installations into "industrial parks" that can be efficiently destroyed by nuclear attack. Moreover, these same zoning practices and related tax measures tend to raise the cost to industry of acquiring large parcels of industrial land, thereby discouraging the separation of industrial buildings. The dispersal of unique machines (e.g., skin mills) among several plant locations or at least separate buildings would increase production costs and hence could not be done in a highly competitive environment without some form of industrywide regulation.

2. Damage-Resistant Construction

Damage-resistant building construction techniques would make sense only if done in conjunction with dispersal. However, the U.S. has not developed the technology to design such buildings. The Defense Civil Preparedness Agency has done some design research and model tests, but further research would be needed. Damage-resistant construction, although it may be no more costly than earthquake-resistant designs, is still not free. Hence, such a requirement could be imposed only through building codes.

3. Protection of Critical Machinery

The measures necessary to protect critical machinery could be implemented by U.S.

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industries within a few days following warning of a Soviet evacuation if each company had an emergency action plan that could be immediately put into effect. To develop the basic methods of protection for the Boeing facilities required several months of study. Although these methods could be used by other aerospace manufacturers, each industry has some unique problems that would require special protection measures. Studies similar to the Boeing study should be conducted for the different industries (e.g., steel) prior to developing specific plans for individual companies. If such industry studies were available, a company could develop specific plans for its own facilities within 2 to 4 weeks. After a plan had been developed, the advance procurement and storage of corrosion preventatives, sheet plastic, and other supplies needed for protection would significantly reduce the time needed to execute the protection plan. Table 3 gives a preliminary estimate of the costs to Boeing of such preparation and the approximate costs of comparable nationwide preparations.

Table 3. Cost and Time for Industrial Protection Planning and Advance Preparation

	Boeing cost	U.S. cost
Industry studies (10 basic industries) plus individual company plans	\$ 0.250M	\$ 20-40M
Preparation for 40- to 80-psi protection	\$ 0.1-0.15M	\$ 200-300M
Preparation for 200- to 300-psi protection	\$ 1.2-15 1.5M	\$ 2,500-3,000M

In the event of a crisis, a major consideration is how to keep the work force in place long enough to protect the industrial machinery. The Russian approach appears to rely on a combination of patriotism, discipline (probably enforced), and blast shelters near the factories to protect the workers should war begin prior to completion of industrial protection measures. As a minimum, the U.S. would probably need comparable sheltering for part of its work force.

4. Restoration and Resiliency

The size of the Soviet arsenal would impose a major requirement for decontamination of radioactive areas. Techniques for decontamination were worked out during the U.S. nuclear testing program. Soviet reports of civil defense exercises describe a variety of rela-

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tively practical decontamination procedures. The effectivity of these procedures, however, is dependent on trained decontamination teams and the availability of radiation-monitoring equipment.

The high degree of automation in U.S. industry is a major drawback to recovery since automation has displaced many of the basic skills. Restoration of basic metalworking and analogous skills would be a prerequisite to rapid recovery.

The Soviet economy has substantial resiliency because of the relatively large amounts of raw materials and in-process goods present in the factories and the finished products in the distribution system. Because of inventory taxes and capital costs, the U.S. lacks this advantage and its economy, therefore, would be much more susceptible to disruption by even relatively light attacks.

5. **Management**

Planning at the national level would be essential to industrial recovery. Such planning would necessarily include provisions for protection of industry as well as procedures and priorities for postwar recovery. National planning should also provide for the communications and personnel who are necessary to assess damage and direct recovery efforts needed to ensure the best application of surviving assets to national needs. The management of a U.S. industrial survival program should be structured so that industrial plans will complement other programs for the defense and security of the United States.

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CONCLUSIONS AND RECOMMENDATIONS

The conclusions derived from The Boeing Company's analysis of the Soviet plans for civil defense and its industrial civil defense planning study are of significant concern to every American. First, the USSR has a civil defense program that can effectively protect their industry and facilitate its rapid recovery should a nuclear war occur. Second, the Soviets can protect their work force by means of evacuation and construction of expedient shelters during the initial stages of a crisis. Although the level of work force survival is influenced by a number of variable factors, the most important of these variables can be controlled by the Soviets rather than by the United States. Third, the Soviets can protect their industrial machinery. This is a critical factor in postattack recovery. Tests show that even large machines, if properly protected, could survive if they were a few hundred feet from a 40-kiloton nuclear blast or 2,000 feet from a 1-megaton blast. More important, if the observed examples of industrial facility dispersal and separation become the pattern for a significant portion of the Soviet Union's future capital expansion, their industry would require little or no preattack hardening to survive and recover rapidly from a nuclear war.

There is increasing evidence that the Soviet Union has mounted a large-scale and well-integrated effort to implement the provisions of its civil defense plan. There are areas of known deficiency in their implementation and other areas where the extent of implementation is largely unknown to the U.S. However, these deficiencies and unknowns are not likely to significantly degrade the effectiveness of the Soviet program. Instead, their effect is to extend the time required to transition from their present posture to a fully evacuated and protected posture. If all advance preparations called for in Soviet plans were complete, they could transition into a war-ready posture in 3 to 4 days. If advance preparations are incomplete, it could take a week for complete dispersal and evacuation of their population and up to several weeks to achieve full protection of their industrial machinery. These times are substantially less than would be required for the U.S. to respond from its present state of preparedness.

The Soviet civil defense preparations substantially undermine the deterrence concept that has been the cornerstone of U.S. national security. Although the U.S. sought through the ABM Treaty to ensure the future viability of mutual deterrence, the Soviet civil defense preparations (which appear to have been accelerated in mid-1972) have circumvented the intent of this treaty. The increasing power of the Soviet strategic offensive forces in combination with the strength of their civil defense program completes the destabilization of the strategic relationship between the two nations.

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Some critics argue that the Soviet evacuation and industrial protection plans are not viable because, if an evacuation was started, the U.S. could attack the evacuees before they could be fully dispersed. Such an argument is contrary to the U.S. objective of deterrence. It would be illogical for the United States to be in a position in which, to preserve the viability of its doctrine to deter war, its only recourse would be to preemptively attack the Soviet Union and accept the subsequent destruction of the United States.

The growing Soviet defensive and offensive superiority will most likely result not in nuclear war, but rather force the U.S. to make costly concessions to avoid nuclear war. In a future confrontation, should the Soviets execute their civil defense plans, the consequences to the U.S. of escalation to nuclear war would be disastrous, while the consequences might be tolerable to the Soviet Union. It is believed that the USSR could recover within no more than 2 to 4 years whereas the U.S. could not recover in less than 12 years. In such a condition, the so-called "balance of terror" would no longer be balanced.

Present Soviet civil defense capabilities require that the United States make some important policy decisions. One course of action would be to adhere to our present doctrine and try to make nuclear war as unthinkable for the Soviet Union as it now is for the United States. Another course would be to try to make nuclear war as survivable for the United States as it now is for the Soviet Union. There may be some middle ground between these two options.

Following the first course would imply an attempt by the U.S. to overpower the Soviet civil defenses. This would require a massive increase in the U.S. nuclear arsenal, or possibly a search for some new terror weapon that if used would really destroy all mankind. The second course would involve increased emphasis on defenses for the United States; probably some combination of air and civil defenses. Such defenses presumably would make nuclear war more thinkable for the U.S. and hence would be objectionable to some. However, unless we can be assured that nuclear war is unthinkable for the Soviet Union, it must be made survivable for the U.S.

There is no technical or economic reason why the U.S. cannot have effective civil defense capabilities. It is recommended that the Congress give consideration to protecting Americans and the industrial capabilities of the nation.

It is not possible that U.S. civil defense preparations could by themselves entirely remove the destabilizing impact of the Soviet civil defense preparations. Such U.S. preparations could,

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however, negate certain destabilizing capabilities that result from the new Soviet weapons now being deployed. Of equal importance, such preparations could balance an instability that is now, in the words of a Library of Congress report, a one-sided "buttress [for] the Kremlin's bargaining power in times of intense international crisis. . .".¹¹ Of even greater importance, it is believed that a civil defense program will permit the United States to maintain its security for less cost and with less nuclear weaponry than would otherwise be required.

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APPENDIX

CIVIL DEFENSE AND THE STRATEGIC BALANCE

Civil defense is not of itself a threatening capability. Both Sweden and Switzerland have extensive and well-prepared civil defense programs. These programs do not threaten either the U.S. or the USSR because neither Sweden nor Switzerland possesses the offensive weaponry to seriously damage either of the two major powers. For this same reason, the Soviet civil defense preparations, although they date from before World War II, did not in earlier years threaten the United States.

However, in 1972 when the SALT I agreements were signed, it was publicly stated that the United States no longer had nuclear superiority; the forces of the two sides were at approximate parity. Since then, the Soviets have initiated concurrent deployment of four new ICBM models, creating serious concerns in the U.S. as to the trends in the strategic balance.

Paul H. Nitze has suggested that there are three different ways in which the strategic balance can be measured:¹⁰

1. That which each side has *before* a strike
2. That *surviving* to the United States after an initial counterforce strike by the Soviet side
3. That remaining to each side *after an exchange* in which the Soviet side attacks U.S. forces and the U.S. responds by reducing the Soviet side's reserve forces to the greatest useful extent

These three types of measurement are illustrated by the figures that follow.

The nuclear balance that each side has in inventory is shown in Figure A-1. The data are presented to eliminate most of the numbers and show not just where the United States stands today, but where the U.S. has been and what prospects the future holds. The data show who is ahead or behind in the principal dimensions of military power: throw weight, equivalent megatonnage, number of warheads, and number of missiles and bombers. The combined effect of the U.S. lead in accuracy and the Soviet advantage in warhead size is illustrated in the "2,000-psi index," a measure of the capability to destroy targets of that hardness. The trends indicate continuing equality in delivery vehicles (missiles and bombers) and in the capability to destroy hard targets. The Soviet Union is ahead in throw weight, equivalent megatons, and total mega-

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tonnage, which are, in effect, different measures of the same thing—deliverable weight. The U.S. leads in number of warheads. If it is assumed that the Soviet lead in deliverable weight (throw weight, etc.) is counterbalanced by the U.S. lead in number of warheads, it is perhaps reasonable to conclude that the U.S.-Soviet strategic nuclear forces are “roughly equivalent.”

The balance of forces that would exist immediately after a Soviet first strike against U.S. strategic forces is shown in Figure A-2. The Soviets would hold a significant margin of superiority over the United States in every index of capability. The Soviets would hold a 3-to-1 superiority in equivalent warheads, which is the most meaningful measure of relative power. The theory of deterrence is predicated on a number of factors: first, the threat that the United States would retaliate, even in the face of the vastly superior Soviet forces; and second, that the surviving U.S. forces could devastate the Soviet economic and political assets. Soviet military strength combined with their civil defenses would deter the U.S. from use of its deterrent force and, if the U.S. did retaliate, would reduce substantially the damage that could be inflicted.

The U.S., instead of retaliating against Soviet economic and political assets could attack the Soviet reserve forces (those not used in the Soviet first strike). This would reduce slightly the Soviet advantage but, as shown in Figure A-3, the Soviets would still retain superiority in all indices of capability except numbers of warheads. Moreover, this last remaining U.S. advantage will disappear within the next 2 or 3 years. Viewed from this perspective, the “roughly equivalent” forces of the United States are seriously defeatable, a condition which, because of Soviet civil defense capabilities, should be of serious concern.

The data shown in the figures in this appendix and in the study report are based on the United States' current plans for strategic forces (which include both the Trident submarine and the B-1 bomber) and the forces that the Soviet Union is believed most likely to deploy. The future force projections *assume that a SALT II agreement had been imposed in 1976*, establishing the limits outlined at Vladivostok in November 1970. The forces and assumptions used in the analysis cannot be spelled out here because security considerations necessarily restrict some of the underlying data.

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The descriptions of the indices of capability used in the preceding figures is as follows:

Megatons—The aggregate total megatons of all warheads carried by missiles and bombers

Equivalent megatons—Same as megatons except scaled to the damage-causing capability of an equivalent number of 1-megaton warheads

Throw weight—The aggregate total of missile and bomber warhead delivery capabilities

Equivalent warheads—Based on number, size, and accuracy of warheads and considering the characteristics of targets against which the warheads would probably be used. (This is the most sophisticated and comprehensive of the indices illustrated.)

Countermilitary potential (CMP)—The capability to destroy hardened targets

Number of warheads—The total number of missile and bomber warheads; it does not account for size or accuracy.

Delivery vehicles—The total number of ICBMs, SLBMs, and bombers having intercontinental range

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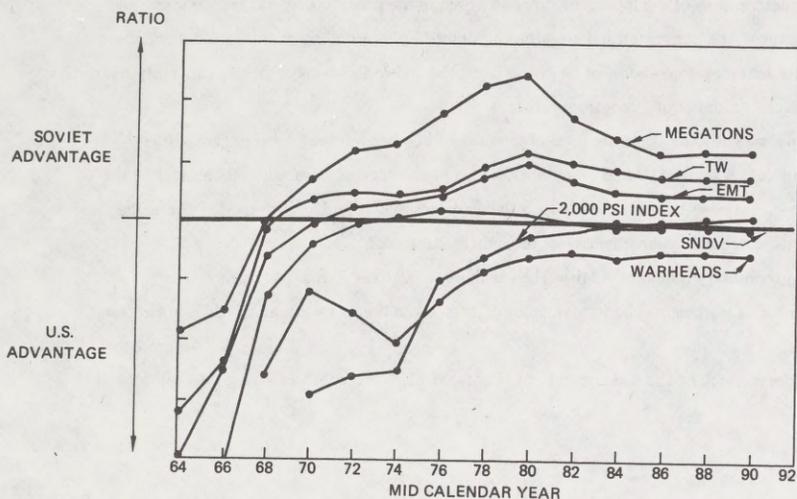


Figure A-1. Balance of Deployed Forces (Static or Pre-Attack Levels)

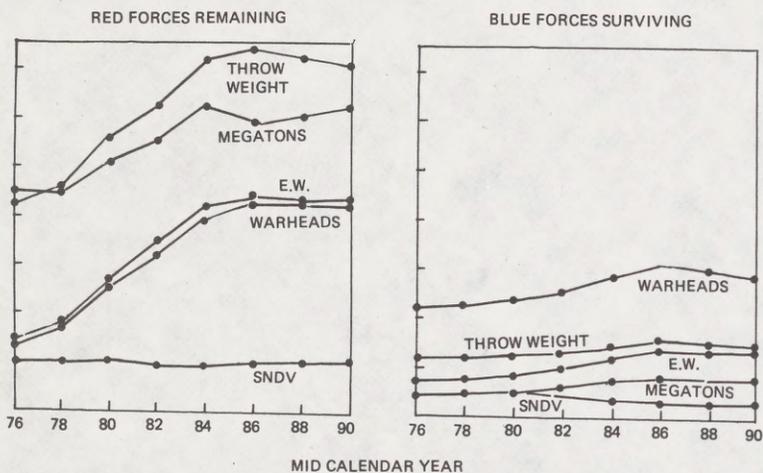


Figure A-2. Capabilities After S.U. First Strike

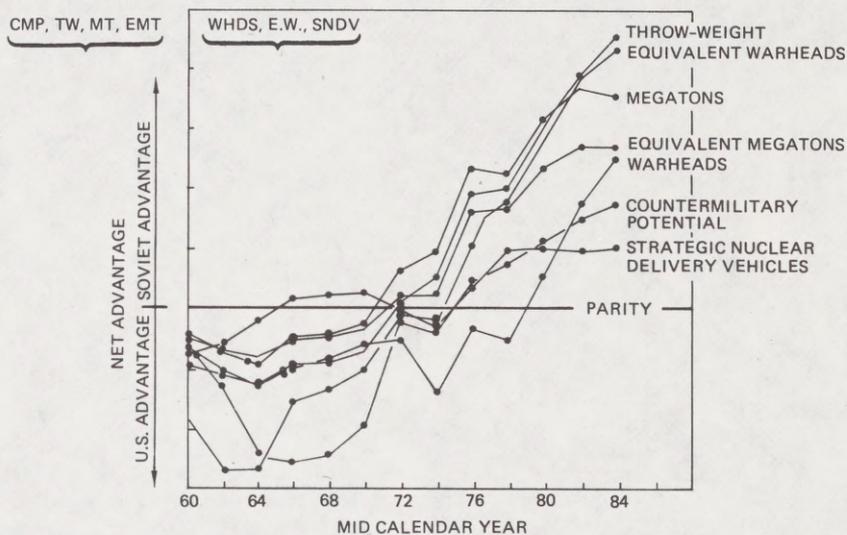


Figure A-3. Comparison of Alternative Indices of Capability (After a Counter Force Exchange)

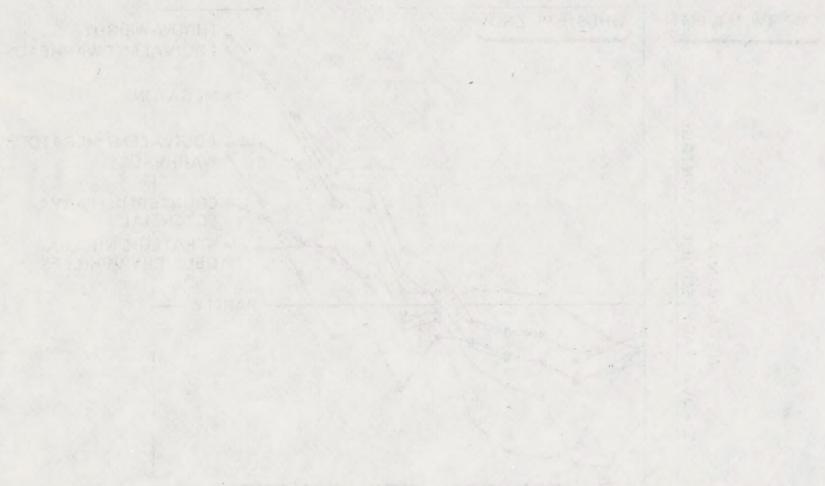


Diagram illustrating the relationship between the variables shown in the adjacent figures.

APPENDIX III

ADDITIONAL QUESTIONS FOR THE RECORD
for
JACQUES S. GANSLER

1. This year the Congressional Budget Office produced two Staff Working Papers relating to Foreign Military Sales: "Budgetary Cost Savings to the Department of Defense Resulting from Foreign Military Sales" and "Foreign Military Sales and U.S. Weapons Costs".

1a. Question: The second of these two studies concluded that the savings produced by Foreign Military Sales are, generally speaking, insubstantial. Do you agree with these conclusions?

Answer: Before addressing the specific question asked, I think it prudent to place Foreign Military Sales (FMS) -- one aspect of the U.S. Government's Security Assistance program, in perspective. We provide defense articles and services to foreign governments and international organizations through FMS in furtherance of U.S. national security and foreign policy interests.

The Congress has reserved security assistance policy matters for the Department of State -- here security assistance means a conglomerate of FMS, grant aid, international military education and training, economic assistance and food for freedom. The Department of Defense mandate deals with the activities related to effecting military aspects of security assistance. Executive Branch decisions as to whether a particular foreign military sale is to be made, and if so in what amount, are based primarily upon an assessment of the total defense and foreign policy interests of the United States as they are seen at the Office of the Secretary of Defense (OSD), State, and National Security Council (NSC) levels and reviewed by Congress. Only those sales are approved which are judged to be in the overall United States interest, measured against these factors.

It is important to realize that United States foreign policy is based in part upon a national policy of strong defense. Thus, decisions as to what serves our foreign policy in security assistance areas must by necessity take into account valid U.S. defense interests as well. Within the framework of approved decisions as to what programs this government will undertake, the policy of OSD is to manage these programs within the Department of Defense (DOD) so that overall U.S. Government objectives are met, and to fulfill the Secretary of Defense's assigned statutory responsibilities which are: determination of military requirements, procurement and delivery of defense articles and services, integration of requirements with other DoD programs, training and supervision of end-use.

The military aspects of security assistance are inextricably woven into the DoD mission. The Congress expressed its views succinctly in a recent arms sales hearing, when it applauded the "news" that foreign military sales are made to promote U.S. national interests, and not in response to economic pressures from U.S. industry or service interests. Savings which accrue to

the U.S. Government as a result of foreign military sales are only a positive, secondary economic by-product, and not the purpose of the program.

The Congressional Budget Office prepared three reports related to foreign military sales in the spring 1976. The first, developed by the National Security and International Affairs Division, appeared on May 5, 1976. This initial study, entitled "Foreign Military Sales and U.S. Weapons Costs", concluded that for selected weapons systems, "the savings from foreign sales are substantial, ranging up to 15% of a weapon's procurement costs in a given fiscal year and 8% of its total research and development (R&D) costs." The report's author pointed out that reduced U.S. weapons requirements as a result of foreign military sales is a "potentially far more important source of savings". The report discussed, in general terms, sources of savings in DoD weapons costs due to foreign military sales, and pointed out the difficulty of quantifying actual savings accruing from enhanced regional stability as a result of FMS.

In late May, the first of two reports prepared by the Budget Analysis Division for the House Armed Services Committee appeared. This report identified i) Research and development recoupment, ii) Learning curve effects and economies of scale, iii) Overhead reduction, iv) Production line gap (line stability without termination and start-up costs), and v) "other" as sources of potential cost savings. Based on a study of 35 major weapons systems, the authors found that in a given fiscal year, a foreign military sales program at a level of \$8 billion would generate savings of \$560 million for that fiscal year. An increase or decrease in the level of FMS agreements signed would cause a proportionate increase or decrease in the savings generated for the fiscal year in question, depending on the mix and timing of the sales. The study commented, in the introduction, that "commercial arms sales have little potential for generating budgetary savings to the Department of Defense."

The second Budget Analysis Division report, "The Effect of Foreign Military Sales on the U.S. Economy", was published on July 23, 1976. This concluding study analyzed certain macroeconomic effects on the U.S. economy of foreign military sales. Within the parameters and assumptions of the study, the authors demonstrated that by fiscal year 1981 a ban on foreign military sales would lead to a "current dollar" lowering of the GNP by approximately \$20 billion, (for the years fiscal 1977 - 81, the GNP would be lowered a total of between 51 and 55 billion dollars). A ban would also lead to a projected drop in net exports of \$7.5 billion by fiscal 1981 (approximately \$14 billion for the period fiscal 1977 - 81) -- this would impact on the U.S. balance of payments. Furthermore, the CBO analysis showed that "under a ban on FMS, by fiscal year 1981 the unemployment rate would be approximately 0.3 percentage points higher than otherwise projected." This translates into about 350,000 jobs lost in fiscal 1981 if FMS were terminated.

The reports do not describe the savings as being "insubstantial." The bottom line of the initial, May 5, 1976, report is a tentative conclusion that if a given foreign military sale does not serve U.S. foreign policy, "it seems

unlikely that cost savings would be sufficient to serve as a counterbalance." We in the Department of Defense cannot and do not disagree with this comment. To do so, would run counter to the purpose and intent of the security assistance program. We do not make decisions to sell a particular weapons system to a foreign government on the basis of purported "substantial or insubstantial" savings.

1b. Question: The first of these two studies contained service estimates of cost savings achieved through FMS for 35 major weapon systems (pages 8-11). Can you confirm and, if necessary, update these figures for each of the 35 major weapon systems now or recently involved in the FMS program and not shown in this report?

Answer: A review of the Service submissions to the Congressional Budget Office of estimates of cost savings through Foreign Military Sales of 35 major weapon systems indicates the continuing validity and usefulness of these data. We realize that as estimates these data are not insensitive to time; however, in view of their very recent nature (summer 1976), we see no reason for their not being current.

2. In his 1974 study, Arming America: How the U.S. Buys Weapons, Harvard Professor J. Ronald Fox wrote:

"If forecasts for continued decline in the sales volume of defense firms are correct, the problem of excess capacity may become urgent. Overcapacity leads to an increase in fixed charges, followed by an increase in the cost of weapon systems. Declining sales volume inhibits contractor investment in labor-saving, capital equipment and also discourages the flow of capital to defense firms."

Comment: I agree with Mr. Fox's statement. Having evidenced the inhibitions of contractor investments in cost reducing capital equipment, we established several initiatives to encourage the reversal of this trend. Our new profit policy, which was implemented this past October, combined with other procurement initiatives now underway should act to help reverse this trend. Additionally, we are studying other longer term initiatives in this area and we will continue to keep the Committee informed.

2a. Question: From your testimony, it would seem that the problem of excess capacity among the prime contractors has now become urgent. Can you estimate the cost to the government of this excess capacity in the aggregate, as a percentage of cost-growth on weapons procurement, or as an additional cost for specific weapon systems?

Answer: We are currently studying the degree of capacity utilization in the aircraft industry and its potential cost versus potential advantages, i.e., increased competition and production surge response. We cannot, yet, quantitatively assess the impact of extra capacity, in the aggregate, to the DoD. Tentative findings from our aircraft study indicate that 17 manufacturers of military and civilian airplanes and helicopters are, on the average, operating at 70% or less of capacity.

We believe that competition and surge capacity can probably be maintained while reducing this underutilized capacity to a minimum. Quantifying the potential cost savings and developing potential policy actions is the purpose of our current study. We will inform the committee of our findings after the study has been completed.

2b. Question: Have you developed information regarding the amount of excess capacity at the level of the prime contractors, either in the aggregate or by type of defense manufacturer (shipbuilding, airframe, etc)? If such information is not currently available, will you please provide it to the committee as soon as it becomes available?

Answer: The response to question 2a also responds to this question

2c. Question: Does the Department of Defense have any criteria for determining how much excess capacity it requires, in percentage terms, by type of defense manufacturer as a hedge against a "surge" requirement or mobilization requirement?

Answer: The Department of Defense does have explicit criteria for determining the amount of extra capacity required, over peacetime production rates, for surge and mobilization production requirements of combat critical materiel. The military departments plan with industry to retain existing production capacity up to that which will provide monthly rates of output to meet combat consumption/attrition rates under hypothetical surge and mobilization scenarios established by the Secretary of Defense in annual guidance to the Military Departments. Where evidence of insufficient capacity becomes evident in the Military Departments' plans, actions are initiated in the form of Industrial Preparedness Measures to attain the required capacity.

2d. Question: If so, what are these criteria and what amount of excess capacity is currently considered desirable for preparedness purposes?

Answer: The response to question 2c also responds to this question. For further amplification, I am providing at Tabs A and B, copies of DoD guidance relative to the allocation of industrial capacity for Industrial Preparedness Planning.

2e. Question: How much of the current excess capacity among prime defense contractors is also excess to "surge" or mobilization requirements?

Answer: As indicated in my response to question 2a, we cannot quantitatively assess current excess capacity until our current study of the aircraft industry is completed.

2f. Question: What does the Department of Defense propose to do about this excess capacity or about the costs that it imposes on the procurement budget?

Answer: Response to this question must await the completion of the current study on capacity utilization in the aircraft industry, as referred to in my response to question 2a.

3. Question: Correspondence received by the Joint Committee from defense contractors indicates that many of them, especially the smaller ones involved in subcontracting or supplying of components, feel that the industry is over-regulated due to regulations that apply to cost-plus contracts. Would it not be easier to attract and retain these companies in the defense market if greater use was made of fixed-fee, rather than cost-plus, contracts?

Answer: Fixed-price versus cost-type contracts are probably more attractive to defense contractors. We are attempting to use this type of contract as much as possible. There are occasions, however, when fixed-price contracts are not appropriate. In accordance with our established policy, cost-type contracts are used only when the uncertainties involved in contract performance are of such magnitude that cost of performance cannot be estimated with sufficient precision to permit use of any type of fixed-price contract.

It should be noted also that our regulations are primarily directed at prime contractors. We are currently studying the impact of these regulations on the subcontractor and supplier base to determine what changes may be necessary to reduce the burden of over-regulation.

4. Question: The government has long maintained policies and programs aimed at facilitating mobilization, should the need arise. Could not some of the current perturbations that are affecting the defense market following the procurement peak of the Vietnam War have been mitigated if the government had also developed policies and programs to facilitate post-war demobilization?

Answer: The DoD did recognize the perturbations upon the Defense Industrial Base resulting from a transition from war to peace in its policy issuance of 8 January 1971 (copy at Tab C). This policy encouraged the development of transition plans with defense contractors to assist in exploring and planning for alternate sources of business during a period of declining Defense expenditures. Unfortunately, at the time this policy was issued, many severe and unusual economic factors interacted which tended to mitigate the intended purposes of the policy. The concomitant recession accompanied by heavy inflation, materials shortages, the energy crisis, high interest rates and international implications such as the devaluation of world currencies, all contributed to an almost total lack of sources for alternate business. As a result, our policy was never able to function as effectively as intended.

5. Question: Does the Department of Defense or the Defense Science Board have any proposals or recommendations for demobilization policies or programs, in light of the post-Vietnam War problems?

Answer: The Defense Science Board Study on Industrial Preparedness did not address demobilization policies or programs. The concept of surge planning, being directly related to peacetime Defense procurement, will enable the DoD to address the problem of transition from war to peace as well as peace to war. The policy iteration of 8 January 1971, referred

to in the response to question 4, is being incorporated into our surge planning concepts. These new concepts should provide the flexibility required for planning for increased or decreased international tensions.

6. Question: If a conflict of short duration but high intensity resulted in a "surge" requirement in the defense marketplace, does current Defense Department planning provide for any measures to lessen untoward effects resulting from meeting this requirement, such as shifts or reductions in labor requirements, capital reallocation, diversion of materials? If so, what are these measures? If not, why has no planning been undertaken that will address the "surge" requirement on the downhill as well as the uphill side?

Answer: In the context of the definition of surge, a conflict of short duration but high intensity could be identified with the Mid-East conflict of 1973. Under our surge concept, we can foresee no untoward effects on the Defense Industrial Base in meeting this type of requirement. Our peacetime production base would surge, primarily through the employment of additional work shifts, to meet the increased material requirements of Allied or friendly nations. The relatively minor impact of Defense procurement in a surge situation upon the Gross National Product of the nation should not create any significant problems in labor requirements, capital reallocation or diversion of materials. Since the peak of Vietnam, Defense procurement has accounted for about 1 1/2% of the GNP. It is not visualized that a surge situation resulting from a conflict of short duration would consume a significantly greater share of the GNP.

In a conflict of short duration involving U.S. forces, our surge concept as described above would also be put into effect. Although chief reliance would be placed upon the war reserve stocks in the inventory for resupply of the forces, peacetime production sources would be surged to refurbish drawn-down inventories or provide continued resupply should the conflict extend beyond a short duration. Although few problems are foreseen in "desurging" industry under this type of conflict, the incorporation of transition planning in our surge concepts, as discussed in the response to question 5, will assist in a smooth transition from surge to peace.

7. Question: Don't certain other federal policies tend to encourage contractors to refuse defense business? The shipbuilders are a case in point. Don't federal subsidies for commercial construction make defense contracts comparatively unattractive? Commercial orders for some types of hulls is at a record high. Isn't that what gives the shipbuilders their present leverage and the luxury of turning down defense contracts?

Answer: Federal subsidies for commercial construction do encourage private firms to place orders in US shipyards. For the shipyards, commercial contracts are more attractive because specifications and inspection requirements are less demanding than those of Defense. Also, it is easier to train personnel for commercial contracts because, for the most part, the skill level requirements are lower.

There is, currently, a backlog of private orders for liquid natural gas (LNG) and oil tankers under contract which should exist for approximately two

years, depending on the demand for these types of energy. There is some indication that this demand will again increase. Most US shipyards are of limited capacity and can only pursue one area of endeavor at a time; i.e., either private or Navy construction. Hence, if they have accepted or are likely to receive a commercial contract, they will not bid on Navy work.

8. A number of defense contractors have made some very unprofitable decisions, both on their commercial and their defense work. For example, there is a declining number of defense companies in the standard lists of "100 Most Profitable Companies" or "100 Best Growth Companies."

8a. Question: Aren't some of the injuries that the defense industry is suffering in a sense self-inflicted?

Answer: Over the recent period, Defense has clearly been a declining business, both relatively and absolutely. This factor, combined with the high risk environment of Defense business, explain the results noted. There are however, steps which have been taken to improve the way in which the DoD conducts its business which will reduce the degree of risk in the Defense business environment. For example, the increased recognition of risk in reaching pre-negotiation profit objectives under the weighted guidelines method of our new profit policy and the allowance of imputed cost of capital for facility investment, under the CASB 414 ruling, should substantially help in reducing the "unprofitable decisions" made by defense contractors. Additionally, the longer term initiatives, referred to in my comment to question 2, will assist in improving the profitability of defense contractor decision.

8b. Question: Does the Department of Defense have any way of distinguishing between companies imperiled by conditions they can't control and those that are imperiled by their own mismanagement?

Answer: Clearly, these situations must be explored on a case-by-case basis. We are taking steps to improve our visibility of the factors which contribute to this imperilment, particularly at the lower-tier levels where it is most prevalent. For example, a recent initiative will ensure early warning of potential problems which could imperil individual contractors or segments of the Defense Industrial Base.

8c. Question: Should the Defense Department be able to make such distinctions?

Answer: The approach outlined in my response to question 8b should enable the Defense Department to make such distinctions.

9. Last April, the Director of the Defense Advanced Research Project Agency, Dr. Heilmair, said:

...in future conflict there will be a premium on fast response. Modern weapons may make the first battle the last. This means that forces in being are more important than inherent capability. The manufacturing base which was critical to the United States in past wars will be

of little use to us in future conflicts that are likely to be short, violent and dominated by advanced technology. There simply won't be any time to mobilize the entire nation and its manufacturing base. There will be no time for bond drives, gearing up, mobilization and determined national production.

9a. Question: Does that mean that this recent study of pre-mobilization or "surge" capacity, war recovery measures and strategic stockpiling addresses only remote or improbable contingencies? Do Dr. Heilmair's views reflect the Joint Chief of Staff's assessments or departmental assessments?

Answer: Naturally, any prognostication of future conflict is highly speculative. There is a fairly wide divergence of opinion among informed observers within and outside of the government about the relative probability of different types of potential future conflicts. This divergence of opinion will not be settled conclusively, short of the real thing.

As a consequence, the Department of Defense must maintain a readiness position to meet a variety of possible contingencies. The recent Defense Science Board study on industrial preparedness addresses those contingencies which are considered possible under existing as well as future international environments. The maintenance of a responsive defense production capability is imperative. The risk of basing defense planning solely on a single concept of war, such as in the quoted paragraph, would not be prudent.

The Joint Chiefs of Staff fully support the Department of Defense assessment of multiple concepts of future contingencies and the industrial preparedness planning being conducted to meet those contingencies.

10. Statement: In your statement, you say that procurement from foreign sources may reduce costs through competition, but that is also driving American suppliers out of the market -- which increases costs -- and that it may make us overly dependent on overseas producers. At the same time, the Defense Department is going ahead with a NATO standardization program which actually promoted foreign procurement. This policy has led to reduction in price differentials on foreign items from the former 50% to a level of 6% to 12%. Also, the Defense Department is asking Congress to suspend "Buy American" laws in certain cases.

Comment: I stated that we welcome foreign competition in order to secure more economies in our peacetime procurements as long as a viable domestic base remains to respond to emergency requirements. I also expressed concern that we may need to further protect and/or create additional domestic production sources in certain critical parts areas.

The reason for considering the reduction in price differentials from 50% to 6% to 12% is due to the much improved U.S. Balance of Payments situation and to return to consistency with other Government agencies in enforcing the 6% price differential on foreign source bids or proposals, as prescribed by Executive Order 10582. No decision has yet been made to revise our procurement policy to affect this change.

Relative to your statement that the Defense Department is asking Congress to suspend "Buy American" laws in certain cases, to our best knowledge, we have never placed such a request before the Congress. As you are aware, Section 802 a(2) of Public Law 94-361 provides authority to the Secretary of Defense to waive the provisions of the Buy American Act in the public interest, whenever NATO standardization is involved.

10a. Question: There is an apparent contradiction here. On the one hand, DoD fears foreign competition and on the other hand, DoD promotes it. How does the Department plan to resolve this conflict in goals?

Answer: Congress in Public Law 94-361 stated that NATO standardization is the policy of the United States. In implementing this policy, the Secretary of Defense recognized the desirability of greater standardization and interoperability of weapon systems within NATO and that the achievement of this goal requires a two-way street of cooperation with Allies. To achieve an effective means to maintain a credible conventional defense of Western Europe requires reliance on our key Allies. This reliance is evidenced by our long-standing-cooperative arrangements with Canada and by the agreement of last year with the United Kingdom to mutually reduce restrictions on inter-country defense purchases. The advantages of standardization including economic savings, compatibility in doctrine and operating procedures and logistics interchange must be balanced against the potential disadvantages we might encounter. Thus, as we work toward improved standardization; we will continue to be alert to these potential disadvantages and take the necessary steps to resolve them. For example, Department of Defense policy excludes certain items from competition under offset agreements by virtue of the need to maintain U.S. production sources for industrial mobilization purposes.

10b. Question: Isn't the NATO standardization program basically an American idea?

Answer: The benefits of the NATO standardization program, in terms of enhancing the combat capability of the NATO alliance and economic efficiency, have been widely recognized and supported throughout the alliance since its earliest days. It is incorrect to say that it is basically an American idea.

The Congress has recognized NATO Standardization as a policy of the United States. Also, recognizing that active United States promotion of the concept is essential for it to work, both the Congress and the Department of Defense have placed increased emphasis on NATO standardization over the last few years.

11. Defense industry is usually called "labor intensive" because of the large inputs of high-salaried, highly skilled workers. The committee is concerned about the availability of these skilled workers, if a partial or full mobilization becomes necessary.

11a. Question: Do any of your industry studies address this problem? Did

the Defense Science Board address the labor problem in its study. If not, why not?

Answer: None of our studies directly addresses the problem of labor availability in the Defense industry. The high degree of "labor intensity" and skill levels in the Defense industry is primarily driven by the very high technology requirements of our research and development programs. As we proceed into the production of the newly developed weapon systems, the skill levels become more attuned to manufacturing type technology which, as you are aware, is currently an area of considerable unemployment.

11b. Question: The mobilization labor pool has reportedly eroded because unemployed or under-employed workers in defense-related occupation groups have shifted to other fields. Is the Defense Department looking at this development?

Answer: My response to question 11a, and 11d that follows, also responds to this question.

11c. Question: A recent report of the General Accounting Office said that the Defense Department had been delinquent in identifying the minimum number of skilled personnel required to run its own production facilities during mobilization. Have you or the Assistant Secretary for Manpower done anything to estimate the numbers or identify the occupational groups that mobilization would require?

Answer: The DoD cooperates with the Federal Preparedness Agency (FPA) and the Department of Labor (the latter having prime responsibility for development of manpower mobilization programs) in obtaining the data necessary to estimate the skills required to support different levels of mobilization.

FPA, by comparing the peacetime skills requirements with the skill requirements for various scenarios, is able to estimate the augmentations which would be required by various occupational categories necessary to support direct defense and essential civilian activities. FPA upon identifying required augmentations can consult with the Department of Labor to determine whether or not such augmentations are feasible and, if not, what steps might be taken to overcome mobilization manpower deficiencies.

11d. Question: If a contractor were to add an additional shift in order to meet the "surge" requirement that you mention in your statement, where would he get the skilled labor for an additional shift? Have you done any planning for this?

Answer: Generally, with today's economic conditions and with eight million citizens currently unemployed, if a contractor were to add an additional shift to meet a surge requirement, the needed manpower could most-likely be obtained from the existing skilled labor supply. We have not done any direct planning for resolution of potential spot labor shortages.

12. Question: Part of the terms of reference for the Defense Science Board's industrial preparedness study was a review of the strategic stockpiles. Is the Board, or are you, satisfied with the new stockpile program that was promulgated in October? Do you see any problems in this new formula for recalculating stockpile needs every year?

Answer: The Defense Science Board's industrial preparedness study concluded that the relationships between stockpile planning and industrial preparedness planning were proper. The study also concluded that the recent inter-agency evaluation of stockpile policies and assumptions and the establishment of procedures for a national planning program constituted a proper direction of effort. The study recommended increased DoD participation in the stockpile planning process. I fully support the study conclusions and recommendations in this regard.

We are also satisfied with the new stockpile program promulgated in October. We recognize that a significant amount of acquisition of raw materials will be required to reach the new inventory goals. Hopefully, the dollars required for purchase of needed commodities can be offset in part by sales of excess materials in the stockpile inventory. We do not foresee any problems in the new formula for recalculating stockpile needs on an annual basis.

13. Question: If the prime contractors are getting enough business to stay in the defense market, while the subcontractors are fleeing it, does it make sense for the government to take over the job "systems integrator?" This would mean that the Defense Department would essentially subcontract a whole system, piece by piece, to both major and second tier contractors, while retaining control of overall financial management. Would such an approach also improve the visibility of all costs and impede profit pyramiding, such as now occurs when the prime contractors control all subcontracts.

Answer: The government could conceivably take over "Systems Integration" responsibility, but it would not appear to be in our best interest. Such an approach would require a substantial increase in personnel to technically develop and manage the acquisition of individual equipments.

Additionally, this approach would likely be in conflict with the intent of Congress and such mandates as OMB Circular A-76. More importantly, perhaps, is the fact that we would lose the benefits of holding a single contractor responsible for the overall operation of the system, and, in effect, become a self-insurer in this regard. Portions of the monies we now pay our prime contractors are to assume the "systems integrator" risk. To assume this responsibility on the part of the DoD would be a significant change and not determined to be in our best interest.

14. Question: What new programs has the Department of Defense implemented or proposed to deal with the problems of erosion in the defense industrial base in terms of procurement, production incentives, etc.

Answer: In the area of procurement policies, a number of relatively recent initiatives are in process. One, of course, concerns the profit incentives which were presented to you by Mr. Clements in his statement on Profit '76. Other new procurement-oriented initiatives are summarized below:

- o An effort to encourage increased contractor capital investment when costs will be reduced and productivity increased by emphasizing the use of multi-year contracts, special termination provisions, cost-plus-award-fee provisions, and sharing of capital investment savings with contractors.

- o An initiative to seek ways to effectively implement Cost Accounting Standards and ease the administrative impact upon industrial establishments.

- o Improved utilization of contract administration resources by emphasizing areas that need strengthening and reducing effort in areas which have a lower pay-off.

In the production area, the management thrust has been to improve the economic efficiency of the materiel acquisition process through increased competition while ensuring the maintenance of a surge production capability. The major initiatives in this area are:

- o Increased emphasis of the DoD Manufacturing Technology Program.

- o Greater integration of industrial preparedness considerations into the procurement process.

- o Identification of areas in the industrial base requiring facilities modernization.

- o Greater use of standard off-the-shelf commercial parts.

- o An initiative to acquire greater visibility over the potential impacts associated with the export of U.S. technology.

- o The issuance of a directive to permit early warning to possible DoD material shortages and plant closures.

15. Question: Why is there a need to develop capacity to meet "surge" requirements if there exists excess capacity at the level of prime contractors already? Won't additional "surge" capacity add to the excess capacity in industry and to the idle capacity represented by unused DoD production equipment?

Answer: Further elaborating upon my previous responses, it is not the purpose of the new surge production planning concept to arbitrarily develop or acquire new production capacity (defined as physical plant and equipment); rather, the purpose is to develop a true surge production capability which integrates the

utilization and allocation of all the essential factors of production. This integration is being focused less at the prime contractor level and more at the subcontractor and supplier levels so as to systematically identify and solve production bottlenecks which could inhibit the efficient flow of defense materiel during a surge situation. As such, the surge concept provides a realistic basis for making industrial base investment decisions as a hedge against the wide range of possible forms of emergency situations which, short of full mobilization under a declared national emergency, could impact the U.S. or its allies.

The establishment of a surge production capability for any system, subsystem or part will not necessarily add any extra capacity; instead it will ensure that the existing capacity within a given production facility will be sized to permit an efficient and timely surge production response.

The continued retention of idle government-owned industrial facilities (plant and equipment) will also be based on the sizing requirements to permit an efficient and timely production response to a surge or a mobilization situation. Any government-owned capacity which is not required for surge will be re-allocated to a more productive peacetime role or declared excess to the needs of the DoD.

16. Question: What office in OSD has the responsibility for mobilization and industrial preparedness planning throughout the Department of Defense? Does this office presently have available a complete assessment of the total U.S. industrial mobilization posture? If so, could this assessment be made available to the Joint Committee? What is the data base for this assessment?

Answer: The Production Resources Directorate of my office has the responsibility for industrial mobilization and industrial preparedness planning, including the new "surge" planning concept, for the Department of Defense.

The DoD does not have available a complete assessment of the total U.S. industrial mobilization posture. Such an assessment would have to consider both the military and civilian demands placed upon the nation's industrial capability during a declared emergency, and the capacity of the nation's industrial production base to meet those demands. A useful step in the development of the demand side of such an assessment has already been achieved, at a moderate level of aggregation, in the interagency stockpile planning study recently completed for the National Security Council. The supply (capacity) side of such an assessment has not yet, to the best of my knowledge, been developed to a commensurate level of completeness and detail, although capacity estimates for many major sectors of the industrial base are available with sufficient accuracy for general planning purposes.

A comprehensive assessment of the total U.S. industrial production capacity to meet all emergency demands probably would be a major interdepartmental task similar to the development of the demand estimates for the referenced stockpile study, and at least as difficult. The Federal Preparedness Agency, GSA, has overall responsibility for such national emergency preparedness

assessments and therefore, that agency should coordinate the interdepartmental efforts required for such assessments.

Within the Department of Defense, industrial preparedness planning is accomplished on about 8000 items. The actual planning mission is delegated to the Military Departments and the Defense Supply Agency. These agencies perform the required planning on an item-by-item basis with lower tier planning support for necessary materials and components. The data base for this planning is reflected in the individual mobilization production planning schedules developed by the planning agencies and the industrial producers. Approximately 9000 planned emergency producers have been enlisted in the DoD Industrial Preparedness Program to produce military materiel in a declared national emergency.

TAB A

July 28, 1972
NUMBER 4005.1

ASD(I&L)

Department of Defense Directive

SUBJECT DoD Industrial Preparedness Production Planning

Ref.: (a) through (k), see Enclosure 1

I. PURPOSE AND AUTHORITY

This Directive:

- A. Establishes Department of Defense (DoD) policy and assigns responsibilities governing industrial preparedness planning for production of essential military items in a national emergency.
- B. Is issued pursuant to the emergency preparedness responsibilities assigned to the Secretary of Defense under section 401, paragraphs (7), (9), (12) and (13) of Executive Order 11490 (reference (a)) and the production readiness functions in support of peripheral war as defined in Defense Mobilization Order VII-7 (Revised) (reference (b)).

II. CANCELLATION

References (c) and (f) are hereby cancelled.

III. APPLICABILITY

The provisions of this Directive apply to the Military Departments and the Defense Supply Agency (hereinafter referred to collectively as "DoD Components").

IV. DEFINITIONS

Terms used in this Directive are defined in enclosure 2.

V. POLICIES AND PROCEDURES

DoD Components will develop and issue implementing instructions which are consistent with the following:

A. General

1. The Department of Defense will provide for a sustained state of industrial preparedness for the production of essential military items to meet the needs of the approved U.S. and Allied Forces in a national emergency. To achieve this goal industrial preparedness planning shall be accomplished on a continuing basis for those essential military items selected in accordance with DoD Instruction 4005.3 (reference (d)) and DoD Manual 4005.3M (reference (e)).
2. The Department of Defense will also insure the existence of adequate commercial maintenance/repair capability to meet readiness requirements for those items of materiel included in the approved forces but not supported by an organic depot maintenance capability. The program will include maintenance of assigned equipment to effectively and efficiently meet sustained readiness requirements during peacetime and to insure a ready and controlled source of technical competence and resources necessary to meet military contingencies in accordance with DoD Directive 4151.1 (reference (1)).

B. Industrial Base Planning

1. In planning for the production of selected items preference shall be given to privately-owned facilities, so as to minimize the need for Government-financed facilities.
2. Government-owned production facilities will be included in the industrial base only when:
 - a. Private industry is unable or unwilling to provide the facilities necessary to support DoD requirements, or
 - b. They are determined to be necessary for reasons of national security or to assure a quick response capability to meet fluctuating or job lot demands.

1/ Supplemental guidance on the U.S. and Allied Forces to be used by the DoD Components as the basis for industrial preparedness planning will be issued annually by the Secretary of Defense in memorandum form.

3. Establishment or expansion of Government-owned production facilities to overcome deficiencies in the privately-owned sector of the industrial base will be governed by the provisions of DoD Directive 4275.5 (reference (g)).
4. Industrial base facilities will be maintained in a high state of readiness to meet emergency requirements. Maximum reliance will be placed on a combination of active production and planned producers as a means of reducing the investment in on-hand stocks and minimizing losses through obsolescence. Economic analysis as prescribed in DoD Instruction 7041.3 (reference (h)) will be used, as applicable, to determine the most cost effective mix of production base capability and on-hand stocks.
5. Consideration shall be given to spreading peacetime procurement for planned items among more than one source when the additional active producer(s) would yield significant improvements in post-M-Day production response capability.
6. Industrial preparedness planning, as defined herein, shall be limited to producers located in the U.S. and Canada and is intended to cover the exigencies of a Limited War wherein it is assumed that the industrial base has not been damaged by enemy attack. However, to minimize the effects of a possible enemy attack on the base, plans should be developed with plants in dispersed locations whenever possible or alternate production sources should be established when appropriate.
7. At the outset of a future military emergency, the Office of Emergency Preparedness will consider applying controls on the economy to channel industrial effort from commercial to emergency support activities. Similarly, the Department of Defense will give consideration to suspension or modification of normal procurement procedures to minimize lead time. Accordingly, plans should be made to minimize the administrative lead time involved in the placement of post-M-Day contracts. Use of letter contracts (ASPR 3-408 - reference (k)) and other time saving measures should be considered. For proper evaluation of these possible actions, reliable information must be available on current assets and on production lead times of the required end items.
8. To accommodate the problems associated with varied lead times pertaining to planned items, production planning with industry will be based on a three-year time frame (planning period).

Also, recognizing the need for both short-range and long-range planning, two separate planning periods are authorized for each planned item. The first planning period will cover M-Day through M+36 months and will begin on 1 July following the date on which the planning agreement DD Form 1519 (reference (e)) is signed by the contractor. The second three-year planning period would begin one year later than the first and would be used only if required by any one of the DoD Components. Annual Secretary of Defense guidance prescribes a target date by which DoD Components must attain their materiel support inventory objectives. Post-M-Day production response estimates required for this planning/programming should make maximum use of data from these planning periods to ensure that war reserve materiel programs are based on the best possible information.

9. The foundation of the industrial preparedness program is the realistic determination of the total production requirements necessary to support the approved forces post-M-Day. These requirements, usually expressed as monthly production rates, are submitted to selected production sources having the required capacity and will assume an M-Day during each of the two separate planning periods defined in paragraph 8 above. Requirements calculations will include the mix of essential items and weapons systems needed to support the force structure expected to be in existence during the time period in question. The required monthly production rate for each item will be derived from the force structure currently approved for that time period, in accordance with instructions in current Secretary of Defense guidance.

C. Incentives for Industry

To encourage more active and effective industry participation in industrial preparedness planning, use of incentives such as the following will be considered:

1. Negotiation of current procurement of planned items with planned producers under the authority of ASPR 3-216.2.
2. Rental of Government-owned equipment in accordance with ASPR 13-405 to planned producers for commercial work when it is in the interest of the Government:
 - a. to keep the equipment in a high state of operational readiness through regular usage; or

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- b. because substantial savings to the Government would accrue through overhead cost sharing and receipt of rental; or
 - c. to avoid an inequity to the planned producer who is required at the Government's request to retain the equipment in-place, often inter-mingled with contractor-owned equipment required for commercial production.
3. Leasing of idle Government-owned plants to planned producers for commercial work pursuant to 10 U.S.C. 2667.
 4. Reimbursing planned producers for participation in industrial preparedness planning when justified by the required effort, importance of the item to military requirements and potential savings in M-Day stocks (this does not include payment to the contractor for layaway of his own equipment).

D. Type and Depth of Industrial Preparedness Planning

1. To assure the most effective and realistic planning approach, each DoD Component will determine the specific type and depth of industrial preparedness planning for each planning item. This could include industry wide capability studies, special studies or recommendation for Department of Commerce Industry Evaluation Board study as defined in DoD Manual 4005.3-M (reference (e)). However, agreements with individual manufacturers, including sub-contractors, for an allocation of their capacity for the production of a planned item(s) in an emergency, must be reflected by a signed DD Form 1519 in accordance with reference (e).
2. Department of Commerce IEB studies will be utilized when appropriate as a method for accomplishing horizontal planning for selected items or groups of similar items that are produced by certain critical industries. The identification of these items will be made by a joint DoD - Department of Commerce task force. However, the DoD Components may, and are encouraged to recommend items for IEB studies to the ASD(I&L) at anytime. Horizontal planning for items identified by the task force will be assigned to a DoD Component which will work with the other DoD Components and Department of Commerce to obtain the necessary capacity data. These IEB studies will be updated on a biennial basis.

E. Industrial Preparedness Data

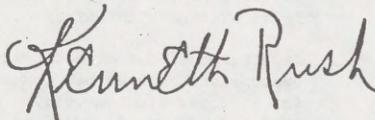
1. To maintain its validity, industrial preparedness data will be updated on a recurring annual cycle, or more frequently when a significant change in production capability invalidates planned schedules. A conscious effort must be made to level the workload as much as possible throughout the planning cycle to avoid peak work periods.
2. DoD Components are to exchange information required for industrial preparedness planning in a timely, efficient, and expeditious manner. DoD Components requiring industrial preparedness information other than that included on the DD Form 1519 will assure that their requests do not violate the provisions of the Federal Reports Act of 1942 as implemented by OMB Circular A-40 and DoD Directive 5000.19 (reference (j)). Every effort must be made to minimize additional burdens upon the agencies providing the required information.

F. Coordination of Current Procurement with Industrial Preparedness Planning

Because of the close correlation between current procurement and industrial preparedness planning, each DoD Component shall coordinate these two activities to the extent necessary to insure compatibility between procurement and industrial preparedness plans.

VI. EFFECTIVE DATE AND IMPLEMENTATION

This Directive is effective immediately. Two copies of implementing instructions shall be forwarded to the Assistant Secretary of Defense (Installations and Logistics) within 90 days.



Deputy Secretary of Defense

Enclosures - 2

1. References
2. Definitions

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REFERENCES

- (a) Executive Order 11490, "Assigning Emergency Preparedness Functions to Federal Departments and Agencies," October 28, 1969
- (b) Defense Mobilization Order VII-7 (Revised), "Maintenance of the Mobilization Base (Department of Defense, Atomic Energy Commission and the Maritime Administration)," March 6, 1957
- (c) DoDD 4005.1, "Department of Defense Industrial Mobilization Production Planning Program - Limited War," June 23, 1967 (hereby cancelled)
- (d) DoDI 4005.3, "Industrial Preparedness Production Planning Procedures" July 28, 1972
- (e) DoD Manual 4005.3-M, "Industrial Preparedness Planning Manual," authorized by DoD Instruction 4005.3
- (f) DoDD 4005.13, "Production Planning with Industry for National Emergency or Mobilization," March 27, 1958 (hereby cancelled)
- (g) DoDD 4275.5, "Industrial Facility Expansion and Replacement," December 3, 1971
- (h) DoDI 7041.3, "Economic Analysis of Proposed Department of Defense Investments," February 26, 1969
- (i) DoDD 4151.1, "Use of Contractor and Government Resources for Maintenance of Materiel," June 20, 1970
- (j) DoDD 5000.19, "Policies for Management and Control of DoD Information Requirements," June 2, 1971
- (k) Armed Services Procurement Regulation (3-408, 3-216.2 and 13-405)

4005.1 (Encl 2)
Jul 28, 72DEFINITIONS

1. Industrial Preparedness Planning - Plans designed to maintain an adequate industrial base to support DoD requirements for selected essential military items (planned items - see 9 below) in a national emergency.
2. Industrial Base - That part of the total privately-owned and Government-owned industrial production and maintenance capacity of the United States, its territories and possessions, as well as capacity located in Canada, expected to be available during emergencies to manufacture and repair items required by the approved forces.
3. Approved Forces - The level of forces approved by the Secretary of Defense for industrial preparedness planning.
4. D-Day - The unnamed day on which a particular operation commences or is to commence. This may be the commencement of hostilities or any other operation. (D-Day and M-Day may occur simultaneously or M-Day may precede D-Day.)
5. M-Day - The term used to designate the day on which mobilization is to begin.
6. P-Day - That point in time at which the rate of production of a military item meets and will continue to meet the estimated requirement.
7. Emergency (National) - A condition declared by the President or Congress by virtue of powers previously vested in them which authorize certain emergency actions to be undertaken in the national interest. Actions to be taken may include partial or total mobilization of national resources.
8. Planned Producer - An industrial firm which has indicated its willingness to produce specified military items in a national emergency by consummating a production planning schedule (DD Form 1519).
9. Planned (or Planning) Item - Any item selected for industrial preparedness planning under the criteria of DoD Instruction 4005.3 (reference (d)).
10. Limited War - Armed conflict short of Nuclear War, exclusive of incidents, involving the overt engagement of the military forces of two or more nations.

TAB B

NUMBER 4005.3
DATE July 28, 1972



Department of Defense Instruction ASD (I&L)

SUBJECT

Industrial Preparedness Production Planning Procedures

- References: (a) DoD Directive 4005.1, "DoD Industrial Preparedness Production Planning" July 28, 1972
 (b) DoD Instruction 4005.2, "Industrial Mobilization Production Planning Requirements", September 11, 1967 (hereby cancelled)
 (c) DoD Instruction 4005.3, "Industrial Mobilization Production Planning Systems and Procedures", December 24, 1968 (hereby cancelled)
 (d) DoD Directive 5000.19, "Policies for the Management and Control of DoD Information Requirements", June 2, 1971

I. PURPOSE

This Instruction -

- A. Authorizes the publication of a single Department of Defense Industrial Preparedness Production Planning Manual (DoD 4005.3-M) containing supplemental procedural guidance in support of the policies established in reference (a) governing:
1. Development and maintenance of an industrial production base;
 2. Planning necessary to insure that the base will be responsive to military production requirements in the event of an emergency.
- B. Provides guidance for the identification and selection of items for which industrial preparedness planning will be accomplished and for the determination of emergency production requirements for such items.

II. CANCELLATIONS

References (b) and (c) are hereby superseded and cancelled.

III. APPLICABILITY

- A. The provisions of this Instruction and the DoD Manual apply to (1) the Military Departments and the Defense Supply Agency, hereinafter referred to collectively as "DoD Components"; (2) other participating Federal Agencies; and (3) that portion of the industrial community which is, or may become, engaged in planning for the fulfillment of DoD requirements under the provision of the DoD Manual.
- B. Terms used in this Instruction are defined in enclosure 1.

IV. RESPONSIBILITIES

The Deputy Assistant Secretary of Defense (Installations and Logistics) for Production Engineering and Materiel Acquisition (D/ASD(I&L)DW) will:

- A. Publish and maintain the DoD Industrial Preparedness Production Planning Manual (DoD 4005.3-M) which will (1) assign functional responsibilities to participating organizational elements; (2) establish procedures governing the operational aspects of industrial preparedness production planning; (3) define terms; (4) prescribe DD Forms and Instructions for their use; (5) specify records to be maintained by users; and (6) establish security standards for the protection of planning in process and planning completed.
- B. Maintain overall surveillance to insure continuous implementation of and compliance with the provisions of this Instruction and the DoD Manual throughout the Department of Defense.

V. POLICY AND CRITERIA FOR ITEM SELECTION

- A. Policy. In accordance with the criteria set forth below, each DoD component is responsible for selection of items necessary for its particular industrial preparedness planning objectives. To assure that the planning effort is maintained within reasonable bounds, each DoD Component should limit its planning to approximately 2,000 items including major weapons systems. Major weapons systems selected for this purpose should not normally exceed about 35 per Military Department. The objective is to limit the total DoD-wide number of major weapons systems to about 100. Office of Assistant Secretary of Defense (Installations and Logistics) will grant exceptions to these item limitations whenever justified. Vertical (i.e., sub-contractor) planning will be mandatory for each major weapons system selected for planning. Items selected for planning will constitute the Industrial Preparedness Planning List (IPPL).
- B. Criteria for IPPL Item Selection. Industrial preparedness planning will be limited to military end items or components which are essential to operational effectiveness under combat conditions, including training, or to the safety and survival of personnel and meet one or more of the following criteria:
 1. Require a long leadtime.
 2. Require development of, or additional capacity to meet emergency production requirements.
 3. Require continuous surveillance to assure preservation or an adequate base to support emergency production requirements.

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4. Require critical skills or specialized production equipment.

C. Prohibitions and Exceptions.

1. Items will not be selected for planning if:
 - a. Solely for comfort, convenience, or morale.
 - b. Will become obsolete within 12 months (i.e., no longer required, phase-out, or being replaced by another item).
 - c. Normally commercially available in sufficient quantities to meet the anticipated requirements.
2. Planning with industry will not be undertaken by the Department of Defense for production of basic materials (e.g., copper, steel, aluminum, etc.) in the mill forms and shapes normally produced for commercial use; machine tools, bulk fuel, food (exception combat rations) and for components common to both military and civilian use. Planning for these items is the responsibility of other Government Agencies: i.e., Office of Emergency Preparedness, Department of the Interior, Department of Agriculture, Department of Commerce, etc.
3. Industrial preparedness planning for mission oriented items shall be limited to the reduction or elimination of M-Day stock deficiencies for these items.
4. Foreign production sources other than Canada will not be used in developing industrial preparedness plans.

D. Determination of Emergency Requirements.

1. Emergency production requirements for selected planning items shall be computed annually in accordance with guidance issued separately for this purpose by the Secretary of Defense. This guidance will specify the force levels and other related information necessary to calculate requirements for use in industrial preparedness planning.
2. The assumed M-Day for the purpose of computing stock requirements and deficits (objective less stock) shall be the first day of each "three-year planning period", i.e., 1 July.
3. Emergency production requirements presented to industry shall be expressed as monthly rates.

4. Planning may take into consideration the buildup to a short term production level higher than the consumption rate to make up M-Day stock deficits. Alternatives, including the possible use of approved substitute items, will be considered in order to spread the deficit "make up" quantity over a reasonable period of time.

E. Industrial Preparedness Planning List Instructions.

1. Each DoD Component will:

- a. Select items for industrial preparedness planning in accordance with the criteria and guidance contained herein.
- b. Submit items selected for industrial preparedness planning in accordance with enclosed instructions to reach OASD(I&L) 60 days subsequent to the issuance of this Instruction. Thereafter, annual submissions will be due in OASD(I&L) on 1 February (or the first working day following) of each year beginning in 1973.
- c. Interchange copies of their item selections with the other Military Services and the Defense Supply Agency at the same time such data are submitted to OASD(I&L).
- d. Provide representation to participate in (1) ASD(I&L)-sponsored meetings for the purpose of reviewing and coordinating the IPPL item selections and (2) Joint DoD and Department of Commerce meetings for the purpose of designating those items on the IPPL that should be the subject of Department of Commerce Industry Evaluation Board (IEB) studies.
- e. Publish and update their own IPPL, including such revisions as may be agreed to as a result of the meetings specified in subparagraph c., above; provide copies to the ASD(I&L) and other DoD Components that have a need to know.
- f. When designated as a "user" of any item on the approved IPPL, submit emergency planning requirements for such item(s) to planning (procuring) DoD Component no later than 31 July annually.
- g. As planning DoD Component:
 - (1) Transmit DD Forms 1519 (DoD 4005.3-M) for items which place multi-service requirements on a given manufacturing facility to the Armed Services Production Planning Officers (ASPPO) as soon as

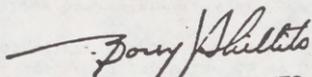
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possible but no later than 1 November annually. DD Forms 1519 for other planning items should be transmitted to the ASPPO's in a manner which will avoid peak workloads.

- (2). Provide feedback of industrial preparedness planning results to the using DoD Components no later than 15 March annually.
2. The ASD(I&L) will designate the time and place for the meetings specified in subparagraph c., above.
3. Report Control Symbol DD-I&L(A)1201 is assigned to the reporting requirement of this Instruction.

VI. EFFECTIVE DATE AND IMPLEMENTATION

This Instruction is effective immediately. Two copies of implementing documents shall be forwarded to the ASD(I&L) within 60 days.



BARRY J. SHILLITO
Assistant Secretary of Defense
(Installations and Logistics)

Enclosures - 3

1. Definitions
2. IPPL Instructions
3. IPPL Format

4005.3, Jul 28, 72
(Enclosure 1)

DEFINITIONS

1. D-Day - The unnamed day on which a particular operation commences or is to commence. This may be the commencement of hostilities or any other operation. (D-Day and M-Day may occur simultaneously or M-Day may precede D-Day.)
2. P-Day - That point in time at which the rate of production of a military item meets and will continue to meet the estimated requirement.
3. Mission-Oriented Items - Items for which requirements computations are based upon the assessment of enemy capabilities expressed as a known or estimated quantity of total targets to be destroyed.
4. Emergency Production Requirement - The quantity of an item (usually expressed as a rate) which must be produced after M-Day in order to provide the necessary materiel support for the approved U.S. and Allied Forces.
5. M-Day - The term used to designate the day on which mobilization is to begin (an M-Day for planning with industry may occur at any time within the planning period, lack of a specific M-Day for planning purposes is called a "floating" M-Day).
6. Planning Periods - The two three-year periods covered by DD Form 1519 (DoD Industrial Preparedness Program - Production Planning Schedule) specified in DoD Manual 4005.3-M. Each period covers a separate mobilization plan and projects requirements from M+1 month through the month in which the level-off requirement rate is reached or M+36 months whichever is earlier. The first three-year period covers requirements beginning one year beyond the Fiscal Year in which the DD Form 1519 is prepared. The second three-year period, which is optional, covers requirements beginning two years beyond the Fiscal Year in which the Form is prepared and will be used only when requested by one of the DoD Components.
7. End Item - A final combination of end products, component parts, and/or materials which is ready for its intended use.
8. Components - Those articles, materials, and supplies which are directly or indirectly incorporated in end items.

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(Enclosure 2)

INSTRUCTIONS FOR
INDUSTRIAL PREPAREDNESS PLANNING LIST (IPPL)

1. The IPPL will consist of two sections. Section I shall contain a listing of all the major weapons systems identified for vertical planning. Section II shall consist of major items and components exclusive of any weapons systems listed in Section I.
2. Under each weapons system and major end item, list the components for which vertical planning will be accomplished.
3. Annotate components which are common to more than one weapons system or other end item.
4. Show planning (procuring) DoD Component and user for each weapons system and end item.
5. Enclosure 3 is a sample format with examples for guidance. The attached format is not compulsory. Any machine run or other format which provides the same information will be acceptable.

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(Enclosure 3)SAMPLE FORMATINDUSTRIAL PREPAREDNESS PLANNING LIST (IPPL)

	<u>PLANNING</u> <u>DOD COMPONENT</u>	<u>USER</u>
<u>SECTION I</u>		
<u>MAJOR WEAPONS SYSTEMS</u>		
<u>AND COMPONENTS</u>		
(Examples)		
A-7 AIRCRAFT	N	N, AF
Engine		
Avionics		
etc.		
UH-1H HELICOPTER	A	A, AF
Engine (T-53-L-13B)		
Starter, Ge-erator		
Tail Boom		
Transmission, Main		
etc.		
<u>SECTION II</u>		
<u>MAJOR ITEMS</u>		
<u>AND COMPONENTS</u>		
(Examples)		
AN/PRC-25/77 RADIO SET	A	A, N, AF, MC, Allies
RT-505/PRC-25 Receiver Transmitter		
RT-841/PRC-77 Receiver Transmitter		
MK 82, GP BOMB, 500 LB	N	N, AF
Bomb Body		
Fin Assembly		
Fuze, Nose		
Fuze, Tail		

TAB C

THE DEPUTY SECRETARY OF DEFENSE
WASHINGTON, D. C. 20321

JAN - 8 1971

WC



MEMORANDUM FOR Secretaries of the Military Departments

SUBJECT: Procurement Procedures During the Transition from
War to Peace

In several recent specific instances it has appeared to me that rather sudden changes in our established method of awarding contracts for a particular commodity may have been made without sufficient advanced planning. Problems have arisen in instances where we have reduced the number of mobilization base suppliers we have been maintaining under mobilization base philosophy.

While my analysis of a number of these instances has substantiated the logic of the action taken, I want to urge that careful consideration be given to the total mobilization base needs for the product involved as we reduce our defense spending. Frequently, it will be necessary and reasonable to preserve this base for selected products even though such action may mean a slight increase in costs.

In order to minimize sudden shifts in our procurement approach as spending is reduced and in order to provide timely notification to companies affected, I would like you to develop on a selective basis individual advance procurement plans to cover the aforementioned situations. We should think of these as transition plans. These plans should be reviewed at an appropriate management level to insure compliance with the thrust of this memorandum. We should try to provide reasonable notice (i. e., up to six months) of any change in plans which would significantly affect all or most mobilization base suppliers. Wherever possible, I would like our people to go out of their way to consult with, counsel, and advise companies involved in any basic change in procurement approach so that these companies may immediately explore and plan for alternate sources of business. I am particularly concerned with small business concerns in this instance, and special attention must be paid to them.

In a related area, we should take maximum advantage of the authorities available to preserve our required industrial base at both the prime and subcontract level. This would cover needed production capability in a specific industrial facility or needed skills that might well cut across several companies. Frequently the capability we need to preserve during the early phases of contract reductions will be greater and less costly than that which may be required during later stages.

We have initiated studies with respect to the industrial base needed to meet mobilization needs. Changes to our established policies that evolve from these studies will be released when available. In the interim, I ask that you remain alert to specific opportunities to avoid sudden shifts in our practices which might adversely affect sources or capabilities essential to our national defense posture.



ADDITIONAL QUESTIONS FOR THE RECORD

FOR

T.K. JONES

Question 1.

On what calculations do you base your estimate that 98% of the Soviet population would survive a massive countervalue attack with the entire U.S. arsenal of 8,500 or more nuclear warheads?

Answer

First, our estimate is based not on the "entire U.S. arsenal" but on the weapons that the U.S. could optimistically expect to survive a Soviet first strike. The reason is that a stated purpose of the Soviet civil defenses is to complement the first-strike counterforce capability of the Soviet offensive forces. This policy was stated in 1974 by Colonel-General Altunin, Chief of Soviet civil defense, in Luidi i Dela Grazhdanskoj Oborony:

While the Armed Forces take as their objective to prevent the use of destructive means against the rear of the country by the destruction of the attack weapons or the interception of the weapons on the way to the target, Civil Defense, by carrying out protective measures and through preparation of the population, seeks to achieve the maximum weakening of the destructive effects of modern weapons.

The Soviet forces used in the estimate are those projected by the U.S. Government as most likely to be deployed by 1985, assuming SALT II limit. Projected estimates of U.S. forces, similarly limited by SALT, assumed deployment of both the B-1 and Trident systems.

Since a Soviet evacuation of their cities would give several days warning, U.S. forces were assumed to be in a highly survivable posture. All ballistic missile submarines not in drydock or major overhaul would be at sea and were assumed totally survivable. Bombers would be distributed to dispersal bases, and it was assumed that all U.S. warning systems would remain intact. Tanker aircraft essential to bomber penetration were arbitrarily assumed to survive. The attack on U.S. ICBMs was assumed to be limited to no more than one warhead per silo. Hence, a large fraction of the U.S. ICBMs would survive.

The Soviet Union was assumed to have no antiballistic missile (ABM) defenses. Soviet air defenses were assumed to have been suppressed even though no U.S. warheads were assumed to be used for this purpose. All U.S. warheads (on SLBMs, bombers, and ICBMs) were assumed to be expended in a retaliatory strike on Soviet urban/industrial areas or on evacuation areas. (This latter assumption is particularly naive since it would leave the United States totally disarmed and leave Soviet military assets largely untouched.) As can be seen from the foregoing, the analytical assumptions were, from the U.S. perspective, highly optimistic and represent what the Soviets would probably view as a worst case.

The estimate that 98% of the Soviet population would survive was one of several estimates considering conditions ranging from no evacuation - no protection to full evacuation and expedient protection and involving two basic types of U.S. retaliatory strikes. Figure 6 of the study report shows these estimates. The 98% figure corresponds to full evacuation and expedient sheltering of the evacuees. The U.S. retaliatory strike was designed to produce maximum destruction of industrial targets. (A fallout-producing attack on the evacuation areas would result in a 96% - 97% survival level at the expense of substantially reducing industrial damage and speeding up Soviet economic recovery.) The basic assumption regarding evacuation was that the Soviets would do what their plans specify and their known preparations permit. Data sources include:

- a. Soviet manuals and textbooks.
- b. Reports from Soviet open literature describing training and preparation in areas such as transportation, firefighting, radiation monitoring, rescue, medical services, protection of food supplies, etc.
- c. Classified evidence of Soviet civil defense preparations.

Calculations were modeled to be consistent with the data from these sources. Several of the more significant assumptions are:

- a. Some essential personnel, including on-shift workers, are left in the cities. It was assumed that the Soviets would not leave more people than the factory area and residential shelters would accommodate.
- b. Radiation protection factor of the Soviet expedient shelters was degraded to 200 (from a calculated value of 1,000) to compensate for operational factors such as ventilation.
- c. For further conservatism, all persons receiving a radiation dose of more than 200 rads were counted as fatalities. (Most analyses are based on 450 rads, which produces about 50% fatalities.)

Question 1.a.

How much warning (in days or hours) of the hypothetical U.S. attack would the Soviet Union require in order to assure the survival of 98% of its population?

Answer

Soviet literature calls for a 3-day period for evacuation (a somewhat longer time is needed for crisis relocation of selected factories.) I regard 3 days as a minimum feasible time; flaws in planning and execution and the possibility of adverse weather could lengthen evacuation time to as long as a week. However, as the initiator of the hostilities, the Soviets could take whatever time is necessary to transition to a fully war-ready posture. Hence, the possibility of delays would have no adverse effect on their survivability.

Question 1.b.

Precisely what measures would the Soviet Union employ to assure so large a portion of its population would survive?

Answer

The most important element of the Soviet preparations is to evacuate the urban residents to the collective farms and outlying villages. The purpose of this measure is to disperse the population over an area many times larger than the total area that could be destroyed by the portion of the U.S. arsenal that would survive a first

strike by the Soviet forces.

Evacuation is supplemented by several measures of secondary importance. One such measure is construction by the evacuees of expedient shelters. Such shelters would be necessary only if the U.S. were to sacrifice half the effectiveness of its arsenal against industrial targets in favor of a fallout-producing attack. Substantial preparations have been made to protect food supplies, and the people are trained in the measures needed to protect livestock and food crops. Also, there is evidence of much training, including practical exercises for the civil defense troops and 20 hours of classroom indoctrination for the general population.

Soviet literature also cites provisions for medical aid and training of medical service cadres. Extensive training exercises are reported for radiation survey and rescue teams since these operations require a fair degree of proficiency. However, in our analysis, we gave the Soviets no credit for the survival benefits of either the medical or the rescue capabilities. The Soviets have also provided extensively for preservation of their leaders and for the communications essential for preservation of government control. The party workers' function would continue to ensure continued control at the local level.

A definitive description of Soviet plans can be found in a translation of the Soviet 1969 manual (ORNL-tr-2306, National Technical Information Service, Springfield, Virginia) and the 1970 manual (Stock no. 008-070-00382-1, Superintendent of Documents, Government Printing Office, Washington, D.C.) The training, planning, exercises, and other preparations being made to implement the Russian plan are cited extensively in Soviet open literature, and many of the preparations have been confirmed by knowledgeable observers touring the Soviet Union.

Question 1.c.

What alternatives does the U.S. possess to blunt the effectiveness of these measures?

Answer

The United States does not possess military capabilities which, if prudently used, could blunt the effectiveness of the Soviet civil defense measures. Moreover, the U.S. has no plans which would provide such capabilities in the future. Even worse, the U.S. cannot counterbalance the Soviet measures. The present lack of civil defense planning, preparation, and training in the U.S. is such that the American population could not transition to a significantly more survivable posture within the 3-7 days required for a Soviet evacuation.

Question 1.d.

Do your estimates of the Soviet survivors include casualties resulting from blast effects, radioactive fallout, and secondary or tertiary effects such as lack of medical care, lack of food, or lack of other essential commodities and services?

Answer

Our estimates of Soviet survivors include all casualties from prompt effects of blast, thermal, and radiation plus the long-term (lifetime) effects of radioactive fallout. We used two sources of nuclear weapons effects data: Physical Vulnerability Handbook - Nuclear Weapons, AP-550-1-2-69-INT, Defense Intelligence Agency, September 1972, and The Effects of Nuclear Weapons by Samuel Glasstone, U.S. Atomic Energy Commission, February 1964.

It should be noted that Soviet data on radiation and biological recovery would indicate a higher level of survival than is shown by our analysis.

The analysis assumed a complete absence of medical care. All persons receiving a radiation dose high enough that they would require medical care (200 rads) were counted as fatalities. Moreover, the "radio-protective pills" referred to in Soviet literature were arbitrarily assumed to provide no protection.

We know of no evidence or other basis to assume that there would be insufficient food -- either near or long-term -- to keep the Soviet population alive and working. Moreover, the relocation of the population into the food-producing areas would mitigate what otherwise might be a difficult problem of food distribution.

About half of the housing spaces in the Soviet Union could realistically be expected to survive an all-out nuclear war. If the observed examples of industrial dispersal (which includes dispersed housing) become the pattern for future development, the Soviets by 1985 could expect about three-quarters of their housing to survive in a habitable condition. We believe that these levels of housing are adequate to avoid fatalities; housing probably would not even be a factor pacing recovery. We know of no other commodities or services the lack of which would increase fatalities above the level of our estimates.

Question 1.e.

Are the means by which the Soviet Union could protect 98% of its population currently in being or are they under development?

Answer

It is believed that the means by which the Soviet Union could protect 98% of its population are available today in the Soviet Union. It is important to note that the analysis on which the 98% survival estimate is based is highly conservative. The only capabilities with which the Soviets were credited in the analysis were use of urban shelters known to exist by the essential workers remaining in the cities, evacuation, construction of expedient shelters by the evacuees, and protection of food supplies. The only additional "in-being" essentials to support such capability are planning and education. Current evidence is that the Soviets are now concentrating on identifying and correcting weaknesses in their detail plans and on increasing the "realism" of their training -- all of which

would indicate that the initial plans and training are either complete or well along.

The Soviets are continuing to develop their protective means. Shortcomings that could lengthen the time required for evacuation are apparently being eliminated. Amenities are being provided that would reduce the privations of an evacuation and could improve survival to a level higher than our estimate. The extensive program to construct hardened shelters within the cities will make it more feasible to keep important industry going during an evacuation. Also, the means of government are becoming better protected through construction of an extensive system of command bunkers and survivable communications.

The effect of this continuing development will be to allow easier and quicker evacuation. The Soviet's stated requirement of a 3-day evacuation capability will become more realizable.

Question 1.f.

How large a proportion of its population could the Soviet Union protect if the U.S. attack came today? What is the basis of this estimate?

Answer

The Soviets today could probably protect more than 98% of their population. The 98% estimate was based on U.S. forces that will not exist until 1984 and assumes that the B-1 and Trident will be built. Figure 8 of the study report shows that if a Soviet attack came today, the U.S. surviving number of equivalent weapons (EW) would be only about half of the number that would survive in an attack against U.S. forces in 1984.

Question 1.g.

At what time do you project the Soviet Union will have the capacity to protect 98% of its population? On what do you base this projection?

Answer

Refer to answers provided for questions 1.e. and 1.f., above.

Question 1.h.

To what do you attribute the prevailing U.S. policy view that the United States possesses the capacity to destroy significant numbers of Soviet citizens and a significant portion of the Soviet economy, a capacity which acts as a deterrent against a Soviet attack? Is this view erroneous? Why or why not?

Answer

The policy view set forth in the Annual Defense Department Report, FY 1977 is that the U.S. deterrent is based on a capability to retaliate with devastating force against an enemy's economic and political assets. Population is not mentioned as an element of deterrent strength. We do not know of any officially stated view that the United States currently has the capacity to destroy a significant portion (25% or more) of the Soviet population. We are aware of unofficial opinions claiming that the Soviet Union would suffer high levels of fatalities but we have yet to see an analysis that supports such claims without relying on the assumption that not even the most rudimentary evaluation will occur.

There are analyses which conclude that the U.S. has the capability to destroy "a high percentage of the industrial targets" in the Soviet Union. However "the industrial targets" referred to in these analyses is a limited list of targets which comprises only a small fraction of Soviet industrial capacity. Our analysis accounts for the following factors which we believe are essential to an accurate appraisal of retaliatory capability against Soviet economic assets:

- a. All of Soviet industry
- b. The actual size of each factory (some analyses treat industrial targets as points, rather than areas)
- c. The projected capital growth of Soviet industry
- d. The effect of hardening machinery -- using techniques described in reports of Soviet training exercises and shown by our tests to be practical and effective
- e. The effect of observed examples of industrial dispersal

Question 1.1.

Can you explain why U.S. officials continue to express confidence in our deterrent forces, if they are no longer capable of destroying over 2% of the Soviet population, instead of the 25% or so once thought to be adequate to make an effective deterrent?

Answer

Many knowledgeable U.S. officials no longer express confidence in the effectiveness of our deterrent. Rather, some official statements have recently expressed extremely serious concerns.

The Annual Defense Department Report, FY 1977, a document remarkably candid for an election year, states that "...confidence in the future adequacy of our force structure is gradually declining" (p. iv), notes that in civil defense "...an asymmetry has developed over the years that bears directly on our strategic

relationship with the Soviets and on the credibility of our deterrent posture" (p. 57), and implies that if the Soviet Union were to attack the U.S. strategic forces the U.S. would not necessarily retaliate (pages 12, 13, and 46). The specific reasoning behind this latter point is as follows:

The Soviets are gaining the capability in an initial counterforce attack to withhold a large percentage of their forces with which they could retaliate in kind. If we struck their cities, they would have strong incentives to do the same. In these circumstances, whatever the other objections to such a U.S. strategy, it would represent a response of uncertain credibility to anything but the most barbaric kind of attack and, as a consequence, cannot serve this country or its allies well as a deterrent. (p. 47)

The results of our force balance studies, shown in the appendix to the study report, are fully consistent with these observations.

Former Secretary of Defense James R. Schlesinger in February 1976 wrote, "The underlying reality is that at no point since the 1930s has the Western world faced so formidable a threat to its survival. As then, the military balance is deteriorating, but the trend in large measures goes unnoticed. . ."

Director of Defense Research and Engineering Dr. Malcolm Currie on February 26, 1976, cited an "intensive effort" in Soviet civilian defense and a program of industrial dispersal and hardening. Currie said the Soviet Union, under this program, would be "postured to survive any war as an industrial power." He cautioned that the United States SLBM warheads cannot "even come close to taking out" the hardened industrial plant other than "to blow off a roof" or inflict similar damage.

Air Force Chief of Staff, General David C. Jones, in an address on September 21, 1976, made the following statement:

My report to you this year must begin with a warning I will express in stark terms: I believe the momentum and the direction of growth in Soviet power represent the greatest potential threat to our survival as a nation since the Civil War. I don't imply an imminent danger of attack, for I consider that highly unlikely and, in any event, unnecessary if the Soviets can achieve their aims through indirection...

The most visible element is the inexorable buildup of the most potent strategic arsenal in history, exceeding ours in sheer destructive power by a factor of two to one. Compounding the hazards of such a margin is the greater vulnerability of our highly concentrated population and industrial centers, compared to the more dispersed pattern in the USSR...

General Jones went on to cite "...the wide gulf between Soviet civil defense preparations and our own" and to note the beliefs and calculations of U.S. experts regarding the effectiveness of the Soviet preparations.

General Russell E. Dougherty, Commander in Chief of the Strategic Air Command, on December 13, 1976, stated, "We live in a very real and sometimes frightening world... a world in which for the first time in the history of our nation, a potentially inimical nation possesses the power to attack this nation directly -- and possibly fatally."

Similar concerns have been voiced within the U.S. Congress. In a report prepared at the request of Senator Culver, the Library of Congress Congressional Research Service stated, "The present balance between U.S. and Soviet strategic offensive forces would be degraded dramatically by pre- and post-launch attrition at the onset of a general nuclear war" and "U.S. strategic defensive problems are perhaps even greater." The report further noted the Soviet emphasis on strong air and civil defenses and stated that "...even partial defenses could buttress the Kremlin's bargaining power in times of intense international crisis, by undercutting our second-strike Assured Destruction Threat." (From "U.S./Soviet Military Balance," January 1976, p. 28)

Senator Howard Baker, in a June 24, 1975, speech before the Senate, stated, "...the U.S. concept of assured destruction, though much propounded, has been undermined by the civil defense measures of the USSR..."

On November 11, 1975, this concern was again brought before the Senate. Senator Peter Domenici stated that "...the Soviet Union has found another way to undermine the strength of the U.S. deterrent force - - by implementing a meticulously planned comprehensive civil defense program." The Senator concluded that such preparations have "effectively circumvented the protection which we sought to achieve from the ABM Treaty."

In summary, we submit that knowledgeable and responsible officials are expressing not confidence but serious concern about the adequacy of U.S. deterrent capability. Our analysis results are consistent with and confirm the factual basis for these concerns.

Question 1.j.

At what point, and for what reasons, did the United States lose its capacity to destroy a significant portion of the Soviet population and its economic infrastructure?

Answer

It appears that the Soviets have for some years had a capability to evacuate their people prior to a nuclear conflict. However, the program was upgraded in 1972 to provide increased classroom training and more realistic exercises. Also, there are many reports of inspections and reviews to identify and correct weaknesses in plans, preparations, and readiness. Although these recent preparations may not have had a determinable effect on U.S. capacity to destroy a significant portion of the Soviet population, they probably have improved Soviet confidence

in the effectiveness of these preparations and reduced the length of time that would be required to transition from a peacetime posture to a fully war-ready posture.

It is more difficult to assess the Soviet Union's readiness to protect its industry because implementation of the necessary preparatory measures is not easily detectable. If plans have been prepared for most factories, if the training exercises reported have been sufficiently widespread to provide a cadre equal to perhaps 5% of the work force, and if materials (plastic, grease, etc.) are available, Soviet industry could transition to a well protected posture within a 3-day period. If no plans have been prepared and the training exercises have been limited to those reported in the Soviet literature, it would take from 4 to 6 weeks of concerted national effort to transition to a protected posture. Hence, the issue is not whether they can protect their industry but how long it would take to transition to a protected posture.

If the observed examples of Soviet industrial dispersal become the pattern for a significant (i.e., 1/3 to 2/3) portion of Soviet capital growth, the transition to a protected posture will become easier and less dependent upon pre-attack hardening measures.

Question 1.k.

What specifically are the deficiencies in U.S. strategic forces that account for this erosion of its deterrent capacity?

Answer

The U.S. strategic forces were designed to retaliate against concentrated and unprotected targets. Hence, these forces do not have the number, yield, and accuracy of warheads that would be required to effectively destroy the highly

dispersed and somewhat hardened target complex that is presented by the Soviet civil defense measures. Moreover, based on our analysis results, it is my judgment that to preserve the U.S. present concept of deterrence by attempting to overpower the Soviet civil defenses would require an unrealistic and imprudent increase in the size of the U.S. nuclear arsenal. It is my recommendation that we search for an alternative, less objectionable concept to deter the Soviet Union.

Question 1.l.

Would your estimates of the surviving percentage of the Soviet population change if the Soviets had no warning of a U.S. nuclear attack?

Answer

Yes. As shown in Figure 6 of the study report, if the Soviets did not evacuate or shelter their population, their losses could range from 70 to 105 million people. A sheltered but unevacuated population could suffer from 50 to 85 million fatalities.

Question 1.m.

If the Soviets evacuated their cities and used expedient measures to harden critical industries prior to an attack on the United States, wouldn't the visibility of these measures permit the United States to take counter-measures, such as a pre-emptive attack, a redeployment of U.S. strategic forces, or a retargeting of U.S. warheads to offset evacuation and industrial hardening?

Answer

Soviet actions to evacuate their population would be highly visible and would allow the United States 3 or more days to implement countermeasures. However, our analysis has already accounted for all of the measures which, in my opinion, the U.S. could prudently or productively take. Specifically, all U.S. ballistic missile submarines not in drydock or major overhaul would be put to sea, all bombers

and tankers would be relocated to dispersal bases, and it was assumed that all U.S. warheads would be retargeted to offset Soviet industrial hardening. This latter assumption is particularly optimistic since it was assumed that the U.S. would know precisely which factories had been hardened and to what level of hardness.

We did calculate the effect of retargeting U.S. warheads to offset evacuation. As shown in Figure 6 of the study report, this would reduce Soviet population survivors to 96% to 97%. However, because lethal area against industry is approximately halved by this tactic and most of the warheads would be targeted in non-industrial areas, the net effect would be to shorten rather than to lengthen Soviet recovery time.

We did not consider a preemptive attack on the Soviet Union to be a course of action which the U.S. could prudently pursue because the Russian retaliation would destroy on the order of 130 million Americans and 50% to 80% of U.S. industrial capacity. More importantly, a deterrence concept that for its viability depends on a U.S. preemptive attack of the Soviet Union would be inconsistent with the objectives of deterrence.

Question 2

In view of the fact that Soviet civil defense manuals themselves claim only that the recommended measures would protect 93-95% of the urban population in the event of a nuclear attack, on what do you base your projection that 98% of the Soviet population would survive such an attack?

The Soviet manual's claim that their civil defense measures would protect 92% to 95% of the urban population equates to 96% to 98% of the total population. The higher figure is consistent with our estimate that 98% of the total population will survive. Should the U.S. attempt to produce fallout instead of mounting an effective

attack against industrial targets, on the order of 96% to 97% of the total Soviet population would survive (Fig. 6 of the study report.) We consider that this figure corresponds to the lower of the Soviet figures.

Question 3.

According to recent population estimates, about 9% or 22,845,000 of the total Soviet population of 258,528,172 is concentrated in eleven urban areas (Moscow, Leningrad, Kiev, Tashkent, Kharkov, Gorky, Novosibirsk, Kuibyshev, Sverdlovsk, Minsk, and Odessa.) In a nuclear confrontation the U.S. could retarget its ample and invulnerable submarine-launched ballistic missiles (SLBMs) so as to provide for the warhead saturation of these eleven major urban areas, including the surrounding territory where "expedient evacuation" refugees would be hosted, using only half, or 2,500, of the five thousand SLBM re-entry vehicles currently available.

- a. In your opinion, would this retargeting, in the absence of additional ABM defenses, be adequate to destroy over 5% of the total Soviet population? Would it be adequate to cripple industrial production in these eleven centers for a significant period of time? If no, why not? If so, why would this not act as an effective deterrent?

Answer

Since the answer to this question can be established by analysis rather than opinion, the following is provided. The estimate is based on the assumption that the size of the evacuation area would be limited to an average of 67 miles from the eleven cities named in the question. The total population at risk would be the 23 million noted in the question plus the approximately 6 million rural residents of the evacuation area -- a total of 29 million people, who in an evacuated posture, would be distributed at an average density of 190 persons per square mile.

Against the most simple shelter described in the Soviet manuals (Fig. 7 of the study report), the warhead specified in the question has a lethal radius of 4,700 feet or a lethal area of 2.5 square miles. This lethal area is based on the worst of the nuclear effects of blast, prompt radiation, and fallout. Each weapon could then destroy 2.5 times 190 persons or 475 persons. The 2,500 weapons noted in the question could destroy a total of 1,187,500 persons. If the Soviets increased the evacuation

distance, the number of fatalities would be reduced. It should be noted that this attack would leave the industrial areas of these cities virtually undamaged.

If the specified warheads, instead of being expended against the evacuation areas, were used against the industrial plants in these cities, the results would be as follows, assuming that all industrial machinery would be hardened to only 40 psi, the minimum protection obtainable with only an earth cover (no crushable material): By targeting each factory individually, we could destroy machinery equal to about 50% of the total productive capacity of the eleven cities. With continuation of Soviet capital expansion, this damage level will decrease, particularly if the dispersal pattern shown in Figure 10 of the study report becomes the model for a significant share of the future industrial expansion around these cities. Also, a higher level of hardening demonstrated in our test program (using crushable material), if applied to the larger factories, would significantly reduce the damage levels.

In addition to the industrial damage, this attack would destroy on the order of 349,000 workers, if the entire on-shift work force was caught in the factory-area shelters.

In summary, the warheads specified are totally incapable of causing the damage implied by the question. It is probable that some industrial production in these cities could be restarted within a few weeks and, even with no outside assistance, these cities could recover to prewar levels within 2 to 4 years. Moreover, these top eleven cities contain only about 20% of Soviet industrial production (based on the percent of urban population they contain.) The attack specified in the question would, then, damage only about 10% of Soviet production, which they could compensate for merely by adding work shifts to factories in other areas of the country.

Question 4.

Your estimate of only 2% Soviet fatalities after a devastating U.S. attack amounts to some 5,170,560 Soviet lives. Assuming that fatalities from such a U.S. attack reached 7% of the total Soviet population, the figure represents 18,096,960 Soviet lives. Do you consider that the Soviet leadership would find the loss of five to eighteen million lives an "acceptable" risk to run in order to bluff or coerce the United States? If so, what evidence do you have to support this interpretation of Soviet thinking? For what kinds of political, economic or territorial benefits do you believe the Soviet leadership would be willing to risk the loss of five to eighteen million lives and the loss of considerable industrial capability?

Answer

The 7% figure cited in this question presumably is derived from the 93% figure cited in question 2. That percentage (which the Soviets state to be 92%) refers to the urban, not the total, population. Eight percent of the urban population works out to about 11 million fatalities rather than the 18 million mentioned in the question.

This question is of crucial importance since it focuses on the realities of what has happened to U.S. deterrent strength. The deterrence definition originally postulated by U.S. officials was based on a capability to destroy in a retaliatory strike two-thirds of the Soviet industrial capability with collateral destruction of one-fourth and perhaps as much as one-half of the Soviet population. Such heavy losses were assumed to be intolerable; i.e., would destroy the Soviet Union as a viable power and probably reduce its society to purely agrarian culture. It was considered that this concept would provide a high level of security since no rational leader would run a finite risk of destroying his country.

The presently estimated losses (ranging from 5 to 11 million) are clearly a tolerable level. The Russians have tolerated far greater losses before, once by their own choice for a political purpose. Since the potential loss has been reduced to a tolerable level, the issue now becomes the magnitude of the risk that such loss might occur and whether or not the Soviet leadership would be willing to accept that magnitude of risk for some projected gain.

The magnitude of the risk to the Soviets is equal to the probability that the U.S. would attack or retaliate against the Soviet population in spite of the fact that, following such U.S. attack or retaliation, the Soviets would then inflict intolerable losses on the United States (107 million fatalities according to a Government study in 1975, plus 50% to 80% industrial destruction by our estimates). Hence, based on the principles of America's own concept of deterrence, the magnitude of the risk to the Soviets is quite low. The main element of this risk arises from the possibility that the United States leaders may act in an irrational manner.

I firmly believe that the present Soviet leadership would have no qualms in risking the loss of 20 million or so of its population. The Soviet state and indeed its predecessor the Tsarist state have long conducted foreign policies dedicated primarily for the enhancement of the state, with the population usually paying a heavy price for these expansionist endeavors. The Soviet leadership can and historically has made comparable sacrifices of population in order to achieve political, economic or territorial benefits. General Secretary Brezhnev made his career under Stalin. By the time of Stalin's death, Brezhnev was already on the fringes of the Politburo.

In order to achieve agricultural collectivization, the Soviet state sacrificed 10 million of its inhabitants (out of a much smaller population base) in the early thirties. Under the same leadership team while Brezhnev was gaining experience and successfully moving up through the ranks, the Soviet state lost over 20 million casualties in the period of 1940-45. Many of these losses were directly due to a desire to acquire territory as in the case of the assault on Finland and in the broad frontal assaults to occupy the territory of Hungary, Czechoslovakia, and the other nations of Eastern Europe. Many lives lost in these secondary theatres of war could have been saved if the effort was concentrated against the Nazi's homeland alone and quite possibly the war would have ended sooner.

The era of detente does not appear to have changed either the Soviet leaderships, fundamental objectives, their acceptance of war as a tool of policy, or their willingness to accept losses in pursuit of their purposes. Leonid I. Brezhnev in a December 21, 1972, speech said, "The Communist Party of the Soviet Union always held and now holds that the class struggle between the two systems -- the capitalist and the socialist -- will continue. It cannot be otherwise, because the world outlook and class aims of socialism and capitalism are opposed and irreconcilable."

On July 4, 1972, shortly after the Moscow Summit meeting, *Pravda* reported Premier Kosygin's statement that peaceful coexistence "...in no case means the rejection of the right of the peoples, arms in hand, to oppose aggression or to strive for liberation from foreign oppression." The government - controlled press has been more explicit. *Izvestia* on September 11, 1973, stated, "...we must not ban civil or national liberation wars -- uprisings -- revolutionary mass movements aimed at

changing the political and social status quo." The Soviet Party military journal, *Communist of the Armed Forces*, in November 1975 contained the following statement:

The attempt of certain bourgeois ideologists to prove that nuclear missile weapons leave war outside the framework of policy and that nuclear war moves beyond the control of policy, ceases to be an instrument of policy and does not constitute its continuation is theoretically incorrect and politically reactionary.

Soviet authors almost universally agree that should a war occur, "losses may be extremely high in this decisive clash between opposing forces."

It is my belief that these views of Soviet leaders convey a clear intention to continue "liberating" various parts of the world -- and pursuing a course of action that may prove detrimental to U.S. security or to the continued supply of resources essential to the U.S. economy. Should this adventurism lead to war, the U.S. would be removed as an impediment to further and more lucrative "liberations." A more fundamental consideration, however, is that the security and survival of the United States should be based on in-being capabilities adequate to counter the capabilities of the Soviet Union rather than on a hope that the Soviet leaders will not do what they say they will do.

Question 4.a.

Do your estimates of Soviet fatalities include only immediate deaths from blast, thermal or radioactive effects or do they include subsequent deaths from secondary causes as well?

Answer

See the answer to question 1.d.

Question 5.

Do your calculations concerning the Soviet "war recovery capability" address any of the social, political or psychological effects of nuclear weapons attacks? If so, how have these factors been taken into account?

Answer

Our calculations on Soviet "war recovery capability" have considered the social, political, and psychological effects of nuclear weapon attacks. This has been done primarily by considering their effect on the classical manner in which mankind recovers from catastrophic events. Basically, this recovery is divided into three periods: survival, in which efforts focus on the fundamental necessities of life such as food, clothing, and shelter; reconstitution, in which the organization of the division of labor needed for industrial societies is reestablished; and recovery, in which the excess production of an industrial society is used to restore damaged assets. The social, political, and psychological effects are predominant in the survival and reconstitution phases. We note here a large asymmetry favoring the Soviets. First and foremost, through the very long-term training and preparations of their civil defense program, they have psychologically prepared their people to survive a nuclear war. Moreover, not only have the Soviets psychologically conditioned their people to survive, but they have provided them with survival training and emergency food stores to sustain them until agricultural production is resumed.

The Soviets have also made careful preparations to insure that societal reconstitution does not change the nature or leadership of the Soviet Union. Their massive program of hardened, dispersed, and redundant command posts; communication facilities; blast and fallout shelters for their leadership (down to the 3rd and 4th echelons of government), and Civil Defense, KGB, and Army troops insure that the reconstitution phase will take place both rapidly and in conformance with Soviet Communist

Party goals. These factors -- which shorten both the survival and reconstitution phases of Soviet recovery -- have been accounted for, to the best of our judgment, in our estimates of recovery time.

The estimate that the U.S. would recover in 10 to 12 years is, by comparison, highly optimistic. Several factors could materially lengthen U.S. recovery time. First, Americans are conditioned to believe that everyone will die in a nuclear war. Such conditioning can only cause more Americans to die should a war occur. Second, while U.S. population losses would be about 50%, the losses in the industrial work force would be much higher, a fact which would significantly prolong recovery. A third factor is that at the end of a war, the Soviet Union would have overwhelming strategic nuclear superiority. Through continued coercion or denial of imported resources, the Soviets could direct or limit U.S. recovery. They could also use this strength to force other industrialized nations to assist them, thereby reducing Soviet recovery time below that which we have estimated.

Question 6

Do you believe that a Soviet attempt to conduct nuclear coercion or "blackmail" which led to the deaths of five million or more Soviet citizens and the extensive destruction of property would have any effect on the composition of the Soviet leadership? If so, what effect? If not, why not?

Answer

"Winning" versus "losing" has historically had more effect on the Soviet leadership than has the cost of an undertaking. Changes in the Soviet leadership would be likely only if the Soviet Union was forced to back down or failed to achieve their sought-after objective in a confrontation with the United States. Consider the situation that would exist if a confrontation did escalate to a level where the

Soviets had lost 5 million of their people. For these Soviet losses to have occurred, the U.S. would have had to expend all or most of its surviving arsenal. The Soviet Union, even after having destroyed the U.S. cities, would still retain a very large strategic nuclear reserve force. Hence, there would be no way that the U.S. could prevent the Soviet Union from achieving its originally sought-after objectives. More importantly, the Soviet citizens would almost certainly be told that it was the "imperialist aggressors" who had attacked the Soviet Union and that the regime, through "vigorous action of its armed forces and civil defense of the people" had "defeated the aggressor" and ensured the survival of the Soviet state.

It is instructive to also consider the corollary question: Would the refusal of a U.S. leader to give in to Soviet demands that led to 107 million American deaths and destruction of most of U.S. industry have an effect on the composition of the U.S. leadership? I believe that it would. Hence, in such a confrontation the leaders of the two countries would face pressures that would be unequal and that would favor U.S. submittal to Soviet demands.

Question 7.

Do you believe that loss of life of this magnitude would have any effect on the stability of the Soviet regime? If so, what effect? If not, why?

Answer

Losses of such magnitude probably would have appreciable but not critical impact on the stability of the Soviet regime. There could well occur localized, temporary breakdowns of stability, but such aberrations would be eradicated before they became a threat to the state. A number of factors indicate that the Soviets will in fact maintain stability. First of all, the Russian state, both in its Tsarist

and Soviet manifestations, has a long history in maintaining strong controls over its population. As a result the Soviet population is not inclined to reject direction from above. Secondly, the Soviets continue vigorous efforts even today to ensure that no significant possible center of organized dissent can exist within the body politic. Thus, in time of crisis, there will be no existing hostile organizations capable of taking advantage of a temporary breakdown of stability. Third, the Soviets recognize the potential for such instability and have made a concentrated effort to prevent such a possibility. Elements of this effort include a broad scale indoctrinization of the general population, close integration of the civil defense and strategic military programs, and a concentration on the development and construction of redundant command and control systems.

Perhaps more importantly, the Communist Party workers and the civil defense forces collaborate closely at the local level, creating the impression of the CPSU as the protector of the people. By contrast, in the United States there probably would be serious doubts regarding the stability of a government that had failed to protect its people.

Question 8.

Do your calculations include any estimate of the probable effectiveness of Soviet civil and industrial defense measures? If so, what statistical techniques were used to establish this level of probability?

Answer

Our calculations have included estimates of the probable effectiveness of Soviet civil and industrial defense measures. The statistical techniques used in our analysis are the same as those which have for many years been used by the Government to assess the survivability and retaliatory effectiveness of the U.S. strategic forces.

The damage resistance of Soviet factory-area shelters was estimated using the same techniques used to estimate the hardness of Soviet military structures (e.g., command and storage bunkers, aircraft shelters, and missile silos). Damage resistance of the Soviet expedient shelters was based on the results of tests in the U.S. of shelters constructed according to the Soviet designs. Damage resistance of protected machinery was based on the static and high-explosive tests outlined in the study report. We used the same test and analysis methods and the same expert personnel that are used to establish the survivability of U.S. military systems.

The damage-producing capabilities of U.S. retaliatory weapons was calculated using the formulas of the "Physical Vulnerability Handbook - Nuclear Weapons" (Defense Intelligence Agency AP-550-1-2-69-INT, June 1969), for kill probabilities of nuclear weapons. These formulas account for all effects of the nuclear weapons, the size and damage resistance of the target, and weapon accuracy. Reliability and penetration capability were also taken into account. These formulas were derived from weapons test programs conducted by the United States Government and are the standards on which retaliatory effectiveness computations have always been based.

Question 9.

Do your calculations include any estimate of the statistical probability that the Soviet Union intends to wage an offensive nuclear war?

Answer

We know of no credible method of estimating the statistical probability of an intention. Moreover, the security of the United States should not be based on a hoped-for absence of Soviet hostile intentions since such intentions could develop quickly. The United States should have the capabilities necessary to reliably deter Soviet aggression or to defend itself against the military forces possessed by the Soviet Union.

Question 10.

Inasmuch as the Soviet Union is potentially threatened with military attack from China and with rebellion among its Eastern European client states -- situations in no way faced by the United States -- is it not likely that their industrial and civilian defense measures are driven more by these considerations and less by the idea of threatening and coercing the United States?

Answer

It is not realistic to assume that the Soviet Union is threatened with a military attack from China. Military analysts generally agree that the large standing army of the PRC is neither postured nor equipped for power projection any significant distance beyond the Chinese borders. These analysts also agree that the small PRC force of nuclear missiles is maintained in a defensive posture to enhance its survivability. This posture does not allow them to undertake an offensive strike without considerable preparations. These preparations, if started, would undoubtedly be detected by the Soviets and might well cause a Soviet preemptive counterforce strike. The PRC bomber force is ill-equipped to challenge Soviet air defenses and highly vulnerable to the Soviet fighters stationed in areas near the PRC border. In addition, its projection range is severely limited.

The Soviet problem with respect to the PRC is essentially one of containment; i.e., border disputes and potential creeping encroachment of settlers of PRC ethnic origins. They have reacted to this problem by stationing large numbers of regular army troops, KGB border guards, air defenses, and fighter aircraft along the Chinese border. Given the PRC's present lack of mechanization, roads, logistic support, or industrial base to conduct an effective offensive into the Soviet Union, the Soviet troops presently stationed along the PRC border are deemed more than adequate to contain any PRC expansionist thrusts. Further,

given the present marked asymmetry in nuclear arsenals as well as the Soviet air defenses, it is inconceivable that the PRC would initiate nuclear war with the Soviet Union.

With reference to the Eastern European states, the inference that the Soviet Union is faced with rebellion of its client states appears to be unfounded. While it is true there is dissension in these states, it is also true that the population is very well controlled by a combination of Soviet and indigenous troops. The Soviets must have a much higher confidence in their ability to control these states than Americans are willing to admit. If they did not, one would have to seriously question why the Soviets have embarked on such an extensive program of civil defense shelters and other protective measures in these client states. Further, a scenario in which the U.S. and USSR have experienced an exchange of nuclear weapons will undoubtedly include attacks on Soviet and probably indigenous military facilities and forces in these client states. Thus, their populations will have been placed at some degree of risk by U.S. weapons. It is difficult to believe they will then rise up in rebellion against the Soviet Union (which will still retain a sizable arsenal of nuclear weapons) if faced with no hope of support from the United States. In any event, it is apparent that the Soviet troops stationed there would be more than adequate to quickly crush any uprisings. One facet of this control, frequently overlooked, is the complete dominance by the Soviets of the command, control, and communications mechanisms of the indigenous forces. Any attempt to use these forces against the Soviets must, of necessity, be spontaneous, individual unit efforts since the means to coordinate them remains firmly in the control of the Soviets.

From the above, we cannot in any way conclude that the Soviet industrial and civilian defense measures are driven more by considerations of China and Eastern Europe than by competition with the United States. While it is certain that the Soviets view civil defense measures as protecting against both the U.S. and PRC, the primary thrust clearly must be against the U.S. It is illogical to infer that the Soviet preparations are driven by threat of rebellion from client states that possess no nuclear weapons, especially when the USSR expends considerable resources building civil defenses for the people and industries of the client states.

Question 11.

In view of these gross strategic disparities between the U.S. and the U.S.S.R., is it not true that the Soviet Union has a lower tolerance for nuclear destruction than the United States, because it is subject to uncertainties on its borders from which we are free?

Answer

In my opinion, the Sino-Soviet border disputes and the occasional dissension within the Eastern European client states do not constitute a "gross strategic disparity." Rather, the Soviet Union appears to be more than adequately prepared to cope with any potential problems on its borders. Even after an all-out nuclear war with the United States, the Soviet Union would have remaining a strategic reserve force more than adequate to deal with China, Europe, and whatever might be left of the United States. (See Figure A-3 of the study report.) In addition, the Soviet non-central systems (medium bombers, cruise missiles, and medium-intermediate range ballistic missiles) would survive in numbers sufficient to provide a second, fully independent capability against China and Europe. Moreover, Soviet conventional forces, together with the materiel and logistics to fight a war, would provide a third independent and adequate capability.

It is also, in my opinion, the United States that has the lower tolerance to nuclear destruction. The Soviet population, notwithstanding desires for personal freedom, is well disciplined and firmly controlled by a regime that continues to be effective in suppressing dissent. Since essentially all of the information they would receive in the event of a nuclear war would be from the Soviet government, the events will be described in a manner which can only cause the Soviet people to blame the United States for the destruction. As was the case with the American people following the attack on Pearl Harbor, their population will undoubtedly be made more cohesive against a common enemy who has "without provocation wreaked this horrible disaster on the peaceloving Soviet people."

By contrast, many people in the U.S. are prone to express their dissent by rioting and violence. When one considers that in 1968 the United States had to deploy almost a full division of troops to its capitol city in order to quell widespread rioting, looting, and arson, it is apparent that nationally our population is totally unprepared to deal with the consequences of nuclear war. Further, we must consider the fact that people have been deceived into believing that a nuclear war is the end of the world and that if such a war occurs they will all die. These facts emphasize the disquieting realization of how totally ill-prepared our nation is to deal with such an event. On the other hand, the Soviets have -- through years of psychological conditioning, practical training, and physical civil defense preparations -- provided their people with the basic mental attitudes and tools to cope with such a catastrophe.

Question 12.

If, as you say in your testimony . . . , the Soviet Union wants to avoid nuclear war and would not initiate it except as a last resort, why do you believe that they would run the risk of provoking one by attempting nuclear extortion?

Answer

The Soviet Union views war ". . . as a continuation of policy by military means." They hope and plan on obtaining their political goals without the use of war. However, ". . . the Communist Party of the Soviet Union always held and now holds that the class struggle between the two systems -- the capitalist and the socialist -- will continue. It cannot be otherwise, because the world outlook and class aims of socialism and capitalism are opposed and irreconcilable."

In general, Soviet leaders recognize that the role of the USSR as a military superpower provides the base for a dynamic Soviet foreign policy. They believe that the changes in the U.S./Soviet military balance have led to political changes and given rise to new opportunities for the Soviet Union to shift the "correlation of forces" still further in its favor. The ultimate Soviet objective, as Brezhnev has indicated, is to achieve a power posture such that ". . . no question of any importance in the world can be solved without our [i.e., Soviet] participation, without taking into account our economic and military might." Thus the Soviets seek a power balance in which they would deal with the U.S. and the rest of the world from a position of superior strength.

The preceding discussion clearly shows that while the Soviets seriously want to avoid a nuclear war, they do not intend to abandon their quest for changing the world social order. They perceive, and in my opinion quite correctly, that the risk of nuclear war is quite low as long as they have a position of superior offensive strength coupled with the ability to limit damage to themselves. The United States, in contrast, remains fully exposed to intolerable damage.

One can also ask why the United States -- a charter member of the United Nations, an organization charged with keeping peace in the world -- risked nuclear war

during the Cuban missile confrontation with the Soviets in 1962. The answers for both the 1962 confrontation by the U.S. and potential Soviet threat are the same. The nation with the superior power, while recognizing that some risk exists, is nevertheless willing to take that risk in order to achieve a vital political objective; i.e., as long as offensive attacks are not initiated, the nation with the superior force is taking only an extremely small risk that his opponent, rather than yield a single political advantage, will commit national suicide and initiate or provoke a nuclear war.

Question 13.

The evidence cited in your statement and study taken from Soviet strategic and civil defense literature suggests only that the Soviet Union be taking measures to protect population and industry in the event of a nuclear war, not that it is planning to wage nuclear war. What is there to substantiate your inference that these defensive capabilities portend an intention to wage nuclear war or to attempt nuclear coercion?

Answer

I did not infer that the Soviets intend to wage nuclear war. In fact, such an inference would be contrary to the published statements of the Soviet leaders. These same leaders, however, have stated that they intend to pursue "wars of liberation;" to continue their unrelenting struggle against the West; and that war, including nuclear war, is an extension of policy. They have cautioned their people that in the process of this struggle nuclear war could occur as a final desperate move by the West to regain its former power and that the Soviet Union must be prepared to survive, recover, and emerge victorious from such a war. These factors, taken together with the considerations discussed in the answer to the previous question, indicate that the Soviet Union intends to continue using its power to get its way in the world.

Moreover, the timing of the Soviet civil defense preparations creates an inference of its own. The acceleration of Soviet civil defense preparations did not occur when the U.S. had nuclear superiority and was threatening the Soviets with "massive retaliation." Instead, the program was accelerated in the early 1970's, in the era of detente, when the trends (see Figures A-2 and A-3 of the study report) showed that a nuclear war-winning capability was within the Soviet grasp.

Question 14.

Even if the Soviet Union were willing to risk an avoidable nuclear war and even if they believed their civil and industrial defenses gave credibility to their threats, what reasons do you believe they have for expecting the United States to back down in a confrontation?

Answer

For the past several years, Soviet spokesmen have pointed out that the "correlation of forces," a term which includes military, economic, and political power, has been shifting in favor of the Soviet Union and that for this reason the U.S. is already being forced to back down. For example, the Soviets asserted that the SALT I agreements represented a change in U.S. policies that was forced on the U.S. by Soviet power:

The strategic course of U.S. policy is now changing before our very eyes from "pax Americana" -- the Americanized formula of world domination -- to a definite form of necessity for peaceful coexistence. But, we must clearly understand that this change is a forced one and that it is precisely the power -- the social, economic and, ultimately, military power of the Soviet Union and the socialist countries -- that is compelling American ruling circles to engage in an agonizing reappraisal of values. ("A Triumph of Realism," Komsomolskaia Pravda, June 4, 1972)

This belief was further amplified in an editorial in the May 1973 Kommunist:

. . . [imperialism] is compelled to adjust to the new condition wherein the correlation of forces in the world arena has changed in favor of peace, progress and socialism. A considerable role in the strategy of the imperialist powers is also played by the realization that a nuclear war would be suicidal for capitalism.

One fulfillment of this view was the October 1973 Middle East war, where a Soviet threat to intervene caused the United States to restrict deliveries to Israel, thereby bringing about the release of the encircled Egyptian army.

Marshal Grechko's view of the matter was that:

It was precisely the change in the correlation of forces in favor of socialism and the process of the relaxation of tension taking place on this basis which prevented the dangerous eruption of the war in the Near East from assuming dimensions threatening universal peace.

In Angola, the United States backed down with minimum protest and no effective counteractions. The Soviet leaders could logically view these events as an emerging tendency of the United States to back down in confrontations. Once such a pattern of concessions is established, it is increasingly difficult to halt the process.

As the correlation of forces shifts further in favor of the Soviet Union, it is not unrealistic to believe that the United States would be willing to back down in confrontations even more important than Angola and the Middle East. By 1978, the Soviet Union will have gained a "war-winning" capability comparable to that which the United States held in 1962 during the Cuban missile crisis. (See Figure A-3 of the study report.) The Soviets believe we have rational leadership and that the U.S. leadership, when placed at a major disadvantage, as the Soviets themselves were in 1962, can be forced to acquiesce to Soviets demands in future confrontations.

Question 15.

The scenario for nuclear coercion suggested in your testimony requires that the Soviet Union have a high confidence that the United States would not engage in nuclear war, if its vital interests were threatened. What information do you have that the Soviet leaders have this high confidence or what factors would entitle them to this high confidence?

Answer

We cannot identify an interest of the United States so vital that it would be worth "defending" at the expense of a 100-million-plus American lives, destruction of most of America's industrial capability, and a postwar military balance such that America's future could be dominated by the Soviet Union. It is ironic that because of American adherence to our own concept of deterrence the Soviet leaders can have high confidence that the U.S. would not engage in nuclear war, even to protect a "vital interest." Indeed, the Soviet leaders' confidence should be further reinforced by the realistic and candid statements of the Annual Defense Department Report (FY 1977), which implies that even if the Soviet Union attacked the U.S. strategic forces the U.S. might not necessarily respond since in such an attack the Soviets could ". . . withhold a large percentage of their forces with which they could retaliate in kind" (p.47).

Question 16.

At different points in your testimony, you say that extensive civil defense measures are "destabilizing" to the strategic balance and that the United States needs to undertake such measures in order to regain the stability of the strategic balance. Are civil and industrial defenses intrinsically "stabilizing" or "destabilizing"? Historically, has not the adoption of "destabilizing" measures in order to achieve stability led, instead, to new rounds of instability?

Answer

In the study report and my testimony, the discussion of strategic stability was in consonance with the definition outlined in the Annual Defense Department Report (FY 1977) (p. 45); i.e., a ". . . situation in which neither side will see any advantage in initiating the use of strategic forces." Moreover, both the prepared testimony and the study report noted specifically that the U.S./USSR strategic relationship had not been destabilized by Soviet civil defenses alone but by the combined effect of these civil defenses and increasing Soviet offensive power.

In more specific terms, the present instability is caused by:

- a. The growing capability of the Soviet Union to improve their military advantage by attacking the U.S. strategic forces. The deployed forces of the two sides are roughly equivalent (Fig. A-1 of the study report). By attacking the U.S. forces, the Soviet Union would gain the position of military superiority shown in Figure A-2 or, if the U.S. sought to redress the imbalance, the superiority shown in Figure A-3.
- b. The Soviet Union following an attack on U.S. strategic forces would still retain a very large portion of their original strategic force (See Fig. A-2 of the study report), a factor which the DOD report notes could deter the United States from using its deterrent force in response.
- c. In the event that the U.S. did respond to a Soviet attack, the Soviet civil defenses can limit the damage to a level that the Soviets know can be tolerated.
- d. Since Soviet civil defenses will allow the USSR to recover from a nuclear war much faster than the United States, and since the USSR would retain military superiority at the end of a nuclear war, the Soviet Union could continue to dominate or at least substantially influence the United States in the postwar period. Thus the Soviets could be reasonably certain that the U.S. would no longer stand between the Soviet Union and its global objectives.

The issue then is not whether civil defenses are intrinsically stabilizing or destabilizing. The issue is that the strategic relationship between the U.S.

and the Soviet Union is now unstable. U.S. civil defense preparations by themselves could not entirely remove the instability caused by the several factors outlined above. Such preparations could, however, make nuclear war less attractive for the Soviet Union and more survivable for the United States.

Question 17.

If, as you say on pages 1 and 73 of your study, non-military (civil and industrial) defense undermines nuclear deterrence, just like an ABM system by provoking destabilizing fears of a first strike, why should the United States incur this increased risk by going beyond its present limited program of fall-out shelters?

Answer

It would not necessarily be correct to say that civil and industrial defense undermines nuclear deterrence by provoking destabilizing fears of a first strike. The statement said that "civil defense undermines deterrence by protecting an aggressor's economic and political assets against retaliation." Hence, U.S. civil defense preparations would not increase any risks to the United States. In fact, since for the reasons noted in the answer to the previous question, the U.S. deterrent concept has been undermined and the strategic relationship is now unstable, the U.S. now faces a finite risk that a nuclear war might occur and a relatively large risk that nuclear blackmail or coercion could be applied. U.S. civil defense preparations could reduce both the magnitude and the potential consequences of this risk.

Question 18.

In view of the universal tendency of population and industrial capacity to become concentrated in relatively small areas, why do you relate the destruction potential of U.S. strategic forces to the entire geographic expanse of 8.65 million square miles of Soviet territory (See page 27) the overwhelming proportion of which contains no worthwhile population or industrial targets?

Answer

The effect of the Soviet civil defense preparations is to reverse "the universal tendency of population and industrial capacity to become concentrated in relatively small areas." For population, this reversal is obtained through evacuation and over the longer term will be facilitated through collocation of new housing units with the dispersed industry. For industry, this reversal is being obtained through the dispersal mechanism shown in Figure 10 of the study report.

Because the thrust of the Soviet civil defenses is to disperse potential targets over very large areas, noting the areas which can be covered by the U.S. arsenal provides a useful perspective, particularly since many Americans have long been conditioned to accept the myth of "overkill." Further information on this matter is included in the answer to question 19.

Question 19.

Does your data indicate what proportion of Soviet territory is occupied by the majority of its population or the majority of its industrial capacity and, if so, will you make those figures available to the committee?

Answer

The Soviet urban population (about half of the national total) is in normal day-to-day living concentrated in a small fraction of one percent of the Soviet land mass. It is for this reason that U.S. weapons could exact heavy destruction if the population is not evacuated (see Figure 6 of the study report). If evacuated to the collective farms and outlying villages, the urban population would be distributed over about 27% of the Soviet land area. If the evacuees are further distributed into nonagricultural areas surrounding the cities, the urban population could be spread over as much as 48% of the Soviet Union.

The industrial dispersal illustrated in Figure 10 of the study report includes housing for the work force. Hence, in the future, an increasing share of the "urban" population will in normal day-to-day living be dispersed over an area that could grow to as much as one-fourth of the Soviet Union.

Since the locations of factories can be precisely defined, industrial targeting is based on the actual factory-by-factory layout of the Soviet industrial complex. Hence, we have not aggregated the total area covered by Soviet industry.

Question 20.

Since the large relative U.S. advantage in re-entry vehicles (over 8,500 to less than 3,500) permits the United States to target more aim-points or to place more warheads on fewer aim-points (thus neutralizing hardened sites), why do you assume that the Soviet Union would find a nuclear attack "tolerable," while for the United States it would be disastrous? Given the imbalances in offensive and defensive capabilities, it would appear to be equally disastrous for both. What assumptions and calculations are required for you to arrive at the conclusion that nuclear attacks would be benign for the U.S.S.R. and catastrophic for the U.S.?

Answer

It would be incorrect to infer that the United States has a large advantage in offensive capabilities. Figure A-1 of the study report shows that "numbers of warheads" is the only measure of military power in which the United States will continue to hold an advantage; the Soviets will be at parity or superiority in the other measures. Moreover, counting the numbers of warheads that each side has is a poor way to measure military strength since it does not account for the size or accuracy of the warheads nor the survivability and penetration capability of the delivery systems.

The portion of my testimony to which this question refers states that ". . . should the Soviet execute its civil defense plans, the consequence of further escalation would be disastrous to the United States. It might well be tolerable to the Soviets." An example of such "further escalation" would be a Soviet attack on

U. S. strategic forces, the outcome of which is shown in Figure A-2 of the study report. If such an incident were to occur in 1980, the U.S. and USSR would end up with an approximately equal number of warheads while the Soviets would have a 4 to 1 advantage in throw weight, a 10 to 1 advantage in megatons, and a 2 to 1 advantage in the number of missiles and bombers. In equivalent warheads, a comprehensive measure of actual capability to destroy targets, the Soviets would have a 3 to 1 advantage. Hence, one consequence of "further escalation" would be to give the Soviets a clear superiority in offensive power. (Even if the U.S. attacked first, the Soviets would still have superiority in equivalent warheads.)

The Soviet civil defenses have the effect of magnifying this superiority in offensive power. Table A illustrates the effect of hardening on the numbers of U.S. warheads required to destroy industrial machinery. Depending on the size of the factory area, hardening could have the same effect as a 22-fold to a 43-fold decrease in the number of U.S. SLBM current warheads. Even the bomber laydown weapons, whose effectiveness is less sensitive to hardening than that of other U.S. warheads, would be subject to a 3- to 9-fold decrease. Dispersion of smaller industry as illustrated in Figure 10 of the study report, has the effect of an 8-fold reduction in numbers of U.S. SLBM warheads even if the machinery is not hardened.

In sum, the Soviet Union may well find such escalation tolerable if it executes the civil defense plans which it has published and is prepared to implement.

The assumptions and calculations of potential damage to the USSR have been described in the answers to questions 1, 1a, 1b, 1d, 1l, 1m, and 8. We assume

TABLE A
EFFECT OF INDUSTRIAL HARDENING ON WARHEAD REQUIREMENTS
(NUMBER OF WARHEADS REQUIRED TO DESTROY 90% OF MACHINERY)

TARGET HARDNESS WEAPON TYPE	TARGET SIZE					
	MEDIUM AREA			LARGE AREA		
	SOFT	**MINIMAL HARDENING	**EXTENSIVE HARDENING	SOFT	**MINIMAL HARDENING	**EXTENSIVE HARDENING
SLBM, CURRENT	1	5	22	2	17	87
SLBM, PROJECTED	1	3	13	2	10	48
BOMBER STAND-OFF WEAPONS	1	1	8	2	4	27
BOMBER LAY-DOWN WEAPONS	1	1	3	1	1	9
MINUTEMAN III	1	1	9	2	4	30

*MINIMAL HARDENING CONSISTS OF EARTH COVERING ONLY.
**EXTENSIVE HARDENING CONSISTS OF SURROUNDING MACHINE WITH CRUSHABLE MATERIAL AND COVERING WITH EARTH OF SUFFICIENT DEPTH TO PROVIDE EARTH ARCHING

that the question does not imply that there is disagreement over our statement that nuclear war would be disastrous to the United States.

Question 21.

Since sufficient economic or industrial capacity would survive a limited nuclear attack in any case, it would appear that your conclusions derive from a large-scale nuclear attack. Is that correct? If this attack or exchange were spread over several days, would it be possible for the U.S. to determine where surviving Soviet industry and population were located and target these areas, since as you say, our methods of verifying these facts are extremely good?

Answer

Our conclusions are based on a large-scale nuclear attack. In my testimony, however, I indicated only that the U.S. would know if the Soviets actually initiated an evacuation of their cities. Following a Soviet attack on U.S. forces and a first portion of a U.S. retaliation against Soviet economic and political assets, it would be highly unlikely that the United States would have remaining the means to determine the location of Soviet surviving industrial facilities or population.

Question 22.

Why do you conclude that the Soviets would have a bargaining advantage over the U.S. if it requires them two to four years to recover from a U.S. nuclear attack? Would not your projected industrial recovery periods (2-4 years for the U.S.S.R., 12 years for the U.S.) make any bargaining power rather academic?

Answer

Let us examine the specifics of the bargaining position that would exist in a future confrontation in which the Soviets had executed their civil defense measures. If the confrontation escalated into full-scale nuclear war:

- a. The United States would lose over 100 million of its citizens, compared to 5 to 10 million Russians.
- b. Half to three-quarters of U.S. industrial capacity would be destroyed, compared to 10% to 30% of Soviet industrial capacity.
- c. The present "rough equivalence" in strategic forces would be gone -- the Russians would have superior strength and hence could dominate or strongly influence U.S. actions for the foreseeable future, particularly since the USSR would recover its industrial capacity much sooner than would the United States.
- d. The Soviet people have been conditioned to believe that they can survive and perhaps even win a nuclear war. Americans have been conditioned to believe that we would all die in such a war.

While "industrial recovery time" may appear to be rather academic, the above specifics which would enter into the bargaining position in a serious confrontation are anything but academic. In my judgment, the above specifics represent a bargaining situation for the United States that is worse than the situation faced by the Soviet leaders during the Cuban missile crisis of 1962.

Question 23.

In view of the historical problems of Soviet economic development (low productivity, misallocation of capital, technological constraints, etc.), is the relatively shorter recovery period you postulate for Soviet industry attributable solely to their industrial defense techniques?

Answer

As we indicated on page 3 of the study report, "survival of the work force is by far the most important factor in industrial recovery." Hence, the relatively rapid Soviet industrial recovery is attributable first to their measures to protect the skilled workers and, second, to their industrial defense techniques.

It is also important to understand that in spite of the problems of Soviet economic development cited in the question the Soviet Union outproduces the United States in several areas including steel, 1.3 to 1; cement, 1.6 to 1; coal, 1.2 to 1; and petroleum, 1.2 to 1; and Soviet machine tool production equals that of the U.S. In fact, the conditions which Americans regard as inefficiencies in the Soviet economic system give the Soviets more resiliency and hence a better prospect of recovery. Soviet factories appear to American observers to be glutted with people, a condition which insures availability of the work force needed for the labor-intensive steps of recovery. Soviet machine tools are less automated and hence easier to protect and restore. The U.S. laborer has lost many of the basic skills that would be needed for recovery -- we employ "machine operators," the Russians employ "machinists." The general lack of communications between enterprises and uncertain delivery of repair parts has forced Soviet factories to become highly self-sufficient in machine tool repair and to keep machinery far in excess of their normal needs. In addition, because of supply difficulties, Soviet managers tend to keep large stocks of raw materials and finished product. While all of these factors attest to the day-to-day inefficiency of Soviet industry, they are marked advantages in recovery from nuclear war.

Question 24.

What evidence is available to indicate that the Soviet industrial defense measures have been implemented throughout the U.S.S.R. and are not merely "pilot" or "demonstration" programs at a few facilities?

Answer

Soviet civil defense literature and commentary by Soviet civil defense spokesmen over the past several years indicate this is not the case. Soviet newspapers and journals, especially the civil defense monthly, VOY ZNAN (circulation in excess of 300,000), refer to industrial defense measures underway at a broad variety of industry installations. Books such as Civil Defense of an Industrial Installation (2 editions totalling 500,000 copies) indicate nationwide programs. The book referenced appears to be a primer for the conduct of civil defense operations at industrial enterprises throughout the country. Training of special civil defense functions in all industrial facilities nationwide is a regular program. Civil defense staffs exist in all government jurisdictions in the USSR. The civil defense staffs for the 15 republics comprising the USSR are in all cases headed by active-duty general officers, varying from one to three star rank, who devote 100% of their efforts to making the program effective. The entire program is headed by a Deputy Minister of Defense, whose sole responsibility is to make the program effective. Far from being a token effort, all the evidence indicates that the various aspects of industrial defense; i.e., training of special civil defense functions, shielding, etc., are being carried out on a broad national scale.

It is of course true that some of the Soviet industrial defense measures are not amenable to cross-checking by more than one method since the preparations associated with these particular measures tend to be unobtrusive or could be normally concealed. However, those measures that are readily observable have been found to be surprisingly widespread. It would not be logical for Americans

to assume that the Soviets had implemented only those measures which could be observed by the U.S. and had failed to implement the remainder of their program, particularly since the more observable measures tend to be more costly than the others.

Question 25.

Do your conclusions about Soviet advantages in industrial defense (less damage, shorter recovery) assume that what is known from Soviet publications is universally practiced throughout Soviet industry? If not, what proportion or what segments of Soviet industry would have to be protected by these measures for your projections to be valid?

Answer

Our conclusions about Soviet industrial defense have been based on the fact that the program is national in scope. We have not assumed that everything that is listed or known from Soviet publications could or would be universally practiced throughout Soviet industry. Industrial protection techniques will vary considerably between industry types. Take a steel mill for example. While it may not be very feasible to harden a blast furnace, it would be relatively easy to stockpile and protect the basic materials to rebuild it (steel and firebrick). On the other hand, the long-lead controlling item in restoring steel production would be the rolling mills. Several Soviet examples have been noted where a single steel mill has two separate rolling plants separated by distances of several miles. These mills, which are inherently hard and very tough, are well suited for protection by the methods selected for machine tools in our Auburn facility.

Moreover, we did not assume that all Soviet industrial machinery would be hardened to a uniformly high level. We assumed that only a selected 5% of machinery would be hardened to about 300 psi, 10% to about 200 psi, 50% to about 60 psi, and 35% would not be hardened. The results of this rather

practical and achievable degree of hardening are sufficient to support our conclusions on Soviet industrial recovery.

Question 26.

In view of the current paucity of intelligence data on Soviet civil and industrial preparedness measures and in view of what you call the "unknowns" in the Soviet program, what is the foundation of the high rating you assign to the effectiveness of Soviet civil and industrial protection?

Answer

In the study report prepared for the committee, we stated on page 73 that "...these deficiencies and unknowns are not likely to significantly degrade the effectiveness of the Soviet program. Instead, their effect is to extend the time required to transition from their present posture to a fully evacuated and protected posture." Moreover, in our analysis we tended to treat the unknowns which could impact effectiveness in a "worst case" manner. For example, because the extent of medical support preparations is unknown, we assumed that medical services were nonexistent and counted as fatalities all persons that would require medical attention.

We do not concur with the inference that there is a paucity of intelligence data, particularly when the data obtainable from open sources is considered. While it is true that there are gaps in the data, we have determined through use of various analytical and modeling techniques and tests that few of the gaps have significant influence on the estimated effectiveness of the Soviet civil defense measures. If anything, the Soviet program could well be more effective than is indicated by our estimates.

Question 27.

Does your estimate of the costs of protecting U.S. industry against nuclear attack address (1) all industry, (2) all defense industry, (3) essential civilian industry, (4) essential defense industry, or (5) essential civilian and defense industry?

Answer

The preliminary cost estimates shown in Table 3 of the study report refer to the protection of essential capital equipment in the entire U.S. civilian and defense manufacturing industry. These estimates are based upon a detailed examination of the preparations and stockpiling of materials necessary to protect the essential machinery and capital equipment at one of Boeing's large manufacturing plants. Approximately 30% of the total capital equipment was considered essential to regain present production levels. The Boeing costs are shown in Table 3. To arrive at a cost estimate to protect all U.S. manufacturing industry against a full-scale attack, it was assumed that the cost of preparation in relation to the replacement cost at Boeing would hold for U.S. industry at large. Thus, with a knowledge of the Boeing and the U.S. capital equipment replacement cost at 1975 prices, a straight-line extrapolation was made to arrive at an estimate to protect the essential capital equipment of the total U.S. manufacturing industry. This is also shown in Table 3.

Question 27.a.

If the answer to the foregoing is (2) or (4), what are your reasons for selecting defense industry for hardening or other nuclear preparedness measures, as opposed to civilian or essential civilian industries?

Answer

The answer to the foregoing is (1).

Question 27.b.

Do you consider that, in the event of a nuclear attack on the U.S., it will be more essential to rebuild war-related industry first or industry essential to civilian recovery first? On what do you base this view?

Answer

Initially, the most important factor in general recovery is survival (see question 5). Therefore, the first thing that must be done is to rebuild those industries that provide the basics of life; i.e., food, clothing, and shelter. Living standards will during this period be far below prewar standards. It is then necessary to reconstitute the productive capacity of society, and this will generally involve rebuilding basic industries such as steel, electric power, fuel production, etc. Since these industries are essential to both "defense industry" and "essential civilian industry," to attempt to classify them as one or the other is largely a matter of semantics. In the final phase of recovery, the mix of civilian versus defense products produced will depend on the external threats and international situation existing at the time.

Since the Soviets are preparing to survive and win any war, it would appear that the ability to reconstitute the industrial base of the U.S. to provide for continued defense will be necessary to the survival of the Western World and democratic governments.

Question 27.c.

If your estimate of the costs of preparing industry against nuclear attack is not inclusive, what would the costs be for protecting other or all segments of industry?

Answer

The cost estimates provided to the Committee are inclusive.

Question 27.d.

Are your estimates of the costs of industrial protection based on a limited attack on U.S. industrial and military targets or on an attack against the U.S. economy as a whole? What is the basis for making this assumption?

Answer

Our estimates of the costs of industrial protection and of the time required for recovery are based on a full-scale attack against the U.S. economy as a whole. This assumption was made since, from the U.S. point of view, it represents what should be a worst case type of attack which would place the greatest possible stress on the industrial protection measures.

Question 27.e.

Are your estimates of costs and recovery periods based on a single, limited attack, a series of limited attacks, a single massive or "national" attack, or a series of massive attacks? What is the basis for this assumption?

Answer

Our estimates were based on a single, full-scale attack on economic and political assets. If part of the available weapons had been directed against military targets, industrial and population damage would have been lower and recovery would occur more rapidly.

Question 27.f.

How would an alteration in this assumption affect your cost and recovery period estimates?

Answer

An alteration in the duration of the attack (single vs. continuing) would change our estimates of recovery time. Economists who participated in the Strategic Bombing Survey of Europe after World War II concluded that the collapse of the German economy was brought about by repetitive attacks carried out over many months and years. This may well turn out to be a possible response to a full-fledged civil and industrial defense effort. However, it argues for and requires types of forces the U.S. does not now possess; that is, those having long-term survivability (years); survivable

and/or replaceable command and control; denial capabilities to enemy reconnaissance (antisatellite forces); and survivable and/or replaceable reconnaissance assets. Repetitive attacks carried out over many months or a few years could probably deny industrial recovery. Today, only the Soviets with their survivable ICBMs, survivable command and control, and nationwide civil defense are in any way postured or prepared to adopt such a strategy.

Question 27.g.

How did you arrive at the comparative estimates of recovery time for the U.S. and the USSR? What kinds of attacks were these comparative estimates predicated on?

Answer

The comparative estimates of recovery time were based on calculation of damage to population and industry using the approaches and factors outlined in the answers to questions 1, 1.d, 25, and 26, together with the results of large-scale economic studies evaluating the factors outlined under question 5. The estimates are based on a massive, full-scale war involving the strategic nuclear arsenals of the the U.S. and the USSR. The results of the economic studies are consistent with the results of the in-depth study of the Seattle-Tacoma-Everett industrial area study, wherein it was assumed that the area received its share of a full-scale nuclear attack on the entire U.S. and that during reconstruction no outside help would be available from other areas of the United States.

Question 28.

Would your advocacy of civil and industrial protective measures also include favoring ballistic missile defensive systems? If so, would you favor wide-area systems to protect population and cities or point defenses to protect specific targets? If the latter, would you recommend ballistic missile defenses for both military and industrial targets? What are the advantages and disadvantages you see in the deployment of ballistic missile defenses? Why wouldn't such deployment lead to the opening of the defensive arms race which the SALT I treaty closed in 1972?

Answer

I would not advocate ballistic missile defensive systems for two reasons:

- a. The technology of ABM systems is still such that the cost of developing and deploying such systems is greater than the cost to the opponent to counter them with offensive system improvements.
- b. Since the ABM Treaty of 1972, the United States has cut back on its research of ABM systems while the Soviet Union has continued a vigorous development effort. It is my judgment that the Soviet Union is or soon will be far enough ahead of the U.S. to beat us in any ABM defense race. Moreover, the Soviet Union's present lead in civil defenses would be an asset to them in an ABM defense race.

Question 29.

The thrust of your testimony is that the United States now requires civil and industrial defense in order to be able to bargain successfully in some undefined confrontation in the indefinite future. Have you considered what measures the Soviet Union might employ to vitiate any American civil and industrial defense programs. If so, what are they?

Answer

I would summarize the thrust of my testimony as being that the United States requires civil and industrial defenses in order to bargain without extremely unfavorable coercion in any confrontation which the Soviet leaders believe is important enough to execute their civil defense measures. Although the Soviets may

not today have the military capability to support such a confrontation, the trends shown in Figures A-2 and A-3 of the study report are such that they will have what I fear to be sufficient capability within the next 2 to 5 years.

We have considered the measures that the Soviet Union might employ to vitiate any American civil and industrial defense programs we might elect to undertake. However, as we have shown, the methods required to negate effective passive defenses require such a large number of weapons that this approach is not practicable. Even if the Soviets were willing to assume the gigantic costs and commit the large resources required to manufacture this large an arsenal, it is doubtful that sufficient nuclear materials could be produced for this number of warheads. Further, as long as the number of delivery vehicles is bounded by Strategic Arms Limitation agreements, there is no practical way the Soviets can overpower effective passive defenses.

Question 30.

How many years do you consider it would take the United States to implement the civil and industrial preparedness measures that you advocate?

Answer

Full and complete implementation of a population evacuation program to include the initial planning, production of training materials, identification and training of a basic cadre of people (such as the National Guard, local police, etc.) for implementation of evacuation plans, and rudimentary education of the population would probably require from 5 to 10 years. However, we believe that action which could be accomplished within 1 to 2 years could substantially improve the survivability of the U.S. population. The very existence of this capability should create uncertainties in the Soviet's minds, which in themselves would be a deterrent to implementation of their evacuation program.

We believe that a credible, expedient industrial protection program could be developed for most industries in about 5 years. This allows 2 to 3 years to do industrial studies and tests similar to those conducted by Boeing plus 2 years to develop and train industry cadres and stockpile minimum essential tools and materials.

Question 31.

Do you foresee any technological innovations during the period of time which would render these preventive measures obsolete before they are completed? If so, what would they be? If not, why?

Answer

There does not appear to be any technological innovations in the offing which would render these preventive measures obsolete before they are completed. Moreover, there do not appear to be any such innovations within the foreseeable future.

APPENDIX IV

JOINT DOD/OMB STUDY, SUMMARY REPORT, U.S. AIRCRAFT INDUSTRY, CAPACITY ANALYSIS AND POLICY IMPLICATIONS

ABSTRACT

This study examined the question of over-capacity in the U.S. aircraft industry. It found there is considerable excess capacity in relation to realistic requirements. The study also indicated such excess capacity is costing the Department of Defense on the order of \$400 million per year. Policy alternatives were identified which could significantly reduce these costs while still maintaining competition to meet peacetime requirements and provide adequate mobilization production capacity. The study results show that the estimated production demand on the U.S. aircraft industry is sufficiently low that the problem of excess capacity will probably get worse in the near term, and is not likely to improve in the long term. Corrective policy actions are suggested for further consideration.

* * * * *

A number of concerns have been expressed about the potential excess capacity in the U.S. aircraft industry as a result of several changes in aircraft procurement that have taken place in the post-Viet Nam era. In constant 1977 dollars, the aircraft procurement budget of the Department of Defense has declined from \$17 billion in 1968 to \$7 billion in 1975. During that same period, major procurements of commercial aircraft in the United States have also been shrinking and commercial aircraft purchases are expected to continue at a low rate until major replacement buys occur in the mid-1980's. Offsetting these factors to some degree, has been the dramatic increase in U.S. military aircraft sales to foreign nations during the past eight years. In 1968 these sales amounted to approximately 10 percent of U.S. military aircraft procurements. By 1976 foreign sales of U.S. military aircraft were up to approximately 60 percent of the U.S. aircraft purchases to supply our own forces. While these foreign sales provided a short-term offset to the declining U.S. demand, there is a growing tendency toward co-production and licensing which may reduce the utilization of U.S. production facilities in future foreign sales. Finally, there has been a significant change in both the number and type of military aircraft systems being purchased. About 3,000 relatively simple systems were delivered by U.S. producers per year during the Korean war. This rate reduced to about 1,000 per year in the late 1960's. Currently, the DOD is buying about 300 highly sophisticated aircraft per year. Such trends have had a significant impact on the structure of the aircraft industry.

As a result of these considerations, Secretary Rumsfeld and Director Lynn initiated a study to obtain a preliminary quantitative assessment as to the degree of capacity utilization today in the aircraft manufacturing industry. The study also examined the advantages and disadvantages of maintaining any excess capacity, and developed policy alternatives which might be considered to alleviate the Government costs of over-capacity.

The study was limited to the 17 major aircraft companies comprising the military and commercial market (including helicopters and general aviation). Government-owned plants and equipment used by these 17 companies were considered.

To assess capacity, three utilization measures were chosen: first, a "nominal", one-shift capacity; second, the "peak" output capacity that had been demonstrated by each company during the last ten years (equivalent to about a 1.4 shift basis operating on a 40-hour week); and third, a "mobilization" output capacity which could be achieved by using current floor space on an all-out, three-shift basis. Results of the assessment show that the overall aircraft industry is using about 60 percent of its nominal, one-shift capacity today; about 45 per-

cent of its aggregate prior peak experience, and about 20 percent of its mobilization capacity. These approximate percentages are about the same using several measures of capacity, such as employment, sales volume (after adjusting for inflation), and physical output. It is normally considered good practice in most industries to operate at between 85 percent and 95 percent of capacity, on approximately a 1.3 shift basis, with critical machinery utilized on multiple shifts.

Figure 1 shows the overall "market" forecast and the historical data for the last 15 years for the U.S. aircraft industry. The forecast for the military sector, based on internal DOD planning documentation, projects that the fighter and attack aircraft market will remain essentially at its current level through the 1980's. The bomber and cargo sectors significantly increase in aircraft production by the mid-1980's. These forecasts assume the current foreign military aircraft sales volume of approximately \$3 billion per year will remain constant, and the helicopter market of commercial and foreign sales will grow by about 70 percent. The civil, fixed-wing aircraft market forecast, based upon contractor and Department of Transportation inputs, projects that major replacement buys of commercial aircraft will occur in the mid-1980's. Since this latter assumption has by far the greatest impact on the study, it should be noted that the primary forecasting uncertainty in this area is the timing of replacement buys, and not the magnitude of such purchases.

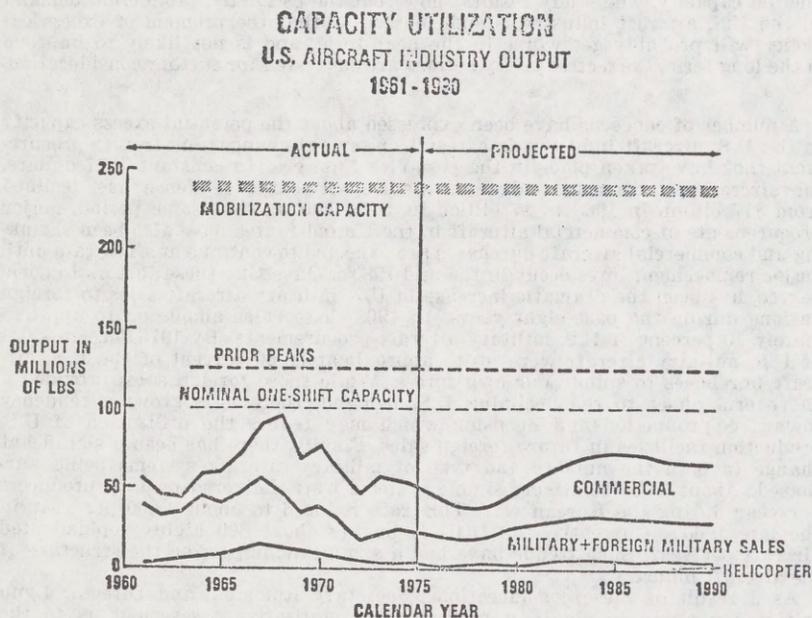


FIGURE 1

Both industry and government officials believe that these overall market estimates are probably accurate to within 25 percent deviation. This level of uncertainty is more than covered by the likelihood that the current capacity of the aircraft industry will grow as a result of new productivity enhancements, such as the use of composite materials and computer-aided manufacturing. Thus, Figure 1 represents a conservative analysis of future excess capacity, since it makes relatively optimistic market forecasts on the demand side and does not include productivity enhancements on the supply side.

To quantitatively assess the costs of the idle capacity, a number of simplifying assumptions were made in the study. First, it was assumed that the Defense "share" of the costs of the excess capacity should equal their share of the total industry sales; i.e., approximately 45 percent. It is believed that this is the more conservative of the possible assumptions, since it is estimated that Defense actually pays a disproportionately larger share of the industry costs of research

and development. Secondly, the costs of excess capacity should not be measured solely in terms of idle floor space and equipment, but should also be measured in terms of the extra costs associated with redundant labor existing in these vertically integrated companies; e.g., engineering, management and marketing people. The study found that these extra labor costs far exceed the idle plant and equipment costs. This is particularly important since it is the latter which are primarily required from the viewpoint of possible production "surge" for military crises.

Considering the uncertainties involved in calculating the cost of excess capacity for the aircraft industry, it was decided to pursue the analysis via several different approaches. Based upon the above assumptions each of these approaches yielded reasonably consistent numbers, showing Defense's share of such costs to be \$300 to \$500 million per year. Subsequent discussions with executives from the aircraft companies further substantiated this estimate.

These estimates consider only economic efficiency and exclude consideration of competition and production mobilization capability. Treating competition independently, a conservative analysis indicates that approximately \$250 M/year of excess capacity costs could be eliminated, while still maintaining adequate competition in each sector of the military aircraft industry; i.e., fighter aircraft, transport aircraft, helicopters, etc. On the question of quantifying the requirement for mobilization production capability, the study had two significant and relevant findings. First, under current planning and mobilization policies, it would take about two years before any increased outputs could be realized from existing production lines. The long response time, relative to earlier mobilization periods such as World War II, is due to the sophistication of modern aircraft systems as well as the increased lead times for critical parts and sub-assemblies. Thus, for a "short war" scenario, the existence of substantial excess production capacity may have limited value; although a significant surge in production is possible and should be considered in long term mobilization planning.

A second finding of the study is that surge production response is limited primarily by the availability of critical parts, sub-assemblies and very selected manufacturing equipment, rather than extra floor space or production capability at the prime aircraft company. Accordingly, prime aircraft production capacity could be reduced substantially below current levels without becoming a constraint to surge. However, corrective actions are clearly needed to improve the availability of critical components and equipment. The DoD has already begun to investigate the cost vs. benefits of pre-stocking some of these long-lead parts and of ordering a few additional pieces of critical assembly equipment.

Based on these findings, the study examined Department of Defense policy alternatives for reducing the costs of excess capacity.

There are several areas in which the Federal Government can play a role in influencing the health and capacity of the aircraft industry. These alternatives include short-term budget actions on specific programs and facilities, together with longer-term actions such as programmatic decisions on aircraft programs and related procurement and planning actions.

Examples of near-term budget actions to be considered include: termination of inefficient low-rate production programs; limits on the maximum allowable overhead expenses charged to Government contracts; constraints on the building of additional production facilities, and closure of selected Government-owned facilities.

Longer term policies or actions which could reduce the cost of excess production capacity in the aircraft industry include: planning the introduction time and size of new aircraft and helicopter programs in order to have a positive effect on industry, including the maintenance of competition; explicit planning for the specific sites to be utilized in the production of an aircraft type (including major subcontracts); careful review of the production rate planning to maintain a more stable workload, and more efficiently utilize facilities and overhead; and a review of individual competitions and source selections to assure that major contracts and/or major sub-contracts are not awarded (without extraordinary cause) to firms that are essentially out of the aircraft manufacturing business.

All of the above policy actions represent alternative approaches to influence the degree of excess capacity in the aircraft industry. Most are highly controversial. Further data must be developed to assess the potential impacts of alternative policy actions. Such assessments are being initiated by the Department of Defense, and the study report will also be released to encourage industry response.

