

measures to ensure the survival and rapid full recovery of nearly their entire workforce and productive plant through combined primary measures of dispersal of industry and urban populations. As cited by Boeing, the Soviet civil defense program has established four types of effective procedures for industrial dispersal since 1932: locating new industry away from major cities; separating adjacent factories by a distance greater than a single weapon's effective radius; separating the industrial buildings within a given factory; and establishing standby relocation facilities which can be rapidly started up. Population dispersal simply involves having the population walk from one to three days away from urban centers to standardized shelters.

On the assumption that half the U.S. nuclear arsenal survives a Soviet first strike, the Boeing report points out that the retaliatory strike could cover no more than 2 to 3 per cent of the Soviet Union. An effective Soviet dispersal, even in the face of a fallout-maximizing attack would reduce total fatalities to no more than 10 million people; within a week, the Soviets could be out of their shelters for an eight hour day in 97 per cent of Soviet territory, using machines that had been protected by "sandbagging" measures.

The U.S., by contrast, has no civil defense program: its industry and urban populations are much more concentrated; and it has at least a factor of three less total nuclear throw-weight and smaller individual nuclear weapons.

The size of the strategic gap is further delineated in the London Daily Telegraph of Nov. 18 by defense correspondent Clare Hollingsworth, who points out that the Soviets annually spend \$10 billion on civil defense compared with \$82.5 million in the U.S. To "remedy" the situation, which the Telegraph reports has greatly alarmed Committee on the Present Danger members Schlesinger and Paul Nitze, the U.S. Defense Civil Preparedness Agency is preparing a 72-hour population dispersal plan — to be completed by the mid-1980s!

Suicide Is No Deterrent

In Western Europe, the top-ranking senior scientist of the

Federal Republic of Germany, Carl Friedrich von Weizsäcker, Director of the prestigious Max Planck Institute, has provided elements in West Germany who are opposed to their own suicide with a powerful and cogent critique of the doctrine of flexible response. Significantly, Weizsäcker's uncompromisingly realistic book "Paths Through Danger" and a companion volume by Herr Ahfeldt, "Defense and Peace," received a favorable review by the military correspondent, Herr Potyka, of the Social Democratic-linked *Süddeutsche Zeitung* Nov. 17.

Potyka, in particular, focused attention on Weizsäcker and Ahfeldt's "doubts concerning the maintenance of the (NATO) second strike capability."

In the light of the clear-cut Soviet strategy of deploying occupying forces only after a total nuclear first-strike, Weizsäcker in his book sarcastically comments that "no knowledgeable officer today would characterize the strategy of flexible response as a logical masterpiece." No proper military doctrine at all, "flexible response is a kind of 'Prinzip Hoffnung' — wishful thinking." The logic of the flexible response "Prinzip" therefore means defeat — whether by surrender or annihilation: "How will we be able to fight — through threatening the enemy with suicide? . . . One day we will be forced to make good our threats or let them be exposed as bluff."

The final note in this vein is sounded Nov. 17 by Henry Stanhope, defense correspondent of the London Times, who reviews a study of the impact of urban sprawl on NATO's "cherished military doctrines." The study was conducted by Paul Bracken of the normally pro-genocide Hudson Institute, which advocates genocide, and was published in *Survival*, the journal of the International Institute for Strategic Studies, a London-based think tank that has often differed with assessments of the RAND Corporation computers. Bracken's study, Stanhope notes, raises an embarrassing question about even the viability of NATO's response to a hypothetical Soviet conventional attack: "Can anyone take seriously a deterrent which calls for laying down several thousand nuclear weapons on the most urbanized terrain in the world?"

Industrial Survival and Recovery After Nuclear Attack

**A Report to the Joint Committee
On Defense Production
U.S. Congress**

November 18, 1976

Statement of Thomas K. Jones

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 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 per cent 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 per cent 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. 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. 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.

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 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 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 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. 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. 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. 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. 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 you. It is interesting to note, however, that a large grinding machine survived 200 psi with only a light dent; all working parts appeared undamaged. A gas-powered minibike was successfully protected against a blast pressure of 600 psi and soil heave of one and one-half feet; after the test it was 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 2-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 with 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.



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