

On the Feasibility of Peace

A world without war is no less plausible and no more difficult than a world built on thermonuclear threat.

Gerard Piel

During the past few months we have come, quite suddenly, to the end of a strange period in the history of our country. That period may be said to have begun slightly over 20 years ago, with the Japanese attack on Pearl Harbor. Pearl Harbor serves, at least, to mark the formal installation of the war economy as the central institution of the U.S. economic system. Within 18 months war production secured the full employment of our labor force for the first time since our national bookkeepers had counted a labor force in our population. The enormous appetite of the war economy for goods and services—it has consumed more than 10 percent of the gross national product on the average throughout the past two decades—has never exacted any visible sacrifice of the domestic economy. On the contrary, it has generated an extra demand for consumer and capital goods that has maintained the domestic economy in a state of unprecedented and uninterrupted prosperity.

Today the war economy lends American power in the world the sanction of a ready capacity for destruction vaster than all of the violence expended by all of the nations throughout the 4 years of World War II. Yet such is the nature of modern weapons that a relative handful of our younger fellow citizens need submit to the inconvenience and distraction of service in the uniform of our armed forces. The rest of the population has been free to join in what our publicists have been calling the American celebration. Though technological unemployment has begun to exclude some citizens from full participation, there has been full employment at the top of the scale of talent and training. The war economy has at all

times directly employed from a third to a half of our engineers and scientists. The rest have been engaged in the regenerative advance of science and technology that has stemmed from the exploitation of science and technology for the ends of national security.

It was discomfiting to recall at times that this age of abundance and adventure rested upon preparation for war. But if science and technology had in truth made war unthinkable, then the enjoyment of abundance and adventure might go on indefinitely.

Civil Defense Revived

This period in our history has now come abruptly to an end. On July 25, the President brought the hazards and complexities of the Berlin question to the nation. "We do not want to fight," he said, "but we have fought before." He coupled this declaration with the announcement that he was seeking new funds from Congress to make "a new start on civil defense." For the first time it was made clear to the American people that the assertion of their country's power abroad is now predicated upon their readiness to accept assault upon their home territory. "In contrast to our friends in Europe," the President said, "the need for this kind of protection is new to our shores, but the time to start is now."

Until that moment, civil defense must have seemed a remote and theoretical subject to most U.S. citizens. It was a realm of policy, rife with supposition and contradiction, that had provided employment for lame-duck politicians and elderly admirals and generals.

The sirens that are blown to clear their throats at stated hours every day in American municipalities go unheard by most citizens. The "Shelter" signs

in public buildings look like souvenirs of World War II, with the quaint solemnity of an air raid warden's helmet of the same vintage. Signs along the freeways leading out of some of our cities declare that the route will be "closed in the event of enemy attack," while blue arrows pointing the way out of some metropolises mark equivalent freeways as "evacuation routes." Of course, no matter how they are marked, all of the freeways are choked with traffic.

The President's civil defense program proved to be modest enough. He was going to ask Congress for funds principally "to identify and mark space in existing structures—public and private—that could be used for fallout shelters in case of attack and to stock those shelters with food, water, first-aid kit and other minimum essentials for survival." What brought the peril most poignantly home, however, was the advice to citizens to set up fallout shelters in their own basements. The war economy, it was now clear, could no longer be expected to produce mere abundance and adventure. The business of the war economy turns out to be war.

The next period of our history poses some dread and insistent questions: Is thermonuclear war feasible as well as possible? Must war furnish the ultimate arbitration of irreconcilable conflicts? These are questions that confront all mankind. To the agenda, I suppose, most Americans will add another: Can we get along without a war economy?

As to the first question, the state of American public opinion may be judged from the response to the promotion—by a hopeful new industry and by the noisy and unstable amplifier of our popular press as well as by the federal government—of family fallout shelters. There has been little action. Something in the popular wisdom recognizes that the peril goes infinitely beyond fallout. To accept the dubious protection of a fallout shelter is to accept that peril as a condition of existence. The questions of the next period of history must be answered first. These questions, like so many in our time, are fraught with technical considerations.

The fallout against which fallout shelters can provide some protection is, of course, one of four effects produced by nuclear weapons. The other three, as the civil defense literature makes plain, are the "prompt effects": initial radiation, heat, and blast, in order of their emission from a nuclear detonation.

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Against the latter three, the civil defense literature and the announced plans of the government offer no protection. The lives of those "close to ground zero" are conceded to be lost; it is the others—"all the others," the official hand-outs say—that may be saved from fallout.

In estimating the relative hazard of the prompt effects one must ask: How close is "close" to ground zero? It is curious to note in the civil defense literature the continued mention of the "initial radiation." This is the pulse of gamma radiation emitted from the nuclear reaction in the first instant of its ignition. At Hiroshima this radiation was a hazard to all who were within the range of heat and blast; for the ranges of the three prompt effects of the "nominal" 20-kiloton fission bomb are the same—about 1 mile.

These three effects assume quite different orders of magnitude in an explosion in the megaton range. As the weapons get bigger, the range of the initial radiation quickly falls away inside the increasing range of the blast effect. What is more, the range of the blast effect, which increases as the cube root of the increase in power, speedily falls behind the increase in the range of the heat effect, which increases as the square root of the increase in power.

Translating these ratios into numbers, one finds that in the detonation of a 20-megaton thermonuclear bomb the blast effect—the "ground zero" of civil defense imagery—has a radius of 10 miles. But the radius of the fire effect reaches out 20 miles farther. In other words, the result is not a disaster somewhere downtown, with time to get the suburbs into fallout shelters. The result is the obliteration of the central city by blast and a conflagration that sweeps the entire metropolitan area.

When the weapon is employed to achieve these results, there is no local fallout. The weapon is burst at a carefully calculated altitude above the ground, just as in the attacks on Hiroshima and Nagasaki (where there was no local fallout). For bombs of 20-megaton and larger caliber, the area embraced in the incendiary effect progressively overtakes and exceeds the area that can be covered by intense fallout.

The incendiary effect of a giant weapon can be greatly magnified by bursting the weapon at very high altitude. The thermal energy then needs to penetrate only the few miles of dense atmo-

sphere closest to the ground on the way to its vast target. As footnote to this analysis, it may be mentioned that preliminary reports on the worldwide fallout from the 30- and 50-megaton thermonuclear bombs tested by the Soviet Union show them to have been relatively clean bombs. There is a reason for making such giant weapons clean—that is, to make them portable. Raising the yield of energy from fusion relative to that from fission reduces not only fallout (which comes from the fission element) but the total mass that must be delivered to the target. This is the crucial consideration in developing a warhead for an intercontinental ballistic missile.

Local fallout must, of course, be accorded its place as a primary hazard of thermonuclear war. It is generated when a weapon is burst on the ground and at some sacrifice of the range of the blast and fire effects. Apart from the deliberate generation of fallout, there is an important reason for employing ground bursts: to destroy a hardened military target. A determined attack on military targets, directed at the destruction of an enemy's capacity to retaliate, would require an enormous tonnage of weapons and would produce a correspondingly huge fallout as a hazard to the civilian population. It has been estimated that the enemy would have to deliver a salvo totaling 300 megatons in order to knock out the 18 hardened Titan missile bases that surround the city of Tucson. By contrast, a single 20-megaton bomb, burst in the air over Chicago, would suffice to destroy the entire metropolis. The first conclusion pressed by this analysis is this: the civil population is far more vulnerable to prompt effects than are its defenders and is more likely to be exposed to these effects should it be chosen as the target of attack.

For Educational Purposes Only

Each of the two sides in the present balance of terror is said to have a minimum of 30,000 megatons of weapons in readiness for use. This, in each case, is about ten times more than enough to kill the corporate body of the other. But, given the delivery systems presently available—still primarily manned aircraft—neither one is equipped to knock out the striking force of the other. The civil populations, therefore, constitute the target against which such

forces would be directed and against which they could expect to deliver an attack with success. Such an attack by one side, however, exposes it to the certainty of the same kind of attack by the other. This is the essence of the present stalemate. A second conclusion, therefore, pressed by this analysis is this: if fallout is ever to be a strategic hazard and the fallout shelter a significant arm of civil defense, now is not the time. The fallout-shelter campaign makes sense only as a means for public education in—or public habituation to—the peril of thermonuclear war.

The advance of military technology will undoubtedly change this picture in the future. In fact, the picture is changing rapidly now. The two powers are completing research and development on their missile systems and are moving them into production and installation in readiness for use. In the future they may be able to contemplate a "counter-force" attack aimed at the opponent's striking power, as well as a retaliatory second strike or a preemptive first strike (that is, retaliation in advance) aimed at the annihilation of the population. As the contestants approach this stage in their progress the situation is bound to become more unstable. It will be made the more unstable by the entry of other nations in the arms race. When the capacity for mutual annihilation mounts beyond the 30,000-megaton stage and as the number of contestants increases, the danger of war by miscalculation and accident must rise. At some point in the ever-less-distant future is the point of no return. As C. P. Snow has bluntly summarized it: "We know, with the certainty of statistical truth, that if enough of these weapons are made—by enough different states—some of them are going to blow up."

Nobody who regards the arms race-to-the-finish as our fated future is so foolish as to think that the U.S. civilization and social order can persist in its present state of above-ground vulnerability under the open sky. Survival, if not victory, requires a civil defense system going far beyond the \$150 family fallout shelter. Various agencies and individuals, working for the armed forces and on their own responsibility, have been exploring this thicket of unknowns and imponderables. Some of the results of these studies are in print and some have even found their way into the popular press. It is possible, therefore, to review them and consider what they imply.

The Road to Sub-topia

One study—study No. R-322-RC of the Rand Corporation—indicates that substantial underground protection could be provided for the population and the economy at a cost of \$150 billion. It is not, of course, suggested that this effort be undertaken all at once. For one thing, the war-game equations show that a crash program of civil defense on such a scale might itself be provocative. The undertaking would accordingly be phased out over a 10- or 15-year period. At the end of that time there would be hard-rock “heavy” blast shelter spaces for 40 million people, “medium” blast shelters for 40 million more, and “light” fall-out shelters for 170 million people. In addition, some \$30 billion of the total appropriation would be invested to take about one-fifth of the nation’s manufacturing plant underground. It was this study that showed our country is already endowed with a resource represented by “750 million square feet of usable space in mines with suitable characteristics for industrial or population shelters.” Of course, not all of this space is conveniently located. Over the long pull, however, it would be possible to pay a premium to the industries that now dig such ubiquitous low-value ores as limestone in open quarries and induce them thereby to mine their ores, where geology permits, near to or under centers of habitation.

The model hard-rock shelter is that made possible by the peculiar geology of Manhattan Island, a granitic outcropping of the Laurentian shield itself. The contemplated shelter spaces would provide 20 square feet per person and would be stocked for a 90-day occupancy. The report on the study furnishes some significant detail: “An engineering calculation of a system of deep rock shelters under Manhattan Island for four million people indicated a cost of \$500 to \$700 per person depending largely on habitability standards. The shelters were to be excavated 800 feet below the surface, using conventional excavation and mining techniques. They were to be almost completely isolated from the surface, with air purified and enriched with oxygen as in a submarine, with water tapped from the Delaware Aqueduct system of tunnels and treated (or, in an emergency, drawn from internal storage), and with power drawn from diesel generators vented to the surface. But isolated from the shelter proper. Occupants would be assigned

to berths in a large dormitory, and would receive two cold meals and one hot meal per day, and would draw fresh clothing, take showers, and exercise on a rotational basis.”

The report found that in order to get the 4 million into the 80-million-square-foot shelter, there would have to be 91 entrances, located so that every home and office building would be within 5 or 10 minutes’ walking distance of one of them. The provision of so many entrances turned out to be a factor that would reduce the security of the shelter. This contingency, however, was met successfully: “The entrances were sloped tunnels and had 500 psi blast doors at both top and bottom; provision could be made to collapse any single tunnel if the upper door gave way.”

The success of this system still required a so-called “strategic evacuation” of the urban population of the country as a whole. The study found that “the bulk of the population could conceivably duck in 30 to 60 minutes,” especially if it were provided with “a dramatic and unequivocal signal, such as exploding a small atomic weapon at a very high altitude over the city. . . .”

The provision of shelter for capital goods offered fewer difficulties to the framers of this plan. The report concedes: “There are differences in the technical problems to be faced—for example, industrial plants that release much heat would require additional cooling equipment, and those with a large volume of material inputs and product outputs would require larger entries and more transport equipment. But there seems little question that either conventionally constructed ‘medium’ shelters or excavated deep rock ‘heavy’ shelters could be designed and built for industrial capital.” Fortunately, the investigators had at hand a study by the “Army Engineers” which showed the cost of reproducing three specific plants on the surface and in existing mines. This showed that “a chemical processing plant . . . cost about twice as much underground, a precision manufacturing plant about a third more, and a warehouse about 15 percent less.” Although government bounties might be offered as an inducement to build new plants underground, the investigators thought that “a manufacturer might absorb higher construction costs considered by themselves,” since these costs would be fully amortizable. It was felt “on the other hand, that incidental effects of underground plants on

location costs and labor costs could be a more serious obstacle.” In the end the report concluded: “Further research in the economical design of plants . . . and into methods needed to induce private firms to accept such locations is needed.”

Another student who has looked into these matters finds they deserve study at a somewhat deeper level. “What can be envisaged” he says “is the following: It is possible to determine within our present economy a sub-economy which provides at least a certain number of interdependent essential activities, free from all luxuries, all frills. It will secure the very barest *but continuing* existence of a part of the population—that part which may be assumed as saved by shelters or by-passed in a large-scale attack. Economic science can make a vital contribution in determining the exact nature of this sub-economy, this ‘nucleus’ or ‘kernel’ of our present economic system. Methods for identifying such ‘kernels’ exist and can be further developed. It is this sub-economy which should be put underground. . . .”

As for the civilization that is left above ground, I am able to report, from my own inquiries in this field, the advice of a distinguished radiation chemist. He says that the incendiary effect of a large nuclear device can be nullified by covering external surfaces of buildings with aluminum foil and dressing the population in white coveralls.

At this point in our consideration of these studies of the feasibility of thermonuclear war, at least two lessons should be apparent. In the first place, the extrapolation of thermonuclear violence and of countermeasures to that violence speedily leads us into a realm of underground subeconomies and sub-topias that appear no more plausible and no less challenging to human ingenuity than a world without war. One may take as much heart from this observation as one can. For, in the second place, it must be borne in mind that this vision of the nation’s future has been projected by realists, by experts in the possible, the probable, and the feasible, and by their expert consultants. This is the work of men who have assumed the public office of national defense and whose profession is war. It is their duty to envision the worst—and the best that can be made of the worst circumstances. By profession, they have no other counsel to offer and, by training, they are qualified for no other.

So long as thermonuclear war remains in prospect—so long as the capacity to wage such war implements the will and power of our nation or any other nation—no part of this extrapolation into a nightmare civilization can be avoided. The extrapolation includes, it should be understood, the conditioning of the population to taking exercise on a rotational basis *before* it goes into the shelters. One cannot cavil at any one of these measures except on technical grounds. On such grounds it ought to be pointed out that the crater of a 100-megaton ground burst might penetrate the Manhattan shelter. Provision can then be made to dig the shelter at a deeper level, care being taken to fill in (with solid concrete) the cavern that may have been excavated, prematurely in the escalation of violence, at the 800-foot depth. But so long as the rest of the citizenry accepts thermonuclear war as an extension of diplomacy, it has no choice but to cooperate in measures that will promote the national security. The war of populations can be fought only by the military state.

In his "farewell address" to the nation, President Eisenhower put forward wise counsel on the situation that confronts us here.

"Until the latest of our world conflicts," he said, "the United States had no armaments industry. . . . But we can no longer risk emergency improvisation of national defense. We have been compelled to create a permanent armaments industry of vast proportions. Now this conjunction of an immense military establishment and a large arms industry is new in the American experience. The total influence—economic, political, even spiritual—is felt in every city, every state house, every office of the Federal Government. We recognize the imperative need for this development. Yet we must not fail to comprehend its grave implications. Our toil, resources and livelihood are all involved; so is the very structure of our society.

"In the councils of Government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. We must never let the weight of this combination endanger our liberties or democratic processes. Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together."

To the military-industrial complex,

President Eisenhower coupled another new element in our culture. He said we must be alert equally to the "danger that public policy could itself become the captive of a scientific-technological elite."

"It is the task of statesmanship," he concluded, "to mold, to balance, and to integrate these and other forces, new and old, within the principles of our democratic system—ever aiming toward the supreme goals of our free society."

If alternatives to war are to be found that can keep in view the supreme goals of our free society, then they must have advocates and voices to advance them in the councils of our government. If the feasibility of thermonuclear war has acquired, sought or unsought, unwarranted influence in public policy, then warranted influence, at least, must be sought for the feasibility of peace.

Can We Live with Peace?

Perhaps the first question for study by responsible U.S. citizens is the third one on our agenda: "Can we get along without a war economy?" This question can be restated to ask more specifically: "How can the country generate \$50 billion of final demand to replace the demand of a war economy cut back by disarmament?" This is a bigger question than it at first appears to be. As the input-output tables of Wassily Leontief show, the \$50-billion final demand of the war economy generates more than \$100 billion of total economic activity in the system. In other words, we are concerned here with maintaining not 10 percent but something more like 20 percent of the gross national product.

One can find many projections of the growth of our economy, originating in influential and authoritative quarters. Most of them ignore the possibility of disarmament. They project our growth to 1970 and beyond with a war economy of relatively equal or larger size. But there is one study that grasps the thorny question of disarmament. It was prepared by the Bureau of the Budget at the request of President Eisenhower and delivered to him on the eve of the inauguration of the new administration.

This "Special Study" draws a summary and wholly fiscal picture of the economy and of the federal budget as it might appear after an international disarmament agreement had permitted

a cutback of military expenditures to 50 percent of the 1960 budget. For reasons that are clear to any student of the recent history of the business cycle, no more than one-quarter of the reduction in expenditure is allocated to a reduction in taxation. The balance is allocated to various other elements in the federal budget to create final demand offsetting the cutback in military expenditures.

It is interesting to see where these allocations are made. One major appropriation goes to "labor and welfare," raising that line item from \$4.4 billion to \$19.7 billion. (It should be mentioned that the increase on this and other lines includes a projection of present trends as well as the allocation from disarmament.) The biggest item under this heading is education, up 12 times from 1960, to \$7.5 billion. Next biggest is public health, up nearly five times, to \$3.7 billion. The budget of the National Science Foundation is increased six times, to \$600 million.

After labor and welfare, the second largest major heading in the disarmament budget is commerce and housing, with an allocation of \$11.4 billion. Here the biggest internal item is housing and community development programs, increased six times, to \$3.2 billion.

Third in the major headings comes expenditures for economic and financial assistance programs, principally to the emerging nations. This item is more than doubled over 1960, to a total of \$4.1 billion.

All told, the figures yield a federal budget of \$92 billion, roughly 16 percent of the 1970 gross national product of \$600 billion, as compared to the 15.6-percent claim on the 1960 gross national product laid by the last Eisenhower budget.

These figures are, of course, projections and estimates. To become real, they must find claimants with logic at least as compelling as that of the designers of the \$150-billion national underground. What educator is prepared to justify a budget of \$7.5 billion for federal aid to education? There need be no water in this figure; the growth and progress of our country in this century stands in demonstration of the fact that education constitutes the most fruitful investment any society can make. As for housing and community development, this surely ranks as the second most urgent challenge to a generation that has permitted the central cities of our country to be reduced to ghettos and jungles. In the realm of

technical and economic assistance there are already influential claimants for the \$4.1 billion projected for 1970. As the emerging nations have come forward under their own leadership they have upset completely the prevailing estimates of their capacity to absorb investment toward the goal of removing destitution from its role of prime subverter of stability in world politics.

There is a heartening lesson in this purely fiscal glimpse of another future. Our society, with its enormous productive capacity, can find significant and fruitful final demands to take the place of the war economy. This lesson in itself is crucial to the recognition that peace is as feasible as war. What is now required to implement this finding is action—unilateral action by interested and responsible citizens, by university study groups, by civic leaders, by community associations, by trade unions and industrial trade associations and institutes.

Educators must come forward with programs that will assert the proper claim of our schools and colleges on the productive capacity of our economy. In the repair of the blight on

our cities, a host of economic interests hold stakes and responsibilities. None has a greater potential stake than the railroad industry. The commitment to automotive transportation, that makes evacuation of the cities impossible, is subsidized by an \$11-billion public subsidy from the federal, state, and local governments every year. Of this total, nearly \$7 billion goes to capital improvement—that is, highways—a figure equal to 10 percent of the annual gross expenditure on automotive transportation. By the same reckoning, the railroad system, with \$10 billion annual revenue, should seek an annual capital improvement subsidy of \$1 billion to restore, and end the dismantling of, its commuter services.

In the economic assistance program the machine-tool industry can find the solution for its chicken-today-feathers-tomorrow economy that has caused its technology to lag behind that of the German and Soviet toolmakers. Perhaps it is in this area that the electronics industry can find at least part of the solution to its disarmament problem. This year the industry has crossed the \$10-billion line, but with one customer

—the war economy—accounting for more than half its sales. The adaptation of missile-control systems to the automatic control of industrial processes can help to make high technology more diversely and immediately exportable to the emerging nations.

It is not supposed in this special study of the Bureau of the Budget that any of these reallocations would be made in the absence of a disarmament convention that provided controls adequate to shut off the arms race permanently. Dangerous and difficult conflicts still remain to haunt the world from the prethermonuclear age, when statesmen could turn them over to the generals. Those conflicts must be settled before the arms race itself brings on the war that will leave no victors and few survivors. This is the task of governments. It is up to the citizens to prepare the peace. Science and technology exploited in the cause of national power have brought mankind to this impasse. War cannot be eliminated from the life of the nations until the genius that thus commands the forces of nature is committed in the cause of man.

News and Comment

Communications Satellites: Private Ownership and Public Control, Neatly Packaged

The Administration has produced a proposal on satellite communications which is wonderfully ingenious, although it is not yet clear that it will work.

The basic problem for the Administration was that it was politically necessary to favor private ownership, even though it is quite possible that serious problems will come up in attempting to use a private corporation, necessarily oriented toward making a profit, as an

instrument in international politics. Perhaps there will be technical conflicts over the details of the system, in which, for example, the government's interest in making participation available to the underdeveloped countries may run counter to the corporation's interest in the most profitable approach; perhaps political conflicts in which the government's willingness to put part or all of the management of the venture into the hands of the U.N. or a specially created international organization may run counter to the corporation's desire to keep maximum control in its investors' or at least in American hands.

What makes these possibilities difficult to deal with is that they are only, at this point, possibilities. It is hard to say anything very explicit about the technical problems because the technology is still in a state of development; it is hard to say anything definite about the political problems because they lie in the future and there are no equivalent situations to look back on for a clear guide to solution of the difficulties that may come up, much less of the problem of trying to deal with these difficulties through a privately owned corporation. It is by no means clear that the private ownership will fail to serve the national interest, and it would be politically awkward for the Administration to advocate public ownership merely on the ground that private ownership may possibly be unsatisfactory. Even if it were advocated, public ownership would have no chance of getting approval from Congress, particularly from the House.

Thus, whatever the Administration's private leanings, there was nothing to be gained, as a practical matter, by advocating public ownership, and perhaps something to be lost, as a political mat-