AN AMERICAN JOURNAL OF CIVIL DEFENSE

SURVIVE

VOL. 2 NO. 4 JULY - AUGUST 1969

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PRESIDENT
NATIONAL ACADEMY
OF SCIENCES

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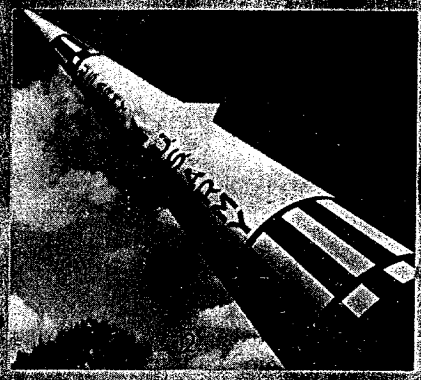
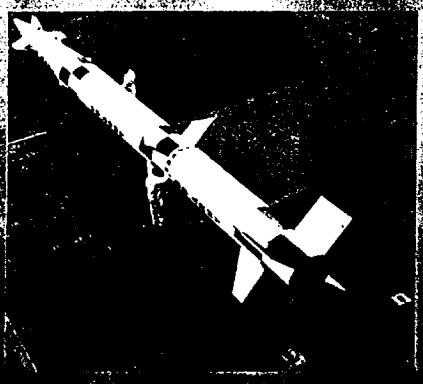
CIVIL DEFENSE
ANALYST,
PRESIDENT OF APNA





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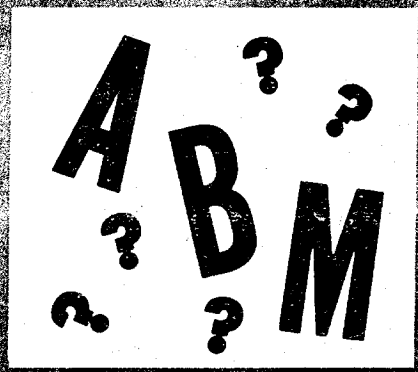

CIVIL DEFENSE FORUM

OAK RIDGE CIVIL DEFENSE SOCIETY

ASSOCIATION FOR COMMUNITY-WIDE PROTECTION FROM NUCLEAR ATTACK

WHAT KOSYGIN SAID

The claim that ABM in the United States would be provocative and escalate the arms race has brought about references to Kosygin's opinion on ABM. The following appeared in the first issue of *Survive* (May-June, 1968):

> *At a press conference in London, Premier Alexei N. Kosygin of the Soviet Union was asked: "Do you believe it is possible to agree on the moratorium on development of an anti-missile defense system, and if possible on what conditions?" Kosygin replied in part:*
>
> *"I believe that defensive systems, which prevent attack, are not the cause of the arms race, but constitute a factor preventing the death of people. Some argue like this: What is cheaper, to have offensive weapons which can destroy towns and whole states or to have defensive weapons which can prevent this destruction? At present the theory is current somewhere that the system which is cheaper should be developed. Such so-called-theoreticians argue as to the cost of killing a man – $500,000 or $100,000. Maybe an anti-missile system is more expensive than an offensive system, but it is designed not to kill people but to preserve human lives. I understand that I do not reply to the question I was asked but you can draw yourselves the appropriate conclusions."*

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2. Close-up of *Sprint* anti-ballistic missile.
3. *Spartan,* long-range, anti-ballistic missile.

The SAFEGUARD anti-ballistic missile (ABM) system consists of both *Sprint* and *Spartan* missiles supported by Perimeter Aquisition Radar (PAR) and Missile Site Radar (MSR).

SURVIVE

. . . AN AMERICAN JOURNAL OF CIVIL DEFENSE

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The Civil Defense Forum
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Survive presents authentic information relating to civil defense – to the survival of free government, the United States, and its people in the nuclear age. Its aim is public education in this field and service as a forum.

Authors are encouraged to submit manuscripts for consideration by the editorial board for publication. Articles (preferably illustrated) should be 1,000 to 1,500 words in length, slanted to the non-technical reader, and oriented toward the civil defense field. Views expressed in contributions to *Survive* are those of the authors and do not necessarily reflect *Survive* policy.

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Press Room Notes:

In planning this July-August issue of SURVIVE, one segment of our editorial board was apprehensive that we were exploiting much too much the views of Eugene Wigner and Edward Teller. Another segment held that it was not possible to milk two minds of this caliber to excess. The latter segment won – at least for this issue.

Wigner and Teller are being heard throughout the nation today – especially in Washington, D. C. – as two foremost proponents of ABM. The debate is not by any means finished. The success of programming a meaningful defense for our country hinges to a heavy degree on the exhaustive efforts of these two scientists. It is both a duty and a privilege for SURVIVE to furnish a free outlet for their convictions.

In our September–October issue we shall focus on other subjects: biological warfare, Russian civil defense in secondary schools, Swedish disaster training, and a look at the new OCD leader.

The May-June issue of SURVIVE announced that Donald C. Latham, co-author of the classic Strategy For Survival, *would write "Anatomy of ABM" for the current issue. Unfortunate circumstances, however, prevented him from doing so. (Mr. Latham ran suddenly and unexpectedly into a Pentagon ruling which forbade him to engage publicly in ABM discussion.) Arthur Broyles, who wrote "Why Worry?" for the May-June issue – the drama of which has brought in reader plaudits–agreed to fill the breach. His version of "Anatomy of ABM" appears on page 6.*

AMONG SURVIVE WRITERS

Frederick Seitz

As president of the National Academy of Sciences since 1962 Dr. Frederick Seitz heads one of the world's most distinquished group of scholars. He is a foremost authority on nuclear physics and its applications to modern weaponry. He obtained his Ph.D. in physics at Princeton University in 1934 and has since then received twelve honorary doctorates from universities across the nation. His kaleidoscopic activities in the fields of science, education and industry would require much more space than we have here. In their task of finding authoritative evidence on the question of ABM, U. S. Senators turned to Dr. Seitz as a scientist who is in a position to consider the many problems in their full perspectives. His congressional testimony appears on page 3.

Herbert A. Sawyer

Civil Engineer "Herb" Sawyer has been way ahead of us for years. Not only did he think in terms of blast shelter in the 1950's when fallout shelter was just being considered for the United States – he planned one. Then he proceeded to build it. It cost him less than $500 (not counting most of the labor, which he contributed). Today, ten years later, the design is still a look into the future. In "Economy Blast Shelter–Family Style" on page 10, Sawyer analyzes the need for blast shelter and gives one common sense solution at a cost still within reach of the average family ($550 to $1200).

READER COMMENT

CONTRADICTION

To: SURVIVE Rochester, New Hampshire

I read your journal of Civil Defense with great interest and learn many things from the articles. However, I would like some assurance that what I read is *fact*, not *fiction*.

Not being a nuclear scientist, I am confused by the following statements in your May-June 1969 – Volume 2, No. 3 Issue.

Dr. Edward Teller states on page 4, column 1, paragraph 2: "There is a great difference between the fallout pattern of a ground burst which gives local effects and a high altitude burst which gives rise to a world-wide distribution of radioactivity."

In direct contradiction, two nuclear scientist specialists, Wm. Cornelius Hall and Carsten M. Haaland, state on page 18 at the top of column two: "If the fireball did not touch the ground, there will be *no danger* of fallout."

Our SAC aircraft apparently carry twenty megaton weapons (according to newspaper accounts) – the fireball of a 20 megaton weapon is roughly five miles in diameter–using a radius of 2½ miles from the detonation altitude. the fireball of a twenty megaton weapon burst at altitudes of 15,000 feet or over, would not touch the surface of the earth.

Is there radioactive fallout or not?

Puzzled

W. R. Williams

There is radioactive fallout (world-wide) in Mr. Williams' 20-megaton air-burst example. It is so diluted and widely distributed that there is no danger associated with this fallout. It is detectable (which gives rise to dramatic fallout distribution maps by alarmists). It is not at all significant in terms of effect on life. The effect on a human being exposed to the world-wide radioactivity produced by nuclear weapons testing (much more than that of Mr. Williams' example) has been compared to the effect produced by moving an individual to a location 100 feet higher in altitude where he would have a slightly thinner cushion of air between him and cosmic radiation and would therefore receive slightly more of this "background" radiation to which we are all exposed all of our lives. If we are to be concerned about this – and some good people are – we must certainly be frightened about the predicament of people in places like Denver. Of course, we are not.

The fallout which is significant in terms of danger to life is produced by that radioactivity which in the fireball of a ground burst or near-ground burst mixes with minute particles of earth and other matter existing near ground zero, becomes weighted by these materials, and therefore falls back to earth in a close-in ("local") concentrated pattern. – Ed.

NEWSPAPER COVERAGE

Santa Fe, New Mexico

To: Survive:

It was with a great deal of interest that I read your news release in the recent edition of "The Tie Line"–"SURVIVE SENT TO NEWSPAPERS FREE."

In view of the crucial days facing every American Citizen, it pleases those of us assigned Civil Defense responsibilities to learn that you are aware of the need of providing this valuable public service to the news media.

I am sure the following newspaper editors and newspapers in New Mexico would be pleased to receive the American Journal of Civil Defense . . . "SURVIVE"–

(List of 14 New Mexico papers follows)

Sincerely,

ALBERTA MILLER
DEPUTY DIRECTOR
Office of Civil Defense
New Mexico

P.S.

Your May-June publication is one of your best publications – chuck full of newsworthy editorials.

United States
ATOMIC ENERGY COMMISSION
Washington, D. C. 20545

To: Survive

The issues of *Survive* which I have read seem to bear out what I consider was the original concept behind it. Namely, to have a first rate journal that would be an independent voice for civil defense. I think it has been an excellent journal and far more effective than we could have ever imagined.

L. J. Deal, Chief
Civil Effects Branch
Division of Biology & Medicine

SEATTLE-KING COUNTY CIVIL DEFENSE
Seattle, Washington 98109

To: Survive

Your journal arrived yesterday and our entire office has been taking turns "swiping" it from one another. We think you are doing a very fine job, and one that needed doing.

I like not only the contents of the journal, but the style in which it is written. It ought to be as fascinating to the civil defense director as the latest thriller is to the mystery story fan.

Congratulations on your excellent work. All of us in civil defense will profit from your contribution. You have certainly earned the satisfaction that comes from a job well done.

Victoria Finch
Public Information Officer

Founded in 1863, the 700-member National Academy of Sciences is the highest scientific body of the nation and is independent of the United States Government. Here its president gives U. S. Senators his studied analysis of the ABM defense question.

DR. FREDERICK SEITZ

April 22 - 23, 1969

TESTIMONY BEFORE THE ARMED SERVICES COMMITTEE U. S. SENATE

At the outset I wish to emphasize that the opinions expressed in this testimony on the matter of anti-ballistic missile system are personal ones and not necessarily representative of those of any of the members of the National Academy of Sciences of which I have been President for the past seven years. In fact, as you know, the university scientific community which is strongly represented in the Academy is currently so divided on this issue that it is almost impossible to make any definitive statement in the circles in which I move which will not generate sincere emotionally heated disputation.

I should add that I first became an adviser to what is now the Department of Defense in the autumn of 1939 soon after the outbreak of World War II in Europe. Moreover, I have served on the Defense Science Board of the Department of Defense for nearly ten years and was Chairman for about four of them.

Perhaps it is not unreasonable to add that I view our national defensive posture as exceedingly important not only for the protection of our national well-being in the narrow sense but also because I feel that our country is a far more effective agent for promoting world peace if it is in a position to protect the interest of the open world of which we are part. World War II probably would not have broken out and followed the course it did had the United States not been so nearly totally disarmed in the 1930's as a result of decisions made in the 1920's to disarm unilaterally. I take it as axiomatic that in the decades ahead our national objective in relation to international affairs should be to encourage peace and stability and that we should be willing to work out formal agreements with other nations, not the least the Soviet Union, to further these goals. In fact, I think it is clear that unless we can achieve universal international agreement on the control of arms, our civilization faces very great jeopardy. As has been said so often, World War III could be an unparalleled disaster to mankind.

For reasons indicated in the following, I believe the time is now appropriate to invest substantial amounts of money, ingenuity and industrial production in a prototype ABM system of the type which President Nixon has proposed, and known as the modified Sentinel system, as the next step in the evolution of our defenses. This should be done with the use of as much imagination as we can muster in order to provide us nationally with the optimum amount of realistic information which we can obtain on the workability of such a system. Practical knowledge of the

functioning of such a system is important for future defense planning. In accordance, those devising the system should have considerable leeway in the course of its erection to introduce technical innovations as circumstances along the route may dictate. This does not mean that the expenditure ceiling should be arbitrary but only that innovations should be encouraged rather than restrained when highly advisable as has been the case for most successful weapons systems.

The principal arguments given against the point of view expressed above, frequently by quite distinguished scientists and analysts, seem to be three in number. First, the system is probably unworkable in detail. Second, even if it should be workable under ideal circumstances it probably would not be effective in a surprise attack because of inadequate alertness. Finally, the development of such a system would be regarded as a new major challenge by the Soviet Union causing it to accelerate the arms race further and plunge the world into a situation even more desperate than the present one.

While highly respectful of the intelligence and rationale behind these points, I am deeply skeptical about their basic correctness.

On the first point I would only call attention to the vast evolution in the field of controlled ballistic systems which has taken place in the United States as well as in the Soviet Union as a result of dedicated attention to rocket propulsion and guidance systems and the achievement of a new level of reliability of components. It is notable, for example, that the final splashdown of the astronauts in the December circumlunar voyage was predicted at launching to within a minute or two even though the trip required nearly a week. Moreover, the location of the splashdown was also predicted with remarkable accuracy. I see no reason to believe that with similar dedication completely comparable further advances will not take place in the next dozen years and give us ever-increasing ability to track and intercept other missiles.

Taken as a whole, this field of technology is still in its infancy; the issue of what is and is not feasible will in the main be determined through both small and large scale development with working systems as has been true in the space program. Paper analysis prior to the development of such systems is of very limited value.

Regarding the matter of alertness and whether or not any given ABM system will operate adequately in an emergency, it is clear that we are continually vulnerable to a sneak attack, as we were at Pearl Harbor. Uncompromising alertness is not first nature in a peace-respecting democratic society. On this matter several points should be made. First, I would hope it would be possible to train operational crews which would be orders of magnitude more alert than our armed forces were at Pearl Harbor, particularly if they are given the assistance of the vast variety of monitors and sensors made possible by modern science and technology. Second, I would assume that an enemy would be most inclined to attack us during a period of international tension such as during the Cuban missile crisis. In fact the raid on Pearl Harbor actually did occur at a time when our relationships with the Japanese were at crisis level. Our nation cannot again afford the type of lapse which allowed us to be caught unawares on that occasion. Third, one might ask whether the existence of a potentially reliable ABM system would increase or decrease the probability of an arbitrary strike against us. I am personally inclined to believe that it would decrease that probability because of the increased uncertainty of the success of such a perilous adventure. Finally, it should be emphasized that knowledge obtained through working practice with a system should give us experience with its strengths and weaknesses and permit us to devise ways of automating alertness within acceptable bounds.

Let me raise next the question of the reaction of the Soviet Union to our own development of an ABM system. It is my personal opinion that in view of the defensive nature of the system, the Soviet leaders would consider its evolution to be a completely reasonable and natural step. The Soviet Union has continually emphasized the defensive aspects of its own armaments and has in fact insisted that its own vast development of intermediate range and intercontinental ballistic missiles is basically defensive. The fact that it regards an ABM system as an automatic adjunct to the deployment of IRBM and ICBM systems is amply demonstrated by the fact that, as best we can determine, it has taken substantial steps to deploy its own ABM system. There are those who suggest that the Soviet Union may actually have abandoned work on its ABM system. As I attempt to sift the evidence they present, however, I find no convincing proof that this actually is the case. It seems to be characteristic of the Soviet deployment of weapons that the process goes in large spurts. I presume the periods between spurts are used for reassessment and innovation.

More generally, I think it can safely be said that ever since the early 1920's the Soviet leadership has consistently and pragmatically devoted all the attention and wealth it

could derive from its economic system to the development and production of arms with the avowed statement that their armaments are principally defensive. They have no valid reason to take issue with the development and deployment of a defensive ABM system in the United States.

In this connection, it is interesting to note there is no significant area of military research, development and production known to us in which the Soviet Union is not fully involved on its own, essentially as a matter of course. It is true that there have been periods when it appeared on the surface that they might be prepared to forego activity in a particular area of development or deployment. However, it has always turned out that, in due course of time, after a suitable cycle of development, they have turned up with tactically or strategically significant quantities of major weapons whether they are tanks, aircraft, surface-to-air missiles, rocket launching submarines, or aircraft carriers. In fact, in certain cases, they have weapons systems, such as the surface-to-surface missile system used to sink the Israeli destroyer Elath, which we do not yet have in our own inventory.

On the broader scale, I wish to emphasize that it is to our own advantage as well as that of other nations that we continue negotiations on arms control with both the Soviet Union and other nations in the period ahead hoping that we can reach a point at which understanding and formal agreement permit all nations to enter into a period of significant disarmament. In this connection it is worth noting that we have made significant strides since 1945. There was, for example, the series of agreements in the mid-1950's which led to the decision to support international cooperation in the development of the peaceful atom. Similarly there were the agreements between ourselves and the Soviet Union on cultural and scientific exchange which occurred somewhat later in that decade and which have done much to promote closer and more friendly understanding among professional groups in our two countries. The agreement to limit the testing of nuclear weapons to underground explosions in the early part of this decade, which was accepted by most but unfortunately not by all nations, was another notable advance. Finally, the treaty on non-proliferation of nuclear weapons which presumably will be agreed upon by a significant number of nations in the next year or two is another hopeful step.

It should be emphasized, however, that the truly major steps along the road toward world disarmament occur at the rate of one or at most two per decade, which is about the same as the rate at which significant new technological systems of major military potential emerge. Moreover, the entire international picture is made complex by our profound lack of knowledge of the ambitions of the communist Chinese. If we were to heed the advice of those who urge that our nation enter into an extended period of essentially unilateral cessation of the development of weapons systems, we might well find ourselves coming to the conference table to discuss disarmament in another decade or so under circumstances in which we would have little to offer to restrict except outclassed or outmoded weapons. This does not seem to be a reasonable national posture to me even though I would welcome world peace and world disarmament as much as anyone I know.

You may recall that just twenty years ago there was a debate concerning hydrogen weapons similar to that underway at present in relation to ABM systems. That debate was resolved by President Truman, who decided to proceed with the development of the fusion bomb. I find it difficult to believe that the balance of national freedom maintained so precariously since 1945 would have been retained in the past twenty years if we had renounced the development of hydrogen weapons and left them to the Soviet Union, which, as we learned subsequently, began research and development on them soon after 1945, presumably well before our own debate took place.

In closing I do wish to reemphasize that I personally have high hopes that we can achieve an even more significant level of understanding with the Soviet Union. As you know, our government authorized a system of scientific exchanges of scientists with the Soviet Union in the period immediately after the first international congress on peaceful uses of the atom in 1955, leaving the administration of the U. S. portion of the exchange program in the hands of the National Academy of Sciences. This has been quite effective in promoting a substantial amount of understanding even though the program has not grown as much as I personally would have liked. While there is no reason to believe that Soviet scientists have a large or even significant voice in determining the political decisions made by their government at the present time, one gains the impression from them not only that they would welcome closer and more friendly relations with us but also that they hope in due course of time the spirit of mutual understanding will grow more broadly and deeply. Sufficient progress has been made in the last ten or fifteen years, but I have hopes that we will be even closer together in another decade or so. ■

How does ABM work?

What are its components?

ANATOMY OF ABM

Why won't ABM be placed near American cities?

What about objections to it?

What will it cost?

- by Arthur A. Broyles

The past few weeks have seen a rising crescendo of debate over the President's proposal to begin the deployment of an Anti-Ballistic Missile (ABM) system. By this time a very large number of people have commented pro or con before Congressional committees in panel discussions, in speeches, and through written articles. It has now become possible to see why the battle has become so intense and, indeed, to recognize that the stakes in the decision made by the Senate are *very* high. The ABM deployment represents a marked departure from a very well laid out and widely accepted theory of nuclear deterrence – a theory of how to prevent a nuclear attack. People on each side of the argument are staking the lives of tens-of-millions of Americans, even the survival of the nation itself, on their conclusions.

The objections raised by those in opposition to the ABM can be summarized in four questions. They are:

1. Will it ever be needed?
2. Is it effective?
3. What would be its effect on the arms race?
4. How would it affect the chances of nuclear war?

Will an ABM ever be needed? Many people feel that the enormous destructive power of our ICBMs and bomber fleet makes certain that the U.S. will never be attacked. It does not seem reasonable that a country would deliberately launch a land-based strike against us in an obvious fashion at the present time. As weapons technology develops, however, some nation may find a way to destroy our attack force, either before it is launched or when it arrives near its target. Missile guidance systems and explosive power are continually being improved so that their capability of seeking out and destroying our ICBMs in their hardened sites is advancing. Newspapers have carried stories of listening devices placed on the ocean floor to detect submarines, since our polaris submarines are located, they can be destroyed with nuclear depth charges, perhaps delivered by missiles. The present stage of development of ABMs suggests the future possibility of a very effective defense. Studies of the value of blast shelters continue to predict that they can greatly reduce the loss of life from a nuclear attack. All of these facts point toward the day when an aggressor may not fear our counterattack.

Our belief that all other nations realize that our counterattack would destroy them may be like the man whose dog was barking at his friend. "Don't worry," the man said, "he won't bite." "I know that and you know that," said the friend, "but does the dog know it?" The attack on Pearl Harbor, the seizure of the Pueblo, and the North Korean attack on an unarmed reconnaissance plane suggests that we are not always able to adequately predict what other nations will do.

There remains the possibility of a sneak attack performed so that we may not be able to identify the originator. Even today we may not be so far from the time when, as Herman Kahn says, the Chinese may hit us with a missile launched by submarine and watch us murder the Russians.

In addition, there is the chance that missiles will be launched unintentionally. This problem increases as more nations acquire weapons of this kind. It does seem, then, that uncertainties about what the leaders of other nations may be thinking, and the possibilities of unforeseen accidents make it extremely risky to assume that a nuclear attack will *never* be launched against this country.

In order to discuss the second question (Is it effective?) it is necessary to understand what the ABM system is. It is made up of two kinds of missiles, two kinds of radar, and interconnecting communications and computing systems.

One of the radar systems – Perimeter Aquisition Radar (PAR) – is for early detection of any incoming Intercontinental Ballistic Missiles (ICBMs). It is installed at points around the borders of the country and is capable of detecting an ICBM about 10 minutes before it arrives at the radar site. This time can be reduced to 3 minutes if the enemy chooses to use a Fractional Orbital Bombardment System (FOBS). An ICBM is fired on a relatively high trajectory while a FOBS warhead is placed in a very low satellite orbit from which it must be removed by firing retrorockets when near the target. Because the radar cannot see very far around the curved earth, the high flying ICBM becomes visible at a much greater distance than the low flying FOBS. Nevertheless the FOBS must pay for its advantage by a 25% to 50% reduction in its payload and thus in the explosive power of its bomb.

CONCEPT OF AREA DEFENSE – SPARTAN ABM

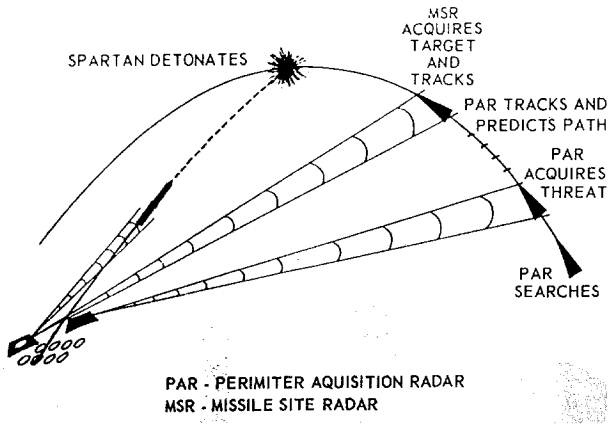


FIGURE 1:
SPARTAN is a long-range anti-ballistic missile which is designed to intercept an incoming missile above the earth's atmosphere.

CONCEPT OF TERMINAL DEFENSE – SPRINT ABM

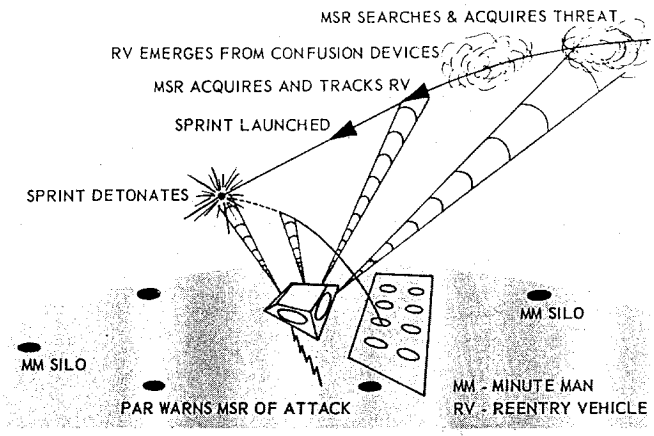


FIGURE 2:
SPRINT is a short-range anti-ballistic missile which is designed to intercept an incoming missile within the earth's atmosphere.

One of the anti-ballistic missiles, the Spartan, is also long ranged and is fired when the long-range radar identifies the incoming missile. It has a range of a few hundred miles and operates at high altitudes, 50 miles or so up. An ICBM will be destroyed if it is within a few miles from the point where the Spartan nuclear warhead explodes.

The Spartan's guidance to its target is aided by the shorter range Missile Site Radar (MSR) located at the launch site. This radar also guides the short-ranged and extremely fast Sprint missile. The Sprint is designed to operate below 18 miles altitude and carries a much smaller nuclear warhead than the Spartan. Its kill radius is measured in hundreds of feet.

This ABM system, the SAFEGUARD, currently being considered by the Congress, is often called a "thin" system and, when fully deployed, would consist of twelve sites of Spartan and Sprint missiles. These sites are so arranged as to provide Spartan protection for all of continental United States and Sprint protection for our bomber and ICBM forces. The cost of the entire system is estimated to be on the order of $6.6 billion although only the deployment of two sites is currently being considered. A sum of $900 million is being requested out of this year's budget. Deputy Secretary of Defense, David Packard, has testified before the Congressional Armed Services Committee that, should new information obtained from construction of the first two sites indicate the need for alterations, plans for the remainder of the system could be changed.

The ABM system is complicated and has many components. Many questions can be raised about the operation of these various parts, and they would have to be answered one by one. We do not have the space here to consider all of these questions, and the answers to many of them are classified secrets and are not available to us. The best we can do to establish how effectively the ABM will destroy enemy missiles is to consider the opinions of experts who have looked at the question. Three such experts are Dr. Eugene P. Wigner, Dr. Edward Teller, and Dr. Hans Bethe. All three of these men are physicists, have been professors on the faculties of three of the leading universities of the country, and are experts on nuclear weapons. Drs. Bethe and Wigner have both received the Nobel prize, and Dr. Teller is well known for his work in the development of the first hydrogen bomb. Dr. Teller states that we have a lot of knowledge on how to get started on an effective ABM system, but we do not know exactly how much it will cost. It is essential for us to construct this proposed thin system to learn the details of deploying it and to learn the cost more accurately. Dr. Wigner agrees with Dr. Teller and presents his ideas in more detail in another article in this issue of *Survive.*

Perhaps the most interesting comments on the effectiveness of the SAFEGUARD system have been made by Dr. Bethe. He has a past record of being very cautious about recommending the development of new weapons. He opposed the crash program for the development of the first American H-bomb. He states that he does not believe that the Russians intend to develop a first strike capability, and we need not hurry to deploy our ABM. As to ABM effectiveness, he believes that both the Spartan and Sprint can destroy incoming missiles *if* the enemy takes no steps to counter them. It is, however, easy for the enemy to confuse the radars guiding the Spartan missile at high altitudes. For example, when an ICBM is launched, it can throw out a cloud of small wires that will drift along with it. The radar will see only the large cloud and will not be able to locate the missile in the cloud. He presents other effective methods of distracting the radar at high altitudes in his article with Richard L. Garwin[1] . When, however, the missile re-enters the atmosphere, any fine wires are swept away, and the missile becomes visible to the radar. Thus he finds that the short ranged Sprint is likely to be effective. In an interview on National Educational Television where he appeared with Senator Henry Jackson (Washington), Dr. Bethe stated that he favored the deployment of the thin ABM system *provided* (and this provided was heavily

[1] Scientific American *V. 218, No. 3, p. 21, March, 1968.*

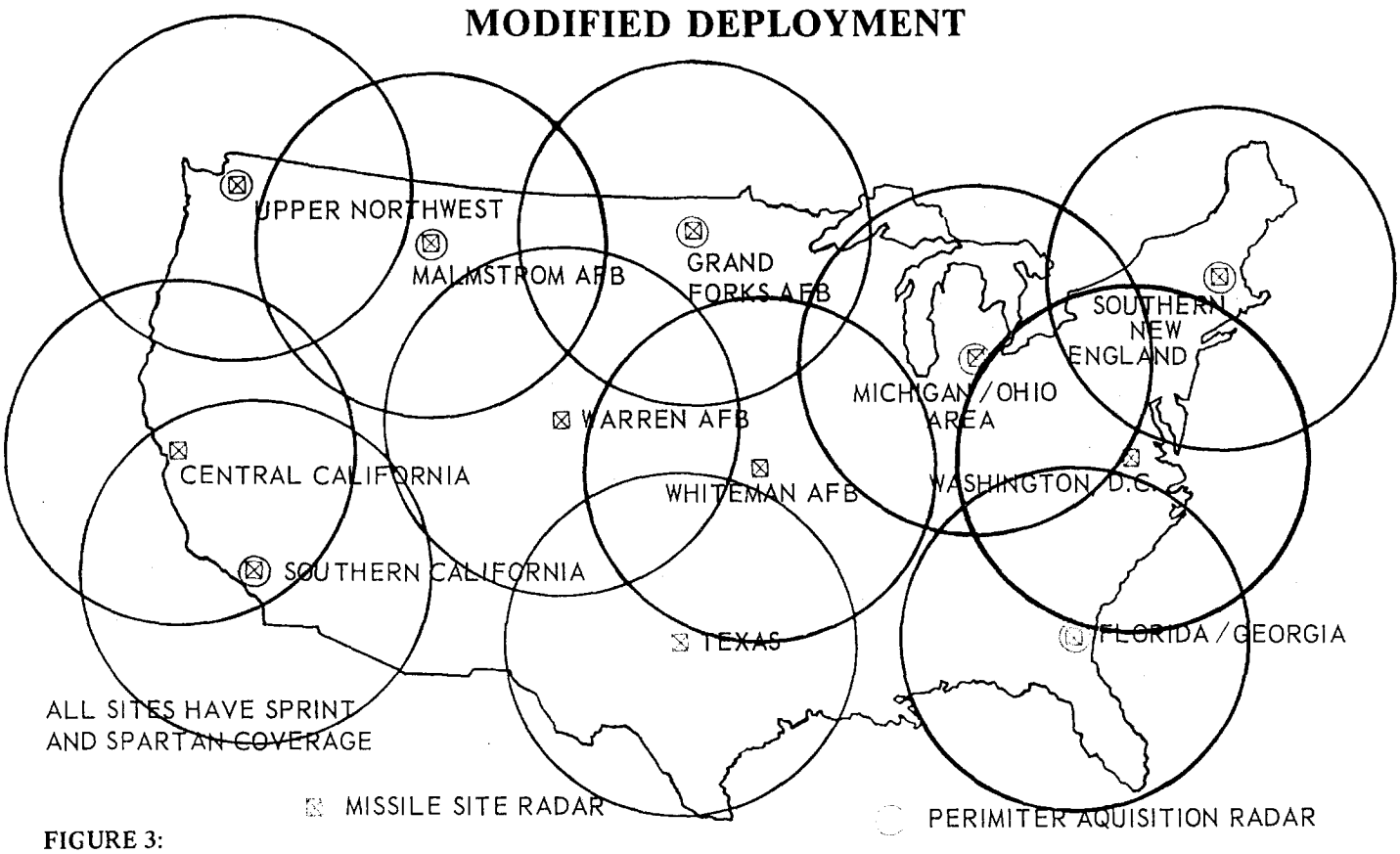


FIGURE 3:
The above 12 sites have been designated for the SAFEGUARD ABM plan. Circles denote SPARTAN coverages. SPRINT coverage is purely local (point) coverage.

emphasized) it did not serve as a first step in the deployment of the (60 billion dollar) "thick" system. This latter system would make Sprint protection available to all of our large cities.

One means of decreasing the effectiveness of even the Sprints is to provide each ICBM with Multiple Independently Targetable Reentry Vehicles (MIRVs). This is a means of dividing the big bomb normally carried by the ICBM into a number of smaller bombs. It is then necessary for the defensive missiles to destroy each of the smaller bombs separately. There are disadvantages to the offense in this, however, because the total explosive power of the smaller bombs is appreciably smaller than the single large bomb that can be delivered in their place.[2]

The third question (What would be its affect on the arms race?) has been raised, in particular, by a number of scientists who were high in government circles during the Johnson administration. The argument is that, if we install an ABM system, the Russians will merely increase their number of ICBMs to replace those likely to be destroyed by the ABMs. We would then both be right back where we were before the ABM was built and would both have spent money that could be better used elsewhere. A better understanding of this point can be obtained from Dr. D. G. Brennan's interesting discussion of arms races.[3] He points out that immediately following the development of nuclear bombs and after the production of the first ICBMs, it was much cheaper to build an attack force than to build a defense to counter it. Under these conditions, each nation in an arms race will concentrate on building up its offense to deter an enemy attack. In a situation where defense is much the cheaper, each nation will concentrate on protecting itself from the damage inflicted during an attack. At the present time, it costs roughly the same amount of money to build the ICBMs and bombers to inflict a given number of casualties as to construct the ABMs and shelters to prevent that number of casualties.

In the case where the offense is much cheaper, the race can stop when each nation has built a sufficient force to destroy the other. Similarly, when the defense has the advantage, each nation can stop when it has sufficient defense to make the damage from an attack quite negligible. But in the situation of rough equality, the race will go on with each nation increasing both its offense and defense until it runs out of money or until it lacks the will to continue. Of course an arms race can be stopped by mutual agreement through a treaty providing for sufficient inspection to assure each nation that others are not cheating.

Any nation that unilaterally withdraws from an arms race runs the risk of being militarily and, eventually, politically dominated by another. Our unilateral cessation of bomb testing some years ago cost our lead in nuclear bomb technology. Recent proposals that the U.S. hold up the development of the ABM amount to suggesting a partial

[2] *See Eugene Wigner's address to the American Physical Society, p. 16, in this issue.*

[3] *D. G. Brennan,* Foreign Affairs, *V. 47, p. 433, April, 1969.*

withdrawal from the race since, in the case of the ABM, we know that the Russians have already deployed systems of their own.

Part of the debate over the ABM arises from the failure of some people to realize that we are passing from the stage where the offense has the advantage to the situation of approximate cost equality between offense and defense. This new condition allows us to take steps to reduce the vulnerability of our population.

An example of just how inexpensive defense can be is given by the national fallout shelter program that was examined by the House Armed Services Committee in 1963. This program would have cost in the neighborhood of $100 million annually, 1/500 of the 1963 defense budget of around $50 billion dollars. The committee found that several tens-of-millions of lives could be saved by these shelters. It is hard to believe that another nation could increase its number of ICBMs enough to kill this many people at anywhere near this low cost.

To consider the fourth question, the effect of an ABM system on the chances of war, it is necessary to understand the basis of our present deterrent posture. The ABM debate has revealed in stark relief the beliefs held by U.S. administrative officials concerning what is needed to prevent nuclear war. When we consider that Congress failed to appropriate $100 million dollars for civil defense out of a $50 billion dollar armed services budget for the saving of tens-of-millions of lives and that the Nixon administration "improved" the Johnson ABM proposals by defending ICBM sites instead of cities, it becomes evident that denial of protection for the American people is deliberate.

In Deputy Secretary of Defense Packard's testimony before the House Armed Services Committee, we find the statements, "We did not recommend deployment of a defense of major cities against a massive attack, the kind the Soviets could launch, because it would not materially increase our security . . . Locating sites away from major cities should make clear to the Soviet Union that the American defense is designed to preserve our deterrent – not to change the strategic balance . . . Modifications of the SENTINEL system that would improve planned protection of our deterrent forces as the threat materializes, protect our population against a small attack, and *demonstrate clearly that we are not attempting a heavy defense of major cities* (italics added). . .And, of course, this recommendation moves the sites away from major cities. Again I want to emphasize that at least in my studies and in the conclusions that I have come to, this is very important because this provides us with no reasonable base in the system we are recommending for going ahead with a thick system . . .[4] It is important, I think, to emphasize that it (SAFEGUARD) is based on the concept which rejects the idea that we can protect our cities from a heavy Soviet attack and provides for a program on which it is not possible to build such a deployment." Apparently Mr. Packard believes that extensive protection of our population would increase the chance of attack.

How is it possible that an unprotected American population can prevent attack? Perhaps this is explained by a comment by Dr. Marshall D. Shulman before a Senate Committee last March 13. Dr. Shulman is a Professor at Columbia University and former special assistant to the Secretary of State. He says, "Finally I would urge that we never lose sight of our longer-term objective to work our way out from under the balance of terror, toward agreed reductions in strategic weapons as these become possible, and toward *at least tentative steps to forms of security that need not hold our people in precarious hostage.*" Here we see the current plan. The American people are to be held in hostage to the Russians. Perhaps this is what President Nixon meant in his statement made on March 14, 1969, concerning the ABM proposal. "The program is not provocative. The Soviet retaliatory capability is not affected by our decision."

A clear statement as to why we must remain hostages is not easy to find. Presumably it is to assure the Russians that we will never attack them first. But if we have so thoroughly guaranteed that we will not attack first, is it clear that we will respond to their attack? If they drop an H-bomb on New York City to gain some political objective, is it certain that we will sacrifice the remainder of our exposed population by launching a counterattack? And if it is not certain, is the H-bomb attack on New York really deterred?

It is, of course, desirable not to have the Russians make the mistake of believing that we are on the verge of a nuclear strike. If they should become convinced that we are ready to go, they may decide to attack first in order to destroy as many of our ICBMs and bombers as possible before they are launched. On the other hand, if we have gone too far in leaving our population exposed to guarantee against this, they will not believe that we will respond to their attack. The question under discussion in Congress reduces to: does development of an ABM make the Russians fearful of a first strike, or would our ABM umbrella make them more certain of our counterattack?

It is interesting to note that the Russians have not seen the necessity for presenting their people as hostages to reassure *us.* It is well known that they have deployed an ABM system around some of their cities, including Moscow and Leningrad. The March-April issue of *Survive* contains an article by Joanne Levey describing their greatly accelerated civil defense program.

When Congress approved the SENTINEL ABM system proposed by President Johnson, a fundamental change in our original defense posture was made. For the first time, over a billion dollars per year was being committed to a program designed to remove the American people from their position as hostages to any foreign power that chose to make nuclear weapons and had the capability of delivering them. Part of this step has been undone by the Nixon Administration's removal of the Sprint missiles from their positions near cities to locations near ICBM sites. Our people now are still to remain largely unprotected. The facts we learn on how to deploy an ABM and its cost will be of great value when we decide to protect these cities and to remove our people from their status of hostages to a potential enemy nation. ■

[4] *The thick system would cost around $60 billion and would protect all major cities with Sprint missiles.*

THINKING POSITIVELY, IT IS POSSIBLE TO PROTECT AGAINST BLAST EFFECTS OF NUCLEAR WEAPONS. IT IS AS A MATTER OF FACT COMPLETELY PRACTICAL. USING THE "EGG-SHELL" PRINCIPLE A HARD-HEADED ENGINEER HERE SHOWS HOW AND FURNISHES PLANS, SPECIFICATIONS AND A BILL OF MATERIALS.

ECONOMY BLAST SHELTER — FAMILY STYLE

by Herbert A. Sawyer

My firm contention is that the family blast shelter is now America's most pressing civil defense need. Here's why:

Although many Americans, mostly children of school age and men, spend 40 hours a week at work or in school near a public fallout shelter, practically all Americans average 100 or more hours a week at their homes, which are usually far from large buildings containing public shelters. True, OCD's "Home Fallout Protection Survey," now almost two-thirds complete, has identifed 30 million home shelter spaces with radiation protection factors of 20 or higher. But even 50 million spaces will shelter but one in every four Americans.

More disquieting is the fact that most of these shelters and almost all of the public shelters are within 10 to 15 miles of urban centers and are thus subject to probable destruction or severe damage from blast or fire effects of even the smaller sized nuclear bombs should the urban centers be targets. And there is little reason to believe that urban centers will not be targets as they were in World War II. Thus, it is dangerously misleading to term any space within 15 miles of an urban center or other potential target as a "shelter" unless it provides significant protection from blast pressures and fire.

On the other hand, the fire and blast resisting properties of the shelter of this article are not needed for any shelter located more than 50 miles from any conceivable target; outside of this radius a shelter designed only for substantial protection from radiation is adequate for even the largest of present nuclear weapons.

To fill this great shelter need of America's urban and suburban people, the emphasis in recent years in planners' *minds* (we must remember that almost nothing has been *realized*) has been on group shelters and ABMs. However, family shelters have properties which make them vitally important components of America's civil defense.

The Advantages of Family Shelters

New developments in bomb delivery systems have generally reduced estimates in warning time, making accessibility more and more critical in shelter planning. A family shelter adjoining a home is obviously far superior to any group or community shelter in family accessibility. Most important, for a well-drilled family the family shelter

will probably function even if the warning time is reduced to that irreducible minimum for any nuclear weapon – the interval between the light-heat pulse, which travels with the speed of light, and the blast wave, which travels at a speed initially somewhat greater than that of sound. For example, for the area afforded blast protection by a 20 psi (pounds per square inch) blast shelter from a 5-megaton detonation, this irreducible warning time ranges from 7 seconds for points nearest the blast to 40 seconds on the area's perimeter.

Another important advantage of the family shelter adjoining the home is that in the interval between a warning by siren, buzzer, or radio, and occupancy of the shelter, the chances of exposure of the family to initial heat radiation are minimized, and for those in the home at time of warning, this exposure is almost eliminated by the thermal shielding provided by the house structure.

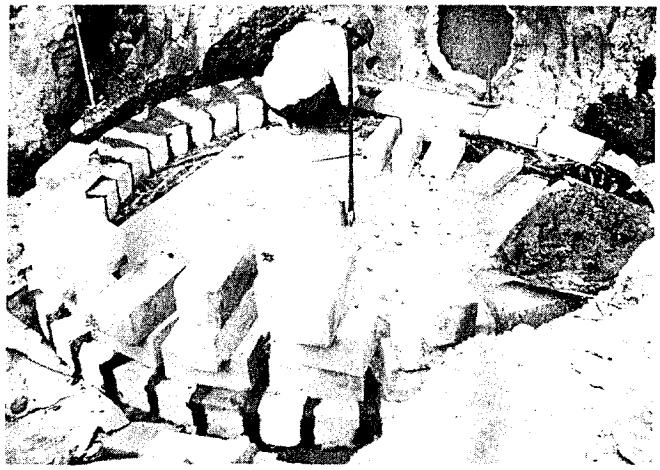
It is difficult to generalize on the cost of family shelters compared to larger shelters because cost depends on so many factors in the specifications of a shelter. It is well known that the wall area per square foot of shelter area increases as the shelter decreases, tending to increase the cost per space for small shelters. However, it is not generally recognized that it is much easier and less expensive to attain high blast resistance as shelter area decreases; the inherent resistance to external overpressure of the "shell" enclosing a volume increases both as the floor dimensions approach the height in magnitude and, for a constant wall thickness, as the shell becomes smaller. Both of these factors tend to make the cost of each blast-shelter space smaller for small shelters.

In the ultimate terror of nuclear attack, when the goal of survival itself overwhelms other considerations, a natural error in shelter planning by both specialist and non-specialist is an overemphasis on avoidance of physical and phychological discomforts. However, at the risk of skirting too closely to this error, the increased recognition by psychiatrists and sociologists of the family as the basic human unit for continuous, close living-together should be mentioned.[1] The strains induced by arbitrary combinations of families in intimate shelter life are avoided by family shelters.

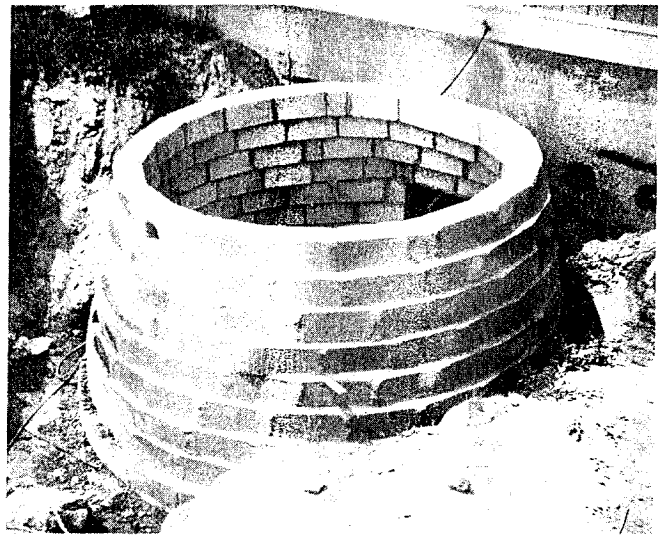
A disadvantage of family shelters is that the isolated family is deprived of professional services important in an emergency, especially medical. After the catastrophe of a nuclear attack there will, of course, be a serious shortage of medical personnel, equipment, and drugs, anyway.

An inherent advantage of a blast and fire-resistant shelter is that it is "tight" enough to be readily sealed for protection for chemical and biological warfare. This protection would also involve the addition of an

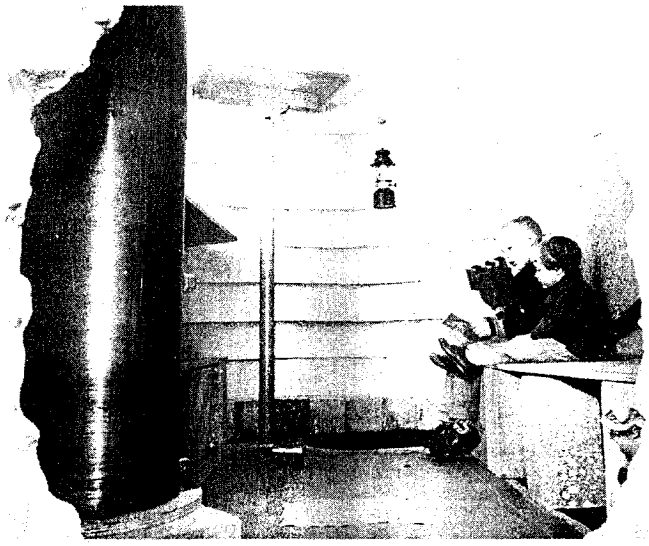
[1] *(See Theodore Lidz'* The Person, *Basic Books, 1969, and* The Family and Human Adaptation, *International Universities Press, 1963).*



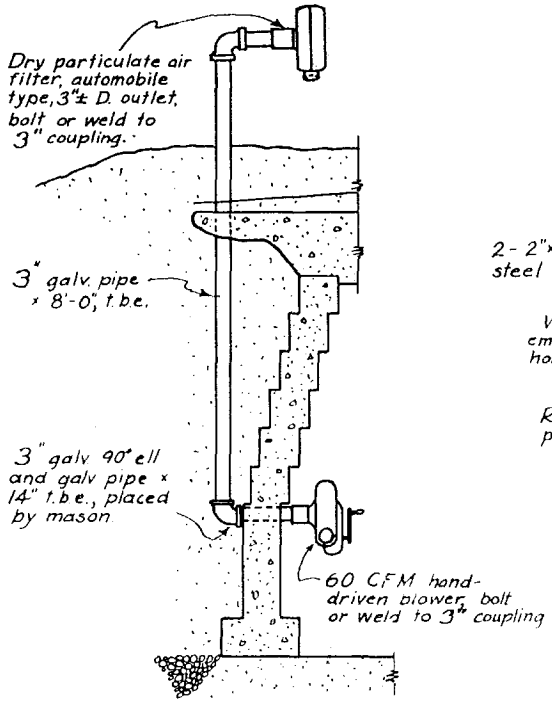
Shelter foundation features solid blocks in a radial pattern. Restricted passageway between shelter and house basement appears to right of workers.



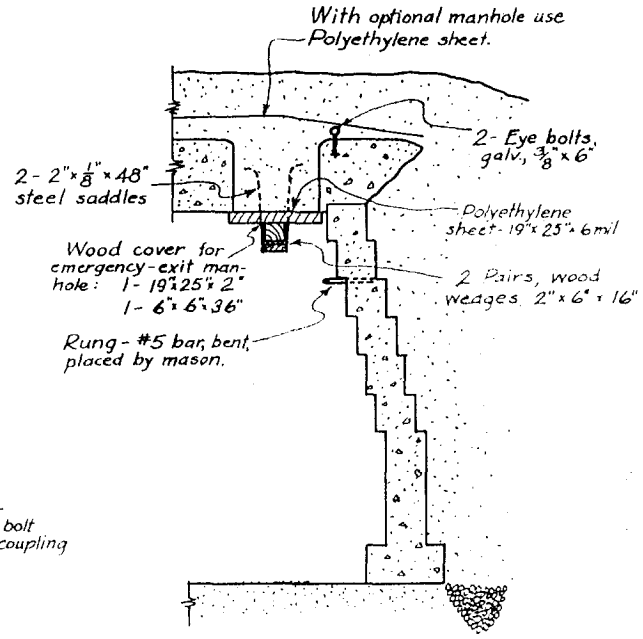
"Egg-shell" design is apparent. Note thick mortar joints which would not be necessary with a tapered block.



Interior of completed/shelter. 30-gallon water drum rests on blocks at left. Note part of upper bunk protrubing midway up drum's height.

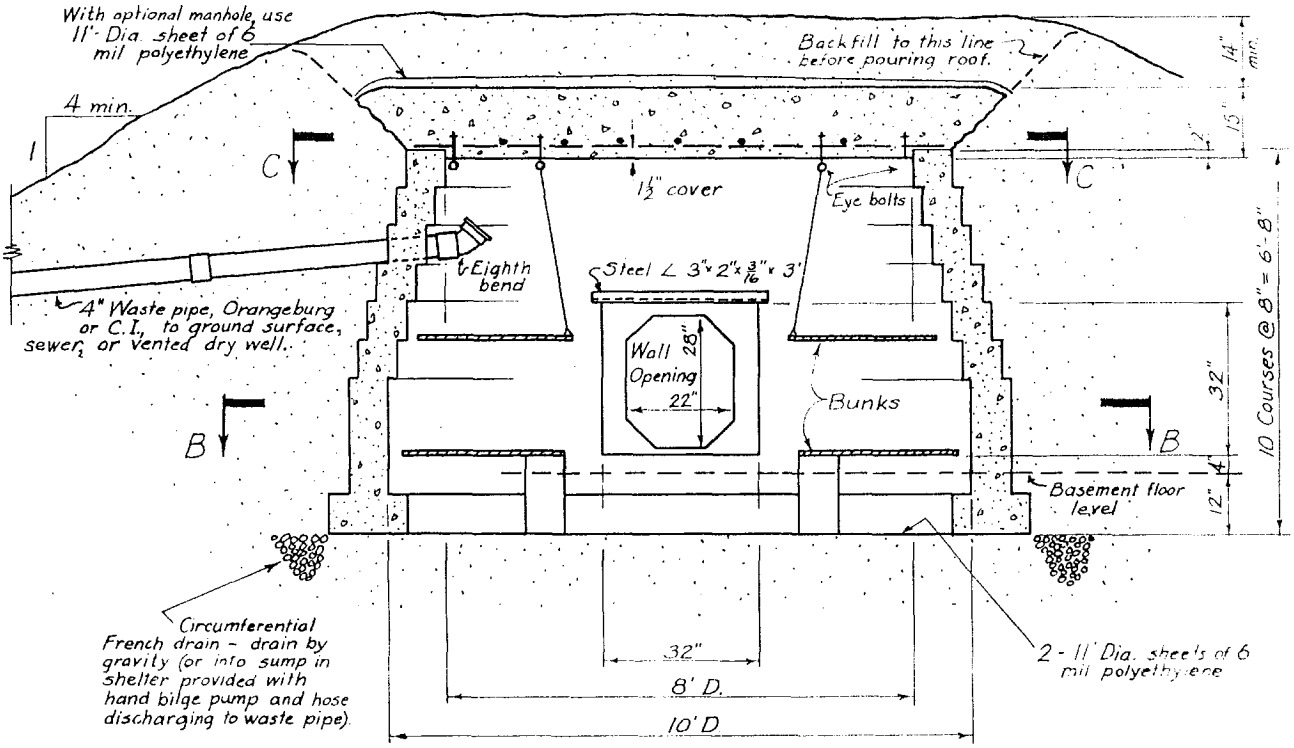


SECTION D-D

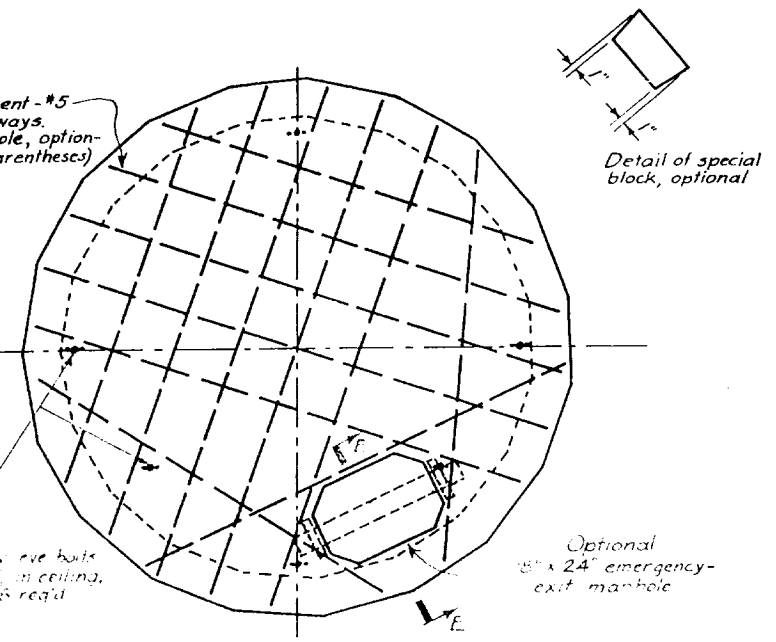


SECTION E-E

Roof reinforcem
bars @ 12" two
(except at manl
al, shown in p
6 @ 9'-6"
(2) 4 @ 8'-6"
(1 @ 8'-0")
4 @ 7'-6"



SECTION A-A



SECTION C-C

NOTES

Wall - 8" masonry, solid sand-concrete block or brick.

Reinforcing bars - Intermediate grade, with ASTM A 305 deformations.

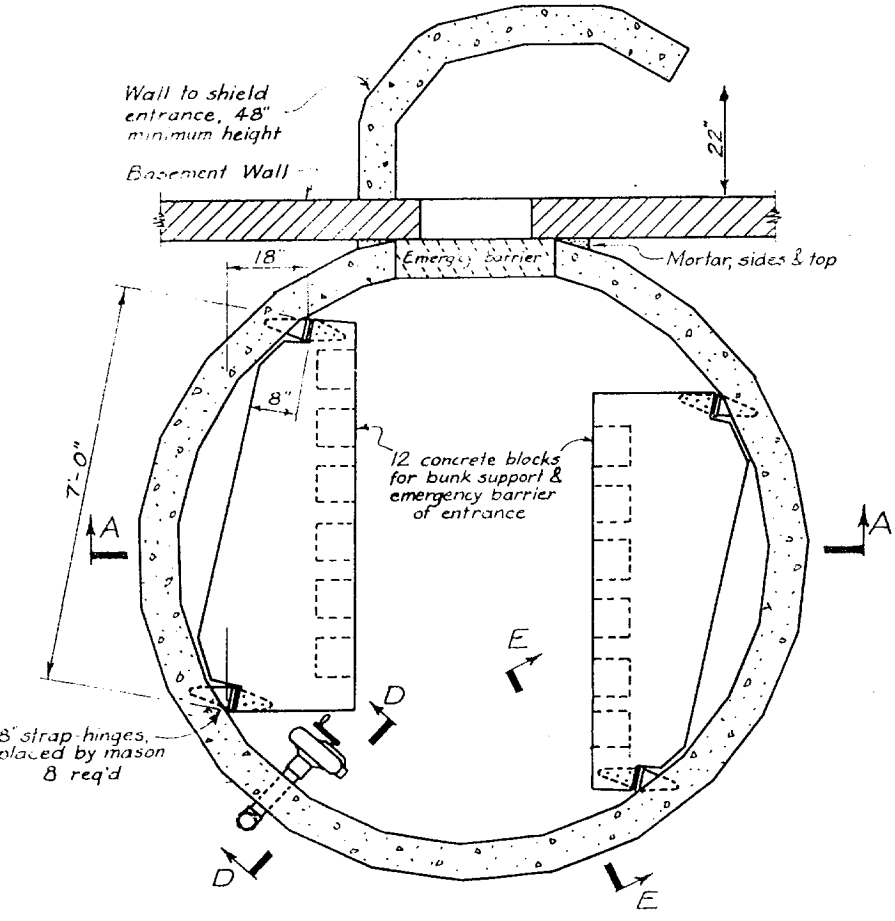
Roof concrete - 3000 psi minimum 28-day strength. (4 cu. yds. req'd)

Waterproof coating for wall exterior - hydrolithic type.

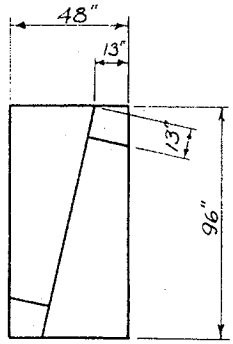
Overpressure rating - Minimum 30psi.

Effective radius from g.z. - 3.5 miles for 20 MT weapon.

Residual-Radiation protection factor rating - 1000



SECTION B-B



Cutting plan for bunk-boards. Use ¾" ext. plywood. At hinges cut to fit.

HOME SHELTER FROM NUCLEAR WEAPONS

DESIGNED BY

H. A. SAWYER, C. E., P. E.

REVISED JUNE 2, 1969

appropriate filter for the air supply.

The shelter here described is designed to have these advantages at a low cost. As shown in the photograph, it is an underground chamber in the shape of a truncated cone made of solid concrete blocks with a reinforced concrete roof. It is constructed adjacent to an exterior wall of a residence, with a hole in this wall for entrance and exit and an optional manhole in the ceiling for emergency exit. Since it is covered with earth, it should be located with its floor level about one foot below a full basement floor level. Alternatively, with mounding it may be constructed adjoining a portion of the wall of a basementless house with its floor level as much as three feet below house floor level if the portion of wall is concrete and designed as a retaining wall. In either case mounding may be reduced at the expense of shelter head-room by omitting one or two of the lower courses of blocks. The shelter provides sleeping space for six people.

Radiation and Fire Protection

For shielding from fallout radiation, the most widespread danger from nuclear detonations, this shelter has a protection factor of approximately 1000, which is 50 times higher than the minimum acceptable protection factor of the OCD's "Home Fallout Protection Survey." This rating is based on some shielding of the basement space outside the entrance wall by the residence and the shielding of the special wall at the entrance. An additional eight-block emergency barrier, laid up by the occupants without mortar after the blast wave has passed by, may be placed in the entrance either to maintain this rating if the shielding outside the entrance wall is negligible or to improve this rating if fallout radiation is ascertained as extremely intense.

This shelter is designed to protect its occupants from a fire which would completely consume the attached residence. The entrance shielding wall and the emergency entrance barrier would afford protection from resulting heat radiation and possible minor explosions. It is likely that the gas pressure from fire at the low level of the entrance opening would be less than atmospheric, but the forced air ventilation system would protect the occupants from this hazard even if this pressure should slightly exceed atmospheric.[2] An emergency manhole exit is shown as an optional feature.

Blast Protection

Although the shell walls of this shelter can resist a uniform external pressure of about 300 psi (compared to the resistance of about 3 psi of the usual flat, unreinforced, 8-inch-hollow-block wall), for the nonuniform, dynamic loadings from nuclear blast, this wall should resist underground forces corresponding to an air overpressure of as much as 50 psi. Favorable factors partially considered in the analysis leading to this conclusion were the prestressing effect of the soil pressure on the shell and the passive resistance of the soil to the deformation that must accompany any probable mode of failure. Table 4.39 and paragraphs 4.45 and 6.60 of *The Effects of Nuclear Weapons* (U. S. Atomic Energy Commission, Government Printing Office, Washington, D. C., 1962) further support this conclusion. However, analytical approximations inherent to this analysis suggest a conservative overpressure rating of 30 psi for this wall.

Although a shelter structure may retain its integrity under a 30 psi overpressure, the sudden compression of a 10 psi blast wave may cause injuries to the human anatomy. Using the detonation of a 5 megaton weapon as an example, the radii for 30 psi and 10 psi overpressures are 2.2 and 4 miles, respectively. Prevention of injuries in the area between the circles of these radii (representing an area-wise reduction in injury probability of 70 per cent) is by a wooden blast door, to be rolled on casters and in light wooden guides across the entrance opening. With this door in place, any pressure increase would be transmitted into the shelter slowly enough (primarily through the vent pipe) to avoid injuries. This door, optional for shelters more than perhaps 10 miles from a potential target, is built up of 32-inch wooden 4 x 4's spanning the 22-inch opening.

Both the waste pipe and the vent pipe are potentially vulnerable to blast. Probably the waste pipe would present no blast difficulties if, preferably, it drains into an underground sewer or dry well. If, on the other hand, it simply drains to a low point on the ground, the outlet end should be shielded with a concrete block to avoid the deadly blast of soil and stone which would occur with a sudden external overpressure. Then, when blast hazards are past, the shielding block may be rammed back from inside just enough to allow outflow of waste.

The analytical basis for design of the roof is more accurate. Using ultimate strength methods, yield line theory, and certain ACI Building Code criteria, the specified roof has an overpressure rating of 31 psi.

The vent inlet should be painted white or aluminum to reflect heat and placed preferably at a distance from the house greater than the house wall-height. The filter, attached to a pipe coupling, may be screwed onto the inlet nipple soon after the blast wave has passed. If for any reason this attachment is not made, fallout intake can probably be reduced to a tolerable level by minimizing use of the blower for 24 hours after the blast.

A shelter with a 30 psi overpressure rating provides blast protection from a 5 megaton detonation for radii exceeding

[2] *This shelter is not designed for more than minimal protection from firestorm, which could occur in exposed areas more than 20 per cent covered with flammable buildings and within 14 miles of a 5 MT air burst. Significant protection from firestorm could be achieved by provision for sealing shelter openings and provision of a six-hour supply of oxygen, together with suitable means for removal of carbon dioxide.* (Design of Structures to Resist Nuclear Weapons Effects, *American Society of Civil Engineers, New York, 1961).*

Bill of Materials for Nuclear-Weapon Shelter

NO.	MATERIAL	COST
280	Solid sand-concrete blocks, 8 in. x 8 in. x 16 in., @ 40 cents (or 300 blocks, tapered, 8 in, x 8 in. by 14 to 16 in.)	$112.00
10	Solid sand-concrete blocks, 4 in, x 8 in. x 16 in., @ 27 cents	2.70
15	Bags, masonry-cement @ $1.35 (11 bags for tapered blocks)	20.25
3,000	Lb of sand (2,200 lb for tapered blocks)	9.00
4	Cu yd of ready-mix concrete of 3,000-psi minimum 28-day strength, @ $15.50	62.00
40	Lb of hydrolithic waterproofing compound	6.00
4	Exterior-grade plywood sheets, 4 ft x 8 ft x ¾ in., @ $10.80	43.20
1	Piece of used lumber, 4 in. x 4 in. x 8 ft 0 in.	1.50
9	Pieces of used lumber, 4 in. x 4 in. x 6 ft 0 in.	10.00
1	Steel angle, 3 in. x 2 in. x 3/16 in. x 3 ft 0 in.	2.00
121	Ft deformed reinforcing bars, intermediate grade, No. 6 @ 11 cents. Cut six @ 9 ft 6 in.; 4 @ 8 ft 6 in.; 4 @ 7 ft 6 in.	13.31
8	Strap hinges, galvanized, 8 in. @ 80 cents	6.40
10	Galvanized steel eye-bolts, 3/8 in. x 6 in	1.30
20	Ft of polyethylene plastic, 20 ft wide x 0.006 in. @ 30 cents	6.00
1	Standard galvanized pipe, 3 in. x 8 ft 0 in., threaded both ends, @ $1.40	11.20
1	Standard galvanized pipe, 3 in. x 14 in., threaded both ends	2.25
1	Standard galvanized pipe, 3 in. x 8 in., threaded both ends	2.00
2	Galvanized 90-deg ells for 3 in. pipe @ $3.00	6.00
2	Galvanized couplings for 3 in. pipe @ $2.05	4.10
1	Hand-driven blower, 60 cfm (through particulate filter), No. 60-A of Champion Blower and Forge Co. or equivalent	55.00
1	Dry particulate air filter and housing, automobile type, used	3.00
2	Solid fiber (orangeburg) drain pipe, 4-in. diam x 8 ft @ $3.76	7.52
1	One-eighth bend for 4-in. fiber pipe	1.75
2	Casters, 2-in. non-swivel rubber wheel (for optional blast door) @ 80 cents	1.60
	TOTAL	$390.08

2.2 miles. Since serious structural or fire damage and resulting casualties to inhabitants will generally occur to conventional residential construction and conventional fallout shelters within 12 miles of ground zero, the use of 30 psi blast shelters reduces the area of suffering casualties by 96 per cent. For other sizes of weapons, although these radii change, this percentage remains essentially constant.

Construction Pointers

In construction of the shelter, the concrete blocks of the first course are laid on a thin mortar bed on the edge of the double-layer polyethylene floor sheet, with their long dimension in a radial direction to provide a footing. The floor sheet should be protected during construction with a corrugated cardboard or plywood covering. The mason must also be instructed to place the bunk-hinges, the short 3-in. vent pipe, the ladder rung, and the 5-in. square opening for the waste pipe in their proper places in the wall. The remainder of the vent pipe and the waste pipe can be placed just before or during the backfilling of the wall. Before the ceiling forms are placed, the bunkboards and any other large items should be placed in the shelter from above.

Ceiling forms for the roof-pour may be two 4 ft. x 8 ft. sheets of 3/4-in. exterior-grade plywood cut to fit within the top wall-course by saber-saw. These sheets can be supported on three parallel 4 x 4 timber stringers 34 in. on centers. The stringers should be supported by seven 4 x 4 posts, with three used for the center stringer. The ceiling eye-bolts may be placed in drilled holes in the plywood-form sheets before pouring. Notches are later chiseled at these bolts to permit stripping of forms. After the forms have been removed the manhole cover can be wedged into place and waterproofed and the manhole filled with dry dirt or sand.

Although concrete blocks of standard nominal 8 in. x 8 in. x 16 in. size were used for the prototype shelter, the use of a specially shaped block with a 2-in. taper in the 16-in. dimension will reduce the mortar space between blocks in the shell-wall, with consequent savings in mortar and mason's time and an increase in strength.[3]

The nominal cost of all materials and equipment for the shelter, including bunks and a complete ventilating system, is approximately $390, as itemized in the accompanying list. Skilled labor and use of construction equipment, including excavation, pneumatic breaking of entrance hole, mason-and-helper, and backfilling, cost $115 for the prototype shelter. This cost could probably not exceed $250 even in relatively high-cost areas. Additional labor, including carpentry, ditching, painting, and cleaning up, should not cost over $250, and could be done by a do-it-yourself owner. Thus, the cost of materials and labor for this shelter is from $550 to $900. If the home-owner does not act as his own contractor for this construction, an additional $200 to $300 should be added to these figures for the cost of a contractor's supervision, coordination, and overhead.

At a total cost of from $550 to $1200, this shelter represents a form of permanent survival insurance well within the means of the average family. ■

[3] *i.e, the taper would be* inward, *reducing the 16-inch block length on the outside of the shelter shell to a 14-inch length on the inside of the shelter shell.*

DEFENSE vs. RETALIATION

Eugene P. Wigner's address before the American Physical Society

Dr. Wigner is a frequent contributor to Survive *and a member of its editorial board. Here, in a condensation of his recent address before the American Physical Society in Washington, D. C., he compares plans for America's defense against plans for "revenge" in the light of odds for peace.*

When preparing for the present session I was acutely aware of the great difference between tonight's discussion and earlier discussions of our Society in which I participated. Little responsibility was involved when I argued for one physical theory as against another. The great responsibility for whatever I shall say this evening weighs heavily on my mind. It is not pleasant to recall the considerations which brought me to the stand I am adopting tonight; it would be unwise to forget them.

It is good, however, first to establish certain facts. The first fact is that the missile strength of the USSR, which has been growing fast in the last two and a half years, is now exceeding that of the United States. This is well known to many in the Defense Department. You see, before we were forced to subdivide our warheads, we had 40 per cent of the USSR strength (Figure No. 1). When the conversion to multiple independent reentry vehicles (MIRV) is completed, our explosive power will be around 20 per cent of the USSR explosive power. Since the USSR has mainly large warheads, the comparison is less extreme from the point of view of area coverage. The area covered with a certain overpressure is proportional to the 2/3 power of the size of explosion. Two 5 MT explosions cover a wider area with a certain overpressure than one 10 MT explosion. In fact, two 3½ MT explosions have the same coverage as one 10 MT explosion. Hence, the advantage of the USSR in area coverage is smaller than in total explosive power, and it will increase to a lesser extent when we convert to multiple warheads than their advantage in total explosive power will increase. The total explosive power is, of course, a measure of the radioactivity and fallout that the weapons create; the area coverage is a measure of the instant destruction. Nevertheless, even in the latter category, the USSR's missile strength is higher than ours by almost 20 per cent before our conversion, and will be higher by 30 per cent after we succeed with our conversion program.

Figure 2 shows the growth of the number of U.S. and of USSR missile launchers. These numbers are probably the most easy to ascertain: the launchers are visible from above.

On the other hand, one should not forget that the size of the launchers can be very different. The launchers of the USSR can loft, as a rule, much larger missiles than can ours. What the figure shows is that, in the last 2½ years, we have hardly increased our missile strength. Our effective strength both with regard to total explosive power and area coverage is now decreasing. The USSR has increased its capability during the same period greatly, by a factor of 2½, and is now ahead of us in both these regards. In a way, I am glad that we did virtually nothing in the past 2½ years – had we increased our strength, many people would say that the USSR only responded to our provocation. As matters stand, the reason for the USSR buildup is not discussed.

You will ask me how my data can be reconciled with the statements of our earlier Defense Secretaries, McNamara and Clifford. They gave the impression that our nuclear strength exceeds that of the USSR by a factor of about 4. However, if you read their statements, they say explicitly that they compared numbers of warheads. In this regard, we are really ahead of the USSR. We still are, although the British Institute for Strategic Studies estimates that they (the USSR) will catch up with us by midyear.

It is important, however, to discuss the significance of the three measures: number of warheads, total explosive power, area coverage.

I shall begin with the significance of the number of warheads. This may be decisive for a first strike which should abolish the opponent's retaliatory power. High accuracy has to go hand-in-hand with it, particularly if the missile sites to be destroyed are hardened--as are both the U. S. and the USSR targets. However, the U. S. certainly does not plan such a first strike, and the number of warheads we possess is, therefore, not a measure of our military strength.

How about total explosive power? We have about 25 per cent of that of the USSR. I must hope, therefore, that this is not of decisive importance either. I would have more justification for this hope, if we had at least adequate fallout

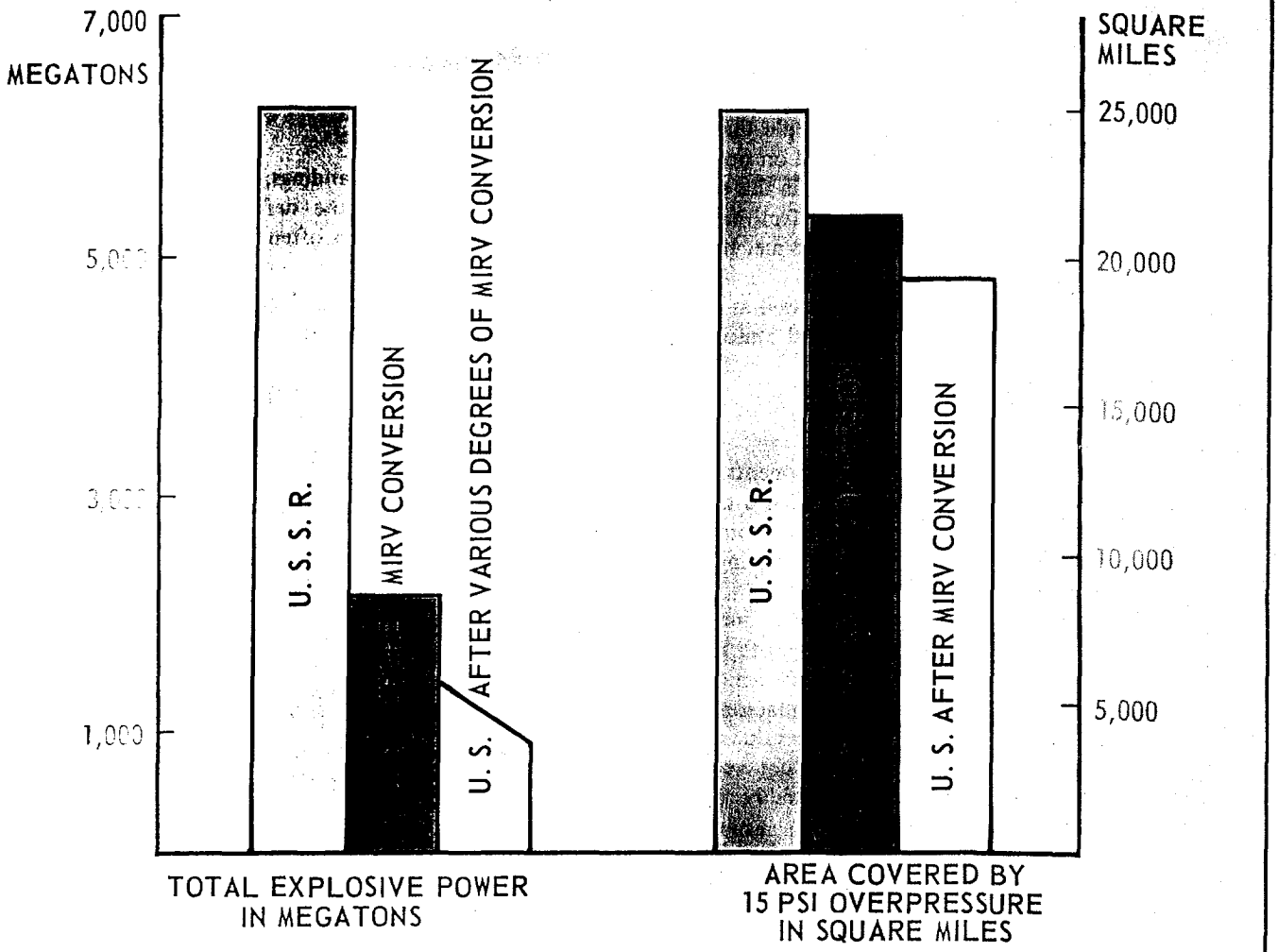


Figure 1. Comparison Between U.S.S.R. and U.S. of Total Nuclear Explosive Power and 15 PSI Area Coverage. (1969 Statistics)

shelters for everyone, but fallout shelters are opposed just as much, or even more, than is ballistic missile defense. It may not be news to many of you that I would, in fact, prefer civil defense to ballistic missile defense if I had to choose only one, but until recently the Defense Department has been even more concerned about opposition to civil defense than about opposition to ABM. However, as the preceding discussion indicates, at least fallout shelters are a necessity if we do not want the total deliverable explosive power, of which the USSR has 4 or 5 times more than we do, to have decisive importance.

As for area coverage, this might become the decisive factor if we have at least fallout shelters. In area coverage we are only 20 to 30 per cent behind the USSR and this would be to some degree reassuring if the civil defense of the USSR were not much superior to ours. However, before turning to this subject, I should make one further remark. Some will consider the comparison of the U. S. and USSR strengths irrelevent because, they say, both parties have so much overkill that the relative strengths matter little. They

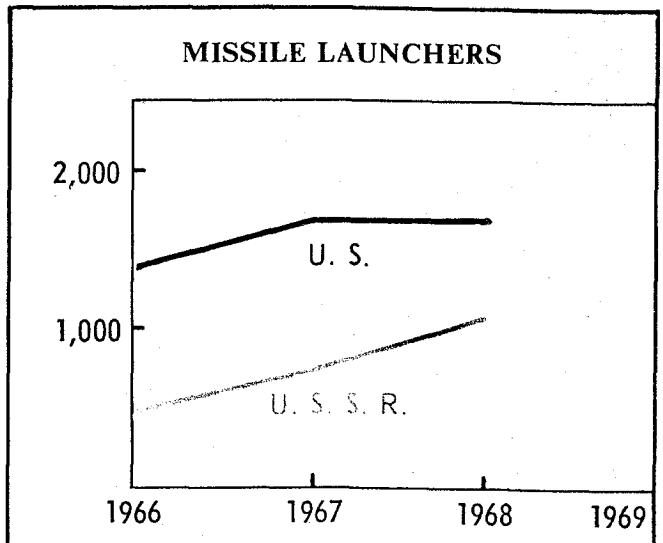


Figure 2. Numbers of Missile Launchers, U.S.S.R. and U.S.

say that, even if it were true that the USSR can kill all of us eight times whereas we can kill all of them only three times, this would have little significance. Fortunately, or unfortunately, this argument is not valid. The defensive measures which the USSR has instituted, and is in the course of instituting, have so drastically reduced the fatalities which we can inflict on their people that it is ridiculous by now to speak about an overkill on our part. This is what I shall discuss next. Since we are, in this regard, far behind the USSR, the increase in the effectiveness of defensive measures should perhaps not please me. It does, nevertheless, because the increased power and effectiveness of the defense—if it extends to the U.S. as well as to the USSR—promises a more relaxed international atmosphere and all of us are surely in need of that.

The Rising Power of Defense

That even a missile defense which the opponents of *our* defense consider very primitive, that even such a defense can be very effective was demonstrated somewhat unintentionally by Secretary Nitze. I am referring to a non-provocative missile defense—that of the USSR. According to an example given in the Congressional testimony of Secretary Nitze, it may prompt us to replace the 10 MT warhead by 10 warheads of 50 KT each. This is a reduction of the total explosive power by a factor 20, of the area coverage to 29 per cent of its earlier value. I have been told that the multiple warheads have not yet been installed—partly for technical reasons, conceivably also for other reasons. The fact that our contemplated response to the very primitive ABM of the USSR involves such a reduction in the effectiveness of one of our weapons certainly proves that the mere existence of some ballistic missile defense can provide a high degree of reduction of the damage that the opponent can inflict. One can say, in fact, that the ABM deployment by the USSR has resulted in the most significant limitation of effective armaments that has been achieved so far.

The reduction of our total power by the Russian ABM was not very great because the changes contemplated for the other missiles are less significant than those for the 10 MT warheads. This is because the other missiles were to carry much smaller warheads to begin with. However, most missiles of the USSR have very large warheads and if these were to be modified in the way Secretary Nitze said the 10 MT warheads are modified, the gain would be, indeed, enormous.

The greatest progress that the Soviet Union has made toward defense does not lie, however, in the area of antiballistic missiles. It lies in its renewed emphasis and energetic progress toward civil defense.

My assessment of civil defense in the USSR is based on a rather thorough study of the Soviet literature on the subject, undertaken by Mrs. (Joanne) Levey of Oak Ridge National Laboratory and myself. The Russian literature seems quite open and frank, telling about the shortcomings of the arrangements as well as about their accomplishments. It leaves no doubt in the mind of the reader what the objectives are. Even if these are not yet fully accomplished—and quite likely they are not as yet—there is no question that they can be reached and that there can be no opposition to them in the USSR.

Most of the decrease in the number of casualties which we can inflict on the people of the USSR is due to their civil defense arrangements.

To avoid misunderstandings, I quite agree with Kosygin and do not consider the defense of the people to be objectionable or, as it is often put when our own defense measures are considered, provocative.

What I find frightening is their very elaborate plans for the evacuation of their cities. These go into the minutest details. When, in the course of a study (the so-called Little Harbor Study) evacuation of the cities was considered as a possible defense measure, all members objected on the basis that evacuation can be effective only if it is ordered well ahead of the inception of the hostilities. We felt, therefore, that it is useful only as an aggressive move, as an introduction to the initiation of a crisis, or of an attack. Even though, I believe, all the participants in the Little Harbor Study were, or became in the course of the study, supporters of an expanded civil defense effort, they all felt that the planning of evacuation is not a proper means toward this, just because it is useful only to the initiator of the conflict. Evacuation is, however, the measure which is now at the center of the Soviet program. It may be, one day, terribly effective. It is true that the evacuation cannot be carried out in secrecy; it is equally true that we could do nothing even if we knew that it was being carried out.

How much would the evacuation of the major cities of the USSR reduce the fatalities in a thermonuclear exchange? We have made tolerably accurate calculations on this; let me give only a crude picture. Moscow and its surroundings have a population of about 6½ million. If these are spread over a circle of 50 mile radius, the density of people would become about 850 per square mile. With the area coverage of our missiles (as given in Figure No. 1) I showed we could cover the territory occupied by about 9½ million people with a blast wave of 15 psi overpressure. This assumes the usual attrition rate of 1/3 and that we use all our missiles, without exception, for this purpose—an unlikely assumption indeed. The midlethal pressure, from lung damage, is much higher than 15 psi, but considering everything 15 psi is a reasonable value. It disregards any damage which a first strike may inflict on our retaliatory force and also the sheltering which their subways provide.

Hence, actual fatalities would be a good deal below the 9½ million I quoted. Certainly, under no likely circumstances of a conflict can one reasonably speak about overkill on our part.

Conclusions

It is not pleasant to have to admit the weakness of our defenses. It is even less pleasant to admit that we are slower than necessary in affording a proper role to the protection of our people and their values and continue to rely solely

on retaliation–that is, the threat of revenge. I feel, however, that in this last regard the blame falls heavily on the intellectual community, part of which has a spontaneous revulsion against all innovations in the defense structure, be these for the better or the worse.

I myself consider the possibility of strengthening the true defense, that is the possibility to protect our people and our installations, one of the most favorable developments that have taken place in the last twenty years. The possibility of mutual annihilation appears to me a most unhappy state of affairs. The U.S. will not start a conflict and, if an enemy destroys our country, what good does it do us to take revenge and destroy his? At the very best, retaliation makes sense only as a threat to deter enemy attack. But it is not even a very plausible threat because the enemy knows it would be purposeless to carry it out. The damage that the mutual ability to destroy the other does to mutual good will need not be enlarged upon. I do, therefore, advocate, and have advocated for some time, a more defense-oriented strategy.

The argument that any innovation on our part will provoke the USSR military is not new to me. My opinion, however, is the opposite. It is difficult to imagine anything more provocative than not to respond to the very rapid increase of the military and defensive might of the USSR. Such lack of responses would dangle before the eyes of the more adventurous elements in the USSR the temptation, first, to shear the United States of discernible influence in international affairs, and then to go on to much more drastic encroachments on our way of life. One may suggest the status of Czechoslovakia or Hungary.

It is not pleasant to remember or to remind others of such fateful words as those of Marshal Sokolowski, who said, "The war will naturally end in the victory of the progessive social-economic system over the reactionary capitalist socio-economic system which is historically doomed to destruction. The guarantee for such an outcome of the war is the real balance between the political, economic and military forces on the two systems which has changed in favor of the socialist camp. However, victory in a future war will not come by itself. It must be thoroughly prepared for and assured."

Second, it seems to me that defense measures undertaken on our part will help rather than hinder disarmament and accommodation negotiations with the USSR. The leaders of that country are not afraid of their own weapons–why should they make any concession? If, in the words of Ernest Bevin, we enter the negotiations naked, we will leave them naked.

Third, I do not believe that defensive measures are provocative under any conditions. As for the USSR leadership, we have Premier Kosygin's words: he said, "I believe that defensive measures prevent attack and are not causing an arms race."

The same point of view was expressed even more strongly around 1963-64 in the magazines of the USSR. The discussion in these magazines expressed bewilderment that the United States did not take protective measures. They wondered: does the U.S. want to strike first? One could almost claim that the *absence* of true defense is considered provocative by the USSR. To avoid misunderstandings, let me repeat that I do not consider preparations for evacuation to be part of true defense.

Finally, let me consider the effect of a successful opposition to ABM on our own people and our own defense establishment. Doing nothing in the face of the now alarming USSR military buildup would give the impression that the leadership of the country does not consider defense to be important. This would make it difficult for all of us to make sacrifices for our defense. And, let us not fool ourselves, such sacrifices will continue to be needed in the future. The effect on the military would be even worse. Not only would their plans be almost hopelessly dislocated; they would feel alienated, repudiated, and discouraged. And this is the last thing that we want. The path to peace is not an easy one: it will continue to require sacrifice, devotion, willingness to adapt to changed circumstances, and an open mind. ■

EDITORIAL . . . . .

WHO'S MAD AT WHOM?

On May 5th the Washington office of the Associated Press released a critical survey of the nation's civil defense posture by writer Dick Barnes.[1] *It made a lot of civil defense people angry. Some local directors were angry because Barnes' barbs did not apply to their particular political subdivisions. Others were angry because the release appeared to reflect adversely on the efforts of dedicated CD staff personnel.*

We're mad too. We're mad because Barnes' information is founded on good journalistic research and is substantially correct. We suspect that Barnes himself was mad, and that this anger prompted his article.

But we've been deeply concerned for a long, long time. It is the kind of concern evinced by Mr. Barnes that is responsible for the publication of Survive.

We are concerned by the fact that our national civil defense program is deplorably weak. We look despairing at a legislative policy which has forced program inadequacy through steadily tightening starvation budgets, then brought condemnation of the program for not being as effective as it should be.

We are deeply apprehensive with the knowledge that other countries have reacted to the nuclear threat with strong civil defense programs that give their populations good survival odds.

We are disturbed among other things because our federal agencies are reluctant to require shelter slanting in new construction.

We are mad too because the fact that most of our people are hostages in the nuclear chess game is apparently acceptable to Washington.

When the survival of the United States is in balance and our national leadership is satisfied with a 4th rate civil defense effort, perhaps it is time to get concerned. Perhaps it is good that the general reaction to Dick Barnes' release is one of anger.

We think so.

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[1] The Associated Press release which is referred to sharply criticized civil defense results obtained in the last two decades. In particular, the release found the shelter program lacking, reporting an imbalance of shelter distribution, and a lag in marking and stocking. (See Book Review on back cover, this issue.) It pointed out that existing shelters offer some protection against radioactive fallout but not against blast. It used OCD statistics to back up its findings. It summarized arguments of civil defense opponents and those of its supporters. It traced the decline in civil defense budgeting. While it revealed the OCD stress on shelter management training, it also indicated that extensive University of Georgia shelter research showed that shelter occupants would be capable of self-management with the help of pre-positioned guidance. (The choice of headlines by the local press was in some cases unfortunate and provocative.)

POLL SHOWS 84% OF PUBLIC FAVORS ABM

Pennsylvania Senator Hugh Scott reports that an Opinion Research Corporation poll shows that 84% of the population of the United States now favors ABM. This is in contrast to an apparent letter-writing campaign which has boosted his mail opinion to a 9 to 1 tally in opposition to ABM. According to New York attorney William J. Casey, chairman of a citizen committee to present the positive side of the ABM question, "the real voice of America is not being heard."

Most people tend to belittle emergencies that confront them but do not directly affect them. They are especially reluctant to act alone in the presence of others. Taking his cue from an article on crisis behavior in the May 1969 issue of *Reader's Digest*, Ted Knote says:

> "The public's inaction in the face or the threat of nuclear war is largely due to concern for the opinion of others. A man hates to do something others may ridicule him for even if he knows it is what ought to be done—or must be done. If he reasons that a shelter is a good and necessary thing the chances are that he will not build one because his family and neighbors, most of whom ban serious thoughts of nuclear war from their minds, will dub him a crackpot. He 'inacts'. He even joins his would-be detractors. It's the path of least resistance. It's mob psychology in reverse."

(Note: Ted Knote, retired Wall Street banker, is a long-time civil defense student, supporter, and contributor.)

Only a small portion of Edward Teller's ABM statement before a U.S. Senate subcommittee was televised. Survive *here presents the entire prepared written statement.*

TESTIMONY BEFORE SUBCOMMITTEE ON INTERNATIONAL ORGANIZATION AND DISARMAMENT AFFAIRS

EDWARD TELLER
May 14, 1969

In order to arrive at a balanced recommendation on the SAFEGUARD ABM deployment, I shall consider the problem from three different points of view. First, I shall compare the inherent advantages of offensive and defensive missiles, assuming that we have a choice to emphasize one or the other form of preparedness.

Secondly, I shall discuss our state of knowledge concerning the expense of defensive deployment as compared to deployment of an offensive force.

And lastly, I intend to discuss the difficulties which have arisen in the ABM debate due to the shifts in the information on vital defense matters which are available to Congress and to the public.

Since these points have influenced my own thinking about missile defense. I will use the same arguments for the purpose of recommending the kind of deployment which I believe is both justified and urgently needed at the present time.

Comparison of Offense and Defense

When the existence of atomic explosives was disclosed to the world on the day of Hiroshima, it seemed that henceforth defense had no chance to withstand the modern power of nuclear attack. This impression was reinforced when thermonuclear explosives multiplied the atomic blast one thousand fold. A last step in this development was achieved when the shift from delivery by airplane to delivery by rocket cut the time needed to cover the distance from home base to target in a dramatic way. The time used to be measured in hours. Now it is measured in minutes.

All of this tended to prove what indeed has become a generally accepted slogan: There is no defense against nuclear attack.

In spite of this evidence, the Russian leaders have consistently claimed that it is their duty to defend the population of Russia and that, in fact, such defense is possible. Historically, Russian air defense played an important role in the Second World War. At no time since the end of that conflict did the Russians relax their effort to protect their country against any possible attack.

Actually, during the last ten years there have been no essentially new major discoveries further to enhance the might of offensive power. In the same period the admittedly difficult task of defense has made considerable progress. In Russia, missile defense was deployed. We have obviously arrived ourselves at a point where a concrete decision of comparing defense with offense has to be made.

There can be little doubt that if defense and offense were equally feasible it would be more humane to emphasize defense. The claim that defense is provocative hardly seems logical. We do know that a nuclear conflict would cost millions of lives no matter under what conditions it is fought. To believe that better defense would encourage aggressive behavior on our part contradicts not only American history but even human nature.

It is an unfortunate circumstance that modern weapons have deprived us of the protection that our relatively isolated location used to offer. For this reason it is now necessary to prepare before actual trouble starts. In both the First and Second World Wars time for preparation was fortunately available. Since it is now necessary to give consideration to arms in times of peace, it will at least be in greater conformity with our feelings and our principles to put emphasis on weapons that fend off an attack and that save lives on our side, than on such weapons which are calculated to kill a maximum number of our enemies.

Secretary McNamara has often emphasized the notion that we shall keep peace by means of possessing the power of "assured destruction". It would be well to remember that in war nothing is assured. If there is any choice in the way in which our survival can be made probable, that method should be given preference which will save lives over the method that escalates destruction.

Apart from such considerations, we are consciously and rightly seeking that kind of policy which leads to maximum stability. Development of aggressive weapons certainly induces fear, and such fear may deter aggression. However, it may also persuade an opponent that he better take advantage of the possibility of a "first strike", because in this way he may minimize potential danger to his own country. Thus continuing deployment of aggressive weapons may indeed lead to instability.

By contrast, the development of defensive weapons is

likely to have a stabilizing influence. If we possess sufficient defensive equipment, an aggressor cannot count on rendering us helpless. This is a more peaceful and not necessarily less effective way of deterrence. Our Russian opponents never have shown a proclivity to take chances. If they cannot be highly confident of success they are not likely to attack.

The mistake often is made of laying down requirements and letting technology be guided by the plans that have been developed. In reality, technical possibilities are rather inflexible. If aggressive weapons are much easier to develop and deploy than defensive ones, then the arguments that have been given above have no real weight. In the first fifteen years after World War II technical opportunities favored the offense, and it would have been dangerous not to explore this potentiality. At that time it was estimated that defense may be 30 times as expensive as the amount of offensive power which could overcome the defense. Under those conditions I could not help but come to the conclusion that missile defense should not be attempted.

But in the last 10 years the technical trends have taken a new turn. The use of phased array radar meant considerable progress in the tracking of missiles. The incredibly rapid development of electronic computers has opened new horizons in the art of handling information. No one claims today as great an imbalance in cost between offensive and defensive weapons as used to prevail. Under the new conditions it is therefore of the greatest importance to compare quantitatively the effectiveness of offense and defense. In case defense has a chance comparable to that of offense, there are strong reasons of common humanity and reasonably conservative behavior to place great emphasis on the development of a defensive force.

The Cost of Offense and Defense

At a future date when all relevant figures might become available to a historian it would be of great interest to compare two expenditures. One is the effort and the money spent by the Russians in deploying missile defense. The second is the effort and the dollars invested by us to develop and deploy penetration aids which were designed to overcome the Russian defensive deployment.

Today this comparison cannot be made. We cannot estimate in any precise manner Russian expenditures. Furthermore, we have insufficient knowledge whether and to what extent our penetration aids will overcome Russian defenses. It should be clearly recognized that the best we can do is to engage in a guessing game. Any claim of a quantitative comparison or a precise scientific evaluation must be discounted.

At the same time, I want to hazard the guess that our expenditures on penetration aids were not much less and possibly were considerably higher than the Russian expenditures on defense. A crude attempt at this type of comparison had a great influence on my own thinking. I am now thoroughly convinced that the possibility of effective missile defense cannot be discounted.

Scientists in the Pentagon who opposed missile defense and advocated penetration aids experienced a similar change. It is easy to say: Let us scatter chaff, employ decoys or let one missile carry several explosives. The execution of these suggestions consumed a lot of money. There are further possibilities to counteract defense. None are cheap and simple. All result in a considerable reduction of explosive power one can deliver for a fixed amount of money.

The result after several years of hard work was an increased respect for missile defense. Those who struggle day-to-day with the problem of how to penetrate Russian ABM are now recommending that we employ some defense in our country.

There is of course, an obvious weakness in any argument for defense. What do we mean by "effective" defense? We should certainly desire to save the lives of as many of our citizens as is humanly possible, even in case that the horrible possibility of a nuclear war should materialize. But it is argued that this would require a perfect defense since the penetration of even one missile carrying a powerful nuclear explosive would spell disaster. Considerations of this obvious type have led scientists who viewed the problem from broader and somewhat more theoretical points of view to the conclusion that no defense can exist.

Actually, one can object to such a conclusion in two ways which are different but which are both valid. On the one hand, one can never ask for perfect success in the horrible and hazardous event of a war. To the extent that the dangers of nuclear war deter war itself, it is right to emphasize these dangers. But if these dangers should convince us that we need not even try to minimize the disaster, if it does strike, then the realization of danger will have had the effect further to increase our hazards. In case of a nuclear war national survival will be at stake. It is indeed possible to increase the chances of national survival even if catastrophic losses are unavoidable. If this situation is realized on both sides then war will be more easily avoided.

The second reason to doubt the validity of the assertion of "no possible defense" is the great scope for future development. In order to gain perspective it is worthwhile to consider what a determined defense effort might accomplish in the future. I shall attempt to indicate such a defense effort even though it would be certainly premature to plan such an effort at the present moment, and even though it would make no sense whatever to place a price tag on items which are as yet in the idea stage.

Any missile defense consists of two phases. First, the missile must be identified and tracked. Then the incoming missile must be destroyed. By using appropriately designed defensive explosives the latter job can be accomplished. The

serious objections to the possibility of missile defense are connected with the first phase: that of identifying and tracking the missile.

In our preliminary plans we are considering relatively small numbers of radars which serve as our eyes. It is indeed possible to destroy these radars or else to fool them even while they function, by using decoys and other penetration aids. Missile defense may become thoroughly effective if and when we find it possible to employ more devices of detection and if we also vary the kinds of detectors we use. In the end, missiles that have a global range have to be observed from extremely widely deployed and greatly varied observation stations. In this way it will become most difficult for the attacking force to escape detection or to destroy a sufficient fraction of the observing stations. A valid argument concerning future feasibility of missile defense must take into account all the variety of detectors which could be made available and which today can be discussed only under our self-imposed rules of secrecy. I have the hope that the cooperative effort of many observation stations may indeed lead to success in defense.

One should mention that the real difficulty in such an ambitious plan will probably lie in the need for rapid communication and rapid evaluation of the results observed in widely dispersed locations. Fortunately, our electronics industries and our computers are progressing so fast that these difficult problems can be attacked with some hope of success. Electronic brains seem to become ten times as effective in every decade – without becoming more expensive.

At the same time it seems likely that our present means of observation, the radar stations, will remain vital components of any defense. Therefore, deployment of defense based on radar observation will serve as a first sensible step toward a more complete and more effective system which may become possible in the future.

We have to return, however, to the immediate question whether or not deployment of presently designed defensive systems is necessary. Furthermore, it is important to ask that if such a deployment is executed, what should be the first goal of this deployment.

Since it is clear that defense is indeed difficult, it is reasonable to start with the easiest task. This was the consideration that guided the decision to deploy SAFEGUARD ABM. Partial success in the defense of missile sites will indeed preserve the effectiveness of our retaliatory force in case the enemy should attempt to destroy the missile sites by a first strike. A similar partial success in defending cities may be less meaningful because of the exceedingly vulnerable nature of the city targets. The decision to defend missile sites rather than cities does not reflect a preference in favor of missile sites. It rather is due to the recognition that in a well-considered development of a defensive system we should give priority to those tasks where success is most likely.

It would be of course, highly desirable to plan our defensive system and indeed all of our military expenditures in a logical manner. Unfortunately, we lack the knowledge to do this. This is the heart of the present argument and it needs special emphasis. *We do not know whether defense or additional offensive force will be cheaper and more effective.* Furthermore, we shall never find out unless we make an actual attempt by the means of a limited deployment.

Our industries have learned long ago that no big undertaking can be planned in a sound manner without first erecting a pilot plant. No amount of calculation or laboratory work will give reliable cost estimates. I consider the SAFEGUARD ABM as such a pilot operation. If we are to plan our defense with any effectiveness we must know whether attack or defense is cheaper. We do not have the answer. The most obvious illustration of this fact is given by the exceedingly divergent estimates you obtain from proponents and opponents of the ABM deployment.

There is a group of people which probably has reliable estimates. They are the Russian experts who have practiced the deployment of defense for many years. Our own experts have widely different opinions as to the effectiveness of the Russian ABM system. I am firmly convinced that all American authorities are basing their evaluation on mere guesses.

If we are to negotiate an agreement on arms limitation, we are going to face experts who have actual experience in the deployment of missile defense. We shall be at a disadvantage in these negotiations unless we gain some experience of our own. Neither planning of national defense nor agreement on arms limitation can proceed in an effective way unless we explore defensive possibilities through actual deployment.

The question will naturally arise whether in this state of affairs more research might not be preferable to the proposed pilot operation. Research would indeed be the determining factor if missile defense were to depend on a single technical discovery. Actually, the defense depends on the coordination of many elements. The resulting intricate system is apt to develop difficulties which we cannot completely foresee. At the same time, when we engage the talents of many engineers, shortcuts and savings will probably be found. For instance, our computer industry has not yet been engaged in ABM work as thoroughly as would be the case if we deployed SAFEGUARD. No cost estimate will be valid without the experience which we are planning to get. No state of readiness can be trusted unless this state of readiness is tested in a deployed system.

The important question is whether defense or offense is cheaper and more effective. At the present stage we must give the answer that *we do not know.* This state of ignorance must be ended. Some important answers will be forthcoming in the near future if we begin deployment as recommended by President Nixon.

The Information Gap

Controversy due to the lack of information on feasibility and cost of defense is further complicated by contradictory presentations given both to Congress and to the American public at different times, by different Secretaries of Defense. Testimony by Secretary Laird disclosed that the Russians are gaining superiority in nuclear weapons which may put them into a position to destroy our ability to retaliate by a "first strike". Recently declassified information given by Laird and by other proponents of ABM has been essential in the debate.

On the other hand, the American public, as well as many members of Congress, remember vividly earlier statements by Secretary McNamara. These statements had given the impression of continuing American strength which would exclude the dangers which are now mentioned.

Have we acquired new information to justify the changed evaluation? Or did McNamara lull us into a false sense of security? Or shall one agree with those who believe that the recent pessimistic statements are made to obtain approval of the ABM deployment by using scare tactics? It will take time before the validity of the new statements can be verified to the satisfaction of the majority, before this situation is put into proper perspective, and before the consequences are widely realized and accepted. Only then will it be possible to reestablish greater objectivity in debates on national defense.

Having watched trends of Russian weapon deployment, I have been in agreement with Secretary Laird's present conclusions for the last three years. But one man's opinion in this question is of little value.

What is much more important is the fact that all our attempts at rational evaluation are hampered not only by effective Russian secrecy but also by the rules of secrecy which we practice ourselves. As long as decisive information is kept secret on our part and is disclosed only in a piece-meal fashion, we cannot hope to arrive at firm and rational conclusions.

The present ABM debate is most instructive as an example of the arguments which influence our decisions. The strong convictions of many opponents of ABM are based on two important statements: "Russia will never dare to attack us" and "The arms race must be stopped".

With regard to the first of these statements it is relevant to find out how Russian ability to attack is developing. Their intentions may never be correctly guessed but their deployment of arms has not remained completely hidden. The facts of this deployment and the evidence we have to support these facts have been surrounded in our country by the greatest of secrecy. This was done even though the Russians know what they have deployed and they also have a very good estimate of our ability to observe their actions. It would seem to be highly desirable if our knowledge concerning Russia's preparations would be currently displayed to public scrutiny.

The second motivating argument, "The arms race must be stopped", depends on an understanding of the nature of the arms race. In the early part of the 20th century, arms race meant a competition in the quantity of arms. The nature of these arms and their performance changed slowly, compared to the exceedingly rapid strides which characterize the technology of the last two decades. As long as an arms race can be defined in quantitative terms it is indeed a competition in brute force and can be defined in clear terms. In principle, it is possible to bring such an arms race under control.

Today's "arms race" is qualitative, rather than quantitative. New possibilities of military developments are more important than mere multiplication of developed arms. In addition to the atomic bombs, thermonuclear bombs and missiles, one may mention the nuclear submarines and electronic equipments of increasing complexity as obvious examples. It is not easy to understand where such an arms race stands or how to limit it even if all facts are available for discussion. But if we superimpose on this situation rules of secrecy whereby the most important developments cannot even be mentioned in public, any discussion of the arms race becomes a meaningless exercise.

At this point we encounter a basic problem of our democratic society. The public demands a voice concerning military expenditures and the public is of course also sensitive to its own physical safety. At the same time, our rules of secrecy deprive the public of any possibility of arriving at an informed opinion. Congress could disregard public opinion and rely on secret information made available to selected members. The present ABM debate is a splendid example of the fact that such a procedure will not work and that public opinion cannot be discounted.

Some scientists raise the objection that the facts are so complex as to be incomprehensible to the public, even in case of full disclosures. From this opinion I differ. The situation may be made to sound complex, but an honest attempt at a straightforward explanation will allow common sense to play an appropriate role. Indeed, if we should discard our respect for common sense, we will have abandoned the basic premise of democracy.

In my opinion, *we have to open the book of military secrets both to the Congress and to the public.* To do this will have the disadvantage that we will give some help to our adversaries. The argument had weight at the end of the Second World War when our information was superior to that of the Russians. Today it is safe to assume that most of our essential secrets are known to Moscow. Indeed, I fear that Russian military research has already found many of the secrets which we are yet to discover.

I believe that our whole policy of secrecy should be carefully reviewed and that far-reaching decisions should be made to encourage open discussion. Secrecy has produced the information gap which impedes orderly discussion of the ABM question. It may produce a new credibility gap which could paralyze our government. It is in the spirit of open discussion that the weighty problem of the arms race must be solved.

Two Recommendations

On the basis of what has been said, I submit that two actions are needed.

> First, *the ABM deployment should be approved for one year.* This means a commitment of $800 million. This money is well spent for information we shall gain.

According to the President's proposal, the ABM problem should in any case be reviewed in one year. This should be done on the basis of information which is as complete and as thoroughly discussed as possible. My second recommendation serves this end:

> *Our rules of secrecy should be rediscussed and made more liberal.*

If ABM deployment is started now we shall have in one year some evidence of initial shortcomings or successes. The main purpose of a pilot operation is to gain experience. This experience should be thoroughly displayed for Congressional criticism. Approval at this time should not mean a commitment for the more distant future. Nor should the present proposal limit future expansion if this can be thoroughly justified.

In the meanwhile, open debate on hitherto classified information should create a more solid background for decisions affecting national defense. If Congress approves the President's plan for next year we shall have gained valuable flexibility. A negative vote on ABM will result in continued ignorance. It will close a path that may lead toward safety by deploying explosives which in a case of emergency would destroy machines, rather than the cities of our opponents. ■

CHEMTREE CONTRIBUTES TO LUNAR RESEARCH

Special Shielding For Moon Samples

A "low-count cave" has been constructed at the Lunar Receiving Laboratory in Houston to examine moon minerals upon the return of Apollo 11 from its scheduled moon landing. According to the Chemtree Corporation, a New York firm which built the "cave", moon minerals are assumed to be radioactive due to the absence of a suitable cushion of atmosphere to absorb most of the cosmic radiation they are exposed to. The "cave" is made of Chemtree 82, a special heavy concrete mixture containing lead shot and other materials. Chemtree 82, by virtue of its composition, has special attenuation powers.

In an article in *Protection Civile,* the French civil defense journal, the Denver, Colorado Emergency Operating Center was reported to have a blast protection of 14psi. Denver Civil Defense Director, Colonel William J. Allen, Jr., says the French are probably optimistic on this point. The blast protection, he points out, is more like 2 or 3 psi.

However, other features of Denver's EOC are unique. Closed-circuit television, for instance, links the EOC with technical services. A "Street Closure Control Center" functions as a day-to-day operation and takes care of disseminating information on traffic stoppages, especially to emergency vehicle dispatchers. Frequent shake-down disaster exercises are staged to work the bugs out of disaster operations.

Finally, Colonel Allen underlines the fact that local government is firmly in the saddle in any emergency. The mayor is boss.

ACT MAKES BOW

Volume 1, Number 1 of the new State of Washington *Act* made its appearance in May. *Act* is published bi-monthly at 4220 E. Martin Way, Olympia, Washington 98501 and is distributed free upon request. In its first issue *Act* underlines the heavy natural disaster role in Washington Civil Defense and the highly effective county search and rescue organizations throughout the state.

BOOK REVIEW

Annual Statistical Report, Fiscal Year 1968, Department of Defense, Office of Civil Defense (distributed free of charge through OCD channels).

The *Annual Statistical Report's* 120 pages contain 73 separate statistical tables in five major OCD programs. Of the book's pages, 56 are devoted to the shelter program, the objective of which is to provide "to those survivors of the blast and heat effects, fallout protection which will support and shield them during the period of intense radiation and fallout." Table 8 shows that, as of June 30, 1968, fallout shelter spaces for 97% of the country's population have been located, with 13 states hitting 100% or better. Table 12, however, shows that while cities with a population of 25,000 or more (45% of country's population) had shelter for 173% of their populations, those in the smaller cities and rural areas (55% of the country's population) had shelter for only 36% of their citizens. The ten most populous cities in the United States (usually assumed target areas) show the following fallout shelter capabilities:

City	Population Sheltered
New York	360%
Chicago	201%
Los Angeles	194%
Philadelphia	337%
Detroit	190%
Houston	165%
Baltimore	169%
Dallas	254%
Washington, D. C.	846%
San Francisco	423%

In rural areas and the smaller cities (less than 25,000) where no blast or fire effects would be expected and where fallout shelters could therefore be presumed to be effective, they are not so plentiful. At the *bottom* of the statistics in this same Table 12 are the less populated areas of the following states:

State	Population Sheltered in Smaller Cities and Rural Areas
Mississippi	9%
Louisiana	10%
South Carolina	14%
Indiana	18%
Texas	19%

Even in New York State where the overall figure shows that 212% of the population can be sheltered, in the rural areas and small towns only 50% of the population can be sheltered. In Illinois it's 40%. In California 27%.

The predicament does not go unnoticed in the Report. It states:

> *Shelter Construction in Federal Buildings* — Forecasts of population growth, and shelter space which will become available through present programs (NFSS, HFPS, etc.) indicate that additional ways must be found to develop shelter space if all the people in the nation are to be provided with protection. The U.S. Congress has authorized the General Services Administration to incorporate shelter construction in new Federal building projects. Since FY 1965 GSA has authorized shelter provisions in 61 new facilities...

According to Table 21 the record of GSA in authorizing shelter in new facilities is as follows:

Thru FY 66	32 building projects
FY 67	22 building projects
FY 68	7 building projects

The conclusion may be drawn from the tables of the *Annual Statistical Report, Fiscal Year 1968* as well as from its text that statistics showing fallout shelter spaces for 97% of the nation's population do not form a basis for optimism. (WM)

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SOVIET CIVIL DEFENSE IN GRADES FIVE, SIX AND SEVEN.
by Joanne Levey