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DETERRENCE & SURVIVAL
in the
NUCLEAR AGE

SECURITY RESOURCES PANEL
of the
SCIENCE ADVISORY COMMITTEE

Washington - November 7, 1957

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EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF DEFENSE MOBILIZATION
WASHINGTON, D. C.

November 7, 1957

The President
The White House
Washington, D. C.



Dear Mr. President:

We have the privilege of transmitting to the National Security Council, through the Honorable Gordon Gray and the NSC Planning Board, the Report of the ODM Security Resources Panel. This Panel was established by the Science Advisory Committee pursuant to NSC Action 1691-b(2), April 4, 1957.

Formation of the Panel began in May, under the able leadership of Mr. H. Rowan Galther, Jr., who, regrettably, had to withdraw in September* from further active direction of the undertaking for reason of health, but not before the study program was completely organized and the Panel was well under way in carrying out its responsibilities.

The make-up and organization of the Panel is shown in Appendix G, attached. Including advisors and staff, more than ninety persons of widely varying specialties and experiences participated in its work. Although the membership includes competent scientists and engineers—many with extensive familiarity with military technology—it was early decided that the Panel would not try for invention but, rather, would concentrate on the many studies undertaken by large and experienced groups, within our area of interest, both within and outside the military, and to try to relate them to our assignment.

Not only have these studies been carefully examined, but our working groups have spent considerable time with many of the participants in them, the better to understand the basic assumptions on which they were predicated and the methodology involved in the more important and pertinent war gamings.

*Mr. Galther recently rejoined the study as a member of the Advisory Panel.

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Special members of our Panel have received authorized access to particularly sensitive studies and Intelligence information, and the implications of these have influenced our final judgments.

Our membership has had complete cooperation from and full opportunity to question civilian and officer personnel of the Department of Defense, the Office of Defense Mobilization, the Central Intelligence Agency, the Federal Civil Defense Administration, the Treasury, the Bureau of the Budget, and other departments and agencies of the Government.

Thus the Panel, in the preparation of this Report, has benefited from information sources of extreme scope and depth; and the membership, in full and vigorous analysis and discussion, has assessed the implications of this knowledge and has directed its findings to the problem confronting the Panel. However, the Steering Committee, which includes the Director, the Co-Director, and the heads of the four Working Groups, have full responsibility for this Report.

We are grateful to the many who have worked and cooperated with us.

Respectfully submitted,



Steering Committee
Security Resources Panel

Robert C. Sprague, Director
William C. Foster, Co-Director

James P. Baxter	Robert C. Prim
Robert D. Calkins	Hector R. Skifter
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DETERRENCE & SURVIVAL
in the
NUCLEAR AGE

I. ASSIGNMENT

The Security Resources Panel was asked to study and form a broad-brush opinion of the relative value of various active and passive measures to protect the civil population in case of nuclear attack and its aftermath, taking into account probable new weapon systems; and to suggest which of the various active and passive measures are likely to be most effective, in relation to their costs. While fulfilling its assignment, the Panel was also asked to study the deterrent value of our retaliatory forces, and the economic and political consequences of any significant shift of emphasis or direction in defense programs.

The Panel has therefore examined active and passive defense measures from two standpoints: their contribution to deterrence; and their protection to the civil population if war should come by accident or design.

We have found no evidence in Russian foreign and military policy since 1945 to refute the conclusion that USSR intentions are expansionist, and that her great efforts to build military power go beyond any concepts of Soviet defense. We have, therefore, weighed the relative military and economic capabilities of the United States and the USSR in formulating our broad-brush opinions, basing our findings on estimates of present and future Russian capabilities furnished by the Intelligence community.

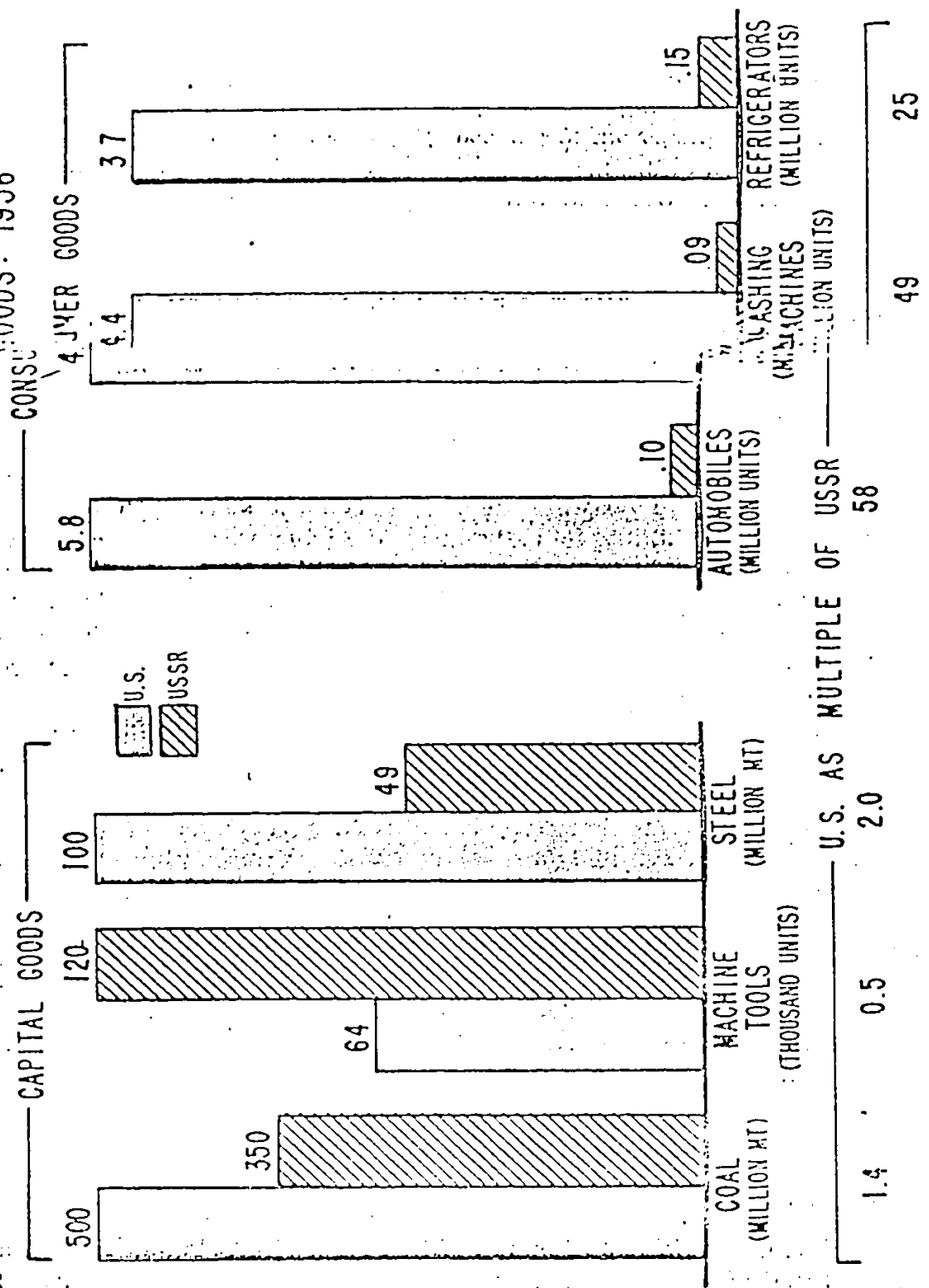
The evidence clearly indicates an increasing threat which may become critical in 1959 or early 1960. The evidence further suggests the urgency of proper time-phasing of needed improvements in our military position vis-a-vis Russia. A time table distinguishing four significant periods of relative military strengths is given in detail in Appendix A.

II. NATURE OF THE THREAT

A. Economic

The Gross National Product (GNP) of the USSR is now more than one-third that of the United States and is increasing half again as fast. Even if the Russian rate of growth should decline, because of increasing difficulties in management and shortage of raw materials, and should drop by 1980 to half its present rate, its GNP would be more than half of ours as of that date. This

FIG. 1
PRODUCTION OF SELECTED CAPITAL & CONSUMER GOODS: 1956

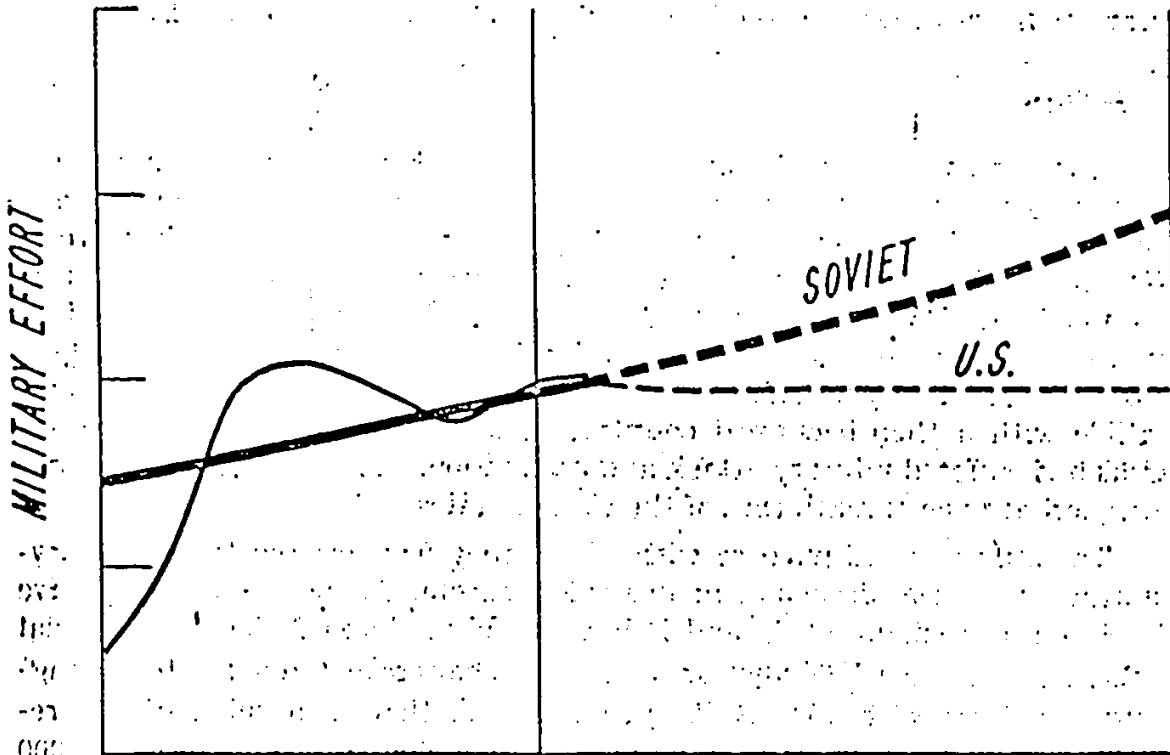


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FIG. 2



PAST AND PROJECTED RELATIONSHIP BETWEEN U.S. AND U.S.S.R. MILITARY EFFORT



1950

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FUTURE

growing Russian economic strength is concentrated on the armed forces and on investment in heavy industry, which this year account for the equivalent of roughly \$40 billion and \$17 billion, respectively, in 1955 dollars. Adding these two figures, we get an allocation of \$57 billion per annum, which is roughly equal to the combined figure for these two items in our country's current effort. If the USSR continues to expand its military expenditures throughout the next decade, as it has during the 1950's, and ours remains constant, its annual military expenditures may be double ours, even allowing for a gradual improvement of the low living standards of the Russian peoples.

This extraordinary concentration of the Soviet economy on military power and heavy industry, which is permitted, or perhaps forced, by their peculiar political structure, makes available economic resources sufficient to finance both the rapid expansion of their impressive military capability and their politico-economic offensive by which, through diplomacy, propaganda and subversion, they seek to extend the Soviet orbit. (See Figs. 1 and 2.)

B. Military

The Soviet military threat lies not only in their present military capabilities—formidable as they are—but also in the dynamic development and exploitation of their military technology. Our demobilization after World War II left them with a great superiority in ground forces, but they had no counter in 1946 for our Strategic Air Force nor for our Navy. They had no atomic bombs, no productive capacity for fissionable materials, no jet engine production, and only an infant electronics industry. This situation was compatible with a then-backward country, so much of whose most productive areas had suffered military attack and occupation. Their industrial base was then perhaps one-seventh that of the United States.

The singleness of purpose with which they have pressed their military-centered industrial development has led to spectacular progress. They have developed a spectrum of A- and H-bombs and produced fissionable material sufficient for at least 1500 nuclear weapons. They created from scratch a long-range air force with 1500 B-29 type bombers; they then substantially re-equipped it with jet aircraft, while developing a short-range air force of 3000 jet bombers. In the field of ballistic missiles they have weapons of 700 n.m. range, in production for at least a year; successfully tested a number of 950 n.m. missiles; and probably surpassed us in ICBM development. They have developed air-to-surface and probably submarine-launched cruise missiles; built 250 to 300 new long-range submarines and partially modernized 200 others. They have created an air defense system composed of 1500 all-weather and 8500 day jet fighters; equipped at least 60 sites, each with 60 launchers, for a total of over 3600 launching pads for surface-to-air missiles provided with a sophisticated and original guidance system and a ground environment

of 4000 radars. At the same time, they have maintained and largely re-equipped their army of 175 line divisions, while furnishing large quantities of military equipment to their satellites and Red China.*

III. BROAD-BRUSH OPINIONS

The Panel has arrived at the following broad-brush opinions as to the present situation:

A. In case of a nuclear attack against the continental United States:

1. Active defense programs now in being and programmed for the future will not give adequate assurance of protection to the civil population. If the attack were at low altitude, or at high altitude with electronic countermeasures (jamming), little protection would be afforded. If the attack should come at moderately high altitude and without electronic countermeasures, some considerable protection will be afforded the civil population.

2. Passive defense programs now in being and programmed for the future will afford no significant protection to the civil population.

B. The protection of the United States and its population rests, therefore, primarily upon the deterrence provided by SAC. The current vulnerability of SAC to surprise attack during a period of lessened world tension (i.e., a time when SAC is not on a SAC "alert" status), and the threat posed to SAC by the prospects of an early Russian ICBM capability, call for prompt remedial action.

The Panel has arrived at the following conclusions as to the value, relative to cost, of various measures for protecting the civil population.

* By the very nature of the sources of intelligence information, none of the specific numbers cited above can be precisely known. The approximate size of each number, however, and more importantly the over-all order of accomplishment, are well established by the available data.



A. Measures to Secure and Augment Our Deterrent Power

Since the prevention of war would best protect our urban population, we assign the highest relative value to the following measures to secure and augment our deterrent power. These would protect our manned bombers from surprise attack, increase our forces available for limited military operations, and give us an earlier and stronger initial operational capability (IOC) with intermediate-range and intercontinental ballistic missiles. Basic elements in this program are:

1. To lessen SAC vulnerability to a Russian surprise bomber attack in a period of low tension (a present threat):

a. Reduce reaction time so an adequate number (possibly 500) of SAC planes can get off, weapons aboard, on way to target, within the tactical warning time available. This can be done by promptly implementing SAC's "alert" concept.

b. Improve and insure tactical warning. Radars in the seaward extensions need to be modernized to assure tactical warning at high and low altitude, and the extensions need to be lengthened to prevent "end runs."

c. Provide an active missile defense for SAC bases (Nike-Hercules or Talos) against bombers.

2. To lessen SAC vulnerability to an attack by Russian ICBMs (a late 1959 threat):

a. Develop, to an operational status, a radar early-warning system for an ICBM attack.

b. Further improve SAC's reaction time to an "alert" status of 7 to 22 minutes, depending on location of bases.

c. Disperse SAC aircraft, to the widest extent practical, to SAC and non-SAC military bases in the ZI and possibly also to commercial airfields in the ZI.

d. Protect a large part of SAC's planes by providing 100 to 200 psi shelters, and equivalent protection for weapons, personnel, and other needed supplies and facilities.

e. Provide SAC bases with an active missile defense against ICBMs, using available weapons such as Nike-Hercules or Talos and the improved long-range tracking radars now existing in prototype.

3. To increase SAC's strategic offensive power (to match Russia's expected early ICBM capability):

a. Increase the initial operational capability of our IRBMs (Thor and/or Jupiter) from 60 to 240.

b. Increase the IOC of our ICBMs (Atlas and Titan) from 80 to 600.

c. Accelerate the IOC of the Polaris submarine IRBM system, which offers the advantages of mobility and greatly reduced vulnerability.

d. Every effort should be made to have a significant number of IRBMs operational overseas by late 1958, and ICBMs operational in the ZI by late 1959.

e. Hardened bases for the ICBMs should be phased in as rapidly as possible.

4. Augment our and Allied forces for limited military operations, and provide greater mobility, to enable us to deter or promptly suppress small wars which must not be allowed to grow into big ones. The Panel suggests that a study be undertaken, at the national rather than at a Service level, to develop current doctrine on when and how nuclear weapons can contribute to limited operations.

B. Measures to Reduce Vulnerability of Our People and Cities

The main protection of our civil population against a Soviet nuclear attack has been and will continue to be the deterrent power of our armed forces, to whose strengthening and securing we have accorded the highest relative value. But this is not sufficient unless it is coupled with measures to reduce the extreme vulnerability of our people and our cities. As long as the U.S. population is wide open to Soviet attack, both the Russians and our allies may believe that we shall feel increasing reluctance to employ SAC in any circumstance other than when the United States is directly attacked. To prevent such an impairment of our deterrent power and to ensure our survival if nuclear war occurs through miscalculation or design, we assign a somewhat lower than highest value, in relation to cost, to a mixed program of active and passive defenses to protect our civil population.

1. A massive development program to eliminate two major weaknesses in our present active defenses:

a. The vulnerability of the radars in our ground environment and in our weapons control to "blinding" by enemy electronic countermeasures (ECM).

b. The small probability of kills against a low-level attack.

2. Further strengthening of our active defenses as soon as their vulnerability to ECM and low-level attack is removed. Current research affords hope that at least our weapons-control radars can be made proof against ECM. Radars can be located at high points to guard against low-level attacks, and a barrage-type defense against low-level attacks from the sea might prove a stopgap. An effective air defense system is so important to ensure continuity of government, and to protect our civil population, our enormously valuable civil property and military installa-

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tions, that these development programs we suggest should be pushed with all possible speed.

3. A nationwide fallout shelter program to protect the civil population. This seems the only feasible protection for millions of people who will be increasingly exposed to the hazards of radiation. The Panel has been unable to identify any other type of defense likely to save more lives for the same money in the event of a nuclear attack.

The construction and use of such shelters must be tied into a broad pattern of organization for the emergency and its aftermath. We are convinced that with proper planning the post-attack environment can permit people to come out of the shelters and survive. It is important to remember that those who survive the effects of the blast will have adequate time (one to five hours) to get into fallout shelters. This is not true of blast shelters which, to be effective, must be entered prior to the attack.

We do not recommend major construction of blast shelters at this time. If, as appears quite likely, an effective air defense system can be obtained, this will probably be a better investment than blast shelters. However, because of present uncertainties, on both active and passive fronts, it appears prudent to carry out promptly a research and development program for such blast shelters since we must be in a position to move rapidly into construction should the need for them become evident.

A more detailed statement of the Panel's findings on passive defense is included as Appendix B.

4. A program to develop and install an area defense against ICBMs at the earliest possible date.

5. Increased emphasis on the R&D program to improve the Navy's anti-submarine effort, including defense against submarine-launched missiles. The principal protection against these latter may have to be provided by air and ballistic missile defense systems.

IV. RELATED CONCERNS

A. Improvement of Management of Defense Resources

The Panel has been impressed with the supreme importance of effective control and management of the resources allocated to defense.

The new weapons systems, in cutting across traditional Service lines, have caused management problems which have been difficult to resolve within existing legislative and organizational restrictions. We have lost ability to concentrate resources, to control performance and expenditures, and to change direction or emphasis with the speed that a rapidly developing inter-

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national situation and rapidly developing science and technology make necessary.

We are faced by an enemy who is able, not only ruthlessly to concentrate his resources, but rapidly to switch from one direction or degree of emphasis to another.

A radical reorganization of the Department of Defense might cause such confusion, at least temporarily, as to weaken our defense. However, some immediate steps to more effective control and management of our defense resources are urgently needed and appear practicable.

Some such steps can be taken without new legislation and certainly they would be timely, even before the return of Congress in January. A further step would appear to be a decision within the Executive Branch to seek from Congress the amendment of present legislation, which freezes the organization of the Defense Department along lines that may have been appropriate before the evolution of present weapons systems, but which are clearly inappropriate today and may become intolerable in the near future.

Changes in the Defense organization might take the following lines:

1. An increased focusing of responsibility and authority in operational commands, with missions appropriate to integrated weapons systems.
2. The concentration of research and development responsibilities for the two or three major integrated and complete weapons systems in manageable organizational units.
3. A more effective concentration of the military departments and departmental staffs upon training and logistics.
4. More direct command channels between the Secretary of Defense and the operational commands.
5. A command post-type staff, responsible directly and solely to the Secretary of Defense to assist him, both in the essentially managerial task of control and command, and in the long-term planning his responsibilities require.
 - a. Such a staff should be organized as a staff, not as an inter-agency committee. Policy should be established to encourage the objectivity of officers serving on such a staff; and rotation would enable them to keep abreast of appropriate developments bearing on the mission.
 - b. Officers serving on such a staff should be selected and relieved directly by the Secretary of Defense. Satisfactory service on this staff should, as on certain other joint staffs, meet one of the preliminary requirements needed for consideration for promotion.

Through such evolutionary development, the functions of planning, budgetary control, and operational command could increasingly be brought together and responsibility focused and delegated, rather than bucked.

The Panel further believes that coordination in depth between the Defense Department and those responsible for other aspects of our national policy, particularly the State Department, can be improved, especially in the field of forward planning.

Existing plans to protect and care for people in the event of attack have become obsolete as a result of the growing threat, and are therefore ineffective. Provisions for relocating government officials and for evacuating civilians are unrealistic in many respects. The plans of many states and metropolitan areas for handling local police, fire, health, water, sanitation and related problems are primitive in many areas.

Protection of the civil population is a national problem requiring a national remedy. We urge the re-evaluation of the existing organizational structure that distributes responsibilities among the Office of Defense Mobilization, the Federal Civil Defense Administration, the military, and state and local governments.

B. Strategic Warning and Hard Intelligence

Strategic warning—information obtained and correctly interpreted prior to the actual launching of an enemy attack on the United States—would be of immense value to this country. Further, it will become even more valuable as the maximum achievable tactical warning time shrinks to a matter of minutes in the case of a missile attack. At present, however, we have no assurance that strategic warning will be received.

We have too few solid facts on which to base essential knowledge of USSR capabilities and too few solid facts to learn how they are changing with time. From such observations, intentions may often be deduced. More positive and direct intelligence of USSR activities and accomplishments can be obtained by vigorous use of presently known techniques and available methods.

Because of their utmost importance to our actual survival, we urge exploitation of all means presently at our disposal to obtain both strategic warning and hard intelligence, even if some risks have to be taken, together with the vigorous development of new techniques.

C. Integration With U.S. Foreign Policy

The reduction of the vulnerability of the United States and its population should be made part of a broad program to improve the security and political position of the Free World as a whole, in accord with the enlightened self-interest of the United States.

If not so integrated into our foreign policy, any substantial program to reduce the vulnerability of the United States might be widely interpreted as signaling a retreat to "Fortress America." The USSR would be sure to fully exploit the resulting uncertainties.

Such an integrated program might include:

1. Measures, some of which are already under way, to pool and make more effective the economic, technological and political resources of ourselves and our allies.

2. Supplying NATO with nuclear weapons, to remain in U.S. custody in peacetime, for use in wartime under NATO command—as a means of increasing confidence.

3. Measures designed to assure the uncommitted nations that their national interests are truly a matter of continuing concern to us.

Such an integrated and comprehensive program could significantly raise the level of hope, confidence and strength in the Free World, and could give renewed prospect of securing Russian agreement to safe arms control and regulation.

V. COSTS AND ECONOMIC CONSEQUENCES

A. Costs

The added defense measures to which the Panel has assigned relative values will probably involve expenditures in excess of the current \$38 billion defense budget.

The measures of highest value, to strengthen our deterrent and offensive capabilities, are estimated to cost over the next five years (1959-1963) a total of \$19 billions.

Additional measures of somewhat lower than highest value, for the protection of the civil population, include a strengthening of active defenses, a fallout shelter program, and the development of a defense system to protect cities from missile attack. The estimated costs of these items total \$25 billions over the next five years.

More detailed cost estimates are shown in Appendix C. To initiate the measures of highest value will cost \$2.87 billions in 1959; and \$3.0 to \$5.0 billions per annum in the following four years. The entire program, including the lower-than-highest-value additional measures, would cost approximately \$4.73 billions in 1959, and annual expenditures rising to a peak of \$11.92 in 1961 and dropping to \$8.97 billions in 1963. Several of these measures will involve further outlays in excess of operating and maintenance costs after 1963.

B. Feasibility

These several defense measures are well within our economic capabilities. The nation has the resources, the productive capacity, and the enterprise to outdistance the USSR in production and in defense capability. This country is now devoting 8.5% of its production to defense, and 10% to all national security programs. The American people have always been ready to shoulder heavy costs for their defense when convinced of their necessity. We devoted 41% of our GNP to defense at the height of World War II and 14% during the Korean War. The latter percentage is somewhat higher than would be required to support all our proposals.

C. Economic Consequences

The additional expenditures for measures of highest value are barely within the estimated receipts from existing taxes in the first three years, and more definitely within estimated receipts thereafter, assuming continued and uninterrupted high employment and growth. To the extent that economies can be achieved in existing defense or non-defense programs, the increase in total expenditures could be minimized. An increase in the debt limit would be necessary. This would be a precautionary measure against the possibility that revenues may initially fall below the estimates based on high employment and because expenditures normally run ahead of revenues during a portion of the fiscal year.

The demands of such a program (measures of highest value) on the nation's economic resources would not pose significant problems. Aside from its psychological impact, increased defense spending would have some influence on capital investment. If a moderate recession is impending, tax receipts would decline, but the increase in Federal expenditures would help to sustain production and employment. Under conditions of full employment, the program would have some inflationary effects, requiring a continuation of monetary and credit restrictions.

To undertake the whole program of active and passive measures would involve outlays of \$4.8 to \$11.9 billions per annum over the next five years, and further unestimated expenditures thereafter. Except as economies can be achieved in defense and non-defense expenditures, these sums would represent additions to the Federal budget.

Large additional expenditures of this sort are still within the economic capabilities of the United States. They would necessitate, however, an increase in taxes, a somewhat larger Federal debt, substantial economies in other government expenditures, and other curbs on inflation. Additional private investment would be required, especially to carry out the shelter program which would impose heavy requirements for steel, cement and labor. In all probability, this program would necessitate some slow-down of highway construction and other postponable public works.

The early announcement of such a program would be a stimulus to the economy and would have an inflationary influence. Measures to cope with the inflationary problem posed by such an increase in defense spending should be planned as part of the program.

VI. PUBLIC EDUCATION AND POLITICAL CONSEQUENCES

The Panel urges an improved and expanded program for educating the public in current national defense problems, in the belief that the future security of the United States depends heavily upon an informed and supporting public opinion. We have been heartened by the recent announcement that positive steps will be taken to initiate what we hope will be a broad and sustained program of such education. We must act now to protect, for this and succeeding generations not only our human and material resources, but our free institutions as well. We have no doubt of the will and capacity of the American people to do so if they are informed of the nature and probable duration of the threat and if they understand what is required of them. Only through such enlightenment and understanding can we avoid the danger of complacency and the enervation of our inherent strengths.

VII. DETERRENCE AND SURVIVAL

The measures advocated by the Panel will help to unite, to strengthen and to defend the Free World, and to deter general war which would expose our cities and bases to thermonuclear attack. They would improve our posture to deter or promptly to suppress subversion or limited war, which may be more likely in the years immediately ahead. No one of these lesser enemy moves might directly threaten our survival. Yet, if continued, they might nibble away the security of the Free World as Germany undermined the superior military power of Great Britain and France between 1936 and 1939.

If deterrence should fail, and nuclear war should come through miscalculation or design, the programs outlined above would, in our opinion, go far to ensure our survival as a nation.

To illustrate the urgency of prompt decision and rapid action, we submit in Appendix A a time table of relative strengths under our present programs and the assumed Russian programs. As this appendix indicates, the United States is now capable of making a decisive air nuclear attack on the USSR. The USSR could make a very destructive attack on this country, and SAC is still vulnerable to a surprise attack in a period of lessened world tension. As soon as SAC acquires an effective "alert" status, the United States will be able to carry out a decisive attack even if surprised. This could be the best time to negotiate from strength, since the U.S. military position vis-a-vis Russia might never be so strong again.



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By 1959, the USSR may be able to launch an attack with ICBMs carrying megaton warheads, against which SAC will be almost completely vulnerable under present programs. By 1961-1962, at our present pace, or considerably earlier if we accelerate, the United States could have a reliable early-warning capability against a missile attack, and SAC forces should be on a 7 to 22 minute operational "alert." The next two years seem to us critical. If we fail to act at once, the risk, in our opinion, will be unacceptable.

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APPENDIX A

TIME TABLE

(Under Our Present Programs and Assumed Russian Programs)

Period A—Present Phase (starting now and ending 1959/early 1960)

Characteristics

1. U.S. has an adequate capability to make a decisive* air nuclear attack on Russia.

2. U.S. has an inadequate retaliatory capability if SAC bases are surprised at a time of lessened world tension, i.e., a time when SAC is not in a state of combat readiness. Prompt and aggressive implementation of the SAC "alert" concept would cure this defect.

3. USSR has capability to make a destructive attack on the U.S.

4. USSR has an inadequate retaliatory capability if SUSAC bases are surprised at a time of lessened world tension.

5. Although Russia will probably add to her inventory of long-range jet bombers during this period, the small number of these produced in recent months and the apparent lack of air-refueling of her large number of medium jet bombers indicate the Soviets are probably taking a calculated risk during this period and are shifting a large part of their national effort from manned bombers to long-range ballistic missiles.

Effects

1. A surprise attack by either SAC or SUSAC in a period of lessened world tension might almost completely disarm the other's long-range air atomic strike capability, unless and until either side has successfully implemented an adequate "alert" concept.

2. During this period, a surprise attack could determine the outcome of a clash between these two major powers.

3. As soon as SAC acquires an effective "alert" status, the U.S. will be able to carry out a decisive attack even if surprised. *This could be the best time to negotiate from strength, since the U.S. military position vis-a-vis Russia might never be as strong again.*

Period B—(starting 1959/early 1960—ending 1961/1962)

Characteristics

1. The USSR will probably achieve a significant ICBM delivery capability with megaton warheads by 1959.

* Decisive is defined as follows: (1) ability to strike back is essentially eliminated; or (2) civil, political, or cultural life are reduced to a condition of chaos; or both (1) and (2).

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2. U.S. will probably not have achieved such a capability.
3. U.S. will probably not have achieved either an early warning of or defense against an ICBM attack.
4. SAC will have increased modestly its number of operational bases, but none will be hardened.
5. Rapid increase in USSR stockpile of fissionable material and in weapons technology will substantially increase megaton load that can be delivered by manned bombers in the U.S.
6. In spite of continuing additions to our continental defense net, the attrition imposed on a manned bomber attack at low altitude and/or with electronic countermeasures will probably destroy only a small portion of the attacking force.

Effects

1. SAC could be completely vulnerable to an ICBM attack directly against its bases and weapons stockpile.
2. If the USSR were successful in a missile disarming attack against SAC bases, manned bombers could then deliver a decisive attack against the U.S.
3. This appears to be a very critical period for the U.S.

Period C—(starting 1961/1962—ending 1970/1975)

Assumptions: As a minimum, the SAC missile bases will be hardened, the U.S. will have a reliable early-warning capability against a missile attack; and SAC will have a significant part of its force on a 7- to 22-minute operational alert. These minimum objectives will require much emphasis and effort if they are to be achieved early in Period C.

Characteristics

1. U.S. and USSR will substantially increase their respective ICBM capabilities.
2. USSR will have achieved an early-warning capability to detect ICBM attack.
3. U.S. and USSR will begin to achieve some anti-ICBM defensive capabilities during the middle of the period.

Effects

1. An air nuclear attack by either side against the other could be decisive unless the attacked country had implemented, at a minimum, a nationwide fallout shelter program.
2. If all missile and bomber bases had also been hardened, the retaliatory strike could also be decisive if the attacker had not also implemented, at a minimum, a nationwide fallout shelter program.

Period D—(starting 1970/1975—onward)

Characteristics

1. U.S. and USSR both will continue to produce large amounts of fissionable material and long-range ballistic missiles.
2. Second and later generations of missiles, with solid propellents, CEPs measured in the thousands of feet instead of several miles, and with larger megaton warheads and quicker reaction time, will be put into production.
3. Both U.S. and USSR will develop improved means for detecting and defending against missile attacks.
4. The missiles in turn will be made more sophisticated to avoid destruction; and there will be a continuing race between the offense and the defense. Neither side can afford to lag or fail to match the other's efforts. There will be no end to the technical moves and counter-moves.

Effects

1. The net megaton attack which each side could deliver through the other's defenses might destroy approaching 100 per cent of the urban population, even if in blast shelters, and a high percentage of the rural population unless it were protected by fallout and blast shelters. An attack of this size and devastation would result in less than one-tenth the radiation required for world contamination.
2. This could be a period of extremely unstable equilibrium.
3. A temporary technical advance (such as a high-certainty missile defense against ballistic missiles) could give either nation the ability to come near to annihilating the other.

Implications of the Table

The above time table suggests the great importance of a continuing attempt to arrive at a dependable agreement on the limitation of armaments and the strengthening of other measures for the preservation of peace.



APPENDIX B

PASSIVE DEFENSE

Active defense cannot alone provide adequate protection to the civilian population. Even if most of the attacking weapons could be shot down, there would still be a major hazard from fallout. Passive defense will materially reduce casualties. The precise number differs widely with the type of program, the weight and pattern of attack, and the effectiveness of active defense.

The Panel has considered passive defense as a two-pronged* program: (1) shelters, and (2) survival in the aftermath of nuclear attack. Each aspect is interdependent with the other; and every shelter proposal must be examined in the context of the post-attack environment to see if, after varying conditions of attack, the sheltered population might reasonably expect to emerge into a situation permitting survival and recuperation.

A. Shelters

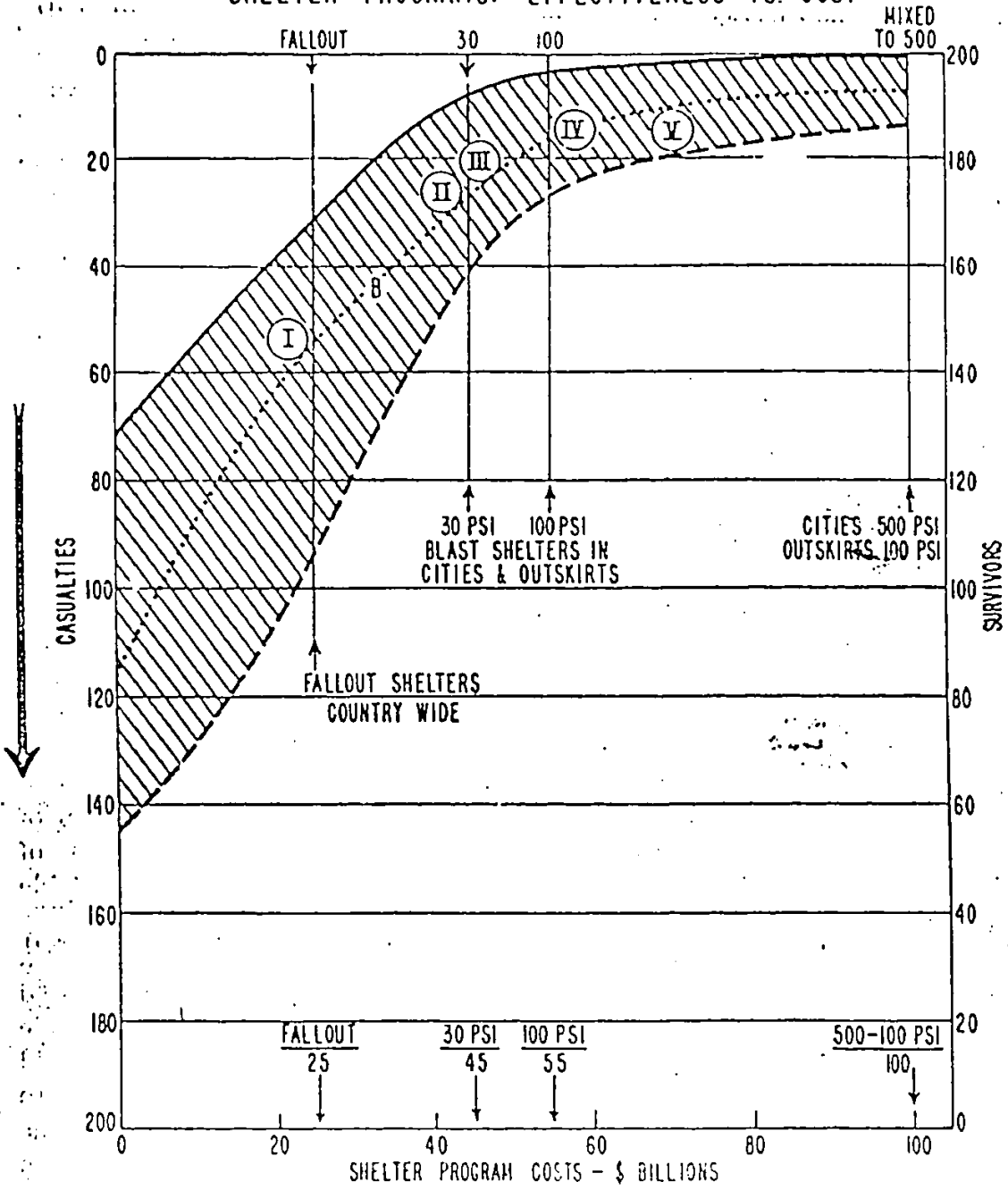
The many shelter plans examined by the Panel indicate that broad protection can be provided, and that the cost varies fairly directly with the effectiveness of the program. All programs are expensive, as might well be expected, since the cost of a nationwide effort is calculated by multiplying an amount in dollars per person by the two hundred million people we will be protecting in 1966. As a natural consequence, the programs must be kept simple, even spartan, to cut down on the cost per person. Safety, not comfort, is the keyword. Last, we emphasize a common aspect of all programs: none offers absolute protection, and even with a prohibitively expensive program we must anticipate heavy casualties if we are attacked.

We have centered consideration on a series of four programs ranging from fallout shelters alone through combinations of blast shelters and fallout shelters described in Fig. B-1. The curves on the chart** show the benefits of

* We have also examined such alternatives as evacuation and dispersal; the magnitudes of the costs and problems involved appear, to us, to make these unacceptable alternatives.

** These are not identical with the five plans considered in the Interdepartmental Report but, as evidenced by the chart, the correlation in cost results is extremely close. (Ref: Report to the National Security Council by the Special Committee on Shelter Programs, July 1, 1957.)

SHELTER PROGRAMS: EFFECTIVENESS VS. COST



-B..... 50/50 EMPHASIS ON URBAN AND MILITARY TARGETS
4000 MT (WEAPONS DETONATING IN UNITED STATES)
- INDICATE RESULTS OF FCDA SHELTER PROGRAMS I-V FOR THIS ATTACK
- EMPHASIS ON URBAN TARGETS, 7000 MT (WEAPONS DETONATING IN UNITED STATES)
- EMPHASIS ON MILITARY TARGETS, 3000 MT (WEAPONS DETONATING IN UNITED STATES)
- ▨ SHADED AREA REPRESENTS VARIATION IN EFFECTS FOR A VARIETY OF ATTACK PATTERNS

FIG. B-1

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the different shelter programs under varying conditions of attack that might penetrate our defenses.* The middle curve (Attack B—medium weight—divided between military and civilian targets—2500 megatons on target) shows that about half the population would be casualties were they completely without protection.

A program of fallout shelters for everyone would cost about \$25 billion and would save nearly half the casualties. Such a program would be equally or more effective in saving lives (perhaps fifty million) under an attack directed entirely at military targets.

It does not appear that any practicable addition to our defense, regardless of cost, can offer so much of a return under as wide a variety of conditions. (For example, their use is not dependent on warning, since they may be entered from one to five hours after attack. Further, fallout shelters are not outmoded by the transition from bomber to missile attacks.) As a bonus, such a program of fallout shelters would have a significant additional advantage of permitting our own air defense to use nuclear warheads with greater freedom.

If an adequate active defense system cannot be devised, we may have to turn to blast shelters to reduce further the severe—and probably unacceptable—casualty list with fallout shelters only. A program that might reduce the casualties under this same Attack B to about 10% of the population will cost \$20 to \$30 billions more, depending on the level of protection furnished.

Blast shelters present substantially more difficult problems than do those designed for fallout alone. Not enough is known of the design problems, nor is there sufficient test experience, to be able to plan a nationwide system of such structures without further extensive research and development. Typical of the factors that complicate planning for blast shelters are the decisions of locating them**—particularly in view of the shorter time that will be available for the population to reach shelters as ICBMs come into use.

We have examined cost estimates on many shelter programs and find a wide variation. The general figures used herein are comparable to those used in the Interdepartmental Report and seem to represent a reasonably attainable figure at the 1957 price level. The cost given for any of these programs would include provision of over \$10 billions' worth of equipment and the supplies to maintain the sheltered population for approximately two to three weeks.

The question of how fast to build any shelters involves balancing the 1959 need against the desire to spread out the expense so as to avoid overloading our construction facilities and our capacity to produce construction materials.

* A level of attack, far above any that we believe need be seriously considered at this time, is conceivable in the distant future; and this, if not intercepted at a distance, could lay down such a level of radiation that very large areas could, as a practical matter, be unusable for a period of years.

** And the elaborate public training required if they are to be used successfully by a high proportion of the public.

Perhaps five years for a fallout program would be an appropriate compromise; any blast shelter program would need to be spread over a longer period.

Any shelter program must presumably be accompanied by:

1. A strong program of organization and management of the construction phases to take advantage of all possible means of reducing costs by proper scheduling of manpower and materials and by efficient production-line techniques.

2. A program providing the necessary trained leadership and trained emotional and physical behavior in the general public requisite for their successful psychological and physical survival under shelter conditions and the aftermath.

B. Survival in the Aftermath

Our investigation of the post-attack environment has involved study of radiation levels, food supply, water, agriculture, transportation, utilities, communications, etc. Unquestionably, conditions may be harsh, increasingly so with each heavier level of attack assumed to penetrate our defenses. It appears, however, for the foreseeable future that sheltered survivors could pull through and remake a way of life in our own country.

Such a prediction presupposes careful planning, training and a strong central organization to handle both the attack and the post-attack situations. And—more important—it presupposes that the pre- and post-attack planning and organization have been done in parallel, with recognition, for example, that industrial preparedness is a necessary complement to any shelter program.

Far too little is really known about the recuperative powers of our industrial economy, and even less of the actual minimum requirements of the population surviving an attack. It is certain that there must be stockpiling of essential survival items to serve the surviving population for six to twelve months. In addition, the construction of additional hardened dispersed plants in a few critical industries (such as drugs and liquid fuels) is imperative. These seem problems of planning and ingenuity rather than items of major expense.

It seems that, for six or eight years, the safeguarding of industrial plant capacity should not be an overriding problem. But in the light of the heavier blows that are conceivable in the later 1960's, and particularly with a well-sheltered population, certain programs should be begun now to protect industrial facilities vital to the survival of this larger surviving population.

We feel it important that, concurrent with other survival plans, a strong program of appropriate medical research be undertaken. This will cost relatively little money; it could have great peacetime value in any case; and, in the event of actual attack, the results of such work might prevent literally millions of casualties from becoming fatalities.

C. Summary

As a consequence of examining various shelter and survival programs, their costs and implications, and of relating these to active defense programs and plans, the Panel believes:

A combination program comprising at a minimum nationwide fallout shelters and augmented air defense will give more protection for a given sum than will either all-out reliance on a maximum shelter program or on an air defense without shelters. This conclusion rests on the assumption that the two major weaknesses in our active defenses can and will be eliminated.

A year from now, the value and cost of still further expansion of air defense can better be weighed against the relative value of blast shelters. Additional active air defense appears now to offer a more favorable prospect of preventing casualties for no more money than a blast shelter program would cost, and, further, would save industry and structures.

In view of the fact that intensive research and development is probably needed before commencing major blast shelter construction, it seems wise to defer any decision regarding blast shelters for a year, during which time a research and development program would be initiated, and presumably the necessary job of augmenting our active air defense would continue.

Of itself, a shelter program would, in the Panel's opinion, forcibly augment our deterrent power in two ways: first, by discouraging the enemy from attempting an attack on what might otherwise seem to him a temptingly unprepared target; second, by re-inforcing his belief in our readiness to use, if necessary, our strategic retaliatory power.

Further, a shelter program might symbolize to the nation the urgency of the threat, and would demonstrate to the world our appraisal of the situation and our willingness to cope with it in strength. It would symbolize our *will to survive*, and our understanding of our responsibilities in a nuclear age.

Needless to say, the benefits that can derive from an intelligent and coordinated passive defense program are realizable only in the context of a superior over-all organization, charged with responsibility for the total job and with authority and means to get this job done.

APPROXIMATE INCREASED COSTS OF DEFENSE

MEASURES

1959 - 1963

EXPENDITURES (Billions of Dollars)

	5-Year Total	Fiscal Years				
		1959	1960	1961	1962	1963
A. Highest Value Measures (to strengthen deterrent and offensive capabilities):						
1a. Reduce bomber reaction time (for 1/3 the force) against bomber attack to less than 2 hours, the tactical warning time.	\$.54	\$.14	\$.17	\$.12	\$.08	\$.03
1b. Improve and insure tactical warning against bomber attack.						
1c. Provide active missile defense of SAC (NIKE-HERCULES or TALOS) against bombers.						
2a. Develop early warning against ICBM attack.	.30	.05	.15	.10		
2b. Further reduce SAC reaction time to 7 to 22 min. alert status.	3.36	.45	.80	1.17	.47	.47
2c. Disperse SAC to SAC, military, and civilian bases						
2d. Build 100-200 psi shelters for SAC planes, weapons and personnel.	1.50	.25	.50	.40	.35	
2e. Provide active missile defense of SAC against missiles—NIKE-HERCULES/TALOS (and against bombers, 1c. above) (assumes expenditures to \$36 million in FY 1958 and includes R&D and introduction of new systems for 4 bases by end of FY 1963).	2.90	.13	.50	.95	.75	.57
3a. Increase initial operational capability of IRBMs from 60 to 240.	.55	.10	.15	.10	.10	.10
3b. Increase initial operational capability of ICBMs from 30 to 600.	2.85	.30	.75	.70	.60	.50
3c. Accelerate initial operational capability of Polaris system (6 subs; 96 missiles).	1.30	.30	.30	.30	.20	.20
3d. Locate IRBMs overseas.	.29	.05	.14	.10		
3e. Harden ICBM bases.						
4. Augment forces for limited war capability. ¹	5.50	1.10	1.10	1.10	1.10	1.10
Sub-total	19.09	\$2.87	\$4.56	\$5.04	\$3.65	\$2.97



¹ A minimum estimate, to check declining capabilities.

APPROXIMATE INCREASED COSTS OF DEFENSE

MEASURES
1959 - 1963

EXPENDITURES (Billions of Dollars)

5-Year Total	Fiscal Years			
	1959	1960	1961	1962
\$ 2.40	\$.60	\$ 1.00	\$.80	
22.50	1.20	3.30	6.00	6.00
.23	.06	.08	.08	.01
<u>\$25.13</u>	<u>\$1.86</u>	<u>\$4.38</u>	<u>\$ 6.88</u>	<u>\$6.01</u>
<u>\$44.22</u>	<u>\$4.73</u>	<u>\$8.94</u>	<u>\$11.92</u>	<u>\$9.66</u>
				<u>\$8.97</u>

MEASURES

B. Lower Than Highest Value Measures (additional, to protect civil population):

1. Development program for eliminating major weaknesses in continental air defense (to correct radar "blinding" and improve low-altitude kill probability).
2. Further strengthen active defenses.¹
3. Fallout shelter program including R&D for blast shelters.
4. Develop city and area defense against ² ICBMs.
5. R&D anti-submarine defense.

Sub-total

Grand Total

Contingent Estimates:

¹ If development successful to eliminate weaknesses in air defense, implement CADOP Program which would involve additional expenditure of \$900 million in FY 1958.

² If development successful, produce initial installation in 1962 and complete national system by 1965.

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APPENDIX D

PROJECTED FEDERAL RECEIPTS AND EXPENDITURES

(Fiscal Years 1959 through 1963)

(Billions of Dollars)

	5-year Total	Fiscal Years				
		1959	1960	1961	1962	1963
Gross National Product*		457.0	473.0	490.0	507.0	525.0
Federal Receipts** (present taxes)		76.1	79.0	82.1	85.2	88.5
Federal Expenditures***		73.1	74.3	75.5	76.7	78.0
Surplus		3.0	4.7	6.6	8.5	10.5
<hr/>						
I Highest-Value Measures: (to strengthen deterrent and offensive power)	19.09	2.87	4.56	5.04	3.65	2.97
Surplus		.13	.14	1.56	4.85	7.53
II Somewhat Lower Than Highest-Value Measures: (additional, to protect civil population)	25.13	1.86	4.38	6.88	6.01	6.00
Total Program	44.22	4.73	8.94	11.92	9.66	8.97
Surplus and/or Deficit		-1.73	-4.24	-5.32	-1.16	+1.53

* Estimates based on uninterrupted growth in GNP at 3½% per annum with no inflation.

** Receipts from existing taxes rise faster than GNP because of income tax rates.

*** Defense expenditures of \$38 billions annually; non-defense expenditures increasing at 3½% per annum.

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APPENDIX E

AN EARLY MISSILE CAPABILITY

The early acquisition by SAC of an ICBM capability and the implementation of an IRBM capability overseas will greatly increase this country's offensive posture and deterrent strength.

An integrated program of Atlas and Titan, and an IRBM program including the achievement of a significant operational capability at the earliest possible date, should be given the highest national priority. It does not appear unreasonable nor too great a risk to consider at this time a rapid build-up of IRBMs and their deployment on overseas bases if they can be obtained. With a major effort, it appears possible to have at least one squadron in place during the last quarter of 1958, and 16 squadrons in place overseas before the end of 1960. Such a time scale would require decisions in the near future, some additional funds and an intensive training program in order to provide operational crews as rapidly as the missiles become available.

It appears possible to plan a build-up of ICBMs in the order of 60 squadrons (600 missiles) by the end of Fiscal 1963. The ICBMs will probably become available during 1959. The limiting factor in their deployment (assuming that no major technical difficulties are encountered) will be the rate at which launching sites and crews are made ready. The first site could become operational in 1959. The speed of build-up is adjustable over a wide range if one is prepared to take some risk now.

Except for the initial Atlas group, all ICBM bases should incorporate hardening against the Soviet ICBM threat.

The Polaris submarine-based weapon system, with its great mobility and security from attack, will be a valuable addition to a mixed strategic offensive force. Strong support should also be given to this program in order to speed up the first planned operational capability for 1963 by at least a year, and to increase the planned force of six submarines for 1965 by approximately a factor of three. A mixed offensive force complicates the defense of an enemy and increases his uncertainty.

The Polaris missile will be a solid-fuel rocket which makes it a much more desirable weapon than the early IRBMs for overseas deployment. It appears that the design of this missile for land-based use could be completed by early 1959 if desired. We believe that it is important to achieve this capability at the earliest possible time.

When this missile becomes available it might be phased into the liquid-fuel IRBM program.

APPENDIX F

ACTIVE DEFENSE

An active continental defense system must contend with three different threats: manned bombers, intercontinental ballistic missiles, and submarine-launched missiles. Each of these poses its own peculiar problems for defense, and each requires alerting for optimum operation. Defense and warning systems to contend with the submarine threat and the bomber threat exist, and are scheduled for improvement. However, these now have and, as presently planned, will continue to have limited capabilities. Design concepts exist for a variety of anti-ballistic missile defense and warning systems. But no operational units have as yet been built or tested.

A. Defense Against Manned Bombers

1. Warning

The present and planned system for providing tactical warning of enemy manned bombers approaching the continental United States has serious limitations which can be corrected. This problem has been studied in detail by a subcommittee of the Joint Chiefs of Staff Ad Hoc Committee on Air Defense of North America, and an excellent report presented 30 June 1957.

In general we are concerned that:

a. The early-warning radar network is our principal means of collecting warning data on aircraft to permit two or more hours' warning, which is absolutely essential in the near future (e.g., for the protection of SAC). However, the complete network is not scheduled to be operational until mid-1960; and, even at this date, much of the network will be equipped with obsolete equipment.

b. Even when completed, the presently planned system can be flanked with distressing ease, considering Soviet capabilities.

c. The presently operational seaward extensions have very poor radar coverage. A significant improvement is immediately feasible.

d. Identification and raid-size determination techniques are weak but can readily be improved.

e. Research on warning devices has lacked direction and emphasis. The search for new and improved techniques should be pressed with vigor. Infra-red techniques should receive particular attention.

We have no reason whatsoever to feel complacent about the effectiveness of our warning system. The cost of warning is small, its value is very real, and provision of the degree of warning required is well within our technical abilities.

2. Air Defense System

The continental air defense system as it now exists, and as it is now planned to be, does not and will not provide this country with a significant level of protection. It has a number of "Achilles' heels" which can be exploited by an intelligent enemy. It is ineffective in the face of electronic countermeasures, saturation tactics, and low-altitude attacks. We believe that it is possible, with a determined effort, to improve this situation markedly by 1961, and to have a highly effective air defense system by 1963. It is our belief that it would take only a moderate increase in total Defense Department budget, properly spent, to make a large improvement in the air defense system. But when we examine the history of air defense, we conclude that an effective air defense system is unlikely within the present organization framework. The lack of a clear-cut single assignment of responsibility for weapons development, systems design, and implementation has allowed vulnerabilities to persist long after they were recognized. It is imperative that a competent technical group be given the responsibility for planning a balanced defense system in the light of *continually* changing technology and the *continually* changing threat. By the very nature of the problem we face, this group must be heavily technical with military support, as opposed to the present concept of being heavily military with technical advice.

B. Defense Against the Ballistic Missile

1. Warning

A detection system capable of providing early warning against a ballistic missile threat is technically achievable. Such a system would ideally consist of a number of radars located far in the north, possibly at Thule and Fairbanks. An orderly program is recommended; however, in addition, we now believe that a crash program to provide some warning at the earliest possible time is vital, and we believe it could be attainable early in 1959.

The airborne infra-red detection system (mentioned earlier in this Appendix) may provide the earliest attainable system having the capability of providing ICBM warning. We urge that it be given a careful evaluation in the near future.

2. Interception of Ballistic Missiles

Several systems have been proposed which appear to have capability of intercepting ballistic missile warheads at sufficient distances to prevent their doing serious damage. These systems fall into two distinct categories.

The first group are systems assembled from air defense components such as Nike-Hercules, or Talos, and existing long-range radars. These proposed early systems offer a reasonably high defense capability for points such as SAC bases against the early threat, but do not have the capability needed to provide protection for extended areas. In addition, early ICBM interception would occur at moderate altitudes—on the order of 30,000 feet or less—so there is danger

of damage to the population and structures from blast and heat. Because these systems are assembled from existing components requiring only moderate modification, a limited operational capability could be available in early 1960, with complete SAC base defense in 1962. These defenses would also have a capability against bombers and thus would prevent sneak attacks.

The other group of proposed missile defense systems aims to intercept the incoming warheads at much higher altitudes. To do this in the face of decoys poses a number of technical questions, the answers for which require a high-priority research and test program. However, the importance of providing active defense of cities or other critical areas demands the development and installation of the basic elements of a system at an early date. Such a system initially may have only a relatively low-altitude intercept capability, but would provide the framework on which to add improvements brought forth by the research and test programs.

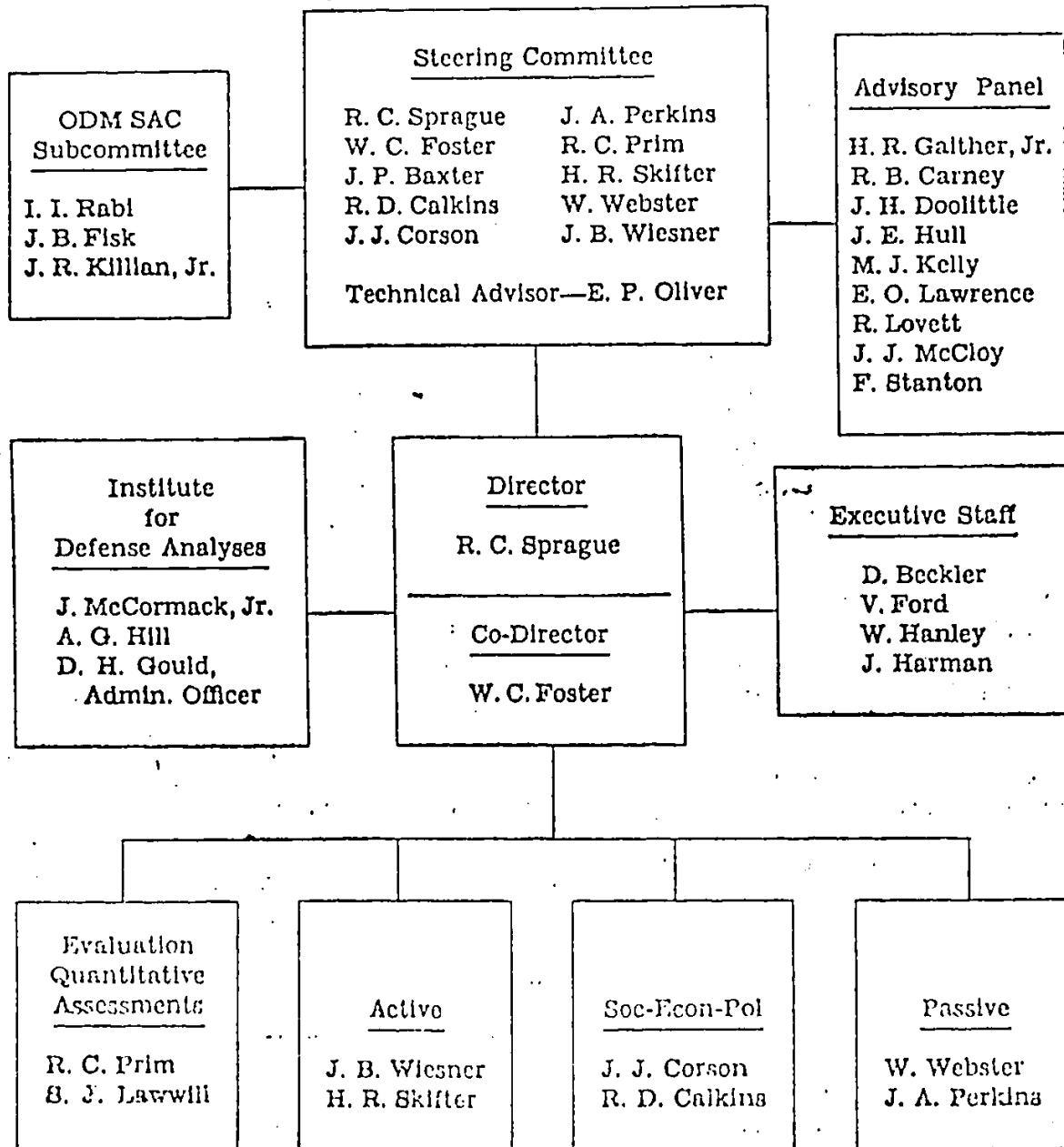
C. Defense Against the Submarine-Launched Missiles

The submarine-launched missile threat is a formidable one for which there is presently no known adequate countermeasure. The SOSUS underwater-sound surveillance system provides some measure of warning of the approach of submarines but the probability of detection of truly quiet submarines is small. Even if a submarine were detected, it is not certain that it could be identified as hostile and killed before it launched its missile load. We believe that anti-submarine efforts should be greatly augmented, particularly in research and development. For the immediate future it seems that the principal protection against submarine-launched missiles will have to be provided by the air defense and ballistic missile defense systems. The submarine-launched missile threat imposes several additional requirements on the design of such systems. A submarine-launched missile defense system is required to acquire targets over a wide range of angles; and the warning time available to alert the system is considerably less—less even than is available against the ICBM. However, it may be noted that at least one of the missile defense systems mentioned above has been conceived with these requirements in mind.

In conclusion, we feel that planning and performance in active defense are inadequate. However, we believe that an adequate defense is feasible and, furthermore, that active defense is an essential part of the national military posture. The active defense system must be balanced, e.g., even in the ICBM era, the manned bomber will remain an important threat.

APPENDIX G

SECURITY RESOURCES PANEL



SECURITY RESOURCES PANEL.

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