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by stockpiling and dispersion. There is no magic formula to simplify this list. We need every element and we need it in time.

Second, most of the basic technical problems raised by the threats of attack by manned bombers and from the sea have been solved; the rest seem solvable. It is the scale of our technical effort, and its planning and integration in detail, which need attention. Above all and throughout, we must strike a realistic balance between technical perfection and timeliness.

Granted solutions to the technical problems the question rises—Can we build *enough* defense and can we built it *fast* enough? The answer hinges on innumerable factors, many of an intangible nature. We have analyzed those within our competence, calculating some, and estimating others. We have concluded:

The nation can afford enough protection against the air and seaborne threats to create a serious obstacle to effective attack, an obstacle whose appreciation by the USSR would be a direct and forceful deterrent. To defend at this level demands an increased and balanced effort which must be matched to the increasing threat.

Our studies of the various aspects of defense have led us to the following conclusions of a more specific nature:

a. Adequate air defense requires effective early warning and surveillance and active defenses in depth. The system visualized and under construction by CONAD has these concepts.

b. It is imperative that an early warning system be completed as rapidly and as effectively as our ability and resources permit. The warning system must provide information in depth. It must detect potential attackers several hours from our boundaries; must give an unequivocal signal for action when attacking aircraft are still a few hundred miles away; and, in the later stages, must provide sufficiently detailed information to permit effective deployment of defensive forces.

c. In addition to numerical deficiencies, the present active air defense system suffers from serious high and low altitude gaps in the radar cover, inadequate interceptor capability at high altitudes, and grave weaknesses in all weapons at low altitudes.

d. Thermonuclear weapons demand strong active defenses and place a premium on destroying attackers long before they reach heavily populated areas where serious damage can result from a downed or jettisoned bomb; a defense which meets these challenges must include extensions seaward and northward, and eventually southward, several hundred miles beyond our continental boundaries. Realistic rules for identification and engagement must develop with the outward extension of the system.

e. Nuclear weapons are the most effective armament with which we can equip our air defense forces. They provide the most direct and reliable method of achieving the high kill probability against single aircraft that modern air defense demands, of creating a potent defense against saturation type attacks, and of actually destroying the enemy nuclear weapons. Recent studies have shown that



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the air-to-air atomic rocket can be made compatible with existing and programmed interceptors. The investment cost of fissionable material for nuclear warheads is a small fraction of the total cost of the air defense system. The radioactivity which would be added to the atmosphere by the large-scale use of nuclear defense warheads would be no more than that from a single large strategic weapon and would cause no dangerous fallout.

f. Nuclear missiles and mines transported by sea and delivered against our harbor and coastal belt could be important components of a surprise attack. Serious deficiencies exist in the present and programmed measures for defense against these threats. Our technological and economic resources are adequate to provide acceptable solutions, but traditional concepts of territorial waters and freedom of the seas must be amended to permit fully effective defensive controls.

g. An effective civil defense may be a major factor in national survival in the event of nuclear attack on this country; without effective civil defense, freedom of action on the part of the United States to adopt a firm peacetime foreign policy may be dangerously limited. Although the advent of thermonuclear weapons has radically increased the threat to our civil population and altered the protective measures required, a civil defense which would save millions of lives is technically and economically feasible.

h. In the event of atomic war, one of the most important elements in providing the requisite national resiliency will be the ability of the people to resume organized activity after the initial attack. We are concerned over the concentration of our essential civilian supporting industries in critical target areas and the lack of a positive national program designed to reduce this vulnerability.

The Threat of the Intercontinental Ballistic Missile

New and complex problems are raised by the threat of the intercontinental ballistic missile which may well face us in the 1960-70 decade. The enormous speed makes warning short at best, leaves little time for defensive or protective action and renders destructive measures extremely difficult. Nevertheless, we feel, the situation is not hopeless. As a result of our studies we have concluded:

a. Although the technical problems are extremely complex, the attainment of means for countering such missiles appears sufficiently promising to justify an expanded and accelerated program of research and experimentation. The recent formation of a special subcommittee of the Air Force Scientific Advisory Board is a significant first step toward the planning of such a program.

b. We believe it practicable to build a radar system providing approximately 15 minutes warning of the arrival of an ICBM, and giving a reasonably good localization of the expected target area. Such a system would be of great value to our retaliatory forces and in saving lives whether or not a successful defensive weapon system can be devised.

c. Attack by manned bombers will continue to be a threat long after the advent of intercontinental missiles.