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PROJECT RAND

DISPERSAL—AN EXPEDIENT FOR PROTECTING SAC (U)

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SUMMARY

Our country's deterrent posture depends critically on how well our offensive striking force is protected against attack. This study examines the feasibility, payoff, and cost of dispersal to civil and non-SAC military airfields as an effective method of increasing the fraction of surviving SAC bombers. We are dealing with the next three to four years--the measures discussed are emergency expedients.

Although dispersal looks good as an emergency expedient, several problems peculiar to dispersal cannot be disregarded. One is the political feasibility of basing combat-ready bombers on civil airfields. Another problem is command and control of small units scattered over the country.

It is concluded that dispersal of the B-47 force and improved alert can further reduce force vulnerability against either a sneak bomber attack or an early ICBM attack. Additional measures, combined with dispersal, can assure an acceptable degree of invulnerability in the long term.

CONTENTS

I. INTRODUCTION

Over the past several years RAND has made a number of studies of the critical dependence of our country's deterrent posture on how well our offensive striking forces are protected. Most of these have dealt with measures appropriate for a period beginning several years in the future. They have allowed the reader to feel that, given sensible actions and choices, our shortcomings might be satisfactorily overcome by the end of the period. But they have not been concerned with the interim between now and the application of the studies. This study deals with the immediate future--the next three to four years. The measures discussed here are emergency expedients.

MEASURES FOR PROTECTING SAC NOW

We can take no lasting comfort in any set of emergency measures that has been examined. Still, there are very substantial differences between our best and worst moves (the worst move of all may well be no move).

Some of these measures that might be taken to protect our retaliatory forces are:

First: increase the extent of warning, and its likelihood.

Second: improve the response of our offensive forces, both in rapidity and in the fractions reacting.

Third: compel the SU to use larger and larger forces, thus making useful warning more likely.

Fourth: increase the fraction of the force that is less exposed and thus less vulnerable to attack.

and Fifth: make the fraction of force surviving a more definite threat by assuring that it will be well organized and able to penetrate into the Soviet Union.

This paper proposes the use of dispersal as an effective method of increasing the fraction of surviving SAC bombers, and provides a detailed examination of the feasibility of dispersal.

The job of continually maintaining a strong retaliatory force is certainly not the responsibility of the Air Force alone, though the Air Force has the major role. The Strategic Air Command is the largest and most vital part of our total retaliatory power. Its capability to act effectively in the face of Soviet military actions against this country is of first priority as has been repeatedly pointed out. For the next few years, the responsibility rests with SAC's bomber force.

PRESENT STATUS

What is being done? What can be done in the next few years? SAC has announced that a fraction of its force is on a 15-min alert, but to take advantage of this readiness we will need warning. We will not have effective ballistic missile warning until 1962, and even then this warning system can be outflanked or jammed. SAC is experimenting with combat air patrol, and RAND is co-operating in these experiments. But the starting point is about 5 per cent of the force airborne, and while the tests show promise, the protection of a large fraction of SAC is far from assured as things now stand. Shelters and measures for the flushing and regrouping of bombers and tankers have been advocated. These are effective measures, but shelters appear to have considerably longer lead times than does the dispersed posture discussed here. Also, the effectiveness of the shelters would be increased by locating them on more bases. Recovery, too, would become a more effective measure as the number of bases is increased.

It follows, then, that dispersal appears to be quite attractive on first thought to most people. A few people then have a second thought about dispersal as a long-term solution: it is clearly not economic to build a new base each time the Russians can increase their delivered missiles by one or two. Dispersal would have to be combined with other measures to be effective in the long term.

On the other hand, so long as the Soviets are limited to a fairly small ready ICBM force, increases in the actual number of SAC bases of operation would reduce the number simultaneously wiped out. A recent check showed that the SAC bomber force was programmed for dispersal on 62 bases in the ZI. While B-52's are to be dispersed to squadron level, B-47's--making up 70 per cent of our bomber force in being--will still be crowded onto 17 bases. Dispersal of these bombers, along with their tanker support, is the objective of this study. It is hoped that through dispersal, time can be bought to take appropriate action for the protection of our heavy bomber force, and our ICBM force as it is phased in.

STUDY STRUCTURE

A decision to disperse during this period should be based on a number of factors. The dearth of clearly good early alternatives has been discussed. Let us discuss now our survey of civil airfields, the availability of non-SAC military fields, the new construction required for SAC use of these fields, and how the dispersed B-47 bombers might be maintained. Then we can discuss how dispersal could affect survival for a spread of intelligence estimates of Soviet ICBM force sizes and qualities. Finally, estimates of costs and timing will be presented.

II. AVAILABILITY OF NON-SAC AIRFIELDS

The quickest way to disperse is to make full use of airstrips now in existence. There are, for instance, almost 600 civil airfields in the United States with at least one runway 5000 ft or more in length. However, after an exhaustive search, the lack of definitive data, particularly on runway load-bearing capacity, required that half of these fields be ruled out for anything other than lightweight B-47 operations at this time. Because of climatic variations and performance limitations of the B-47 on takeoff, only two civil fields can be expected to support these bombers for maximum gross weight takeoff, year around. One way to alleviate this situation is to extend runways. A less costly alternative and perhaps more quickly attainable would be to operate from the civil fields at less than maximum gross weight. The effect on the alert strike of this expedient has been investigated and it is felt that the effect can be tolerated or overcome; a point to which we shall return later.

Specifically, reduced fuel loads down to 30 per cent of maximum were examined. The number of usable civil airfields, in winter and in summer, for each of three fuel-loading conditions: 100, 70, and 30 per cent, are shown in Fig. 1.

Acceptable runway utilization, or frequency of use, is shown on the figure by the hatching indicated in the legend. High or full utilization is 50 times the low or emergency utilization rate.

At 100 per cent fuel loading, a takeoff gross weight of 226,000 lb, there are, as mentioned earlier, only two civil airfields capable of supporting the B-47 under the worst summer conditions. On the other hand, if bombers are fueled to 70 per cent of capacity and low utilization rates are acceptable,

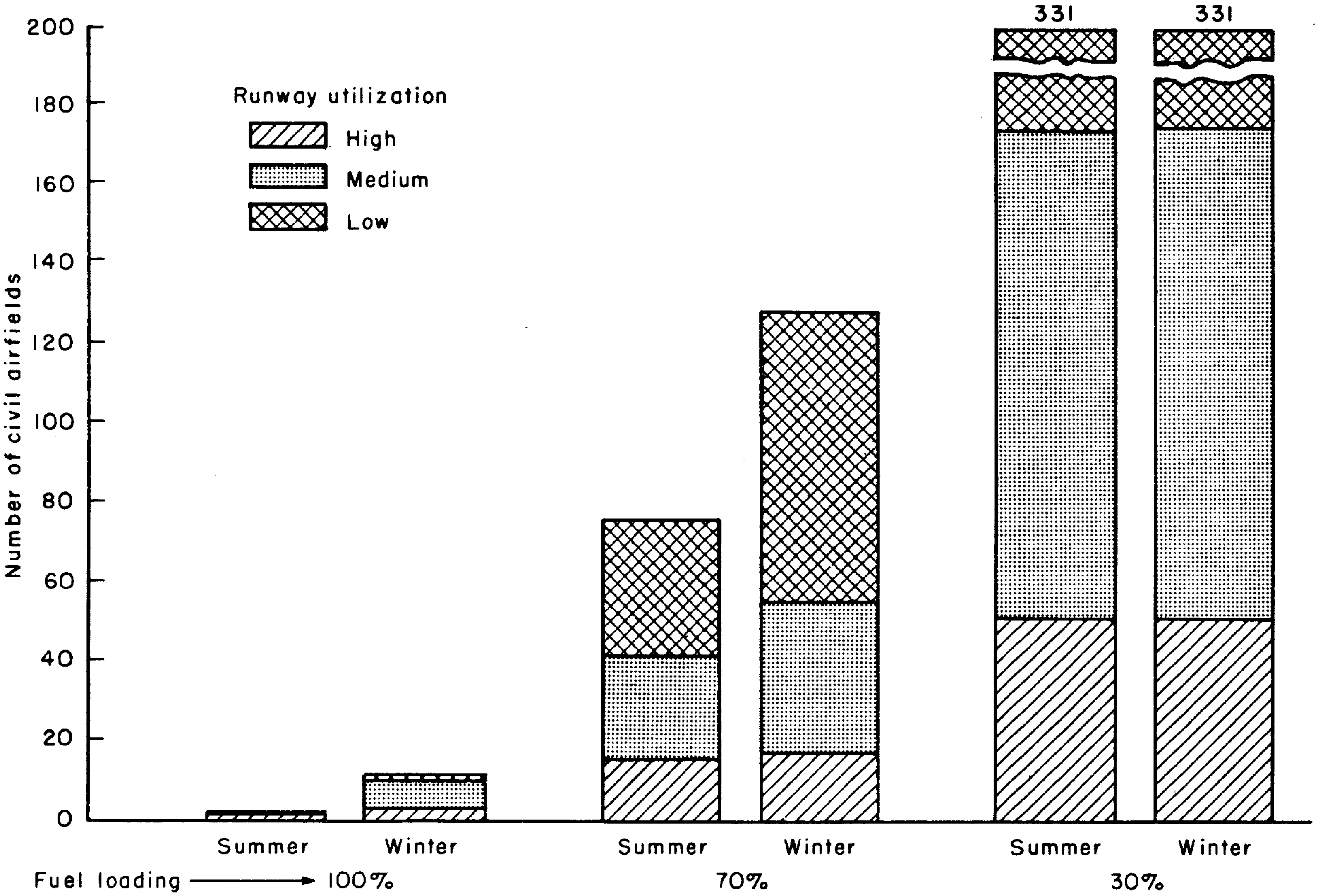
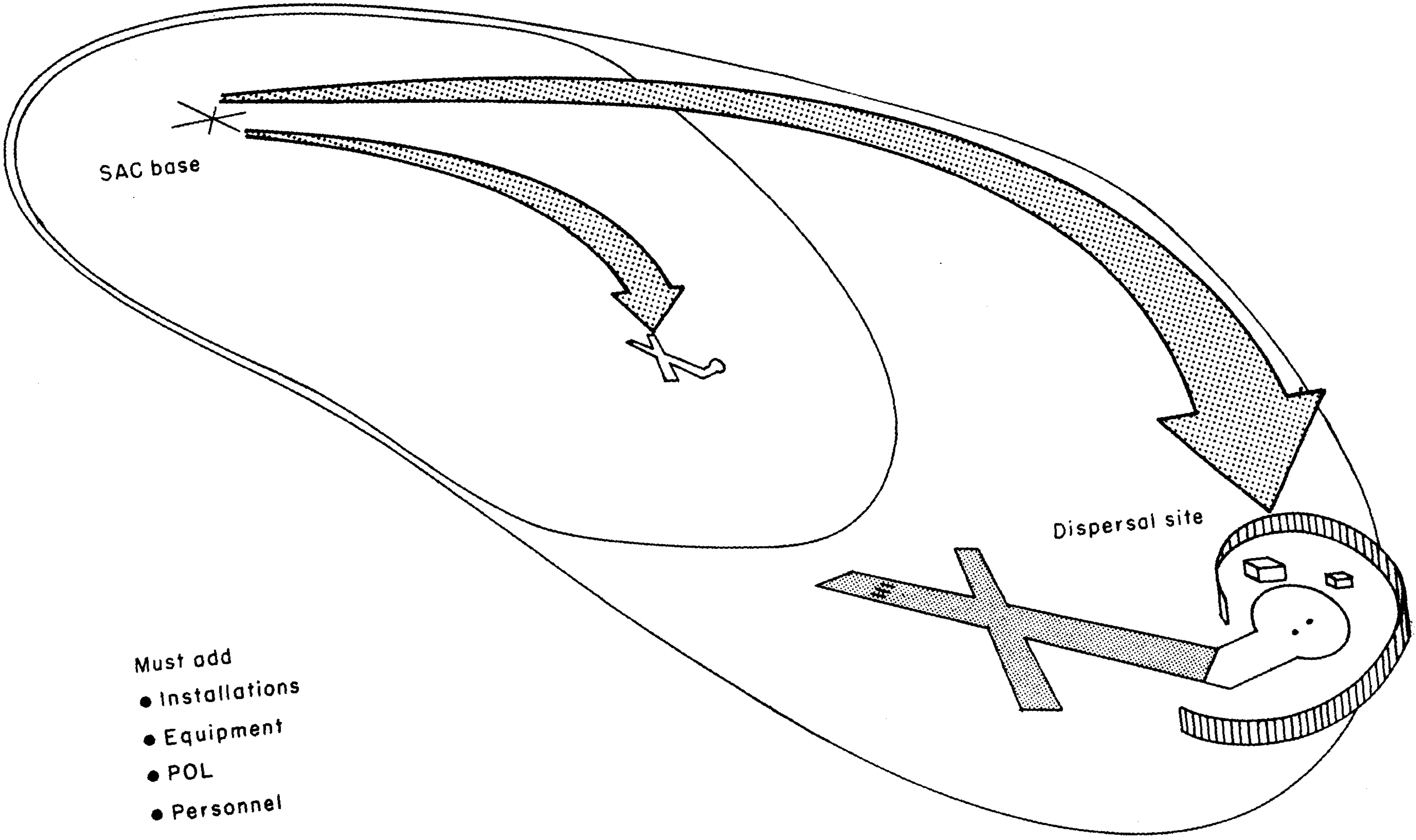


Fig. 1—Number of usable civil airfields

(B-47E IV: water injection, ATO, no wind) additional fields can be used. We estimate that there are 76 existing civil fields that will support takeoffs at at least 70 per cent fuel load, even in summer, using both water injection and ATO. In winter, the number of usable fields is estimated to be 129. Since the kind of operation we will be discussing generates only 100 to 125 cycles per year, and these at an even lower gross weight, say 30 per cent fuel load, fields shown in this class may be useful also. Only in emergency, taking off for target, need the takeoff gross weight be as high as the aircraft weight with at least 70 per cent fuel load.

It is estimated that an additional 50 military, non-SAC bases may be usable by the B-47 at this same reduced fuel loading--70 per cent. Considering the civil and non-SAC military bases in the ZI combined, there are, therefore, about 126 fields in existence today that might be used in a dispersal plan for the B-47 in emergency. Including the 62 programmed SAC bases, our strategic bomber force might possibly be deployed on 188 bases.

The existence of a runway, however, is not sufficient to support bomber operations, and interference with operations already established should be kept to a minimum. To these ends, each dispersal site would be modified, perhaps as shown in Fig. 2. At the dispersal site (Fig. 2), concrete would have to be added for a heavyweight turn-off branch and alert pad. Fuel storage could be provided by two 1000-barrel, above-ground, portable tanks, and a pumping system (an alternative of underground tanks with two hydrants has been considered also). Alcohol-water fluid and LOX storage, perhaps supplied by civil contractor, would be required. Quarters would have to be added for personnel, and some storage or shelter provision should be provided for ground-handling and maintenance equipment. No provision



Must add
- Installations
- Equipment
- POL
- Personnel

Fig. 2 — Operational concept

for weapon storage would be provided, since bombs could remain on board the bombers at the dispersed sites.

III. MODE OF OPERATION

Given these facilities, we have studied several modes of dispersed operation that keep both cost and operational complexity low, and still provide an effective, combat-ready alert force. The operation of SAC B-47's from dispersed airfields might, for example, take the following form or some variation of it. It is assumed that 12 dispersed alert aircraft per wing are spread over three sites, or four per site. These aircraft, along with necessary personnel, are rotated into the dispersed sites for a period of two to three weeks before being relieved, and are on alert for as much of the period as possible. The rotation is at random so the Soviet Union must target all usable fields. Except in an emergency (taking off for target) and when being rotated to and from the main base, these aircraft remain alert on the ground, with both mission fuel (≥ 70 per cent) and bombs aboard. The actual operation might go something like this:

Early on the day rotation is to occur, the aircraft already at the site (group 1) are defueled from the mission fuel load down to a light, runway-saving condition that permits them to return to home base with normal fuel reserves. Shortly after these aircraft have departed, group 2 aircraft arrive, together with one additional KC-97 carrying group 2 operations, maintenance, security and housekeeping personnel. The B-47's have flown in light, weapon aboard, and with ATO in place but unexpended. Group 1 ground personnel still at the site "spot" the arriving aircraft on the alert pad and fuel them to mission takeoff weight. Post-landing inspection is accomplished by the group 2 ground crews, and required flight-line maintenance. A simulation of this arrangement using B-47 data indicates that 80 per cent of the bombers could be expected to be emergency combat-ready within 16 hours of arrival of the planes, and 90 per cent would be ready within 24 hours.

Surprisingly enough, it is estimated that neither concept would degrade flight-line maintenance at the home base badly enough to prevent the flying of the full training program with the 33 aircraft remaining there.

IV. EFFECTIVENESS OF DISPERSAL

The value of dispersal can be illustrated in terms of the major uncertainties concerning Soviet missile capability; these are--number of ready missiles in their force, relative simultaneity of their assumed strike, and the time, or year, by which various capabilities may be attributed to them. To help define the assumptions used and to provide a basis for comparing various SAC postures under assumed Soviet attack, it will be necessary to introduce a few campaign numbers at this point. Although specific numbers are used, the emphasis should be on their relative values.

We are dealing here with an alert force of 420 aircraft, deployed on the 62 bases in the SAC program or on all 188 usable airfields in the ZI, under summertime conditions. Increasing numbers of "ready" missiles are assumed in the Soviet attacks. The S.U. missiles are presumed to have been held on 15-min alert for an intermediate period of time. The countdown reliability from this "ready" state is 0.65; in-flight reliability is assumed to be 0.80. Both reliability figures are those commonly quoted as planning factors for our own missiles.

Light Missile Attacks

If the SAC alert force is deployed on only 62 bases, fully fueled, with bombs aboard, and the Russians employ 2-MT warheads, with 5-n-mi CEP's, fired to impact simultaneously, the expected force surviving deteriorates so rapidly with an increase in missiles that less than a fifth of the force could be expected to survive a simultaneous salvo of 400 missiles. Deployed on 188 bases, that is, every usable field, approximately 60 per cent of the force might survive. Even under a 600-missile attack, 35 to 40 per cent of the alert force can be expected to survive.

Heavy Missile Attacks

Much stronger attacks are shown in Fig. 3, in which missiles with 5-MT yield and 3-n-mi delivery accuracy are assumed. The solid lines represent alert force survival in the face of a well coordinated attack such that the missiles impact simultaneously on either the programmed SAC-base system or the 188-base system. The horizontal arrows at the bottom of the chart indicate, by year, a spread of several intelligence estimates of Soviet missile capability. Two points are of particular note: First, the programmed base system is destroyed by a no-warning missile salvo credited to the Soviets in 1960 and after. Second, dispersal can be expected to provide payoffs ranging from one fourth to over half of the alert force in this contingency, depending on which intelligence estimates are assumed.

If the Soviets successfully launch an attack which impacts simultaneously on either base system with no warning, then bomber-alert status would be of no value. However, the Russians may find it impossible to get off a compact volley. In this event, a high state of alert made feasible through dispersal, and tied into the bomb alarm system for minimal warning, can be expected to provide additional payoff. Let us assume, for example, that the SAC alert force, with bombs aboard, is on 5-min alert, and that because they are dispersed, all aircraft can become airborne in less than 10 min. The Soviets, on the other hand, launch a ragged attack represented by two-thirds of their missiles being fired in the first 5 min and the remaining third 5 min later. This particular time constraint would be imposed if the Soviets had at least a 1:3 ratio of guidance stations to number of "ready" missiles, as we assume. Actually, this time constraint is indicative of a

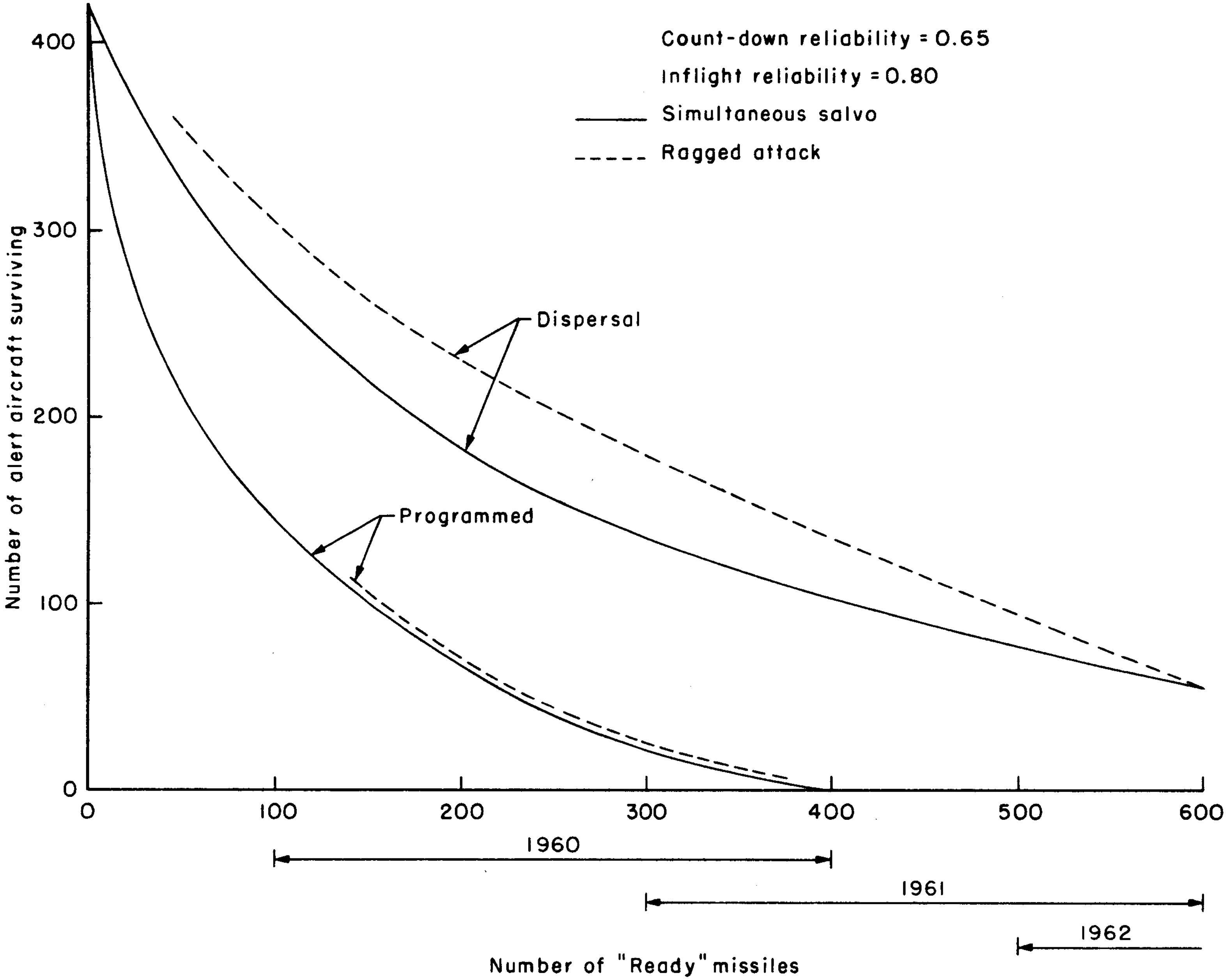


Fig. 3 — Campaign summary: heavy attack

range of contingencies, including the difficulties of achieving simultaneity during final missile countdown in any preplanned firing schedule. The ragged attack results are shown by the dashed line on Fig. 3. Payoff is achieved by standing improved alert when more widely dispersed, but no gain is indicated for the programmed base system and alert posture.

A bonus effect is hidden in these results in the contingency that a sneak, manned-bomber attack is attempted. Dispersal to 188 bases may increase Soviet force size requirements sufficiently to alleviate the manned-bomber warning problem.

Bomber Strike Variations

Clearly, adequate dispersal and improved alert can alleviate our vulnerability problem in the short term. Having considered survival, let us consider the two principal effects on anticipated strike operations. To illustrate these effects, a feasible kind of SAC alert strike was designed involving 312 bombers at maximum gross weight on takeoff, and landing overseas at post-target bases with emergency war plan (EWP) fuel reserves. Ninety per cent of these aircraft were B-47's. Supporting the strike was a force of 302 tankers, a quarter of which were KC-135's. The strike lasted 12 hours, measured from the time the first bomber crossed enemy radar until the last bomber was over target; the average penetration distance for the B-47's was 550 miles--a fairly shallow penetration. When it is assumed that the Soviets strike first, 25 to 50 per cent of the surviving alert bombers do not accomplish their mission because their assigned tankers do not survive; the lower value being associated with a dispersed posture. This loss in striking power could be alleviated by improved planning to reduce tanker support requirements, changing the refueling points for the alert force, rerouting some bomber cells now requiring double refuelings, and possibly reallocating certain targets.

The other effect devolved from taking off on strike at less than maximum gross weight. The B-47 alert force was dispersed to a selected set of civil airfields, fueled to at least 70 per cent of maximum, and sent on the same basic strike as used for the SAC base system. In this case, aircraft performance, principally fuel overages in the bombers and tankers for flexibility of operation, was stretched to the maximum. Post-strike landing reserves provided in the basic case, however, were not reduced. Through use of ATO for all B-47 emergency take-offs, and by dipping into fuel overages of both bombers and tankers, the basic strike was still feasible under the most stringent limitations of summertime operation. A useful kind of job could also be done by dispersing both B-47's and their supporting tankers, though the dollar cost of doing so could be expected to go up somewhat.

V. ESTIMATES OF COST

While austere in character, such an operation as suggested here could not be achieved overnight, nor at no cost. Normal planning factors for providing the necessary additional installations and facilities, including decision making, budgeting, designing, letting bids, and actual construction, sum to about 5 years. If dispersal were adopted as an emergency measure, however, designing, letting of bids, and construction might be compressed into 15 to 18 months. Maximum compression of decision making and budgeting time would require full approval in Congress and in the Department of Defense so the program could be expedited with a free hand--a way often suggested, but seldom permitted.

Regarding costs, let us assume that all 126 civil and non-SAC military airfields throughout the country, usable year around, are to be occupied by alert aircraft. In this event, between $136 and $138 million would have to be invested in installations and equipment immediately; that is approximately $1.1 million per field. The incremental annual operating costs are estimated to be about $63 million a year--an annual operating cost for all 126 airfields roughly equivalent to that required for one and a half wings of B-47's today. If fewer than 126 bases were involved, the cost, of course, would be proportionally less.

Initial investment in facilities and equipment plus estimates of annual operating costs are shown for a single dispersed site in Fig. 4. The most austere operation considered, that of a mobile maintenance team, a small, flight-line maintenance cadre of 17 men that remains at the site, and 34 men making up necessary crews, security guards, etc., is priced in the first column. The second column represents the cost of providing for a

	Maintenance Support	
	Mobile	Permanent
Initial Investment--		
Installations (pad & taxiway, personnel quarters, POL & Lox storage, equipment storage, etc.)	0.600	0.611
Equipment (starters, maintenance stands, fire carts, compressors, comm. (HF), spares, etc.)	0.188	0.188
Initial Training	0.296	0.296
Total:	1.084	1.095
Annual Operation--		
Pay and allowances, annual operation training, incremental subsistence	0.324	0.382
Upkeep	0.030	0.031
Logistics	0.100	0.100
Total:	0.454	0.513

Fig. 4--Costs per Site
(millions of dollars)

permanent cadre of 59 men--a slightly less austere operation providing a higher combat-ready rate.

Beyond cost is another consideration, the political feasibility of dispersal. After discussions with the major civil aeronautics associations, boards and councils, we concluded that the problems are not insoluble. Air traffic, noise, ground facilities, infrequent SAC alert takeoffs, and proximity of sites to cities, are factors entering in this conclusion. There are precedents to suggest that the risk of accident with a nuclear weapon aboard the aircraft is the most pressing single problem. Risk could be reduced substantially by providing for bomb storage at each dispersed site, so that bombers could be rotated between home base and a dispersal site without a bomb aboard. The additional cost would be negligible.

VI. CONCLUSIONS

To sum up, the programmed base system is untenable if current intelligence is right. Dispersal of the B-47 force and improved alert are measures that would help in the short term against either a sneak bomber attack or an early ICBM attack. Of the numerous measures considered, dispersal looked best as an emergency expedient, and hence was studied most exhaustively, However, the validity of dispersal depends critically on two factors that are poorly defined. First, we cannot with complete confidence state the yearly growth of the Soviet ICBM force, and second, we cannot specify just how ragged its first volley might be. If the less formidable estimates of either size or simultaneity included in this study are correct, then dispersal looks good. If the higher estimates are correct, additional protective measures also should be taken.

In view of our force vulnerability it is suggested that SAC try dispersing four aircraft to a civil field for a couple of months, and if it works out, proceed with a program of dispersal on an emergency basis. As the program enters each new phase--for example, just before construction begins--the latest test results and intelligence data should be re-examined, and a new decision made if necessary. Admittedly, this puts a strain on Air Force relationships with the budget-makers and Congress, but the position is a sound one. Finally, it should be emphasized that during this time we should not be diverted from other measures such as shelters, evacuation and recovery, and airborne patrol, which, combined with dispersal, can assure an acceptable degree of invulnerability in the long run.

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