2. When the study is completed it will be circulated to the normal distribution.

K. A. ANDERSON
By direction of Deputy
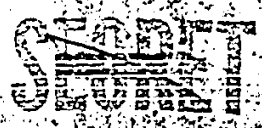Chief of Naval Operations (Air)

K-S-8595

1. Figure 1, attached hereto, shows ... [illegible] ... of a study of cost effectiveness of POLARIS ... Here is plotted the number of MINUTEMAN missiles to be required in a hardened (100 PSI) base so that ... surviving an attack will equal the POLARIS missile ... can be kept on station constantly with ... since this amounts to about ... we must then have ... ing and still assure survival by ... that we must then have ... enemy ICBM capabilities ... number of MINUTEMAN required to assure survival ... increase steadily with time due to increasing ...

2. Let's examine the trends revealed by these curves ... abscissa shows time and the ordinate, the total number of MINUTEMAN required in order to assure the survival of ... Here we have plotted various levels of Soviet ICBM ... potential.

3. Now let's choose a point in time, say 1961, ... the Soviets would devote only ... of their blunting effort to MINUTEMAN. Entering the curves with these values we find that a total of about 1200 MINUTEMAN must exist in order to assure the survival of 396 to retaliate.

4. These curves reveal a very significant trend which cannot be ignored; that is, as enemy capabilities increase with time, more and more MINUTEMAN would have to be built to assure continued survival of a given number. This, of course, means ever increasing expense to the United States. Another way of stating this conclusion is that as enemy capabilities increase with time, fixed hardened sites become more and more vulnerable and a less efficient means of assuring an effective national retaliatory posture.

5. We know the approximate cost of creating and operating a POLARIS system of 45 SSB(N) and the necessary supporting ships and installations. If then we are able to create and support enough MINUTEMAN to assure the survivability of at least 396 of them for less money than it costs to create and operate this POLARIS system, then MINUTEMAN has the better cost effectiveness for the point in time selected.

6. The Navy costs for building and operating a 45 boat POLARIS system have been calculated. MINUTEMAN costs have been estimated by the Air Force and separately by the Navy. Both the Air Force and Navy have found that in the case of MINUTEMAN it was necessary to prepare a range of estimates because of the lack of firm data. Both the Air Force and Navy estimates of MINUTEMAN costs have been separately compared arithmetically with the POLARIS costs in order to determine the so-called break-even points; that is, where enough MINUTEMAN can be bought and maintained to assure the survival of 90% then for the same amount of money required to buy and maintain a 45 SSB(N) system. The horizontal lines on these curves represent the break-even points.

7. It is immediately apparent that a very great deal depends on which MINUTEMAN cost estimate is used (see figure 1). If the Air Force low estimate is valid, MINUTEMAN will have a better cost effectiveness than POLARIS through 1969 on the assumption that only ½ of the Soviet blunting capacity is devoted to MINUTEMAN. Conversely, if the Navy high cost estimates of MINUTEMAN are used, MINUTEMAN can never be more cost effective than POLARIS. No matter which cost estimate is used, however, the trend is clear. From the standpoint of long term investment, it is far better to invest in a mobile system than one which is fixed.

CONCLUSIONS

1. The relative cost effectiveness of MINUTEMAN, compared to POLARIS, is very dependent on the time at which MINUTEMAN can be produced:

   a. If MINUTEMAN were available now, it would provide a system with better cost effectiveness than POLARIS.

   b. An operational MINUTEMAN available in 1962-1963 but introduced at approximately equal cost effectiveness with POLARIS.

   c. MINUTEMAN missiles produced after 1966 will have a lower cost effectiveness than POLARIS, throughout their lifetime.

(These conclusions are not altered even if fairly large POLARIS submarine attrition (25% of at-sea boats) is assumed.)

2. Although the above results are somewhat dependent on the level of enemy ICBM effort assumed, the effect of reasonable

... MINUTEMAN becomes the less expensive ... only one or two years.

3. The above conclusions are based on cost ... for the MINUTEMAN system, which are between those provided by the Air Force and the Navy. The differences in these two estimates are very large, and have a great influence on the conclusions.

   a. If the Air Force low cost estimate is used, MINUTEMAN is superior to POLARIS until about 1968, and a ... program is probably justified if the planned operational dates can be met.

   b. If the Air Force high estimate is used, MINUTEMAN produced prior to 1963 will equal or exceed POLARIS in cost effectiveness.

   c. Neither Op-51, SP, nor other outside technical groups contacted believe the Air Force estimates to be valid. The Navy certainly could not do MINUTEMAN for the higher Air Force estimate.

   d. If the Navy low estimate of MINUTEMAN costs is employed, MINUTEMAN must be produced before 1962 to equal or exceed POLARIS in cost effectiveness, while

   e. If the Navy high estimate of MINUTEMAN costs is used, POLARIS is always equal or superior.

4. The above wide discrepancies limit the utility of any cost effectiveness study comparing POLARIS and MINUTEMAN - unless jointly acceptable cost estimates can be obtained - and indicate the inadequacy of using cost effectiveness studies to analyse systems of different operational areas.

5. Further, no cost effectiveness study yet has been able to assign values to the cost to the United States of relying on ... based systems which

   a. Demand from our political leaders a "hair trigger" decision to retaliate.

   b. Inflict bonus kills on our population by enemy efforts to counter it.

3

hidden the other ....
to strike first.

    d. Lead to a constantly increasing U. S. retaliatory force levels for when the Soviets do perfect an effective blunting force, the U. S. must build more in order to retain the necessary edge.

    e. Promote a spiralling arms race which the controlled Soviet economy can much better afford than ours.

    f. Require further depletion of our nuclear raw material reserves for the production of warheads to place on the extra missiles needed to absorb the enemy blunting attack.

TRANSCRIBED COPY FOLLOWS

Memorandum for Chief of Naval Operations

Via: Vice Chief of Naval Operations

Subj: Cost Effectiveness of POLARIS vs. MINUTEMAN
         (Assuming same target system, CEP and Yield) (U)

1.   This is the first-cut summary in Op-51 of the study which has not yet been completed.
RADM Masterson or GDR Backus will be available to elaborate on this, if required.

2.   When the study is completed it will be circulated to the normal distribution.

1. Figure 1, attached hereto, shows on one graph the results of a study of cost effectiveness of POLARIS vs. MINUTEMAN. Here is plotted the number of MINUTEMEN missiles that would be required in a hardened (100 PSI) Base so that the missiles surviving an attack will equal the POLARIS missiles which can be kept on station constantly with a 45 boat FBM program. Since this amounts to about 396 FBM weapons always on station we must then have enough MINUTEMEN to absorb the Soviet blunting and still assure survival of 396. The number of MINUTEMEN that we must then have in tote is entirely dependent on the enemy ICBM capabilities at point in time selected. This total number of MINUTEMEN required to insure survival of 396 will increase steadily with time due to increasing enemy capabilities.

2. Let's examine the trends revealed by these curves. The abscissa shows time and the ordinate, the total number of MINUTEMAN required in order to assure the survival of 396. Here we have plotted various levels of Soviet ICBM blunting potential.

3. Now let's choose a point in time, say 1965, and assume the Soviets would devote only 2 of their blunting efforts to MINUTEMAN. Entering the curves with these values we find that a total of about 1200 MINUTEMAN must exist in order to assure the survival of 396 to retaliate.

4. These curves reveal a very significant trend which cannot be ignored; that is, as enemy capabilities increase with time, more and more MINUTEMEN would have to be built to assure continued survival of a given number. This, of course, means ever increasing expense to the United States. Another way of stating this conclusion is that as enemy capabilities increase with time, fixed hardened sites become more and more vulnerable and a less efficient means of assuring an effective national retaliatory posture.

5. We know the approximate cost of erecting and operating a POLARIS system of 45 SSB(N) and the necessary supporting ships and installations. If then we are able to create and support enough MINUTEMEN to assure the survivability of at least 396 of them for less money than it costs to create and operate this POLARIS system, then MINUTEMEN has the better cost effectiveness for the point in time selected.

6. The Navy costs for creating and operating a 45 SSB(N) POLARIS system have been calculated. MINUTEMEN costs have been estimated by the Air Force and separately by the Navy. Both the Air Force and Navy have found that in the case of MINUTEMAN it was necessary to prepare a range of estimates bec: of the lack of firm data. Both the Air Force and Navy estimates of MINUTEMAN co.ts have been separately combined arithmetically with the POLARIS costs in order to determine the so-called break-even points; that is, where enough MINUTEMEN can be bought and maintained to assure the survival of 396 of them for the same amount of money required to buy and maintain a 45 SSB(N) system. The horizontal lines on these curves represent the break-even points.

7. It is immediately apparent that a very great deal depends on which MINUTEMAN cost estimate is used (see figure 1). If the Air Force low estimate is valid, MINUTEMAN will have a better cost effectiveness than POLARIS through 1969 on the assumption that only 1/2 of the Soviet blunting capacity is devoted to MINUTEMAN. Conversely, if the Navy high cost estimates of MINUTEMAN are used, MINUTEMAN can never be more cost effective than POLARIS. No matter which cost estimate is used, however, the trend is clear. From the standpoint of long term investment, it is far better to invest in a mobile system than one which is fixed.

Conclusions

1. The relative cost effectiveness of MINUTEMAN, compared to POLARIS, is very dependent on the time at which MINUTEMAN can be produced:

    a. If MINUTEMAN were available now, it would provide a system with better cost effectiveness than POLARIS.

    b. An operational MINUTEMAN available in 1962-1963 would have approximately equal cost effectiveness with POLARIS.

    c. MINUTEMAN missiles produced after 1964 will have a lower cost effectiveness than POLARIS, throughout their lifeline.
(These conclusions are not altered even if fairly large POLARIS submarine attrition (25% of at-sea boats) is assumed.)

2. Although the above results are somewhat dependent on the level of enemy ICBM effort assumed, the effect of reasonable change on this assumption is to vary the date in which MINUTEMAN becomes the less effective weapon by a matter of only one or two years.

3. The above conclusions are based on cost estimates for the MINUTEMAN system, which are between those provided by the Air Force and the Navy. The differences in these cost estimates are very large, and have a great influence on the conclusion.

    a. If the Air Force low cost estimate is used, MINUTEMAN is superior to POLARIS until about 1968, and a one-generation program is probably justified if the planned operational dates can be met.

    b. If the Air Force high estimate is used, MINUTEMAN produced prior to 1963 will equal or exceed POLARIS in cost effectiveness.

    c. Neither Op-51, SP, nor other outside technical groups contacted believe the Air Force estimates to be valid. The Navy certainly could not do MINUTEMAN for the higher Air Force estimate.

    d. If the Navy low estimate of MINUTEMAN costs is employed, MINUTEMAN must be produced before 1962 to equal or exceed POLARIS in cost effectiveness, while

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5. Further, no cost effectiveness study yet has been able to assign values to the cost to the United States of relying on fixed based systems which

    a. Demand from our political leaders a "hair trigger" decision to retaliate.

    b. Inflict bonus kills on our population by enemy efforts to counter it.

c. Create an unstable politico-military situation where we have U.S. and Soviet ICBM forces facing each other, one hidden the other known; an aggressor would be greatly tempted to strike first.

d. Lead to a constantly increasing U.S. retaliatory force levels for whom the Soviets do possess an effective blunting force, the U.S. must build more in order to retain the necessary edge.

e. Promote a spiralling arms race which the controlled Soviet economy can much better afford than ours.

f. Require further depletion of our nuclear raw material reserves for the production of warheads to place on the extra missiles needed to absorb the enemy blunting attack.