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to the
TECHNICAL DISCUSSIONS ON THE PROBLEM OF SURPRISE ATTACK

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STABILITY -- A CRITERION FOR EVALUATING

INSPECTION AND CONTROL SYSTEMS


APPLICATION TO MIXED SYSTEMS
AND TO THE 1962 STRATEGIC POSTURES

(This is a continuation of SAW/147)


by

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## SUMMARY

The stability of strategic attack systems, such as ICBMs, IRBMs, manned aircraft, and ballistic missile submarines in various combinations are compared to the stability determined in SAW/147 for the case where ICBMs are the only strategic weapon on both sides. Due to time constraints, only criteria A stability is considered. Although some combinations change the degree of stability or instability of the ICBM duel, there are only two strategic postures which make all cases uniformly stable independent of the ICBM capability:

1. Possession by both sides of a manned bomber force invulnerable to surprise attack by ICBMs (perhaps by being continuously airborne), which is capable of penetrating alert air defenses and inflicting critical damage on the aggressor's cities (15-20 10-MT bombs or 40-60 1-MT air-to-surface missiles).

2. Possession by both sides of a ballistic missile submarine capability which can inflict critical damage on the aggressor's cities in retaliation (80-85 ½-MT POLARIS-type missiles). Estimates of the total number of submarines re-quired ranges from 9 to 16.

The estimated 1962 strategic posture of the US and USSR is examined for stability, with and without some types of inspection. Without any inspection, the dominating influence on the likelihood of a US surprise attack is the available intelligence on the location of Soviet ICBM bases. The USSR can always insure critical damage by retaliation, if the US does not know the location of more than 75-80 percent of these bases. Since such complete intelligence is unlikely without inspection, the US may be considered to be always deterred. Stability, therefore, depends on whether or not the USSR is also deterred. The dominating influence on the likelihood of a Soviet surprise attack is the alert status of US forces. If fast response forces, capable of inflicting critical damage on the USSR, can be made invulnerable to ICBM attack (with or without a BMEWS), the situation is stable. If the USSR ICBM attack catches US bombers and ICBMs on the ground, the situation is unstable and favorable to the USSR.

With an

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With an inspection system of a sufficiently high order
to guarantee that the US can attack 80 percent or more of the
Soviet ICBM bases, stability depends entirely on the alert
status of the forces on both sides. If sufficient retaliatory
forces on both sides survive an ICBM attack, the situation is
always stable. If the retaliatory capability of only one side
survives, the situation is unstable in favor of that side. If
a sufficient retaliatory capability on neither the US or USSR
survive, the situation is unstable in the highest degree. Both
the US and USSR can make a highly successful surprise attack,
and both fear that the other will do so. Inspection, there-
fore, does increase stability only to the extent that it pro-
vides sufficient warning to render effective retaliatory
forces invulnerable on both sides.

An examination of the unilateral actions, which both
the US and the USSR might take prior to the inception of an
agreement, or after some types of agreements, clearly demon-
strates that such actions can produce a stable posture with
inspection. Stability will only be achieved, however, if
both the US and the USSR take such actions. If one side
takes action and the other does not, symmetric instabilities
may become asymmetric in favor of the side taking the action
and stable postures may become asymetrically unstable. Ex-
amples of unilateral actions are hiding, hardening, dispers-
ing, or changing the configuration of ICBM/IRBM and bomber
bases; building ballistic missile submarines; maintaining
larger bomber forces on airborne alert or in general increas-
ing the response time of offensive systems. We have not ex-
amined unilateral actions in detail, and have omitted detail
consideration of active defenses. Yet it is clear that even
low level active ICBM defenses, particularly if used in con-
junction with hardening and dispersal, could affect stability
as much as the other unilateral actions discussed.

# PART I.  STABILITY OF MIXED STRATEGIC SYSTEMS

## PROBLEM

To determine to what degree the stability, found in
SAW/147 for pure ICBM systems, is changed by introducing
other strategic systems:  IRBMs, submarine-launched missiles,
and manned bombers in various combinations.

## DEFINITION OF STABILITY

In SAW/147, Criteria A stability was defined in terms
of the relative effectiveness of surprise retaliatory attacks
in inflicting critical damage while holding one's own damage
to less than critical level.  We shall consider Criteria A stan-
bility in this report unless otherwise specified.  The follow-
ing definitions distinguish between stable and unstable situa-
tions:

> Stable.  Neither the US nor the USSR, by surprise
> attack can both inflict critical damage on the enemy
> and prevent the retaliation from inflicting critical
> damage on himself.

> Unstable.  Either the US and/or the USSR, or both,
> by surprise attack, can both inflict critical
> damage on the enemy and prevent the retaliation
> from inflicting critical damage on himself.

Critical damage was defined as the ability to kill 20 per-
cent of the urban population and destroy 30 percent of the
industry of a nation.  It was assumed that no rational ag-
gressor would make a surprise attack if he were convinced
that his own losses would be at least this great.

It is possible to indicate degrees of stability and
instability by reference to Figure 1.  All possible out-
comes of a thermonuclear exchange are indicated by a point
on the following diagram, relating the damage inflicted by
surprise attack to the damage suffered in retaliation.
The most stable situation is one in which the attacker who
attempts to minimize his own damage receives more damage
from the retaliatory strike than he inflicts by a surprise
attack.  These outcomes are "C" for a USSR attack and "D"

for a US

Figure 1.  Outcomes of Strategic War between US and USSR

Damage to USSR

20-30%
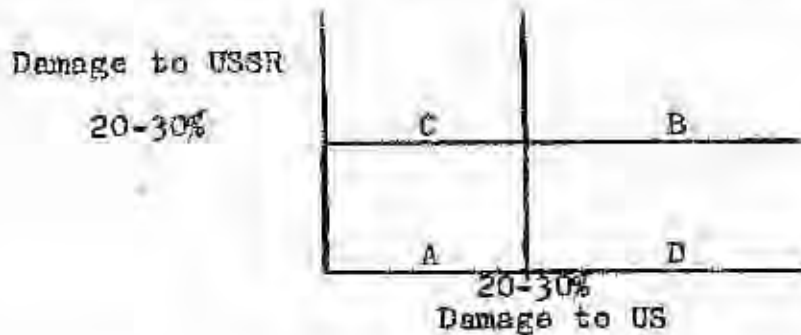


for a U.S. attack.  Still stable but less so are cases where
critical damage is received by both sides regardless of who
attacks:  "B" for each side, or where there are indecisive
outcomes:  combinations of "A" and "B" with "C" and "D"
("C" occurring when the USSR attacks and "D" occurring when
the US attacks).  The unstable cases may be subdivided into
the least unstable:  USSR attack gives "D" but US attacks gives
"A" or "D", where the aggressor has no fear, either of retalia-
tion or of surprise attack by the other side; to the most un-
stable:  "D" for USSR attack and "C" for US attack, where both
sides can make effective surprise attacks and fear a surprise
attack by the other.*

## STABILITY OF PURE ICBM SYSTEMS

The stability of pure ICBM systems is shown in Table 1,
where parity in numbers, yield, CEP, base hardness, and base
configuration is assumed between the US and the USSR.  Un-
stable situations arise generally when both sides have soft

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* We do not consider the indecisive situation where neither
side can inflict critical damage by surprise attack nor make
an effective retaliation.  All of this discussion of stability
refers only to a single criterion of damage, defined at that
level of damage to himself which would deter a rational ag-
gressor.  SAW/147 discussed another criterion, defined as a
higher level of damage which would deter a less rational ag-
gressor, and assumed to be 50 percent death of urban popula-
tion, 60 percent destruction of industry.

bases and

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bases and accurate missiles; stable situations when both sides have hard bases and inaccurate missiles. In conditionally unstable situations, stability depends on the absolute numbers and/or yields between reasonable limits, such as 200-800 missiles and $\frac{1}{2}$-10 megatons. In general, greater numbers make unstable situations more unstable and stable situations more stable. The model used to obtain Table 1 consisted of a surprise attack which directed enough missiles at the defender's bases to prevent effective retaliation and directed the remaining missiles, if any, at the defender's cities. The retaliation was always directed at cities only.

Table 1. Stability of Pure ICBM Systems

| | CEP n.mi. | | | |
|---|---|---|---|---|
| Base Hardness | $\frac{1}{2}$ | 1 | 2 | 5 |
| 2 psi | U | U | U | ?* |
| 25 psi | U | *? | *? | S |
| 100 psi | U | *? | S | S |
| crater & lip | ?* | S | S | S |

U - unstable
? - conditionally unstable
S - stable
?* - conditionally unstable favoring USSR
*? - conditionally unstable favoring US

## STABILITY FOR ICBM-IRBM SYSTEMS

Unlike ICBMs, IRBMs inevitably produce an asymmetric situation between the US and the USSR. We can assume that the USSR can and would move their ICBM bases out of range of US and NATO IRBMs; she cannot move her cities out of range. Thus, US and NATO IRBMs, deployed overseas, can attack Soviet IRBMs and cities, while Soviet IRBMs will only attack US and NATO IRBMs.*

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\* For simplicity, the model does not consider US attacks on Satellite cities nor Soviet attacks on the cities of our allies.

The stability

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The stability of a mixed ICBM-IRBM system is shown in
Table 2. The ICBM model is the same as before. IRBMs are

Table 2. Stability of Mixed IRBM-ICBM Systems

| Base Hardness | CEP n.mi. | | | |
|---|---|---|---|---|
| | $\frac{1}{2}$ | 1 | 2 | 5 |
| 2 psi | U | U | U | *U |
| 25 psi | U | *? | *? | S |
| 100 psi | ? | *? | S | S |
| crater & lip | ?* | S | S | S |

U - unstable
? - conditionally unstable
?*- conditionally unstable favoring USSR
*? - conditionally unstable favoring US
S - stable
*U - unstable favoring US

treated differently for simplicity. All IRBMs are assumed to
have a yield of 2-MT and a CEP for 2 n.m. The US is given
100, while the USSR is given enough to destroy all overseas
IRBM bases when making a surprise attack. These assumptions
regarding numbers appear reasonable because the US needs only
40 to cause 20 percent deaths to the Soviet urban population
by IRBM-attack only, and because intelligence estimates indi-
cate that USSR capabilities in IRBMs will depend on their re-
quirements and their requirements never exceed a few hundred
in this model.

If we compare Table 1 and Table 2, we see that there is
little change. One unstable case is changed to a conditionally
unstable case (100 psi, ½-mile CEP) and a conditionally un-
stable case with USSR superiority is changed to an unstable
case with US superiority. The lack of change in stability is
the more remarkable when it is recalled that the assumptions
imply that the US surprise attack will always produce a critical
damage to the Soviets, while the Soviet surprise attack outcome
is not changed.

STABILITY FOR

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## STABILITY FOR ICBM-SUBMARINE-LAUNCHED MISSILE SYSTEMS

No calculation is required for determining the stability when the attack systems consist of ICBM and submarine-launched missiles. The submarine force at sea is invulnerable to ICBMs, either initially or in retaliation during the first few hours of an attack. We can safely assume, therefore, that in this case all submarines within range of their targets at the outbreak of war can fire their entire load of missiles. If both sides have a capability of 100 or so missiles, the situation is always stable because only 80 to 85 missiles with a $\frac{1}{2}$-MT warhead and a CEP not more than 2 n.m. are required to inflict 20 percent damage on the US or USSR. Thus, neither side can prevent effective retaliation on its cities after a surprise attack.

The number of submarines required by each side to assure itself of this capability need only be determined for the defender, since the attacker can always place his total submarine capability in the proper area. The defender, if he is truly surprised, will only have his on-station submarines properly placed. Estimates of the fraction of on-station submarines varies from one-third to one-half of the total force. If we assume that all submarines carry 16 missiles, the attacker requires 6 submarines, and the defender 12-18 submarines to guarantee stability. The number required by the defender may well be less than this, if he has reasonable assurance that his in-transit submarines can reach their operating areas and fire their missiles undetected. The enemy cities and industrial plants will still be there for the late-comers to destroy, although the population will be much better protected at this time. The only vulnerable submarines are assumed to be those in the defender's ports at the time of the surprise attack. Optimistically, we will estimate that two-thirds of the defender's ballistic missile submarine force can fire their weapons. The required number of submarines, in this case, is nine.

We may conclude that Criteria A type stability may be assured if between 9 and 18 missile-carrying submarines are possessed by both sides.

If we consider the case where only the US possess missile-carrying submarines, the situation is identical to that given in Table 2 for IRBMs, except that all the instabilities are in favor of the US. The Soviet capability is not changed, since their IRBMs now have no counter-force role. The US possesses the capability by surprise attack and retaliation which assures

effective damage

effective damage to the Soviet Union. One should be careful, therefore, not to consider stability synonymous with one's own preponderance. The other side will hold a vastly different point of view.

## STABILITY FOR ICBM-MANNED BOMBER SYSTEMS*

Attacks by manned bombers differ from ballistic missile attack because active defenses against manned bombers exist today in both the US and USSR. It is not sufficient, therefore, merely to determine the alert capability and survival probability of manned bombers in the face of attacks on their bases by ballistic missiles. One must also estimate reasonable performance levels against the active defenses of a country in order to obtain the number which must be sent in a surprise attack or which must survive a counter-force attack in order to inflict critical damage on the enemy.

It is possible, however, to limit the number of cases in which the introduction of manned bombers changes the stability which has been estimated for pure ICBM systems. For example, if the situation is stable because both sides can retaliate effectively, with ICBMs alone, manned bombers cannot make the situation unstable. The attacker will already be critically damaged by retaliating ICBMs before a manned bomber attack can influence the issue. The remaining stable cases and unstable cases, however, must be examined one by one to estimate the effect of ICBM attack on the retaliatory capability of the opponent's manned bombers, making assumptions regarding warning, alert status, and penetration capability, and the targets appropriate

An adequate analysis of the manned bombers and ICBMs is not available for this paper. Accordingly, we will consider two extreme cases: an alert bomber force and a non-alert bomber force.

An alert force will be defined as one which is capable of inflicting critical damage on an enemy who makes a surprise attack with ICBMs. We do not specify how this is done. Presumably, it is done by a combination of an airborne alert force and an effective BMEWS combined with a runway alert force. ICBM attacks against bomber bases under such conditions accomplished little.

A non-alert force is one which is sufficiently vulnerable to ICBM attack that a successful ICBM attack on bomber bases will prevent manned bombers from inflicting critical damage in

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* Carrier-based planes are implicitly included in the manned bomber discussion.

retaliation. It

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retaliation. It is assumed that an average damage of 90 per-
cent to all bomber bases will prevent a non-alert force from
making an effective retaliation. For purposes of this paper,
an average damage of less than 50 percent to bomber bases is
assumed to permit even a non-alert bomber force to inflict
critical damage in retaliation.

The manned bomber force of the attacker, similarly,
can be considered in two extreme cases: his bomber force
can inflict, by itself, critical damage on the enemy, or it
cannot. This grouping gives us 5 cases for manned bombers
alone, which are shown in Figure 2 with the outcomes result-
ing from the subsequent activities of the manned bombers
alone. All outcomes are stable except the D/C case. To de-
termine stability in a war in which the only strike forces

Figure 2. Outcomes for Manned Bomber Attack $O_n$ly

Defender's Manned Bombers

| Attacker's Manned Bombers | | Alert | Non-Alert | |
|---|---|---|---|---|
| | Inflict critical damage | B/B | D/C | Attackers ICBMs kill SAC bases |
| | | | B/B | do not kill SAC bases |
| | do not inflict critical damage | | A/A | kill SAC bases |
| | | | C/D | do not kill SAC bases |

USSR attack/US attack

are manned bombers and ICBMs, we must add the pure manned
bomber outcomes of Figure 2 to the ICBM duel. But before doing
that, we can arrive at several conclusions by inspection. It
is obvious that all cases are stable in which the defender's
bombers are invulnerable to ICBMs. We need consider, there-
fore, only the cases where the defender's manned bombers are
not alert.

The ICBM duel

The ICBM duel consists of three target systems for the attacker: equal number of ICBM bases, 50 US and 55 USSR SAC bases, and cities; the defender, as before, attacks only cities. We combine the results of the ICBM calculations and Figure 2 into Tables 3 and 4, for the two cases of interest; the defender is not alert and the attacker's bombers are in-effective; the defender is alert and the attacker's bombers are ineffective.

Table 3. Stability of ICBM-Manned Bomber Systems
(Attacker's Bombers Effective)

| | CEP | | | |
|---|---|---|---|---|
| | $\frac{1}{2}$ | 1 | 2 | 5 |
| 2 psi | U | U | UU | ?* |
| 25 psi | U | *? | *? | S |
| 100 psi | ? | ? | S | S |
| Crater & lip | ? | S | S | S |

Table 4. Stability of ICBM-Manned Bomber Systems
(Attacker's Bombers Ineffective)

| | CEP | | | |
|---|---|---|---|---|
| | $\frac{1}{2}$ | 1 | 2 | 5 |
| 2 psi | U | U | U | ?* |
| 25 psi | U | *? | *? | S |
| 100 psi | ? | S | S | S |
| Crater & lip | ? | S | S | S |

U - unstable
? - conditionally unstable
?*- conditionally unstable favoring USSR
*? - conditionally unstable favoring US
*S - stable

Two conclusions

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Two conclusions can be drawn from a glance at these tables. The addition of manned bombers of ICBMs does not greatly change the number of cases which are stable or unstable. There are a few more stable cases with an attack by ineffective manned bombers, but not as much as one would intuitively suppose. The second conclusion is that symmetrically effective manned bombers do not change the number of stable or unstable cases at all, but they do change the character of conditional instabilities adversely to the US. In the pure ICBM duel, 3 out of 5 conditional instabilities favored the US. When effective manned bombers are added, none favor the US.

It should be observed again that only criteria "A" type stability is being considered here and that considerations of lethal damage may modify some of the statements made. Whereas the ICBM model may give stable results when only critical levels are considered, the combined ICBM-Manned Bomber Model would, in general, cause the attacked nation to sustain a lethal level of damage. This would have a greater destabilizing effect than that indicated here. This is particularly true if asymetric bomber assumptions hold.

Tables 3 and 4 assumed the same alert status for both sides. The situation for effective bomber attack and only the US alert is shown in Table 5.

Table 5. Stability for ICBM-Manned Bomber Systems
(US Alert)

| | CEP | | | |
|---|---|---|---|---|
| | $\frac{1}{2}$ | 1 | 2 2 | 5 |
| 2 psi | $_*$U | $_*$U | $_*$? | $_*$? |
| 25 psi | $_*$U | $_*$U | S | S |
| 100 psi | $_*$U | S | S | S |
| Crater & lip | S | S | S | S |

U - unstable
? - conditionally unstable
?* - conditionally unstable favoring USSR
*? - conditionally unstable favoring US
S - stable
*U - unstable favoring US

From the US

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From the US point of view, the situation is excellent: all the instabilities result from a US capability for successful attack when the USSR has not such capability. From the Soviet point of view, the situation is disastrous. If we compare Table 5 with Table 4 from the purely objective standpoint of stability, we find a slightly greater number of stable cases, but the general degree of stability is often much less. Two conditionally unstable cases have become stable, two conditionally unstable cases have become unstable, and one unstable case has become conditionally unstable.

The case where only the USSR is alert is nearly identical, except that the USSR is substituted for the US as the favored side in the unstable cases.

If we do not distinguish between critical and lethal damage, we may conclude that manned bombers together with ICBMs have the following effects on stability as established by the ICBM blast duel.

1. Both sides alert with     stable irrespective of
    BMEWS                 ICBM outcome

2. Neither side alert       stable cases less stable
                                   unstable cases less unstable

3. Only US alert          stable cases less stable
                                   all unstable cases favor US

4. Only USSR alert        stable cases less stable
                                   all unstable cases favor USSR

## MIXED ATTACK SYSTEMS

In the preceding sections, we considered the effect of various attack systems one at a time. In this section, we will put them together in various combinations to determine the effect on stability compared to the pure ICBM duel. The general conclusions are given in Table 6 which compares 36 combinations of ICBMs, IRBMs, alert manned bombers, non-alert manned bombers, and POLARIS submarines, to the pure ICBM duel. From the standpoint of stability alone, alert manned bomber forces or 9 to 18 POLARIS submarines are as good as, non-alert manned bombers, and the pure s... ...ber..... (assuming that

(assuming that these are truly invulnerable and those on station can always deliver their full complement of weapons) on each side can assure equilibrium in the sense that neither the US nor the USSR can, by surprise attack prevent effective retaliation by the other.* The stability achieved, therefore, is stability by fear, not stability in the sense of positive assurance that one's own country can survive.

Table 6 illustrates the dominating effect of relatively invulnerable systems that also possess a capability to inflict critical damage. Missile-carrying submarines and alert manned bombers dominate their respective rows and columns. If both sides possess this capability, the situation is always stable. The stability does not depend on the ICBM posture. If only one side possesses this capability, the stability does not depend on the ICBM posture. Cases which were stable for the ICBM duel remain stable; cases which were unstable remain unstable but the unstable cases always favor the side possessing the capability.

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* It is necessary to recall, at this point, that the alert manned bomber force was assumed sufficient to penetrate the area and local defenses of the other. If this assumption is rejected, there is no difference between alert and non-alert manned bomber forces in Table 6.

Table 6.  Changes in Stability as ICBM Systems
are Imbedded in Mixed Attack Systems

| USSR | IRBM | IRBM alert bombers | IRBM non-alert bombers | IRBM POLARIS | IRBM POLARIS alert bombers | IRBM POLARIS non-alert bombers |
|---|---|---|---|---|---|---|
| IRBM | Little change | Little change US ∕ | Little change US ∕ | Little change US ∕ | Little change US ∕ | Little change US ∕ |
| IRBM Alert Bombers | Little change USSR ∕ | ALWAYS STABLE | Little change USSR ∕ | ALWAYS STABLE | ALWAYS STABLE | ALWAYS STABLE |
| IRBM Non-alert Bombers | Little change US ∕ | Little change US ∕ | Little change US ∕ | Little change US ∕ | Little change US ∕ | Little change US ∕ |
| IRBM POLARIS | Little change USSR /- | ALWAYS STABLE | Little change USSR ∕ | ALWAYS STABLE | ALWAYS STABLE | ALWAYS STABLE |
| IRBM POLARIS Alert Bombers | Change USSR ∕ | ALWAYS STABLE | Little change USSR ∕ | ALWAYS STABLE | ALWAYS STABLE | ALWAYS STABLE |
| IRBM POLARIS Non-alert Bombers | Change USSR ∕ | ALWAYS STABLE | Little change USSR ∕ | ALWAYS STABLE | ALWAYS STABLE | ALWAYS STABLE |

∕ = favored

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PART II. SOME EFFECTS OF INSPECTION AND CONTROL ON STABILITY

INTRODUCTION

In part I, various combinations of strategic attack systems were examined for stability under conditions of approximate parity in numbers and quality of weapons. In Part II, we consider the effects of various inspection proposals on the stability of mixed systems in general and on the 1962 strategic posture of the US and USSR in particular. In the latter case, we also examine the effects on stability of various unilateral actions which both sides might take in any event or as a result of an inspection agreement.

EFFECTS OF INSPECTION ON STABILITY OF MIXED SYSTEMS

Manned bomber inspection proposals might affect stability in at least three ways; by decreasing the size of the initial wave of a surprise attack and generally by increasing the warning time and, thus, allowing the defender's bombers a greater chance of avoiding ICBM attack; and by increasing the knowledge of both sides of the location of current active bomber bases. If inspection increases warning time for both sides, stability is increased to the extent that the alert bomber force on both sides could execute an effective retaliatory attack in the face of a surprise ICBM attack on airbases. The improved intelligence on the daily status of SAC and SUSAC base activity for both sides would tend to decrease stability by increasing the probability of a successful attack on these bases. This statement assumes that the intelligence on both sides is about the same. If, as may be likely, the USSR already has sufficient intelligence on SAC operations to blunt the US manned bomber retaliation by ICBM attack on air bases and active bomber defenses and the USSR believes that the US does not possess a similar capability against the USSR, the intelligence arising from an inspection agreement would decrease stability by increasing USSR fears of a surprise attack; but this would probably be off-set by the USSR's increased knowledge of the status of our forces. If ICBM inspection provided sufficient early warning, then both sides would possess an alert manned bomber force. As we have seen in Part I, an alert manned bomber force on both sides, which is adequate to inflict critical damage in retaliation, will make all

unstable.

unstable situations stable regardless of the ICBM posture.

The only proposal regarding missile-carrying submarines which can affect stability concerns the division of the world's oceans between the US and USSR such that neither side would have on-station submarines capable of inflicting damage on the other by surprise attack. In evaluating the effect of this proposal on stability, it is necessary to consider the probability that the defender's missile-carrying submarines can reach their attack stations after an ICBM attack and fire their missiles without detection and destruction. If the potential aggressor believes this probability to be high, an agreement limiting deployment merely delays the retaliation and he will be deterred from attacking. If both sides have a high probability of submarine penetration and sufficient submarines all cases are stable. The stability achieved by limiting peacetime deployment of missile-carrying submarines depends not only on the capability of both sides to reach their firing station and fire their missiles after an ICBM attack, but on the numbers available.

Inspection proposals for IRBMs do not differ from ICBMs. So long as the inspector cannot keep his hand on the firing button when a potential aggressor decides to attack, the best that can be achieved by agreements is an increased warning time. Current inspection systems for ICBM's and IRBM are aimed at providing either tactical warning alone, essentially warning of launch, or both tactical and strategic warning of missile attack, warning of the order of from one to six hours for first generation missiles. The second type of warning has not been evaluated in this report, but it is doubtful that warning of USSR IRBM launches will permit a retaliatory strike by US IRBM. It is also doubtful as to whether aircraft on runway alert could avoid destruction by warning of IRBM attack. It is probably not far wrong to state that tactical or launch warning obtained from IRBM inspection systems will be of marginal value to the defender, and will have little effect on stability.

The effects of symmetric tactical ICBM warning are many, but perhaps the most important is that it would provide both sides with relatively effective BMEWS. The

effect

effect of this upon stability would depend on the alert status of the
two A/C forces, and hence very much upon unilateral actions. Tactical
warning may or may not be accompanied by position disclosure. If, in
addition, greater specific intelligence is obtained by inspections,
stability may be affected greatly. In general, such disclosures will tend
to destabilize from a mutual point of view, by improving the U. S.
capability for counterforce action.

The improved intelligence of IRBM locations can only affect stability
in the model considered when the USSR does not know the precise locations
of U. S. and NATO IRBM's*. But it appears unlikely that this is the case.

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* US ignorance of the location of Soviet IRBMs does not affect stability
  because the stability model does not take account of attacks on Allied
  or Satellite cities. From the Soviet point of view an IRBM attack on
  USSR cities is more to be feared than an IRBM attack on their IRBM
  sites. Therefore, US IRBMs attack only cities. Soviet IRBMs, on the
  other hand, must destroy US IRBMs in order to protect USSR cities.

The Us-USSR

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STABILITY OF ESTIMATED US-USSR POSTURE IN 1962

The US-USSR posture in 1962 regarding ICBMs is estimated to be as follows:

### US Capability [1]

| Type Missile | Number of Bases | Hardness | Configuration | Total Missiles | Min H+15 Response | Max H+15 Response |
|---|---|---|---|---|---|---|
| ATLAS | 13 | 2 psi | 1 x 3 | 39 | 4 | 13 |
| ATLAS | 14 | 25 psi | 1 x 3 | 42 | 5 | 14 |
| TITAN | 4 | 100 psi | 1 x 9 | 36 | 4 | 36 |
| Total | 31 | | | 117 | 13 | 63 |

### USSR Capability [1]

| Type Missile | Number of Bases | Hardness | Configuration | Total Ready Missiles | Total Reserve Missiles |
|---|---|---|---|---|---|
| Fixed | 25 | 2 psi | 1 x 5 | 125 | 125 |
| Mobile | 25 | 2 psi | 1 x 5 | 125 | 125 |
| Total | 50 | | | 250 | 250 |

1) All missiles have 2 MT warheads.

We shall consider first of all the stability of just the manned bomber - missile weapons system.

1. Without inspection (i.e., US intelligence less than 50%). If the US attacks the USSR and yields are at least 2 MT on both sides, then with any CEPs up to 2 n.m. both sides will suffer damage to at least the 20% level. This follows from the facts that:

(a) USSR always has sufficient missiles whose locations are unknown to the US to destroy 20% of US cities (60 missiles at most).

(b) US always has sufficient missiles to destroy known USSR missile sites (25 sites at most) and has sufficient missiles remaining to destroy 20% of USSR cities (40 missiles at most).

If the USSR

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If the USSR attacks the US and BMEWS does not work, or the US does not fire on warning, or only the minimum H+15 response (13 missiles) is fired by the US, then the USSR attack is successful in the sense that the US will receive 20% damage, but the USSR will suffer less than 20% damage in the retaliatory blow.

On the other hand, if the USSR attacks the US and BMEWS does work and US does fire on warning and the maximum H+15 response is achieved (63 missiles), then the USSR attack is unsuccessful in the sense that although the USSR destroys at least 20% of US cities, he always suffers 20% destruction of his cities in return.

If manned bombers are considered in addition to ICBMs to the extent of 50 soft bases on each side, then the situation is unchanged when the US attacks the USSR. This is because the manned bombers cannot result in less damage to either side, and each side already has received 20% city damage.

If manned bombers are considered in addition to ICBMs and the USSR attacks the US with 2 MT weapons the USSR has sufficient ICBMs to destroy enough US ICBMs to prevent effective retaliation (112 weapons), destroy US cities to the 20% level (60 weapons) and attack each US SAC base to the level of 1½ weapons per base (78 weapons). He would expect to destroy about 48 of the 50 SAC bases, or at the very least to disrupt them and make them vulnerable to a later bomber attack.

The situation then for estimated 1962 postures without inspection is as summarized in Table 7:

Table 7.    Stability of 1962 ICBM-Manned Bomber Posture
(Without Inspection)

| US Response | Pure ICBMs | ICBMs and Manned Bombers |
|---|---|---|
| BMEWS does not work or US does not fire on warning or only minimum H+15 US response | D/B 1/ | B/B 1/ or D/B 1/ for 2 MT weapons depending upon alertness of US SAC and/ or effectiveness of un-destroyed SAC |
| BMEWS works and US fires on warning and maximum H+15 US response | B/B 1/ | |

The B/B

1/  See Figure 1 for key.

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The B/E cases are stable by criteria A, both the US and the USSR being deterred from making a surprise attack by receiving as much damage as they inflict.

The D/E cases are unstable in favor of the USSR: the US is deterred from making a surprise attack by receiving as much damage as we inflict, while the USSR need not fear critical damage by retaliation if she makes a surprise attack. The necessary conditions for stability, therefore, apply only to the US. Without BMEWS, stability can only be achieved in 1962 by maintaining a bomber force capable of penetrating alert Soviet air defense and dropping on target cities at least 15 10-MT weapons (40 HOUND DOG missiles) after a surprise missile attack. With BMEWS and the capability of firing at least 40 ICBMs in 15 minutes, the US can achieve stability without regard to the alert status of bombers, so long as we are willing to fire ICBMs on warning only. If we are not, the alert SAC bomber capability must be capable of delivering at least 15 10-MT bombs (40 HOUND DOG missiles) on particular target cities.

2. With Inspection. In the foregoing non-inspection case, it was assumed that locations of all US ICBM sites were known to the USSR, but that at most 50% of the USSR ICBM sites were known to the US. (An assumption of 50% makes no difference in the arguments presented.) In this section, the effects of inspection will be examined from the point of view of determining what fraction of USSR missile sites must be vulnerable to US missile fire in order to affect the stability. Assumption relative to manned bomber remain the same. When this fraction is over 50%, as will always be the case, it implies the existence of an inspection and communications system which will determine and report locations of mobile USSR sites sufficiently rapidly to make them vulnerable to US missile fire.

When the USSR attacks the US, the fraction of vulnerable USSR missile sites is immaterial. Hence, in these cases, the relative posture is unchanged. When US attacks USSR, the relative posture represented letter/B will be changed to /C if a high enough level of US intelligence on USSR missile sites exist and if the USSR has no effective alert force.

The US intelligence, as measured by the fraction of USSR missile sites vulnerable to US fire, required to change B to C in the pure ICBM case when the US attacks is as follows:

Minimum US Intelligence Requirements
on Soviet ICBM Bases

| | 2 MT | | 10 MT | |
| --- | --- | --- | --- | --- |
| | 1 n.m. | 2 n.m. | 1 n.m. | 2 n.m. |
| 1x5 sites | 78% | 76% | 92% | 92% |
| 1x10 sites | 88% | 88% | 96% | 96% |

If USSR can use its reserve missiles in the retaliation blow the 1x10 configuration applies. If not, the 1x5 configuration applies. When manned bombers are added on the US side nothing is changed.

Now consider the case when manned bombers are added to the USSR side. Assuming the levels of US intelligence indicated above, the US, when it attacks, will have from 31 to 39 missiles left over for USSR airfields — probably an insufficient number to prevent a retaliatory USSR bomber blow. Thus US intelligence does not change the mixed ICBM-Bomber case.

The situation then for estimated 1962 postures with the levels of inspection indicated above is summarized in Table 8:

Table 8.  Stability of 1962 ICBM-Manned Bomber Posture
(With Inspection)

| US Response | Pure ICBMs | ICBMs and Manned Bombers |
| --- | --- | --- |
| BMEWS does not work or US does not fire on warning or only minimum H+15 US response | D/C | B/B or D/B depending upon alertness and/or effectiveness of undestroyed SAC |
| BMEWS works and US fires on warning and maximum H+15 US response | B/C | B/B |

If we compare Table 8 with Table 7, we find that inspection works to the advantage of the US. The only case where inspection does not change the favorable position possessed by the USSR without inspection consists of a non-alert US bomber and missile force. The mixed ICBM-bomber attack is otherwise always stable.

We now consider the influence of IRBMs and missile-carrying submarines on the stability of the 1962 posture. We assume that the US possesses 60 overseas IRBM sites and 5 POLARIS submarines, with a total of 120 IRBMs and 80 POLARIS missiles. We further assume that no IRBM bases or submarines will be destroyed by retaliation when the US makes a surprise attack.

The IRBMs cannot change the results of Table 7 (no inspection) because the destruction of USSR bomber bases does not reduce its ICBM capability to inflict critical damage on US cities for a US surprise attack, and because the USSR may be presumed to know the location of all US IRBM sites and possess a sufficient IRBM capability of its own to destroy them before they can fire, in the case of a USSR surprise attack. POLARIS also will not change the results of Table 7 because the submarine capability for immediate retaliation on the USSR will be no more than 40 missiles at best, which is less than one-half the requirement to inflict critical damage on Soviet cities, in the case of a Soviet surprise attack. In a US surprise attack, we could station all 5 submarines and fire their full complement of 80 missiles, but the US lack of intelligence on the location of Soviet ICBM bases always allows her to inflict critical damage on the US by retaliation.

With inspection, however, the existence of US IRBMs and POLARIS submarines does change the results given in Table 8. If the US makes a surprise attack on the USSR, there will be sufficient missiles to destroy all 55 SUSAC bases and reduce the ICBM force to impotence, locations assumed to be known.

If the USSR does not possess a bomber force on continuous airborne alert capable of penetrating an alert US air defense and inflicting critical damage on US cities, the destruction of these SUSAC bases can be considered equivalent to blunting their retaliatory capability by manned bombers. Against a non-alert Soviet bomber force, therefore, a US surprise attack with ICBMs, IRBMs, POLARIS submarines, and manned bombers can inflict critical damage on the USSR without fear of receiving critical damage in return. As before, inspection yielding only tactical warning does not change the outcome when the USSR makes a surprise attack. The results for IRBMs on both sides and 5 US POLARIS submarines are shown in Table 9.

Table 9.   Stability of 1962 Posture
ICBMs, IRBMs, Manned Aircraft
(With Inspection)

### US Response

| | |
|---|---|
| BMEWS does not work<br>or US does not fire on warning<br>or only minimum H+15 US response | B/C and D/C depending upon<br>alertness and/or effectiveness<br>of undestroyed SAC |
| BMEWS works<br>and US fires on warning<br>and maximum H+15 US response | B/C |

### USSR REQUIRED POSTURE IN 1962

The preceeding section analyzed the stability of the 1962 strategic postures based upon current US intelligence estimates of the Soviet force levels, organization, and deployment in 1962.

The intelligence on USSR ICBM force levels, organization, and particularly deployment is admittedly weak. Mirror-image reasoning and some additional evidence has led to the estimate that 10 USSR missiles will be deployed at a soft site (2 psi) with 5 pads. Hence 5 missiles would be in reserve. If these sites are soft, as estimated, then once their locations become known they become extremely vulnerable if the manner in which they are deployed is not changed. If the estimates are correct and if inspection agreements were implemented and locations revealed, the temptation to change these deployments would be strong, economical, and could be accomplished either prior to disclosure or after disclosure. The latter would not abbrogate an agreement unless specifically provided for. In view of these facts it appears desirable to examine the effects of changes in deployment upon stability.

Intelligence relative to hardening and force level at any future time likewise is not firm; hence these also will be varied. The general approach will be to determine a spectrum of requirements which would make the 1962 posture unstable with USSR superiority. Accordingly, we shall consider both Soviet offensive and defensive requirements. The effects of unilateral actions and some forms of inspection on these requirements will also be considered.

Offensive

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1. _Offensive Requirements._ We consider first the Soviet missile requirements to make an effective surprise attack on the United States and its overseas bases. If the US has a continuously airborne bomber force capable of inflicting critical damage on Soviet cities, the USSR cannot hope to eliminate effective retaliation except by improving its air defense and civil defense capability. A detailed examination of the various alternatives for this case is beyond the scope of this study. If all 5 US missile-carrying submarines can deliver their full complement of missiles (80), the Soviet Union can eliminate critical damage only by reducing the US ICBM/IRBM capability to less than 5 2-MT missiles. The ICBMs needed to accomplish this order of destruction to the 25 psi ATLAS sites and 100 psi TITAN sites are very large indeed. Nearly 500 ICBMs would be required against the ICBM capability alone, a further 100 or so are required to reduce SAC bases and cause critical damage to US cities and population.

If, however, no more than 3 POLARIS submarines can attack the USSR and an ICBM attack is capable of blunting the US bomber and missile force, the Soviet requirements become reasonable and well within their economic capacity. The calculation requires the USSR to be capable of firing 310 ICBMs in a very short time with a 2-MT warhead and a CEP of 2 n.m. to cause at least 90 percent damage to 27 soft and medium ATLAS sites and 50 soft SAC bases, 65 percent average damage to 4 hard TITAN sites, and to kill at least 20 percent of the US industrial population and destroy at least 30 percent of US war manufacturing capacity. The remaining US ICBMs (20) and effective POLARIS missiles (48) are insufficient to inflict critical damage on the Soviet population and economy and it is not unreasonable to assume that the residual US bomber capability can be further reduced by follow-up attacks with Soviet bombers, if not by Soviet air defenses.

Soviet IRBM requirements against US overseas IRBM sites number about 100 reliable IRBMs of the same yield and CEP as the ICBMs. Under these assumptions, missile-carrying submarines are not necessary for Soviet offensive requirements. The targets remaining for Soviet manned bombers appear to be a relatively small number of clean-up types if only critical damage is considered.

The presence

The presence or absence of inspection does not appear to
significantly affect the Soviet posture or requirements in
offensive warfare. Inspection, of course, may make it more
difficult to achieve surprise and thereby reduce the chances
of ones the chances of success, but the reduced chances of
success arise from sources that they cannot be compensated for
by additional physical means of attack. It appears to be
generally agreed that present Soviet knowledge of US bases and
forces is entirely adequate for a successful surprise attack
to be made. Thus, it may be doubted whether the additional
intelligence of US operations gained by inspection has any
substantial pay-off for the Soviet Union as far as offensive
requirements are concerned.

2. __Defensive Requirements.__ The maximum US capability for
a surprise missile attack on the Soviet Union is the basis for
discussion of USSR defensive requirements. It is reasonable for
the Soviet Union to make the following assumptions as to the
US missile capability in 1962:

| | | | |
|---|---|---|---|
| 117 | 2-MT | ICBM | 2 n.m. CEP |
| 120 | 2-MT | IRBM | 2 n.m. CEP |
| 80 | ½-MT | POLARIS | 2 n.m. CEP |

Faced with this threat, the most obvious requirement for
the USSR is to place their ICBM bases out of range of US
IRBMs and POLARIS missiles. Throughout the present paper we
have assumed that this has been done. Even so, present US
estimates of the 1962 Soviet posture makes the USSR extremely
vulnerable to a US surprise attack. If the US knows the loca-
tion of 80 percent of the Soviet ICBM bases and if the vul-
nerability of these bases remains as estimated, the US is
capable of inflicting critical damage on the USSR and can
prevent the USSR from inflicting critical damage on the US
by retaliation. The US IRBM and POLARIS capability alone
can always inflict critical damage on the Soviet population
and economy (40 2-MT or 85 ½-MT missiles). Even in the un-
likely case of warning sufficient to allow the population to
reach shelters before IRBM attack, the Soviet industrial
plant remains vulnerable to attack. The best that the
Soviet Union can do, when facing the possibility of a US
surprise attack, is to hide, harden, and disperse their re-
taliatory force in order to assure that enough survive to
inflict critical damage on the US. So long as IRBMs and
POLARIS exist in the US force structure and no anti-missile

missile defense

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missile defense are available, the Soviet Union cannot hope to reduce the vulnerability of her industry to critical damage from a US surprise attack.

We now examine, in turn, the unilateral actions which the Soviet Union might take between now and 1962 to strengthen the retaliatory capability of her manned bombers, ballistic-missile submarines, and ICBMs.

    a. <u>Defenses for Manned Bombers</u>. It would be possible for the USSR to make some portion of her manned bomber force invulnerable to ICBM attack by maintaining a continuously airborne alert force which might be strong enough to have some chance of penetrating alert US air defenses and inflict some damage on the US population and industry. If this force could inflict critical damage on the US (20 10-MT bombs on specific target cities), it would serve alone as an effective deterrent.

A second possibility would be to harden air bases so that even non-alert bombers would have some protection against ICBM attack. If all aircraft on the ground were protected to 25 psi, for example, the number of 2-MT weapons required by the US for 90 percent probability of neutralizing an airbase increase from one to about six to eight.

If the hardened bases were also dispersed out of range of US IRBMs, the entire US ICBM capability, after destroying 50 soft ICBM sites, could not destroy more than one-third of these hardened and dispersed airbases.

Since these actions are relatively straightforward, if expensive, the Soviet Union has no need to try to hide bomber bases from the US. Disclosure of all bomber bases has been assumed in the preceeding calculation of US ICBM requirements and under disclosure the USSR could through unilateral actions assure a reasonable assurance of survival against a US surprise attack as far as their manned aircraft are concerned.

    b. <u>Ballistic-Missile Submarines</u>. Present US intelligence estimates suggest that the USSR will have one submarine capable of firing ballistic missiles in 1962. To assure quick retaliation after a surprise attack by the US, the Soviet Union would require a capability of firing about 80 POLARIS-type missiles. The size of the submarine force needed to maintain 5 or 6 vessels near the coasts of the US ranges from 9 to 18 submarines. When the USSR can operate an FBM-submarine fleet of this magnitude, effective retaliation is reasonably assured in the event of a US surprise attack, even without any other of the possible Soviet alternative actions.

    c. <u>ICBM Requirements</u>

c. ICBM Requirements. It was shown above that, when the US attacks, the USSR has a requirement for sufficient ICBMs to absorb the attack from all 117 US ICBMs and possess enough ICBMs left over to inflict critical damage on the cities of the US. This requirement can be fulfilled by various combinations of base hardness, concealment, and configuration.

Consider, first, the requirement in terms of numbers of missiles located on soft (2 psi) bases with a 1 x 5 configuration and perfect intelligence on the part of the US. Since one attacking missile can destroy one Soviet ICBM base, the USSR must have 60 missiles to inflict critical damage to US cities plus 117 sites to absorb the US ICBM attack. With all sites 1 x 5, the USSR needs 129 sites and 645 ICBMs. If all other conditions remain the same, except that the ICBM bases are hardened, fewer sites are needed to absorb the 117 US ICBMs. The numbers are given below.

### USSR Missile Sites Required
### (no concealment)

| Hardness | No. of Sites | No. of Missiles |
|----------|--------------|-----------------|
| 2 psi | 129 | 645 |
| 25 psi | 34 | 170 |
| 100 psi | 2020 | 100 |

As an alternative to hardening and, perhaps, much less expensive, the USSR might render some sites invulnerable to US missile fire by concealment. This would certainly be the case without inspection and would probably occur even with a sophisticated inspection system. The effect of concealment might also be achieved by mobile missile sites with very fast reaction times. In any event, there is a trade-off between concealment, however obtained, and hardening. This trade-off is shown in Figure 3.

In words,

Figure 3.  USSR ICBM Requirements
(No. of sites)

Hardness

| 100 psi | 12 | 14 | 15 | 16 | 18 | 18 | 18 | 19 | 19 | 19 | 20 |
| 25 psi | 12 | 14 | 15 | 17 | 20 | 22 | 25 | 28 | 30 | 31 | 34 |
| 2 psi | 12 | 14 | 15 | 17 | 20 | 24 | 30 | 40 | 60 | 120 | 129 |
| | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |

Fraction of ICBM sites
known to US

In words, Figure 3 is interpreted as follows:  If the US
attacks with the estimated 1962 POLARIS, ICBM, and IRBM capability,
the USSR is always critically damaged.  If, however, the USSR has
at least as many 1 x 5 ICBM sites as is shown in Figure 3, with
the indicated hardness and concealment, the USSR always critically
damages the US in retaliation.  The relative posture is thus de-
scribed by ?/B.  If the USSR has fewer than the number of ICBM
sites indicated in Figure 3, the outcome is ?/0.

As an alternative to hardening and concealment, the USSR
might decrease its missile requirements by a change in configura-
tion.  The complete trade-off table for hardness, concealment,
and configuration has not been worked out due to lack of time.
For zero concealment (perfect inspection), the number of sites
and missiles required for various degrees of hardness and various
configurations are shown in the following table:

No. USSR Missiles and Missile
Bases Required (no conceal-
ment)

| Hardness | CONFIGURATION | | | | | | | |
| | 1 x 1 | | 1 x 3 | | 1 x 5 | | 1 x 10 | |
| | Bases | Mis-siles | Bases | Mis-siles | Bases | Mis-siles | Bases | Mis-siles |
| 2 psi | 177 | 177 | 137 | 411 | 129 | 645 | 123 | 1230 |
| 25 psi | 88 | 88 | 43 | 129 | 34 | 170 | 24 | 240 |
| 100 psi | 68 | 68 | 28 | 84 | 20 | 100 | 13 | 130 |

Without inspection

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Without inspection and, hence, with low US intelligence,
it is seen in Figure 3 that the USSR ICBM requirements are
modest -- of the order of 20 soft 1 x 5 bases. With inspec-
tion, an obvious Soviet action would be to establish 60
covert ICBMs in soft bases of any economical configuration,
say 1 x 5, and disperse and harden his overt bases enough
to absorb the US attack of 117 ICBMs. The Soviet requirement
for this combination of concealment, hardening, and configura-
tion is as follows:

No. USSR Missiles and Missile Bases Required
(60 missiles concealed in 12 soft bases)

| Hardness | CONFIGURATION | | | | | |
| | 1 x 1 | | 1 x 3 | | 1 x 5 | |
| | Bases | Mis-siles | Bases | Mis-siles | Bases | Mis-siles |
| 2 psi | 129 | 177 | 129 | 411 | 129 | 645 |
| 25 psi | 28 | 76 | 28 | 108 | 28 | 140 |
| 100 psi | 17 | 65 | 17 | 75 | 17 | 85 |

      d. Effect on Stability. If we recall from page 23
that the USSR requires 300-600 ICBMs for an adequate offensive
capability, it is apparent that she has great latitude in base
configuration and concealment by reason of her very small de-
fensive requirements in numbers of ICBMs. Any one of the proposed
changes in posture -- whether for manned bombers, ICBMs, or
ballistic-missile submarines -- will deter the US from making a
surprise attack by making it impossible to limit the Soviet
retaliatory capability below the critical level (20 percent
deaths to the US city population, 30 percent destruction of
US war industry). Any postures, therefore, which are unstable
and favorable to the US, will become stable. Unstable postures
which are favorable to the USSR can only be rectified by US
unilateral actions.

## US REQUIRED POSTURE IN 1962

      The courses of action which the USSR might take to reduce
its vulnerability to surprise attack apply equally to the US.
It seems unnecessary to present detail numbers here. The scale
and costs of US actions are probably greater than for the USSR
because the USSR ICBM threat is 3-5 times as great as the US
ICBM threat in 1962. The effect on stability, however, will

be the same.

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be the same. It may be impossible for the US to protect its war industry against surprise attack, but it is certainly possible to deter a surprise attack by the USSR by making it impossible for the Soviet Union to reduce the US retaliatory capability below the critical level. By this means, all unstable postures which are favorable to the USSR will become stable. If it is assured that both sides take the necessary unilateral action, all postures become stable.

\* \* \*