THE CRUISE MISSILE AND THE STRATEGIC BALANCE

by

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In an age when US intercontinental ballistic missiles (ICBMs) may become vulnerable to a Soviet preemptive first strike, when the strategic nuclear balance appears to be shifting in favor of the Soviet Union, and when only costly alternatives seem to be available to the United States to preserve both the survivability of its retaliatory forces and the existing strategic balance, a product of modern technology has emerged. That product—a weapons system small in size, potentially mobile, highly accurate, and relatively inexpensive—is known as the "cruise missile."[1]

The idea of a nonballistic, long-range, air-breathing missile is not new. During World War II, the Germans used V-1 "buzz bombs" to terrify the English. Immediately after the war, the US Navy initiated the design of the submarine-carried and surface-launched Regulus I cruise missile. By the late 1950's, the United States had developed several nuclear-armed cruise missiles, including the Matador and the submarine-launched, supersonic Regulus II. By 1958, the US Air Force had activated its first intercontinental-range cruise missile system, the Snark.[2]

Improvements in air defense and ballistic missile technology, however, presaged the demise of these early versions of a "strategic" cruise missile. The Air Force continued to pursue the development and deployment of air-launched standoff air-to-surface weapons and unarmed decoys such as the Hound Dog and the Quail and to show an interest in drone and Remotely Piloted Vehicles (RPV) for a variety of applications. But large, high-altitude, nonmaneuvering, easily detected intercontinental cruise missiles came to be viewed as highly vulnerable to improving Soviet surface-to-air missile (SAM) defense networks.[3] As a result, strategic cruise missiles were seen as a less attractive alternative than the more accurate and less vulnerable manned bombers and ICBMs.

In recent years, the United States has reopened development of its strategic cruise missile program. Advances in guidance technologies, miniaturization of electronics, improvements in small turbine engine design,

and the advent of high energy/heavy hydrocarbon fuels have made it possible to produce relatively small, highly accurate missiles capable of traveling great distances. At a time when Soviet technological advances in missile accuracy and warhead design appear to be threatening the survivability of our strategic retaliatory forces, the cruise missile has been considered a relatively inexpensive[4] means not only of complementing the manned bomber and enhancing its penetration of advanced threat environments, but also of providing an invulnerable reserve force which could be launched from a wide variety of surface and subsurface platforms.

Dr. Malcolm Currie, former Director of Defense Research and Engineering, in testimony before Congress, has argued that the cruise missile can contribute to a more efficient utilization of bomber/tanker assets by acting as an extension of the launching platform in order to destroy outlying and isolated targets. The fuel saved by employing such an extension can then be converted into higher payloads or an increase in endurance at low altitudes which would reduce the vulnerability of the bomber during the penetration phase. Moreover, he has contended that in the process of executing their attack, cruise missiles provide a bonus to the penetrating bomber force engaged in attacking numerous defended aim points. The bonus is the dilution and decoy effect resulting from the operation of many hundreds of vehicles in the enemy air defense net, to the obvious benefit of bomber survivability.[5]

Other Defense Department witnesses have testified that, because of its adaptability and versatility, the cruise missile can be launched from a wide variety of platforms and could be called on to perform a wide variety of tasks. It can be deployed on aircraft, surface ships, submarines, or land-mobile launchers. As such, it could constitute an almost invulnerable strategic deterrent reserve force. Furthermore, it could be called on to conduct a wide variety of nuclear options, thus adding a real margin of flexibility at the strategic and theater levels.[6] Dr. Currie has suggested that "To the degree that they contribute to a credible deterrent, an impregnable defense, they have a stabilizing effect."[7]

Its critics have argued that there is no objective need for a strategic cruise missile and that its acquisition is strategically destabilizing and likely to result in a net long-term disadvantage to the United States.[8]

First, such critics contend that the United States and the Soviet Union already have forces sufficient to deter one another from a strategic attack. Therefore, it would be pointless and costly to add new kinds of weapons to existing inventories. Townsend Hoopes, former Under Secretary of the Air Force, has argued that:

> Large-scale overkill exists in the nuclear stockpiles on both sides. No one needs any more new or marvelous instruments of destruction.[9]

In like manner, Thomas Halsted, as Executive Director of the Arms Control Association, contended that:

> We and the Soviet Union, with our existing forces, are deterred from attacking each other already; adding new kinds of weapons such as cruise missiles to enhance deterrence is pointless and costly.[10]

Second, even if such weapons were required, they would be vulnerable to advances in Soviet air defenses. The opposition has been quick to note that the Soviet Union possesses a substantial air defense network which could be a useful, even if not totally effective, means of neutralizing a cruise missile attack.[11] They point out that even Defense Department witnesses have recognized the vulnerability of the cruise missile to targets defended by "high quality terminal surface-to-air missile units."[12]

Third, critics believe that acquisition of a strategic cruise missile force would enormously complicate the verification problem and that, in the absence of a

verifiable arms control agreement, SALT limitations would be meaningless. They point out that through national technical means[13] it is not only impossible to distinguish an unarmed or conventionally armed cruise missile from a nuclear one, but it is also impossible to differentiate between "strategic" and "tactical" variants.[14] Since neither the United States nor the Soviet Union is likely to permit intrusive inspection, numbers and types of cruise missiles are likely to remain unverifiable in the foreseeable future. Furthermore, because the cruise missile can be employed on a wide variety of vehicles, the potential for a proliferation of these weapons is enormous. As Halsted has emphasized:

> We could have as many as 11,000 air-launched, and 10,000 sea-launched cruise missiles. Compared to these numbers, the Vladivostok ceilings of 2,400 strategic launchers . . . allowable on each side look ridiculously low.[15]

Hence, critics conclude that acquisition of the cruise missile will be strategically destabilizing.

Finally, critics say that it is by no means clear that the United States would win a cruise missile arms race with the Soviet Union. They note that the Soviet Union has a greater number of submarines, a growing surface fleet, and a large number of medium- and long-range bombers which could serve as launching platforms for nuclear-armed strategic cruise missiles. Furthermore, they contend that during the penetration phase, cruise missiles are potentially vulnerable to sophisticated air defenses. Presently, the United States has virtually no air defense capability against a large-scale cruise missile attack, but the Soviet Union has a well-developed and integrated SAM and antiaircraft artillery network which could serve as the basis for a potentially effective cruise missile defense. Also, since the United States has more targets which are close to the coastline, it is potentially more vulnerable to current and near future generation cruise missiles launched from standoff airborne or naval platforms.[16]

What has been absent from both sides of the discussion is a clear delineation of the criteria upon which the acquisition of strategic nuclear systems should be based, followed by an uncluttered assessment of the need for strategic cruise missiles, based on the strengths and projected vulnerabilities of the current Triad of strategic forces, and the impact which the acquisition of the cruise missile is likely to have in offsetting Triad vulnerabilities and preserving the strategic balance.

CRITERIA FOR ASSESSMENT

Acquisition of strategic systems should be based on an assessment of the relative effect such systems are likely to have on the overall US worldwide strategic posture. As a minimum, such an assessment should take into consideration four fundamental parameters of the strategic equation.

First, strategic sufficiency: US forces should be sufficient not only to deter limited and general nuclear war, but also to preclude the USSR from reaping a foreign policy advantage as a result of third nation perceptions of a relative US strategic military weakness. To such an end, US strategic forces must be able to survive a limited or general Soviet counterforce first strike; to penetrate Soviet defenses; to conduct limited options in support of a favorable early termination of conflict; and, as a last resort, to inflict a level of damage on the Soviet political and economic infrastructure and residual military

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capabilities which would clearly be perceived by Soviet leaders as a cost exceeding any conceivable benefit to be derived from actions likely to lead to a strategic exchange.

Second, strategic stability: US strategic forces should contribute to crisis stability. The capabilities or limitations of such forces should in no way provide an incentive for either side to launch a disarming first strike or permit either side to launch a limited nuclear attack with impunity. Moreover, such forces should permit responses to limited attacks that serve to suppress rather than foster incentives to escalate.

Third, resource conservation: The fundamental task is to minimize cost (capital, material, human) in order to free resources for other necessary defense and nondefense sector requirements, while maintaining sufficiency and stability at the strategic level and flexibility at all other levels of potential competition or conflict.

Finally, decisions guiding the acquisition or negotiated limitation of US strategic nuclear weapon systems should take into consideration the effect such systems are likely to have on US regional, theater, and sea control/general purpose forces—a parameter often overlooked in a world still haunted by the awesome specter of nuclear holocaust brought on during the cold war. Nevertheless, in today's environment, which has come to be characterized by a reasonably high level of strategic stability, the real competitions between the United States and the Soviet Union for influence in the international arena are likely to take place at levels other than the strategic nuclear. In such an environment, the US regional, theater, and sea control/general purpose forces, which support US initiatives in defense of national interests in peacetime and during conflicts below the strategic nuclear level, are likely to be of paramount importance.

Within these parameters, it is possible not only to appraise the strengths and weaknesses of the current US strategic nuclear arsenal, but also to systematically assess the contribution cruise missiles are likely to make in terms of offsetting current and foreseeable future deficiencies in US strategic forces and enhancing the overall US worldwide strategic posture. First, let us turn to an assessment of the relative strengths and weaknesses in the current generation of US strategic forces.

ICBMs

There is ample evidence to suggest that the *present* generation of US ICBMs is not only sufficient in the sense established in this paper but also strategically stabilizing and cost-effective.

Given the *current* hard target counterforce capability of Soviet ICBMs and the negotiated limitations on ballistic missile defense, it is likely that a large portion of the US ICBM force not only would be able to survive a Soviet first strike, but also would be capable of penetrating Soviet defenses in order to inflict a high level of damage on the Soviet urban-industrial complex. The US ICBM force is also sufficiently accurate and responsive to conduct, in a qualified manner, some measured time-urgent counterforce options in support of limited or general war or theater nuclear operations.

Furthermore, strategic stability is enhanced by the reliability and relative security of the ICBM command, control, and communications (C_3) net and the inherent security of systems housed in hardened and underground silos or located in well-guarded launch sites.

Finally, the current generation of ICBMs is relatively inexpensive to maintain. While a high percentage of the cost of any strategic system is usually associated with its research, development, and initial acquisition phases, rather than with operation and maintenance, the silo-housed, "static" nature of the ICBM force makes it the least expensive of the Triad of strategic forces to maintain.

On the other hand, the short time-of-flight from launch to impact and the inability to recall an ICBM force once launched could contribute to instability in certain crisis situations. For example, in a severe crisis, one or the other of the superpowers, when confronted with the possibility of a strategic nuclear first strike, might be tempted to launch a preemptive

strike of its own. Since the short time-of-flight of ICBMs promises only a short warning period, it might appear wise to attempt to destroy the bulk of an opponent's strategic nuclear forces before they were launched.

Furthermore, the advent of strategic parity between the superpowers has limited the utility of the US ICBM force as a deterrent to theater aggression. No longer can the United States rely on the threat of massive retaliation to deter regional aggression. Nevertheless, ICBMs can be used, if required, to support theater nuclear warfare. In light of the SALT I numerical limitations, however, the number of ICBMs which can be allocated for theater use is circumscribed by a prudence which requires that a certain number be retained to deter or conduct a general nuclear war.

In a sense, the ICBM force is currently the mainstay of the US strategic nuclear capability. It is the only force capable of reliably conducting a full range of time-urgent responses, while hardened silos render it essentially invulnerable to a Soviet preemptive strike. It is, however, likely to become more vulnerable to a Soviet counterforce first strike as improvements in ballistic missile guidance and multiple independently targetable reentry vehicles (MIRVs) permit the USSR to combine their current throw-weight advantage with accuracy.

BOMBERS

Given adequate warning time, bombers are perhaps the most survivable, most flexible, and most stabilizing element of the strategic Triad. First, given time, bombers can be dispersed and placed on airborne or runway alert. With current and projected technologies, aircraft on airborne alert are likely to remain virtually invulnerable to a preemptive strike, while aircraft that have been well dispersed on ground alert seriously complicate Soviet counterforce targeting.

Second, the present generation of bombers, carrying electronic countermeasures (ECM) equipment, is likely to be able to penetrate the Soviet air defense network with acceptable losses well into the 1980's.[17] Once having penetrated enemy defenses, bombers offer a high degree of flexibility. They are not only capable of striking targets of opportunity, providing post-strike reconnaissance, and destroying Soviet residual military capabilities, but they are also currently capable of inflicting a crippling level of damage on the Soviet urban-industrial base.[18]

Third, bombers are perhaps the most stabilizing element of the Triad. The number of bombers can be ascertained through national technical means. Hence, arms control agreements which limit the number of bombers can be verified. Bombers can be launched on warning and recalled. Furthermore, their long time-of-flight provides warning to the other side and therefore, practically speaking, precludes their use in a first-strike counterforce attack. Hence, in an age of rapid communications and sophisticated warning systems, the bomber contributes little, if indeed at all, to pressures for preemption during severe crises.

Finally, strategic bombers add to the total deterrent and defensive potential of US regional forces. They can be employed to support theater or regional conventional and nuclear conflicts. However, like ICBMs, their use in such cases is somewhat restricted by the requirement to retain an adequate strategic retaliatory capability. Of course, "adequacy," in this sense, is in part a function of the nature of the crisis and the intensity of Soviet involvement in the conflict. Hence, while it is possible to use bombers to a considerable extent in support of conflicts like Vietnam, where a US-Soviet nuclear confrontation is unlikely, such use may not be as prudent in support of a conventional conflict in such places as Western Europe, or perhaps the Middle East, where strategic assets would be necessary to deter conflict escalation.

On the other hand, bombers and their supporting tankers are not only likely to remain vulnerable to a Soviet no-warning, "bolt-out-of-the-blue" first strike, no matter how improbable such a strike may be, but also are likely to become increasingly vulnerable to attack as a result of shortened

warning, should the Soviets decide to develop and deploy depressed trajectory submarine-launched ballistic missiles (SLBMs).

Furthermore, the present generation of strategic bombers is a product of 1950's technology. The first B-52 rolled off the assembly line in 1952. While a number of modifications have been made since that time to enhance its ability to survive and penetrate enemy defenses, a number of deficiencies remain. They are highly susceptible to the effects of nuclear weapons. They are not able to withstand nuclear near-misses nor are they likely to be able to escape safely from an airfield under attack. They have a large radar cross section and technologically obsolescent ECM equipment. As a result, foreseeable improvements in Soviet air defense electronic "counter-countermeasures" are likely to seriously threaten the ability of the B-52 to penetrate to the target. They have a heavy "footprint," that is, their weight is concentrated on a small section of the runway, and they have a long take-off roll. Both of these characteristics tend to limit the number of airfields to which they can be dispersed during crises. Moreover, the B-52 airframe is aging. If the United States is to have a bomber fleet capable of operating into the 1990's and beyond at high speeds and low altitudes, the airframe will require extensive modifications or replacement. In either case, continued maintenance of a manned bomber fleet will involve considerable costs.

SLBMs

Given the current state of the art and likely near future technological advances in antisubmarine warfare (ASW), the present generation SLBM force is likely to remain highly invulnerable to preemptive attack, yet capable of penetrating Soviet defenses. However, SLBMs are neither sufficiently accurate to be a reliable means of conducting hard target counterforce retaliatory strikes against such targets as reloadable silos, nor are they, in some cases, sufficiently responsive to be a useful means of executing limited options which demand an immediate response. Nevertheless, the SLBM fleet's relative invulnerability contributes significantly to crisis stability.

SLBMs can also be used to support theater conflicts—a number are currently dedicated for use in the event of conflict in Western Europe. Hence, SLBMs add to the total deterrent and defensive potential of US theater and regional forces. As with the ICBM, their use is somewhat restricted by the necessity to maintain an adequate strategic retaliatory capability. Unlike strategic bombers, however, while SLBMs serve to deter conventional aggression where escalation is likely to result in the use of nuclear weapons, they have only a nuclear role once deterrence to conventional aggression has failed.

Perhaps the single most significant disadvantage of SLBMs is cost. Ballistic missile submarines are not only expensive to construct but also costly to maintain.

ASSESSING THE NEED

Cruise missiles would appear to be ill-suited replacements for ICBMs for a variety of reasons. Among the more obvious, of course, is the fact that current generation cruise missiles lack the intercontinental range for strikes on the Soviet Union from the security of bases located within the United States.[19] However, even if intercontinental ranges could be achieved, highly mobile intercontinental range cruise missiles would be less secure in terms of C_3 and more vulnerable to sabotage than the current generation of silo-housed ICBMs.[20] Also, cruise missiles are not likely to carry a payload sufficient to strike hardened targets deep within the Soviet Union in the foreseeable future,[21] would be more vulnerable than are ICBMs during the penetration phase,[22] and, if deployed in a highly land-mobile configuration, would make verification virtually impossible. Thus arms control agreements would become an almost totally unreliable means of limiting the arms race and in turn reducing arms costs.

The most significant factor which lobbies

against developing intercontinental cruise missiles as a replacement for the current generation of ICBMs, however, is the loss in the ability to execute those limited or general war options which might require an immediate response. At present, the ICBMs are perhaps the only force which can be called on at any moment to execute such options. Loss of this capability would not only jeopardize the sufficiency of US strategic forces, but also be strategically destabilizing.

A cruise missile-carrying standoff aircraft could be employed as a substitute for the manned penetrating bomber. Such an employment mode would retain some of the flexibility of the manned bomber. However, if such a carrier were designed for surface and airborne alert, including rapid takeoff and safe escape from under nuclear attack, it would likely be at least as expensive as the cancelled B-1.[23] Without such a capability, a cruise missile standoff carrier force would be more vulnerable to a Soviet preemptive attack than the B-1s. Moreover, the strengths which are inherent in a manned bomber (such as the ability to take high-speed evasive action and employ ECM to avoid and confuse Soviet fighter and SAM defenses) would be lost. Also, no claims are made that even advanced prototypes of these craft could match the manned penetrating bomber in its ability to strike secondary and tertiary targets and targets of opportunity in lieu of primary targets which already may have been destroyed.

Cruise missiles, however, could be successfully employed on manned bombers to enhance their penetrating ability and extend their range. Cruise missiles designed to project radar images similar to those of the manned bomber could be used to draw SAM fires and dilute defenses. They could also be used to strike the air defenses themselves or as an extension of the launching platform in order to destroy outlying and isolated targets. Additionally, cruise missiles employed on manned bombers would obviate the need for verification, since the bombers themselves can be verified and their maximum cruise missile capacity ascertained.

There has been no serious suggestion that strategic cruise missiles be employed as a replacement for SLBMs. The high probability of a continued relative invulnerability of the SLBM fleet has insured a continuing confidence in that leg of the Triad. On the other hand, it has been suggested that cruise missiles could be used to augment the current fleet of seaborne ballistic missiles by placing them on attack submarines and surface vessels. As critics have noted, however, the placement of strategic cruise missiles, whose targets have been integrated into the strategic operations plan, on attack submarines and surface ships would detract from the primary missions of such vessels.[24] This would be especially true if large-scale nuclear conflict were preceded by intensive conventional or limited nuclear exchanges. Under such circumstances, attack submarines and surface ships withheld from action and reserved as a deterrent to strategic conflict would not be available to support sea control actions. And, since ballistic missile submarines are the least vulnerable leg of the strategic Triad and likely to remain so into the foreseeable future, there is no current need to augment that leg of the Triad in this way. Finally, the placement of cruise missiles on surface ships and submarines would make it virtually impossible to verify numbers and, in turn, achieve some meaningful numerical limitations through arms control negotiations.

Conceivably, as each leg of the Triad becomes more vulnerable to a Soviet first strike, the current Triad could be converted to a "quadrad" by adding a fourth leg of cruise missiles stationed on land and/or at sea. Such a leg could serve as an independent strategic force or as a strategic reserve. As an independent force, it would be subject to the limitations mentioned in the above assessments of its value as a replacement for ICBMs, SLBMs, and bombers. As a strategic reserve, it would need to be rapidly retargetable. Such a requirement would not only entail a tight integration into the post-strike C_3 net so that targets which have not been eliminated for various reasons could be passed to the cruise missile force, but would also involve the physical

retargeting of the missiles themselves.[25] However, while a strategic reserve force could only be targeted against nontime-urgent targets, it might provide a substantial additional measure of deterrence against strategic nuclear conflict and interwar escalation by adding to the nuclear warfighting capability of the United States. As a minimum, it might offset expected losses due to growing vulnerabilities of the other legs of the strategic Triad.

From the above discussion, it would appear that the bounds of strategic utility of the cruise missile have been narrowly circumscribed by limitations of existing technology. Its long time-to-target, its lack of flexibility once in the target area, and other drawbacks render it ill-suited as a replacement for any of the three legs of the Triad or as an independent strategic force. On the other hand, it could be employed successfully to enhance the bomber and/or to serve as a strategic reserve, subject to the constraints mentioned above.

Perhaps the greatest value of the cruise missile, however, results not from its use as a strategic system, but from its utility as a tactical weapons system. As a tactical system, cruise missiles can be employed in a wide variety of roles, such as:

- Intelligence collection.
- Satellite relay.
- Emitter location.
- Nuclear and nonnuclear interdiction.
- Target and weather reconnaissance.
- Sensor emplacement and monitoring.
- Extension of the Airborne Warning and Control System (AWACS).
- SLBM detection and destruction.
- Ocean and battlefield surveillance.
- Data dissemination.
- Battlefield communication.
- Sea control.
- Coastal bombardment.
- Target designation.
- Defense suppression.
- ECM.
- Battle damage assessment.
- Search and rescue.

In such roles, the cruise missile could significantly enhance US regional and theater nuclear and conventional postures and would greatly improve our ability to control selected parts of the world's oceans and seas during times of limited conflict. Thus, the technological advantage which the United States possesses in cruise missiles, while having only a limited—although perhaps in the long run very significant—effect on the balance of strategic nuclear forces, would have a substantial impact on those other forces upon which the US ability to project its influence abroad is largely dependent.

THE SALT CONNECTION

If calculations concerning the utility of the cruise missile weapons system were the only determinants of decisions regarding its procurement, one might conclude from the discussion so far that the United States ought to simply embark on the acquisition of a limited number of cruise missiles to enhance its strategic deterrent posture, while placing major emphasis on acquiring those tactical weapons likely to significantly enhance its worldwide peacetime posture. However, in an environment where the superpowers have embarked upon what appears to be a serious attempt to manage strategic arsenals, if one wishes to enhance stability at the strategic nuclear level, one must first ascertain the effect of an unbridled weapons acquisition program on efforts to limit strategic armaments.

Cruise missile critics contend that failure to achieve some limitation on such systems may seriously threaten current and future strategic arms control agreements from at least two perspectives.

First, the Soviets are likely to refuse to sign any agreement on strategic arms limitations which does not restrict the cruise missile. They have already accused the United States of "a desire to step up the arms race" by seeking to deploy a new weapon.[26] Critics also note that in the absence of a new accord, the Soviet Union might choose to expand its ICBM and SLBM forces, thereby threatening the current state of strategic parity.

On the other hand, there are those who have contended that limitations on the cruise

missile could be used as a "bargaining chip" to secure some limitations on factors which currently favor the USSR (e.g., throw-weight and missile size). Moreover, in theory, at least, there is some finite limit on the number of survivable weapons required for an assured-destruction retaliatory capability beyond which further acquisitions are subject to the law of diminishing returns. If, practically speaking, such is the case, we may be entering an era where the survivability of strategic weapons systems obviates the need for SALT limitations.

Second, critics contend that failure to achieve some limitations on the strategic cruise missile could prove to be crisis destabilizing. Without an agreement which limits the numbers of strategic cruise missiles, it may be possible, as accuracies improve, for either superpower to dedicate the major portion of its present strategic forces to a counterforce first strike, while holding its strategic cruise missiles in reserve in order to force negotiations. Such a situation may well lead to another spiraling arms race as each side seeks to offset advantages perceived as accruing to its opponent as a result of strategic cruise missile acquisitions.

On the other hand, proponents contend that to the extent that highly mobile cruise missiles are themselves invulnerable to a counterforce attack and thus enhance the invulnerability of each side's strategic retaliatory forces, they would enhance crisis stability by assuring that neither side could conduct a totally effective counterforce first strike. Moreover, they note that the long time-of-flight of the cruise missile makes its use as a counterforce first strike weapon highly unlikely.

If one is inevitably drawn, however, to the conclusion that some form of limitation should be negotiated with regard to the cruise missile (if for no other reason than to insure the perpetuation of the current strategic balance at the lowest possible cost), a number of factors operate to the detriment of negotiated limitations.

First, the USSR already has a wide variety of subsonic and transonic air- and surface-launched nuclear and conventional cruise missiles with ranges up to 550 nautical miles (nm), and they are developing supersonic versions.[27]

Second, the United States—in addition to such vehicles as the Hound Dog and the Short Range Attack Missile (SRAM), which were developed for strategic uses—has a number of unmanned, self-propelled, airbreathing guided vehicles which have been developed for reconnaissance and other tactical missions.

Third, it does not appear to be possible to distinguish tactical from strategic variants of the cruise missile through national technical means. Hence, while it may be possible to verify a complete ban on all cruise missiles, such a ban is not necessarily desirable, because of its impact on tactical uses, nor is such a ban likely, since both the United States and USSR consider cruise missiles currently in their inventories as an integral part of their tactical (and in some cases strategic) forces.

It would seem, then, that the task (if some restraint of the cruise missile in the SALT context is desired) is to fashion a limited ban on cruise missiles which is verifiable and which would restrict their employment for strategic purposes while permitting their continued use for tactical purposes.

Given advances in fuels and engine technologies and electronic component miniaturization currently considered within the state of the art, Soviet cruise missiles are of sufficient size to be extended in range (as the Soviet Union acquires such technologies) by several orders of magnitude. Therefore, while it may be possible to secure a limitation on cruise missiles based on range only, such a limitation would be virtually impossible to verify except within wide limits.[28] Moreover, range limitations would have an unequal effect on the United States and the USSR. Given the relative numerical and technical superiority of the US bomber force, a 600 kilometer (about 325 nm) limit on air-launched cruise missiles would tend to benefit the United States more than the Soviet Union. On the other hand, given the size of

the Soviet fleet and the proximity to the coastline of major US urban-industrial complexes, a similar restriction on sea-launched cruise missiles would operate in favor of the Soviet Union.[29] However, it is not certain that the unequal effects are mutually cancelling. Since a sizable number of cruise missiles could only be carried in bombers as a substitute for gravity bombs, such a limitation would have only a limited effect in enhancing the number of weapons delivered by a US bomber force. But cruise missiles, if permitted on surface ships and submarines, in many cases could result in a significant increase in the total warheads available for use on strategic targets by the Soviet Union.

TOWARD SOLVING THE PROBLEM

Suggestions relating to the cruise missile have ranged from advocacy of a complete ban to arguments for its unrestricted deployment. It would appear, however, that despite the potential military advantages relating to its acquisition, the instability at the strategic level likely to result from its unchecked deployment would warrant a concerted effort by both the United States and the Soviet Union to achieve some arms control agreement. Moreover, within the bounds of the potential strategic and tactical advantages already noted and the constraints which serve to circumscribe the likely limits of any agreement, it would appear that some movement toward cruise missile limitations can be made.

One promising alternative is to seek a limited ban (3-5 years) on the development and deployment of air-, sea-, and land-launched strategic cruise missiles (missiles with ranges of over 2000 nm). As a limited guard against cheating, the ban could include a clause which restricts deployment of cruise missiles over a certain cubic volume. With some agreement on volume and assuming some knowledge of the state of the art, both sides would be capable of assessing the maximum range/payload tradeoffs if one side were believed to be violating the range limitation aspect of the agreement.

Such a ban would permit the continued development of tactical cruise missiles (ranges less than 2000 nm), including tactical nuclear cruise missiles positioned in Western Europe to deter, and if necessary, support a tactical nuclear conflict in Europe. These missiles could be in a highly mobile configuration and positioned well to the rear, ideally outside the NATO guidelines area.[30] So deployed, they not only could serve to free tactical air assets currently tasked to support theater nuclear warfare, thus enhancing the conventional deterrent and defense, but also would serve to offset the massive Soviet investment in medium- and intermediate-range ballistic missiles (MR/IRBMs).

Such a limited ban on cruise missiles would have an approximately equal effect on increasing the vulnerability of both the United States and the USSR to a strategic cruise missile attack. While a large portion of the United States would be vulnerable to Soviet air- and sea-launched missiles, including those which might be launched from the Backfire bomber, a significant portion of the Soviet Union would also be vulnerable to US air- and sea-launched cruise missiles and land-launched missiles based in Western Europe. As noted above, at lesser ranges the United States would be significantly more vulnerable to a strategic cruise missile attack than would be the USSR.

Furthermore, within the confines of such a ban, the United States would be able to deploy cruise missiles in order to significantly enhance the range and recoverability of the bomber fleet. In many instances, the current range limitations imposed by low-altitude flight force recovery of the current generation of bombers at bases on the periphery of the Soviet Union. In a general nuclear conflict, it is unlikely that the USSR would fail to destroy such bases and thus permit the successful recovery and reconstitution of the US bomber force. By extending the range of the bomber through the use of cruise missiles, in some cases bombers may then be able to recover at bases more distant from the Soviet Union.

In addition to a limited ban on strategic cruise missiles, it would now seem

appropriate to seek to convene in the near future negotiations designed to set limits on tactical weaponry in order to stem the developing tactical arms race between the United States and the USSR. Such negotiations should deal with cruise missiles of less than 2000 nm range and with forward based systems (FBS)—including tactical aircraft, MR/IRBMs, and battlefield nuclear systems stationed in Europe. Eventually such negotiations might be expanded to include other nations which have developed or are in the process of developing or deploying weapons which might threaten stability at the strategic nuclear level.

SUMMARY

In this paper we have assessed the impacts which such cruise missile systems as are currently envisaged are likely to have on offsetting Triad vulnerabilities and preserving the strategic balance. We have seen, however, that such an assessment must take into consideration both present and future requirements.

Weighing the current strengths and weaknesses of the US Triad of strategic forces, it would appear that the Triad is likely to remain sufficient in the immediate future not only to deter limited and general nuclear war, but also to preclude the USSR from reaping a foreign policy advantage as a result of third nation perceptions of the relative capabilities of the United States and the USSR. The US Triad should be able to survive a Soviet first strike (including one which is augmented by cruise missiles) and to penetrate to inflict unacceptable damage. Hence, acquisition of a *strategic* nuclear version of the cruise missile is not likely to alter in any significant manner the current US-USSR balance of strategic nuclear forces.

With the current trends in Soviet counterforce capabilities and the threats they portend for future force survivability, however, it appears necessary to take steps now to insure the future sufficiency of US strategic nuclear forces. Such steps should include negotiations calculated to achieve qualitative as well as quantitative limitations on strategic forces. Through qualitative restrictions, it may be possible to preserve the survivability of current strategic nuclear forces (and thereby to underwrite the strategic sufficiency which is essential for crisis stability) without embarking on major new strategic programs.

Conceivably, failure to achieve an agreement on the qualitative aspects of strategic armaments may make it necessary for the United States eventually to acquire long-range strategic cruise missiles. While other force modifications and improvements (such as the MX ICBM) might be able to arrest any projected decline in the sufficiency of the US strategic force posture, strategic cruise missiles appear to be potentially the least costly option. Such missiles could be used to improve the penetrating ability and target coverage of the bomber force; to offset the growing vulnerabilities of the Triad; or to serve as a highly mobile, highly survivable reserve force capable of assuring the Soviet Union of its own ultimate destruction should it choose to initiate hostilities.

Unfortunately, the current SALT II guidelines offer little prospect for any such agreement on the qualitative aspects of strategic armaments. Hence, the United States must carefully avoid foreclosing any of its options which would permit the future acquisition of a long-range strategic cruise missile. To this end only a limited ban (3-5 years) on the development of strategic cruise missiles should be considered. Such a ban should include air-, sea-, and land-launched cruise missiles with ranges over 2000 nm and include a clause which also restricts these by volume in order to provide some measure of assurance against cheating. Moreover, future negotiated limitations on strategic cruise missiles should be contingent on the degree of success achieved up to that time.

At the same time, any contemplated restraints on the development and acquisition of the cruise missile must be evaluated in terms of their likely effect on *tactical* applications which, in an important and immediate sense, might weigh heavily on the US worldwide strategic posture. The high

utility of tactical cruise missiles, coupled with the inability to distinguish the tactical from the strategic, would appear to make it inadvisable to enter into a SALT agreement which would unduly affect the development and acquisition of cruise missiles for tactical uses. Indeed, restrictions on cruise missiles of lesser ranges should not be an integral part of a SALT agreement, as is currently contemplated. Rather, the question of such tactical cruise missiles should be reserved for theater level arms control negotiations.

With such considerations as these in mind, we might then approach arms control negotiations confident that we are prepared for serious, reasonable, and mutually beneficial discussions designed to preserve the strategic balance without unnecessarily risking theater nuclear instability.

NOTES

1. A cruise missile is an unmanned, self-propelled, winged projectile capable of flying through the atmosphere in a nonballistic trajectory assisted by aerodynamic lift much like an aircraft. Cruise missiles can be armed with either conventional or nuclear warheads and sustain flight through the use of an "air breathing" engine.

2. The Snark was designed to carry a nuclear warhead at near-sonic speeds at altitudes above 50,000 feet over intercontinental distances up to 5000 nautical miles.

3. The Snark, for example, was 67.2 feet long and had a wing span of 42.2 feet.

4. Current NAVAIR estimates place the average unit flyaway cost for the General Dynamics strategic cruise missile at approximately $600,000 (exclusive of warhead costs). See US Congress, Senate, Committee on Armed Services, *Hearings on Fiscal Year 1977 Authorization for Military Procurement, Research and Development, and Active Duty, Selected Reserve and Civilian Personnel Strengths*, 94th Cong., 2d Sess., 1976, p. 6230. Hereafter cited as *Hearings, FY 77 Authorization*.

5. *Ibid.*, pp. 2099-100.

6. *Ibid.*, pp. 6127-249.

7. US Congress, Senate, Committee on Armed Services, *Hearings on Fiscal Year 1976 and July-September 1976 Transition Period Authorization for Military Procurement, Research and Development, and Active Duty, Selected Reserve and Civilian Personnel Strengths*, 94th Cong., 1st Sess., 1975, p. 5180.

8. For a more detailed presentation of the opposing arguments, see "The Cruise Missile: A Weapon in Search of a Mission," *The Defense Monitor*, Vol. V, No. 7 (September 1976); Townsend Hoopes, "There is No Objective Need for the Cruise Missile," *The New York Times*, 30 December 1975, p. 25; Thomas A. Halsted, "Should We Deploy Cruise Missiles?" *Baltimore Sun*, 17 January 1976, p. 12; Kosta Tsipis, "The Long-Range Cruise Missile," *Bulletin of the Atomic Scientists* (April 1975), 14; Alexander R. Vershbow, "The Cruise Missile: The End of Arms Control?" *Foreign Affairs* (October 1976), 33.

9. Hoopes, p. 2.

10. Halsted, p. 12.

11. *Ibid.*

12. *Hearings, FY 77 Authorization*, p. 2099.

13. National technical means is a generally understood term for satellite or other means normally employed by one country to determine the state of the military forces of another.

14. It is argued that it is impossible to determine the range of a given version by observing test flights, because a cruise missile test vehicle need not be tested at full range to determine its accuracy. Accuracy is a function of the most recent update of the guidance package.

15. Halsted, p. 12.

16. *Ibid.*

17. During the air offensive against North Vietnam just prior to the peace settlement in Vietnam, the United States launched B-52s operating ECM equipment against some of the most heavily defended targets in the history of air warfare. The loss rate to SAMs was less than three percent.

18. According to Ira C. Eaker, bombers deliver 75 percent of our total megatonnage. See Ira C. Eaker, "The Attempt to Kill the B-1," *Air Force Times*, 21 June 1976, p. 17.

19. While the exact range of the two versions of the cruise missile (the air-launched ALCM and the sea-launched SLCM), is classified, the range of the ALCM has been estimated to be approximately 1600 nautical miles and the range of the SLCM about 2000 nautical miles. See "Tomahawk Clears Crucial Test," *Aviation Week and Space Technology*, 22 November 1976, p. 15.

20. On the other hand, if deployed in a fixed mode, strategic cruise missiles would be at least as vulnerable to a Soviet counterforce first strike as our present generation of ICBMs.

21. In a Congressional Research Issue Brief, Al Tinajero put the range of the SLCM at 300 nautical miles with a 1000 pound warhead and 1200 nautical miles with 200-kiloton yield nuclear warhead. A. A. Tinajero, "Cruise Missiles: US Sea Launched and Air Launched," *Issue Brief Number IB76018* (updated, 26 October 1976), p. CRS-2.

22. Under the terms of the ABM Treaty and the Protocol to the Treaty signed in Warsaw 3 July 1974, the Soviet Union and the United States are restricted to one antiballistic missile launch site of not more than 100 launchers. As a result, the successful penetration of ballistic missiles is virtually assured, whereas cruise missiles would be required to penetrate the very formidable Soviet surface-to-air missile (SAM) defense network enroute to target.

23. On 23 December 1974, Dr. Malcolm Currie, then Director of Defense Research and Engineering, submitted the "Joint Strategic Bomber Study," a classified report, to the Appropriations and Armed Services Committees of Congress. Given the nature of the Soviet threat and Soviet defenses, the study apparently concluded that it was cost-effective to procure the B-1, in lieu of either a standoff missile carrier or modification of the current B-52 fleet. See US Congress, *Congressional Record*, 94th Cong., 2d Sess., 1976, 122, No. 68, pp. S6719-25. A competing analysis entitled "Modernizing the Strategic Bomber Force," published by the Brookings Institution, concluded that the purchase of a standoff cruise missile carrier could shave $10 billion to $15 billion off the first 10-year costs associated with the B-1. This study, however, did not include the cost of a totally new standoff aircraft designed for rapid takeoff and safe escape.

24. See "The Cruise Missile: A Weapon in Search of a Mission," *The Defense Monitor*, p. 6; Tinajero, p. 6; and Halsted, p. 12.

25. The requirement to retarget is perhaps the single most significant obstacle to the use of cruise missiles as a strategic reserve. The current generation strategic cruise missiles will

depend on a terrain contour matching system (TERCOM) for guidance to the target. Such a system requires the construction of accurate digital maps depicting time-independent terrain features which are then inserted electronically into the missile guidance system. (For an excellent description of TERCOMs, see Kosta Tsipis, "The Long-Range Cruise Missile," *Bulletin of the Atomic Scientists*, pp. 22-23.) For a cruise missile force to function as a strategic reserve, digital TERCOM maps would probably have to be created for all current ICBM, bomber, and SLBM targets.

26. See Henry S. Bradsher, "US Rejects Soviet Bid to Ban Cruise Missiles," *Washington Star*, 17 September 1975, p. 3.

27. *Hearings, FY 77 Authorization.*

28. Kosta Tsipis underscores this notion, but contends that limitations on cruise missiles can be verified by some combinations of volume, engine type, and thrust. See Kosta Tsipis, "Cruise Missiles," *Scientific American* (February 1977), 29. While volume might be of value as a limiting factor, the type of engine used and its thrust seem to be of questionable utility. The range of a particular weapons system is, in part, a function of thrust versus payload. A tactical cruise missile with sufficient thrust to deliver a 1000 pound conventional warhead 600 miles might be able to deliver a small nuclear weapon a much greater distance. Likewise, a cruise missile limitation based on type of engine (Tsipis suggests considering all turbojet engines as "strategic" and therefore subject to limitation) might unduly restrict high altitude long-range reconnaissance drones and RPVs, for which turbojet engines might clearly be cost-effective.

29. It has been reported that a three-year protocol currently under discussion in SALT II would restrict sea- and ground-launched cruise missiles to approximately 325 nm, while air-launched cruise missiles would be limited to about 1500 nm. The United States is likely to be the immediate beneficiary of any agreement which permits longer ranges for air-launched cruise missiles because they can be used at the strategic level to enhance the effectiveness of the aging B-52 fleet. However, it should be noted that any long-term agreement that permits longer ranges on air-launched cruise missiles will serve to increase the range and effectiveness of the Soviet bomber forces also.

30. The NATO guidelines area (NGA) consists of Czechoslovakia, Poland, East Germany, West Germany, Belgium, Luxemburg, and the Netherlands. The NGA is currently the subject of negotiations on the mutual reduction of forces in Central Europe.