

SS-25s, I am not sure what that truly does for them. As long as I have survivable systems at sea, for example, what would they do with these? What incentive is there for them to move in that direction?"

During the course of the arms race a number of authors have estimated the robustness of the surviving nuclear force by using sensitivity analysis⁷ with nuclear exchange models ("red attacks blue"). These calculations have shown that break-outs from arms control treaties by the other Party did not greatly affect the result. An attack can be enhanced by increasing the numbers and yields of warheads, by making the warheads more accurate and reliable, and by discovering that one's silos were not as hard as estimated. By varying the various parameters, one can show that the U.S. has always had a robust triad and the marginal utility of additional warheads beyond START levels is very small.

SUBMARINE VULNERABILITY

In a similar fashion, GAO concluded that the threats to the submarines had also been exaggerated. GAO concluded that the threat had been overstated in "unsubstantiated allegations about likely future breakthroughs in Soviet submarine detection technologies, along with the underestimation of the performance and capabilities of our own nuclear powered ballistic missile submarines." These exaggerated threats to the SSBNs were then used as a justification for costly modernization in the other legs of the triad to cover the possible vulnerabilities to the SSBNs. The threats to the SSBNs have been categorized⁸ as "non-acoustic anti-submarine warfare," which uses radar, laser, or infrared detectors on satellites to search out the signatures of the SSBNs. Two submarine signatures that have been discussed are (1) the slightly raised ocean surface above a moving submarine (the Bernoulli hump) and (2) the V-shaped wave above the moving submarine (the Kelvin wave). In principle, these signatures might be observed from submarines near the surface if one knows where to look with synthetic-aperture radar accompanied with significant computer capabilities. The U.S. and Russia have carried out joint experiments on these phenomena, but the GAO concluded that these experiments do not give evidence for concern for survivability of the SSBNs when they are at sea. In fact, it is very difficult to observe the very small oceanographic signals from submerged submarines. When SSBNs observe radar from satellites, they can easily diminish their reflective signature by cruising just a little deeper. Even if the submarines were silly enough to cruise

too close to the surface, the job of coordinating a very large number of satellites to observe some 14–18 SSBN submarines, as well as doing the on-board computer analysis to obtain near-real time data for targeting would be too large and too expensive. General Powell concurred by stating: “based on our first examination of the claims [of a successful non-acoustic anti-submarine warfare technology], we do not believe that they are accurate [but] we will explore this to make sure that we are correct, that it is not feasible.” Nonetheless, in their report on the START treaty, the Senate Armed Service Committee recommended⁹ that a condition be added to the START II Treaty that would give “strong support for the joint U.S./Russian submarine detection program.”

GAO had access to the classified data on submarine detectability and discussed these issues with the intelligence and military communities. GAO concluded¹⁰ that “Our specific finding, based on operational test results, was that submerged SSBNs are even *less* detectable than is generally understood, and that there appear to be no current or long-term technologies that would change this. Moreover, even if such technologies *did* exist, test and operational data show that the survivability of the SSBN fleet would not be in question.” (emphasis by GAO)

VULNERABILITY OF PENETRATING BOMBERS

In a similar vein, the threat to heavy bombers was also exaggerated. In her analysis¹¹ of the CIA Team B report of 1976, Anne Cahn pointed out that the extreme worst-case analysis by Richard Pipe's Team B was a leading factor in the political pressure for the U.S. build-up under President Carter (MX and B-2) and President Reagan. The Team B report,¹² *Soviet Low Altitude Air Defense: An Alternative View*, concludes that “it is not inconsistent with current evidence that the Soviets believe they have and may already possess the inherent ability to prevent most, if not all, penetrating bombers (of the kind presently in the force, in raid sizes of a few hundred) from reaching targets the Soviets value.” This conclusion is obviously wrong because it states “most, if not all” implies a kill probability of better than 99 percent which is far beyond expectation. In addition, cruise missiles have been added to the B-52s which allow them to attack the Soviet Union while over the ocean. This overly strong assessment on Soviet air defense was based on projections of significant improvements in the kill probabilities and reliabilities of improved Soviet SA-2s and SA-3s, as well as their very extensive deployments. Although