

NATIONAL WAR COLLEGE

**DO WE STILL NEED BALLISTIC MISSILES?**

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A LONG ESSAY IN LEIU OF REQUIREMENTS FOR COURSE 5603 and 5605

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# Report Documentation Page

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## DO WE STILL NEED BALLISTIC MISSILES?

Ballistic missiles have become synonymous with America's nuclear deterrent. Always ready at high reliability to provide widespread devastation to any attacker in less than an hour after launch, these weapons presented the ultimate deterrence against the nightmare scenario of the Cold War: a Soviet bolt-out-of-the-blue attack. Why would anyone question whether we should continue to maintain and operate ballistic missiles well into the future?

But we no longer expect the kind of attack that ballistic missiles were designed to counter. The unclassified summary of the recent Nuclear Posture Review (NPR) says that the United States will "no longer plan, size or sustain its forces as though Russia presented merely a smaller version of the threat posed by the former Soviet Union".<sup>1</sup>

If we are not deterring a large-scale surprise attack, we may not need to deliver such large-scale destruction. Cruise missile and bomber delivery systems offer a more effective deterrent to countries, or even to non-state actors, that might doubt our willingness to inflict widespread destruction as punishment for limited attacks on the U.S. Moreover, cruise missile and bomber platforms could be dual-use weapon systems, and avoid the cost of maintaining a nuclear deterrent infrastructure separate from our war-fighting forces. As it becomes necessary to fund increasing maintenance costs and to consider replacements for Minuteman III and Trident II, the relevance of ballistic missiles must be increasingly questioned.

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<sup>1</sup> Foreword to the (otherwise classified) Nuclear Posture Review Report that was submitted to Congress on December 31, 2001. The Pentagon released the Foreword on January 9, 2002. Available at <http://www.defenselink.mil/news/Jan2002/d20020109npr.pdf>

## **Ballistic Missiles – Proven Strengths and Well-known Issues**

Strategic ballistic missiles are the primary weapon system used by the United States for deploying nuclear weapons. In July 2001, the United States had 7013 deployed nuclear weapons. Strategic ballistic missiles carried 5,695 of these weapons: 2079 on Intercontinental Ballistic Missiles (ICBMs) and 3616 on Submarine Launched Ballistic Missiles (SLBMs).<sup>2</sup> If all were launched together, these missiles are capable of delivering almost 2000 Megatons of nuclear destruction. The smallest single warhead on one of these missiles has an explosive power of about 180 kilotons, or nine times the power of the atomic weapon that destroyed Hiroshima at the end of World War II. Ballistic missiles can be ready for launch in minutes, and can then be launched in seconds. Ballistic missiles form two legs of a triad consisting of land-based ballistic missiles, strategic bombers, and submarine-launched ballistic missiles that help to insure against any unexpected weakness in the means of delivering nuclear weapons.

The numbers and capabilities of our ballistic missiles have been primarily driven by a requirement to assure that a surprise attack by the Soviet Union could not destroy so many U.S. nuclear weapons that overwhelming retaliation could be in doubt. SLBMs are generally considered the most survivable of our nuclear delivery systems in a nuclear attack, because the submarines themselves are largely impossible to locate once they hide in the ocean. But an equally important part of our deterrence has been the large scale of destruction implied by even a small part of our arsenal delivered in a retaliatory strike. Even a single Minuteman missile, missed in a surprise attack, would deliver three 350-kiloton explosions in the Soviet Union.

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<sup>2</sup> “START I Aggregate Numbers of Strategic Offensive Arms,” Fact Sheet, Bureau of Arms Control, Washington, DC, October 1, 2001. Available at <http://www.state.gov/t/ac/rls/fs/2001/1716.htm>

U.S. emphasis on deploying nuclear weapons as ballistic missile warheads comes from this calculus. Ballistic missiles with multiple warheads provide a cost-effective answer to the U.S. requirement to deliver a very large number of nuclear weapons in a single attack. For example, the 2003 Operations and Maintenance budget for the ICBM force is only \$259 million dollars, only 0.1% of the DOD budget.<sup>3</sup>

Ballistic missiles have many advantages as nuclear weapon delivery systems. There is little likelihood that strategic ballistic missiles, once launched, will fail to reach their targets. Only one Anti-ballistic Missile (ABM) system, around Moscow, can intercept strategic ballistic missile warheads, and large numbers of incoming warheads can overwhelm that ABM system. Ballistic missiles are impervious to jamming or other guidance countermeasures, because they rely on inertial guidance without reference to external sensors. Compared to most weapon systems, a trivial preparation time is required between deciding to use them and launch; a warning of even minutes is sufficient to guarantee their survival.

The combination of a payload capability scaled at about a ton (for cost-effectiveness in missile sizing) and limited accuracy make strategic ballistic missiles appropriate for the job of delivering large numbers of relatively large nuclear warheads. Modern strategic ballistic missiles are much more accurate than the first ICBMs developed in the late 1950s, and are reportedly capable of striking within hundreds of feet of their targets. An accuracy of hundreds of feet can destroy many targets with nuclear weapons significantly larger than the 20-kT Hiroshima bomb. But

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<sup>3</sup> Fiscal Year (FY) 03 Budget Estimates to Congress, Operations and Maintenance, Air Force, Volume 1, February 2002, page 56-57.

such miss distances are still orders of magnitude greater than the accuracy achievable by modern cruise missiles and precision-guided weapons, and would limit their usefulness in delivering a conventional warhead with 1000 to 2000 pounds of explosive force.

Strategic ballistic missiles have always been judged to have very high reliability. But this reliability is based primarily on the extensive testing of missile components and assemblies, coupled with a few full-scale flight tests and well-researched models of the missile system reliability. Some analysts have always questioned the actual reliability of strategic ballistic missiles during a nuclear exchange. In contrast, bombers and cruise missile systems are operated routinely in conditions that stress their performance, and have been used in a variety of combat situations and, in *relative* terms, confidence in the reliability of these systems is higher.

Since ballistic missiles are intended to be on alert, ready for launch on short notice, some analysts have worried that a misinterpretation of data or a communications error would lead to ballistic missile launches. No other system has the same risk of launch in response to error. Bombers can be recalled. Cruise missiles can be re-programmed during their long flight times to targets. Bruce Blair, President of the Center for Defense Information, has been the leading proponent of claims that the risk of launch through misunderstanding is the greatest current risk for creating a large-scale nuclear exchange.<sup>4</sup> In the absence of tension between the U.S. and Russia, he argues that there is no need for what many call “hair-trigger” alert status. But

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<sup>4</sup> For example, see Bruce Blair, Harold Feiveson and Frank N. von Hippel, “Taking Nuclear Weapons Off Hair-Trigger Alert,” *Scientific American* Vol. 281, No. 11 (November 1997).

reviews of this topic by the U.S. Government have always judged that safety and operational readiness of ballistic missiles requires us to keep the active weapons on alert.

Finally, strategic ballistic missiles face an existential argument as uniquely deterrent weapons. These weapons have usually been presented as “weapons designed never to be used”. As such they are fundamentally different from other weapon systems, which are usually designed to deter attack but also to be useful if deterrence fails. Even tactical nuclear weapons were designed to stop a formation of troops or destroy a critical naval asset. In contrast, strategic ballistic missiles are useful only as deterrents, given the scale of destruction implied by each missile. If they are used, it is unlikely that they will counter some military activity, but will only represent revenge for an attack on the United States. Over many decades, reasonable analysts have raised the question of whether a U.S. President would actually order such large scale-destruction.

### **Comparing Delivery Systems for Nuclear Weapons**

By the late 1980s, the view that the “triad” of ICBMs, SLBMs and strategic bombers was the best way to assure retaliation and nuclear stability was widely accepted. But this conclusion was not obvious in the early days of superpower competition. Debate continued throughout the Cold War about the best types of weapon systems and the best mix of platforms and weapons.<sup>5</sup>

Primary arguments revolved around the relative merits of placing nuclear weapons on aircraft, ships, submarines, land-based mobile transports and in fixed land bases. Ballistic missiles,

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<sup>5</sup> A short review of the evolution of our systems for delivering nuclear weapons is provided in Appendix 1. The review indicates how much variation occurred over the history of the Cold War in the kind of weapon systems we designed to deliver nuclear weapons, and why the U.S. settled on long-range ballistic missiles as the primary element in our nuclear deterrent.

cruise missiles, and aircraft-launched weapons were usually compared in all of these basing schemes. Criteria for evaluating the weapon system and basing usually consisted of survivability to a surprise attack, survivability to countermeasures after launch, post-launch control, targeting flexibility, reliability, and resource requirements.<sup>6</sup> A significant additional issue was often the status of development for the weapon system under consideration – whether the weapon system was already operational, proven in testing, or just “under development”.

One of the last debates to challenge the triad concept concerned the development and deployment of nuclear-capable cruise missiles during the Reagan Administration. Since the accuracy of the new class of cruise missiles could be much greater than ballistic missiles, cruise missiles provided the opportunity to deploy smaller warheads capable of a more flexible nuclear response. Nuclear cruise missiles could be used in both an operational role (such as stopping a ground advance) and as a strategic deterrent. Such precise nuclear weapons were more credibly *useable* if nuclear deterrence failed. Proponents argued that these weapons could be easily hidden and proliferated to protect against surprise attack.<sup>7</sup> Although cruise missiles did not displace ballistic missiles as the primary weapon system for nuclear deterrence, this debate led to the development of nuclear-capable air-launched cruise missiles that enabled strategic bombers to make nuclear strikes without risking Soviet air defenses.

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<sup>6</sup> A typical unclassified study is Strategic Nuclear Delivery Systems: How Many? What Combinations?, by John M. Collins and John Steven Chwat, Congressional Research Service Report 74-177, October 7, 1974

<sup>7</sup> An excellent contemporary exposition of the argument for cruise missiles as an alternative to ballistic missiles is given in Richard K. Betts, Cruise Missiles: Technology, Strategy, Politics, Washington, DC, The Brookings Institution, 1981.



## The Nuclear Posture Review and Numbers of Nuclear Weapons

The number of nuclear weapons required to provide deterrence is obviously an important element in determining the types of weapon system needed to deliver them. The table below gives perspective on the number of weapons the United States has felt the need to deploy.

<u>Year</u>	<u>Number of ready nuclear weapons</u> <sup>8</sup>	<u>Comment</u>
1949	200	Year of first Soviet nuclear test
1969	32,5000	Peak size of U.S. arsenal (includes tactical weapons)
1991	9,000	End of the Cold War
2001	7,000	Approximate current arsenal

In addition to raw number changes, the definition of deployed or “active” weapons, and of strategic and tactical weapons, has varied over the years. In 1991, major changes to our concept of active weapons occurred when President George H.W. Bush de-alerted large portions of the Air Force’s bomber force and directed the removal of nuclear weapons from all ships and attack submarines.

The Nuclear Posture Review (NPR) delivered in December 2001 argued for a new approach to deterrence, taking into account our ability to deliver both nuclear and non-nuclear destruction. The report recommended moving away from a vulnerability-driven nuclear force structure to a “capability-based” framework, with an emphasis on providing the President with a range of options to defeat any aggressor. But in that context, the report maintained the triad concept in its conclusion that “Intercontinental Ballistic Missiles (ICBMs), Submarine Launched Ballistic

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<sup>8</sup> Table adapted from Stansfield Turner, “The Dilemma of Nuclear Weapons in the Twenty-first Century,” *Naval War College Review*, Vol. 54, No. 2, Spring 2001, p. 20.

Missiles (SLBMs) and long-range nuclear-armed bombers ... will be ... integrated with new non-nuclear strategic capabilities that strengthen the credibility of our offensive deterrence.”<sup>9</sup>

There has been an unending literature on the right number of survivable nuclear weapons to ensure deterrence.<sup>10</sup> Most of this literature has been based on a debate about what would deter Russia against a first strike. But President George W. Bush directed that the NPR be based on ending the relationship of mutual assured destruction with Russia.<sup>11</sup> The report argues that the nation can, with low risk, draw its forces down to a goal of 1700-2000 operationally deployed nuclear warheads by 2012.

The NPR argues that the best way to achieve these reductions is to convert four ballistic missile submarines to cruise missile firing submarines, retire the Peacekeeper ICBMs, and to reduce warheads on operationally deployed ICBMs and SLBMs. The NPR also indicates that we will no longer retain capability to return B-1 bombers to a nuclear delivery role. Such actions should reduce our active nuclear weapons to 3800 by 2007.<sup>12</sup> Such a force would maintain a balanced

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<sup>9</sup> Foreword to the otherwise classified Nuclear Posture Review Report that was submitted to Congress on December 31, 2001. The Pentagon released it on January 9, 2002. Available at <http://www.defenselink.mil/news/Jan2002/d20020109npr.pdf>

<sup>10</sup> For a recent example, see Jan M. Lodal, “For Modest Defenses and Low Offensive Numbers,” *Survival*, Vol. 43, No. 3 (Autumn 2001), p. 72.

<sup>11</sup> “Findings of the Nuclear Posture Review,” 9 January 2002, Special Briefing by, J.D. Crouch, ASD ISP, Rear Adm. Barry M. Costello, deputy director for Strategy and Policy, Joint Staff; John Harvey, director, Office of Policy, Planning, Assessment and Analysis, Department of Energy; Richard McGraw, Principal Deputy Assistant Secretary of Defense for Public Affairs. Presidential guidance is shown on the fifth chart of the package, “New Environment and the President’s Direction”. Available at <http://usinfo.state.gov/topical/pol/arms/stories/review.htm>

<sup>12</sup> “Findings of the Nuclear Posture Review,” 9 January 2002, Special Briefing by, J.D. Crouch, ASD ISP, Rear Adm. Barry M. Costello, deputy director for Strategy and Policy, Joint Staff; John Harvey, director, Office of Policy, Planning, Assessment and Analysis, Department of Energy; Richard McGraw, Principal Deputy Assistant Secretary of Defense for Public Affairs. Available at <http://usinfo.state.gov/topical/pol/arms/stories/review.htm>

deployment among the existing triad: about 1600 warheads would be on Minuteman III ICBMs, about 1000 would be assigned to Trident II SLBMs, and about 1200 warheads would be assigned to strategic bombers. Presumably, this number weapons are required to respond to specific numbers and kinds of targets that are judged critical to deterrence and warfighting scenarios, since the NPR does not suggest a fundamental change in the nuclear targeting criteria or process.

If planners accept the NPR assumption that 1700-2000 weapons will be necessary in the second decade of the 21<sup>st</sup> Century, valid questions remain about the kind of weapon delivery systems needed, and who the weapons are expected to deter, and how they would be used if deterrence fails. These questions need to be more explicitly addressed than at any time since the beginning of nuclear strategy.

### **But We Already Have Strategic Ballistic Missiles ...**

According to the NPR, the first step in downsizing the nuclear forces should be to reduce the number of warheads from the ballistic missile force. This recommendation primarily reduces the number of weapon system maintained in the inventory, reflecting a belief that there is no need for such large numbers of warheads if we are not trying to maintain the mutual assured destruction relationship with Russia. But the report assumes that we will maintain all three elements of the existing nuclear triad.

Maintaining sizable ICBM and SLBM forces will be a relatively low-cost decision in the near term. Ballistic missiles are still a very inexpensive way to deliver large numbers of nuclear weapons. But even in FY03, there is an increase ICBM expense of over \$35 Million (out of an

O&M budget of about \$200 Million) to provide the first of many sustaining engineering efforts. Since Minuteman III missiles are about 25 years old, we will need to spend an increasing amount of money to replace aging and obsolete materials and parts.<sup>13</sup>

The NPR also calls for studies to define follow-on missiles for both the ICBM and SLBM force<sup>8</sup>, which would introduce new procurement costs for ICBMs. The U.S. is currently procuring the Trident II SLBMs at a quantity of 12 per year for an annual cost of about \$600 Million per year. Procurement of hundreds of new strategic ballistic missiles in the next decade would be a significant cost. Increasing maintenance costs and the potential for new strategic ballistic missile procurement will likely raise questions in Congress about the relevance of strategic ballistic missiles.<sup>14</sup>

The primary question is whether these weapons are really the right tools for deterring Twenty-first Century aggressors. ICBMs and SLBMs are relatively cheap to operate when they deliver many large nuclear weapons from each missile launched, but are not scaled for delivering single, small nuclear weapons. The least destructive missile in the current arsenal, Minuteman III, would deliver three warheads of about 350 kT. And the ballistic missile infrastructure only makes sense if we plan to launch many such missiles, not one or two; the cost of maintaining, training and operating Minuteman fleet would not come down dramatically with reduced numbers.

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<sup>13</sup> Antonella Thompson and Brad Harlow, "Missile Systems – the Year in Review," *Aerospace America*, Vol. 36, No. 12, Dec. 1998, p. 84.

<sup>14</sup> Early indications of such discussions already exist. See Walter Pincus, "Questions Raised on Trident Subs; Cost and Size of Strategic Nuclear Deterrent are Issues," *The Washington Post*, Jan 3, 1999, p. A22.

If a nuclear surprise attack is no longer a threat to national survival, a more considered nuclear response would be appropriate; if we don't expect a large attack, a more proportional response would be desired. The need to limit the scale of nuclear retaliation comes not only from a moral desire to kill as few innocents as possible, but also from a practical desire to prevent the worldwide ecological impacts implied by multiple large-scale nuclear explosions.

Rogue regimes engaged in a conventional conflict with the U.S. might conclude that we would lack the will to engage in the mass killing implied by strategic ballistic missiles. Even if they attacked the U.S. with a nuclear weapon, would we be likely to respond with dozens? The ability to rain hundreds of nuclear weapons from ballistic missiles may be irrelevant to deterring such countries; the ability to deliver a few nuclear weapons – or one – to a well-chosen location may be intensely relevant. Our deterrent against countries with small nuclear arsenals must rest on the certainty that we would punish their government for a nuclear attack on the U.S. with an attack of comparable scale. If nuclear deterrence is possible against non-state actors, it would have to rest on the ability to destroy only the targets relevant to them without destroying uninvolved civilian populations.

### **Alternative Nuclear Weapon Delivery Concept – Deterrence Without Ballistic Missiles**

A strategic nuclear delivery concept that does not include ballistic missiles would primarily rely on cruise missiles to deliver small, precisely aimed nuclear weapons, and strategic bomber capability to deliver large thermonuclear weapons. Strategic bombers or submarine-launched cruise missiles would deliver all strategic deterrent weapons.

Nuclear-capable air-launched or submarine-launched cruise missiles would be the response to an attack on the United States that called for nuclear response. Such weapons systems would deliver small nuclear weapons, targeted on the elements of government leadership and the military forces responsible for the attack. Such an approach would be proportionate, create the smallest risks of escalation and environmental damage, and yet satisfy the need to demonstrate the reality of deterrence. If the President decided to use nuclear warheads to attack deeply buried leadership or WMD facilities during a concurrent conventional conflict, cruise missiles with nuclear warheads would also be the most likely tool. Making it clear that we have the ability to conduct such a focused retaliation should enhance the credibility of our deterrence, and reduce doubt that the United States would actually use nuclear weapons.

A capability to deliver large weapons by strategic bomber would preserve the ability to respond in kind if another country chose to attack the United States with one or more large nuclear weapons. While the major threat to bomber survivability has disappeared with the end of SLBM threats to the U.S., it is possible that future threat assessments would require these heavy bombers to return to the airborne alert schedules flown during the Cold War. Together with a suitable number of nuclear capable cruise missiles, these weapons would ensure that China or a recidivist Russia would not survive an attack on the United States. Given the proliferation, accuracy and survivability of cruise missiles, 1700 relatively small nuclear warheads should provide a significant deterrent to any country contemplating a first strike.

In this approach, the United States would not develop, maintain and operate any weapon uniquely for nuclear deterrence. The United States would no longer have any weapon system

“designed never to be used,” even though we would hope to never use the nuclear warheads. If a conventional conflict between a nuclear-armed enemy and the United States crossed the nuclear threshold, the nuclear-armed cruise missiles would be the appropriate scale of weapon for response. Military personnel responsible for loading and launching cruise missiles would not have any uniquely “nuclear weapon” requirements. In most cases, they would conduct the same operations whether handling a nuclear or a non-nuclear cruise missile. Nuclear control would doubtless introduce many complications in practice, but these should be additions to normal cruise missile operations.

Reliability of these weapon systems should be assured without additional costs through the normal maintenance and replacement of cruise missiles in the field. Many of the uncertainties about the performance of ballistic missiles in real operation would be removed, since the weapon delivery systems would be well-tested and operationally proven in conventional use. Removing these uncertainties should enhance the credibility of deterrence.

An additional benefit of this approach would be reduced risk of nuclear attacks in error – the residual fear of the Cold War. The operations concept for these weapons would be deliberate response, rather than having to consider launch-on-warning contingencies. Such weapon systems would not be launched before command authorities had determined that a nuclear strike was necessary.

Finally, removing strategic ballistic missiles from our arsenal could help the U.S. goals for the non-proliferation of ballistic missiles. One of the most challenging parts of the U.S. position has

been the disparity between our possession of such missiles and our claim that other countries should not build them. Some analysts argue that the prestige of having ballistic missiles – which represent the core of the U.S. and Soviet nuclear deterrent – is a primary reason for other countries to seek such weapons. If so, an U.S. decision that the country can live without strategic ballistic missiles could be a useful element in discouraging ballistic missile proliferation.

This concept for nuclear weapon delivery need not require the U.S. to develop new nuclear weapon designs, nor to revoke the premises of existing arms control treaties. The United States has developed and tested nuclear warheads for cruise missile delivery and a large number of strategic-bomber delivered weapons. Such designs would only have to be re-manufactured. Whatever framework is pursued with Russia for defining strategic nuclear weapons could still count weapons and assigned delivery systems as START does today, with different sub-limits to reflect our alternative distribution.

### **Comparing the Concepts**

When we have considered alternative concepts for nuclear delivery in the past, the concepts have been evaluated primarily on the basis of vulnerability to first strike, reliability, credibility of second-strike response, flexibility of use, and cost. These still seem reasonable dimensions for considering three concepts:

- (1) “Deterrence Without Ballistic Missiles” as defined above,
- (2) our existing nuclear forces, and



- (3) the NPR-implied force that assumes a smaller force of ICBMs, SLBMs and nuclear-capable bombers and supplements it with non-nuclear precision strike weapons used as deterrent weapons.

On these criteria, it is difficult to find a significant difference between the concepts. Submarine-launched nuclear cruise missiles are no more vulnerable than SLBMs. In 2002, these weapon system concepts could compete on an equal basis as delivery systems for nuclear weapons. All of these weapon systems are well proven, and could be used to deliver nuclear weapons. It would be hard to argue that strategic bombers like the B-2, air-launched cruise missiles (ALCMs), or submarine launched cruise missiles (SLCMs) are less reliable or survivable than ballistic missiles. All three concepts should have high reliability, assuming that the funding is available to maintain reliability in the ICBM and SLBM force.

None of these concepts is vulnerable to first strike by the small arsenals we expect to see deployed in the next few decades by countries other than Russia. During the Cold War, the primary threat to our bomber force was from a hypothetical large attack by Soviet SLBMs fired relatively close to our shores. This threat seems very unlikely today; no country is capable of doing so in the near term. Deployment of nuclear-capable ALCMs, which would be rotated regularly among the bomber force, would provide many difficult targets for any country attempting to wipe out our non-submarine-based deterrent.

Comparing costs is only conceptually possible. Procuring a new strategic ballistic missile cost about 5-10 million dollars; a new cruise missile costs 0.5-1.5 million dollars.<sup>15</sup> Operations and Maintenance for the ICBM force is only 259 million dollars, and for the current air-launched cruise missiles about 35 million dollars.<sup>16</sup> The cost of maintaining the strategic ballistic missile forces is not large enough to provide a clenching argument against maintaining them. But ballistic missiles may be an additional expense above nuclear-capable cruise missile and bomber forces that we will need to provide flexible response against smaller aggressors.

Which concept is most appealing therefore turns on the weight given to flexibility and credibility of the deterrent forces. If strategic ballistic missile forces are not a credible deterrent for any threat short of a massive attack on the United States, we should seek to maintain deterrence without ballistic missiles.

### **Risks and Drawbacks of Retiring Ballistic Missiles**

Any proposal to change the way we maintain our nuclear deterrent should address certain risks. Will we again face the situation that originally led us to develop ballistic missiles in the near future? If we need to re-build ballistic missiles in the future, can we do so? If we transition from ballistic missiles to other delivery systems, will we face a period of vulnerability in the transition?

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<sup>15</sup> Department of Defense, Program Acquisition Costs by Weapon System, Department of Defense Budget for Fiscal Year 2003, February 2002, p. 35-36.

United States Air Force, Committee Staff Procurement Backup Book, FY 2003 Budget Estimates, Feb 2002, Missile Procurement, Air Force, p. 46, "Missile Procurement, Air Force Budget Activity 02, Other Missiles"

<sup>16</sup> Department of the Air Force, Fiscal Year (FY) 2003 Budget Estimates to Congress February 2002, Operation and Maintenance, Air Force, Volume I, p. 57, "Detail by Subactivity Group: Primary Combat Weapons"

None of these risks seem very daunting. It is very unlikely that we will face an enemy in the next two decades who will have the capability for a disabling attack on our country. No one predicts that China, Iran or North Korea is planning to produce nuclear weapons or ICBMs in such quantity as to threaten a nation-destroying attack on the United States.

And, if these judgments are wrong, the survivability of a deterrent based on bombers and submarine-launched cruise missiles is not significantly less than the existing nuclear triad. Rapid response to a nation-ending surprise attack is no longer a credible requirement. Even if the President's NPR guidance is wrong, and it were desirable to maintain a relationship of mutual assured destruction with Russian nuclear capabilities, a deterrent based on cruise missiles and bombers is a credible counter to a first strike by any Russian arsenal. Such an alternative force structure might not respond to an unexpected Russian attack within minutes, but neither would it be destroyed and unavailable for retaliation.

A frequent issue for proposals to end the use of a class of weapons is the potential that the technical and industrial base for producing the weapons will disappear, and could not be reconstituted if needed. In this case, there seems little reason to fear a loss of the capability to produce ballistic missiles if we need them. The technology of ballistic missiles is very closely tied to the requirements of space launch vehicles, which will still be in production.

Some may argue that smaller nuclear weapons will increase the likelihood that the U.S. will use nuclear weapons in a future conflict. The scale of even these smaller weapons and the risk of

escalation should always make use of nuclear weapons a tool of last resort. But so long as nuclear weapons are necessary to deter other countries from their use against us, an argument that our weapons should always be too horrible to use seems counterproductive.

### **Less Dramatic Alternatives**

Could we meet the goal of proportional response to smaller threats without taking the dramatic step of giving up all strategic ballistic missiles? In addition to the baseline NPR recommendation to reduce the number of active strategic ballistic missiles, there are three interesting cases:

- reducing the number of ballistic missile warheads to one-per-missile;
- eliminating ICBMs but retaining SLBMs; and
- improving the accuracy of strategic missiles to give them a conventional strike capability, and make them dual-use weapons.

The NPR recommendation to achieve rapid reductions by retiring Peacekeeper and four boatloads of SLBMs is an attempt to reduce gross numbers of warheads quickly. But if each remaining missile still has several warheads, it is hard to see how they can be used as anything other than a response to Russian forces. Costs for maintaining a smaller fleet will be comparable to a larger one, and our ability to maintain the industrial base for sustaining the missiles will be reduced. Air Force efforts to phase out the fifty Peacekeeper missiles shows the challenges of maintaining a small force of strategic missiles. As the number of missiles is reduced, the ability to keep a cost-effective infrastructure will be challenged. It may be that this recommendation

reflects a desire to bring down the number of warheads quickly, with no other thought about what kind of mix is required.

Keeping a large number of ballistic missiles, but reducing the warheads to one-per-missile, would allow us to maintain a robust missile infrastructure, and might make the missiles more credible as threats to small countries. But maintaining hundreds of large ballistic missiles to deliver small warheads, which could be delivered much more cheaply by cruise missiles already in the inventory, seems hard to justify.

Eliminating ICBMs but retaining SLBMs is appealing primarily to retain an ability to threaten a potential arms-race competitor – a country that might try to out-build us to first strike capability – and to base that insurance on a very survivable platform. It would reduce the number of missile systems that must be maintained, and maintain only the Trident II (the most modern ballistic missile system available). If the U.S. judges that it must maintain a capability for widespread nuclear destruction, instead of providing more focused nuclear retaliation, an SLBM-only force structure may be a good solution. But if the threat of massive exchanges with Russia is now an acceptably low risk, this option does not explain what we would do with missiles that deliver ten warheads in every attack.

Finally, it is possible to develop maneuverable re-entry vehicles and thereby increase the accuracy of ballistic missile warheads sufficiently to allow them to be used for conventional ordnance and to deliver small nuclear weapons. This capability is technically feasible, but is not very cost effective. Since strategic ballistic missiles cost 5-10 million dollars, they are a very

expensive way to deliver a ton or so of high explosive. Moreover, it is hard to imagine that strategic ballistic missiles would become practical “dual use” weapons, when ballistic missile attack has become so closely identified with large-scale strategic attack and other weapons are available to accomplish the same tasks.

## **Conclusions**

The ballistic missile is the best weapon system ever developed to deliver high-megaton destruction over a large area. But deterring China, Iran, Iraq, or North Korea should not require such widespread destruction. It is necessary to demonstrate that we have deterrent nuclear weapons deliverable with precision against the elements of government leadership and the military forces responsible for any attack. Once we have thousands of such small deterrent weapons, it is not clear how strategic ballistic missiles would further enhance our deterrence.

Realistically, it is unlikely that we will retire our ballistic missiles soon. But future Nuclear Posture Reviews will need to define what role the ballistic missile will play, and define exactly what threat ballistic missiles are deterring. If one takes seriously the NPR commitment to “no longer plan, size or sustain its forces as though Russia presented merely a smaller version of the threat posed by the former Soviet Union,” the role of large numbers of near-megaton weapons is not clear. As it becomes necessary to consider a replacement missile for the Minuteman ICBM, even such a venerable part of the strategic triad will have to justify its existence.

Tomorrow’s nuclear scenarios are likely to be significantly different from the well-practiced deterrence calculations of the Cold War. Defining a new mix of strategic weapons should

carefully take into account *who* we want to deter and *what* they are likely to find a credible retaliatory threat.

## **Appendix: A Short History of U.S. Nuclear Delivery Systems**

Nuclear weapon delivery has gone through dramatic changes in the five decades since World War II. Nuclear weapons initially could only be delivered by long-range bombers, and required bases near the Soviet Union to strike within that country. The major issue that came to dominate discussion of nuclear deterrence was the potential vulnerability of the bomber fleet. In particular, it was judged that overseas bases, and even bases in the U.S., could be attacked without warning. RAND analysts were the first to make the case that our nuclear deterrence depended on assuring that our deterrent forces could not be overwhelmed by a Soviet first strike. To some extent this concern was met by creating an early warning network, and to some extent by the development of new CONUS-based bombers and operations strategies that reduced vulnerability.<sup>17</sup>

The development of long-range ballistic missiles both increased and decreased concern about vulnerability of our strategic nuclear forces. On the one hand, Soviet ballistic missiles might strike U.S. bombers before any warning was possible; on the other hand U.S. Intercontinental Ballistic Missiles (ICBMs) should be ready to launch even on the tardiest of warnings.

Although relatively slow to embrace the need for ballistic missiles, the Eisenhower administration eventually led the development of a range of ballistic missiles – the first ICBM (Atlas), the first silo-based ICBM (Titan<sup>18</sup>), the first intermediate range ballistic missile (Jupiter), and the first submarine-based ballistic missile (SLBM). The latter two systems were developed

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<sup>17</sup> Fred Kaplan, The Wizards of Armageddon, New York, NY, Simon and Schuster, 1983.

<sup>18</sup> Titan was silo-based, but elevate-to-launch, in a mode we would hardly recognize as silo-based today. None-the-less, it was stored in a hardened, buried silo and was therefore less vulnerable to attack.



in part as a technological hedge against the difficulty of ICBM development, but all of these missiles were deployed for the first time within a period of about two years over 1957-60. These first strategic ballistic missiles were made possible by the development of the thermonuclear warhead. The combination of relatively low accuracy (between 1 and 5 miles CEP) and limited payload capability (a 1500-pound warhead) required a multi-megaton thermonuclear weapon to meet operational requirements of threatening Soviet facilities.<sup>19</sup>

When we deployed the first Atlas ICBMs on the Air Force Bases at Cape Canaveral and Vandenberg, we claimed that we had established a strategic deterrent that could not be defeated by surprise attack. But our concern over the uncertainties of a potential “bolt-out-of-the-blue” missile attack led us to develop more survivable forms of deterrent weapons – Minuteman solid-fuel ICBMs in hardened silos. We improved the accuracy, reliability and operational control of ICBM and SLBMs, and deployed for the first time over 1000 missiles. Secretary of Defense Robert S. McNamara argued that the sheer scale of our capability for massive retaliation would deter a Soviet attack. When large numbers of nuclear weapons were to be launched in a single attack, ballistic missiles provided the most cost-effective solution. However, the U.S. in the 1960s created a nuclear variant for almost any type of explosive ordnance in the inventory, deploying nuclear torpedoes, tactical bombs, mines and mortar shells. These weapons were to be used in conjunction with conventional military operations that might precede or be concurrent with a major nuclear exchange.

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<sup>19</sup> G. Harry Stine, ICBM: The Making of the Weapon that Changed the World, New York, NY, Orion Books, 1991.

In the 1970s we began to convert our ICBMs and SLBMs to carry Multiple Independently Targeted Re-entry Vehicles (MIRVs), in which one rocket launch could target as many as ten enemy sites. MIRVs dramatically increased the number of nuclear weapons in the deterrent forces, but both sides deployed them to insure against first strike vulnerability. The United States also began constructing long-range cruise missiles as nuclear delivery systems<sup>20</sup>, arguing that these weapons were so small and could be so widely dispersed that they would be a more effective deterrent than ballistic missiles. Both of these developments were made possible by improved guidance systems that allowed a smaller nuclear weapon to destroy a target in the Soviet Union that had previously required a larger megaton-class weapon.

The trend of developing larger numbers, improved performance, and more diverse nuclear weapon systems began to reverse by the late 1970s. Although debates about the kinds of nuclear forces needed to deter and fight wars was common throughout the Reagan Administration, these debates led to very few new weapon systems being fielded. By the end of the 1980s, the United States began to reduce the kinds of nuclear weapons deployed. Arms control agreements capped the numbers of strategic delivery systems, and eliminated the option of nuclear delivery by intermediate range ballistic missiles or forward-based ground-launch cruise missiles. Cruise missile development became focused on providing a precise delivery system that could destroy important targets using only conventional explosives. Nuclear attack submarines and tactical air wings asked to be relieved of nuclear weapons, citing the safety hazards and administrative difficulties that came with these devices.

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<sup>20</sup> It is entertaining today to read reports of the time which state that cruise missiles would have no applications in conventional conflicts because of the small payload capabilities.

Our interest in nuclear weapons had been driven by a need for a credible deterrent to any use of nuclear weapons by the Soviets, and a desire for some capability to use nuclear weapons in combat situations if required. By the 1980s, this requirement was simplified to the need for a few “tactical” nuclear weapons for responding to unusual attack scenarios, and the need to confidently guarantee that hundreds of warheads would fall on the Soviet Union if it launched a massive surprise attack on the U.S. A key response to that second requirement was to maintain thousands of warheads at ready alert on ballistic missiles.

After the Cold War ended, existing nuclear delivery systems were maintained for two reasons: a general belief that we needed a nuclear deterrent to preclude attack by any country (including the large arsenal inherited by the Russian Federation), and a Congressional mandate that we not go below the ceilings set by the START I arms control agreement without creating a new framework for joint reductions with Russia.

The new NPR provides the first step towards defining the nuclear weapons we will need for the first decades of the Twenty-first Century. The NPR envisions reducing the number of deployed warheads to about one-third of the present complement. Press reports indicate that it also calls for providing the capability – under clear authority and control– for the President to order use of nuclear weapons in regional conflicts when no other option will meet our needs.

## BIBLIOGRAPHY

Ball, Desmond. Politics and Force Levels: the Strategic Missile Program of the Kennedy Administration, Berkeley CA, University of California Press, 1980.

Barnett, Roger W. "What Deters? Strength, Not Weakness," *Naval War College Review*, Vol. 54, No. 2, Spring 2001.

Baylis, John and Robert O'Neill. Alternative Nuclear Futures: the Role of Nuclear Weapons in the Post-Cold War World, New York, Oxford University Press, 2000.

Beard, Edmund. Developing the ICBM: a Study in Bureaucratic Politics, New York, Columbia University Press, 1976.

Betts, Richard K. ed. Cruise Missiles: Technology, Strategy, Politics. The Brookings Institution, Washington DC, 1981.

Binnendijk, Hans and James Goodby. Transforming Nuclear Deterrence, Washington DC , National Defense University Press, 1997.

Blair, Bruce, Harold Feiveson and Frank N. von Hippel "Taking Nuclear Weapons Off Hair-Trigger Alert," *Scientific American* Vol. 281, No. 11 (November 1997)

Bottomo, Edgar M. The Missile Gap: a Study of the Formulation of Military and Political Policy, Fairleigh Dickinson University Press, 1971.

Bunn, M. Elain, and Sokolsky, Richard D. "The U.S. Strategic Posture Review: Issues for the New Administration," *Washington, DC*, National Defense University, Institute for National Strategic Studies: *Strategic Forum*, Number 177, February 2001.

Center for Counterproliferation Research. The NBC Threat in 2025: Concepts and Strategies for Adversarial use of Nuclear, Biological, and Chemical Weapons, Washington DC, National Defense University, 1997.

Cimbala, Stephen J. Deterrence and Nuclear Proliferation in the Twenty-first Century, Westport, CN, Praeger, 2001.

Collins, John M. and John Steven Chwat, Strategic Nuclear Delivery Systems: How Many? What Combinations? Washington DC, Congressional Research Service Report 74-177, October 7, 1974.

Department of the Air Force. Fiscal Year (FY) 2003 Budget Estimates to Congress, Operation and Maintenance, Air Force. February 2002

Department of Defense. "Findings of the Nuclear Posture Review," Special Briefing by, J.D. Crouch, Assistant Secretary of Defense for International Security Programs, Rear Adm. Barry M. Costello, Deputy Director for Strategy and Policy, Joint Staff; John Harvey, Director, Office of Policy, Planning, Assessment and Analysis, Department of Energy; Richard McGraw, Principal Deputy Assistant Secretary of Defense for Public Affairs. Washington DC, January 9, 2002. Available at <http://usinfo.state.gov/topical/pol/arms/stories/review.htm>

Department of Defense. "Foreword to the otherwise classified Nuclear Posture Review". Washington DC, January 9, 2002. Available at <http://www.defenselink.mil/news/Jan2002/d20020109npr.pdf>

Department of Defense, Program Acquisition Costs by Weapon System, Department of Defense Budget for Fiscal Year 2003, February 2002.

Department of State. "START I Aggregate Numbers of Strategic Offensive Arms," Fact Sheet, Washington DC, Bureau of Arms Control, October 1, 2001. Available at <http://www.state.gov/t/ac/rls/fs/2001/1716.htm>

Feiveson, Harold A., ed. The Nuclear Turning Point: A Blueprint for Deep Cuts and De-Alerting of Nuclear Weapons. Washington DC, The Brookings Institution, 1999.

Fiebig, Victor R. The U.S. nuclear arsenal: too big to deter? Washington, DC, National War College, 1994.

General Accounting Office. NSIAD-91-319FS Strategic Weapons, Nuclear Weapons Targeting Process. Washington DC, September 27, 1991.

General Accounting Office. NSIAD-93-47, Air Force Appropriations, Funding Practices at the Ballistic Missile Organization. Washington DC, July 27, 1993.

Joseph, Robert G. and Reichert, John F. "The Case for Nuclear Deterrence Today," *Orbis*, Winter 1998.

Johns, Claude J. The United States Air Force Intercontinental Ballistic Missile Program, 1954-1959: Technological Change and Organizational Innovation, United States Air Force Academy, 1965.

Johnson, Tom. "The Rise and Fall of Missiles," *IEEE Spectrum*, Vol. 36, No. 6, June 1999, p. 6.

Johnson, Stephen B. "Bernard Schriever and the Scientific Vision," *Air Power History*, Vol. 49, No. 1, Spring 2002, p. 30.

Kaplan, Fred. The Wizards of Armageddon, New York, NY: Simon and Schuster, 1983.

Kelly Henry C. and Michael A. Levi. "Nix the mini-nukes," *Christian Science Monitor*, Mar 28, 2002.

Kerry, Robert and Hartung, William D. "Toward a New Nuclear Posture: Challenges For the Bush Administration," *Arms Control Today*, April 2001.

Lewis Kevin N. Historical U.S. Force Structure Trend: a Primer. Santa Monica, CA, Rand, 1989.

Levi Barbara G., Mark Sakitt, and Art Hobson. The Future of Land-based Strategic Missiles, New York, American Institute of Physics, 1989.

Lodal, Jan M. "For Modest Defences and Low Offensive Numbers," *Survival*, Vol. 43, No. 3, Autumn 2001.

McGahan, Michael P. Nuclear Deterrence: a Look at the Past and Future through the Eyes of a Beholder, Washington, DC, National War College, 1996.

Pincus, Walter "Nuclear Plans Go Beyond Cuts; Bush Seeks a New Generation of Weapons, Delivery Systems," *The Washington Post*, Feb. 19, 2002, p. A13.

Pincus, Walter "Questions Raised on Trident Subs; Cost and Size of Strategic Nuclear Deterrent are Issues," *The Washington Post*, Jan 3, 1999, p. A22.

Quester, George. H. "Some Possible Surprises in Our Nuclear Future," *Small Wars and Insurgencies*, Vol. 11, No. 2, Autumn 2000, p. 38.

Ramo, Simon. "Memoirs of an ICBM Pioneer," *Fortune*, Vol. 117, No. 9, Apr. 25, 1988.

Schelling, Thomas C. Nuclear weapons and Limited war, Santa Monica, CA, Rand, 1959.

Schneider Barry R., Colin S. Gray, and Keith B. Payne, ed. Missiles for the Nineties: ICBMs and Strategic Policy, Boulder, CO, Westview Press, 1984.

Sokolsky, Richard D. and Eugene B. Rumer. "Nuclear Alarmists," *The Washington Post*, Mar. 15, 2002, p. A23.

Steinbruner, John D. and Thomas M. Garwin. "Strategic Vulnerability: The Balance between Prudence and Paranoia," *International Security*, Vol. 1, No. 1, Summer 1976, p. 138.

Stern, Warren M. New Nuclear Conceptions: How We have Changed the Way We Think about Nuclear Weapons and Why it Matters, Washington, DC, National War College, 1997.

Stine , G. Harry. ICBM: The Making of the Weapon that Changed the World, New York, NY: Orion Books, 1991.

Strain, Frederick R. Confronting Nuclear Addiction: the Challenge of Proliferation, Washington, DC, U.S. Air Force, Directorate of Plans, 1992.

Thompson, Antonella and Brad Harlow, "Missile Systems – the Year in Review," *Aerospace America*, Vol. 36, No. 12, Dec. 1998.

Turner, Stansfield. "The Dilemma of Nuclear Weapons in the Twenty-first Century". *Naval War College Review*, Vol. 54, No. 2, Spring 2001.

United States Air Force, Committee Staff Procurement Backup Book, FY 2003 Budget Estimates, Feb 2002, Missile Procurement, Air Force, February 2002

United States Congress, Senate, Committee on Armed Services. Briefing on Results of the Nuclear Posture Review: Hearing before the Committee on Armed Services, United States Senate, On Hundred Third Congress Second Session. Washington, DC, September 22, 1994.

Utgoff, Victor A. The Coming Crisis: Nuclear Proliferation, U.S. Interests, and World Order. Cambridge, MA, MIT Press, 2000.

Weinberger, Caspar W. "The Dangers of Denuclearization" *Forbes*, Feb 23, 1998.

Wong-Fraser, Agatha S. Y. The Political Utility of Nuclear Weapons: Expectations and Experience, Lanham, MD, University Press of America, 1980.

Zaloga, Steven J. "Missile Markets: Uneven Recovery," *Aviation Week and Space Technology*, Vol. 154, No. 3, Jan. 15, 2001, p. 181.