



# UNITED STATES AIR FORCE CENTER FOR UNCONVENTIONAL WEAPONS STUDIES

at The Air University



## The Role of the Long-Range Strategic Bomber

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The long-range bomber is the only nuclear delivery vehicle that has employed a nuclear weapon in war. Since 1945, the nuclear bomber has played a primary role in what has become known as the US Nuclear Triad. The other two components are Intercontinental Ballistic Missiles (ICBM), which came on-line in 1959, and the Submarine Launched Ballistic Missiles (SLBM), which began operations in 1960. Considering the end of the Cold war and the aging of its platforms, is the traditional triad still the optimal structure for nuclear deterrence?

Long-range strike will continue to be a mission of the United States, thus the long-range bomber will remain a required capability for the execution of the US security strategy. The reasons below will provide advocacy for the bomber, both in the nuclear and conventional role, as a military weapon necessary for national defense. Even if nuclear weapons were eliminated, as the Nuclear Nonproliferation Treaty (NPT) alludes to, the long-range bomber would still perform a conventional role and would not need to be retired. Specifically, this paper advocates the continued need for nuclear bombers as a means for nuclear deterrence and employment based on the National Security Strategy (NSS) and Nuclear Posture Review (NPR).

This paper proceeds in three parts: first, the establishment of the need to retain nuclear weapons for both deterrence and employment as stated in the NSS and the NPR; second, an analysis of the current US Nuclear Triad and advocacy for the bomber to remain part of nuclear deterrence; and third, a proposed force structure for the long-range bomber.

### — Nuclear Weapons and the NSS and NPR —

After World War II, nuclear weapons became the centerpiece of US National Security Strategy as most statesmen and military leaders believed that nuclear weapons would be used in all future wars. Though other states were considered in determining US nuclear strategy, the Soviet Union garnered the most

attention and set the foundation for what would be termed Cold War nuclear strategy. After the collapse of the Soviet Union, the United States began to reevaluate the role of nuclear weapons. With the Soviet Union now gone, would nuclear weapons be used only as a weapon “of last resort” or would nuclear deterrence still be necessary?<sup>1</sup> The Clinton administration carried on the Cold War nuclear strategy throughout the 1990’s, relying on the same nuclear triad, with little resistance from senior policy leaders as the re-emergence of Russia was still considered a possibility.<sup>2</sup>

The first mention of a change to the triad came in the 2001 NPR when the Department of Defense established a “New Triad” consisting of offensive nuclear and conventional strike (the old triad), active/passive defenses, and a responsive infrastructure.<sup>3</sup> The NPR focused on reducing the size of the nuclear force and not keeping the same strategy as though Russia represented a smaller Soviet Union.<sup>4</sup> Rather than relying on vast numbers, the emphasis on nuclear weapons was to “provide credible capabilities to deter a wide range of threats...”<sup>5</sup> Though this approach was verbalized, a restructuring of the nuclear force for addressing these threats was not accomplished, and nuclear forces remained similar to that of the 1990s.<sup>6</sup>

The 2010 NSS states that major nuclear powers are at peace and although the threat of nuclear war has diminished, nuclear dangers have not.<sup>7</sup> Within this declaration lies the basis for the United States to reduce its nuclear arsenal while increasing deterrence.<sup>8</sup> The NSS discusses how the threat of nuclear attack has increased even with the end of the Cold War, as more states have acquired nuclear weapons and proliferation is reaching entities that have no concern for the nuclear status quo.<sup>9</sup> Reversing the spread of nuclear weapons while also assuring US allies and other security partners that they can count on America has become a top priority.<sup>10</sup> In order to accomplish this objective, the nuclear triad must remain robust enough to extend the nuclear deterrence umbrella to all US allies. The current

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nuclear arsenal must remain credible (safe, secure and effective); if it is not, partner nations may lose faith in US nuclear deterrence. If this occurs, allied nations may seek to develop their own nuclear deterrence which would be contrary to the NSS goals of strengthening the NPT and limiting nuclear proliferation.

The 2010 NPR reemphasizes that “the United States must sustain a safe, secure, and effective nuclear arsenal – to maintain strategic stability with other major nuclear powers, deter potential adversaries, and reassure our allies and partners of our security commitments to them.”<sup>11</sup> The NPR describes the global environment in a similar way as the NSS; by acknowledging that the risk of global nuclear war is remote, but the risk of nuclear attack has increased.<sup>12</sup> This is indicated by the proliferation of terrorism and acquisition of nuclear weapons by rogue states at odds with the United States or its allies. The NPR emphasized that while the nuclear force is getting smaller, efforts should continue to minimize the possibility of accidental launches while maximizing launch decision time.<sup>13</sup>

In addition to terrorists and rogue state threats, the United States must continue to address the nuclear power of Russia as well as those of rising states such as China and India. While these states may not pose a direct security threat to the United States, they provide an environment of unpredictability in their respective regions that poses a security threat to US allies. Although the NPR identifies the nuclear arsenal from the Cold War as being poorly suited to address current challenges posed by terrorists and unfriendly states, a credible nuclear deterrent to reinforce regional security is still required.<sup>14</sup> To reinforce regional security, the United States plans to reduce the role of nuclear weapons by declaring they will not use nuclear weapons against those states that have signed and are in compliance with the NPT.<sup>15</sup> In place of its nuclear force, the United States will use its conventional force. Though this would seem to de-emphasize the triad, it is only pertinent to states that do not possess nuclear weapons. The threat for the United States to use nuclear weapons must remain optional to those states with nuclear weapons; therefore, the United States does not prescribe to the use of nuclear weapons only for deterrence.<sup>16</sup>

— The Nuclear Triad —

Though the NSS and NPR still maintain the traditional nuclear triad as the US force for nuclear deterrence, a goal of US security policy is to reduce the role of nuclear weapons while still providing a viable deterrent. By default, reducing the role of nuclear weapons leads to an evaluation of the traditional triad.<sup>17</sup> Considering the current fiscal and global environment, is the traditional triad still required? Since the time the New Triad was mentioned in the 2001 NPR, two influential studies concerning the structure of the triad have been accomplished. These are *Triad, Dyad, Monad? Shaping the US Nuclear Force for the Future* by the Mitchell Institute and a Global Zero U.S. Nuclear Policy Commission Report titled *Modernizing U.S. Nuclear Strategy, Force Structure and Posture*. The following summarizes issues presented in these studies and provides details on the conventional and nuclear roles of the bomber.

In 2009, the Mitchell Institute for Airpower Studies evaluated a nuclear force consisting of 1,500 warheads.<sup>18</sup> The Mitch-

ell team evaluated each triad leg based on a definition of deterrence as the ability to inflict assured destruction and wage nuclear war,<sup>19</sup> and stability as pressure to reduce risk of first strike.<sup>20</sup> For the nuclear force to achieve deterrence and stability, nine distinct attributes were examined. These attributes are: warheads on alert, survivability (day-to-day and generated), targets at risk from the enemy, ability to penetrate enemy air defenses, promptness of retaliatory strike, signal of alert readiness changes, crisis stability, and connectivity/retargeting.<sup>21</sup>

The Mitchell team evaluated the possibility of a monad (SLBMs only), three dyads (SLBM/bomber, ICBM/bomber, and SLBM/ICBM), and the traditional triad. In an effort to visualize the characteristics of each leg of the triad, a circular chart was constructed that contained the nine attributes listed above. Each of the proposed nuclear forces was assessed subjectively based on the collective knowledge of the research team and compared to the current triad.<sup>22</sup> The report concluded that if the United States continues to downsize its nuclear force, then the ICBM/SLBM is the optimal choice.<sup>23</sup> In addition to the deterrent analysis, the report cited a lack of funding for Air Launched Cruise Missile (ALCM) upgrades as shifting the triad toward an ICBM/SLBM dyad. In the final conclusions, the Mitchell report did not discuss the relationship of the values with respect to the shaded area. The two graphs below depict the assessment concerning the two dyad options of ICBM/Bomber and ICBM/SLBM.

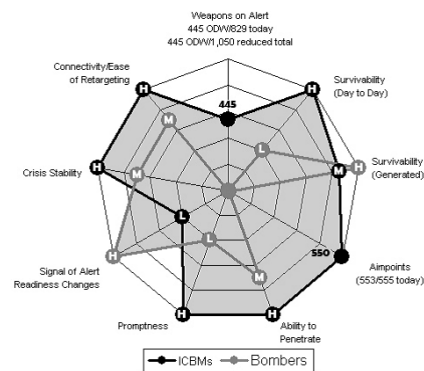


Figure 1. ICBM/Bomber Dyad<sup>25</sup>

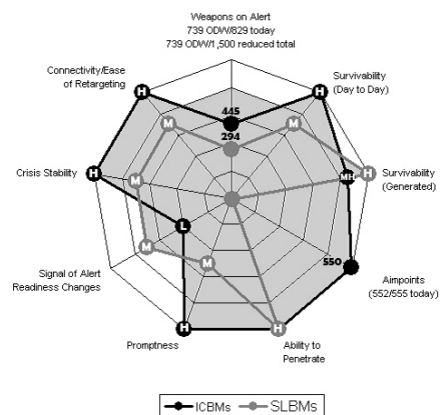


Figure 2. ICBM/SLBM Dyad<sup>26</sup>

The research team concluded that the ICBM/SLBM dyad was the best option due to the notional deterrent value depicted in

the shaded area.<sup>27</sup> The report did not address the relationship between each characteristic, thus leaving it unclear as to the value of the shaded area. For example, an argument can be made that the ICBM/Bomber dyad provides the best option since it is closest to the original triad in each specific category, with the exception of the warheads on alert.<sup>28</sup> Although the report favored the ICBM/SLBM dyad, it recommended that the B-2 retain its nuclear capability. This would not reduce the need for B-2 or B-52 modernization (due to the continuing conventional mission) thus negating any cost savings in that area.

### — Modernizing US Nuclear Strategy, Force Structure, and Posture —

Global Zero, an international movement promoting the elimination of all nuclear weapons, produced a 2012 report entitled *Modernizing US Nuclear Strategy, Force Structure and Posture*. This report analyzed the US nuclear force structure and recommended levels of warheads and delivery systems to meet current threats. The study focused on two objectives: reducing US reliance on nuclear weapons and the environment of a multi-polar nuclear environment.<sup>29</sup> The study is based on five basic premises, which are:

1. Mutual nuclear deterrence based on the threat of nuclear retaliation to attack is no longer a cornerstone of the U.S.-Russia security relationship.
2. The actual existing threats to our two countries [United States and Russia] (and the globe) cannot be resolved by using nuclear arsenals.
3. The recommendation to make nuclear arms reductions a multilateral enterprise would remedy a basic deficiency in the framework of ongoing nuclear arms talks: the exclusion of everyone except for Americans and Russians.
4. The world is spending vast sums on producing and maintaining nuclear arms and on mitigating their environmental and health consequences.
5. The launch-ready nuclear postures of Russia and the United States present unnecessary risk.<sup>30</sup>

The US nuclear strategy during the Cold War was primarily focused on deterring or defeating the Soviet Union, but now with the end of the Cold War, new security priorities are emerging. The study points to these areas of concern instead of nuclear war with Russia or even China.<sup>31</sup> An argument is made that a shift in strategy is required to deal with the new security challenges of nuclear proliferation and nuclear terrorism.<sup>32</sup> The basic emphasis in the strategy shift is to transform US thinking from one or two main threats to many threats that can be mitigated with conventional weapons. This transformation requires increased cooperation among current world powers to shift nuclear deterrence to general deterrence.<sup>33</sup> To accomplish this, the United States should decrease its nuclear stockpile, implement a nuclear posture that requires 24-72 hours from notification to launch, improve security of existing stockpiles, provide a missile defense and conventional strike capability that is timely and

far reaching, and improve communication systems for early warning and command and control of nuclear stockpiles.<sup>34</sup> The study claims that a force of 900 strategic nuclear weapons with 450 deployed and the other 450 in ready storage would be best suited for the security threats posed by nuclear proliferation and terrorism.<sup>35</sup>

The study advocated that the ICBM would no longer be needed, since the emphasis in deterrence would be on indication of escalation and the elimination of the threat of a sudden nuclear strike.<sup>36</sup> The condition for the elimination of ICBMs would be contingent on agreement with Russia to do the same, since Russia is the only state targeted with US ICBMs.<sup>37</sup> Additional reasoning for eliminating ICBMs is the short decision time allotted between attack warning and launch. Since ICBMs are in fixed locations, they are easily targetable and a decision to launch must be made in a matter of minutes or retaliation ability could be eliminated. This short decision time increases the risk of launch on a false warning.<sup>38</sup>

The recommendations discussed in the Global Zero study are cohesive with the NSS and the NPT, and the proposed size and construct of the US nuclear force is consistent with the five premises above. The report provided background information on how the premises were derived, but did not mention the adversary's point of view. "Security is mainly a state of mind, not a physical condition, and mutual assured destruction (MAD) no longer occupies central psychological or political space in the US/Russia relationship."<sup>39</sup> This statement may be evident from current US/Russia treaties; however, could Russia be replaced with China, Iran, India, or North Korea? Even if the United States decided unilaterally to draw down nuclear forces, could our nuclear umbrella commitments to European and Asian allies be achieved with only ten ballistic missile submarines (SSBM) and 18 nuclear bombers? The report claimed current threats could not be deterred with nuclear weapons;<sup>40</sup> however, this may not be the thoughts of countries such as South Korea and Japan who have halted their nuclear weapons programs on the promise of US extended deterrence. While this report did retain the bomber as part of the US nuclear posture, the number required defaulted to the current inventory of 18 and did not provide an analysis on the bomber's role.

### — Nuclear and Conventional Mission —

Early air power leader Giulio Douhet understood the role of the bomber when he stated "for now it is possible to go far behind the fortified lines of defense without first breaking through them. It is airpower which makes it all possible."<sup>41</sup> Since WW I, the bomber played a key role in breaking the enemy's will to fight. What makes the bomber such an instrumental tool in achieving strategic objectives? The following details the bomber's role in the NSS and NPR.

Consistent with the NSS, the strategic bomber provides a credible capability in deterring multiple threats in different areas of the world. As stated in the 2013 *Flight Plan for the Air Force Nuclear Enterprise*, "DOD guidance makes clear the continuing need for strategic deterrence, requiring our forces to be '... capable of deterring and defeating aggression by any potential adversary.' Twenty-first century deterrence demands credible and flexible nuclear capabilities."<sup>42</sup> This capability to

### — Number and Force Structure Needed —

deter aggression was demonstrated by the B-2 with deployments to Europe and South Korea in 2013. No other triad leg could have illustrated US global reach and demonstrated US capabilities to our allies as well as the bomber. The ICBM's credibility lies in the faith that an aggressor has in the launch capability, and it can only be demonstrated through the launching of satellites or launches with flight paths that are not close to the potential aggressor's state. A SSBM does not provide the same deterrence as it cannot be seen close to the aggressor's borders. The bomber also provides a flexible force because of its ability to deliver conventional or nuclear munitions.

Both the NSS and the NPR discuss the goal of reducing the US arsenal and reliance on nuclear weapons. This dialog was present even in the midst of the Cold War. In former Secretary of Defense Robert McNamara's 1983 article, he quoted former Commander in Chief of US Forces in the Pacific as saying "There is no sensible use of any of our nuclear forces. Their only reasonable use is to deter our opponent from using his nuclear forces."<sup>43</sup> If the world ever reaches the point of elimination of all nuclear weapons, the bomber is the optimal nuclear delivery vehicle to transition to a conventional role. The conventional role would already be active in nuclear deterrence through the employment of deep penetration munitions. In addition, bomber modifications would only be necessary under specific treaty limitations of delivery vehicles. Although past treaties have included delivery vehicles, a treaty focused strictly on the number of warheads could provide more flexibility in the number of bombers available for employment. The other two legs of the triad would require de-militarization even if delivery vehicles were not limited, since they do not perform a conventional mission.

The 2010 NPR and the Global Zero study emphasized the need for increased decision launch time and a reduction in the risk of false alarms. The bomber is the only portion of the triad that provides the ability for signal of alert readiness changes (signs of escalation). This is accomplished through the movement of weapons and the visible generation of aircraft. ICBMs and SSBMs do offer a heightened stage of alert; however, these are not visible to the adversary. Visible escalation allows for stability by giving decision makers additional options in negotiations. If a launch alarm does occur, the decision to launch the bomber fleet can be made simultaneously as there is the ability to recall the fleet once the launch has been confirmed.

The bomber also provides the greatest flexibility with respect to flyover paths. The SSBMs incur much the same over flight restrictions as noted with the ICBMs. Although SSBMs have the capability to relocate, the possibility for flyover of a coastal state to reach a target incurs the risk of the flyover state assuming it is under attack. The bomber has the capability to develop flight paths around belligerent or non-allied states. In addition, the stand-off capability of cruise missiles allow for further options. The flexibility in flight paths provides further deterrence as an adversarial state is not safe just because of its geographic location. While we can never guarantee that a new weapon will be introduced that could negate the role of the strategic bomber, currently it offers the most options through the use of stand-off and hardened target munitions.<sup>44</sup>

As detailed above, the bomber will remain a strategic weapon for the United States even if nuclear weapons are eliminated, but how many are required to achieve the objectives in the NSS? The bomber has been a part of the US inventory since WW I, but its biggest impact to warfare came in WW II where it was used to deliver the first nuclear weapon. The B-29 remained the only nuclear-capable bomber until the B-36 arrived in 1948.<sup>45</sup> A total of nine strategic bombers have been manufactured since the first nuclear employment, but only the B-2 and B-52 remain nuclear capable.<sup>46</sup> Not including 1945, the active nuclear fleet has varied from a high of 1,854 in 1959 (1,366 B-47 and 488 B-52) to a low 96 in 2013 (76 B-52 and 20 B-2).<sup>47</sup> Since 1959, the number of nuclear bombers began a slow decrease due to the introduction of the ICBMs and SSBMs.

The acquisition of two additional delivery vehicles and the Strategic Arms Limitation Treaty of 1979 (SALT II) allowed for the continued steady decline through the 1960s and 1970s, eventually leveling off to approximately 350 in the 1980s. Following the signing of the first Strategic Arms Reduction Treaty, delivery vehicles were limited to a total of 1,600.<sup>48</sup> These provisions brought the number of strategic bombers down to a little over one hundred in 1996. During the late 1990s, advancements in conventional weapons enabled strategic bombers to participate in Close Air Support (CAS).<sup>49</sup> Even though the current bomber fleet of 96 is supplemented by an additional 63 B-1Bs (conventional only), the highly sought after CAS capability placed an additional burden on a legacy bomber force structured for the Cold War. While the last US Air Force Long-Range Strike Aircraft White Paper, published in November 2001, called for a total force structure of 157,<sup>50</sup> the number should be higher than this due to the current strains on the existing fleet.

The current bomber fleet consists of two dual-role and one conventional-only aircraft. All three of these platforms require extensive modifications to remain viable in future threat environments, and all three face replacement part issues due to diminishing manufactures, parts obsolescence (due to small fleet sizes), and heavy maintenance schedules (due to age). Together, modifications, Programmed Depot Maintenance (PDM), and parts shortages impact aircraft availability. The newest platform in the bomber fleet is the B-2 Spirit, which was designed in the late 1980s and manufactured in the 1990s.<sup>51</sup> The initial procurement called for 132; however, with the end of the Cold War in 1992, the number was reduced to 75 and eventually to 20.

Although the B-2 performed well during the initial days of Operation Iraqi Freedom, in order for it to continue to be viable against advanced enemy air defenses of the future, several modifications are required.<sup>52</sup> The B-52 entered into service in 1955 with an original service life of 5,000 hours, and of the 744 built, only 76 remain in service.<sup>53</sup> The B-1B was designed in the 1970s as a replacement for the B-52, but fell ill to budget cuts until Reagan pushed for funding in the early 1980s. While one hundred B-1Bs were manufactured from 1983-1988, only 63 remain in service.<sup>54</sup> The B-1B has flown missions in support of Operation Desert Fox, Allied Force, and Enduring Freedom. Like the B-2 and the B-52, the B-1B requires modernization of its communications systems.

In order to best provide nuclear deterrence and convention-

al support for the United States and its allies, the United States should procure 90 dual-role Long-Range Strategic Bombers (LRSB) and 90 conventional-only bombers. The 90 dual-role bombers could be adjusted to fall within New START limitations and would replace the current inventory of 96. This number falls well above the 44 combat-ready B-52s (plus the additional 20 B-2s) mandated by Congress in the FY2007 Defense Authorization Bill.<sup>55</sup> The dual-role bombers will be capable of delivering gravity nuclear weapons as well as the new Long-range Stand-off Missile (LRSO). The dual-role and conventional aircraft will be capable of delivering conventional hard target penetration munitions. The additional 90 conventional-only bombers would replace the current B-1B force of 63. The increase of 33 from the 2001 white paper is required to alleviate strains within the logistics system and allow for greater flexibility in PDM, scheduled maintenance and modification schedules, while also adding more flexibility to support multiple CAS operations.

Any number less than 180 will place strains on the logistic system such as is common with small fleet aircraft. 180 aircraft will allow for production incentives for part manufacturers and provide suppliers steady work flow. The additional numbers will also allow for modification programs to not interfere with aircraft availability by allowing what many believe are available to actually be available.<sup>56</sup> For example, each fleet of aircraft would be separately managed but have similar maintenance and modifications schedules. If the PDM schedule is set for five years and takes six months to complete (comparable to current fleet time schedules), then 36 aircraft per year would require PDM, leaving 18 unavailable throughout the year. A minimum of three aircraft per configuration (six total) should be set aside for test and evaluation, two at each installation for modification (two per base for a total of 10), and an estimated four aircraft at each installation will be down for scheduled maintenance (20 total). This allows for 126 (63 dual-role and 63 conventional) to be available for immediate taskings and training requirements. The additional 33 aircraft would also aide in the strategy for the “Pacific Pivot.” Though this pivot has not yet been addressed in the NSS or NPR, a shift to the Pacific may place a greater demand on the bomber fleet. The additional 33 conventional-only aircraft would help alleviate scheduling conflicts and still allow sufficient numbers available for Europe and the Middle East.

The structure for the assignment of the 180 aircraft would align with the current basing pattern. The 90 conventional-only bombers would be assigned to the two B-1B bases and consist of three squadrons of 15 (12 primary and three back-up inventory). The 90 dual-role bombers would be assigned to the current B-52 and B-2 bases (three total).<sup>57</sup> The squadron configuration of the dual-role bombers would vary based on current infrastructure, but each location would have one squadron assigned with a nuclear only role while the other squadrons would have dual-role aircraft but perform a conventional only mission. This would allow for flexibility in meeting any nuclear commitment as there would be sufficient aircraft available at any time without regard to scheduled maintenance or modifications and also allow nuclear bombers to be on alert while conventional operations are ongoing.

These three nuclear-only squadrons would aid in the accomplishment of two of the Strategic Vectors outlined in the

2013 *Flight Plan for the Air Force Nuclear Enterprise*. Personnel assigned to these units would become part of the set of airmen described in Vector 1; “Deliberately develop and manage an experienced cadre of airmen with nuclear expertise to support and conduct nuclear deterrence operations (NDO).”<sup>58</sup> Concentration on the nuclear mission would allow for greater development of nuclear operations, technical expertise, critical thinking skills, and attention to detail.<sup>59</sup> The emphasis of the nuclear mission without mixing in a conventional role would allow time for professional development and critical thinking in nuclear deterrence and assurance, which is the goal of Vector 5.<sup>60</sup> These units would produce a generation of leaders with deeper knowledge of deterrence and assurance built on operational experience.<sup>61</sup>

The configuration of nuclear-only and conventional-only squadrons would also provide the additional benefit developing the conventional strike with regard to nuclear deterrence. Although not discussed as part of a new triad since 2001, the 2010 NPR mentions the use of conventional forces to meet nuclear security objectives.<sup>62</sup> Discussions on the triad’s role and configuration will continue to occur within the leadership framework and the conventional capability for nuclear deterrence would have time to mature. As stated previously, the bomber is still a necessary platform even in the event that nuclear warheads are eliminated. If nuclear warheads are reduced further, a bomber fleet composed of 180 aircraft would give greater flexibility for multi-mission roles,<sup>63</sup> whereas the ICBM and SSBM would be placed out of service.

### — Conclusion —

The traditional triad of ICBMs, SLBMs and bombers was very successful in nuclear deterrence for over 60 years; will this configuration continue to be the most effective nuclear deterrent, or will new technologies or budget cuts alter the triad? Even if the bomber is no longer needed for nuclear deterrence and employment, it will continue to have a role in the US NSS. The bomber will never reach the numbers it had in 1960 because new technologies have allowed planners to determine how many targets per aircraft are required instead of how many aircraft per target.

However, the United States must not be placed into a situation where its current bomber fleet cannot meet security commitments. Unlike investments in the current ICBM fleet, investments in new bomber acquisitions or upgrades will not be eliminated through treaties.<sup>64</sup> The recommendations proposed for the number and structure of a new LRSB are based on the existing triad remaining in place. If any leg of the current triad is eliminated, the number of bombers should be adjusted accordingly.

All three legs are in need of modification or the traditional triad will cease to exist, as SSBMs are planned to start retiring in 2027, followed shortly after by the ICBMs in 2030. Currently, the leg with the greatest life-expectancy is the bomber at 2058. Whatever the new nuclear deterrence structure will be, it must be credible and capable in order to “deny an aggressor the prospect of achieving his objectives,” and it must also “form the complimentary capability to impose unacceptable costs on the aggressor.”<sup>65</sup>

## — NOTES —

1. Amy Woolf, *Nuclear Weapons in the U.S. National Security Policy: Past, Present, and Prospects* (Washington, DC: Congressional Research Service, 2010), 2.

2. *Ibid.*, 2.

3. GAO report, cover page.

4. Woolf, *Nuclear Weapons*, 2.

5. *Ibid.*, 3.

6. Janet Laurent, *Actions needed by DOD to More Clearly Identify New Triad Spending and Develop a Long-term Investment Approach* (Washington, DC: Government Accountability Office, 2005), 4.

7. White House, *The National Security Strategy of the United States of America* (Washington, DC: White House, 2010), 1.

8. *Ibid.*, 4. Consistent with a NSS goal of reducing nuclear weapons, the United States has entered into a Strategic Arms Reduction treaty with Russia, New START. New START maintains the current triad, but will reduce the total number of strategic warheads to 1,550 while reducing deployed strategic vehicles and deployed/non-deployed launchers to 700 and 800 respectively.

9. *Ibid.*, 23.

10. *Ibid.*, 23.

11. *Ibid.*, i.

12. *Ibid.*, iv.

13. *Ibid.*, x.

14. *Ibid.*, v.

15. *Ibid.*, viii.

16. *Ibid.*, viii. The NPR does leave open the option of employing nuclear weapons.

17. Christopher Bowie, Robert Haffa, and Dana Johnson, *Triad, Dyad, Monad? Shaping the US Nuclear Force for the Future* (Washington, DC: Mitchell Institute Press, 2009), 4. The triad is in need of many modernization and upgrade programs requiring large investments. To put nuclear force spending in perspective, the 1962 military budget allotted \$82 billion for strategic nuclear forces whereas the projection for 2013 is only \$8.8 billion (calculated in 2008 using FY2008 dollars). 1960s investment numbers can be attributed to the acquisition of ICBMs and SSBMs; however, the triad needs major modifications or complete acquisitions which will require large investments (though not as much as that of the 1960s).

18. *Ibid.*, 7. This study was accomplished prior to New START limitations of 1,550 warheads.

19. *Ibid.*, 11.

20. *Ibid.*, 13.

21. *Ibid.*, 22.

22. *Ibid.*, 19-26. In evaluating the SLBM as the monad, the team noted that the current number of 1,152 would fall well within 1,500, even allowing for the addition of Multiple Independently Targetable Re-entry Vehicles (MIRV) on SLBMs or new Ballistic Missile Submarines (SSBM). The SLBM monad option was rated high in survivability (deployed) and ability to penetrate, but rated low on aimpoints, thus providing a de-stabilization effect. The remaining characteristics fell within approximately fifty percent of the effectiveness of the current triad. In evaluating the dyad option of SLBMs and bombers, the only additional contribution the bombers made

was in signal of alert readiness changes. The SLBM/Bomber dyad rated the worst for survivability (day-to-day) by providing conditions for five dedicated strikes to neutralize home bases (three for bombers and two for SSBMs). The second dyad option of ICBMs and bombers allowed for the increase in MIRVs for ICBMs or additional bombers. The only advantage the bomber brings to this configuration is the signal of alert readiness changes, just as it did in the SLBM/Bomber dyad. The third option for the dyad consisted of SLBMs and ICBMs. This combination would require reductions to fall within the total warhead count of 1,500, but the study concluded this combination was the most advantageous since the SLBMs offer a secure second strike capability and the ICBM force offers a large number of warheads on alert. In addition, this dyad provided the largest number of aimpoints leading to greater stability.

23. *Ibid.*, 27.

24. Michael Miller, *U.S. Air Force Bomber Sustainment and Modernization: Background and Issues for Congress* (Washington, DC: Congressional Research Service, 2013), 31. Since this report, Congress approved appropriations for ALCM upgrades in FY2012 and 2013 until the Long Range Stand-Off (LRSO) missile can be fielded.

25. Bowie, *Triad, Dyad, Monad?*, 22.

26. *Ibid.*, 25.

27. *Ibid.*, 25.

28. *Ibid.*, 11. The advantage of having warheads on alert is only crucial in a “bolt from the blue” attack where there is no warning phase to ready bombers for dispersal. While this form of attack is still a reality, the remaining ICBMs would be more than capable of a retaliatory strike in such an event. In most cases, a nuclear war would be preceded by a conventional strike and allow time for nuclear bombers to be alerted and dispersed. This would enable the total weapons on alert to surpass the number in the ICBM/SLBM dyad.

29. James Cartwright, et al., *Modernizing U.S. Nuclear Strategy, Force Structure and Posture* (Washington, DC: Global Zero U.S. Nuclear Policy Commission, 2012), 1.

30. *Ibid.*, 1-5.

31. *Ibid.*, 6.

32. *Ibid.*, 6.

33. *Ibid.*, 6.

34. *Ibid.*, 6.

35. *Ibid.*, 6-7.

36. *Ibid.*, 6.

37. *Ibid.*, 7. Due to the positioning and launch trajectory of US ICBMs, potential adversaries (DPRK, China, or Iran) could not be hit without flying over Russia, thus an ICBM launch would risk retaliation from Russia. The ICBMs at current locations could not be converted for conventional use due to the same reason.

38. *Ibid.*, 8.

39. *Ibid.*, 1.

40. *Ibid.*, 2.

41. Giulio Douhet, *The Command of the Air* (Tuscaloosa, AL: University of Alabama Press, 2009), 9.

42. USAF, *Flight Plan for the Air Force Nuclear Enterprise* (Washington, DC: Headquarters Air Force, 2013), 4.

43. Robert McNamara, "The Military Role of Nuclear Weapons: Perceptions and Misperceptions," *Foreign Affairs*, vol. 62, issue 1, (Fall 1983), 60.

44. *Flight Plan for the Air Force Nuclear Enterprise*, 7

45. Natural Resources Defense Council, "Table of US Strategic Bomber Forces," Archive of Nuclear Data, note 1. Available at <http://www.nrdc.org/nuclear/nudb/datab7.asp>

46. *Ibid.*, table. These were the B-29, B-36, B-50, B-47, B-52, B-58, FB-111A, B-1B and the B-2.

47. *Ibid.*, table.

48. Woolf, *U.S. Strategic Nuclear Forces: Background, Developments, and Issues* (Washington DC: Congressional Research Service, 2013), 4. The first START treaty only limited delivery vehicles to 1,600. This did not include warheads.

49. With the advancement in precision guided munitions, a bomber could now loiter above the battlespace and drop ordinance when directed by ground personnel.

50. USAF, *U.S. Air Force Long-Range Strike Aircraft White Paper* (Washington, DC: Secretary of the Air Force, 2001), 2. 96 combat coded, 28 training, 7 test and 26 back-up inventory

51. Originally developed specifically to defeat Soviet defenses, the B-2 was highly successful during operations in Kosovo, Afghanistan, Iraq, and Libya. The average airframe hours as of October, 2013 are 5100 hours with a service life expectancy date of 2058.

52. Miller, *U.S. Air Force Bomber Sustainment and Modernization*, 23. Modifications include communications upgrade, low observable modifications, defensive management system upgrade, engine service life extension, and a stores management upgrade.

53. *Ibid.*, 16. The current average airframe hours of the in service B-52 fleet is approximately 17,900, clearly exceeding its original design. Several structural modifications have extended the service life to 2040; however, the B-52 is also in need of communication upgrades as well as continued structure enhancements. Of the 76 in service, only 44 are required to be combat ready. Others are devoted to test, training, etc.

54. *Ibid.*, 19. The B-1B retained a nuclear role until 1992 when it transitioned to conventional only and has a service life expectancy date of 2040. Current inventory is 63.

55. Woolf, *U.S. Strategic Nuclear Forces*, 25.

56. Mission capable rates are often confused with availability rates. Availability rates are derived from total aircraft inventory where mission capable rates are derived from possessed aircraft. Aircraft in PDM status are not counted in mission capable rates thus skewing the percentage of aircraft that can actually perform a mission.

57. Basing the nuclear bombers at three locations increases survivability and capability for second strike.

58. *Flight Plan for the Air Force Nuclear Enterprise*, 12.

59. *Ibid.*, 12.

60. *Ibid.*, 24.

61. *Ibid.*, 24.

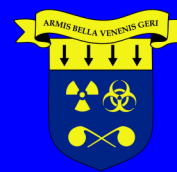
62. DoD, *Nuclear Posture Review Report* (Washington, DC: Department of Defense, 2010), v.

63. Additional missions are; CAS, deep penetration air strikes, and ability to destroy deep underground targets).

64. No treaties have limited the number of bombers, though they have limited the number of nuclear bombers. Bombers do not need to be demilitarized; they can just be modified as was the case with the B-1B fleet.

65. *Flight Plan for the Air Force Nuclear Enterprise*, 4.

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