

Minuteman III intercontinental ballistic missiles need not and should not be replaced because of the danger of their launch-on-warning posture^{1*}

Frank von Hippel, 14 November 2020

US Strategic Command plans to replace its 400 single-warhead Minuteman III intercontinental ballistic missiles (ICBMs) with an equal number of new missiles (the “Ground Based Strategic Deterrent,” GBSD) between 2029 and 2036 and to purchase 242 spare and test missiles as well. The new ICBMs would be deployed in refurbished Minuteman III silos and monitored by refurbished underground launch control centers (one per ten missiles) for a total estimated program acquisition cost of very roughly [\\$100 billion](#). This is in the context of a larger “modernization” plan that includes replacing the two other components of the US “triad” of long-range nuclear-weapon delivery vehicles: ballistic missile submarines and long-range bombers, each for a similar cost.

Given their launch-on-warning posture, which is becoming increasingly dangerous in an era of cyber-hacking, ICBMs are not a net positive for US nuclear security, however. They are so postured because their silos are targetable and Strategic Command insists that they not be sitting ducks even though Russia would have to expend more than one of its warheads to destroy one US warhead. At the same time, most deployed US nuclear warheads are on untargetable ballistic missile submarines at sea, which can be backed up in a crisis by strategic bombers on runway alert. (Unlike ballistic missiles, bombers can be recalled.)

The ICBMs therefore should be retired rather than replaced. There is a need to prune the military budget. As of 2019, about seven in ten voters, including a majority of Republicans, were open to phasing out the ICBM force. The support of the Senate “ICBM caucus” for the economic benefits that the ICBMs bring to their small-economy states is potent, however, as is the multi-state coalition based on subcontracts that Northrop-Grumman, the prime contractor for the GBSD, has created. If an interim solution is necessary while the long term future of the ICBMs is being debated, a relatively low-cost life-extension of the Minuteman III is available.

The US Strategic “Triad”

The warheads on the ICBMs represent about [one quarter of US deployed strategic warheads](#). More than half of US strategic warheads are mounted on submarine-launched ballistic missiles (SLBMs) and the remainder are nuclear bombs and warheads on air-launched cruise missiles deployed at three US strategic bomber bases.

Strategic Command argues that each “leg” of the triad has its own strengths and weaknesses. Originally, the unique strength of the ICBMs was their high accuracy and thereby their ability to destroy hardened Russian missile silos and command bunkers. Today, however, [the accuracy and lethality of SLBM warheads is comparable to that of the ICBMs](#) and the argument for the silo-based ICBMs is [the number of warheads that would be required to destroy them](#).

Another strength of the ICBMs is that they have multiple communication links with US national command posts and can launch quickly if ordered (hence the name “Minuteman”). This is part of a US “counterforce” strategy of targeting Russia’s targetable nuclear forces so as to be able to destroy them before they can be used, however, which is destabilizing. Communications to the

^{1*} APS Project on Nuclear Threat Reduction Advocacy Paper.

half of US submarines at sea that are on station at any time with their Very Low Frequency antennas deployed near the surface are today comparably robust to those with US ICBMs.

The perceived weakness of silo-based ICBMs is that their locations are known and therefore they can be targeted.

Ballistic Missile Submarines. At any one time, eight to ten of the 14 US *Ohio*-class ballistic missile submarines are at sea in the Pacific and Atlantic, two are in overhaul and the remaining two to four are in port for supplies and a change of crews. The 20 Trident II missiles on each *Ohio*-class submarine could carry up to eight warheads each for a total of 160 warheads per submarine. The missiles carry about four warheads on average today, however, because of the New START Treaty limits on total deployed warheads. Today, the US therefore has 600 to 800 SLBM warheads untargetable at sea. About half are in deployment areas within range of their targets, cruising slowly near the surface with their missiles launch ready and their radio antennas and satellite signal receivers deployed so that they can receive launch orders as quickly as the ICBMs. The other half are in transit at higher speeds to or from their deployment areas with their missiles not launch-ready. The nuclear weapons in transit are considered a survivable reserve.

The submarines are carefully designed to emit very little sound and travel deeply enough at transit speed so there is no detectable evidence of their presence on the surface. Measures are employed to detect and prevent trailing as they depart their bases. Currently no threat to their survivability is foreseen that cannot be countermeasured with decoys and other means. It could be argued that they are a sufficient nuclear deterrent by themselves. Indeed, both France and the UK have decided that having only one ballistic-missile submarine is a sufficient survivable nuclear deterrent. In a crisis, they could increase this number to two or three.

The Navy plans to replace its 14 ballistic-missile submarines between 2028 and 2042 with 12 new *Columbia*-class submarines initially carrying 16 Trident II missiles each. The cost of the new submarines is estimated at about [\\$100 billion](#) in Fiscal Year (FY) 2019 dollars. The Navy argues that, because the new submarines will have lifetime reactor cores, it will be possible to keep about the same minimum number of submarines at sea as today. However, a two-year delay in the replacement program without a change in the retirement schedule of the *Ohio*-class submarines will result in the US having a fleet of only ten ballistic-missile submarines during most of the 2030s.

Bombers. Long-range bombers were the first US strategic nuclear-weapon “delivery vehicles.” With the advent of Soviet ICBMs in the 1960s, Strategic Air Command (SAC), which subsequently merged into Strategic Command) became concerned about the vulnerability of its bomber bases to missile attack. SAC therefore kept some of its bombers, loaded with multimegaton bombs, aloft at all times. After a few crashes, this practice was abandoned in 1968 as too dangerous. For the remainder of the Cold War, a fraction of the bombers were kept loaded and on “strip alert,” ready to take off within ten minutes of warning. With the end of the Cold War, the bombers were taken off alert but could be returned to that posture in a crisis. They could also be dispersed to many airports.

The DOD proposes to buy at least one hundred new B-21 bombers, starting in the mid to late 2020s. The B-21 will have improved “stealth” capabilities for penetrating Russian and Chinese air defenses. Like the current B-2A and B52H nuclear bombers, the B-21 would be available for non-nuclear missions. In fact, the B-21’s would replace the remaining 66 B-1 bombers, built in the 1980s and now equipped only for non-nuclear missions. They would also replace the twenty

B-2 stealth bombers, produced during 1987-2000. Some or all of the 46 older B-52Hs that are equipped to carry nuclear cruise missiles might be retained. They were built during 1952-62, but, like the Minuteman III, have had most of their parts replaced in cycles of refurbishment.

The Air Force has refused to make public the estimated cost of the B-21 but has also declared that its goal is an “average procurement cost” of [\\$56.4 billion for 100 B-21s](#) in FY16 dollars plus perhaps [\\$20-45 billion for R&D](#) plus [\\$11 billion](#) for about 1,000 new stealthy nuclear cruise missiles (the Long-Range Standoff, LRSO) weapon and perhaps as much more for refurbishing the W-80 nuclear warhead used on the nuclear version of the current US air-launched cruise missiles carried by the B-52s. Like the ICBM and ballistic-missile submarine replacement programs, the B-21 program therefore will cost on the order of \$100 billion but much of its justification is for non-nuclear missions.

Concerns about a possible Russian first strike

Despite the end of the Cold War, Strategic Command remains postured for a first strike on Russia’s nuclear forces and focused on the possibility of a Russian first strike on its own nuclear forces.

The idea that either side would mount a first strike seems implausible – especially given the extremely low probability that either country could accomplish one without suffering catastrophic nuclear retaliation. But the obsession with first strikes persists. As a result, both countries’ silo-based ICBMs have been postured to have a launch-on-warning option that is sometimes described as a [“hair-trigger” posture](#) because of fears that it could lead to an accidental nuclear war.

Any first strike on US nuclear forces would have to be massive and, in the case of US ICBMs, would require more than one warhead for each US warhead destroyed as long as each US ICBM carries only one warhead. (They were originally deployed with three warheads each but were downloaded as part of the post-Cold War reductions.) The hypothetical Russian attack would also target 50 launch-control centers and also 50 US silos that are maintained “warm” to receive stored Minuteman III missiles. The lethal fallout from an attack on either the US or Russian missile fields would [extend hundreds of miles downwind, killing millions](#). If Russia struck first, it would have to assume that the US would retaliate to the extent of its abilities. Even if the US bombers were not on alert and were destroyed by the same first strike, several hundred US nuclear warheads at sea would be available for retaliation. Even with a maximal attack on US command and control – which would kill additional millions – Russia could not assume that there would be no retaliation from US ballistic missile submarines at sea. Only a deranged leader would launch an attack in the face of the prospect of such massive retaliation.

Launch under attack.

Nevertheless, because ICBM silos are targetable, Strategic Command insists on maintaining the option of launching them on warning of attack. According to General George Lee Butler, former Commander in Chief of Strategic Command, in a long interview in Jonathan Schell’s *The Gift of Time* (pp. 181-208) “launch under attack” is Strategic Command’s preferred option because it would make it possible for the ICBM warheads to still destroy their assigned targets, even the Russian missile silos, which would be empty because the hypothetical Russian first strike, because they might be reloaded.

The flight time of a Russian ICBM would be about 30 minutes. Of this time, the US would devote about 10 minutes to confirming and assessing the launch with data from US early-warning satellites and radars and about ten minutes to transmitting and implementing the launch order for the US ICBMs early enough for them to escape before the incoming Russian warheads arrive.

This would leave the president with about [ten minutes](#) to make a decision that would result in the deaths of at least millions of human beings. If the attack included an attack on Washington from an offshore Russian ballistic missile submarine, the amount of time available for decision making would be less.

Recall how close President Kennedy and General Secretary Krushchev came to causing a nuclear catastrophe during the 1962 Cuban Missile Crisis even though they had 13 days to try to sort out their mutual misunderstandings. The short timelines associated with launch on warning of attack raises the possibility of massive US or Russian launches based on false warning due to an equipment or personnel failure – [both of which have occurred](#). There is also a more recent concern: a computer hack either causing a false warning or launch of some of the alert ICBMs.

Given [frequent alerts of possible missile attack from US early-warning satellites](#), which require rapid and fault-free evaluation, the possibility of accidental nuclear war should be, under non-crisis conditions, a greater concern than a deliberate first strike.

US Strategic Command has given priority, however, to assuring that nothing will prevent its ICBMs from getting to their targets. For example, while Strategic Command assumes that its cybersecurity is adequate to prevent a false launch of U.S. ICBMs, it assumes that it is *not* adequate to prevent hacking into safety systems that could destroy a missile in flight if the launch were discovered to be mistaken. US nuclear-armed, launch-ready ICBMs therefore do not have the “command-destruct” systems that are installed when they are flight tested without nuclear warheads lest they go off course.

[The US launch-on-warning option dates back to the 1970s](#) and has been controversial ever since. At his October 1986 Reykjavik meeting with General Secretary Gorbachev, President Reagan was so worried about it that [he proposed to eliminate ballistic missiles in favor of bombers](#). Both Presidents G.W. Bush and Obama came into office proposing to take the ICBMs off “hair trigger.” Once in office President Obama pursued the issue but [retreated in the face of opposition](#) from Strategic Command and Russian disinterest in reciprocal de-alerting. ([Russian and Chinese ballistic missile submarines are not secure from US detection and tracking](#).) This history of intransigence of Strategic Command has resulted in some, including former [Secretary of Defense William Perry, proposing elimination of US ICBMs](#).

Two years before he was nominated, General James Mattis, President Trump’s first Secretary of Defense, asked rhetorically in testimony before the Senate Armed Services Committee, “Is it time to reduce the Triad to a Dyad, removing the land-based missiles? [This would reduce the false alarm danger](#).” But he abandoned that position in his confirmation hearing. Instead, he argued there, “With the ICBM force, it is clear that they are so buried out in the central U.S. that [any enemy who wants to take us on is going to have to commit two, three, four weapons to make certain that they take each one out](#). In other words, the ICBM force provides a cost-imposing strategy on an adversary.” This rationale for keeping the US ICBMs, is sometimes described as the “nuclear sponge” justification. In the face of the strong political support for the US strategic “triad” in the Senate, during his confirmation hearing, General Mattis did not repeat his warning

about “the false alarm danger” associated with the US ICBM launch-on-warning posture, nor did he oppose spending \$100 billion to replace the Minuteman III missiles with Ground-based Strategic Deterrent ICBMs in the same vulnerable silos.

De-alert?

The nuclear-sponge argument would still be valid even if US ICBMs were physically incapable of being launched on warning, i.e. if they were “de-alerted.” Russia still would have to target them in a first strike because otherwise they could be made launch ready for a retaliatory strike. Strategic Command insists, however, that “de-alerted” ICBMs are not worth keeping – presumably because of their counterforce role in targeting Russia’s nuclear capabilities.

Given the danger posed by the launch-on-warning option, Secretary Perry’s recommendation that the US ICBMs be eliminated becomes persuasive. A 2019 public-opinion survey found [70% of the public, including 62 percent of Republicans, to be open-minded on this issue.](#)

ICBM Caucus

The [Congressional “ICBM caucus” sees ICBM-related bases as important, however](#) – including to the economies of their five states: Montana, North Dakota and Wyoming, which host the missile bases, Utah where the missiles are serviced, and Louisiana where the headquarters for the combined ICBM and bomber command is based. Strategic Command has taken responsibility for paving and ploughing the roads off which its missile silos and launch-control centers are located and directly supports an average of about 1000 families each on the three ICBM bases in Montana, North Dakota and Wyoming, with a median family income of about \$30,000. The loss of income from shutting down the missile bases therefore would be on the order of \$0.1 billion per year for the three states combined. This is about one thousandth the cost of the ICBM replacement program. One could easily conjure up a win-win solution in which a small fraction of the savings from not proceeding with the program could be repurposed to support long-term programs that would offset the losses to the three states.

Life-extend the Minuteman III?

Given the ICBM caucus, in combination with the talismanic significance the triad has developed within the US nuclear-weapons policy community, however, it may take years for Congress to decide that the elimination of U.S. ICBMs would be in the national interest. It is important not to preempt this debate by making a \$100 billion commitment to a new ICBM with [subcontracts deliberately spread over many states.](#)

Fortunately, the time necessary for debate can be made available by preparing to life-extend some of the Minuteman III missiles instead of replacing them all. The lifetime of the Minuteman III ICBM is determined primarily by its solid fuel and its guidance system, both of which can be replaced. This has already been done once. The missiles were first deployed around 1970 and were refurbished 30 years later. They could be refurbished again around 2030 for a small fraction of the cost of the new ICBMs. [In 2014, RAND estimated the cost of refurbishing 420 Minuteman III’s at \\$20-40 billion.](#) In 2017, the Congressional Budget Office [estimated the savings from delaying the launch of the ICBM modernization program until 2036 at \\$37 billion](#) FY2017 dollars.

Minuteman IIIs are being expended by testing at an average rate of 4.5 launches per year – up from a previous rate of three per year. There were 500 missiles in inventory in 2017. If the current testing rate were maintained, the number of remaining missiles would fall below the currently deployed number of 400 in 2040 and below 300 in 2060. If the testing rate were returned to three per year, [these dates could be deferred to about 2050 and 2080](#).

Fetter and Reif have also pointed out unnecessarily conservative Air Force assumptions about the Minuteman III fuel longevity. After retirement, the boosters have proven highly reliable as space launch vehicles. Fetter and Reif suggest that [nondestructive inspection could be used to determine if the fuel still meets specifications](#).

Recommendation. The US Minuteman III ICBMs should not be replaced. Eight *Columbia* ballistic-missile submarines at sea, each carrying up to 128 warheads – backed up in a crisis if need be by a re-alerted strategic bomber force – would constitute a more than adequate US nuclear deterrent under any plausible circumstances. Congress could give itself more time for debate on this option by authorizing planning for the refurbishment of a fraction of the current Minuteman ICBMs.

Relevant legislation. The “Smarter Approaches to Nuclear Expenditures (SANE) Act” ([S. 2727](#) and [H.R. 4904](#)) proposes that the US reduce from 400 to no more than 150 Minuteman III ICBMs as part of an overall reduction to the 1,000 deployed US strategic warheads that the DOD’s 2013 Report on [Nuclear Employment Strategy of the United States](#) found would constitute an adequate US deterrent, and that no funds be spent on follow-on ICBMs.

Additional reading

David Wright, William D. Hartung and Lisbeth Gronlund, *Rethinking Land-Based Nuclear Missiles: Sensible Risk-Reduction Practices for US ICBMs* (Union of Concerned Scientists, 2020)
<https://www.ucsusa.org/sites/default/files/2020-06/rethinking-land-based-nuclear-missiles.pdf>.