

United States

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The following content is the same as was published in May 2020. For a brief update on the status of United States nuclear modernisation, please see the Annex found on page 130.

While every nuclear-armed state is certainly unique, the magnitude and diverse modalities of geopolitical power unapologetically wielded by the United States in its perceived self-interest makes the US an exceptionally important barrier to successful disarmament diplomacy.

By the same token it is impossible to understand why the US deploys—and is modernising—so *many*, and so many *kinds*, of nuclear weapons, without understanding the specific nuclear dangers that arise from the unique US ambition to project overwhelming military force in support of its economic and geopolitical interests globally, especially in Eurasia.

The overall geopolitical threat from the US is not just theoretical or latent but is constantly exercised in ways great and small, through means overt and covert, in large wars, small wars, special forces missions,¹ regime change operations, drone attacks and much more, all supported by an “exceptionalist” ideology that is the *lingua franca* of all senior US officials.

The stated primary *raison d’être* for most US nuclear forces, and therefore also for the scale and urgency of modernisation efforts overall, is Russian nuclear arms. Together, the US and Russia possess 93 per cent of the world’s nuclear weapons. Both the US and Russia maintain active stockpiles an order of magnitude more numerous than those of any other nuclear-armed state.² Both countries are modernising their forces.

Yet the security situations of the two countries are very different. The US has eleven times the military budget of the Russian Federation; US military spending exceeds the *combined* total military spending of *all the other countries in the world*, save three.³ Despite repeated US promises otherwise, the North Atlantic Treaty Organisation (NATO) has expanded eastward to Russia’s borders, adding 14 countries since 1999.⁴ NATO’s military outlays are 16 times Russia’s—in fact, NATO military spending is more than the rest of the world combined.⁵ The US maintains a global garrison of nearly 800 US military bases in more than 70 countries, a great many in Eurasia near Russia.⁶ The US uses its unequaled economic power as a weapon, with dozens of states currently under some form of US sanctions, including Russia.⁷ The US has spent more than US \$200 billion since 1985 in pursuit of an effective

ballistic “missile defence” (BMD) system, not counting battlefield systems.⁸ In June 2002, the US unilaterally withdrew from the Anti-Ballistic Missile (ABM) Treaty; US BMD systems are by now located in Romania and Poland as well as at sea.

From the Russian perspective, attempts to enforce unipolar global security have led to “an almost uncontained hyper use of force—military force—in international relations, force that is plunging the world into an abyss of permanent conflicts,” where “one state... first and foremost the United States, has overstepped its national borders in every way.”⁹ The Russian government has made it clear that it will not relinquish a large, advanced nuclear arsenal, capable of overcoming all foreseeable US ballistic missile defences, as long as existential threats to its existence and sovereignty persist.¹⁰

For its part the US will spare no expense to maintain and modernise a large nuclear arsenal as long as Russia does. Thus the present nuclear arms race between these two states will persist without addressing wider security threats and conventional weapon systems and alliances and without the US abandoning its claims to exceptionalism and unipolar power.

As long as an enormous disparity exists in conventional military force based near or quickly deployable to Russia’s borders, together with an equally enormous disparity in non-military modes of power, nuclear disarmament will be off the table for nearly all the world’s nuclear weapons.

Current status

The US nuclear weapons programme is relatively transparent. Three overviews are particularly useful.¹¹ Figure 1, taken verbatim from the Federation of American Scientists, provides a succinct overview.

There have been a number of changes in the US nuclear modernisation programme since the April 2019 edition of *Assuring Destruction Forever*. These are not so much changes in *scope* but in *speed*:

First, accelerated, massive hiring is occurring across the nuclear weapons enterprise:

We have... in excess of 41,000 people working on the NNSA mission today.... Since March of 2019 we've added more than 4,700 employees in that group of federal employees and labs, plants, and sites. We're going to need to add another 20,000 people by 2025.¹²

Second, parallel investments in warhead core ("pit") factories have begun, to front-load production in the 2020s to support new-warhead (W87-1) production.¹³

Third, accelerated and early-to-need development of a new submarine warhead (W93) is beginning, budgeted at US \$53 million for FY2021 with first production in 2034 (see Table 1), a two-year advancement at both ends of the development period.¹⁴

Fourth, an unusually early—years-ahead—sole-source contract has been awarded for the Long Range Stand Off (LRSO) cruise missile.¹⁵

Fifth, unprecedented near-term spending increases for FY21 have been requested to enable these accelerations as discussed below, despite the US \$8 billion already available in unspent prior appropriations.¹⁶

At this point the success of these attempted accelerations remains uncertain. There have been significant delays in the B61-12 and W88 Alt 370 warhead upgrades,¹⁷ which may affect the W87-1 warhead programme.¹⁸ Delays are likely in several other programmes including warhead core ("pit") production,¹⁹ special explosives production,²⁰ and infrastructure projects.²¹ Congressional auditors are warning that there are too many accelerated nuclear modernisation programmes proceeding in parallel, with attendant increases in the risk of delays, cost overruns, and failures.²²

Meanwhile, some existing nuclear weapons face mounting maintenance and sustainability issues, from lack of unique spare parts to bulging walls, water intrusion, and corrosion in missile silos.²³

Two programmes were completed since the April 2018 edition of this report. The W76-1 submarine warhead upgrade was completed in late 2018, extending this

warhead's life by a planned 30 years while dramatically increasing its accuracy.²⁴ Some W76 warheads were easily and cheaply converted to low-yield W76-2s in early 2019. These low-yield warheads began deployment in December 2019.²⁵

The context in which US nuclear modernisation is conducted has also changed over the last two years, primarily in ways that challenge nuclear modernisation.

First, the Pentagon's share of the military budget request for FY2021 is 1.1 per cent lower than FY2020 spending (US \$705 billion vs. US \$713 billion). The four subsequent years are expected to have flat Department of Defense (DoD) spending in constant dollar terms.²⁶ This intensifies the latent conflict between conventional and nuclear weapons in the overall military budget.

The as-yet-unknown extent of the cascading crises that have befallen the United States, US allies, and the world due to COVID-19 threatens to rock the weapons world. In just a few weeks, the expected federal deficit has increased by roughly a factor of four to the neighborhood of US \$4 trillion; tens of millions of US citizens are out of work, many permanently, with unemployment levels exceeding those of the Great Depression; additional resources for economic renewal are expected to be required, also to be financed by debt; five hundred million people globally could be pushed into poverty;²⁷ famines of "biblical" proportions²⁸ may occur. Supply chains and specialised labour needs for nuclear modernisation may be at risk.

In this environment, current US military expenditures, and therefore nuclear modernisation plans, do not appear politically sustainable. We do not believe they are socially or managerially sustainable in some key situations either.²⁹

As this goes to press, US authorities are almost doubling their predictions of COVID-19 deaths even as restrictions are relaxed. No one can say where this will lead, from either public health, economic, or political perspectives. All in all, we see rising risk to complex modernisation programmes across the board, for many reasons that go far beyond the scope of this chapter.

Table 1: US nuclear forces, 2020

TYPE/DESIGNATION	NO.	YEAR DEPLOYED	WARHEADS X YIELD (KILOTONS)	WARHEADS (TOTAL AVAILABLE) A
ICBMs				
LGM-30G Minuteman III				
Mk12A	200	1979	1-3 W78 x 335 (MIRV)	600 ^b
Mk21/SERV	200	2006 ^c	1 W87 x 300	200 ^d
Total	400^e			800^f

TYPE/DESIGNATION	NO.	YEAR DEPLOYED	WARHEADS X YIELD (KILOTONS)	WARHEADS (TOTAL AVAILABLE) A
SLBMs				
UGM-133A Trident II D5/LE	240^a			
Mk4A		2008 ^h	1-8 W76-1 x 90 (MIRV)	1,486 ⁱ
Mk4A		2019	1-2 W76-2 x low (MIRV) ^j	50 ^k
Mk5		1990	1-8 W88 x 455 (MIRV)	384
Total	240			1,920^l
Bombers				
B-52H Stratofortress	87/44 ^m	1961	ALCM/W80-1 x 5-150	528
B-2A Spirit	20/16	1994	B61-7 x 10-360/-11 x 400 B83-1 x low-1,200	322
Total	107/60ⁿ			850^o
Total strategic forces				3,570
Nonstrategic forces				
F-15E, F-16 DCA	n/a	1979	1-5 B61-3/-4 bombs x 0.3–170p	230
Total				230^q
Total stockpile				3,800
Deployed				1,750 ^r
Reserve (hedge and spares)				2,050
Retired, awaiting dismantlement				2,000
Total Inventory				5,800

ALCM: air-launched cruise missile; DCA: dual-capable aircraft; ICBM: intercontinental ballistic missile; LGM: silo-launched ground-attack missile; MIRV: multiple independently targetable reentry vehicle; SERV: security-enhanced reentry vehicle; SLBM: submarine-launched ballistic missile.

a) Lists total warheads available. Only a portion of these are deployed with launchers. See individual endnotes for details.

b) Roughly 200 of these are deployed on 200 Minuteman IIIs equipped with the Mk-12A reentry vehicle. The rest are in central storage.

c) The W87 was initially deployed on the MX/Peacekeeper in 1986 but first transferred to the Minuteman in 2006.

d) Of 567 W87s produced, 540 remain. The 200 Mk21-equipped ICBMs can each carry one W87. The remaining 340 W87s are in storage. Excess W87 pits are planned for use in the W78 Replacement Program previously designated IW-1 but now called W87-1.

e) Another 50 ICBMs are in storage for potential deployment in 50 empty silos.

f) Of these ICBM warheads, 400 are deployed on operational missiles and the rest are in long-term storage.

g) Only counts 240 SLBMs for 12 deployable ballistic missile submarines. Two other ballistic missile submarines are in refueling overhaul, for a total of 280 launchers. There are a total of 448 SLBMs in the inventory, of which about half are for spares and flight tests. The life-extended DFLE is replacing the original missile.

h) The W76-1 is a life-extended version of the W76-0 that was first deployed in 1978.

i) All W76-0 warheads are thought to have been replaced on ballistic missile submarines by W76-1 warheads, but several hundred are still in storage, and more have been retired and are awaiting dismantlement. After the W76-1 life-extension program production is completed in FY2019, the remaining W76-0 warheads will be scrapped.

j) The W76-2 is a single-stage low-yield modification of the W76-1 with an estimated yield of 5–7 kilotons.

k) Assumes two SLBMs, each with two W76-2s, available for each deployable SSBN.

l) Of these SLBM warheads, approximately 890 are deployed on missiles loaded in ballistic missile submarine launchers.

m) Of the 87 B-52s, 76 are in the active inventory. Of those, 46 are nuclear-capable, of which less than 40 are normally deployed.

n) The first figure is the total aircraft inventory, including those used for training, testing, and back-up; the second is the portion of the primary-mission aircraft inventory estimated to be tasked with nuclear missions. The United States has a total of 66 nuclear-capable bombers (46 B-52s and 20 B-2s).

o) Of these bomber weapons, only about 300 are deployed at bomber bases. These include an estimated 200 ALCMs at Minot Air Force Base and approximately 100 bombs at Whiteman Air Force Base. The remaining 550 weapons are in long-term storage. B-52s are no longer tasked with delivering gravity bombs. p The F-15E can carry up to 5 B61s. Some tactical B61s in Europe are available for NATO DCAs (F-16, PA-200). Maximum yield of B61-3 is 170 kt; maximum B61-4 yield is 50 kt.

q) Up to 150 B61-3 and –4 bombs are deployed in Europe, of which about 80 are earmarked for use by NATO aircraft. The remaining 80 bombs are in central storage in the United States.

r) Deployed warheads include approximately 1,300 on ballistic missiles (400 on ICBMs and 900 on SLBMs), 300 weapons at heavy bomber bases, and up to 150 nonstrategic bombs deployed in Europe.



Economics

In January 2020, the Congressional Research Service (CRS) summarised recent official estimates of current and future US nuclear weapons costs. CRS found “a broad base of agreement,” noting, however, that:

It was difficult, if not impossible, to determine how much the United States spent each year on nuclear weapons, as the funding was divided between the Department of Defense and the Department of Energy, and, in many cases, was combined with funding for other, nonnuclear activities. In other words, the United States does not maintain a single, unified budget for nuclear weapons and other nuclear activities.³⁰

“Broad ... agreement” does not imply accuracy. Ambiguities, omissions, programme changes, rapid cost escalations, and secrecy make nuclear weapons costs difficult to estimate now and in the immediate future—and impossible to predict beyond that.

Already, observed rising costs and schedule delays are signaling mounting “execution risks” in an increasingly contingent, unpredictable future. Over the next ten years US nuclear weapon modernisation programmes will require ever-increasing funding, the recruitment and retention of tens of thousands of skilled workers, capable management, and an enduring political consensus, among other factors, all far from guaranteed. This is discussed further below.

For FY2019, the most recent year for which an independent estimate is available, the Congressional Budget Office (CBO) assessed annual then-current spending on US nuclear weapons at \$33.6 billion—US \$21.8 billion in DoD and US \$11.8 billion in Department of Energy (DOE).³¹ This figure does not include the development of naval reactors for nuclear weapons platforms (US \$1.8 billion, in DOE) or warhead-associated DOE environmental expenses of US \$6 billion in that year. If included, these would raise the total to US \$41.4 billion.³² By way of comparison, this is larger than the *total* military spending in all but nine other countries.³³

Costs are increasing rapidly. That same CBO ten-year estimate showed US \$42 billion in unanticipated cost growth over the front decade in comparison to its 2017 ten-year estimate—5.3 per cent/year above inflation. Most of the unanticipated growth came from “new modernisation programmes” added since 2017 and “more concrete plans for nuclear command-and-control systems.”³⁴

The Trump Administration is now requesting US \$44.5 billion for nuclear weapons in FY2021,³⁵ not including US \$1.7 billion for naval reactors and US \$5.0 billion for environmental cleanup, or US \$51.2 billion in all. The request includes US \$15.6 billion for warheads—a 25 per cent increase over FY2020 and a 40 per cent increase over FY2019—as well as US \$28.9 billion for nuclear weapons in DoD, a 32 per cent increase over two years. Some US \$14.8 billion in DoD research and development costs are requested.³⁶ In 2017, CBO had

estimated FY2021 nuclear weapon costs would be about US \$40 billion, so the FY2021 request represents about US \$5 billion (11 per cent) in unanticipated cost growth in FY2021 since then.³⁷

This US \$51.2 billion, the Administration's estimate of nuclear weapon costs in FY2021 including environmental management, is now greater than the *total* military budgets of all but four other countries.³⁸

Given this observed steep cost growth, and the long-standing nuclear management challenges in both DoD and DOE discussed briefly below, all nuclear weapon cost estimates must be taken with a large grain of salt.

Now, given the cascading, multifaceted COVID-19 crisis, with its very large fiscal and national security implications,³⁹ uncertainty has exploded. All stockpile plans and costs must be considered highly mutable, subject to hitherto unthinkable magisterial forces—biological, ecological, economic—that operate quickly, without submission to prior political consensus.

Even prior to the present national emergency, stockpile plans and associated costs carried a large number of hidden business-as-usual assumptions. Change has been unimaginable. Centrally in the present context, deployment of a thousand or more nuclear weapons has been assumed not just by government but also by several leading non-governmental organisations (NGOs)—in effect, nuclear Non-Proliferation Treaty (NPT) article VI noncompliance.

Despite their absurdity, we nonetheless include the official government projections here as well as NGO alternatives based on them.

In 2017, CBO estimated the 30-year (2017–2046) cost of US nuclear weapons (modernisation, operation and sustainment, command and control, and the warhead complex) at \$1.24 trillion (US \$1.32 trillion in 2020 dollars). Of this, 28 per cent (US \$352 billion) was in DOE (for warheads) and 72 per cent (US \$890 billion) was in DoD (for everything else). Of the total, US \$400 billion was for modernisation; the balance was for operations and sustainment of existing forces.⁴⁰

This figure did not include DOE's legacy environmental liabilities. In 2018, DOE estimated its warhead-related liabilities at US \$541 billion (US \$573 billion in today's dollars).⁴¹ Despite cleanup investments, these estimated environmental liabilities have grown in each of the last seven years at an average rate of US \$31 billion/year.⁴² Given this pattern we can roughly estimate, in the absence of any official figure and accounting for estimated savings in the programme to dispose of surplus

plutonium, that DOE's environmental liabilities lie in range of US \$600 billion today.

So, including environmental costs, CBO's 2017 estimate of 30-year US nuclear weapon costs would expand to US \$1.92 trillion in 2020 dollars.

Considering the cost growth seen by CBO over the 2017–2019 period, and the 30 per cent requested real annual cost growth just over the past two years as reflected in this year's budget request, we can safely estimate that the present-value cost of sustaining, deploying, and modernising US nuclear weapons over the next 30 years will be greater than US \$2 trillion, well above the "broad ... agreement" observed by CRS.

Before proceeding, we can observe that this 30-year sum comes to more than US \$15,460 per US household, in present value. On an annual basis, the average cost of US nuclear weapons over the next 30 years is at least US \$67 billion/year, including current legacy environmental costs, or at least US \$44 billion/year—US \$5 million per hour, 24/7—without those costs. These figures do not include interest on the federal debt used to finance these programmes.

In 2017, CBO was concerned about whether these large commitments could be sustained:

Pursuing nuclear modernization will be challenging in the current environment.... Even if the [2011 Budget Control Act] funding caps were lifted, nuclear modernization would compete with other defense priorities in those years, including proposals to increase the number of warships in the Navy's fleet, modernize DoD's fleet of aircraft, and expand the size of the Army. Beyond 2021, budgetary pressures may continue: appropriations for both defense and nondefense programs may be constrained in the longer term because of rising spending on the aging population (for Social Security and Medicare benefits), health care, and interest on the national debt.⁴³

In its 2017 report CBO examined the savings available from nine policy and stockpile variations from the then-current programme of record. Rightly or wrongly, CBO estimated that even significant stockpile changes would produce only modest savings over the coming 30 years. Eliminating bombers would save only 6 per cent of total costs; eliminating intercontinental ballistic missiles (ICBMs) only 10 per cent; eliminating bombers while cutting deployment to 1,000 warheads would save only 9 per cent; eliminating ICBMs while cutting deployment to 1,000 warheads would save only 11 per cent of total costs.⁴⁴

\$35.1
BILLION

**ANNUAL COST FOR U.S.
NUCLEAR WEAPONS**

OR



300,000
BEDS IN
INTENSIVE
CARE

+



35,000
VENTILATORS

+



150,000
NURSES

+



75,000
DOCTORS

Sources: see [icanw.org/healthcare_costs](https://www.icanw.org/healthcare_costs)



ICAN has calculated how the annual cost for US nuclear weapons could pay for health care services.

Combining CBO's 2017 estimated savings from four of its options (immediately eliminating all US ICBMs, long range bombers, gravity bombs, and nuclear cruise missiles, while continuing to deploy and modernise a stockpile of 1,000 deployed warheads on ten ballistic missile submarines (SSBNs) and their replacements) would save approximately 26 per cent of the 30-year costs for the current arsenal and comprehensive modernisation plan.⁴⁵ Keeping only eight SSBNs would shave off another US \$19 billion (1.4 per cent).

All CBO's estimates assume that the costs for DOE's "laboratories and supporting activities" remain unchanged at US \$261 billion (2017 dollars) over 30 years (US \$8.7 billion/year), under all options.⁴⁶ For comparison, DOE's expenses for comparable activities during the Cold War averaged US \$4.79 billion/year (2017 dollars), for a far larger and much less well-understood arsenal. DOE is requesting US \$16 billion for FY2021, including administrative expenses.⁴⁷ See Figure 1.

Dropping back to Cold War spending levels in DOE, while still allowing tens of billions of dollars in new and renewed infrastructure, again using CBO's estimates, would bring the 30-year cost of a 1,000 warhead monad on ten submarines down to roughly two-thirds of current estimates, to roughly \$882 billion in today's dollars or US \$29 billion/year. This would save roughly US \$435 billion (US \$15 billion/year) over the coming 30 years.

The scenario of a 1,000 warhead monad (with dramatic DOE management reform added) is roughly the lower limit of 30-year costs that can be constructed from policy

options in CBO's 2017 analysis. It reflects neither a "minimum deterrence" policy nor the trajectory toward full disarmament required by Article VI of the NPT.

If CBO is right, fielding even dramatically smaller nuclear forces than the US possesses today—smaller but still far larger than any country except Russia—would remain a costly endeavor. At US \$29 billion/year, the vastly reduced nuclear scenario above would still cost more than the *total* military expenditures of all but 12 countries.⁴⁸

In 2019 the Arms Control Association (ACA) generated three nuclear cost-saving and force reduction scenarios based on CBO's analysis and other sources, with projected 30-year savings ranging from US \$29 billion to US \$282 billion.⁴⁹ The smallest savings envisioned came from elimination of four post-2016 additions to nuclear modernisation.⁵⁰ The largest savings resulted from a 1,000 deployed-warhead dyad based on elimination of all ICBMs plus the Long Range Stand Off (LRSO) missile and its warhead, the withdrawal of all B61s from Europe, reduction of the SSBN force to eight boats, and the elimination of post-2016 additions to nuclear modernisation.⁵¹ And like the scenario above, none of the ACA scenarios envisioned a trajectory toward NPT compliance.

A different smorgasbord of possible nuclear policies and cost savings, but also built around CBO's 2017 analysis, was assembled by the Cato Institute.⁵²

Current modernisation costs and schedules for US nuclear weapons are assembled in Table 1.

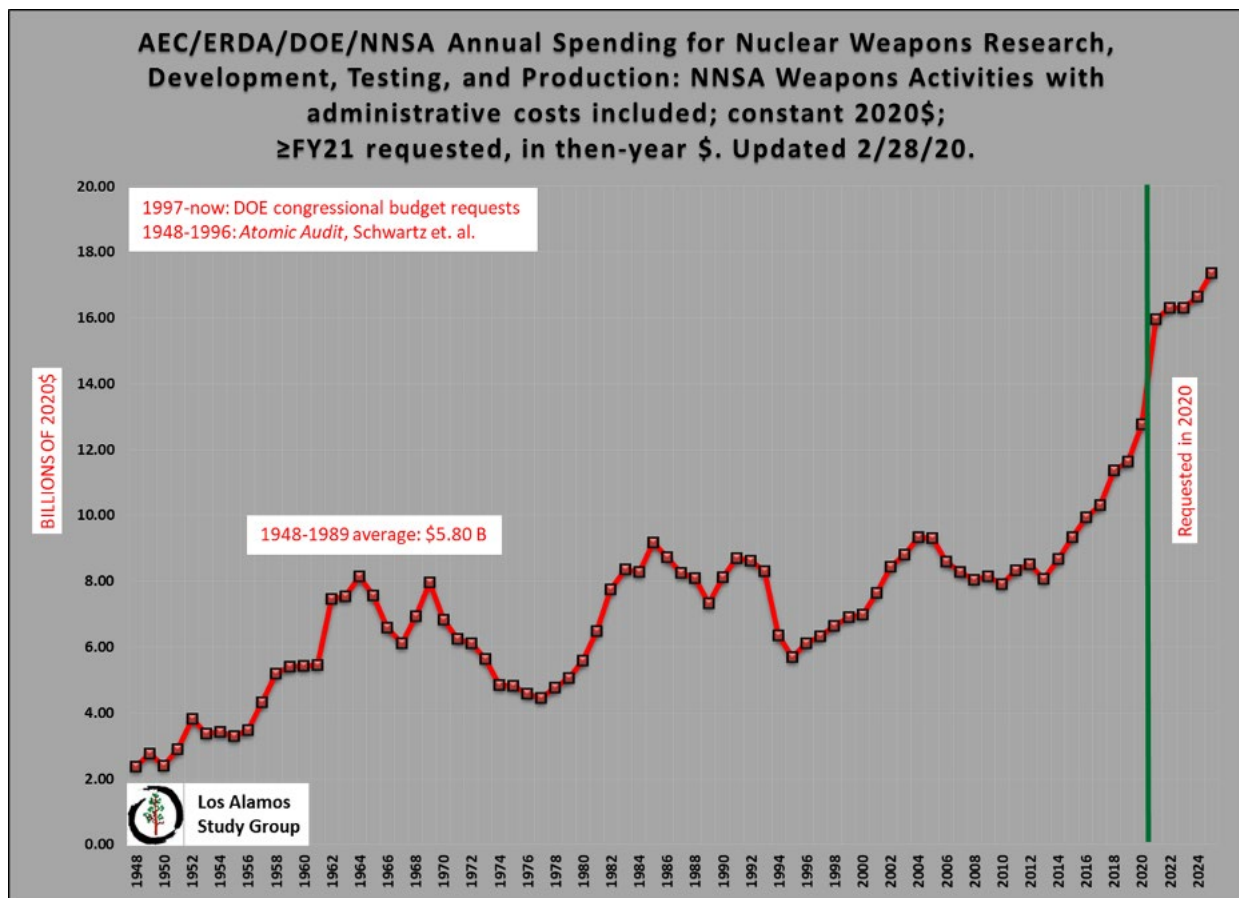
Table 2: US nuclear weapons

BOMBS (B) OR WARHEADS (W)	FISCAL YEAR (FY) 2020 COST (\$M)	FY 2021 REQUESTED (\$M)	TOTAL	FIRST PRODUCTION UNIT OR FIRST DEPLOYMENT, ESTIMATED COMPLETION YEAR (ECY)
B61-12 life-extension program (LEP)	792.6 (2, 111)	815.7 (2, 111)	9.9 (3, 8-37 & 11, 4)	2022; ECY 2026 (2, 120)
B61-12 Tail Kit Assembly	100.0 (7, 4-2)	50.0 (7, 4-2)	2.0 (6, 2)	2020 (6, 2)
B61-13 LEP	none	none	22.5 (3, 8-41)	2038
B83-1	51.5 (2, 111)	30.8 (2 p 111)	n/a	as of 2018, to be retained indefinitely (3, 1-5)
W76-1 LEP (for SLBMs)	n/a	n/a	4.2 (3, 8-36)	completed in 2019 (1, 8)
W76-2 Modification (Mod) (for SLBMs)	10.0 (2, 111)	n/a	.076 (3, 8-36)	Feb 2019 (3, 2-38); deployed Dec 2019
W80-4 LEP (for LRSO cruise missile)	898.5 (2, 111)	1.0 (2, 111)	12.0 (11, 4)	2026; ECY 2031 (2, 120)
W87-1 Mod for ICBM, former W78 replacement or W1 (3, 1-6)	112.0 (2, 111)	541.0 (2, 111)	14.8 (11, 4)	2030 (2, 121); ECY 2038 (11, 8)
Mk21A aeroshell for W87-1	65.7 (14, 22)	112.8 (14, 22)		2030
W88 Alteration (Alt) 370	304.2 (2, 111)	256.9 (2, 111)	2.75 (11, 4)	2021; ECY 2025 (2, 120-122)
W93/Mk7 SLBM Next Navy Warhead, former IW2 (3, 2-45)	0	53.0 (2, 111)	17.6 (3, 8-41)	2034 (3, 8-6); ECY 2041 (11, 8)
Future strategic missile warhead LEP, former IW3	0	0	18.6 (3, 8-41)	2037 (3, 8-6)
Bombers & Dual-Capable Aircraft (DCA)				
B-2A Spirit Defensive Management System	3,057 (5, 143)	337 (7, 8-3)	1.91 (16, 763)	June 2022 (5, 143)
B-21 Raider (Long-Range Strike Bomber, LRS-B)	3,000 (7, 4-2)	2,800 (7, 4-2)	102.8 (13, 53)	2025 (6, 2)
B-52H (replacing engines, upgrading radar, avionics, and NC3 systems)	2,116 (5, 167)	unknown	unknown	November 2025 (5, 167)
F-15 Eagle DCA (upgrade passive active warning & survivability systems – EPAWSS)	47.3 (16, 2)	170.7 (16, 2)	4.0 (17)	2019 (16)
F-16 DCA Mid-Life Upgrade	18.8 (10, 39)	57.6 (13, 43)	unknown	n/a
F-35A DCA (expected to replace F-15E)	70.0 (7, 4-8)	110 (7, 4-8)	unknown	Nuclear certification expected 2024 (7, 4-8), deployment 2025 (8, 40)
Missiles				
Ground-Based Strategic Deterrent (GBSD) (to replace MMIII ICBM)	557.5 (4, 5-19)	1,525 (4, 5-19)	85-150 over 30 years (19, 2)	2029; ECY 2036 (6, 2)
LRSO cruise missile – replaces AGM-86B ALCM	712.5 (4, 5-21)	474.4 (4, 5-21)	10.8 (6, 2)	2026 (14, 41)

BOMBS (B) OR WARHEADS (W)	FISCAL YEAR (FY) 2020 COST (\$M)	FY 2021 REQUESTED (\$M)	TOTAL	FIRST PRODUCTION UNIT OR FIRST DEPLOYMENT, ESTIMATED COMPLETION YEAR (ECY)
Trident II D-5 Submarine-Launched Ballistic Missile (SLBM) Life-Extension (D5LE)	1,189 (4, 5-15)	1,191 (4, 5-15)	19.0 (13, 53)	February 2017 (7, 4-8); ECY 2040 (15, 3)
Sea-Launched Cruise Missile, Nuclear (SLCM-N) (19, 12)	5.6 (1, 10)	none	unknown	Analysis of Alternatives
Ballistic Missile Submarine				
Columbia class ballistic missile submarine (SSBN)	2,480 (7, 4-2 & 2, 694)	4,470 (7, 4-2 & 2, 694)	139.0 for 12 subs (6, 2)	2031 (6, 2); ECY 2043, if purchase one/
Nuclear Command, Control and Communications (NC3)				
NC3	3,500 (7, 4-8)	7,000 (18, 1)	195.0 over 30 years (13, 17)	ECY 2037 (14, 20)

Sources for Table 2 can be found at the end of the chapter.

Figure 1 summarises current and planned near-term cost growth in warhead spending in historical context.



Source: Los Alamos Study Group.

As of this writing, there are no current long-term estimates for the National Nuclear Security Administration (NNSA)'s warhead work. This year's proposed huge increase in warhead spending, coupled with the arrival of COVID-19 on top of other converging crises, have made all long-term estimates obsolete.

International law and doctrine

More than four decades after the United States signed and ratified the NPT, it retains a nuclear arsenal large enough to end civilisation, if not human life, in a few minutes. Stockpile reductions, which began in 1968, are not disarmament, and in any case no further reductions are currently planned or being negotiated. At the conclusion of the 2000 NPT Review Conference, the US agreed that a no-backtracking "principle of irreversibility" applies to nuclear disarmament. Yet endless modernisation of the research laboratories and factories necessary to design and produce nuclear weapons is inherently incompatible with any "principle of irreversibility" in regard to disarmament. Doing so with the express intention of being able to re-arm, and to permanently hold open the potential to reconstitute large nuclear arsenals throughout the course of disarmament, also is inconsistent with an "unequivocal undertaking" to eliminate nuclear arsenals.

Since 2018, the US government has been promoting an initiative it calls Creating the Conditions for Nuclear Disarmament (CEND).⁵³ This approach, which focuses on the measures other countries need to take in order for the US to feel "secure" enough to engage in nuclear disarmament, undermines past NPT commitments and other nuclear weapon governance agreements. It demands that the international community should focus on "the underlying security concerns" that led to the creation of nuclear weapons. Of course, implementation of the NPT, including article VI, has never been predicated on first establishing conditions or an environment deemed appropriate by the nuclear-armed states. The leap backwards from decades of agreed commitments is an affront to all of the efforts made over the years in the NPT, and to the United States' own allies that support the step-by-step approach. While some countries have engaged with the CEND initiative as a credible process, most have expressed concern that this is another ploy by the US government to detract from its own responsibilities and defer action on disarmament.⁵⁴

The US has not signed or ratified the Treaty on the Prohibition of Nuclear Weapons. It has repeatedly said that will "never" support the Treaty and that it does not consider itself bound by it through customary international

law.⁵⁵ The US has actively lobbied its allies and other countries to not support the negotiation of the Treaty or to ratify it after its adoption in 2017.⁵⁶

The US has signed but not ratified the Comprehensive Nuclear Test Ban Treaty (CTBT); ratification was rejected by the US Senate in 1999 even after a bargain was made to modernise its nuclear weapons infrastructure in exchange for ratification.⁵⁷ There has been no technical need, or any publicly expressed desire, for nuclear testing in or from the US warhead complex for 20 years. The negative consequences of nuclear testing for US security are very well-established throughout the foreign policy establishment. Comments from the current US administration have given rise to concerns that the US may resume testing, though officials have said the US intends to abide by its explosive nuclear testing moratorium (it has continued to engage in ever-more-sophisticated subcritical testing since the CTBT's adoption in 1996).⁵⁸

The US announced its withdrawal from the Anti-Ballistic Missile Treaty in 2001; continuing US development and deployment of ballistic missile "defence" systems is a serious impediment to further disarmament progress as well, to say the least. Russia understood that withdrawal as a bid for strategic supremacy, as many in the US had long warned, and undertook development of multiple kinds of non-ballistic nuclear delivery systems.⁵⁹

On 2 August 2019, the US completed its withdrawal from the Intermediate-Range Nuclear Forces (INF) Treaty. It blamed its withdrawal on Russia, which it accused of violating the INF Treaty by testing and deploying a banned missile system. Russia denied the accusations and said that it would "mirror the development" of any missiles the US makes.⁶⁰

The New Strategic Reduction Arms Reduction Treaty (New START) is the only remaining treaty that places limits on US and Russian nuclear weapon deployments. It is set to expire in February 2021. The US government has said it is interested in pursuing "tripartite" nuclear arms control with Russia and China rather than a bilateral agreement,⁶¹ which China does not see as reasonable given its much smaller arsenal size.

On 8 May 2018, the US government announced its withdrawal from the Joint Comprehensive Plan of Action (JCPOA) with Iran and other states, despite the fact that the International Atomic Energy Agency (IAEA) consistently found Iran to be in compliance with the agreement. The US then reapplied sanctions against Iran; as the JCPOA was endorsed unanimously by the UN Security Council on 20 July 2015 in resolution 2231, the unilateral sanctions are in violation of this resolution. The

US withdrawal and sanctions led Iran, after a “year of patience,” to slowly begin reducing its compliance with the JCPOA in 2019.

The 2018 Nuclear Posture Review (NPR) continues but also makes more explicit, and in newly-bellacose language, a number of long-standing US nuclear weapons policies. In contrast with the 2010 NPR, the most recent version highlights the possibility for the first use of nuclear weapons, in detail, and calls for new nuclear weapons.⁶² The first such weapon, the low-yield Trident ballistic missile warhead, has entered deployment.

Public discourse

“Talk is cheap,” they say. Does public discourse regarding nuclear weapons matter in the US? And in an age of propaganda, social media, and fragmentation of the public sphere, does “public discourse” even exist, in any meaningful sense?

Setting aside the second question, a large body of research has shown that citizen opinion—and public discourse based on those opinions—have little or nothing to do with national policy outcomes.⁶³ The NGO community, which still attempts to mold overall public discourse and “build awareness” of the need for nuclear disarmament, has not sufficiently processed this reality.

To a considerable extent, the US is simply not a functioning democracy at the national level. In 2017 the *Economist* downgraded the US to a “flawed democracy,” finding that the US had been “teetering on the brink” of that downgrade for years and is now struggling to sustain representative democracy.⁶⁴

This is especially true in regard to military and defence issues, ring-fenced as they are with secrecy and subject to a rigid chain of command. Even congressional dissent—ostensibly the main channel through which public discourse could influence policy—is minimal on defence issues, as any comparison of funding requests versus congressional authorisations and appropriations would show.

Congressional dissent on some nuclear weapons issues has nonetheless been important at times, though mostly on the margins of policy.

Success in modifying proposed executive branch policies requires bipartisan support. Unfortunately, dissent from executive proposals has in recent years acquired a strongly partisan and divisive character, which has undermined effectiveness. Much of this dissent is relatively insubstantial, as both major parties have

adopted belligerent rhetoric toward Russia and China, which implies strong political support for “defence” and nuclear weapons programmes in particular.

At present there is no significant public or congressional opposition to any major US nuclear weapons modernisation program.

Acceptable narratives in US public discourse on nuclear issues largely flow directly and indirectly from government sources—“newsmakers”—which news outlets favour. Narratives from other sources, if present at all, come primarily from certain academics, think tanks, and government- or party-aligned NGOs and are typically reactive, and secondary or *pro forma*.

In other words, most “public” discourse about nuclear weapons comes directly or indirectly from government. Government is in turn largely captive of the “unwarranted influence” of the “military-industrial complex.”⁶⁵

The “born-secret,”⁶⁶ formidably technical issues relating to nuclear weapons are among the least accessible of all defence issues to informed public discourse. Nuclear modernisation is managed in a uniquely corrupt manner in government.⁶⁷ In the absence of effective congressional oversight or arms control interest, the political power of the warhead laboratories, the core of the modernisation lobby, has grown in discernable steps since 1994.⁶⁸

There are no signs that public enfranchisement on nuclear weapons issues will increase any time soon. On the other hand, local concerns—which in cases of nuclear deployment and modernisation activities become national concerns—remain potentially potent. Within narrow limits, so does informed analysis within and among the specialist community and government decisionmakers. This discussion is inaccessible to a disempowered and distracted public.

Recent polls reveal that Americans overall don’t know or care much⁶⁹ about nuclear weapons, and harbor contradictory ideas about them.⁷⁰ They do clearly support further mutual stockpile reductions with Russia,⁷¹ and if asked do express a wish to rid the world of nuclear weapons.⁷² Recent polling once again affirms support for arms control objectives.⁷³

While popular attitudes about nuclear weapons change with events and media narratives, and factual knowledge is at best vague, these polls and others suggest *there is no popular barrier to significant—even deep—mutual nuclear disarmament*. Thus the low salience of nuclear issues cuts both ways.

What is absent is leadership capable of confronting and transcending the nuclear weapons lobby. In the past, antinuclear activism in the United States has concretely impacted nuclear weapon policies. Today, efforts in the United States have not placed sufficient pressure on the actual decisionmakers regarding specific material policies and programs.

Effectively challenging the nuclear-industrial complex is different today than in past decades: highly-negative trends in campaign finance; steep declines in the quality, quantity, and independence of journalism; the extreme fragmentation of public information sources coupled with a rising inability to discern facts from ever more sophisticated propaganda; deepening economic inequality and expanding precarity; rapidly rising student debt; perceptions of disenfranchisement leading to political withdrawal and cynicism; the enormous rise of various forms of identity politics, which fragment politics; a shocking foreshortening of historical memory; and the rise of other existential crises with immediate impact—a process which will intensify from this point forward—are among the factors that have made US citizens much more malleable and quiescent as regards nuclear weapons issues.

The COVID-19 pandemic has ushered in an era of widespread precarity unprecedented in the US since the Depression of the 1930s, and still growing. We are observing that even among strongly antinuclear constituencies, the quantum of attention formerly available for activism is now directed to more basic human needs such as safety and security. Even more fundamental needs, such as for food and shelter, may be increasingly challenged in the months and years ahead as additional economic and environmental dimensions of our converging crises manifest.

There is no reason to think the material, social, and political conditions for single-issue antinuclear activism will return. On the other hand, the time is riper than ever for activism based on the fundamental redirection of security priorities, in which nuclear weapons issues are an important aspect. To be fruitful in the long run, activism must achieve short-term victories that halt nuclear modernisation projects. Real traction will produce real victories.

Politically meaningful discourse about nuclear modernisation is inseparable from discourse about nuclear weapons more generally, for the simple reason that as long as nuclear weapons are retained, modernisation will occur. Modernisation can be slowed and its scope narrowed, but nuclear modernisation has an inconvenient internal logic that defies gradual reforms. Stasis and like-for-like replacement are impossible—continual modernisation is required or the else the industry will collapse.

Nuclear weapon modernisation is strongly shaped and constrained by a complex interplay of internal institutional imperatives within the privatised US nuclear weapons enterprise involving (in no particular order) technological opportunism, considerations of workforce stability and recruitment, infrastructure modernisation (sometimes with construction timelines exceeding one decade), transmission of key skills and ideologies, stability of specialised supply chains, “pork-barrel” politics, worker safety and environmental priorities, economies of scale, and efficiencies in manufacturing and maintenance. These constraints are largely impervious to democratic, or even congressional or executive branch, control.

Why? Any nuclear weapon that is retained must sooner or later be modernised or replaced. The people and the labs and factories necessary to undertake this massively complex task will need to be in place, trained, equipped, resourced, and in practice when the time comes to do so. The necessary technology must be developed and tested. In some cases, it will not be the technology of 30 years prior (for which no supplier base exists), which is not taught in schools. The only way this readiness can be maintained is for these facilities and staff, both of which must themselves be continually renewed, to design and produce modernised warheads more or less continuously.

What *can* be changed, above minimum stability thresholds, is the scale of the sustainment and modernisation endeavor, which depends on the diversity and size of the stockpile to be maintained. Great savings and downscaling in modernisation can be achieved, but only if the stockpile is cut deeply.

Detailed questions regarding modernisation are largely inaccessible to the public and even to most members of Congress. The President will delegate such decisions to his appointed experts, all drawn from within the field and subject to its loyalties.

For these and many other reasons, popular discourse about nuclear weapons and modernisation doesn't, and won't, influence US nuclear weapons policy, *within the current broad parameters of current US national security discourse.*

These broad parameters are however changing due to the cascading impacts of the COVID-19 pandemic, although precisely how, how much, and when is impossible to ascertain at present.

Late last month the CBO estimated the current-year federal fiscal deficit at US \$3.7 trillion, 18 per cent of estimated GDP—over three times last year's deficit.⁷⁴ For structural and psychological reasons, as well as from premature lifting of social distancing requirements and a likely second pandemic wave, official and popular estimates of economic recovery may be optimistic.

Even *before* the pandemic, US military and national defence accounts were likely to be unsustainable, as CBO gently warned in 2017.⁷⁵

The situation is much worse now. The pandemic involves at least four out of the eight top strategic risks to the US, as identified in the 2015 National Security Strategy. None of these four has a military character or requires a military response.⁷⁶

As noted above, the CBO found that even fairly large adjustments in modernisation policy and the nuclear arsenal did not generate large budget savings in the context of military spending overall, in which spending for nuclear weapons comprises only about 7 per cent.

Whereas cuts to the *overall* military budget, including but not limited to nuclear weapons, *would* generate large savings—and liberate resources on the scale needed to address the truly existential national security crisis of climate collapse, while also creating millions of accessible, near-term jobs and careers. At present, the total US military budget approaches—or, if interest payments are included, exceeds—one trillion dollars per year.⁷⁷ The US lacks any viable plan for replacing the tens of millions of jobs that the coronavirus will destroy. Redirecting national security priorities could provide that plan.

In this context, expert discourses that involve paring the US nuclear arsenal to save US \$1–9 billion annually—the range of savings in the Arms Control Association report cited above—will likely not find much traction. That much savings isn't significant when hundreds of billions, even trillions, in new debt-based spending are being authorised, quite likely in vain, to quickly end the current "recession".

"Make no small plans" is sound advice in this context.⁷⁸ Efforts at gradual reform have conspicuously failed; their political effect has been to protect the status quo.

It should be noted that in the US, nuclear weapons function politically to help deter military budget cuts. The presence of a nuclear adversary that is capable of annihilating the entire United States allows the aggressive nature of US foreign policy and global military adventurism to pass largely unnoticed. Without existential nuclear fears, it would be difficult to maintain current levels of austerity in social programmes while US "defence" expenditures far exceed those of all potential adversaries put together.

The *New York Times* recently quoted Dominique Moïsi, a political scientist and senior adviser at the Paris-based Institut Montaigne, "[In its response to the pandemic] America has not done badly, it has done exceptionally

badly.... America prepared for the wrong kind of war.... It prepared for a new 9/11, but instead a virus came. It raises the question: Has America become the wrong kind of power with the wrong kind of priorities?"⁷⁹

This question will grow in importance.

The Gallup organisation conducts a monthly open-ended poll that asks US citizens, "What do you think is the most important problem facing the country today?" In April 2020, "national security," "lack of military defence," "situation with China," and "situation with Russia," were each chosen by less than 0.5 per cent of respondents. No military- or defence-related concern topped the 0.5 per cent popularity mark. "War/conflict between Middle East nations" and "situation with North Korea" had zero responses. It was coronavirus (45 per cent), "government/poor leadership" (20 per cent), the economy (13 per cent), and healthcare (6 per cent) which topped the most recent list.

Even in the few months prior to the pandemic and despite constant government and heavy media propaganda, "situation with Russia" never cracked 0.5 per cent. All national security issues taken together fell in the 1–3 per cent range while environmental issues fell in the 3–5 per cent range and healthcare in the 5–10 per cent range. The "Overton Window" is wide open.⁸⁰

In announcing the assassination of Dr. Martin Luther King, Robert Kennedy quoted Aeschylus, "And even in our sleep, pain which cannot forget falls drop by drop upon the heart, until in our own despair, against our will, comes wisdom through the awful grace of God."⁸¹

Wisdom is something more than "discourse". Truth matters, and the truth of our overall predicament, interpreted variously, is beginning to seep in for many people. We are at the end of an age. What was "normal" is vanishing irrevocably in the rear-view mirror.

The truth is that neither the US nor world civilisation can long survive the madness of the US investing so much of its political attention, scarce real capital, and skilled labour in armaments, including nuclear armaments—which are primary lynchpins in our ever more complex predicament. The central historical and ecological reality of our time is that we—all of us—are in the first stages of a complex catastrophe which will re-sort our priorities and stress our institutions to—and beyond—the breaking point.⁸² The public discourse we most need to focus on is our own.



"End the arms race." This picture was taken during the Australian "Nobel Peace Ride", where ICAN members journeyed from Melbourne to Canberra by bicycle with the Nobel Peace Prize medal, raising awareness of the UN Treaty on the Prohibition of Nuclear Weapons, September 2018, © Martin Ollman

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United States: Annex

Continuity and change since the 2020 edition of *Assuring Destruction Forever*

Greg Mello and Trish Williams-Mello

We see no significant changes in the United States' (US) nuclear weapons force structure, policies, or programmes since the detailed US programme descriptions provided in the 2020 edition of *Assuring Destruction Forever*.¹ We urge you to refer to that publication for background to the present update.

To some extent, this continuity expresses slow decision-making in the US government overall. COVID-19 and its ramifications are the main but not the only culprit. The new (Biden) administration was months late in proposing its first budget; Congress has not yet passed its annual military authorization bill this year, or any government appropriation bill including for nuclear weapons programs. The work of agencies that review nuclear issues has slowed dramatically as well, increasing government opacity.

The administration's Nuclear Posture Review (NPR) is not expected until early next year. All indications suggest the NPR will contain no major changes in nuclear posture, force structure, or declaratory policy.²

There are however three dramatic changes in the nuclear environment to report since last year. The first relates to threats against Russia and China; the second to economics; and the third to factors within the US population.

First, is the marked increase in the number and intensity of US military and proxy threats against Russia and China.

The cold war between NATO plus Ukraine and Russia could become hot at any time, within days or weeks. The situation is now so volatile that we cannot be fully sure that war between nuclear powers will not break out before the 2022 nuclear Non-Proliferation Treaty (NPT) Review Conference.³ This is the most important new element to bring forth at this time.

The danger of war with China is equally grave, if also more cryptic. As one well-informed scholar recent put it, "the insanity of encouraging Ukraine to attack Donbass is matched by the insanity of encouraging Taiwan to tell China to go to hell."⁴

There is a grave danger that the present collapsed state of diplomacy has been normalised in US and Western

minds to such an extent that the very real risk of war has become invisible. Raising tensions to achieve geopolitical goals can easily pass an unseen point of no return, especially as there are many independent actors with diverse interests and strategies – some of which actually favor war. Political elites, apparently even more so in this administration than in the past, are leading us toward what Einstein and his colleagues called "unparalleled catastrophe."⁵

Second, is the dramatic change presented by a rapidly-rising, linked set of economic issues that directly and indirectly affect every aspect of US nuclear weapon policies and programmes. Interrelated problems of energy supply, inflation, labor, debt, supply chains, public health, and governance have catapulted into prominence since the COVID-19 pandemic and will continue to evolve and intensify.

Despite their privileged position in the US polity, nuclear weapons programmes cannot fully evade the triple dangers of a) inflation, b) local and industry-specific insufficiencies of trained, skilled and motivated labor, and c) instabilities in often narrow and therefore fragile supply chains.⁶

The Biden Administration is attempting to modestly rebalance national priorities toward long-neglected domestic needs by adding domestic spending. The new programmes will compete with nuclear weapons programmes for labor and materials and may be inflationary, as nuclear managers recognise.⁷ On a multiyear time scale, funding uncertainty is rising, as the Congressional Budget Office (CBO) already noted before these new problems arose, in 2017.⁸

Beyond recent causes, US foreign policy, and US military structure and postures including nuclear weapons policies, always change slowly. US nuclear policies have changed little since the modernisation commitments made by former president Barack Obama made with the Senate in 2010 to secure ratification of New START.⁹ Obama's stance was in turn based on a 2009 strategic consensus among long-time nuclear and intelligence "graybeards," supported by nuclear bureaucrats and staff from defense institutions.¹⁰ This is more or less how US nuclear decisions are always made.

Defense and nuclear weapons policies are the responsibility of special bureaucracies anchored outside the original, constitutionally-established institutions of Congress and the Presidency.¹¹ These special, permanent bureaucracies, created by the National Security Act of 1947, respond not just to elected government but also to a complex web of vested interests within and outside government.¹² Legalised corruption is more a norm than an exception. Congress, for its part, is increasingly unwilling to provide meaningful oversight, especially over nuclear weapons programmes and policies. And as noted last year, US citizens lack democratic agency.¹³

Because of these realities, US nuclear policy will only change as a result of overpowering forces external to government, e.g. the actions of other states, intractable economic changes, internal political crises, or natural disasters.

The US is a highly militarised country, on a uniquely large scale. The US is not just “a” nuclear weapons state. It is the predominant nuclear-military-political power in the world, which seeks to dominate or control all others. Until COVID-19, the US spent about two-thirds of all congressional appropriations and about one-fifth of all federal expenditures on military functions. The military-related fraction of federal spending is likely to fall somewhat next year but the amount, measured in current dollars, will rise. Covid-19 temporarily changed the balance of US spending but these huge relief expenditures created no permanent institutions that could help rebalance US priorities.¹⁴

These conditions and others result in an uncanny continuity on national security issues—and nuclear weapons issues in particular—between seemingly different administrations.

Much is made in the US defense press about advances in Russian and Chinese hypersonic weapons, which have entered significant deployment in the case of both countries. These weapons are truly revolutionary, but not so much in the nuclear sphere as in conventional warfare. Their greatest relevance to nuclear weapons lies in the potential that the US might be more tempted to use nuclear weapons to prevent losing expeditionary wars. We do not address hypersonic weapons here—beyond the ballistic missiles the US already has.

Nuclear weapons are situated in the context of military forces overall, and that is how the Biden administration’s NPR will be presented. In the NPT’s article VI, the responsibility of states parties to negotiate nuclear disarmament and overall disarmament are linked (and separated) by a comma. As we did in ADF 2020, we update here the important disparities in overall military commitments between the US and its rival nuclear powers, measured financially.

US military spending in 2020 was:

- More than the next 11 countries combined, eight of which are US allies;
- More than three times China’s;
- More than twelve times Russia’s; and
- Two and half times that of Russia and China combined.

Over the 2016-2020 period, US military expenditures rose 12 per cent in constant dollars, while Russia’s fell 16 per cent over the same period. Chinese military expenditures rose 20 percent over the same period.¹⁵ In 2020, the total military expenditure by NATO countries was almost seventeen times that of Russia.¹⁶ By this measure alone, who are the aggressors here?

The third major change is at present poorly understood and documented. We believe there has been a major sociological, cultural, psychological change in the US population as a result of the pandemic and the public health measures enacted. Mental health has deteriorated; people are frightened, isolated, and more malleable. Our news media is far more accepting of government authority as well.

In the 2020 edition we pointed out the low popular salience of nuclear weapons and disarmament issues. This continues and if anything has increased.¹⁷ Nuclear disarmament has essentially no current electoral significance.

Other key changes and updates

A few days before 2 December 2021, the B61-12 gravity bomb entered serial production.¹⁸ Entry into service will shortly follow. Current plans are to make about 480 of these highly-accurate (30-meter circular-error-probable), 0.3 – 50 kiloton (kt) bombs, at a cost of roughly \$12 B.¹⁹ It is likely that about 100 of these bombs will be forward-deployed at six European bases, assuming they replace current B61 variants on a one-to-one basis.²⁰

The three or four dozen 400 kt B61-11 earth-penetrating strategic gravity bombs may or may not be eventually replaced by the B61-12, an issue related to the fate of the other US nuclear gravity bomb, the 1.2 megaton B83-1.

The future of the B83-1 remains uncertain. In June 2020, the US Nuclear Weapons Council decided to extend the service life of this bomb, and the administration’s FY2022 budget request included \$98.5 million (M) to begin this work in FY2022.²¹

This contravenes earlier assurances to retire this bomb when the B61-12 entered service.²² The B61-12, having at most 4% of the B83-1's explosive yield, is thought to lack sufficient cratering and seismic effects to hold certain deeply buried targets at risk. At present, these targets are addressed via the heavily-built B61-11.

Alteration 370 of the 455 kt W88 submarine-launched ballistic missile (SLBM) warhead is on track to begin early next year, a year later than NNSA previously estimated. This operation will refresh high explosives and add a new "smart" arming, fuzing, and firing (AFF) assembly, greatly increasing the probability of hard-target kill.²³

There have been no significant changes in the total number of *deployed* and reserve US weapons over the past year. However, we believe the number of deployed US gravity bombs and air-launched cruise missiles could or should be reinterpreted to include most or all active bomber-delivered weapons, as these can be readily shifted to active bases and/or loaded onto nuclear-capable aircraft on short notice. Kristensen and Korda count 300 deployed and 550 reserve warheads and bombs in this category.²⁴ The authors believe all 850 should be considered deployed, raising the estimated total number of deployed warheads and bombs to 2,350 and lowering the estimated number of reserve weapons to 1,450.

Beyond the above projects, unspecified future NNSA warhead projects are now at "very high risk" of delay due to difficulties in producing uranium components.²⁵ The W87-1 warhead, to be deployed on the proposed silo-based Ground-Based Strategic Deterrent (GBSD), is among those at risk. That warhead also faces potential delays from insufficient or delayed production of plutonium warhead cores ("pits") (see below).

It is too early to see if any major nuclear delivery system replacements will be delayed, beyond the warning signs already visible last year. Of note, the Navy now says that if necessary, individual Ohio-class submarines could be life-extended by up to five years, contradicting previous statements, as Columbia-class production margins narrow.²⁶

The sea-launched cruise missile (SLCM) proposed by the Trump administration has died. Upon information and belief, the Navy's Analysis of Alternatives (AoA) concluded that any proposed SLCM provided no deterrence advantages and many practical problems. On 4 June 2021, acting Navy Secretary Thomas Harker cut all expenditures for this nascent program.²⁷ Some complained,²⁸ but the programme is now dead before it ever started.

NNSA infrastructure upgrades are proceeding, with large estimated cost increases for long-term projects, specifically pit production infrastructure. Current early estimates of pit production costs through FY2033 now lie in the staggering \$33-39 B range.²⁹

Los Alamos National Laboratory (LANL) estimates its pit costs over the present decade at \$18 B, exclusive of other plutonium programs.³⁰ The cost of pit production at LANL in the 2020s increases overall W87-1 warhead costs by a factor of at least three, making that warhead at least three times as expensive as the B61-12 and by far the most expensive warhead ever, if it is built.³¹

This dramatic cost inflation is a harbinger of serious trouble in NNSA's long-term plans, as we warned in ADF 2020.

The total labour force working on US nuclear weapons is increasing rapidly. We have no specific labour data on DoD nuclear contracting, though expenses are rising as production begins. NNSA and its contractors are meanwhile hiring apace. By 30 September 2019, NNSA's site contractors employed 44,444 people, up 3,926 employees over the previous year. Including all worker categories, NNSA's total federal and contract workforce had reached 50,000 by that same date.³²

We believe the total NNSA workforce lies in the vicinity of 54,000 to 58,000 today, two years later. Over just the past year, and despite COVID-19, LANL hired 1,277 people, the most in at least 30 years.³³ Other sites are also expanding their workforces, although none quite as fast as this.

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Russian Defence Minister Sergei Shoigu said that Moscow had noted a significant increase in the activity by U.S. strategic bombers which he said had carried out 30 flights close to Russia this month. That, he said, was 2.5 times more than the same period last year.

Shoigu complained in particular of what he said was a simulated US nuclear strike against Russia earlier this month.

"The defence minister underlined that during the US military exercises 'Global Thunder', 10 American strategic bombers rehearsed launching nuclear weapons against Russia from the western and eastern directions," Shoigu was quoted as saying in a defence ministry statement.

"The minimum proximity to our state border was 20 km."

At the cruising speed of a B-52 heavy bomber (845 km/hour), 20 km is traversed in 1.4 minutes.

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As of this writing, FY 2021 spending is continuing unchanged into FY2022 (with the exception of the 15 November 2021 "Infrastructure Investment and Jobs Act" and covid-19 relief, see below). Bipartisan majorities in the House and Senate favor increases of about \$25 B over the Administration's FY2022 baseline military spending request, but no FY2022 military spending bills have been enacted as yet. An active but small minority of lawmakers prefer lower defense budgets.

Total US federal outlays by year see <https://www.statista.com/statistics/200397/outlays-of-the-us-government-since-fiscal-year-2000/>.

The 15 November 2021 "Infrastructure Investment and Jobs Act," new infrastructure Act will add an average of \$58 B annually to non-defense spending over the coming decade. See "The True Costs of the \$1.2 Trillion Bipartisan Infrastructure Bill," Taxpayers for Common Sense, 12 November 2021, <https://www.taxpayer.net/infrastructure/the-true-costs-of-the-1-2-trillion-bipartisan-infrastructure-bill/>.

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Even with both pieces of new legislation, US military spending would consume as much of US fiscal resources as all other discretionary spending combined, assuming no other change in national priorities.

FY2020 and FY2021 were unusual years. Through four emergency laws in calendar year 2020, Congress allocated about \$4 trillion (T) in covid-19 funds. "Breaking Down \$3.4 Trillion in COVID Relief," Committee for a Responsible Federal Budget, 7 January 2021, <https://www.crfb.org/blogs/breaking-down-3-4-trillion-covid-relief>. By the end of FY2021, \$3.5 T had been spent across two fiscal years with \$0.5 T yet to be spent. "COVID-19 Spending," <https://www.usaspending.gov/disaster/covid-19?publicLaw=all>. These legislative acts radically changed the proportion of discretionary spending devoted to the military, from 68 per cent in FY2019 to roughly 27 per cent in FY2020 and FY2021, using the above sources. Military spending as a fraction of total spending fell from 20 per cent in FY2019 to 13–14 per cent in FY2020 and FY2021.

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