The Global Nuclear Balance

Nuclear Forces and Key Trends in Nuclear Modernization

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Photo: ALEXANDER NEMENOV/AFP/Getty Images

Introduction

This survey uses a wide range of summary official and expert estimates of global nuclear forces to illustrate the rapid changes that are now taking place in the global nuclear balance, which are summarized in the slide that follows this page. While it addresses the forces of all the world's nuclear powers, it focuses on the trends in the United States, Russian, and Chinese nuclear balance. It provides an unclassified overview of recent U.S. official force planning and intelligence data on U.S. Russian, and Chinese nuclear forces; and compares summary estimates of global nuclear and related missile forces by the International Institute for Strategic Studies (IISS), the Federation of American Scientists (FAS), Bulletin of Atomic Scientists, House of Commons Library, U.S. Congressional Research Service (CRS), Stockholm International Peace Research Institute, Roual United Services Institute (RUSI), and Center for Strategic and International Studies (CSIS).

Its final section contains summary data on U.S. force improvement plans taken from the testimony of General Anthony J. Cotton, commander of the U.S. Strategic Command, before the House Armed Services Committee on Strategic Forces on March 8, 2023, and on U.S. plans and strategy on the aspects of missile defense that affect the strategic balance.

Shifts to Three Major Nuclear Powers and Increases in the Strength and Modernization of British, French, Iranian, Israel, Pakistani, and Indian Nuclear Forces

Its main purpose is to illustrate the extent to which nuclear forces have again become a key factor shaping international security, and *some* of the different ways that experts now portray the changes taking place in nuclear modernization and in the balance between the major powers. It shows that the balance between the major powers has shifted from the nuclear balance between the United States and Russia to one where China is emerging as a nuclear great power; and where important shifts are the shifts taking place in the strength and modernization of other nuclear forces like those of the United Kingdom, France, North Korea, Iran, Israel, India, and Pakistan.

Focusing on the Problems in Estimates Based on Unclassified Data

At the same time, its summary comparisons of different expert assessments highlight the many areas where key data on nuclear forces and nuclear warfighting are not available or present major issues in terms of uncertainty or conflicting data. Such summary data can only illustrate a limited number of the different ways in which experts now estimate the nuclear balance, but the analysis draws upon some of the most respected unclassified sources now available to illustrate the range of data now available and its limitations.

Major Shifts in the Nuclear Balance

- **Chinese shift to major nuclear forces**
- **Russian, Chinese, and U.S. nuclear modernization**
- **Russia has threatened the collapse of New Start and other US-Russian arms control efforts. China refuse to engage**
- **Ukraine-related Russian tactical nuclear threats, nuclear arms transfers to Belarus (?)**
- **Rising North Korean threat, Iranian break out capability.**
- **Decades of rising counter-value vulnerability.**
- **Future status of non-strategic and reserve non-deployed nuclear weapons.**
- **Advances in missile and drone defenses, anti-satellite warfare.**
- **Impact of AI, new satellite capabilities, for targeting and retargeting, conflict management and assessment, shift from tactical to counterforce to countervalue strikes and restrikes.**

This survey has been substantially updated and expanded as of May 2023 in response to outside comments and suggestions that reviewed an earlier draft, but the estimates it summarizes continue to change and evolve, and the updated data on force strengths in 2023 and on future modernization are especially uncertain. However, even a book-length comparison totaling some 200 pages must ignore much of the work done by the experts it draws upon.

The source of each estimate is listed at the end of each summary, and full text of the work by national governments, Hans M. Kristensen. Matt Korda, Robert Norris, and others in the country-by-country *Nuclear Notebooks* published in the Bulletin of Atomic Scientists, in the SIPRI annual yearbooks, the various reports by the Congressional Research Service, and the reports by Claire Mills for the House of Commons Library are particularly helpful in comparing different countries, understanding the limits and uncertainties in such data, and the extent to which many estimates are dated, uncertain, or based on uncertain sources.

Limits to the Coverage of this Analysis

Other key limits to the data presented include the fact that the official data on U.S., Russian, Chinese, British, and French programs have consistently tended to underestimate the costs, technical, and delivery date risks in the actual modernization efforts. They also understate the probability of major changes in major national programs as countries deploy new systems warfighting capabilities and change their strategies. Estimates of future forces are also based on current plans that do not reflect in the impact of the war in Ukraine, the collapse of many arms control efforts, and ongoing increases in Chinese forces and tensions over areas like Taiwan and the Koreas.

These serious uncertainties in the data that are available on nuclear weapons and delivery systems. Many of the data on the type of non-U.S. nuclear weapon —fission, boosted, or thermonuclear—and its yield are uncertain. So are the background data on the level of technical sophistication in designing the weapon, upgrades and serving of weapons over the years, and its reliability in a real-world delivery on target.

Data on the actual level of success in each country’s explosive tests of nuclear weapons and progress in weapons design are often uncertain, and so is progress in testing weapons designs using simulated weapons with low levels of enrichment remain classified—although both India and Pakistan are reported to have used such methods. The readiness of stored weapons is not assessed, and the ability to use existing weapons assemblies in missiles and other delivery systems that are normally assessed as having conventional warheads is unknown.

More generally, the summary estimates of existing forces generally only reflect a limited portion of the history of their development, changes in declared national strategy, long-standing questions about the real-world success of given powers in developing advanced systems, the history of arms control efforts, and national nuclear politics. Many of these details are uncertain and debated at the expert level. The narrative summaries of national nuclear efforts in Wikipedia often provide extensive background in these areas but also have serious gaps, are often badly dated, and vary sharply by country in their coverage.

Uncertainties in Data on Delivery Systems

There are few reliable estimates of the changes that most nuclear powers are making to their delivery systems, and much of the data focuses on the performance of individual missiles, aircraft, SSBNs, and potentially dual-capable systems, rather than the numbers to be deployed, actual deployment, and impact on war fighting.

Many of the data on non-U.S. missiles are based on estimates of range based on the type and size of the missile rather than actual flight test data. Estimates of accuracy are often based on the maximum capability of the guidance platform rather than actual missile tests; accuracy is not tied to reliable estimates of nuclear weapons yield, and no reliability data based on actual tests of even the missile system alone are normally available.

Data are lacking on the targeting and retargeting capabilities of given countries, and on their ability to retarget, launch on warning, and accurately detect and characterize nuclear strikes on their own territory and enemy territory, and characterize the difference between *counterforce* strikes on nuclear and other military forces, and countervalue strikes on civilian populations, key economic and infrastructure targets, and other critical nonmilitary and recovery capabilities.

Failing to Examine Changes in Warfighting Capability

More broadly, the unclassified data now available on nuclear capabilities focus almost exclusively on nuclear delivery systems and nuclear weapons, rather than analyzing actual warfighting capabilities, and the results of a possible nuclear conflict. The unclassified data on nuclear strategy often consists of little more than national political statements about no first use, a desire for arms control, and a focus on deterrence rather than war fighting – none of which may apply in a crisis and at a time when most of the U.S. and Russia nuclear arms control efforts have been canceled or have an uncertain future, China does not participate in meaning arms control negotiation, and smaller nuclear power make statements that are ambiguous and given no clear picture of what might happen in a crisis.

Open-source efforts to analyze the warfighting impact of actual nuclear exchanges largely ended after the collapse of the former Soviet Union, as most tactical and theater nuclear forces were withdrawn from active service, and as arms control seemed to create a truly stable balance of strategic nuclear deterrence. As a result, there are only a handful of credible data on how a nuclear war might now lead to given patterns of counterforce strikes against an opposing side's nuclear and other military forces, and the impact of fall out and the countervalue impact of counterforce strikes.

There is little recent unclassified analysis of how a nuclear war might lead to countervalue strikes against populations, economies, and recovery capabilities, and of the levels of damage and casualties that might result in a world with radically different economic structures and target bases from that exist at the time of the Cold War. There is also little meaningful open-source analysis of the shifts taking place in key aspects of vulnerability to nuclear attacks, like dependence on imports, manufacturing capability, and changes in the economic value of given cities, key infrastructure targets, and key industrial centers.

Furthermore, only limited data are available on the major changes that have taken place in the ability to use space and other assets to provide reliable warning of attacks, analyze nuclear engagements in near real-time, change counterforce and countervalue targeting dynamically in near real time to reflect the actual course of nuclear exchanges, and assess the value of given counterforce and countervalue targets in both warfighting terms and in terms of recovery capability.

This lack of open-source analysis of the changing nature of actual nuclear warfighting seems increasingly dangerous. China is emerging as a major nuclear power and radically changing the potential nature of nuclear warfare between the major powers. Past efforts to actually analyze nuclear warfighting ignore the fact that there are now three major groups of nuclear forces: the United States, France, the United Kingdom, Russia, and China. This not only presents major problems in modeling the possible patterns in nuclear warfighting and escalation, but it also presents the problem for the United States that any exchange with only Russia or China would make the power that stayed out of the conflict the de facto winner in a major nuclear exchange.

Dual Capability and a Return to Theater Nuclear Warfare

The war in Ukraine has shown that Russia is willing to make nuclear threats, and much of the arms control efforts in Europe and between the United States and Russia have now ended or have an increasingly uncertain future. China has so far refused to engage in arms control negotiations. The end result is that there is a major risk that the deployment of theater nuclear weapons, dual-capable delivery systems that can

be armed with nuclear or conventional warheads, and strategic nuclear warheads with yields suitable for theater warfare will increase steadily in the near future. The analysis shows that smaller nuclear powers have remained a relatively limited global threat but pose a steadily growing strategic threat to given nations in their region. Proliferating states like Israel, North Korea, India, and Pakistan are modernizing and increasing their forces, and the potential nuclear efforts of nations like Iran illustrate the rising risk proliferation may pose in the future. North Korea has also been reported to have declared that it has already deployed delivery systems that have both nuclear and conventional warheads.

Other Key Areas of Uncertainty

There are several other major areas of uncertainty that affect the estimates of nuclear forces in this summary analysis:

- One is proliferation. Key cases involve the steady rise in Indian and Pakistani near force capabilities, the uncertainties surrounding the real-world nuclear capabilities of Israel, North Korean efforts to develop and deploy ICBMs, and the risk of Iran acquiring nuclear weapons and its impact on the development of nuclear forces by Iran's Arab neighbors.

- Another is the ways in which nuclear forces can be used in combat and the extent to which the ability to manage a nuclear war in near-real time is becoming far more dynamic. There has been almost no open-source discussion of the potential impact of space sensors, AI, and big data in radically changing the current and future ability to provide reliable launch-on-warning capability and real-time data on the exact nature of nuclear strikes and their effects.

- These advances in technology may allow the managers of an actual nuclear war to rapidly retarget, shift in near real-time from counterforce to countervalue targets, and fight even the highest levels of nuclear combat dynamically in near real-time. These issues are now being publicly explored in designing forces for advanced forms of conventional Joint All-Domain Operations, but there has been little public discussion of how they might change the modernization of nuclear war fighting.

- A third area of uncertainty, as the 2023 edition of the ODNI's *Annual Threat Assessment* highlights, is the risk that new forms of biological warfare pose a rising strategic threat and one that could be used anonymously and to produce a wide range of lethalities and economic and social effects.

- A fourth is the fact that most existing U.S. and Russian, and NATO and Russian, arms control agreements have either been halted or suspended, while China has not engaged in arms control negotiations with the United States.
- A fifth is the fact that the number of precision-strike theater and tactical missiles that are dual capable is steadily increasing, but there is no indication of whether U.S. and Russian tactical and theater nuclear weapons will be returned to active deployment in Europe or elsewhere, and whether today's U.S., Russian, and Chinese "triads" will become a "quad" that includes theater and dual-capable nuclear forces.
- Similarly, no reliable estimates exist of the future development and deployment of missile and air defense weapons capable of intercepting nuclear delivery systems, or of cyber, antisatellite, and other systems that can degrade the ability to escalate and conduct nuclear warfare.
- Finally, as noted earlier, no reliable unclassified estimates seem to exist of the impact that counterforce strikes launched to destroy an opponent's nuclear forces would have on the opponent's civil population, economy, and recovery capabilities. Past studies indicated that the real-world difference between counterforce and counter value could be limited by fall-out and longer-term weapons effects in major counterforce exchange, but they are now seriously outdated.

  It should be noted that the comparative summary analysis in this report shows that few nuclear powers provide full national statements of their nuclear modernization efforts, the full spectrum of their current and future nuclear capabilities, and actual warfighting capabilities. Statements like "no first use" are matters of doctrine that any nation can declare and ignore in a crisis, and no nuclear state has declared possible limits to its uses of nuclear weapons, possible ways in which it might agree to halt nuclear escalation once it begins, and limits to its countervalue targeting.

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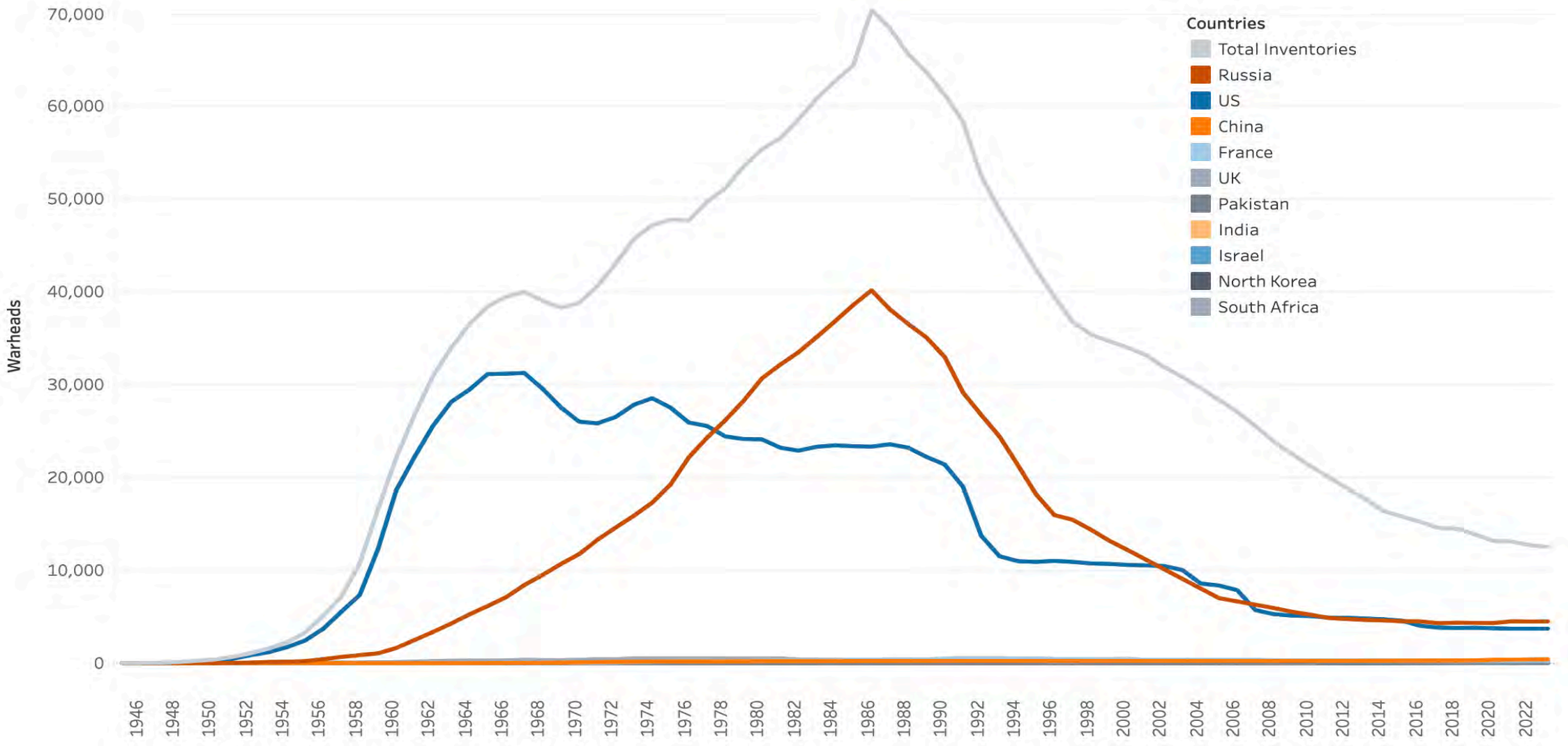
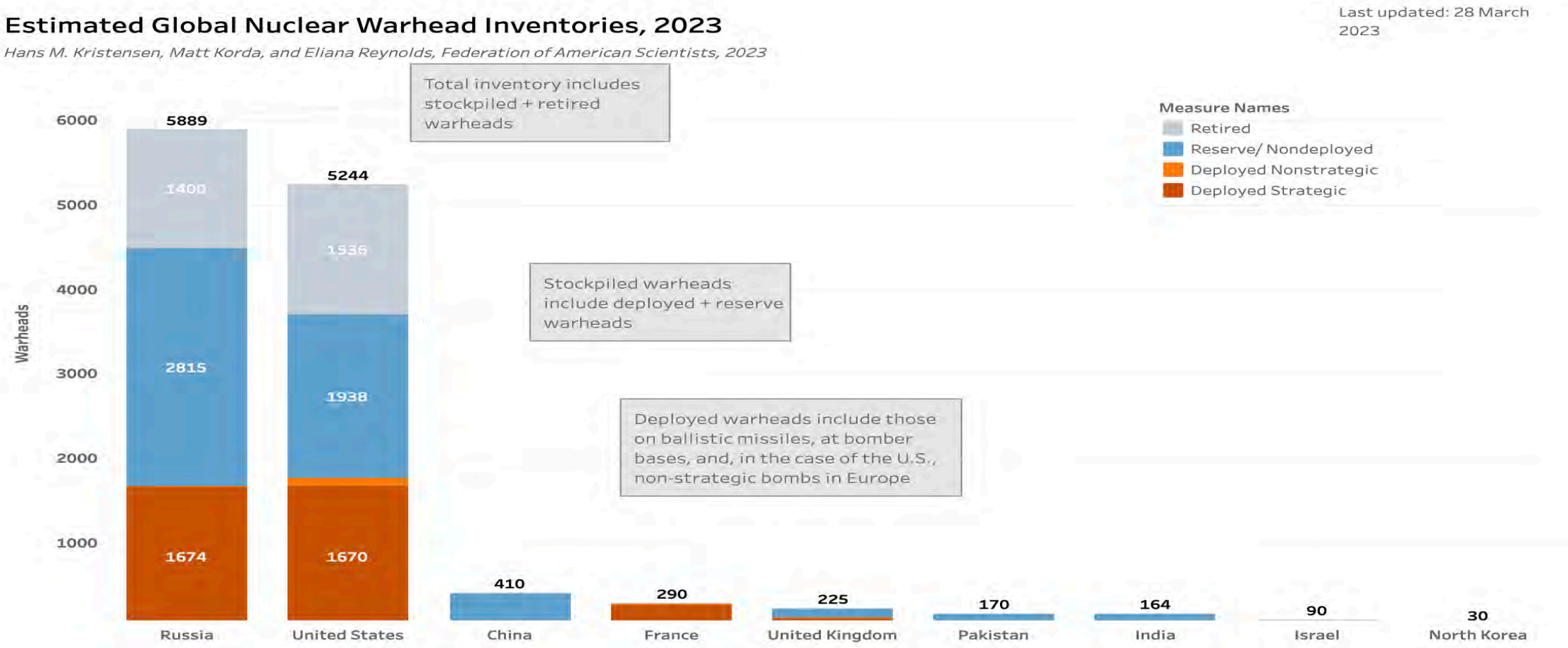
Summary Comparisons of U.S. Russian, Chinese, European, Iranian, and North Korean Nuclear Forces

Six Decades of a Global Nuclear Arms Race



Source: Hans M. Kristensen. Matt Korda, and Robert Norris, "Status of World Nuclear Forces," 2023, Federation of American Scientists (FAS), March 29, 2023, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/,

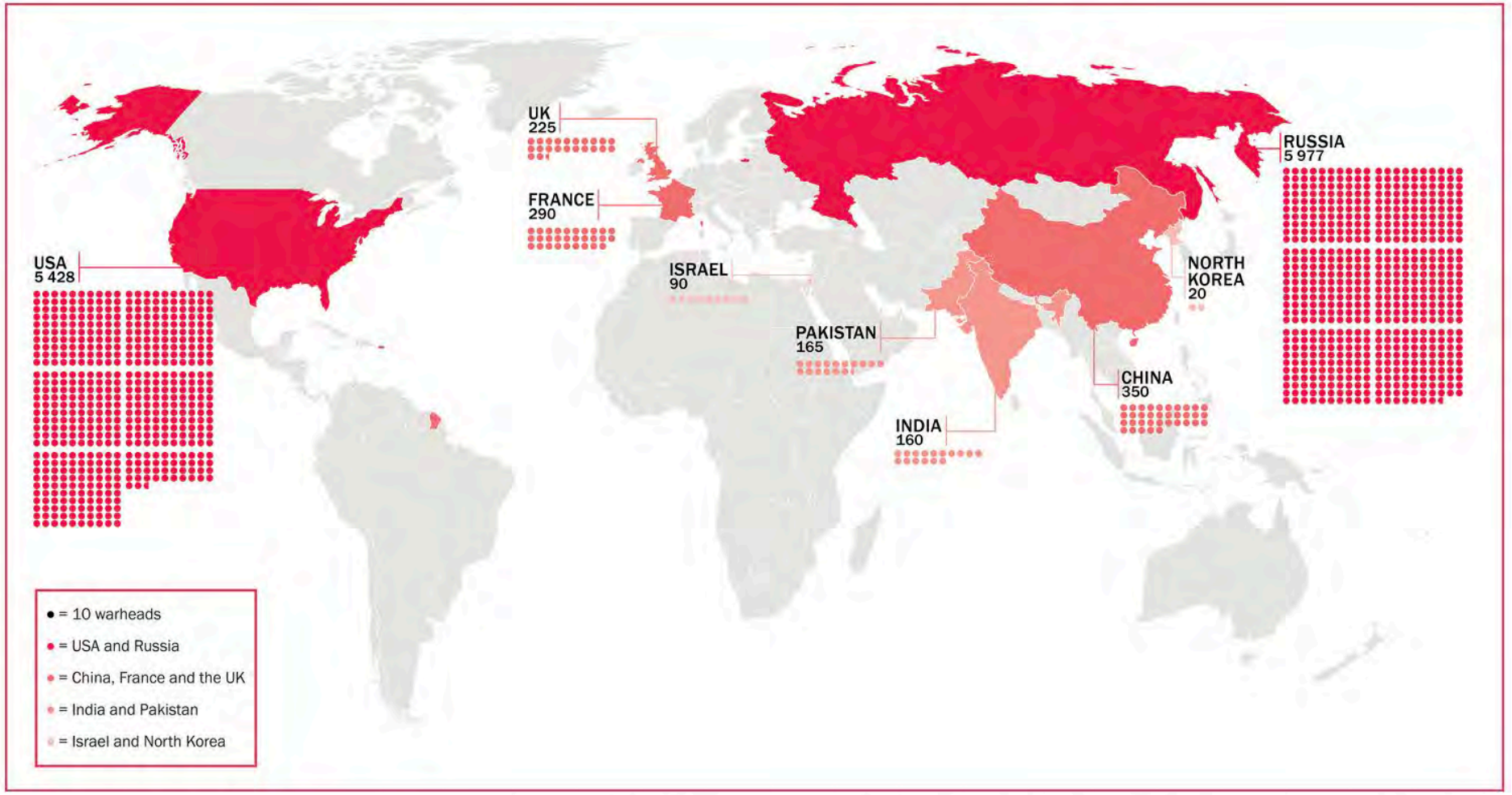
U.S. and Russia are *the* Major Nuclear Powers. China Lags But Its Nuclear Inventory Has Grown Sharply Over the Last Few Years



are those deployed on bases with operational short-range delivery systems. “Reserve/Nondeployed” warheads are those not deployed on launchers and in storage (weapons at bomber bases are considered deployed). The “military stockpile” includes active and inactive warheads that are in the custody of the military and earmarked for use by commissioned deliver vehicles. The “total inventory” includes warheads in the military stockpile as well as retired, but still intact, warheads in the queue for dismantlement.

Source: Hans M. Kristensen. Matt Korda, and Robert Norris, “Status of World Nuclear Forces,” 2023, Federation of American Scientists (FAS), March 29, 2023, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/,

SIPRI Estimate of Global Nuclear Forces in 2022



Note: The boundaries used in this map do not imply any endorsement or acceptance by SIPRI.

Source: SIPRI, *10. World Nuclear Forces*, https://www.sipri.org/yearbook/2022/10

SIPRI Estimate of World Nuclear Forces in 2022 - I

State	Year of first nuclear test	Deployed warheads[a]	Stored warheads[b]	Total stockpile[c]	Retired warheads	Total inventory
United States	1945	1 744[d]	1 964[e]	3 708	1 720[f]	5 428
Russia	1949	1 588[g]	2 889[h]	4 477	1 500[f]	5 977
United Kingdom	1952	120	60	180	45[i]	225[j]
France	1960	280	10[k]	290	..	290
China	1964	–	350	350	–	350
India	1974	–	160	160	..	160
Pakistan	1998	–	165	165	..	165
Israel	..	–	90	90	..	90
North Korea	2006	–	20	20	..	20[l]
Total		**3 732**	**5 708**	**9 440**	**3 265**	**12 705**

.. = not applicable or not available; – = nil or a negligible value.

Source: SIPRI, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022**, p 342,*** https://www.sipri.org/yearbook/2022/10

SIPRI Estimate of World Nuclear Forces in 2022 - II

Note: SIPRI revises its world nuclear forces data each year based on new information and
updates to earlier assessments. The data for Jan. 2022 replaces all previously published SIPRI
data on world nuclear forces.
a These are warheads placed on missiles or located on bases with operational forces.
b These are warheads in central storage that would require some preparation (e.g. transport
and loading on to launchers) before they could be deployed.
c Some states, such as the USA, use the official term ‘stockpile’ to refer to this subset of
warheads, while others, such as the UK, often use ‘stockpile’ to describe the entire nuclear
inventory. SIPRI uses the term ‘stockpile’ to refer to all deployed warheads as well as warheads
in central storage that could potentially be deployed after some preparation.
d This figure includes c. 1344 warheads deployed on ballistic missiles and c. 300 stored at
bomber bases in the USA, as well as c. 100 non-strategic (tactical) nuclear bombs deployed
outside the USA at North Atlantic Treaty Organization partner bases.
e This figure includes c. 100 non-strategic nuclear bombs stored in the USA.
f This figure is for retired warheads awaiting dismantlement.
g This figure includes c. 1388 strategic warheads deployed on ballistic missiles and
c. 200 deployed at heavy bomber bases.
h This figure includes c. 977 strategic and c. 1912 non-strategic warheads in central storage.
i This figure refers to retired warheads that have not yet been dismantled. It seems likely that
they will be reconstituted to become part of the UK’s total stockpile over the coming years (see
note j).
j The British government declared in 2010 that its nuclear weapon inventory would not
exceed 225 warheads. It is estimated here that the inventory remained at that number in Jan.
2022. A planned reduction to an inventory of 180 warheads by the mid 2020s was ended by a
government review published in 2021. The review introduced a new ceiling of 260 warheads.
k The 10 warheads assigned to France’s carrier-based aircraft are thought to be kept in central
storage and are not normally deployed.
l In previous editions of the SIPRI Yearbook, this figure referred to the number of nuclear
warheads that North Korea could potentially build with the amount of fissile material it has
produced. However, SIPRI’s estimate for Jan. 2022 is that North Korea has assembled up to
20 warheads. This is the first time that figures for North Korea have been included in the global
tot

Source: SIPRI, “10. World Nuclear Forces**,”** ***SIPRI Yearbook 2022, p 342,*** https://www.sipri.org/yearbook/2022/10

Guesstimating the Future: Open Source Report on U.S. Intelligence Estimate of balance for 1999 and 2020 made in 1999

Selected Worldwide Nuclear Weapons Inventories

Country	1999	2020
Russia*		
Strategic	8,200-10,600	1,600-2,800
Tactical	8,500-15,900	3,400-6,000
China		
ICBM	40-45	180-220**
SLBM	0-12	28-44
SRBM	100	150-200
India	10-15	50-70
Pakistan	25-35	60-80
Israel	60-80	65-85
North Korea***	1-2	10+
Iran		10-20
Iraq		10-20

Source is FAS, https://nuke.fas.org/guide/israel/nuke/ claimed to be excerpted from 160-page DIA report entitled The Decades Ahead: 199-2020, July 1999, p. 38. It was, first disclosed and reproduced in Rowan Scarborough, *Rumsfeld's War* (Regnery, 2004), pp. 194-223

Summary Comparisons of U.S. Russian, Chinese, European, Iranian, and North Korean Holdings of Enriched Uranium and Separate Plutonium

SIPRI Estimate of World Holdings of Separated Plutonium in 2021

State	Total stock (tonnes)[a]	In weapons/ available for weapons (tonnes)	Not directly available for weapons, unsafeguarded (tonnes)	Not available for weapons, monitored/ under safeguards (tonnes)	Military production status
China	2.9	2.9 ± 0.6	0.04[b]	–	Stopped in 1991
France	85.4	6 ± 1.0	–	79.4[c]	Stopped in 1992
India	9.2	0.71 ± 0.14	8.1 ± 4.3[d]	0.4	Continuing
Israel[e]	0.8	0.83 ± 0.1	–	–	Continuing
Japan	46.1	–	–	46.1[c]	–
Korea, North[f]	0.04	0.04	–	–	Continuing
Pakistan[g]	0.5	0.46 ± 0.16	–	–	Continuing
Russia	191	88 ± 8	88.3[h]	15[i]	Stopped in 2010
UK	119.3	3.2	116.1[c]	–	Stopped in 1995
USA[j]	87.8	38.4	46.4	3[k]	Stopped in 1988
Total[l]	**545**	**140**	**260**	**145**	

– = nil or a negligible value.

Note: See original source for footnotes and description of major uncertainties in the data.

Source: Moritz Kütt, Zia Mian and Pavel Podvig, International Panel on Fissile Materials, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, p 424-427,* https://www.sipri.org/yearbook/2022/10

SIPRI Estimate of World Holdings of Highly Enriched Uranium in 2021

State	Total stock (tonnes)[a]	In weapons/ available for weapons (tonnes)	Not directly available for weapons, unsafeguarded (tonnes)	Not available for weapons, monitored/ under safeguards (tonnes)	Production status
China	14	14 ± 3	–	–	Stopped 1987–89
France[b]	29	25 ± 6	–	3.8	Stopped 1996
India[c]	4.5	–	4.5 ± 1.9	–	Continuing
Iran[d]	0.02	–	0.02	–	Continuing
Israel[e]	0.3	0.3	–	–	Unknown
Korea, North[f]	Uncertain	–	–	–	Uncertain
Pakistan[g]	4	4 ± 1.2	–	–	Continuing
Russia[h]	678	672 ± 120	6[i]	–	Continuing[j]
UK[k]	23	22	0.6[l]	–	Stopped 1962
USA[m]	495	361	134	–	Stopped 1992
Other states[n]	~4	–	–	~4	. .
Total[o]	**1 250**	**1 100**	**145**	**10**	

. . = not available or not applicable; – = nil or a negligible value.

Note: See original source for footnotes and description of major uncertainties in the data.

Source: Moritz Kütt, Zia Mian and Pavel Podvig, International Panel on Fissile Materials, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, p 424-427,* https://www.sipri.org/yearbook/2022/10

SIPRI Estimate of Significant Global Uranium Enrichment Facilities and Capacity in 2021

State	Facility name or location	Type	Status	Enrichment process[a]	Capacity (thousands SWU/yr)[b]
Argentina[c]	Pilcaniyeu	Civilian	Uncertain	GD	20
Brazil	Resende	Civilian	Expanding capacity	GC	45
China[d]	Lanzhou	Civilian	Operational	GC	2 600
	Hanzhong (Shaanxi)	Civilian	Operational	GC	2 000
	Emeishan	Civilian	Operational	GC	1 050
	Heping	Dual-use	Operational	GD	230
France	Georges Besse II	Civilian	Operational	GC	7 500
Germany	Urenco Gronau	Civilian	Operational	GC	3 800
India	Rattehalli	Military	Operational	GC	15–30
Iran[e]	Natanz	Civilian	Limited operation	GC	3.5–10
	Qom (Fordow)	Civilian	Limited operation	GC	0.7–2
Japan	Rokkasho[f]	Civilian	Resuming operation	GC	75
Korea, North	Yongbyon[g]	Uncertain	Operational	GC	8
Netherlands	Urenco Almelo	Civilian	Operational	GC	5 200
Pakistan	Gadwal	Military	Operational	GC	. .
	Kahuta	Military	Operational	GC	15–45
Russia	Angarsk	Civilian	Operational	GC	4 000
	Novouralsk	Civilian	Operational	GC	13 300
	Seversk	Civilian	Operational	GC	3 800
	Zelenogorsk[h]	Civilian	Operational	GC	7 900
UK	Urenco Capenhurst	Civilian	Operational	GC	4 500
USA	Urenco Eunice	Civilian	Operational	GC	4 900

. . = not available or not applicable.

Note: See original source for footnotes and description of major uncertainties in the data.

Source: Moritz Kütt, Zia Mian and Pavel Podvig, International Panel on Fissile Materials, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, p 424-427,* https://www.sipri.org/yearbook/2022/10

Potential Role of U.S. and Russian Reserve/Non-Deployed Weapons in Redeploying Theater Nuclear and Dual-Capable Conventional and Nuclear Warheads

The Critical Potential Role of Reserve/Non-Deployed U.S. and Russian Weapons

Status of World Nuclear Forces 2023

Country	Deployed Strategic	Deployed Nonstrategic	Reserve/ Nondeployed	Military Stockpile[a]	Total Inventory[b]
Russia	1,674[c]	0[d]	2,815[e]	4,489	5,889[f]
United States	1,670[g]	100[h]	1,938[i]	3,708[j]	5,244[k]
France	240[l]	n.a.	50[l]	290	290
China	0[m]	n.a.	410	410	410[m]
United Kingdom	120[n]	n.a.	105	105	225[n]
Israel	0	n.a.	90	90	90[o]
Pakistan	0	n.a.	170	170	170[p]
India	0	n.a.	164	164	164[q]
North Korea	0	n.a.	30	30	30[r]
Total:[s]	**~3,704**	**~100**	**~5,772**	**~9,576**	**~12,512**

How to read this table: "Deployed strategic warheads" are those deployed on intercontinental missiles and at heavy bomber bases. "Deployed nonstrategic warheads" are those deployed on bases with operational short-range delivery systems. "Reserve/Nondeployed" warheads are those not deployed on launchers but in storage (weapons at bomber bases are considered deployed). The "military stockpile' includes active and inactive warheads that are in the custody of the military and earmarked for use by commissioned deliver vehicles. The "total inventory" includes warheads in the military stockpile as well as retired, but still intact, warheads in the queue for dismantlement.

Source: Hans M. Kristensen. Matt Korda, and Robert Norris, "Status of World Nuclear Forces," 2023, Federation of American Scientists (FAS), March 28, 2023, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/. .

The Uncertain Impact of Arms Control*

For a summary overview of the history of arms control, see Amy F. Wolf, Paul K. Kerr, and Mary Beth Nitikin; *Arms Control and Nonproliferation: A Catalog of Treaties and Agreements*, Congressional Research Service, Updated April 25, 2022

* The Uncertain Future of New Start

- **Russia Stops Sharing New START Data April 11, 2023**
  Russia terminates New START data exchanges with the United States. Facility for tactical nuclear weapons in Belarus to be completed by July, according to Russia. U.S. lawmakers want more nuclear weapons to counter China.

- **U.S. Cites Russian Noncompliance with New START Inspections February 9, 2023**
  U.S. determines Russian noncompliant with New START due to ongoing on-site inspections suspension and refusal to reschedule a required treaty meeting. Pentagon estimates Chinese nuclear arsenal climbs above 400.

- **U.S., Russia Discuss Threats of Nuclear Use November 17, 2022**
  Some senior Russian officials have discussed the potential use of tactical nuclear weapons in Ukraine, according to reports. The United States and Russia will meet soon for a meeting of New START's Bilateral Consultative Commission. Majority of G20 condemns Russian aggression in Ukraine and nuclear threats.

- **U.S., Russia Agree to Call for Negotiating New START Successor September 8, 2022**
  The United States and Russia agree to language supporting arms control talks on a successor to New START at the 10th review conference for the NPT. Moscow temporarily pauses New START on-site inspections. Washington sees no possibility of imminent Russian nuclear use.

- **U.S.-Russian Dialogue Remains Paused as Putin Wields Nuclear Threats July 19, 2022**
  This issue of the newsletter recaps developments related to arms control and disarmament since the beginning of 2022. This includes Russian President Vladimir Putin's threats to use nuclear weapons against any country seen as interfering in Ukraine, the pause of the U.S.-Russian dialogue to discuss future arms control, and the release of NATO's new strategic concept, naming Russia as its biggest threat.

Source: Arms Control Association, Nuclear Disarmament Monitor , March 2023, https://www.armscontrol.org/blogs/nuclear-disarmament-monitor. ;

* Other Cancelled or Suspended Nuclear-Related Arms Control Efforts

- **U.S. Announces will withdraw from Open Skies Treaty in Six Months:** May 27, 2020
- **U.S. Threatens to Withdraw from Open Skies Treaty:** October 17, 2019, stating that Russia has violated the treaty by imposing restrictions on certain flights over its territory.
- **NATO rejects a proposal from Russia regarding a moratorium on INF range missiles:** October 2019.
- **U.S. Withdraws from INF Treaty August 2, 2019,** stating Russia has not complied for years and has deployed the the SSC-8 or 9M729 ground-launched, intermediate-range cruise missile
- **Russia gives official notice of its suspension of the INF Treaty on March 20, 2019**. The United States is planning to flight-test two INF-Treaty range missiles this year.
- **United States withdraws from 1972 Anti-Ballistic Missile (ABM) Treaty on June 13, 2002. Announced withdrawal six months in advance on December 13, 2002.**
- **Comprehensive Test Ban Treaty signed 26 September 1996 is still in force for some states, but are major exceptions.** Eight states, including China, U.S. Egypt, Israel, and Iran have signed but not ratified. Ten state have not supported or ratified, including India, Pakistan, North Korea, Saudi Arabia, and Syria.
- **Treaty on Conventional Armed Forces in Europe** (**CFE**) was concluded during the last years of the Cold War and established comprehensive limits on key categories of conventional military equipment in Europe. It potentially could have limited conventional systems that could be used to delivery nuclear weapons. In 2007, Russia "suspended" its participation in the treaty, and on 10 March 2015, citing NATO's alleged *de facto* breach of the Treaty, Russia formally announced it was "completely" halting its participation in it as of the next day

Source: Adapted from Arms Control Association, Wikipedia, and Carnegie Endowment reporting

Arms Control Limits in START, Moscow Treaty, and New Start

Treaty	START (1991)	Moscow Treaty (2002)	New START (2010)
Limits on Delivery Vehicles	1,600 strategic nuclear delivery vehicles	No limits	800 deployed and nondeployed ICBM launchers, SLBM launchers, and heavy bombers equipped to carry nuclear weapons Within the 800 limit, 700 deployed ICBMs, SLBMs, and heavy bombers equipped to carry nuclear weapons
Limits on Warheads	6,000 warheads attributed to ICBMs, SLBMs, and heavy bombers 4,900 warheads attributed to ICBMs and SLBMs 1,100 warheads attributed to mobile ICBMs 1,540 warheads attributed to heavy ICBMs	1,700-2,200 deployed strategic warheads No sublimits	1,550 deployed warheads No sublimits
Limits on Throwweight	3,600 metric tons	No limit	No limit

Source: State Department fact sheets.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 35.

* U.S. and Russian Strategic Nuclear Arms Control Agreements

	SALT I	SALT II	INF Treaty	START I	START II	START III	SORT	START
Status	*Expired*	*Never Entered Into Force*	*Terminated*	*Expired*	*Never Entered Into Force*	*Never Negotiated*	*Replaced by New START*	*In Force*
Deployed Warhead Limit	N/A	N/A	N/A	6,000	3,000-3,500	2,000-2,500	1,700-2,200	1,550
Deployed Delivery Vehicle Limit	US: 1,764 ICBMs & SLBMs USSR: 2,568	2,250	Prohibits ground-based missiles of 500-5,500 km range	1,600	N/A	N/A	N/A	700
Date Signed	May 26, 1972	June 18, 1979	Dec. 8, 1987	July 31, 1991	Jan. 3, 1993	N/A	May 24, 2002	April 8, 2010
Date Ratified, U.S.	Aug. 3, 1972	N/A	May 28, 1988	Oct. 1, 1992	Jan. 26, 1996	N/A	March 6, 2003	Dec. 22, 2010
Ratification Vote, U.S.	88-2	N/A	93-6	93-6	87-4	N/A	95-0	71-26
Date Entered Into Force	Oct. 3, 1972	N/A	June 1, 1988	Dec. 5, 1994	N/A	N/A	June 1, 2003	Feb. 5, 2011
Implementation Deadline	N/A	N/A	June 1, 1991	Dec. 5, 2001	N/A	N/A	N/A	Feb. 5, 2018
Expiration Date	Oct. 3, 1977	N/A	Aug. 2, 2019	Dec. 5, 2009	N/A	N/A	Feb. 5, 2011	Feb. 5, 2026*

Source: Excerpted from Arms Control Association, Ukraine, Nuclear Weapons, and Security Assurances at a Glance, Feb 2022, https://www.armscontrol.org/factsheets/USRussiaNuclearAgreements

* Trends in U.S. & Russian Strategic Nuclear Forces Under New Start

BUREAU OF ARMS CONTROL, VERIFICATION AND COMPLIANCE

Fact Sheet

September 1, 2022

(The data in this Fact Sheet comes from the exchange of data required by the treaty. This data is current as of September 1, 2022.)

Category of Data	United States of America	Russian Federation
Deployed ICBMs, Deployed SLBMs, and Deployed Heavy Bombers	**659**	**540**
Warheads on Deployed ICBMs, on Deployed SLBMs, and Nuclear Warheads Counted for Deployed Heavy Bombers	**1420**	**1549**
Deployed and Non-deployed Launchers of ICBMs, Deployed and Non-deployed Launchers of SLBMs, and Deployed and Non-deployed Heavy Bombers	**800**	**759**

Source: U.S. State Department; Arms Control Association, The Three-Competitor Future: U.S. Arms Control With Russia and China, March 2023, https://www.armscontrol.org/act/2023-03/features/three-competitor-future-us-arms-control-russia-china; Note that the State Department description of inspection and verification measures in described in the "New Start Treaty," https://www.state.gov/key-topics-bureau-of-arms-control-verification-and-compliance/.

* Arms Control Association Estimate of U.S. Strategic Nuclear Forces Under New Start - III

On April 8, 2010, Russia and the United States signed the New Strategic Arms Reduction Treaty (New START). The treaty requires the sides to limit the number of deployed strategic nuclear warheads to no more than 1,550 and fielded delivery platforms to 700. The treaty also permits the United States and Russia to conduct 18 annual on-site inspections of facilities operated by the other country. Biannual data exchanges indicate the current state of their strategic forces. For a factsheet on Russian nuclear forces, click here.

Both the United States and Russia met these limits by the February 2018 deadline, and the limits will hold until February 2021.

As of March 1, 2022, the United States has 686 deployed strategic delivery systems, 1,515 deployed strategic warheads, and 800 deployed and non-deployed strategic launchers.

Under New START, the United States retains a deployed strategic force of up to 400 ICBMs, 60 nuclear-capable bombers, and 240 SLBMs.

- As of September 2020, the United States deploys 397 Minuteman III ICBMs, with 261 ICBMs in a non-deployed status, all of which have a single warhead. At any given time, an estimated 50 non-deployed silo launchers of ICBMs remain in a warm, operational status.
- Some bombers were converted to conventional-only missions (not accountable under New START), and 48 nuclear-capable bombers were deployed as of September 2020. Bombers are not on alert or loaded with weapons in peacetime, and New START counting rules allow each bomber to be counted as "one" deployed warhead, even though bombers can carry up to 16-20 nuclear weapons.
- The United States retains all 14 of its strategic nuclear submarines (SSBNs), although it reduced the number of SLBM launch tubes per SSBN from 24 to 20, for a total of 280 tubes across the entire fleet. Between two and four submarines are in dry dock at any given time. The United States deployed 230 submarine-launched ballistic missiles as of September 2020.

In addition to the treaty limit of 700 deployed systems, the treaty allows for 800 deployed and non-deployed missile launchers, and bombers. As of September 2020, the United States retains 454 deployed and non-deployed ICBM launchers, 280 deployed and non-deployed SLBM launchers, and 66 deployed and non-deployed heavy bombers.

The strategic forces that remain under the treaty are currently being upgraded or replaced. Over the 30 years, the administration plans to invest an estimated $1.7 trillion to modernize the nuclear weapons complex and nuclear delivery systems. For more on U.S. nuclear modernization, see U.S. Nuclear Modernization Programs.

Under New START, both sides release aggregate data on their stockpiles every six months.

	2017		2018	
	Delivery Vehicles	Est. Warheads	Delivery Vehicles	Est. Warheads
ICBMs				
Minuteman III	399 (as of Sept. 1, 2017)	N/A	400 (as of Feb. 2018)	400
SLBMs				
Trident II D5	212 (as of Sept. 1, 2017)	N/A	203 (as of Feb. 2018)	901
Strategic Bombers				
B-52H	38 (as of Sept. 1, 2017)	49	36 (as of Feb. 2018)	49
B-2A	11 (as of Sept. 1, 2017)		13 (as of Feb. 2018)	
Total Deployed	660 (as of Sept. 1, 2017)	1,393 (as of Sept. 1, 2017)	659 (as of Sept. 2018)	1,398 (as of Sept. 2018)

Arms Control Association, *U.S. Strategic Nuclear Forces Under New START*, April 2022, https://www.armscontrol.org/factsheets/USStratNukeForceNewSTART.

U.S. Nuclear Forces Under New Start

System	Total Launchers	Deployed Launchers	Warheads
Minuteman III ICBM	454	397	397
Trident (D-5) SLBM	280	230	1,012
B-52 bombers	46	36	36[a]
B-2 bombers	20	12	12[a]
Total	800	675	1,467

Source: U.S. Department of State. New START Treaty Aggregate Numbers of Strategic Offensive Arms, December 1, 2020.

[a] The treaty attributes one warhead to each deployed bomber, although they could carry up to 20 bombs or cruise missiles.

Source: Paul K. Kerr, Defense Primer: Strategic Nuclear Forces, Congressional Research Service, IF10519, February 2,2023, p. 1.

U.S. Strategic Nuclear Forces Under START I and START II

	Deployed under START I (2001)		Planned for START II (2003)	
System	Launchers	Accountable Warheads[a]	Launchers	Accountable Warheads
Minuteman III ICBMs	500	1,200	500	500
Peacekeeper ICBMs	50	500	0	0
Trident I Missiles	168	1,008	0	0
Trident II Missiles	264	2,112	336	1,680
B-52 H Bombers (ALCM)	97	970	76	940
B-52 H Bombers (non-ALCM)	47	47	0	0
B-1 Bombers[b]	90	90	0	0
B-2 Bombers	20	20	21	336
Total	**1,237**	**5,948**	**933**	**3,456**

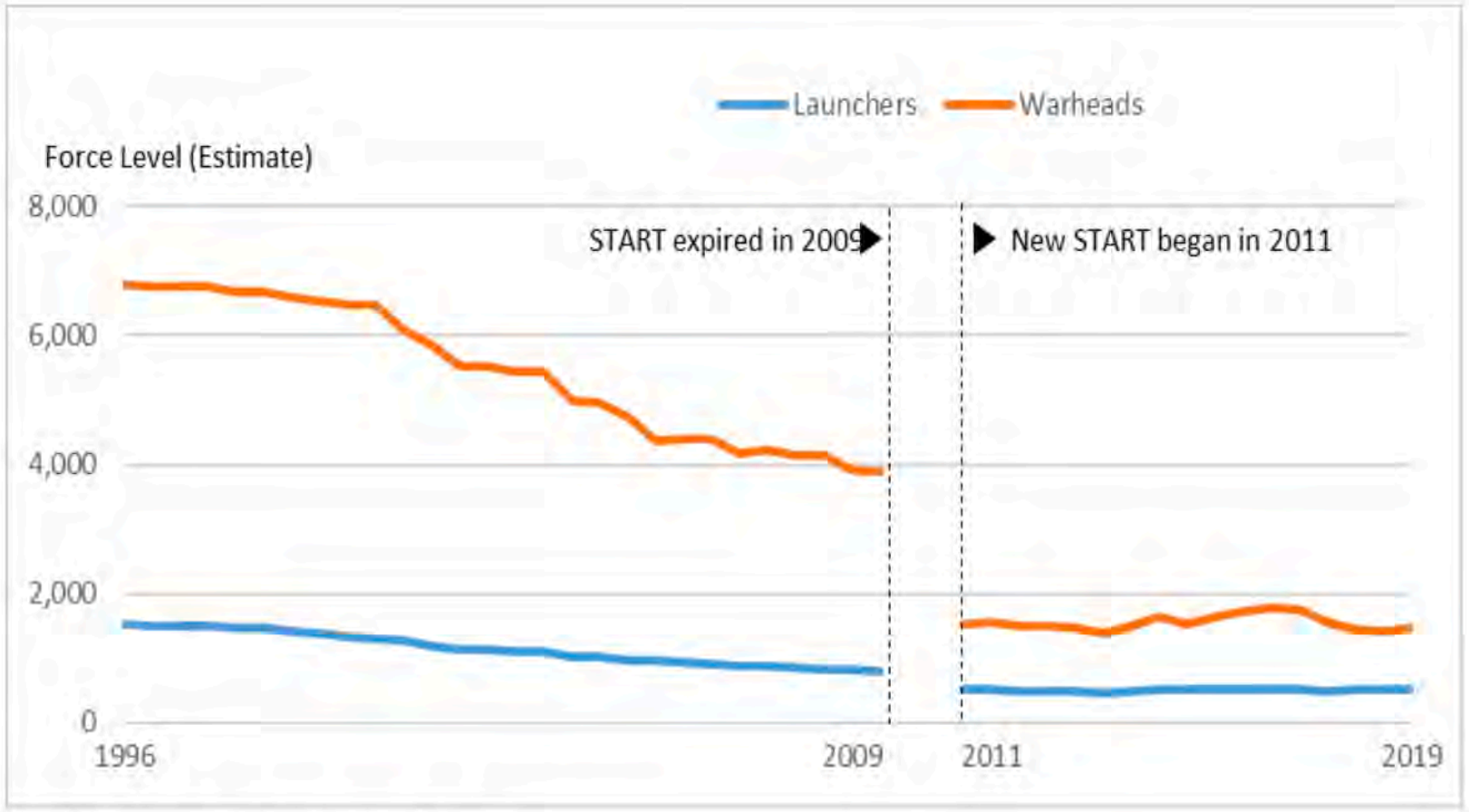
Source: U.S. Department of State and CRS estimates.

a. Under START I, bombers that are not equipped to carry ALCMs count as one warhead, even if they ca carry up 16 nuclear bombs; bombers that are equipped to carry ALCMs count as 10 warheads, even if t can carry up to 20 ALCMs.

b. Although they still counted under START I, B-1 bombers are no longer equipped for nuclear missions.

Source: Amy F. Woolf, *U.S. Strategic Nuclear Forces,: Background, Developments, and Issues*, Congressional Research Service, RL33640, December 14, 2021, pp. 6

Russian Strategic Forces and Arms Control START: 1994-2009, New START: 2011-2019



Source: State Department Fact Sheets.

Notes: The break in the graph between 2009 and 2011 reflects the fact that START expired in 2009 and New START entered into force in 2011. Although the Moscow Treaty remained in force during that time, the two parties did not exchange data under that treaty.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 35

U.S. Nuclear Forces

Posture Review - U.S. Nuclear Forces Modernization Plan as of October 2022

Land-Based Forces

- **Fully fund Sentinel ICBM replacement program as called for in 2023-2027 Future Year Defense Program**
- **Sentinel will replace Minuteman III on one-for-one basis. $00 ICBMs on alert.**
- **Sentinel will field W88-0/Mk21 and W87 1/Mk21A warheads & aeroshells.**
- **Any alternative to the Sentinel program extending life of MMIII increases risk and cost**

Sea-Based Forces

- **Fully Columbia-Class SSBN program to deliver a minimum of 12 boats to relace the Ohio-class fleet beginning in 2030.**
- **Prioritize near-term investment in submarine industrial base and Ohio-class sustainment to completion of the Columbia-calls transition.**
- **Prioritize near-term investment in the Trident II D5 strategic nuclear weapon system.**
- **Continue W93 warhead program. Continue to support UK with its warhead replacement program, common missile compartment, and Mk7 aeroshell.**

Air-Based Forces

- **Modernize theB-52H bomber fleet through 2050 as a nuclear standoff force with global reach.**
- **Fully fund the B-21 bomber to replace the B-2A, and acquire a minimum of 100 B-21 bombers.**
- **Fully fund the long-range standoff weapon and associate W80-4 warhead to replace the Air-Launched Cruise Missile.**
- **Retire the B83-1 gravity bomb. Leverage existing capabilities in the near- term and develop an enduring capability for improved defeat of Hard and Deeply Buried Targets.**

Supplemental Capabilities

- **Retain the W76-2 low yield Submarine Launched Ballistic Missile option and periodically reassess its deterrent value.**
- **Cancel the nuclear-armed Sea-Launched Cruise Missile Program. m**
- **Continue nuclear certification of the F-35A fighter and transition from the F-15E to the F-35A to support the NAQTO nuclear mission.**
- **Replace B61-3/4/7 nuclear gravity bombs with life-extended B61-12.**

Source: Adapted from 2022 Nuclear Posture Review, DoD web site, October 27, 2022, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF

Posture Review - U.S. Shifts in Nuclear Strategy and Forces: Plan as of October 2022

Adopt a strategy and declaratory policy that maintain a very high bar for nuclear employment while assuring Allies and partners, and complicating adversary decision calculus.

Adopt an integrated deterrence approach that works to leverage nuclear and non-nuclear capabilities to tailor deterrence under specific circumstances.

Field and maintain strategic nuclear delivery systems and deployed weapons in compliance with New START Treaty central limits as long as the Treaty remains in force. We will continue to deploy a nuclear triad and are fully committed to the programs that will begin to field modernized systems later this decade. Programs are also being executed to modernize U.S.DCA, the nuclear weapons stockpile, the NC3 architecture, and the weapons production infrastructure.

Clearly convey to the PRC that the United States will not be deterred from defending our Allies and partners, or coerced into terminating a conflict on unacceptable terms. Forces that provide this flexibility include the W76-2 low yield submarine- launched ballistic missile warhead, globally-deployable bombers, dual-capable fighter aircraft, and air-launched cruise missile

Deter theater attacks and nuclear coercion of Allies and partners, by bolstering the Triad with capabilities that strengthen regional deterrence, such as F-35A dual-capable fighter aircraft (DCA) equipped with the B61-12 bomb; the W76-2 warhead; and the Long-Range Standoff (LRSO) weapon.

Eliminate “hedge against an uncertain future” as a formal role of nuclear weapons.

Take steps to strengthen extended deterrence and Allied assurance.

Pursue enhanced security through arms control, strategic stability, non-proliferation, and reducing the risks of miscalculation.

Affirm full-scope Triad replacement and other nuclear modernization programs, including NC3.

Retire the B83-1 gravity bomb.

Cancel the nuclear-armed Sea-Launched Cruise Missile (SLCM-N) program.

Deliver a modern, adaptive nuclear security enterprise based on an integrated strategy for risk management, production-based resilience, science and technology innovation, and workforce initiatives.

Source: Data for October 2022 are excerpted from *2022 Nuclear Posture Review*, DoD web site, October 27, 2022, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF

Arms Control Association - Other Aspects of US Modernization Plans as of January 2022

The U.S. nuclear modernization effort also includes:

Modernized Strategic Delivery Systems: Existing delivery systems are undergoing continual modernization, including complete rebuilds of the Minuteman III ICBM and Trident II SLBM. The service lives of the Navy's 14 Trident Ohio-class ballistic missile submarines are being extended. Additionally, a new submarine, the Columbia-class, which will replace the Ohio-class ballistic missile submarines, is undergoing development and is expected to cost $127 billion to acquire the 12-ship class…The B-2 strategic bomber, a relatively new system, is being upgraded, as is the B-52H bomber. The Air Force is also planning a new strategic bomber, the B-21 Raider, and a new nuclear-capable cruise missile, known as the Long-Range Standoff Weapon (LRSO) to replace the existing Air-Launched Cruise Missile (ALCM).

Refurbished Nuclear Warheads: The U.S. stockpile of nuclear warheads and bombs is continually refurbished through NNSA's Life Extension Program (LEP). Existing warheads are certified annually to be safe and reliable. The NNSA is currently pursuing a controversial and expensive plan to refurbish or replace nearly every warhead type in the stockpile.

Modernized Production Complex: The nuclear weapons production complex is being modernized as well, with new facilities planned and funded. For example, the FY 2021 NNSA budget request includes $750 million for the Uranium Processing Facility (UPF) at Oak Ridge, Tennessee. The total construction cost for UPF is estimated at $6.5 – 7.5 billion, according to an independent study conducted by the Corps of Engineers, although some estimates put the price tag at $11 billion. NNSA has has pledged to complete construction by 2025 at a price tag of no more than $6.5 billion.

Command and Control Systems: The Defense Department maintains command, control, communications, and early-warning systems that allow operators to communicate with nuclear forces, issue commands that control their use, and detect or rule out incoming attacks. The 2018 NPR calls for placing greater attention and focus on sustaining and upgrading command and control capabilities. The CBO estimates that the Pentagon will need to spend $77 billion on these activities between FY 2019 and FY 2028 in order to implement the department's plans.

Source: Excerpted and adapted from Shannon Bugos, "Nuclear Modernization Program Fact Sheet," Arms Control Association, https://www.armscontrol.org/factsheets/USNuclearModernization#snapshot.

Shifts in U.S. Nuclear Strategy ad Key U.SA. Modernization Activities: STRATCOM Posture Statement in 2023

For the first time in our country's history, the United States faces two major nuclear powers, the PRC and the Russian Federation, which have the capability to employ nuclear coercion as a way to achieve their national objectives. Russia presents a growing nuclear deterrence challenge centered on its potential perception that the threshold for regional nuclear employment is lower with low-yield systems.

The PRC is also developing capabilities that would present a similar deterrence challenge, and it is unconstrained by any nuclear arms control treaty limitations. Additionally, the activities of the Democratic People's Republic of Korea (DPRK) are regionally destabilizing and have global implications.

In the longer term, emerging technologies—including HSWs, fractional orbital bombardment (FOB) capabilities, anti-satellite capabilities, artificial intelligence (AI), autonomous systems, advanced computing, quantum information sciences, biotechnology, and advanced materials and manufacturing—pose a growing challenge to our national defense. Meeting these near-term and longer-term threats requires a globally focused national strategy and commitment that spans decades.

…The nuclear triad is the foundation of U.S. national security, and I thank Congress for fully funding our modernization programs: Sentinel intercontinental ballistic missile (ICBM), COLUMBIA-class submarine, D5 submarine launched ballistic missile (SLBM) second life extension and modernization (D5 LE2), B-21 Raider bomber, and Long Range Standoff (LRSO) cruise missile. In addition to these systems, the U.S. must continue investment in sustainment of current systems and critical capabilities that support and complement the nuclear triad.

These include nuclear weapons infrastructure overseen by the National Nuclear Security Administration (NNSA), NC3, nuclear security, and long-range conventional strike capabilities such as hypersonic weapons (HSWs). Alongside capability is capacity. We must expand our critical munitions stockpiles while working with manufacturers to make the defense industrial base as responsive as possible.

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Statement of Anthony J. Cotton . Commander, U.S. Strategic Command, before the House Armed Services Committee on Strategic Forces, March 8, 2023, https://www.stratcom.mil/Portals/8/Documents/2023%20USSTRATCOM%20Congressional%20Posture%20Statement.pdf?ver=bFFdbYI2D5Tju5nPNsebbw%3d%3d .

CRS - U.S. Nuclear Modernization of ICBMs and Warheads: 2023

Before implementing the New START Treaty, the United States deployed 450 Minuteman III ICBMs at three Air Force bases: F.E. Warren AFB in Wyoming, Malmstrom AFB in Montana, and Minot AFB in North Dakota.

Under New START, the number has declined to 400 deployed missiles, although the Air Force has retained all 450 silo launchers. While each Minuteman III missile originally carried three warheads, each now carries a single warhead, both to reduce U.S. forces to New START levels and to adopt what is considered a more stabilizing posture.

The Air Force has completed several programs designed to improve the accuracy and reliability of the Minuteman fleet and to "support the operational capability ... through 2030." The Air Force is also developing a new ICBM, the Ground-based Strategic Deterrent (GBSD), which will replace all missiles and ground launch control facilities. It plans to acquire 642 missiles to support testing and the deployment of a force of 400 missiles. The Air Force expects the program to reach its initial operational capacity, with 9 missiles on alert, by 2029; it expects to complete the deployment, with 400 missiles on alert, in 2036.

The Biden Administration has included $3.6 billion for the program in its FY2023 budget request. The National Nuclear Security Administration (NNSA), a semi-autonomous agency in the Department of Energy, is working on a new warhead—known as the W87-1—that will deploy on the new GBSD missile.

Source: Paul K. Kerr, Defense Primer: Strategic Nuclear Forces, Congressional Research Service, IF10519, February 2,2023, pp. 1-2.

CRS - U.S. Nuclear Modernization of SLBMs and Warheads: 2023

The United States currently has 14 Trident (Ohio-class) ballistic missile submarines, with 2 in overhaul and 12 in the operational fleet. Under New START, each submarine carries only 20, rather than the original 24, missiles. Using treaty counting rules, the 14 submarines count as a total of 280 deployed and nondeployed launchers, with a maximum of 240 deployed launchers and around 1,000 warheads counting on the 12 operational submarines. The Navy operates two bases for these submarines—one in Bangor, WA, and one in Kings Bay, GA.

The Navy plans to begin retiring Ohio-class submarines in 2027, with the new Columbia-class submarine expected to begin entering the fleet in 2031. The Navy has recently indicated that the fleet of 12 new submarines will cost $139 billion. It has requested $6.3 billion for the Columbia-class submarine in its FY2023 budget.

The Navy purchased over 530 D-5 missiles to support the Trident fleet. It has pursued a life-extension program for the missiles, funded at about $1 billion per year, so that they will remain capable and reliable into the deployment of a new, Columbia-class submarine. It has also initiated a second life extension program for these missiles, known as the D5LE II, and has included $173 million in its budget request for FY2023.

NNSA is also working to extend the life of the warheads carried by U.S. SLBMs. It has conducted a life extension program (LEP) for the W76 warhead, which is carried by most Trident missiles, and provided a small number of low- yield warheads, known as the W76-2, to the Navy in late 2019. NNSA is also altering the W88 warhead, which is carried by a portion of the fleet, to address concerns with its safety and reliability. In particular, the program will replace the aging arming, fusing, and firing components. It has also initiated work on the W93 warhead, which will eventually deploy on D-5 missiles

Source: Paul K. Kerr, Defense Primer: Strategic Nuclear Forces, Congressional Research Service, IF10519, February 2,2023, pp. 1-2.

CRS -U.S. Nuclear Modernization of Heavy Bombers and Warheads: 2023

The Air Force has 20 B-2 bombers, based at Whiteman AFB in Missouri. The B-2 bomber can carry both B61 andnB83 nuclear bombs, but it is not equipped to carry cruise missiles. It can also carry conventional weapons and has participated in U.S. military campaigns from Bosnia to Iraq. The Air Force maintains 76 B-52H bombers at two bases, Barksdale, LA, and Minot, ND. The B-52 bomber, which first entered service in 1961, is equipped to carry nuclear or conventional air-launched cruise missiles (ALCMs). The B- 52 bombers can also deliver a wide range of conventional arms, and are currently receiving numerous upgrades to their communications and electronics systems.

The Air Force is also acquiring a new B-21 bomber, for both conventional and nuclear missions. It hopes to field between 80 and 100 of the new bombers, with the first to enter service around 2025. The Air Force has included $5 billion for this bomber in its FY2023 budget request.

According to unclassified estimates, the United States has around 475 B61 and B83 bombs. Several variants of the B61 bomb are undergoing a life extension program (LEP), to enhance the bomb's safety, security, and use control features. This program will produce a single variant, known as the B61-12, which will deploy with a new tail kit. This will replace the parachute currently used to slow the bomb's descent and will improve its accuracy. NNSA estimates that the B61 LEP will cost nearly $9 billion, with an additional $1-$2 billion in Air Force funding for the new tail kit. The new model is expected to begin to enter the force in 2022.

NNSA had planned to retire the B83, the largest bomb remaining in the U.S. arsenal, around 2025, after the completion of the B61 LEP. The 2018 NPR supported plans to retain the B83, but the 2022 NPR also announces retirement of the weapon.

The Air Force is planning to replace the aging air-launched cruise missiles carried by B-52 bombers with a new advanced Long Range Standoff (LRSO) cruise missile. According to the Air Force, the existing ALCM has been through several life extension programs and is beginning to show reliability problems. Reports indicate that the Air Force plans to buy a total of 1,000-1,100 LRSO missiles, at a cost of around $10.8 billion. It has included $1 billion for the missile in its FY2023 budget request. NNSA is also conducting a life-extension program on the W80 warhead to provide a warhead for the new LRSO.

Source: Paul K. Kerr, Defense Primer: Strategic Nuclear Forces, Congressional Research Service, IF10519, February 2,2023, pp. 1-2.

US Nuclear Weapons Modernization: House of Commons Library – I: 2022

The 2022 Nuclear Posture Review (NPR) sets out the current nuclear policies of the US Administration. An unclassified version of the NPR is still awaited but it is thought to place greater reliance on disarmament and US leadership on arms control than the previous NPR led by the Trump administration. Despite considerable progress in bilateral arms control since the 1970s, the United States still deploys an extensive nuclear force and is in the process of modernizing and replacing its nuclear capabilities.

- As of January 2022, the total US nuclear stockpile was estimated at 5,428 warheads. Of those 3,708 are operational (strategic and non-strategic). A further 1,720 warheads are awaiting dismantlement.
- Under the US-Russian New START treaty, the number of deployed strategic warheads must not exceed 1,550. New START was extended in February 2021 for a further five years.
- Non-strategic warheads are not currently subject to any arms control limitations.
- US forces are organized on the nuclear triad principle.
- A portion of nuclear forces are maintained on day-to-day alert and the US adopts the practice of open ocean targeting of its strategic nuclear forces.
- The US retains a first-use option.

…The US is undertaking an extensive modernization program across every element of the nuclear triad. The US nuclear program is estimated to cost $634 billion over the next decade, of which $188 billion will be spent on weapons modernization. In 2017, the Congressional Budget Office estimated that the US modernization program would cost at least $1.2 trillion over the next 30 years. On the basis of the existing modernization plan, and the Biden administration's budget request for 2023, the Pentagon's modernization priorities are s:

1. • A new class of SSBN (the Columbia class submarine) which will replace the current Ohio class from October 2030 onwards. Twelve new SSBN are planned and will be equipped with 16 missiles tubes, as opposed to the current 24 (although only 20 are operational). Construction of the first vessel started in September 2020. $6.3 billion has been requested for FY2023, but the current estimated cost of the total program is $111.9 billion (including research and development), or an average of $9.35 billion per submarine).53 It will be the Pentagon's third largest procurement program and is expected to consume around 40% of the US Navy's shipbuilding budget. On 9 December 2020, the Pentagon published its 30-year shipbuilding plan in which fully funding the Columbia class program was identified as the main priority. The Columbia class will initially be deployed with the upgraded Trident II D5 missile. That missile was expected to be replaced by a new SLBM. In 2021 however, the US Navy confirmed that a second service-life extension program (D5LE2) of the Trident II D5 would be undertaken to maintain the missile in service until 2084 and the end of the service life of the Colombia class SSBN.
2. A new long-range strategic bomber (B-21 Raider) for deployment in the mid-2020s. Current expectations are for a fleet of at least 100 aircraft, although the final total may be higher. The 2023 budget request for the program is $5 billion. On the basis of initial US Air Force estimates (uprated to current prices), the total cost of the program is estimated at $73 billion. Independent estimates have, however, said the cost could be at least $110 billion.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance*: *United States*, House of Commons Library, July 28, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9082/CBP-9082.pdf.

US Nuclear Weapons Modernization: House of Commons Library – II : 2022

- The new bomber will be equipped with the new B61-12 guided stand-off nuclear gravity bomb. The B61-12 entered full scale production in May 2022 and is expected to be completed in 2026,56 at a cost of $8-9 billion. The B61-12 will also be deployed in Europe in the mid-2020s. Initially it will be retrofitted to existing F-15, F-16 and Tornado aircraft but will eventually arm US F-35 aircraft once they are deployed.
- A new long-range standoff (LRSO) cruise missile will also be deployed on both the new B-21 Raider and the Air Force's existing B2-A and B-52H strategic bombers. The Air Force plans to procure approximately 1,000 LRSO missiles, of which half will be nuclear armed, for deployment in 2030. Total acquisition cost, including research and development, is currently estimated at $14 billion.
- A next-generation ICBM (the Ground Based Strategic Deterrent program) which will replace the Minuteman III, and associated command and control infrastructure from 2028. The GBSD has been designated the LGM-35A Sentinel and will be capable of carrying single or multiple warheads. It is expected to achieve full operational capability in 2036. The new missile is expected to have greater range that the current Minuteman, making it theoretically possible to target, not only Russia, but also China, North Korea and Iran from the continental US.
- Under current plans replacement of the Minuteman III and rebuilding the existing infrastructure is expected to cost in the region of $95 - $140 billion over the next 30 years. It will provide the US with a nuclear ICBM capability well into the 2070s. There has been controversy over the Pentagon's handling of the program after Boeing dropped out in July 2019 citing unfair competition. That decision left Northrop Grumman as the sole bidder. In September 2020 the US Air Force awarded an initial $13.3 billion manufacturing contract to the company.

In support of these plans, a number of nuclear warhead programs are also underway by the National Nuclear Security Administration (NNSA). In its 2023 budget request the NNSA has identified $21.4 billion of required funding, including:

- $162 million for the W88 Alteration 370 program for the Trident II D5 missile.
- $672 million for the B61-12 LEP (see above)
- $1.1 billion for the W80-4 LEP, which will provide a warhead for the long- range stand-off cruise missile (LRSO) program.
- $680 million for the W87-1 warhead, which will arm the Sentinel ground based strategic deterrent. The total projected cost of that program is $14.8 billion1
- $241 million for the new W-93 warhead and $97.1 million for its Mk7 re- entry vehicle, which would be deployed on the Trident II D5 from the mid- 2030s. The W-93 will eventually replace the W-76 and the W-88. At an estimated $14 billion in total, the W-93 will be the Navy's third submarine-launched warhead program. As such it has been labelled by many analysts as unnecessary. Crucially, however, work on the W-93 program will support the UK's own replacement warhead program.

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance*: *United States*, House of Commons Library, July 28, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9082/CBP-9082.pdf.

U.S. Nuclear Weapons: 1960- 2021

Figure 1. U.S. Strategic Nuclear Weapons: 1960-1990

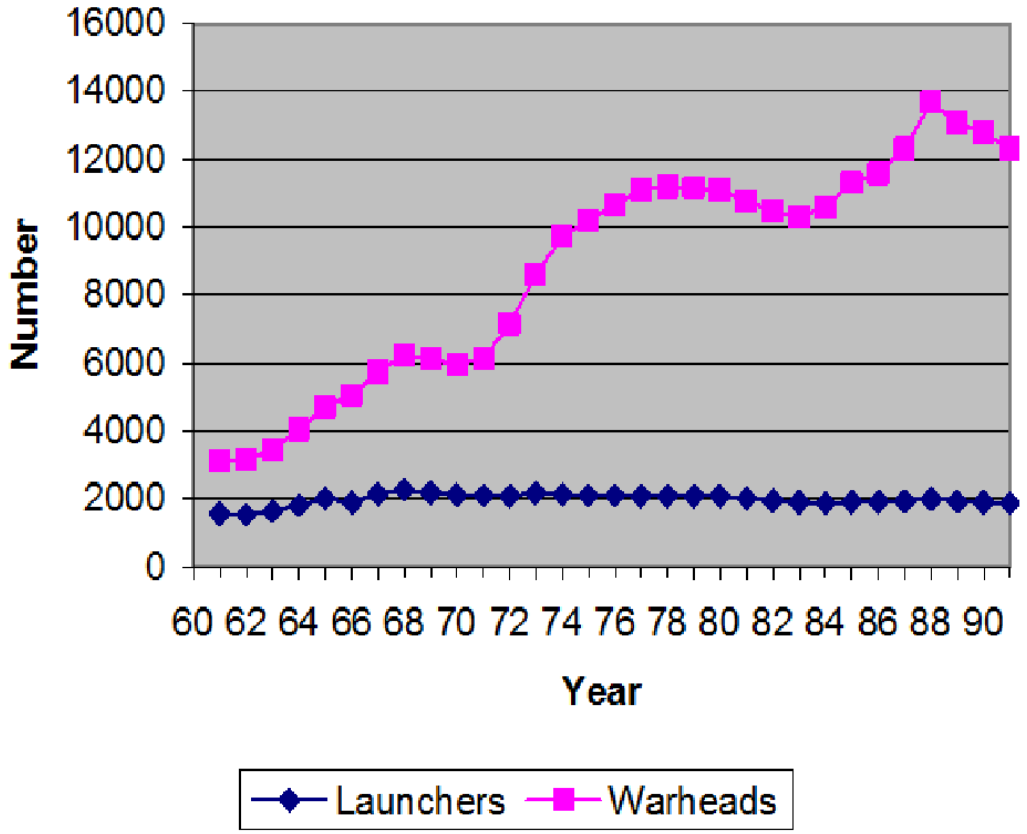
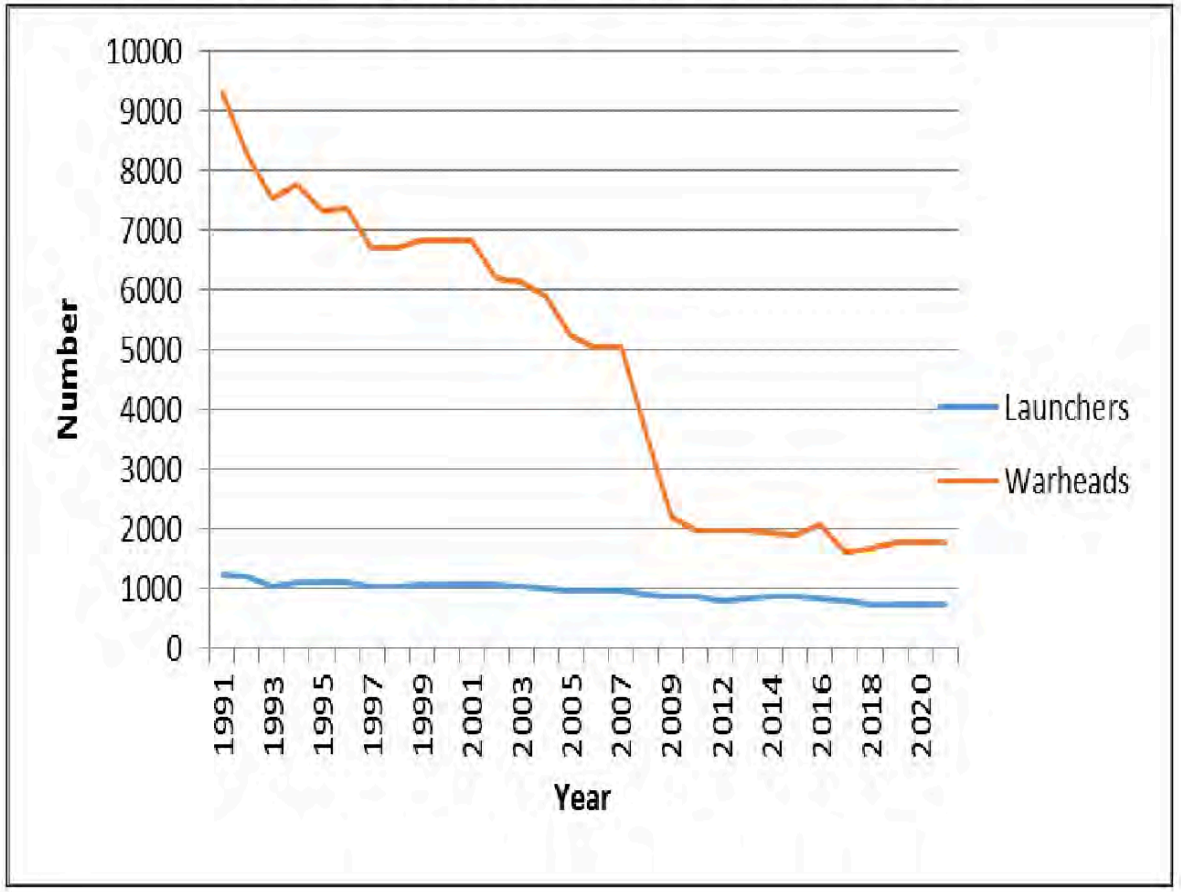


Figure 2. U.S. Strategic Nuclear Forces: 1991-2020



Source: Amy F. Woolf, *U.S. Strategic Nuclear Forces,: Background, Developments, and Issues*, Congressional Research Service, RL33640, December 14, 2021, pp. 3

US: IISS Estimate of Strategic Nuclear and Defense Forces in 2023 - I

US Strategic Command
HQ at Offutt AFB (NE)

US Navy
SUBMARINES • STRATEGIC • SSBN 14 *Ohio* with up to 20 UGM-133A *Trident* D-5/D-5LE nuclear SLBM, 4 single 533mm TT with Mk 48 ADCAP mod 6/7 HWT

US Air Force • Global Strike Command FORCES BY ROLE
MISSILE
9 sqn with LGM-30G *Minuteman* III **BOMBER**
5 sqn with B-52H *Stratofortress*
2 sqn with B-2A *Spirit* (+1 ANG sqn personnel only)
SURFACE-TO-SURFACE MISSILE LAUNCHERS ICBM • Nuclear 400 LGM-30G *Minuteman* III (1 Mk12A or Mk21 re-entry vehicles per missile)

AIRCRAFT
BBR 66: 20 B-2A *Spirit*; 46 B-52H *Stratofortress*
AIR-LAUNCHED MISSILES ALCM • Nuclear AGM-86B

Strategic Defenses – Early Warning
RADAR
NORTH WARNING SYSTEM 50: 14 AN/FPS-117;
36 AN/FPS-124
SOLID STATE PHASED ARRAY RADAR SYSTEM (SSPARS) 5 AN/FPS-132 Upgraded Early Warning Radar located at Beale AFB (CA), Cape Cod SFS (MA), Clear SFS (AK), Thule AB (GL) and RAF Fylingdales (UK)
SPACETRACK SYSTEM 7: 1 AN/FPS-85 Spacetrack Radar at Eglin AFB (FL); 6 contributing radars at Cavalier SFS (ND), Clear SFS (AK), Thule AB (GL), RAF Fylingdales (UK), Beale AFB (CA) and Cape Cod SFS (MA); 3 Spacetrack Optical Trackers located at Socorro (NM), Maui (HI), Diego Garcia (BIOT) **PERIMETER ACQUISITION RADAR ATTACK CHARACTERISATION SYSTEM (PARCS)** 1 AN/ FPQ-16 at Cavalier SFS (ND)
DETECTION AND TRACKING RADARS 5 located at Kwajalein Atoll, Ascension Island, Australia, Kaena
Point (HI), MIT Lincoln Laboratory (MA)
GROUND BASED ELECTRO OPTICAL DEEP SPACE SURVEILLANCE SYSTEM (GEODSS) Socorro (NM), Maui (HI), Diego Garcia (BIOT)
AIR DEFENCE
6 SAM bde
STRATEGIC DEFENCES – MISSILE DEFENCES SEA-BASED: *Aegis* engagement cruisers and destroyers **LAND-BASED**: 40 ground-based interceptors at
Fort Greely (AK); 4 ground-based interceptors at Vandenburg SFB (CA)

US: IISS Estimate of Strategic Nuclear and Defense Forces in 2023 - II

Space
EQUIPMENT BY TYPE SATELLITES 144
COMMUNICATIONS 47: 6 AEHF; 6 DSCS-III; 2 *Milstar*-I; 3 *Milstar*-II; 5 MUOS; 5 SDS-III; 2 SDS-IV; 1 *TacSat*-4; 1 *TacSat*-6; 6 UFO; 10 WGS SV2 **POSITIONING, NAVIGATION & TIMING** 30: 12 NAVSTAR Block IIF; 7 NAVSTAR Block IIR; 7 NAVSTAR Block IIRM; 4 NAVSTAR Block III **METEOROLOGY/OCEANOGRAPHY** 4 DMSP-5
ISR 14: 5 FIA *Radar*; 5 *Evolved Enhanced/Improved Crystal* (visible and infrared imagery); 2 NRO L-71; 2 NRO L-76 **ELINT/SIGINT** 31: 6 *Mentor* (advanced *Orion*); 2 *Mercury*; 2 *Nemesis*; 1 *Sharp* (NRO L-67); 3 *Trumpet*; 4 Improved *Trumpet*; 12 Naval Ocean Surveillance System (NOSS); 1 NRO L-85
SPACE SURVEILLANCE 8: 6 GSSAP; 1 SBSS (Space Based Surveillance System); 1 ORS-5
EARLY WARNING 10: 4 DSP; 6 SBIRS *Geo*
REUSABLE SPACECRAFT 1 X-37B OTV **COUNTERSPACE • EW** Counter Communications System (CCS)

Source: Adapted from IISS, *Military Balance, 2023*, "United States"

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United States: Bulletin of Atomic Scientists 2023 - I

Table 1. United States nuclear forces, 2023.

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]
SLBMs				
UGM-133A Trident II D5/LE	14/280[g]			
Mk4A		2008[h]	1–8 W76-1 x 90 (MIRV)	1,511[i]
Mk4A		2019	1–2 W76-2 x 8 (MIRV)[j]	25[k]
Mk5		1990	1–8 W88 x 455 (MIRV)	384
Total	**14/280**			1,920[l]
Bombers				
B-52H Stratofortress	87/46[m]	1961	ALCM/W80-1 x 5–150	500
B-2A Spirit	20/20	1994	B61-7 x 10–360/-11 x 400 B83-1 x low-1,200	288
Total	**107/66**[n]			788[o]
Total strategic forces				3,508
Nonstrategic forces				
F-15E, F-16C/D, DCA	n/a	1979	1–5 B61-3/-4 bombs x 0.3–170[p]	200
Total				200[q]
Total stockpile				**3,708**
Deployed				1,770[r]
Reserve (hedge and spares)				1,938
Retired, awaiting dismantlement				**1,536**
Total Inventory				**5,244**

U.S.: Bulletin of Atomic Scientists 2023 - II

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]The 200 Mk21-equipped ICBMs can each carry one W87. The estimated 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]The first figure is the total number of nuclear-powered ballistic missile submarines (SSBNs) in the US fleet; the second is the maximum number of missiles that they can carry. All 14 SSBNs have now completed their mid-life reactor refueling overhauls and could potentially carry 280 missiles, but 2–4 are undergoing repairs at any given time and the Pentagon has stated that no more than 240 SLBMs will be deployed. The life-extended Trident II D5LE 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 now been replaced on ballistic missile submarines by W76-1 warheads, but some are still in storage, and more have been retired and are awaiting dismantlement.

[j]The W76-2 is a single-stage low-yield modification of the W76-1 with an estimated yield of 8 kilotons.

[k]Assumes two SLBMs, each with one W76-2, available for each deployable SSBN.

[l]Of these SLBM warheads, approximately 1,000 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), but normally only about 50 nuclear bombers are deployed, with the remaining aircraft in overhaul.

[o]Of these bomber weapons, up to 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 weapons are in long-term storage. B-52H aircraft 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-16MLU, PA-200). The maximum yield of the B61-3 is 170 kilotons, while the maximum yield of the B61-4 is 50 kilotons.

[q]An estimated 100 B61-3 and –4 bombs are deployed in Europe, of which about 60 are earmarked for use by NATO aircraft. The remaining 100 bombs are in central storage in the United States as backup and contingency missions in the Indo-Pacific region. The new B61-12 gravity bomb is in production and will begin replacing the older versions in Europe and the United States from early-2023.

[r]Deployed warheads include approximately 1,370 on ballistic missiles (400 on ICBMs and 970 on SLBMs), 300 weapons at heavy bomber bases, and 100 nonstrategic bombs deployed in Europe.

Source: Hans M. Kristensen, Matt Korda,, **Nuclear Notebook: United States nuclear weapons, 2023, https://thebulletin.org/premium/2023-01/nuclear-notebook-united-states-nuclear-weapons-2023/#post-heading /.**

SIPRI Estimate of US Nuclear Forces in 2022 - I

All figures are approximate and some are based on assessments by the authors.

Type	Designation	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield	No. of warheads[b]
Strategic nuclear forces		**746**				**3 508**[c]
Aircraft (bombers)		*107/66*[d]				*788*[e]
B-52H	Stratofortress	87/46	1961	16 000	20 x AGM-86B ALCMs 5–150 kt[f]	500[g]
B-2A	Spirit	20/20	1994	11 000	16 x B61-7, -11, B83-1 bombs[h]	288
Land-based missiles (ICBMs)		*400*				*800*[i]
LGM-30G Minuteman III						
	Mk12A	200	1979	13 000	1–3 x W78 335 kt	600[j]
	Mk21 SERV	200	2006	13 000	1 x W87 300 kt	200[k]
Sea-based missiles (SLBMs)		*14/280*[l]				*1 920*[m]
UGM-133A Trident II D5(LE)						
	Mk4	..	1992	>12 000	1–8 x W76-0 100 kt	–[n]
	Mk4A	..	2008	>12 000	1–8 x W76-1 90 kt	1 511
	Mk4A	..	2019	>12 000	1 x W76-2[o] 8 kt	25
	Mk5	..	1990	>12 000	1–8 x W88 455 kt	384
Non-strategic nuclear forces						**200**[p]
F-15E	Strike Eagle	..	1988	3 840	5 x B61-3, -4	80
F-16C/D	Falcon	..	1987	3 200[q]	2 x B61-3, -4	60
F-16MLU	Falcon (NATO)	..	1985	3 200	2 x B61-3, -4	30
PA-200	Tornado (NATO)	..	1983	2 400	2 x B61-3, -4	30
Total stockpile						**3 708**[r]
Deployed warheads						1 744
Reserve warheads						1 964
Retired warheads awaiting dismantlement						**1 720**[s]
Total inventory						**5 428**[t]

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022 , p 344-345*, https://www.sipri.org/yearbook/2022/10

United States: Operational Missile Forces*

Missile Name	Class	Range	Status
ALCM	ALCM	950 - 2,500 km	Operational
FGM-148 Javelin	ATGM	2.5-4.5 km	Operational
Harpoon	ASCM	90 - 240 km	Operational
Hellfire	ASM	7 - 11 km	Operational
JASSM / JASSM ER	ALCM	370 - 1,000 km	Operational
Lance	SRBM	130 km	Obsolete
Peacekeeper	ICBM	9,600 km	Obsolete
ATACMS	SRBM	165 - 300 km	Operational
Minuteman I	ICBM	10,000	Obsolete
Minuteman II	ICBM	12,500 km	Obsolete
Minuteman III	ICBM	13,000 km	Operational
Pershing 1	SRBM	740	Obsolete
Pershing 2	MRBM	1,700	Obsolete
SM-62 Snark	ICCM	10,186 km	Obsolete
SM-65 Atlas	ICBM	14,000	Obsolete
SM-78 Jupiter	MRBM	2,400 km	Obsolete
Titan I	ICBM	10,000 km	Obsolete
Titan II	ICBM	15,000 km	Obsolete
Tomahawk	Cruise Missile	1,250-2,500 km	Operational
Trident D5	SLBM	12,000 km	Operational

* All missiles listed as operational in the original source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of the United States," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/united-states/.

Russian Nuclear Forces

Russia: ODNI's Summary Threat Analysis in 2023

Russia maintains the largest and most capable nuclear weapons stockpile, and it continues to expand and modernize its nuclear weapons capabilities. Russian nuclear material security also remains a concern, despite improvements to material protection, control, and accounting at Russia's nuclear sites since the 1990s.

Throughout its invasion of Ukraine, Moscow has continued to show that it views its nuclear capabilities as necessary for maintaining deterrence and achieving its goals in a potential conflict against the United States and NATO, and it sees its nuclear weapons arsenal as the ultimate guarantor of the Russian Federation.

After Russian military losses during Ukraine's counteroffensive in late summer 2022, Putin publicly warned the West that he was ready to use nuclear weapons to defend Russia. Moscow continues to develop long-range nuclear-capable missile and underwater delivery systems meant to penetrate or bypass U.S. missile defenses. Russia is expanding and modernizing its large, diverse, and modern set of nonstrategic systems, which are capable of delivering nuclear or conventional warheads, because Moscow believes such systems offer options to deter adversaries, control the escalation of potential hostilities, and counter U.S. and allied conventional forces.

…Russia continues to train its military space elements, and field new antisatellite weapons to disrupt and degrade U.S. and allied space capabilities. It is developing, testing, and fielding an array of nondestructive and destructive counterspace weapons—including jamming and cyberspace capabilities, directed energy weapons, on-orbit capabilities, and ground-based ASAT capabilities—to try to target U.S. and allied satellites. Similar to the space sector, resource and technology challenges could have an impact on the quality and quantity of Russia's future counterspace capabilities.

Russia is investing in electronic warfare and directed energy weapons to counter Western on-orbit assets. These systems work by disrupting or disabling adversary C4ISR capabilities and by disrupting GPS, tactical and satellite communications, and radars. Russia also continues to develop ground-based ASAT missiles capable of destroying space targets in low Earth orbit.

Office of the Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, 2/6/23, https://www.dni.gov/files/ODNI/documents/assessments/ATA-2023-Unclassified-Report.pdf

Russia: STRATCOM Posture Statement in 2023

Russia's brutal invasion of Ukraine is a violent attempt at territorial seizure that aims to undermine the rules-based international order with conventional force backed by nuclear coercion. Russia's nuclear rhetoric is underpinned by its nuclear arsenal, which is the largest and most diverse in the world. Russia continues to flight test its new heavy ICBM, the SS-X-29 Sarmat, with plans to begin fielding it in 2023 and eventually replace the legacy SS-18 heavy ICBM. With Sarmat, Russia joins the PRC in developing ICBMs that use at least partial orbital trajectories.

Russia also continues to field new DOLGORUKIY-class SSBNs, armed with the new SS-N-32 Bulava SLBM, and SEVERODVINSK-class nuclear-powered cruise missile submarines.

Russia's significant investment in launch platforms and systems not subject to the New START Treaty (NST) provides it with increasingly diverse and flexible nuclear deterrence options.

Russia now fields nuclear-capable hypersonic systems such as the Avangard HGV, the Tsirkon land-attack cruise missile, and the Kinzhal air-launched ballistic missile, the last of which Russia has employed in Ukraine with conventional warheads. Russia also has a stockpile of approximately 2,000 theater nuclear weapons that does not fall under the limits established by the NST.

The continued degradation of Russian conventional capability in Ukraine will likely increase Russia's reliance on its nuclear arsenal. This phenomenon, along with the PRC's rapid breakout and development of capabilities that present a similar deterrence challenge, underscores the increased perceived utility of nuclear weapons in the contemporary environment. The U.S. faces a complex, multipolar nuclear world that requires concerted U.S. effort to address these deterrence challenges, strengthen assurance to our Allies and partners, and prevent proliferation.

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Statement of Anthony J. Cotton . Commander, U.S. Strategic Command, before the House Armed Services Committee on Strategic Forces, March 8, 2023, https://www.stratcom.mil/Portals/8/Documents/2023%20USSTRATCOM%20Congressional%20Posture%20Statement.pdf?ver=bFFdbYI2D5Tju5nPNsebbw%3d%3d .

Russia Has a Major Nuclear and Missile Modernization Effort Underway In Spite of Resource Constraints – CRS: 2022

System	Warheads	Notes
Avangard HGV	One per vehicle, nuclear	Can be delivered by SS-19 and potentially the Sarmat ICBMs; intended to overcome missile defense
RS-28 (Sarmat) silo ICBM	10+, nuclear	Deployment expected around 2022; intended to overcome missile defense
Poseidon Autonomous Underwater Vehicle	Conventional or nuclear	Carried by special-purpose submarines; intended as a second-strike, retaliatory weapon
Burevestnik Nuclear Powered Cruise Missile	Nuclear	"Unlimited" range, owing to its nuclear reactor; intended to overcome missile defense
Kinzhal Air-Launched Ballistic Missile	Conventional or nuclear	Intended to target naval vessels
Tsirkon Hypersonic Cruise Missile	Conventional or nuclear	Intended to attack ships and ground targets
Barguzin Rail-Mobile ICBM	up to 4? Nuclear	Program reportedly postponed in 2017
RS-26 Rubezh ICBM	up to 4? Nuclear	Program reportedly postponed in 2018

Source: Compiled by CRS.

Note: While the text used both Russian designations (RS-X) and U.S./NATO designations (SS-X) to identify deployed Russian weapons systems, this table displays the Russian only the Russian designation (RS-X) because a NATO designation has not yet been assigned.

Source: Excerpted from Amy F. Wolf, *Russia's Nuclear Weapons: Doctrine, Forces and Modernization*, Congressional Research Service, R45861, March 21, 2022, pp. 28-30; https://crsreports.congress.cgov.

Russian Nuclear Delivery Modernization Efforts: CRS 2022

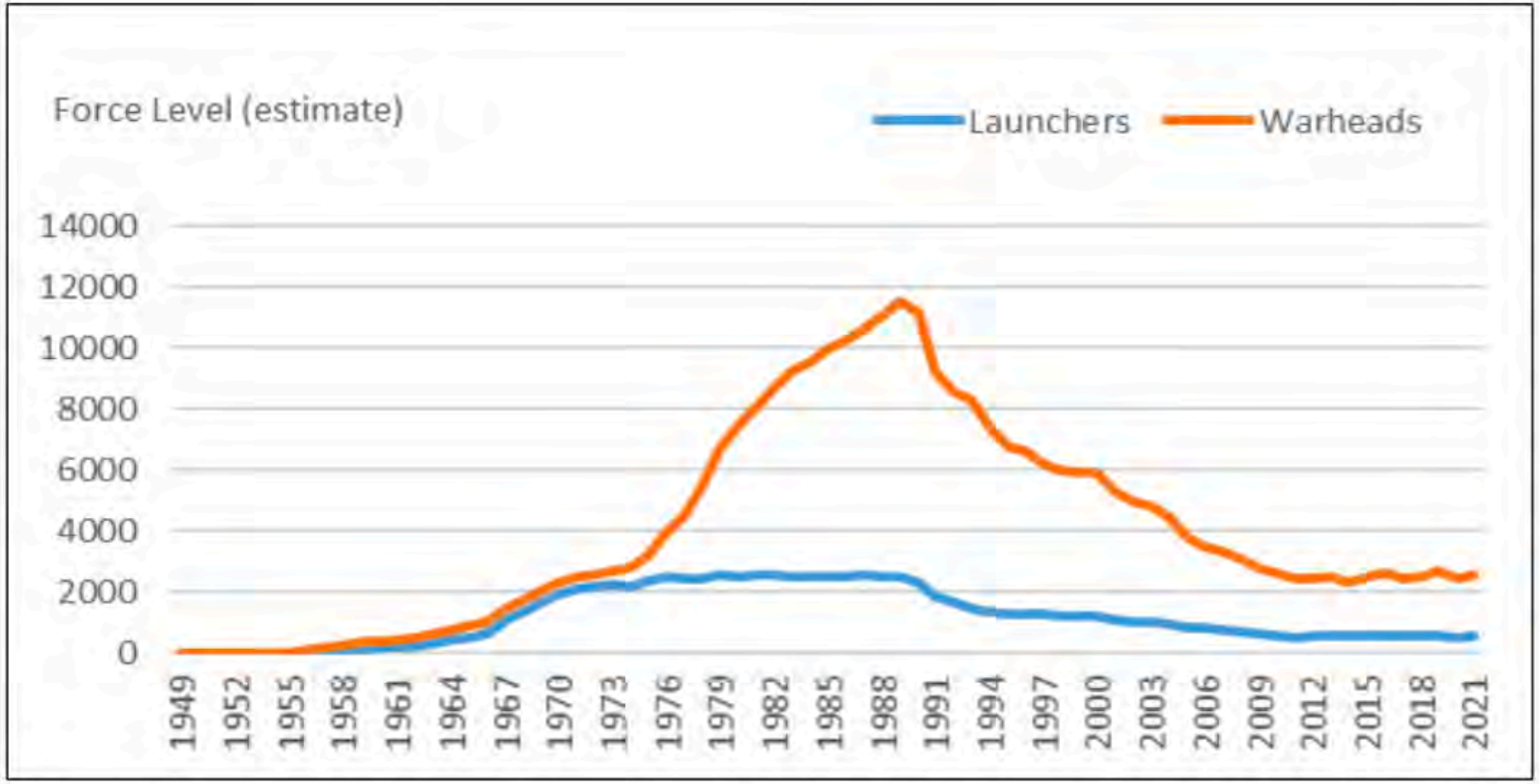
Article I. System	Article II. Warheads	Article III. Notes
(1) Avangard HGV	(2) One per vehicle, nuclear	(3) Can be delivered by SS-19 and potentially the Sarmat ICBMs; intended to overcome missile defense
(4) RS-28 (Sarmat) silo ICBM	(5) 10+, nuclear	(6) Deployment expected around 2022; intended to overcome missile defense
(7) Poseidon Autonomous Underwater Vehicle	(8) Conventional or nuclear	(9) Carried by special-purpose submarines; intended as a second-strike, retaliatory weapon
(10) Burevestnik Nuclear Powered Cruise Missile	(11) Nuclear	(12) "Unlimited" range, owing to its nuclear reactor; intended to overcome missile defense
(13) Kinzhal Air-Launched Ballistic Missile	(14) Conventional or nuclear	(15) Intended to target naval vessels
(16) Tsirkon Hypersonic Cruise Missile	(17) Conventional or nuclear	(18) Intended to attack ships and ground targets
(19) Barguzin Rail-Mobile ICBM	(20) up to 4? Nuclear	(21) Program reportedly postponed in 2017
(22) RS-26 Rubezh ICBM	(23) up to 4? Nuclear	(24) Program reportedly postponed in 2018

Source: Compiled by CRS.

Note: While the text used both Russian designations (RS-X) and U.S./NATO designations (SS-X) to identify deployed Russian weapons systems, this table displays only the Russian designation (RS-X) because a NATO designation has not yet been assigned.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 24.

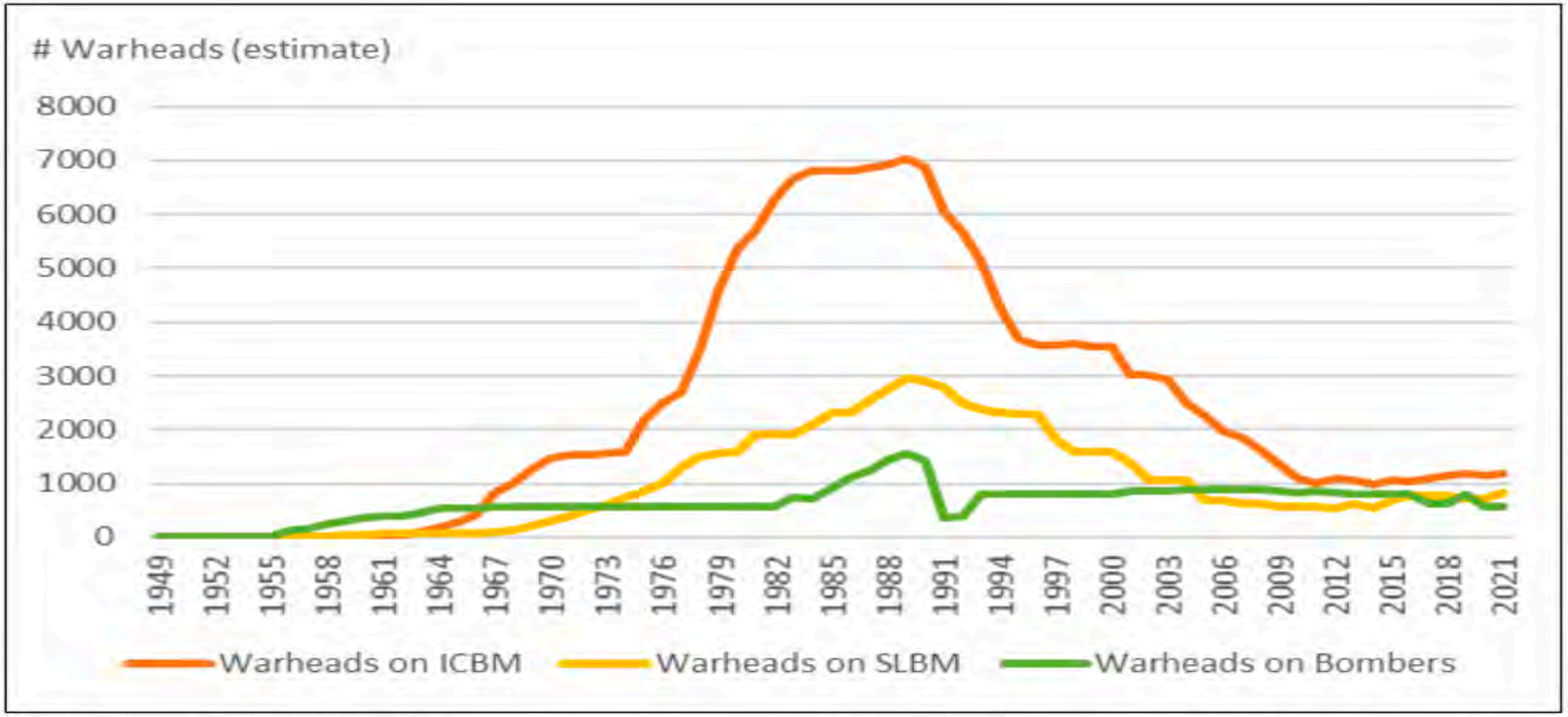
Russian Strategic Nuclear Forces - CRS: 1949-2022



Source: Natural Resources Defense Council, Archive of Nuclear Data and *Bulletin of the Atomic Scientists*, Nuclear Notebook.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 12.

Russian Strategic Nuclear Warheads by Delivery System –CRS : 1949-2021



Source: Natural Resources Defense Council, Archive of Nuclear Data and *Bulletin of the Atomic Scientists*, Nuclear Notebook.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 14.

Russian ICBM Systems -CRS: 2022

In service and under development

ICBM System	Launchers	Warheads	Notes
SS-18 (R-36M2)	46	10	Retiring, to be replaced by Sarmat
SS-19 (UR-100NUTTH)	0	0	Retired, replaced by Yars
SS-19 with Avangard HGV	4	1 HGV	Deployment of 2 planned in 2019 and 12 planned by 2027
SS-25 (Topol)	27	1	Retiring, being replaced by Yars
SS-27 Mod 1 (Topol-M) silo	60	1	Currently deployed
SS-27 Mod 2 (Topol-M) mobile	18	1	Currently Deployed
SS-27 Mod 2/RS-24 (Yars) mobile	135	4	Currently Deployed
SS-27 Mod 2/RS-24 (Yars) silo	20	4	Currently Deployed
SS-X-30 (Sarmat) silo		10 +	Expected in 2022

Sources: Hans Kristensen and Matt Korda, "Russian nuclear forces, 2020," *Bulletin of the Atomic Scientists*, 2021, vol. 77, no. 2, p. 91, https://www.tandfonline.com/doi/pdf/10.1080/00963402.2021.1885869?needAccess=true, and Pavel Podvig, Russian Strategic Nuclear Forces blog.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 18.

Russian Ballistic Missile Submarines and Missiles - CRS : 2022

Strategic Submarine	Number of SSBN	Type of SLBM	Number of Missiles	Warheads per Missile	Notes
Delta III (Project 667BDR)	1	SS-N-18 (R-29R)	16	3	Being withdrawn from service, with two decommissioned in 2018
Delta IV (Project 667BDRM)	6	SS-N-23 (R-29RM)	96	4	4-5 of each operational at any given time
Typhoon (Project 941)					Test bed for Bulava missiles
Borei (Project 955)	4	SS-N-32 (Bulava R-30)	64	6	Planned deployment of 10 submarines

Sources: Hans Kristensen and Matt Korda, "Russian nuclear forces, 2020," *Bulletin of the Atomic Scientists*, 2021, vol. 77, no. 2, p. 91, https://www.tandfonline.com/doi/pdf/10.1080/00963402.2021.1885869?needAccess=true. Pavel Podvig, Russian Strategic Nuclear Forces blog.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 19.

Russian Heavy Bombers - CRS: 2022

Russia's strategic aviation units are part of the Russian Aerospace Forces' Long-Range Aviation Command. This command includes two divisions of Tu-160 (Blackjack) and Tu-95MS (Bear H) aircraft, which are the current mainstay of Russia's strategic bomber fleet. These are located in the Saratov region, in southwestern Russia, and the Amurskaya region, in Russia's Far East.[81]

Unclassified sources estimate that Russia has 60 to 70 bombers in its inventory—50 of them count under the New START Treaty.[82] Around 55 of these are Tu-95MS Bear bombers; the rest are Tu-160 Blackjack bombers. The former can carry up to 16 AS-15 (Kh-55) nuclear-armed cruise missiles, while the latter can carry up to 12 AS-15 nuclear-armed cruise missiles. Both bombers can also carry nuclear gravity bombs, though experts contend that the bombers would be vulnerable to U.S. or allied air defenses in such a delivery mission.

Russia has recently modernized both of its bombers, fitting them with a new cruise missile system, the conventional AS-23A (Kh-101) and the nuclear AS-23B (Kh-102). A newer version of the Tu-160, which is expected to include improved stealth characteristics and a longer range, is set to begin production in the mid-2020s. Experts believe the fleet will then include around 50-60 aircraft, with the eventual development of a new stealth bomber, known as the PAK-DA, as a part of Russia's long-term plans.[83]

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 20.

Russian Non-Strategic Nuclear Weapons – CRS : 2022

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Russia has a number of nuclear weapons available for use by its “naval, tactical air, air- and missile defense forces, as well as on short-range ballistic missiles.”85 It is reportedly engaged in a modernization effort focused on “phasing out Soviet-era weapons and replacing them with newer versions.” Unclassified estimates place the number of warheads assigned to nonstrategic nuclear weapons at 1,912.86 Recent analyses indicate that Russia is both modernizing existing types of short-range delivery systems that can carry nuclear warheads and introducing new versions of weapons that have not been a part of the Soviet/Russian arsenal since the latter years of the Cold War. In May 2019, Lt. Gen. Robert P. Ashley of the Defense Intelligence Agency (DIA) raised this point in a public speech. He stated that Russia has 2,000 nonstrategic nuclear warheads and that its stockpile “is likely to grow significantly over the next decade.” He also stated that,

Russia is adding new military capabilities to its existing stockpile of nonstrategic nuclear weapons, including those employable by ships, aircraft, and ground forces. These nuclear warheads include theater- and tactical-range systems that Russia relies on to deter and defeat NATO or China in a conflict. Russia’s stockpile of non-strategic nuclear weapons [is] already large and diverse and is being modernized with an eye towards greater accuracy, longer ranges, and lower yields to suit their potential warfighting role. We assess Russia to have dozens of these systems already deployed or in development. They include, but are not limited to: short- and close-range ballistic missiles, ground-launched cruise missiles, including the 9M729 missile, which the U.S. Government determined violates the Intermediate-Range Nuclear Forces or INF Treaty, as well as antiship and antisubmarine missiles, torpedoes, and depth charges.

It is not clear from General Ashley’s comments, or from many of the other assessments of Russia’s nonstrategic nuclear forces, whether Russia will deploy these new delivery systems with nuclear warheads.

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Source: Amy F. Woolf, *Russia’s Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 21.

Russia: Nuclear Weapons Modernization: House of Commons Library – I: 2022

Russia has the largest nuclear arsenal in the world, with a stockpile estimated at 5,977 warheads, of which 4,477 are operational (strategic, non- strategic and reserve). Russia's large arsenal of 1,910 non-strategic/tactical warheads are not currently subject to any arms control limitations.

Forces are organized on the nuclear triad principle. Russia does not operate a policy of continuous at-sea deterrence but patrols periodically. Russia has been undertaking an extensive program of capabilities modernization since 2008.

In 2018 President Putin outlined a number of new nuclear weapons capabilities under development that are intended to counter US missile defense systems. These include hypersonic missiles and glide vehicles, a nuclear-powered torpedo and a nuclear-powered cruise missile. In December 2021 the Russian Ministry of Defense said that modern weapons systems comprised 89% of its nuclear inventory..

For over a decade, Russia has been undertaking an extensive program of military modernization. Established in 2008, the intention of Russia's wholesale modernization plan was to rebuild a cohesive military out of the old Soviet structures. As part of that program, the modernization of the strategic nuclear deterrent has been a priority. While the broader plan has been beset with financial pressures and industrial challenges, upgrades to Russia's nuclear capabilities have remained largely unscathed.

In March 2018 President Putin announced details of several new nuclear weapons systems under development, intended to defeat US missile defense systems. Those new capabilities include hypersonic delivery systems,… a nuclear-powered torpedo and a nuclear-powered cruise missile. All form part of the State Armament Plan 2018-2027 and either have been, or are expected to, deploy over the next five years…

In its 2021 annual update, the Russian Defense Ministry Board stated that Russia's nuclear forces were now equipped with 89% modern armaments across the whole of the nuclear triad… Russian nuclear weapons spending is largely classified. In 2019 the International Campaign to Abolish Nuclear Weapons (ICAN) estimated that Russia spent $8.5 billion in that year alone on its nuclear weapons. A previous SIPRI estimate in 2018 suggested that Russia spent 606 billion.

Russia possesses a significant nonstrategic arsenal that is thought to total approximately 1,910 warheads… Nonstrategic nuclear weapons are often referred to as tactical, or battlefield, nuclear weapons as they are intended for use within a limited battlefield context. According to the Russian Ministry of Defense, non-strategic warheads are kept in central storage and are not deployed with their delivery systems…

Russia retains a nonstrategic capability for two primary reasons: the existence of potential nuclear powers within Russia's sphere of influence and the deployment of US nuclear weapons in Europe. Such capabilities could also potentially be deployed against elements of the proposed US ballistic missile defense architecture in Eastern Europe. Within the context of the current Ukraine crisis, fears have been expressed that Russia could resort to the use of tactical nuclear weapons to achieve its objectives

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: China*, House of Commons Library, July 29, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9088/CBP-9088.pdf

Russia: Nuclear Weapons Modernization: House of Commons Library – II: 2022

…Russia is estimated to be installing Avangard equipped missiles at a rate of two per year, and the first Avangard regiment achieved its full complement of missiles in December 2021…A second regiment is expected to be installed by 2027. The Russian Ministry of Defense has stated that the Avangard HGV falls within the scope of the New START treaty. The remaining ICBM are Topol-M single warhead ICBM (both silo-based and road mobile) and the RS-24 Yars ICBM (road mobile and silo based) which has MIRV capability. The older Soviet-era missiles are gradually being phased out to be replaced by these two ICBM variants.

Previous estimates have put delivery of new Topol-M and RS-24 Yars ICBM systems at 40 per year. The last of the Soviet-era missiles are expected to be phased out by 2024, although the slow pace of modernization has left this timetable in question. Russian ground forces also possess an undisclosed number of non-strategic (tactical) nuclear weapons.

…Work has been ongoing to develop a new silo-based ICBM, the RS-28 Sarmat, for some years. A replacement for the RS-20, it is expected to be capable of carrying up to 10 warheads. It has recently been suggested that a few may be equipped with the Avangard hypersonic glide vehicle….The first Sarmat prototype was due to be completed in March 2016, with entry into service expected in 2019/2020. However, flight testing of the missile has been delayed until 2022. Given the delays in the testing program, it is unclear when the missile may enter service. In November 2019 the Russian Ministry of Defense confirmed that the Sarmat ICBM would fall within the scope of the New START treaty. Russia also plans to deploy two Avangard HGV regiments, each with six missiles, at Dombarovsky in southern Russia by 2027.

Russia is also developing the Burevestnik ground-launched nuclear cruise missile. Nuclear-powered, it has an estimated range of over 25,000km. While achieving intercontinental range, it would also be low flying and potentially radar evading, therefore posing a major challenge for any missile defense system. However, a fatal explosion in northern Russia in August 2019 is thought to have been caused by a test of the missile that went wrong, raising concerns over the viability of the program. In October 2020 Russia was preparing to resume testing of the Burevestnik, although experts still remain skeptical of the program's future.

Estimates vary but SIPRI's 2021 assessment suggests that 90 warheads are assigned to 164 ground-launched, short-range ballistic missiles. The majority are deployed on the dual-capable Iskander-M tactical short-range ballistic missile system, which over the last few years has reportedly been stationed close to NATO territory, for example around St Petersburg and in the Russian enclave of Kaliningrad, between Poland and Lithuania. More recently, Russia has also been deploying the nuclear-capable Novator 9M729 ground-launched cruise missile. With a range of between 500km and 5,500km, it was the fielding of this missile which led to the collapse of the Intermediate Nuclear Forces Treaty in August 2019.

Modernization of Russia's SSBN fleet has been a priority since 2008. The Delta IV SSBN have been upgraded to deploy with a modified SLBM, codenamed Sineva, which carries up to four warheads. Since 2008 five new vessels of the new Borei class have also entered service with the Pacific and Northern fleets. Two of those vessels are the improved Borei-A design. The first entered service in June 2020 and the second in December 2021. The first SSBN to be constructed since the end of the Cold War, the Borei class is equipped with 16 new Bulava SLBM, each with an operational range of 8-9,000 km and capable of carrying 6 warheads apiece. A total class of ten boats is anticipated by 2027, divided equally between the Pacific and Northern fleets, to replace the ageing Delta III SSBN which has largely been retired from service…. further vessels of the Borei class SSBN, and its complement of Bulava SLBM are expected up to 2030. A total class of ten boats is anticipated, with the boats currently under construction expected to be the modified Borei-A.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: China*, House of Commons Library, July 29, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9088/CBP-9088.pdf

Russia: Nuclear Weapons Modernization: House of Commons Library – III: 2022

Work is also expected to begin on a fifth generation SSBN, and equivalent SLBM, which will enter the production phase from 2031 onwards.
Russia's nonstrategic naval capabilities have also been the focus of modernization, with the expected introduction into service of a new class of attack submarine, the Yasen, equipped with a new type of long-range sea- launched cruise missile which is nuclear capable. The Yasen class will also be able to deliver nuclear armed anti-submarine missiles as well as nuclear torpedoes.

As President Putin outlined in March 2018, the Navy has a ship-launched dual- capable hypersonic cruise missile (the Tsirkon) and a new long-range, nuclear-armed, nuclear-powered torpedo (Poseidon), under development. The Tsirkon had initially been earmarked for deployment in the 2025-2030 timeframe. In April 2021, however, President Putin suggested that the Tsirkon would be placed on alert "in the near future". Defense Minister, Sergei Shoigu, confirmed in December 2021 that acceptance trials for the missile were nearing completion and that deliveries would begin in 2022.52 There have been reports that the Tsirkon could also be deployed aboard the Borei-class SSBN.53 Poseidon is expected to deploy after 2027. It will be deployed on two special-purpose submarines: the Belgorod and Khabarovsk, each capable of carrying up to 6 Poseidon torpedoes.

Russia's air-delivered nuclear capability is operated by Long Range Aviation Command from two strategic bomber bases at Engels in Saratov Oblast in Western Russia, and Ukrainka in Amur Oblast in the Russian Far East. It consists of four squadrons operating 68 bomber aircraft: the Tu-160'Blackjack' and the Tu-95MS 'Bear H'. Both aircraft are in the process of being incrementally upgraded with significant improvements to the aircrafts' weaponry, navigation and avionics.

Modernization of the Tu-160 and Tu-95 strategic bomber fleets remains ongoing, which will allow them to remain in service until the late 2020s-early 2030s. Going forward the Russian Ministry of Defense is procuring a next generation strategic bomber (PAK-DA), to replace the fleet of Tu-160 and Tu-95 aircraft, and the Tu-22 in a tactical role. Flight testing of a prototype had been expected in 2019, although the project has suffered delays. Construction of the first prototype PAK-DA is reported to have begun in May 2020, with flight testing expected in 2025 or 2026. Serial production is earmarked for 2028 or 2029. It is unclear when the PAK-DA will enter service.

In 2019 the Russian Government confirmed that it would restart the Tu-160 production line to manufacture up to 50 Tu-160M2 variants, starting in the early 2020s. Production is underway, with the first aircraft undertaking flight testing in January 2022. That aircraft is expected to enter service later this year, with serial production beginning in 2023, with a production rate of at least three aircraft per year.54 The project is intended to fill a gap until the PAK-DA enters service. In February 2020 Russian media reported that the Tu- 160 was also being modified to carry the hypersonic Kinzhal dual-capable ballistic missile.

Concerns have been expressed over the capacity of Russian aviation industry to manufacture two strategic bombers at the same time.55
Russia is also developing the nuclear-capable Kh-32 air-to-surface missile, which will upgrade the existing AS-4.

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: China*, House of Commons Library, July 29, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9088/CBP-9088.pdf

Russia: Nuclear Weapons Modernization: House of Commons Library – III: 2022

deploying with nuclear-arm. Those upgrades will allow both aircraft to remain in service until the late 2020s-early 2030s, and to deploy with the new KH-102 stealthy air-launched cruise missile (ALCM).

While modernization is progressing, the pace of delivery has, however, been slower than anticipated.
One squadron deploys 13 Tu-160 and the upgraded Tu-160M1 aircraft. Both are equipped with up to 12 AS-15B nuclear air-launched cruise missiles (ALCM). The Tu-160M1 is also equipped with the new KH-102 ALCM, which has a range of approximately 5,000km, twice that of the AS-15. Three squadrons operate the Tu-95MS 'Bear H' (55 aircraft in total), each with between six and 16 AS-15A ALCM.

…Modernized aircraft (the Tu-95MSM) have been delivered thus far, including four in 2021, which are also equipped with the Kh-102. Both platforms can also be equipped with nuclear-armed free-fall bombs. Approximately 495 non-strategic warheads are also estimated to be deployed on AS-4 air-to-surface missiles and free fall bombs assigned to tactical air forces.

The air force operates a medium-range bomber, the Tu-22M, which is capable of firing cruise missiles.

The Su-24, the Su-34 and the newest Su-57 combat aircraft can also be deployed in a tactical nuclear role. In November 2019 Russia also conducted the first tests of the new Kinzhal hypersonic air-launched ballistic missile, deployed aboard a MiG-31K. That missile entered service in 2021…

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: China*, House of Commons Library, July 29, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9088/CBP-9088.pdf

Russian Bases for Strategic Nuclear Forces

Source: Compiled by CRS, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 17.
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Russian Nuclear Storage Facilities

Source: United Nations Institute for Disarmament Research (UNIDIR), Lock them Up: Zero-deployed Non-strategic Nuclear Weapons in Europe, 2017, http://www.unidir.org/files/publications/pdfs/lock-them-up-zero-deployed-non-strategic-nuclear-weapons-in-europe-en-675.pdf.

Source: Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, Congressional Research Service, R45861, April 21, 2022, p. 42

Russia: IISS Estimate of Strategic Nuclear and Defense Forces in 2023 - I

Strategic Deterrent Forces ε80,000 (incl personnel assigned from the Navy and Aerospace Forces)

Navy
SUBMARINES • STRATEGIC • SSBN 11:
6 *Delfin* (Project 667BDRM (*Delta* IV)) with 16 R-29RMU2 *Sineva*/R-29RMU2.1 *Layner* (RS-SS-N-23 *Skiff*) nuclear SLBM, 4 single 533mm TT with 53-65K HWT/SET-65K HWT/USET-80K *Keramika* HWT
3 *Borey* (Project 955 (*Dolgorukiy*)) with 16 *Bulava* (RS- SS-N-32) nuclear SLBM, 6 single 533mm TT with USET-80K *Keramika* HWT/UGST *Fizik* HWT
2 *Borey*-A (Project 955A) with 16 *Bulava* (RS-SS-N-32) nuclear SLBM, 6 single 533mm TT with USET-80K *Keramika* HWT/UGST *Fizik* HWT

Strategic Rocket Forces 50,000
3 Rocket Armies operating silo and mobile launchers organized in 12 divs. Regt normally with 6 to 10 silos or 9 mobile launchers, and one control center

SURFACE-TO-SURFACE MISSILE
1 ICBM regt with RS-12M *Topol* (RS-SS-25 *Sickle*)
8 ICBM regt with RS-12M2 *Topol*-M (RS-SS-27 mod 1) 2 ICBM regt with RS-18 (RS-SS-19 *Stiletto*)
1 ICBM regt with RS-18 with Avangard HGV (RS-SS-19 mod 4 *Stiletto*)
8 ICBM regt with RS-20 (RS-SS-18 *Satan*)
14 ICBM regt with RS-24 *Yars* (RS-SS-27 mod 2) 7 ICBM regt with *Yars*-S
SURFACE-TO-SURFACE MISSILE LAUNCHERS ICBM • Nuclear 339: 9 RS-12M *Topol* (RS-SS-25 *Sickle*) (mobile single warhead); 60 RS-12M2 *Topol*-M (RS-SS-27 mod 1) silo-based (single warhead); 18 RS-12M2 *Topol*-M (RS-SS-27 mod 1) road mobile (single warhead); up to 20 RS-18 (RS-SS-19 *Stiletto*) (mostly mod 3, 6 MIRV per msl) (being withdrawn); ε6 RS- 18 with *Avangard* HGV (RS-SS-19 mod 4 *Stiletto*); 46 RS-20 (RS-SS-18 *Satan*) (mostly mod 5, 10 MIRV per msl); ε99 RS-24 *Yars* (RS-SS-27 mod 2; ε3 MIRV per msl) road mobile; ε18 RS-24 *Yars* (RS-SS-27 mod 2; ε3 MIRV per msl) silo-based; ε63 *Yars*-S (ε3 MIRV per msl) road mobile
COUNTERSPACE • DE • Laser *Peresvet*

Long-Range Aviation Command *
BOMBER
1 sqn with Tu-160/Tu-160 mod *Blackjack* 3 sqn with Tu-95MS/MS mod *Bear*
AIRCRAFT
BBR 76: 9 Tu-160 *Blackjack* with Kh-55SM (RS-AS-15B *Kent*) nuclear LACM; 7 Tu-160 mod *Blackjack* with Kh- 55SM (RS-AS-15B *Kent*)/Kh-102 (RS-AS-23B *Kodiak*) nuclear LACM; 42 Tu-95MS *Bear* H with Kh-55SM (RS- AS-15B *Kent*) nuclear LACM; 18 Tu-95MS mod *Bear* H with Kh-55SM (RS-AS-15B *Kent*)/Kh-102 (RS-AS-23B *Kodiak*) nuclear LACM

Russia: IISS Estimate of Strategic Nuclear and Defense Forces in 2023 - II

SPACE COMMAND
SATELLITES 89
COMMUNICATIONS 32: 4 *Blagovest*; 1 *Garpun*; 3 *Globus*-M (*Raduga*-1M); 6 *Meridian*; *3 Meridian*-M*;* 15 *Rodnik*-S (*Strela*-3M)
POSITIONING, NAVIGATION & TIMING 27: 3 GLONASS-K1; 24 GLONASS-M
ISR 10: 3 *Bars*-M; 2 GEO-IK-2; 1 *Neitron*; 2 *Persona*; 2 *Resurs*-P
ELINT/SIGINT 8: 6 *Lotos*-S; 1 *Pion*-NKS; 1 *Tselina*-2
EARLY WARNING 5 *Tundra* (EKS)
RENDEZVOUS & PROXIMITY OPERATIONS 7: 6 *Nivelir*; 1 *Olymp*-K (*Luch*)
MISSILE DEFENCE some S-500 (entering service) **RADAR** 12; Russia leases ground-based radar stations in Baranovichi (Belarus) and Balkhash (Kazakhstan). It also has radars on its own territory at Lekhtusi (St Petersburg); Armavir (Krasnodar); Olenegorsk (Murmansk); Mishelevka (Irkutsk); Kaliningrad; Pechora (Komi); Yeniseysk (Krasnoyarsk); Baranul (Altayskiy); Orsk (Orenburg); and Gorodets/Kovylkino (OTH)
Aerospace Defense Command

AIR DEFENCE
2 AD div HQ
4 SAM regt with S-300PM1/PM2 (RS-SA-20 *Gargoyle*) 5 SAM regt with S-400 (RS-SA-21 *Growler*); 96K6 *Pantsir*-S1 (RS-SA-22 *Greyhound*) **EQUIPMENT BY TYPE**
AIR DEFENCE
SAM • Long-range 186: 90 S-300PM1/PM2 (RS-SA-20 *Gargoyle*); 96 S-400 (RS-SA-21 *Growler*)
SPAAGM 30mm 36 96K6 *Pantsir*-S1 (RS-SA-22 *Greyhound*)
MISSILE DEFENCE 68 53T6 (RS-AB-4A *Gazelle*) **RADAR** 1 BMD engagement system located at Sofrino (Moscow)

* As of 2022, Moscow was following three paths simultaneously: upgrading current types, restarting manufacture of one design, and supporting the research and development of a new bomber. The Tupolev Tu-22M3 *Backfire* C, Tu-95MS *Bear* H and Tu-160 *Blackjack* A are all the subject of upgrade programs, while the last is also re-entering production as the Tu-160M *Blackjack* B. Tupolev is also working on the Item 80 design to meet the Aerospace Forces'
Next-generation *Blackjack*
The Tu-160M draws on upgrade programs implemented for the *Blackjack* A, but with a new airframe and aerostructures. The VKS has ten aircraft on order for delivery by 2027, and a notional ambition to field up to 50 Tu-160Ms by the mid-2030s. (VKS) Future Long-Range Aviation Complex (PAK DA) project. A prototype of this design, almost certainly a subsonic low-observable flying wing, could be flown possibly by the middle of this decade. Meanwhile, after a three-decade gap in production, the first new-build Tu-160 was flown for the first time at the beginning of 2022. The modernized Tu-160M is being built at the Gorbunov production site in Kazan, and the design to meet the PAK DA requirement will likely be built there too. However, it remains unclear whether Russia has the economic and industrial capacity to sustain all its currently planned bomber projects. **Kh-101 (RS-AS-23A *Kodiak*)** The aircraft may be able to carry several long-range land-attack cruise missile (LACM) designs, with the most obvious system the Raduga Kh-101/102 (RS-AS-23A/B *Kodiak*) which is already operated with the Tu-160. The Kh-BD (Item 506) is also in development by Raduga and is intended to provide a yet-longer-range LACM. **PAK DA, Item 80**
A Tupolev patent published in March 2022 provides possible insight into the configuration of the VKS's next bomber. The patent illustration showed a twin-engine flying wing, with the patent related to the engine intake duct.

Source: Adapted from IISS, *Military Balance, 2023*, "Russia"

Russia: Bulletin of Atomic Scientists 2022 - I

Type/name	Russian designation	Launchers	Year deployed	Warheads x yield (kilotons)	Total warheads
Strategic offensive weapons					
ICBMs					
SS-18 M6 Satan	RS-20V	40	1988	10 x 500/800 (MIRV)	400[1]
SS-19 M3 Stiletto	RS-18 (UR-100NUTTH)	0	1980	6 x 400 (MIRV)	0[2]
SS-19 M4	? (Avangard)	6	2019	1 x HGV	6
SS-25 Sickle	RS-12M (Topol)	9[3]	1988	1 x 800	9
SS-27 Mod 1 (mobile)	RS-12M1 (Topol-M)	18	2006	1 x 800?	18
SS-27 Mod 1 (silo)	RS-12M2 (Topol-M)	60	1997	1 x 800	60
SS-27 Mod 2 (mobile)	RS-24 (Yars)	153	2010	4 x 100? (MIRV)	612[4]
SS-27 Mod 2 (silo)	RS-24 (Yars)	20	2014	4 x 100? (MIRV)	80
SS-X-29 (silo)	RS-28 (Sarmat)	—	(2022)	10 x 500? (MIRV)	—
Subtotal		**306**			**1,185**[5]
SLBMs					
SS-N-18 M1 Stingray	RSM-50	0/0	1978	3 x 50 (MIRV)	0[6]
SS-N-23 M2/3	RSM-54 (Sineva/Layner)[7]	5/80	2007	4 x 100 (MIRV)	320[8]
SS-N-32	RSM-56 (Bulava)	5/80	2014	6 x 100 (MIRV)	480[9]
Subtotal		**10/160**[10]			**800**[11]
Bombers/weapons					
Bear-H6/16	Tu-95MS6/MS16/MSM	55	1984/2015	6-16 x AS-15A ALCMs or 14 x AS-23B ALC	448
Blackjack	Tu-160/M	13	1987/2021	12 x AS-15B ALCMs or AS-23B ALCM, bombs	132
Subtotal		**68**[12]			**580**[13]
Subtotal strategic offensive forces		**534**[14]			**2,565**[15]
Nonstrategic and defensive weapons					
ABM/Air/Coastal defense					
S-300/S-400 (SA-20/SA-21)		~750	1992/2007	1 x low	~290
53T6 Gazelle		68	1986	1 x 10	68[16]
SSC-1B Sepal (Redut)		8[17]	1973	1 x 350	4
SSC-5 Stooge (SS-N-26) (K-300P/3M-55)		60	2015	(1 x 10)[18]	25
Land-based air					
Bombers/fighters (Tu-22M3(M3M)/Su-24M/Su-34/MiG-31K)		~300	1974-2018	ASMs, ALBM, bombs	~500
Ground-based					
SS-26 Stone SSM (9K720, Iskander-M)		144	2005	1 x 10-100	70[19]
SSC-7 Southpaw GLCM (R-500/9M728, Iskander-M)[20]					
SSC-8 Screwdriver GLCM (9M729)[21]		20[22]	2017	1 x 10-100	20
Naval					
Submarines/surface ships/air				LACM, SLCM, ASW, SAM, DB, torpedoes	~935
Subtotal nonstrategic and defensive forces					**~1,912**[23]
TOTAL					**~4,477**
Deployed					1,588
Reserve					2,889
Retired warheads awaiting dismantlement					**1,500**
Total inventory					**5,977**

Russia: Bulletin of Atomic Scientists 2022 - II

1 It is possible that the SS-18s now carry only five warheads each to meet the New START limit for deployed strategic warheads. It is also possible that a fourth regiment at Dombarovsky is operational.

2 It is thought that all SS-19 ICBMs have been retired, although activities continue at some former regiments.

3 It is possible that one regiment at Barnaul has not yet completed an upgrade to the SS-27 Mod 1. One additional regiment at Yurya has 9 SS-25 launchers and will upgrade to the SS-27 Mod 2 in 2022; however, the regiment serves a back-up launch transmission function and is not nuclear-armed, so it is therefore not included in this table.

4 Two more road-mobile regiments are being upgraded from SS-25 to SS-27 Mod 2. It is possible that the SS-27 Mod 2s now carry only three warheads each to meet the New START limit on deployed strategic warheads.

5 Only about 812 of these warheads are believed to be deployed. The rest are in storage for potential loading.

6 The remaining Delta III-class SSBN has been converted to an attack submarine.

7 Layner appears to be the latest modification of the SS-N-23 SLBM (previous version was named Sineva) and has probably been downloaded to carry four MIRVs to meet the New START limits, even though its upload capacity is rumored to be larger. NASIC did not include the system in its 2020 report, and there is some uncertainty regarding its status and capability.

8 At any given time, only 256 of these warheads are deployed on four operational Delta IV submarines, with the fifth boat in overhaul. Often two boats are out. One Delta IV submarine has been withdrawn from service to prepare for decommissioning in 2022.

9 It is possible that Bulava SLBMs now carry only four warheads each for Russia to meet the New START limit on deployed strategic warheads.

10 The first figure is the number of operational SSBNs; the second is the total number of missiles (launchers) on the SSBNs. Note that several SSBNs may be in overhaul at any given time.

11 At any given time, one or two SSBNs are in overhaul and do not carry nuclear weapons, so not all 800 warheads are deployed—perhaps only around 576.

12 Only about 50 of the bombers are thought to be deployed.

13 The total bomber force can theoretically carry more than 800 nuclear weapons, but weapons are probably only assigned to deployed bombers. Bomber weapons are not deployed on the aircraft under normal circumstances, but we estimate a couple hundred weapons are present at the two bomber bases, with the remainder in central storage.

14 This number of total fielded strategic launchers is higher than the 527 listed in the New START aggregate data as of September 1, 2021because some bombers are not counted as deployed. This is the total number of operational launchers (ICBMs, SLBMs, and bombers) in service. Russia also has more than 250 non-deployed launchers, many of which are mothballed or in the process of being dismantled.

15 Only about 1,588 of these warheads are deployed on missiles and at bomber bases. New START counts fewer deployed warheads because it does not count weapons in storage and because at any given time, some SSBNs are not fully loaded.

16 We estimate that the warheads for the remaining Gazelle interceptors are kept in central storage under normal circumstances. All previous 32 Gorgon missiles have been retired.

17 It is assumed that all SSC-1B units, except a single silo-based version in Crimea, have been replaced by the K-300P by now.

18 The US National Air and Space Intelligence Center lists the ground-, sea-, and sub-launched 3M55 as "nuclear possible."

19 This estimate includes warheads for both SS-26 and SSC-7.

20 The US National Air and Space Intelligence Center lists the R-500/9M728 as "Conventional, Nuclear Possible."

21 It is possible that SSC-8 launchers are co-located with some of the Iskander brigades.

22 This figure assumes five SSC-8 battalions, each with four launchers, for a total of 80 missiles. It is assumed there is at least one reload for at least 160 missiles. Most are thought to be conventional, with 4–5 nuclear warheads per battalion for a total of about 20.

23 All nonstrategic warheads are thought to be in central storage. The 1,912 listed make up the estimated nominal Screenshot -capable delivery platforms. Only some of these may be available for deployment by operational forces. It is possible there are more unreported

SIPRI Estimate of Russian Nuclear Forces in 2022 - I

Type/ Russian designation (NATO designation)	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield	No. of warheads[b]
Strategic nuclear forces	**516**				**2 565**[c]
Aircraft (bombers)	*68*[d]				*580*[e]
Tu-95MS6/16/M (Bear-H)[f]	55	1984/ 2015	6 500– 10 500	6–16 x 200 kt AS-15A or AS-23B ALCMs	448
Tu-160/M/M2 (Blackjack)	13	1987/ 2021	10 500– 13 200	12 x 200 kt AS-15A or AS-23B ALCMs, bombs	132
Land-based missiles (ICBMs)	*306*				*1 185*[g]
RS-20V Voevoda (SS-18 Satan)	40	1988	11 000– 15 000	10 x 500–800 kt	400[h]
RS-18 (SS-19 Stiletto)	0	1980	10 000	6 x 400 kt	0[i]
Avangard (SS-19 Mod 4)[j]	6	2019	10 000	1 x HGV	6
RS-12M Topol (SS-25 Sickle)	9[k]	1988	10 500	1 x 800 kt	9
RS-12M1 Topol-M (SS-27 Mod 1/mobile)	18	2006	10 500	1 x [800 kt]	18
RS-12M2 Topol-M (SS-27 Mod 1/silo)	60	1997	10 500	1 x [800 kt]	60
RS-24 Yars (SS-27 Mod 2/mobile)	153	2010	10 500	[4 x 250 kt]	612[l]
RS-24 Yars (SS-27 Mod 2/silo)	20	2014	10 500	4 x [250 kt]	80
RS-28 Sarmat (SS-X-29)	..	[2022]	>10 000	[10 x 500 kt]	–
Sea-based missiles (SLBMs)	*10/160*[m]				*800*[n]
RSM-50 Volna (SS-N-18 M1 Stingray)	0/0	1978	6 500	3 x 50 kt	0[o]
RSM-54 Sineva/Layner (SS-N-23 M2/3)	5/80	2007/ 2014	9 000	4 x 100 kt[p]	320[q]
RSM-56 Bulava (SS-N-32)	5/80	2012	>8 050	[6 x 100 kt]	480[r]

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 356-357*, https://www.sipri.org/yearbook/2022/10

SIPRI Estimate of Russian Nuclear Forces in 2022 - II

Type/ Russian designation (NATO designation)	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield	No. of warheads[b]
Non-strategic nuclear forces					**1 912**[s]
Navy weapons	..				*935*
Submarines/surface ships/naval aircraft	..	Land-attack cruise missiles, sea-launched cruise missiles, anti-submarine weapons, surface-to-air missiles, depth bombs, torpedoes[t]			935
Air force weapons	*260*				*500*
Tu-22M3 (Backfire-C)	60	1974	..	3 x ASMs, bombs	300
Su-24M/M2 (Fencer-D)	70	1974	..	2 x bombs	70[u]
Su-34 (Fullback)	120	2006	..	2 x bombs	120[u]
Su-57 (Felon)	–	[2024]	..	[bombs, ASMs]	..
MiG-31K (Foxhound)	10	2018	..	1 x ALBM	10
Air, coastal and missile defence	*886*				*387*
53T6 (SH-08, Gazelle)	68	1986	30	1 x 10 kt	68
S-300/400 (SA-20/21)	750[v]	1992/ 2007	..	1 x low kt	290
3M55/P-800 Oniks (SS-N-26 Strobile), 3K55/K300-P Bastion (SSC-5 Stooge)	60	2015	>400	1 x [10–100 kt]	25
SPU-35V Redut (SSC-1B Sepal)	8[w]	1973	500	1 x 350 kt	4
Army weapons	*164*				*90*
9K720 Iskander-M (SS-26 Stone), 9M728 Iskander-K (SSC-7 Southpaw)	144	2005	350	1 x [10–100 kt]	70[x]
9M729 (SSC-8)	20	2016	2 350	1 x [10–100 kt]	20[y]
Total stockpile					**4 477**
Deployed warheads					1 588
Reserve warheads					2 889
Retired warheads awaiting dismantlement					**1 500**
Total inventory					**5 977**

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022*, *pp 356-357*, https://www.sipri.org/yearbook/2022/10

* Arms Control Association Estimate of Russian Strategic Nuclear Forces Under New Start - I

On April 8, 2010, Russia and the United States signed the New Strategic Arms Reduction Treaty (New START). The treaty requires both sides to limit the number of deployed strategic nuclear warheads to no more than 1,550 and fielded delivery platforms to 700. The treaty also permits the United States and Russia to conduct 18 annual on-site inspections of facilities operated by the other country. Biannual data exchanges indicate the current state of their strategic forces.
As of March 1, 2022, Russia had 526 deployed strategic delivery systems, 1,474 deployed strategic nuclear warheads, and 761 deployed and non-deployed strategic launchers. Russia is in the process of both retiring many of its older strategic systems and replacing them with new systems.

Missile system	Number of systems	Warheads	Total warheads	Deployment
R-36M2 (SS-18)	46	10	460	Dombarovsky, Uzhur
Avangard/UR-100NUTTH (SS-19 Mod 4)	2	1	2	Dombarovsky
Topol (SS-25)	45	1	45	Barnaul, Vypolzovo
Topol-M silo (SS-27)	60	1	60	Tatishchevo
Topol-M mobile (SS-27)	18	1	18	Teykovo
RS-24 mobile	135	4	540	Teykovo, Yoshkar-Ola, Novosibirsk, Nizhniy Tagil, Irkutsk, Barnaul
RS-24 silo	14	4	56	Kozelsk
Total	**320**		**up to 1181**	

Arms Control Association, *Russian Strategic Nuclear Forces Under New START*, April 2022, https://www.armscontrol.org/factsheets/Russian-Strategic-Nuclear-Forces-Under-New-START

* Arms Control Association Estimate of Russian Strategic Nuclear Forces Under New Start - II

As of early 2020, the Navy had 10 functional strategic submarines of three different types, of which 10 are functional and 1 is being overhauled. They are deployed with the Northern Fleet and the Pacific Fleet.

Bases of the Northern Fleet host five 667BDRM (**Delta IV**) submarines. One other Delta IV is undergoing overhaul. The Northern Fleet also hosts the lead submarine of the Project 955 class. The Pacific Fleet base hosts one 667BDR (**Delta III**) submarine and two Project 955 submarines.

Project 955 (also known as **Borey or Yuri Dolgorukiy**) is the newest class of submarines. Construction began in 1996, and the first joined the Northern Fleet in 2013, though subsequent submarines of this class have joined the Pacific Fleet in September 2015 and September 2016. As of January 2016, three Project 955 submarines have been accepted into service, with an additional four under construction.

When the missiles on **Project 941 (Typhoon)** class submarines reached the end of their service lives, these submarines were withdrawn from service. The one exception is the lead ship of the class, TK-208 Dmitry Donskoy, which was refitted for the new missile system, R-30 Bulava. This new system is designed for deployment on the Borey-class nuclear submarines. The Borey class submarines are expected to constitute the core of the Russian strategic submarine fleet, replacing the aging **Project 941** and **Project 667** boats. Russia is planning to build eight **Borey** and **Borey-A** class subs by 2020.

Submarine-Launched Ballistic Missiles

RIA News reported, in June 2012, that the Bulava sea-based ballistic missile had entered service. The **Bulava** (**SS-NX-30**) SLBM, developed by the Moscow Institute of Thermal Technology, carries up to 6 MIRV warheads and has a range of over 8,000 kilometers (5,000 miles). Borey class strategic submarines will carry up to 16 Bulava ballistic missiles, each with multiple warheads.

Strategic submarines	Number of submarines	Number of SLBMs and their type	Warheads	Total warheads
Project 667BDR (Delta III)	1	16 R-29R (SS-N-18)	3	48
Project 667BDRM (Delta IV)	6[a]	80 R-29RM (SS-N-23)	4	320
Project 941 (Typhoon)	1[b]	---	---	---
Project 955 (Borey)	3	48 R-30 Bulava	6	288
Total	**10**	**144**		**up to 656**

[a] One submarine is undergoing overhaul and those missiles are not counted.

[b] One submarine of the Project 941 type has been refitted as a test bed for the Bulava missile system. It is not counted in the total number of operational submarines.

Arms Control Association, *Russian Strategic Nuclear Forces Under New START*, April 2022, https://www.armscontrol.org/factsheets/Russian-Strategic-Nuclear-Forces-Under-New-START

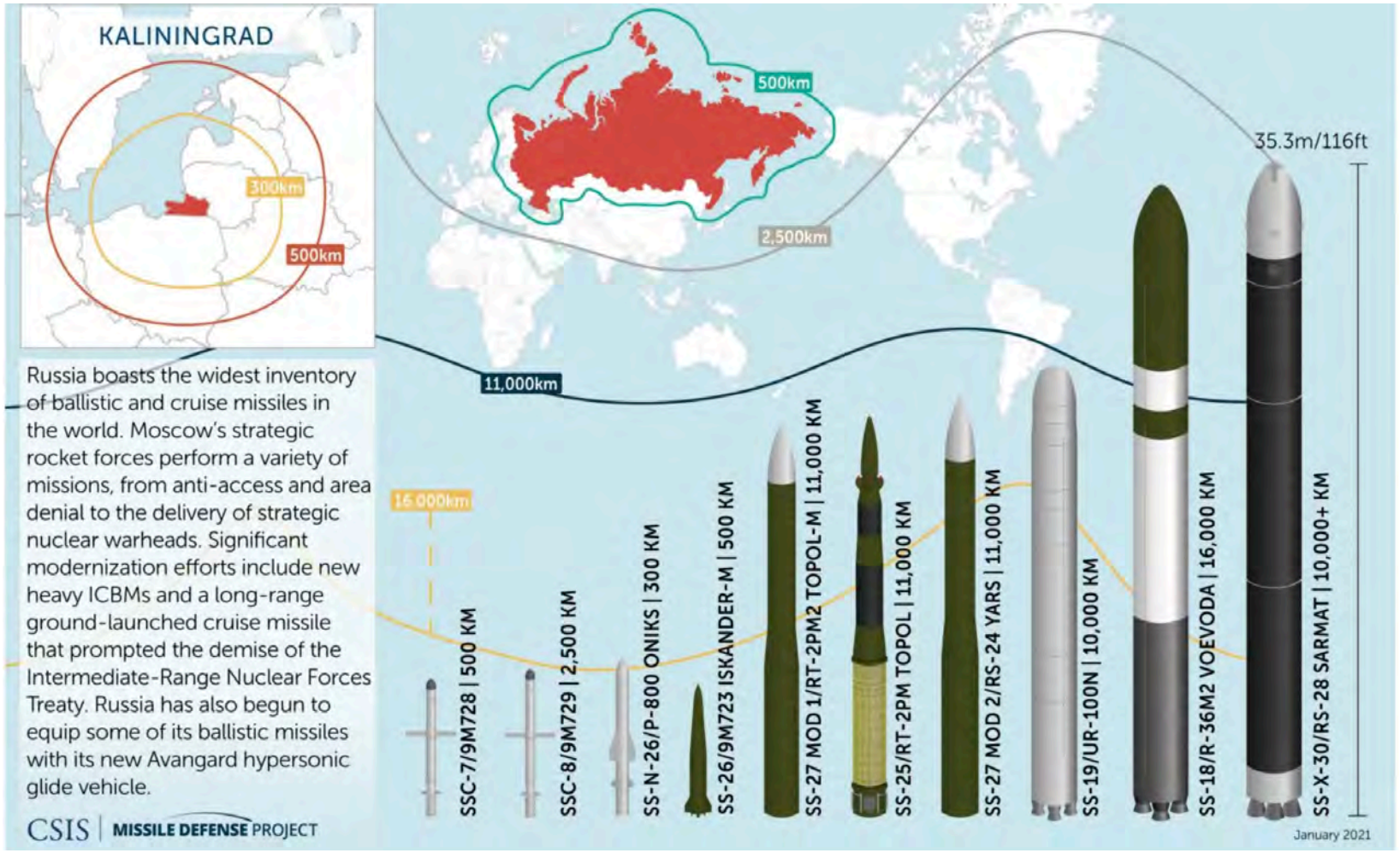
Russia: Operational & In-Development Missile Forces*

Missile Name	Class	Range	Status
Kalibr (SS-N-30A)	LACM	1,500 - 2,500 km	Operational
3M-54 Kalibr/Club (SS-N-27 "Sizzler")	ASCM	220 - 300 km	Operational
Iskander (SS-26 "Stone")	SRBM	500 km	Operational
9M729 (SSC-8)	GLCM	2,500 km	Operational
Avangard	HGV	6,000+ km	In development
Kh-101 / Kh-102	ALCM	2,500 - 2,800 km	Operational
Kh-47M2 Kinzhal	ALBM	1,500 - 2,000 km	Operational
Kh-55 (AS-15 "Kent")	ALCM	2,500 km	Operational
OTR-21 Tochka (SS-21 "Scarab")	SRBM	70 - 120 km	Operational
P-800 Oniks/Yakhont/Bastion (SS-N-26 “Strobile”)	ASCM	300 km	Operational
R-29 Vysota (SS-N-18 "Stingray")	SLBM	6,500 km	Operational
Shtil (SS-N-23 "Skiff")	SLBM	11,000 km	Operational
R-36 (SS-18 "Satan")	ICBM	10,200 - 16,000 km	Operational
Granat (SS-N-21 "Sampson")	Cruise Missile	2,400 - 3,000 km	Operational
RS-24 Yars (SS-27 Mod 2)	ICBM	10,500 km	Operational
RS-26 Rubezh	ICBM/IRBM	2,000-5,800 km	In development
RS-28 Sarmat	ICBM	10,000+ km	In development
Bulava (SS-N-32)	SLBM	8,300 km	Operational
Topol (SS-25 "Sickle")	ICBM	11,000+ km	Operational
Topol-M (SS-27 Mod 1)	ICBM	11,000 km	Operational
UR-100 (SS-19 "Stiletto")	ICBM	10,000 km	Operational

* All missiles listed as operational or in development in source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of Russia," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified August 10, 2021, https://missilethreat.csis.org/country/russia/.

Russia: Land-Based Missile Forces



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Missile Defense Project, "Missiles of Russia," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified August 10, 2021, https://missilethreat.csis.org/country/russia/.

Chinese Nuclear Forces

Chinese Nuclear Capability Is Growing Sharply

- Seems to be more than doubling its stockpile of nuclear weapons. May have risen from around 200 to 350 by 2020. Has 272 operational for exiting missiles and bombs and 78 for new systems. Possibly grew by 118 warheads during 2020-2021.
- Have detected 270+ new missile silos. 119 in Northwestern China seem to be for ICBMs.
- Has shunned arms control and transparency.
- Steadily improving nuclear command and control and battle management systems.
- Deploying advanced solid-fuel mobile ICBMs (DF-21 & DF-31/DF-31A/DF-32AG), MIRV'd liquid fuel ICBM (DF-5B), new MIRV'd DF-41 ICBM, Type 094 SSBN with JL-2 SLBMs.
- Developing low noise 096 SSBN and 9,000 kilometer range 096 SLBM.
- Progressively harder to determine what theater and short-range delivery systems may become dual-capable. DF-21 MRBM (2,150 KM) and DF-26 IRBM (4,000 KM) known to be nuclear. DF-21 is precision strike, dual-capable and could deliver low-yield nuclear weapons.
- Modifying H-6 nuclear bombers to H-6N with refueling, missile carrying capability. H-20 stealth bomber in development.
- May be evolving far beyond countervalue second strike capability. Examining use as theater warfare threat?

Source: Hans M. Kristensen. Matt Korda, and Robert Norris, "Status of World Nuclear Forces," 2022, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces; SIPRI Yearbook, *Section 2: China's Nuclear Forces: Moving Beyond a Minimal Deterrent*, 2021, https://www.uscc.gov/sites/default/files/2021-11/Chapter_3_Section_2--Chinas_Nuclear_Forces_Moving_beyond_a_Minimal_Deterrent.pdf; and DIA, *China, Military Power*, 2021.

China: STRATCOM Posture Statement in 2023 - I

As the National Defense Strategy (NDS) states, the PRC is our most consequential strategic competitor and pacing challenge; its significant nuclear force expansion reflects an increasing assertiveness and the capability to employ nuclear coercion. The PRC's rapid qualitative and quantitative expansion
of military capabilities enables a shift in its strategy and requires the Department of Defense (DoD) to make immediate and significant alterations to plans and capabilities. The PRC is aggressively pursuing their global ambitions through a national strategy of "Military-Civil Fusion"—a comprehensive focus on advancing civilian research to develop and then apply new technologies towards military and defense innovations. For example, the PRC's development and construction of fast breeder reactors and reprocessing facilities allows the swift expansion of its warhead manufacturing capacity. The PRC believes that its robust nuclear weapons program is essential to counter the U.S. in the near future in order to achieve what its leaders have deemed "great power status."

Correspondingly, the PRC seeks to match, or in some areas surpass, quantitative and qualitative parity with the United States in terms of nuclear weapons. The PRC's nuclear capabilities already exceed those needed for its long-professed policy of "minimum deterrence," but PRC capabilities continue to grow at an alarming rate. Additionally, the PRC is making substantial investments to expand its inventory of land-, sea-, and air-based nuclear delivery platforms and is constructing the infrastructure necessary to support the significant expansion of its nuclear forces. Notably, the PRC is developing capabilities inconsistent with its historical minimum deterrence posture.

Within the past three years, the PRC has built hundreds of new ICBM silos, further indicating a move away from a minimum deterrence posture. The PRC's three new missile fields collectively provide it with more than 300 silos. Each of these silos can be equipped with the CSS-10 Mod 2 ICBM, which is capable of ranging the continental United States (CONUS) with multiple independently targetable reentry vehicles (MIRVs). Additionally, the PRC maintains other ICBMs, some of which are road-mobile. Unconstrained by arms control treaty limitations, the PRC is fielding a new generation of mobile missiles, with MIRV and penetration aid capabilities. The PRC's most modern road-mobile and MIRV-capable ICBM advanced from concept to deployed system in only a few years. The PRC is now projected to have over 1,000 warheads by the end of this decade. In accordance with statutory requirements, I recently reported to Congress that the number of land-based fixed and mobile ICBM launchers in the PRC now exceeds the number of ICBM launchers in the U.S.

China: STRATCOM Posture Statement in 2023 - II

Just like the ground leg, the air and sea legs of the PRC's nuclear triad are now armed with newly developed weapon systems. The air-refuelable H-6N bomber is armed with new nuclear-capable cruise missiles and air-launched ballistic missiles that may be nuclear capable, and the PRC is building a new stealth strategic bomber with global reach. The PRC's six JIN- class ballistic missile submarines (SSBNs) are now being equipped with the new third-generation JL-3 SLBM capable of ranging CONUS. PRC strategists also highlight their country's perceived need for lower-yield nuclear weapons. Significantly, the PRC's investment in lower-yield, precision systems with theater ranges points to investment in asymmetric capabilities that could be employed coercively during an escalation crisis, similar to Russia's irresponsible nuclear saber-rattling during its war against Ukraine. This presents the U.S. with a deterrence challenge that must be addressed with a range of U.S. capabilities, both conventional and nuclear. The PRC currently has an arsenal of approximately 1,000 medium- and intermediate-range ballistic missiles, many of which are dual capable (i.e., able to be armed by either conventional or nuclear warheads) and able to inflict significant damage to U.S., Allied, and partner forces in the Indo-Pacific.

The PRC's 2021 test of a hypersonic glide vehicle (HGV) with FOB capability exemplifies its pursuit of weapons systems with implications for strategic stability. FOB systems use a low earth orbit to deliver a warhead most of the way to its target destination, deorbiting just before reaching its target. These systems represent a more challenging threat because their non- ballistic trajectories complicate missile detection and tracking, and degrade the target country's ability to characterize the scale of an attack.

The trajectory of the PRC's nuclear advancements points to a large, diverse nuclear arsenal with a first-strike offensive capability and a high degree of survivability, reliability, and effectiveness. When considered in the context of its heavy investment in NC3, as well as increased readiness, the PRC's nuclear modernization highlights emergent capabilities that could provide it with a spectrum of first-strike offensive options before and during a crisis or conventional conflict. The PRC may believe that nuclear weapons represent a key component of its counter-intervention strategy and could use these weapons coercively against our Nation, Allies, or partners.

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Statement of Anthony J. Cotton . Commander, U.S. Strategic Command, before the House Armed Services Committee on Strategic Forces, March 8, 2023, https://www.stratcom.mil/Portals/8/Documents/2023%20USSTRATCOM%20Congressional%20Posture%20Statement.pdf?ver=bFFdbYI2D5Tju5nPNsebbw%3d%3d .

China: ODNI's Summary Threat Analysis in 2023

China is reorienting its nuclear posture for strategic rivalry with the United States because its leaders have concluded that their current capabilities are insufficient. Beijing worries that bilateral tension, U.S. nuclear modernization, and the PLA's advancing conventional capabilities have increased the likelihood of a U.S. first strike. Beijing is not interested in agreements that restrict its plans and will not agree to negotiations
that lock in U.S. or Russian advantages. Beijing's heightened confidence in its nuclear deterrent is likely to bolster its resolve and intensify conventional conflicts… China is building hundreds of new ICBM silos.

…China is steadily progressing toward its goal of becoming a world-class space leader, with the intent to match or surpass the United States by 2045. Even by 2030, China probably will achieve world-class status in all but a few space technology areas. China's space activities are designed to advance its global standing and strengthen its attempts to erode U.S. influence across military, technological, economic, and diplomatic spheres.

The PLA will continue to integrate space services—such as satellite reconnaissance and positioning, navigation, and timing—and satellite communications into its weapons and command-and-control systems in an effort to erode the U.S. military's information advantage.

Counterspace operations will be integral to potential PLA military campaigns, and China has counterspace- weapons capabilities intended to target U.S. and allied satellites. The PLA is fielding new destructive and nondestructive ground- and space-based antisatellite (ASAT) weapons.
China already has fielded ground-based counterspace capabilities including electronic warfare systems, directed energy weapons, and ASAT missiles intended to disrupt, damage, and destroy target satellites. China also has conducted orbital technology demonstrations, which while not counterspace weapons tests, prove China's ability to operate future space-based counterspace weapons.

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Office of the Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, 2/6/23, https://www.dni.gov/files/ODNI/documents/assessments/ATA-2023-Unclassified-Report.pdf

US Department of Defense: Chinese Nuclear Developments in 2022 - I

- Over the next decade, the PRC aims to modernize, diversify, and expand its nuclear forces. Compared to the PLA's nuclear modernization efforts a decade ago, current efforts exceed beyond previous attempts in both scale and complexity.
- The PRC is investing in, and expanding, the number of its land-, sea-, and air-based nuclear delivery platforms and constructing the infrastructure necessary to support this major expansion of its nuclear forces. The PRC is also supporting this expansion by increasing its capacity to produce and separate plutonium by constructing fast breeder reactors and reprocessing facilities.
- In 2021, Beijing probably accelerated its nuclear expansion; DoD estimates China's operational nuclear warheads stockpile has surpassed 400.
- The PLA plans to "basically complete modernization" of its national defense and armed forces by 2035. If China continues the pace of its nuclear expansion, it will likely field a stockpile of about 1500 warheads by its 2035 timeline.
- The PRC is fielding the DF-41, China's first road-mobile and silo-based ICBM with MIRV capability. The system is likely intended to carry no more than three warheads per missile and has improved range and accuracy over DF-31 class ICBMs. The PRC is conducting continuous at-sea deterrence patrols with its six JIN-class (Type 094) submarines (SSBNs), which are equipped to carry up to 12 JL-2 or JL-3 SLBMs.
- The PRC is rapidly establishing its silo-based solid-propellant missile fields likely consisting of over 300 silos in total, which are capable of fielding both DF-31 and DF-41 class ICBMs. This project and the expansion of China's liquid-propellant silo force suggests that the PRC intends to increase the peacetime readiness of its nuclear force by moving to a launch-on-warning (LOW) posture.

US Department of Defense, *China Military Power 2022*, pp. 94-97

US Department of Defense: Chinese Nuclear Developments in 2022 – II

Land-Based Platforms. The PRC's land-based nuclear forces primarily consist of ICBMs with different basing modes complimented by several theater-range road-mobile MRBMs and IRBMs. The PRC has approximately 300 ICBMs, including the silo-based CSS-4 Mod 2 (DF-5A) and Mod 3 (DF-5B) and possibly more recently a CSS-10 class missile (DF-31 class); the solid-fueled, road-mobile CSS-10-class (DF-31 class) with new versions having improved survivability and lethality and CSS-20 (DF-41); and the more limited range roll-out-to-launch CSS-3 (DF-4). The PRC is establishing additional nuclear units and increasing the number of launchers in mobile ICBM units from six to 12. This strategic arsenal is complemented by road-mobile, solid-fueled CSS-5 Mod 2 and Mod 6 (DF-21) MRBMs and DF-26 IRBMs capable of ranging targets in the Indo-Pacific region. The PLA is probably upgrading its existing unitary and MIRVed DF-5 liquid propellant ICBMs.

Sea-based Platforms. The PRC likely began near-continuous at-sea deterrence patrols with its six operational JIN class SSBNs, which are equipped to carry up to 12 CSS-N-14 (JL-2) or CSS-NX-20 (JL-3) SLBMs. The PRC's next-generation Type 096 SSBN is probably intended to field MIRVed SLBMs judging from past developmental trends. The 096 SSBNs will likely begin construction in the early-2020s. Based on the 30-plus-year service life of the PRC's first generation SSNs, the PRC will operate its JIN and Type 096 SSBN fleets concurrently. The current range limitations of the JL-2 will require the JIN to operate in areas north and east of Hawaii if the PRC seeks to target the east coast of the United States. The fielding of newer, more capable, and longer ranged SLBMs such as the JL-3 gives the PLAN the ability to target the continental United States from littoral waters allowing the PLAN to consider bastion operations to enhance the survivability of its sea-based deterrent. The South China Sea and Bohai Gulf are probably the PRC's preferred options for employing this concept.

Air Platforms. The PLAAF has operationally fielded the H-6N bomber, providing a platform for the air component of the PRC's nascent nuclear triad. The H-6N, compared to other H-6 bombers, adds an air-to-air refueling probe, as well as its recessed fuselage modifications that would allow for external carriage of an air-launched ballistic missile (ALBM) assessed to be nuclear capable. China is probably also developing a strategic stealth bomber, according to PRC state media.

Future Developments. Over the next decade, the PRC will expand and diversify its nuclear forces. The PRC probably intends to develop new nuclear warheads and delivery platforms that at least equal the effectiveness, reliability, and/or survivability of some of the warheads and delivery platforms currently under development by the United States and/or Russia. The PLA seeks a diverse nuclear force, comprised of systems ranging from lower-yield precision strike missiles to ICBMs with multi-megaton yields. Developing robust nuclear strike options is likely intended to provide deterrence predominantly against a "strong enemy," as well as ensure China can inflict unacceptable damage with both proportionate and overwhelming retaliatory capabilities, and thus denying an adversary victory if a war escalates to the nuclear domain.

China is establishing new nuclear materials production and reprocessing facilities very likely to support its nuclear force expansion. Although these efforts are consistent with China's goals to increase nuclear energy generation and to close its nuclear fuel cycle, Beijing likely also considers this dual-use infrastructure as crucial to supporting its military goals, judging from Chinese nuclear industry reporting and think tank publications. Despite China's public support for a fissile material cutoff treaty, we judge that Beijing intends to use this infrastructure to produce nuclear warhead materials for its military in the near term.

US Department of Defense, *China Military Power 2022*, pp. 94-97

US Department of Defense: Chinese Nuclear Developments in 2022 – III

- **Plutonium.** China is constructing two CFR-600 sodium-cooled fast breeder nuclear reactors at Xiapu, each capable of producing enough plutonium for dozens of nuclear warheads annually from blankets (referring to uranium placed around the fuel core for the purpose of breeding plutonium) surrounding the core, according to think tank estimates and informed by PRC state media and nuclear industry reporting. China originally planned to use Russian-sourced mixed-oxide (MOX is a blend of uranium and plutonium) fuel for these reactors but changed the order to highly enriched uranium (HEU) fuel through 2030, according to nuclear industry reporting. By using HEU fuel, China has the potential to generate additional weapons-grade plutonium. In addition, China is constructing multiple new reprocessing plants that could extract this plutonium, according to a Western think tank. China has reduced transparency in its nuclear program as its capabilities are increasing. It ceased reporting its stockpile of separated plutonium to the International Atomic Energy Agency in 2017 while still being capable of producing plutonium in reactors and separating it at its reprocessing plant at Jiuquan, judging from PRC state media and a Western think tank.
- **Uranium and Tritium.** In the past several years, China's organization traditionally associated with military uranium enrichment has expanded production capacity and likely will continue to do so. China is also working to expand and diversify its capability to produce tritium by methods such as using tritium production targets in reactors and extraction from tritiated heavy water, according to Chinese nuclear industry reporting.

Evolving Nuclear Posture. The PRC's evolving posture is presently more consistent with what PLA writings describe as a "limited deterrent"—a posture that the PLA describes as the very wide space between a minimum and maximum deterrent. The PRC claims to adhere to a minimum deterrent which it defines as "…keeping its nuclear capabilities at the minimum level required for maintaining its national security." The PRC perceived national security requirements will grow as it transitions from a 'large country' to a 'powerful country' and its minimum number of military forces—to include nuclear—needed to defend those greater interests is also likely to grow.

Stockpile Size. In 2020, the DoD estimated China's operational nuclear warhead stockpile was in the low-200s and expected to at least double by 2030. However, Beijing probably accelerated its nuclear expansion, and DoD estimates this stockpile has now surpassed 400 operational nuclear warheads. By 2030, DoD estimates that the PRC will have about 1,000 operational nuclear warheads, most of which will be fielded on systems capable of ranging the continental United States (CONUS).

Beijing has not declared an end goal nor acknowledged the scale of its expansion, and has declined to engage in substantive arms control discussions. We continue to assess the PRC is constructing the infrastructure necessary to support this force expansion, including increasing its capacity to produce and separate plutonium by constructing fast breeder reactors and reprocessing facilities. Though this is consistent with the PRC goal of closing the nuclear fuel cycle, the PRC likely intends to use some of this infrastructure to produce plutonium for its expanding nuclear weapons program.

US Department of Defense, *China Military Power 2022*, pp. 94-97

US Department of Defense: Chinese Nuclear Developments in 2022 – IV

The PRC's long-term nuclear requirements—and the relationship between the PRC's nuclear requirements and its national strategy and goal to field a "world-class" military by mid-century—remain unclear from public sources. Hawkish PRC state media outlets have asserted that the PRC needs 1,000 warheads, while retired PLA officers have suggested that the PRC should possesses a 'mutually assured destruction' capability. The PLA plans to "basically complete modernization" of its national defense and armed forces by 2035. If China continues the pace of its nuclear expansion, it will likely field a stockpile of about 1,500 warheads by that time. While neither of those claims are official, anticipated changes to the capacity, capability, and readiness of the PRC's nuclear forces in the coming years seem likely to outpace potential developments by the nuclear forces of any adversary that could plausibly threaten the PRC ability to retaliate against a first strike. A Western think tank publication indicated that the PRC could field more than 1,000 nuclear warheads by the end of the decade, judging from the amount of plutonium that could be produced from reactors under construction.

In recent years, the PRC's possible preparation to operate its Lop Nur nuclear test site year-round and lack of transparency on its nuclear testing activities have raised concerns regarding its adherence to the U.S. "zero yield" standard adhered to by the United States, the United Kingdom, and France in their respective nuclear weapons testing moratoria.

Regardless of the ultimate number of nuclear weapons it makes, the PRC will probably continue to claim it is, like other nuclear powers, adhering to the minimum of nuclear weapons needed to protect its security interests.

Hypersonics and Fractional Orbital Bombardment. The PRC is probably developing advanced nuclear delivery systems such as a strategic hypersonic glide vehicle and a fractional orbital bombardment (FOB) system in part due to long-term concerns about United States missile defense capabilities, as well as to attain qualitative parity with future worldwide missile capabilities. On July 27th, 2021, the PRC conducted a test of an ICBM-range hypersonic glide vehicle that travelled 40,000 kilometers. The test likely demonstrated the PRC's technical ability to field a FOB system.

Lower-yield Nuclear Weapons. The PRC probably seeks lower yield nuclear warhead capabilities to provide proportional response options that its high-yield warheads cannot deliver. PRC strategists have highlighted the need for lower-yield nuclear weapons in order to increase the deterrence value of the PRC's nuclear force, though they have not defined specific nuclear yield values. A 2017 defense industry publication indicated a lower-yield weapon had been developed for use against campaign and tactical targets that would reduce collateral damage. By late 2018, PRC concerns began to emerge that the United States would use low-yield weapons against its Taiwan invasion fleet, with related commentary in official media calling for proportionate response capabilities. The DF-26 is the PRC's first nuclear-capable missile system that can conduct precision strikes, and therefore, is the most likely weapon system to field a lower-yield warhead in the near-term.

Launch on Warning (LOW). The PLA is implementing a launch-on warning posture, called "early warning counterstrike" (预警反击), where warning of a missile strike leads to a counterstrike before an enemy first strike can detonate. PLA writings suggest multiple manned C2 organs are involved in this process, warned by space and ground based sensors, and that this posture is broadly similar to the U.S. and Russian LOW posture. The PRC probably seeks to keep at least a portion of its force, especially its new silo-based units, on a LOW posture, and since 2017, the PLARF has conducted exercises involving early warning of a nuclear strike and launch on warning responses.

China's considerations to attain a LOW posture date back to even the 1970s and 1980s, when the PRC considered using existing land-based ballistic missile early warning radar to support a LOW posture for its silo-based CSS-4 ICBMs, but apparently this early warning system was unreliable. In recent years, the PRC has been able to make advances in early warning needed to support a LOW posture. China has several ground-based large phase array radars—similar in appearance to U.S. PAVE PAWS radars—that could support a missile early warning role. There has likely been progress made in space-based early warning as well. In 2013, foreign media sources claimed to be in possession of PLA documents indicating expedited plans to field three geostationary satellites capable of detecting ballistic missile launches. Then, in 2015, the PRC's Defense White Paper identified "improved strategic early warning" as specific nuclear force modernization goals with the PRC's 13th Five-Year Plan (2016-2020) reported including requirements to place early warning satellites in space. As of 2022, the PRC likely has at least three early warning satellites in orbit. In 2019, Russia offered to assist China in developing a missile early warning system.

US Department of Defense, *China Military Power 2022*, pp. 94-97

China: IISS Estimate of Strategic Nuclear and Defense Forces in 2023 - I

Strategic Missile Forces 120,000+
People's Liberation Army Rocket Force
The People's Liberation Army Rocket Force organizes and commands its own troops to launch nuclear counter- attacks with strategic missiles and to conduct operations with conventional missiles. Organized as launch brigades subordinate to 6 army-level missile bases.

SURFACE-TO-SURFACE MISSILE*
1 ICBM bde with DF-4
3 ICBM bde with DF-5A/B
1 ICBM bde with DF-31
1 ICBM bde with DF-31A
5 ICBM bde with DF-31A(G)
2 ICBM bde with DF-41
6 IRBM bde with DF-26
3 MRBM bde with DF-17 with HGV
2 MRBM bde with DF-21A/E
1 MRBM bde with DF-21C/D
2 SRBM bde with DF-11A/DF-15B
2 SRBM bde with DF-16
3 GLCM bde with CJ-10/CJ-10A/CJ-100 8 SSM bde (forming)

SURFACE-TO-SURFACE MISSILE LAUNCHERS ICBM • **Nuclear** 140: ε10 DF-4 (CH-SS-3); ε20 DF-5A/B (CH-SS-4 Mod 2/3); ε8 DF-31 (CH-SS-10 Mod 1); ε24 DF-31A (CH-SS-10 Mod 2); ε54 DF-31A(G) (CH-SS-10 Mod 3); ε24 DF-41 (CH-SS-20)
IRBM • **Dual-capable** 110+ DF-26 (CH-SS-18)
MRBM 94: **Nuclear** ε40 DF-21A/E (CH-SS-5 Mod 2/6); **Conventional** 54: ε24 DF-17 with HGV (CH-SS-22); ε30 DF-21D (CH-SS-5 Mod 5 – ASBM)
SRBM • **Conventional** 225: ε108 DF-11A (CH-SS-7 Mod 2); ε81 DF-15B (CH-SS-6 Mod 3); ε36 DF-16 (CH-SS-11 Mod 1/2)
GLCM • **Conventional** 108: ε54 CJ-10/CJ-10A (CH-SSC-9 mod 1/2); ε54 CJ-100 (CH-SSC-13 *Splinter*)
Navy

SUBMARINES • **STRATEGIC** 6
SSBN 6 Type-094 (*Jin*) with up to 12 JL-2 (CH-SS-N-14)/ JL-3 (CH-SS-N-20) strategic SLBMs, 6 single 533mm TT with Yu-6 HWT

* Although US government reports have estimated that China's ICBM force has increased from 100 to 300 launchers and from 150 to 300 missiles, satellite imagery analysis of the silo fields does not appear to display evidence that these silos have been filled. Moreover, additional construction work will be required to support the necessary infrastructure for these to become fully operational. Once ready, however, China is likely to fill these silos with either the solid-fuel DF-41 (CH-SS-20) or the DF-31A (CH-SS-10 Mod 2), both of which can reach targets on the United States' eastern seaboard. Although the DF-5A/B variants (CH-SS-4 Mod 2/3 respectively) are also capable of striking targets at similar ranges, both systems are liquid- fueled, and their lengthy fueling process means that they can be vulnerable to pre-emptive attack. ...Whether the PLARF will fill all of these silos is a matter of debate among analysts

China: IISS Estimate of Strategic Nuclear and Defense Forces in 2023 - II

Defensive

RADAR • STRATEGIC: 4+ large phased array radars; some detection and tracking radars
Space

SATELLITES 207
COMMUNICATIONS 11: 2 *Shen Tong*-1; 4 *Shen Tong*-2; 2 *Feng Huo*-1; 3 *Feng Huo*-2
POSITIONING, NAVIGATION & TIMING 45: 3 *Beidou-* 2(M); 5 *Beidou*-2(G); 7 *Beidou*-2(IGSO); 24 *Beidou*-3(M); 3 *Beidou*-3(G); 3 *Beidou*-3(ISGO) **METEOROLOGY/OCEANOGRAPHY** 8: 2 *Yunhai*-1; 6 *Yunhai*-2
ISR 55: 2 *Jianbing*-5; 4 *Jianbing*-6; 4 *Jianbing*-7; 5 *Jianbing*-9; 3 *Jianbing*-10; 3 *Jianbing*-11/-12; 3 *Jianbing*-16; 4 LKW; 4 *Tianhui*-2; 3 *Yaogan*-29; 2 *Yaogan*-34; 15 *Yaogan*-35; 3 *Yaogan*-36
ELINT/SIGINT 81: 30 *Chuangxin-5 (Yaogan*-30*)*; 15 *Jianbing*-8; 3 *Qianshao*-3; 10 *Shijian*-6 (5 pairs – reported ELINT/SIGINT role); 7 *Shijian*-11 (reported ELINT/ SIGINT role); 12 *Yaogan*-31; 4 *Yaogan*-32
EARLY WARNING 5: 5 *Huoyan*-1
RENDEZVOUS & PROXIMITY OPERATIONS 2: 1 *Shijian*-17; 1 *Shijian*-21
REUSABLE SPACECRAFT 1 CSSHQ **COUNTERSPACE • MSL** SC-19 (reported)

Source: Adapted from IISS, *Military Balance, 2023*, "China"

.

China: Bulletin of Atomic Scientists 2023 - I

Table 1. Chinese nuclear forces, 2023.

Type	NATO designation	Number of launchers[a]	Year deployed	Range (kilometers)	Warheads x yield[b] (kilotons)	Warheads
Land-based ballistic missiles						
Medium-range ballistic missiles						
DF-17	CSS-22	54[c]	2021	1,800+	1 × HGV	?[d]
DF-21A/E	CSS-5 Mods 2, 6	24	2000, 2016	2,100+[e]	1 × 200–300	24[f]
Subtotal		*78*				*24*
Intermediate-range ballistic missiles						
DF-26	CSS-18	162[g]	2016	3,000+	1 × 200–300	54[h]
Intercontinental ballistic missiles						
DF-4	CSS-3	6[i]	1980	5,500	1 × 3,300	0
DF-5A	CSS-4 Mod 2	6	1981	12,000	1 × 4,000–5,000	6
DF-5B	CSS-4 Mod 3	12	2015	13,000	Up to 5 × 200–300	60
DF-5C	(CSS-4 Mod 4)	. .	(2024)	13,000	(MIRV)	. .
DF-27	?	. .	(2026)	5,000–8,000	1 × 200–300	. .
DF-31	CSS-10 Mod 1	6	2006	7,200	1 × 200–300	6
DF-31A	CSS-10 Mod 2	24	2007	11,200	1 × 200–300	24
DF-31AG	CSS-10 Mod 2[j]	60	2018	11,200	1 × 200–300	60
DF-41	CSS-20 (mobile)	28[k]	2020	12,000	Up to 3 × 200–300	84
DF-41	CSS-20 (silo)[l]	.	(2025)	12,000	(3 × 200–300)	.
Subtotal		*142*				*240*
Land-based ballistic missile subtotal		*382*				*318*
Submarine-launched ballistic missiles						
JL-2	CSS-N-14	0[m]	2016	7,000+	1 × 200–300	0
JL-3	CSS-N-20	6/72	2022[n]	9,000+	("Multiple")	72
Aircraft[o]						
H-6K	B-6	10	1965/2009	3,100+	1 × bomb	10[p]
H-6N	B-6	10	2020	3,100+	(1 × ALBM)	10
H-20	?	. .	(2028)	?	(bomb/ALCM?)	. .
Total		**474**				**410**

China: Nuclear Weapons Modernization: House of Commons Library – I: 2022

Over the last two decades China has, however, been actively expanding its nuclear capabilities in order to achieve a more robust and survivable nuclear force; at the same time as developing a credible second-strike capability.

- China's nuclear posture is based on the concept of "self-defence" and, as such, it maintains a nuclear force based on the minimum required for its national security.
- It has a longstanding no first-use policy.
- China's nuclear stockpile is estimated at 350 warheads.
- Nuclear forces are maintained at a low alert level. No warheads are thought to be operationally deployed but kept in storage under central control.
- Is believed to have a viable nuclear triad of ground, air and sea-launched forces.
- Does not operate continuous at-sea deterrence.

The extent of China's nuclear expansion has raised questions over the compatibility of its modernization plans with its posture of self-defence and no first use.

The Chinese Government has never declared the size or status of its nuclear stockpile. As of January 2022, SIPRI estimates the Chinese nuclear stockpile to be in the region of 350 warheads, an increase of 70 warheads in the last four years alone. None of those warheads are thought to be operationally deployed but are "de-mated" from their delivery vehicles and kept in storage under central control.

China has not declared its fissile material production and there are varying estimates as to its holdings.

The primary nuclear mission is the responsibility of the People's Liberation Army Rocket Force. Ground-launched capabilities comprise approximately 280 land-based missiles, including:

- Intercontinental ballistic missiles (ICBM), specifically the DF-31, DF-31A, DF-5A and DF-5B.
- DF-26 dual-capable, intermediate range ballistic missiles (IRBM), which began deployment in 2018. With an estimated range in excess of 4,000km it is capable of striking targets in the western Pacific Ocean, including US military facilities in Guam. However, it is unclear how many of these dual-role missiles are assigned a nuclear role.
- DF-21 medium-range ballistic missiles. A third variant of the DF-21 (Mod 6), with improved range, mobility and accuracy was deployed in 2017.
- The DF-4 ICBM is thought to have been retired, or is in the process of being retired, from service.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: China*, House of Commons Library, July 29, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9088/CBP-9088.pdf

China: Nuclear Weapons Modernization: House of Commons Library – II: 2022

DF-31A ICBM, which deployed in 2018, has provided China with the ability to deploy multiple warheads aboard its ICBM,19 and ensures coverage of most of the continental US. They have replaced the DF-4, while the process of replacing its older DF-5A ICBM with the new DF-31A is ongoing. China is also reported to be bringing the new DF-41 road-mobile ICBM into service, with two mobile brigades fielded to date. Believed to be capable of carrying up to 10 warheads, it will have a range in excess of 12,000km. In their most recent assessment of Chinese nuclear capability, however, Hans Kristensen and Matt Korda suggest that three warheads are more likely to be assigned per missile in order to maximize range. The remaining missile payload, they argue, is intended for decoys and penetration aids.…In its 2021 report to Congress on China's military power, the Pentagon also suggested that a new "long-range" missile, the DF-27, was also under development,..

… in support of China's rapid expansion of its ICBM capabilities, in 2021 commercial satellite imagery revealed that three new ICBM missile silo fields were being constructed in the north of the country, capable of housing 300 individual missile silos. Located beyond the reach of conventional US long-range cruise missiles, analysts have suggested that the motivation behind the new missile fields could be to reduce the vulnerability of China's nuclear arsenal from long-range conventional first strikes …These new missile fields, along with the introduction of more MIRV-capable missiles is the basis for many of the estimates on future warhead numbers

China established a submarine-launched nuclear capability in the mid-1980s with the development of a single Xia class SSBN equipped with 12 JL-submarine-launched ballistic missile (SLBM). However, its operational status was questioned…t is only since 2016, with the development of four Jin class SSBN, each equipped with 12 JL-2 SLBM, that China is considered to have established a credible sea-based element of its nuclear triad. In April 2020, a further two Jin class boats were delivered to the PLA Navy and entered service in 2021, to give a current SSBN force of six…The Jin class constitutes major technological advancement over the Xia class submarine, particularly in relation to stealth, sonar, propulsion, command and control systems and overall survivability of the sea-based deterrent. The JL-2 SLBM, is a sea-based variant of the DF-31 and was successfully flight tested in 2013 and 2014. It provides greater range23 and accuracy than its predecessor. Importantly the Jin class, provides China with a potential second-strike capability if it is operationally deployed. However, while the JL- 2 would be capable of targeting Alaska, Guam, Hawaii, Russia and India from waters near China, it could not target the continental US unless it sailed deep into the Pacific Ocean.

A next-generation SSBN, the Type 096, is expected within the next decade. It will reportedly carry the next generation JL-3 SLBM, which is thought to have a longer range (10,000km) than the JL-2 and might be MIRV capable. The most recent successful test of the JL-3 was in December 2019. Construction of the Type 096 reportedly began in 2021. The PLA Navy is expected to operate the Jin class and the Type 096 SSBNs concurrently and could have eight-12 SSBNs in service by 2030

…. In October 2019, China confirmed the PLAAF's nuclear status by publicly revealing the H-6N as its first long-range strategic bomber. A modified H-6 bomber, the H-6N has air to air refueling capability and is capable of deploying with a nuclear-armed, air-launched ballistic missile (ALBM)…Two such missiles are thought to be under development. Such capability would represent a major advancement of China's aerial strategic nuclear deterrent.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: China*, House of Commons Library, July 29, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9088/CBP-9088.pdf

China: Nuclear Weapons Modernization: House of Commons Library – III: 2022

China is currently developing its first long-range stealth bomber known as the H-20. It is expected to be dual-role and fielded sometime in the late 2020s. There is speculation that the H-20 could be equipped with a nuclear cruise missile, although those reports have not been confirmed.

In October 2019 China unveiled its DF-17 hypersonic boost glide vehicle (HGV). While the HGV was presented at the time as having a conventional role, it has been suggested that it will be dual-capable. In February 2020 the Head of US Strategic Command, Admiral Charles Richard, referred to the DF- 17 as a "strategic nuclear system". Reports suggest that China has begun to operationally deploy the DF-17.3

China has continued to test hypersonic technologies which has led many to believe that the PLA Rocket Force "may be developing innovative new weapons-delivery systems"… Of note were two tests, conducted in mid-2021, of what is thought to be an orbital hypersonic weapon system, what has been referred to as a fractional orbit bombardment system.... While such technology could significantly increase China's nuclear second- strike capabilities, there is uncertainty over the role that it could play in China's overall nuclear posture.

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: China*, House of Commons Library, July 29, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9088/CBP-9088.pdf

China: Bulletin of Atomic Scientists 2023 - III

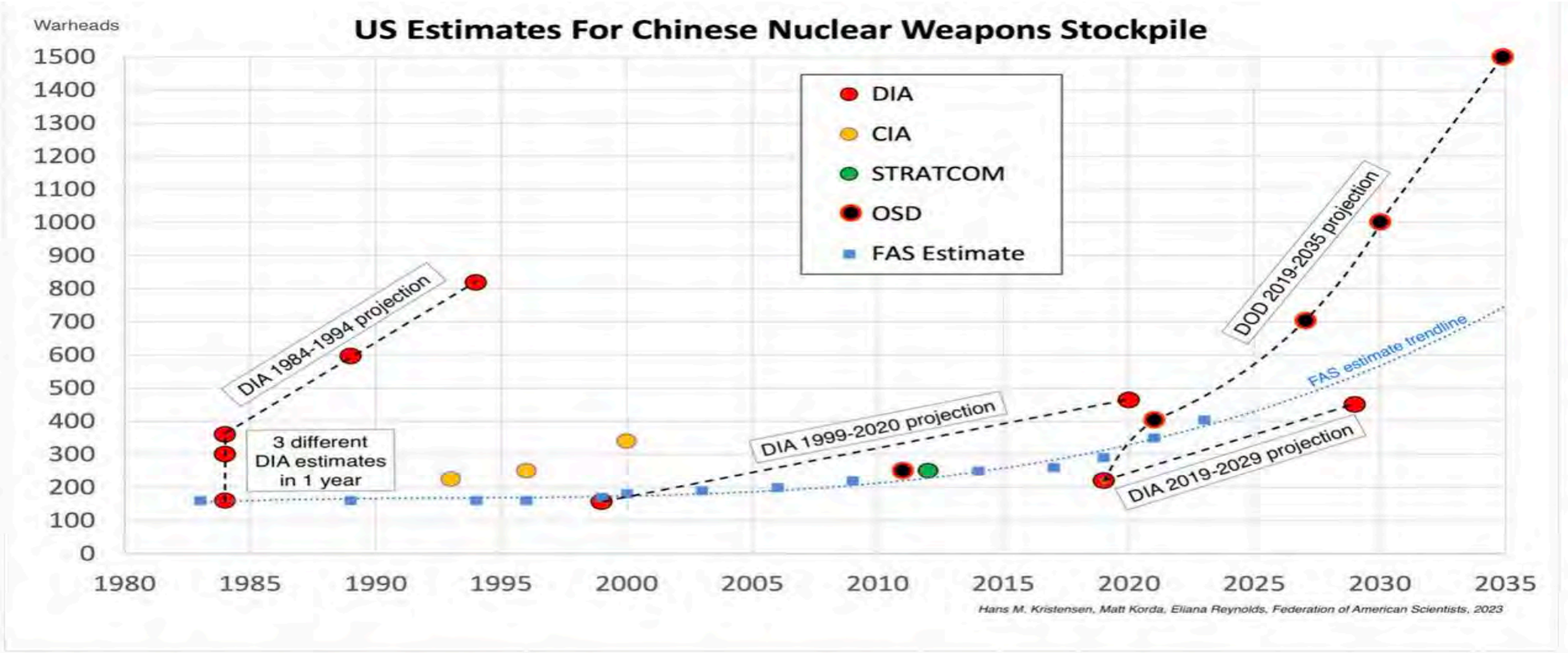

Figure 1: US organizations' estimate of China's nuclear weapons stockpile. Abbreviations used: CIA, Central Intelligence Agency; DIA, Defense Intelligence Agency; DOD, US Department of Defense; FAS, Federation of American Scientists; OSD, Office of the Secretary of Defense; STRATCOM, US Strategic Command. Credit: Hans M. Kristensen, Matt Korda, and Eliana Reynolds/Federation of American Scientists. (view large version)

Source: Hans M. Kristensen, Matt Korda, Eliana Reynolds , **Nuclear Notebook: Chinese nuclear weapons, 2023, https://thebulletin.org/premium/2023-03/nuclear-notebook-chinese-nuclear-weapons-2023/.**

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Two dots (. .) imply the number is unknown or premature.

[a]Numbers in parenthesis indicate weapons in the process of entering service but not yet operational.

[b]The Chinese nuclear testing program demonstrated a wide range of warhead yields. While older and less accurate missiles were equipped with megaton-yield warheads, new and more accurate missiles carry warheads with much lower yields, possibly in the few hundreds of kilotons. It is possible that some warheads have even lower yield options.

[c]Assumes two brigades are operational and possibly three more under preparation to receive the DF-17.

[d]The DF-17 was presented as a conventional missile at the 2019 Beijing parade. US Department of Defense says it is "primarily a conventional platform [but] may be equipped with nuclear warheads." FAS is awaiting more information before attributing warheads to the DF-17.

[e]US Department of Defense lists the range of the DF-21A/E as 1,750 km, but the US Air Force has reported it as 2,150 km.

[f]This table only counts nuclear versions DF-21A (CSS-5 Mod 2) and DF-21E (CSS-5 Mod 6), of which fewer than 50 launchers (probably 24) are deployed. Not much is known about the DF-21E. It may be replacing the DF-21A. It is assumed that nuclear launchers do not have reload, unlike conventional versions (DF-21C and DF-21D) that are assumed to have one reload.

[g]This table only counts DF-26s at observable bases. The US Department of Defense lists 250 IRBM launchers, up from 200 in 2021, which is significantly more than the apparent operational base infrastructure indicates. The Department of Defense's estimate may include launchers for bases that are upgrading to DF-26 but not yet fully operational and include launchers in the final stage of production.

[h]This assumes most dual-capable DF-26 launchers have a conventional mission and only a portion (perhaps one-third) are assigned a nuclear mission. It assumes reload for conventional missile only.

[i]The 2022 US Department of Defense report still lists the old liquid-fuel DF-4. But with the fielding of greater numbers of solid-fuel DF-31AG and DF-26 missiles and new silo construction underway at what was thought to be the last remaining DF-4 deployment site in Hunan province, it is likely that the DF-4 is in the process of being retired and may no longer have an operational role. Therefore, we no longer count warheads for the DF-4.

[j]The DF-31AG is thought to carry the same missile as the DF-31A.

[k]Assumes possibly three brigades are operational with the DF-41.

[l]Three large missile silo fields are in the early stages of construction with a total of approximately 320 silos. Based on construction time for training silos, it is estimated that the entire fields will not become fully operational until the mid- to late-2020s, although some silos may be completed before. The Department of Defense states the silos are compatible with both DF-31 and DF-41 solid-fuel ICBMs.

[m]In November 2022, the commander of the US Pacific Fleet stated that China had replaced all of its deployed JL-2 SLBMs with JL-3s.

[n]Although US officials have stated that the JL-3 has become operational on Type 094/A SSBNs, it is also thought to be intended to eventually arm the future Type 096 SSBN.

[o]Bombers were used to conduct at least 12 of China's nuclear test explosions between 1965 and 1979 and gravity bomb models are displayed in museums. The People's Liberation Army Air Force nuclear capability was dormant for years, but the mission has recently been reestablished.

[p]Although the US Department of Defense lists only the H-6N as nuclear with an air-launched ballistic missile, we estimate a small number of gravity bombs were possibly retained in the stockpile.

Source: Hans M. Kristensen, Matt Korda, Eliana Reynolds , **Nuclear Notebook: Chinese nuclear weapons, 2023, https://thebulletin.org/premium/2023-03/nuclear-notebook-chinese-nuclear-weapons-2023/.**

SIPRI Estimate of Chinese Nuclear Forces in 2022

All figures are approximate and some are based on assessments by the authors.

Type/Chinese designation (US designation)	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield[b]	No. of warheads[c]
Aircraft	*20*[d]				*20*
H-6K (B-6)	20	2009	3 100	1 x bomb	20
H-6N (B-6N)	–	2021	. .	1 x ALBM	–
H-20 (B-20)	–	[2025]	. .	. .	–
Land-based missiles[e]	*398*				*258*
DF-4 (CSS-3)	6[f]	1980	5 500	1 x 3 300 kt	6
DF-5A (CSS-4 Mod 2)	10	1981	12 000	1 x 4 000–5 000 kt	10
DF-5B (CSS-4 Mod 3)	10	2015	13 000	5 x 200–300 kt	50
DF-5C (CSS-4 Mod 4)	. .	[2020s]	13 000	[MIRV]	. .
DF-15 (CSS-6)	. .	1990	600	1 x . .[g]	. .
DF-17 (CSS-22)	36[h]	2020	>1 800	1 x HGV[i]	. .
DF-21A/E (CSS-5 Mod 2/6)	40[j]	2000/2016	>2 100[k]	1 x 200–300 kt	40[l]
DF-26 (CSS-18)	200	2016	4 000	1 x 200–300 kt	20[m]
DF-31 (CSS-10 Mod 1)	6	2006	7 200	1 x 200–300 kt	6
DF-31A/AG (CSS-10 Mod 2)[n]	72	2007/2018	11 200	1 x 200–300 kt	72
DF-41 (mobile version) (CSS-20)	18[o]	2020	12 000	3 x 200–300 kt	54
Sea-based missiles (SLBMs)	*6/72*[p]				*72*
JL-2 (CSS-N-14)	72	2016	>7 000	1 x 200–300 kt	72
JL-3 (CSS-N-X-. .)	. .	[2020s][q]	>10 000	[MIRV]	. .
Total stockpile	**490**				**350**[r]

. . = not available or not applicable; – = nil or a negligible value; [ ] = uncertain SIPRI estimate; ALBM = air-launched ballistic missile; HGV = hypersonic glide vehicle; kt = kiloton; MIRV = multiple independently targetable re-entry vehicle; SLBM = submarine-launched ballistic missile.

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 380-390,* https://www.sipri.org/yearbook/2022/10

US Department of Defense: Estimate of Chinese Missile Forces: 2022

System	*Launchers*	*Missiles*	*Estimated Range*
ICBM	300	300	>5,500km
IRBM	250	250+	3,000-5,500km
MRBM	250	500+	1,000-3,000km
SRBM	200	600+	300-1,000km
GLCM	100	300+	>1,500km

US Department of Defense, *China Military Power 2022*, p. 167.

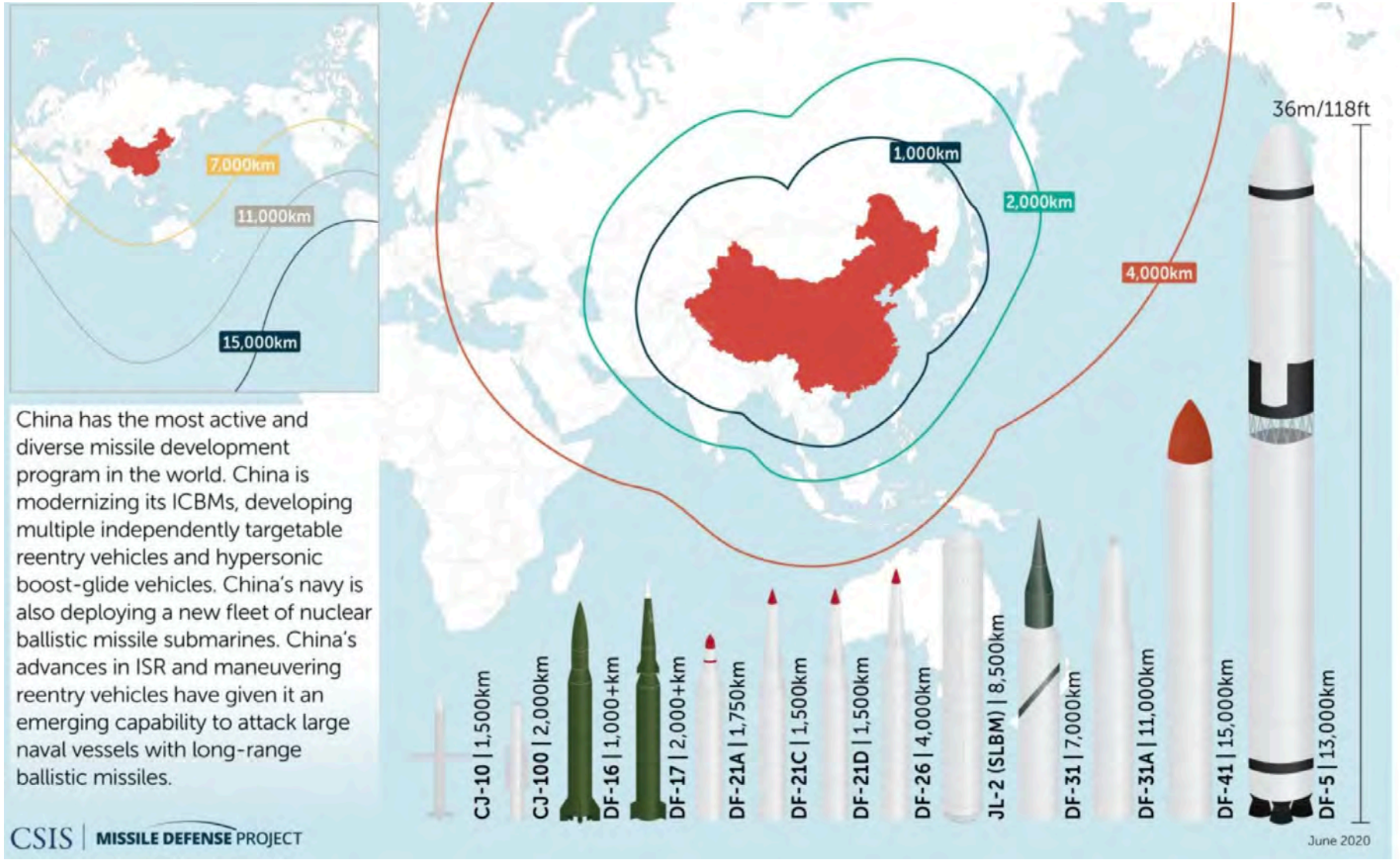
China: Operational Missile Forces*

Missile Name	Class	Range	Status
DF-11	SRBM	280 - 300 km	Operational
DF-12 / M20	SRBM	280 km	Operational
DF-15	SRBM	600 km	Operational
DF-16	SRBM	800 - 1,000 km	Operational
DF-17	HGV	1,800 - 2,500 km	Operational
DF-21	MRBM	2,150 km	Operational
DF-26	IRBM	4,000 km	Operational
DF-31	ICBM	7,000 - 11,700 km	Operational
DF-4	IRBM/ICBM	4,500 - 5,500 km	Operational
DF-41	ICBM	12,000 - 15,000 km	Operational
DF-5	ICBM	13,000 km	Operational
HN 2	Cruise Missile	1,400-1,800 km	Operational
HN 3	Cruise Missile	3,000 km	Operational
HN 1	Cruise Missile	50 - 650 km	Operational
JL-2	SLBM	8,000 - 9,000 km	Operational
YJ-18	Cruise Missile	220 - 540 km	Operational

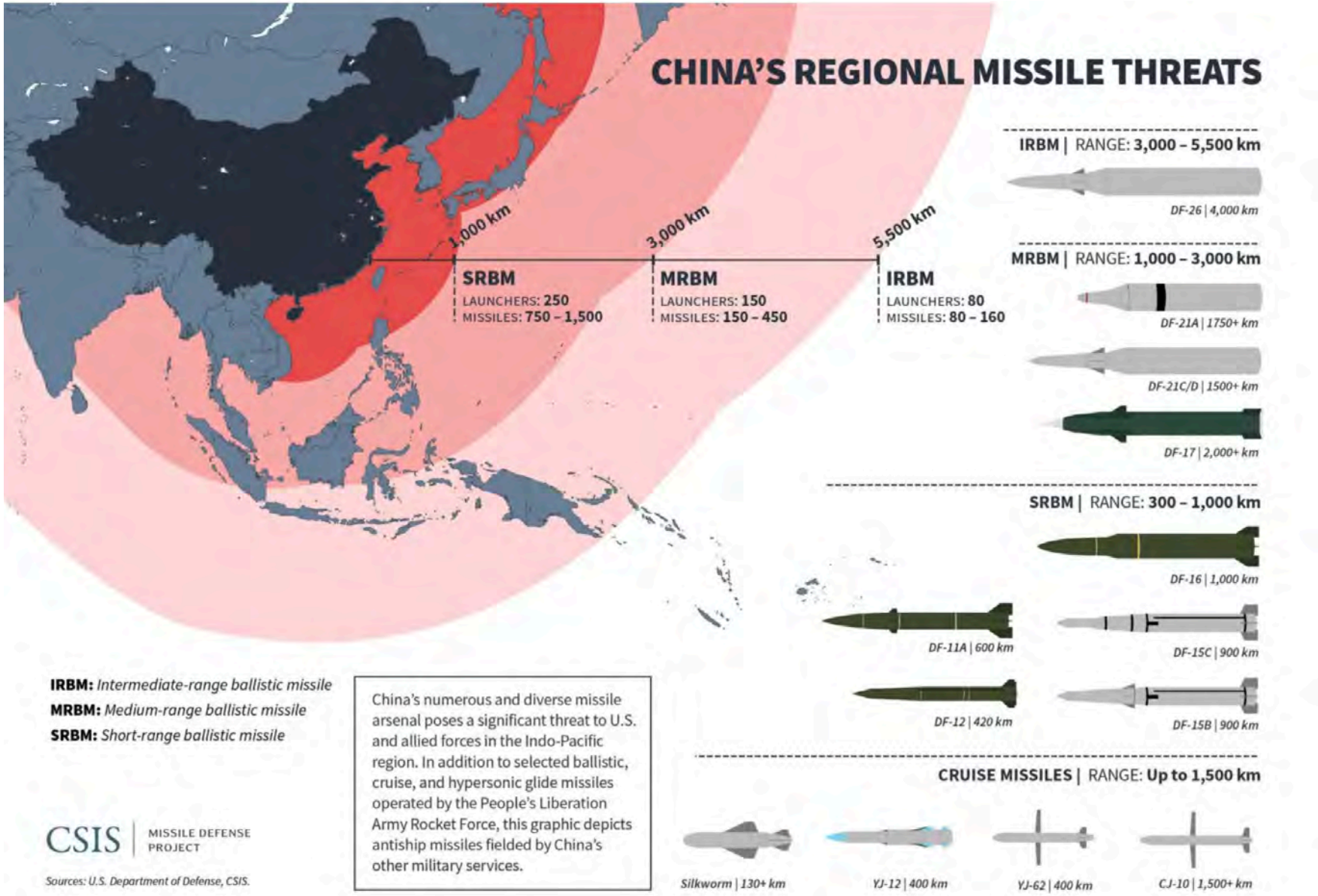
* All missiles listed as operational in source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of China," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified April 12, 2021, https://missilethreat.csis.org/country/china/.

China: Ballistic and Cruise Missile Forces



Missile Defense Project, "Missiles of China," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified April 12, 2021, https://missilethreat.csis.org/country/china/.



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Missile Defense Project, "Missiles of China," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified April 12, 2021, https://missilethreat.csis.org/country/china/.

United Kingdom Nuclear Forces

United Kingdom: Refresh of the Integrated Defense Review: 2023 - I

…The 2023 refresh … builds on the approach set out in the Integrated Review, setting out the next evolutionary step in delivering on its aims, against the backdrop of a more volatile and contested world. Its main conclusion is that unless democracies like our own do more to build our resilience and out-cooperate and out-compete those that are driving instability, the global security situation will deteriorate further, to the detriment of all states and peoples. As in 2021, it paves the way to greater integration across government in pursuit of the four campaign priorities that will guide our national security strategy in this changing context. And it does so with further investment in our national security.

First, we must shape the global strategic environment, working with like-minded partners around the world and also with those who do not necessarily share our values and our perspective. The security and prosperity of the Euro-Atlantic will remain our core priority, bolstered by a reinvigoration of our European relationships. But that cannot be separated from our wider neighborhood on the periphery of our continent and a free and open Indo-Pacific. We will deepen relationships, support sustainable development and poverty alleviation, and tackle shared challenges including climate change.

China poses an epoch-defining challenge to the type of international order we want to see, both in terms of security and values – and so our approach must evolve. We will work with our partners to engage with Beijing on issues such as climate change. But where there are attempts by the Chinese Communist Party to coerce or create dependencies, we will work closely with others to push back against them. And we are taking new action to protect ourselves, our democracy and our economy at home.

Second, as threats and volatility increase, we recognize the growing importance of deterrence and defense to keep the British people safe and our alliances strong. Our immediate and most urgent priority is supporting the self-defense and restoration of sovereignty and territorial integrity of Ukraine. This is not just about our values. We are acting because Ukraine's security is all of our security. Russia's invasion and continuing occupation of Georgia, invasion and occupation of Crimea, threats to the UK homeland and attempts to destroy Ukraine are assaults on European security. That is why we have committed at least £2.3 billion of support for Ukraine as it enters the second year of its war of national self-defense, just as we did in 2022.

This geopolitical moment not only requires us to act now but to plan for the long-term. As a result of the refresh of the Integrated Review, defense will receive £5 billion of additional funding over two years – focusing on the priority areas of nuclear resilience and conventional stockpiles. Building on the record investment announced in 2020, overall UK defense spending is expected to reach 2.2% of GDP this year (2.29% when including our military support to Ukraine). But we will go further still, moving away from the baseline commitment of spending at least 2% of GDP on defense to a new aspiration to reach 2.5%. Taken together, these commitments will maintain our leading position in NATO and continue the modernization of our armed forces, which will be further strengthened as we learn the lessons from the war in Ukraine. It will also allow us to invest in the next stages of the AUKUS and GCAP programs. We will also support efforts to renew arms control and counter-proliferation, as it is when tensions are highest that leadership to establish clear routes for de-escalation is most vital.

… **An integrated approach to deterrence and defense**

The foundational component of an integrated approach to deterrence and defense remains a minimum credible, independent UK **nuclear deterrent**, assigned to the defense of NATO. It ensures that potential adversaries can never use their capabilities to threaten the UK or our NATO allies or to deter us from taking the action required to maintain regional and global security and stability. We would consider using our nuclear weapons only in extreme circumstances of self-defense, including the defense of our NATO allies. Only the Prime Minister can authorize their use. The UK's negative security assurance remains unchanged.

As IR2021 set out, the UK is committed to a one-in-two-generations modernization of our nuclear forces. IR2023 reinforces this with further investment. As part of the Government's broader ambition on the nuclear enterprise (see textbox), we will publish a Defense Nuclear Strategy to set out how we will deliver the recapitalization programs necessary to strengthen and build resilience in UK capabilities, including an updated approach to people and specialist skills.

United Kingdom: Refresh of the Integrated Defense Review: 2023 - II

In addition to our nuclear deterrent, the UK's **conventional, cyber and space forces** must be sufficiently capable, resilient, deployable and adaptive to deter potential adversaries from engaging in conflict, and to win a conflict if deterrence fails. The UK's forces already have cutting-edge technologies and capabilities across all five domains of land, sea, air, space and cyberspace. Combined with our ability to train and operate with others in an integrated way, this enables the UK to deliver disproportionate effect relative to our size. But as others modernize their own armed forces, we must work to maintain our edge.

… Of this new money, £3 billion will be invested across the defense nuclear enterprise, supporting areas such as the construction of industrial infrastructure at Barrow, Derby and at the Atomic Weapons Establishment, allowing us to continue to grow our graduate and apprentice nuclear skills programs, and enhancing support to in-service submarines. This investment will help to modernize our manufacturing and maintenance capacity so that we can improve submarine availability and increase resilience, as well as supporting the delivery of AUKUS.

…In the changing strategic context, the UK's defense and civil nuclear sectors are of increasing importance for our security, our energy needs and our prosperity. They make a substantial contribution to the UK's economic growth and technological edge, supporting a highly-skilled workforce and investment across the whole of the UK.

The defense nuclear enterprise is collectively responsible for the development, build, maintenance and – through the Royal Navy – delivery of our Continuous at Sea Deterrent. The success of the defense nuclear enterprise remains a critical national endeavor, requiring significant and sustained investment and support from government.

The delivery of the four new Dreadnought Class submarines, the first of which will enter service in the early 2030s, is an illustration of our investment; as is the to replace the UK's sovereign nuclear warhead, which has now entered its concept phase. We are also investing in personnel, infrastructure, and capabilities at the Atomic Weapons Establishment (AWE) that are essential to deliver the UK Replacement Warhead program and sustain the current in-service warhead until it is withdrawn from service.

In 2022, the Government announced a £2 billion investment in the UK's submarine delivery across Barrow-in-Furness and Derby, as part of the current phase of Dreadnought. We will continue to build on that investment, providing thousands of British jobs across the enterprise and supply chain. This will support the delivery of a new, world class fleet of nuclear-powered attack submarines for the Royal Navy.

This will underpin the delivery of AUKUS, working with the US to deliver the optimum pathway to provide Australia with conventionally armed nuclear-powered submarines. The AUKUS program will be an important part of the nuclear enterprise, providing an unrivalled opportunity to share innovation and build resilience with the US and Australia. It will improve the continued delivery of non-nuclear advanced capabilities across all three countries and enhance how we share information with each other. It will also deliver on our commitment to setting the highest nuclear non-proliferation standards.

…We will proactively look for opportunities to align delivery of the civil and defense nuclear enterprises, seeking synergies where appropriate to ensure a coherent demand signal to our industry and academic partners. The Defense Nuclear Strategy, which will be published later this year, will signal government's future ambitions for the defense nuclear enterprise, setting our plans for skills and make clear the vitally important role that our industry partners play in supporting both the civil and defense nuclear sectors.

… Well-established channels for dialogue and de-escalation with Russia are currently limited and under significant strain, but we remain ready to reinvigorate them when the moment is right. IR2023 also includes a clear articulation of the principles that will underpin the UK's approach to bilateral relations with China, in which the importance of dialogue and diplomacy is emphasized. Ultimately, the UK seeks to re-establish a stable, constructive and frank relationship that can both create better conditions for cooperation and underpin the kind of strategic dialogue required to prevent miscalculation and misunderstanding.

…More broadly, the UK will support a new agenda for arms control that is multi-domain, multi-capability and draws together a wider set of actors. We will strengthen the elements of the existing architecture that remain vital – such as the Chemical Weapons Convention, the Biological and Toxin Weapons Convention, and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The NPT has been the cornerstone of nuclear security and civil nuclear prosperity for the last 52 years, and the UK remains committed to its implementation in full.

Source: Cabinet Office, Policy paper, *Integrated Review Refresh 2023: Responding to a more contested and volatile world***,** 13 March 2023, https://www.gov.uk/government/publications/integrated-review-refresh-2023-responding-to-a-more-contested-and-volatile-world/integrated-review-refresh-2023-responding-to-a-more-contested-and-volatile-world.

United Kingdom: House of Commons 2022

…the 2021 Integrated Review announced that the 2010 commitments could no longer be met due to the current security environment. As such, it announced that the cap on the nuclear stockpile will now be raised and that information on operational stockpile, deployed missiles and deployed warheads would no longer be made available. Both decisions have led many to question the Government's commitment to disarmament.

- Nuclear stockpile – Currently 225 warheads.
- Under the 2021 Integrated Review the cap on the UK's nuclear stockpile, will increase to no more than 260 warheads, a 40% increase on previous commitments.
- The UK is the only nuclear weapon state that has reduced to a single deterrent system.
- Operates continuous at-sea deterrence (CASD).

The program to replace the UK's nuclear deterrent has been underway since 2006. It involves the replacement of the Vanguard class submarines (SSBN) with a new Dreadnought class of SSBN from the early 2030s. A Common Missile Compartment (CMC) for the SSBN, which will house the existing Trident strategic weapons system, is being developed in conjunction with the United States.

The estimated cost of the design and manufacture of a class of four SSBN is £31 billion, including inflation over the life of the program. A £10 billion contingency has also been set aside. The UK is also participating in the current US service-life extension program for the Trident II D5 missile.
In February 2020 the Government confirmed that a program to replace the UK's Mk4 nuclear warhead was also underway.

The UK does not have a policy of "no-first use", deeming such a posture to be incompatible with NATO's doctrine of deterrence.
The Government's Integrated Review of Security, Defense, Development and Foreign Policy, published on 16 March 2021, reaffirmed the UK's longstanding position of ambiguity on the precise details of when, how and at what scale the UK may consider the use of its nuclear weapons capability.
It did confirm, however, that nuclear weapons would only be used in "extreme circumstances of self-defense" and that the UK "will not use, or threaten to use, nuclear weapons against any non-nuclear weapon state party to the NPT".1 This assurance does not apply, however, to any state in material breach of the NPT.
In a shift from previous declaratory policy set out in the 2015 Strategic Defense and Security Review, the Integrated Review does, however, make two significant changes:
1. To extend the UK's position of deliberate ambiguity, the review confirms that the UK will no longer provide public figures on the UK's operational stockpile, deployed warheads and deployed missile numbers. In doing so, the review states: This ambiguity complicates the calculations of potential aggressors, reduces the risk of deliberate nuclear use by those seeking a first-strike advantage, and contributes to strategic stability.

2. Security assurances extended to other countries by the UK are now also subject to review "if the future threat of weapons of mass destruction, such as chemical and biological capabilities, or emerging technologies that could have a comparable impact, makes it necessary".5
The inclusion of "emerging technologies" is new language6 in the Integrated Review that has prompted some commentators to speculate that nuclear weapons could be used in response to a cyber-attack on the UK.
Reaction to these changes is examined in Integrated Review 2021: Increasing the cap on the UK's nuclear stockpile, House of Commons Library.

Source: Claire Mills, *Nuclear weapons at a glance: United Kingdom*, House of Commons Library, 28 July 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9077/CBP-9077.pdf.

United Kingdom: IISS Estimate of Nuclear Forces in 2023

Strategic Forces 1,000

Royal Navy

EQUIPMENT BY TYPE

SUBMARINES • STRATEGIC
SSBN 4 *Vanguard* with 16 UGM-133A *Trident* II D-5/ D-5LE nuclear SLBM, 4 533mm TT with *Spearfish* HWT (recent deployment practice of no more than 8 missiles/40 warheads per boat; each missile could carry up to 12 MIRV; some *Trident* D-5 capable of being configured for sub-strategic role)

MSL • SLBM • Nuclear 48 UGM-133A *Trident* II D-5

Royal Air Force

EQUIPMENT BY TYPE

RADAR • STRATEGIC 1 Ballistic Missile Early Warning System (BMEWS) at Fylingdales Moor

Space
EQUIPMENT BY TYPE
SATELLITES • COMMUNICATIONS 6: 2 *Skynet*-4; 4 *Skynet*-5

.

Source: Adapted from IISS, *Military Balance, 2023,* “France ” and United Kingdom”

United Kingdom: Bulletin of Atomic Scientists 2023 - I

Table 1: British nuclear forces, 2021

Type/Designation	No.	Year deployed	Range (km)	Warheads x yield (kilotons)	Warheads (total available)
Trident II D5(LE)	48	1994	>10,000	1-8 x 100 kt[1]	225[2]

[1] A small number of warheads were previously modified to produce a low yield; however, these warheads are not deployed.

[2] Lists total warheads in stockpile. Of these, 120 are operational available and 40 are deployed on the single SSBN that is at sea.

Figure 1. Estimated United Kingdom Nuclear Weapons Stockpile, 1953-2025. Note: The United Kingdom has not declassified the history of its nuclear weapons stockpile size, so this estimate is provided for illustrative purposes.

Britain : Bulletin of Atomic Scientists 2023 - II

Carrying approximately 40 warheads, one of the four SSBNs is deployed at sea at all times in what is called a Continuous At-Sea Deterrent (CASD) posture. Two of the submarines remain in port and can be deployed on short notice, while the fourth remains in overhaul and could not be quickly deployed, if at all. The patrol SSBN operates at "reduced alert;" that is, its capability to fire its missiles is measured in days, rather than a few minutes (as during the Cold War). Its missiles are also kept in a "detargeted" mode—target coordinates are stored in the submarine's launch control center instead of in the navigational system of each missile.

…To safeguard against the degradation of its nuclear command, control, and communications in wartime, the United Kingdom uses a system of handwritten letters to command its submarines in the event an adversarial strike incapacitates the country's leadership. On their first day in office, the Prime Minister is expected to offer preplanned instructions regarding the United Kingdom's nuclear response, which are said to include options like "Put yourself under the command of the US, if it is still there," "Go to Australia," "Retaliate," or "Use your own judgment."

… In 2006, the UK government announced that they would be "reducing the number of operationally available warheads from fewer than 200 to fewer than 160" (Ministry of Defense 2006, 17). It is believed that around that time, the UK nuclear stockpile included 240 to 245 nuclear warheads. In May 2010, Foreign Secretary William Hague declared, "[f]or the first time, the government will make public the maximum number of warheads that the United Kingdom will hold in its stockpile—in [the] future, our overall stockpile will not exceed 225 nuclear warheads" (Hague 2010, col. 181). The Ministry of Defense subsequently revealed that these reductions to a 225-warhead ceiling had already been completed by May 2010 (UK Ministry of Defense 2013)….Later that year, in October 2010, the Strategic Defense and Security Review (SDSR) declared that the United Kingdom would "reduce the number of warheads onboard each submarine from 48 to 40; reduce our requirement for operationally available warheads from fewer than 160 to no more than 120; reduce our overall nuclear weapon stockpile to no more than 180; [and] reduce the number of operational missiles on each submarine"

… In its 2021 Integrated Review, the UK Government suddenly reversed decades of gradual disarmament policies and announced a significant increase in the upper limit of the United Kingdom's nuclear inventory, up to no more than 260 warheads (HM Government 2021, 76). This decision joins the United Kingdom together with China and Russia as the three members of the so- called P5 NPT countries to increase the sizes of their nuclear stockpiles. In clarifying statements, UK officials noted that the target of 180 warheads promised in the 2010 and 2015 SDSRs "was indeed a goal, but it was never reached, and it has never been our cap," stating that 225 remained the cap even after the 2015 SDSR explicitly declared that "we will reduce the overall nuclear weapon stockpile to no more than 180 warheads" (Liddle 2021; HM Government 2015, 34). In a speech to the Conference on Disarmament, foreign minister James Cleverly stated that the 260 warheads "is a ceiling, not a target, and is not our current stockpile" (Cleverly 2021).

Excerpted from Hans M. Kristensen, Matt Korda, "Nuclear Notebook: How many nuclear weapons does the United Kingdom have in 2021?" *Bulletin of the Atomic Scientists*, May 13, 2021; https://thebulletin.org/premium/2021-05/nuclear-notebook-how-many-nuclear-weapons-does-the-united-kingdom-have-in-2021/.

SIPRI Estimate of British Nuclear Forces in 2022

All figures are approximate and some are based on assessments by the authors.

Type/designation	No. of launchers	Year first deployed	Range (km)	Warheads x yield	No. of warheads
Sea-based missiles (SLBMs)	4/64[a]				*120*
Trident II D5	48[b]	1994	>10 000[c]	1–8 x 100 kt[d]	120
Total operationally available warheads					**120[e]**
Other stored warheads					105[f]
Total inventory					**225[g]**

kt = kiloton; SLBM = submarine-launched ballistic missile.

[a] The first figure is the total number of nuclear-powered ballistic missile submarines (SSBNs) in the British fleet; the second is the maximum number of missiles that they can carry. However, the total number of missiles carried is lower (see note b). Of the four SSBNs, one is in overhaul at any given time.

[b] The three operational SSBNs can carry a total of 48 Trident SLBMs. The United Kingdom has purchased the right to 58 missiles from a pool shared with the United States Navy.

[c] The Trident II D5 missiles on British SSBNs are identical to the Trident II D5 missiles on US Navy SSBNs, which have demonstrated a range of more than 10 000 km in test flights.

[d] The British warhead is called the Holbrook, a modified version of the USA's W76 warhead, with a potential lower-yield option.

[e] Of the 120 operationally available warheads, approximately 40 are deployed on the single SSBN that is at sea at any given time.

[f] This figure includes *c.* 45 retired warheads that have not yet been dismantled. It seems likely that they will be reconstituted to become part of the UK's total stockpile over the coming years (see note g). Many of the stored warheads that have not been retired are thought to be undergoing upgrade from the Mk4 to the Mk4A.

[g] The British government declared in 2010 that its inventory would not exceed 225 warheads, and that the UK would reduce the number of warheads in its overall nuclear stockpile to no more than 180. Despite these stated intentions, the UK's nuclear inventory appears to have remained at approximately 225 warheads throughout the decade 2010–20. The integrated review of security, defence, development and foreign policy undertaken in 2020 and published in early 2021 introduced a new ceiling of 260 warheads.

Sources: British Ministry of Defence, white papers, press releases and website; British House of Commons, *Hansard*, various issues; *Bulletin of the Atomic Scientists*, 'Nuclear notebook', various issues; and authors' estimates.

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 369-34*, https://www.sipri.org/yearbook/2022/10

United Kingdom: House of Commons Library - I: 2022

The UK adopts a posture of minimal credible nuclear deterrence, assigned to the defense of NATO. The UK does not have a policy of 'no-first use'.

The UK first tested a nuclear explosive device in October 1952, becoming the third state to develop nuclear weapons after the United States and the Soviet Union.

Since the end of the Cold War, the UK has taken a number of disarmament steps in support of the NPT. It has withdrawn all other nuclear weapons systems except for its submarine-launched Trident system. It has made changes to the operational status of the deterrent and been increasingly transparent about its nuclear inventory.

Under commitments outlined in the 2010 Strategic Defense and Security Review (SDSR), the UK was expected to have achieved, by the mid-2020s, a 65% reduction in the size of its overall nuclear stockpile since the height of the Cold War. However, the 2021 Integrated Review announced that the 2010 commitments could no longer be met due to the current security environment. As such, it announced that the cap on the nuclear stockpile would be raised and that information on operational stockpile, deployed missiles and deployed warheads would no longer be made available. Both decisions have led many to question the Government's commitment to disarmament.

- Nuclear stockpile – Prior to the 2021 Integrated Review, the UK had a stockpile of 225 warheads. Following the review, the cap on the UK's nuclear stockpile will increase to no more than 260 warheads. The Government has provided no timeframe for doing so and no longer publishes transparency information, so the precise figure for the stockpile is unclear.
- The UK is the only nuclear weapon state that has reduced to a single deterrent system.
- Operates continuous at-sea deterrence (CASD).

The program to replace the UK's nuclear deterrent has been underway since 2006. It involves the replacement of the Vanguard class submarines (SSBN) with a new Dreadnought class of SSBN from the early 2030s. Nuclear weapons at a glance A Common Missile Compartment (CMC) for the SSBN, which will house the existing Trident strategic weapons system, is being developed in conjunction with the United States.

The estimated cost of the design and manufacture of a class of four SSBN is £31 billion, including inflation over the life of the program. A £10 billion contingency has also been set aside.

The UK is also participating in the current US service-life extension program for the Trident II D5 missile.
In February 2020 the Government confirmed that a program to replace the UK's Mk4 nuclear warhead was also underway.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: United Kingdom*, House of Commons Library, May 3, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9077/CBP-9077.pdf.

United Kingdom: House of Commons Library - II: 2022

The 2010 SDSR reduced the number of operational launch tubes of the Vanguard class SSBN from 12 to 8 (each submarine has 16 independently controlled missile tubes in total) and reduced the maximum number of deployed warheads onboard from 48 to 40. Each Trident missile is capable of carrying 12 warheads apiece, although the limitations imposed in 2010 suggests that each missile carries, on average, five. The Government has never confirmed the ratio of warheads to missiles

The Government's 2021 Integrated Review of Security, Defense, Development and Foreign Policy (PDF), and its subsequent refresh in March 2023, reaffirmed the UK's longstanding position of ambiguity on the precise details of when, how and at what scale the UK may consider the use of its nuclear weapons capability. Both reviews confirmed, however, that nuclear weapons would only be used in "extreme circumstances of self-defence" and that the UK "will not use, or threaten to use, nuclear weapons against any non-nuclear weapon state party to the NPT".1 This assurance does not apply, however, to any state in material breach of the NPT.

In a shift from previous declaratory policy set out in the 2015 Strategic Defense and Security Review (PDF), the 2021 Integrated Review made two significant changes:

1. To extend the UK's position of deliberate ambiguity, the UK will no longer provide public figures on the UK's operational stockpile, 2 deployed warheads and deployed missile numbers. In doing so, the review states: This ambiguity complicates the calculations of potential aggressors, reduces the risk of deliberate nuclear use by those seeking a first-strike advantage, and contributes to strategic stability.

2. Security assurances extended to other countries by the UK are now subject to review "if the future threat of weapons of mass destruction, such as chemical and biological capabilities, or emerging technologies that could have a comparable impact, makes it necessary". The inclusion of "emerging technologies" is new language6in the Integrated Review that has prompted some commentators to speculate that nuclear weapons could be used in response to a cyber-attack on the UK.

…the 2021 Integrated Review announced that the 2010 commitments could no longer be met due to the current security environment. As such, it announced that the cap on the nuclear stockpile would be increased to no more than 260 warheads, an increase of just over 40% on the 2010 commitment.

The UK ceased production of fissile material for weapons production in 1995. According to the latest report of the International Panel on Fissile Materials it does, however, retain a fissile material stockpile of 22 metric tons of highly enriched uranium (HEU) and 3.2 metric tons of plutonium for weapons purposes.

In July 2005 the Government announced a new program of investment for the AWE under the Nuclear Warhead Capability Sustainment Program (NWCSP). Over a period of 20 years, and at an estimated cost of £20 billion, the NWCSP aims to sustain key nuclear skills, technological capability and deliver improved infrastructure to ensure the safety and reliability of the current nuclear stockpile.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: United Kingdom*, House of Commons Library, May 3, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9077/CBP-9077.pdf

United Kingdom: House of Commons Library - III: 2022

As part of the NWCSP, AWE is currently refurbishing the UK warhead to replace obsolete components and incorporate the US-designed Mk4A arming, fusing and firing system. In June 2016 the MOD highlighted that this refurbishment did not equate to a new warhead and "does not change the destructive power of the weapon The work of the NWCSP will underpin the warhead replacement program. The UK-French Teutates project on nuclear stockpile stewardship also forms part of the NWCSP.

The projects being undertaken under the NWCSP are funded as part of the annual in-service costs of the nuclear deterrent, which currently stand at around 6% of the defense budget.26 Under planned defense expenditure, in 2023/24 those costs will equate to £3 billion.

The deterrent is based in western Scotland at HM Naval Base Clyde. The submarines are based at Faslane and the warheads are stored, processed and maintained at the Royal Naval Armaments Depot at Coulport. In-service maintenance of the Vanguard class is conducted at Faslane; while deep maintenance/refit is conducted at HM Naval Base Devonport in Plymouth. Devonport is also responsible for decommissioning nuclear-powered submarines, including the SSBN fleet, at the end of their service lives.
(*The HoC Library document provides a range of additional data and references on the British program, strategy, and arms control*)

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: United Kingdom*, House of Commons Library, May 3, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9077/CBP-9077.pdf

United Kingdom: Operational & In-Development Missile Forces*

Missile Name	Class	Range	Status
Brimstone	Air-to-surface	8 - 60 km	Operational
Harpoon	ASCM	90 - 240 km	Operational
PGM-500 / PGM-2000	Air-to-surface	15 - 50 km	Operational
SCALP EG / Storm Shadow	ALCM	250-400 km	Operational
SPEAR 3	ALCM	120-140 km	In development
Trident D5	SLBM	12,000 km	Operational

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of the United Kingdom," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/united-kingdom/

French Nuclear Forces

France: Strategic Update 2021 - I

The deterioration of the strategic context is accelerating, jeopardizing existing balances, the international security architecture, and multilateralism, while crises persist and threats are spreading in all conflict domains, even on national soil.

The proliferation of weapons of mass destruction and their delivery systems is a growing threat, as illustrated by the worsening North Korean and Iranian nuclear proliferation crises, as well as the continuous upgrading of certain ballistic missiles and the use of chemical weapons in the Syrian theatre3. The CBRN threat has also diversified and is no longer limited to theatres of operations. The repeated use4 of chemical agents to spread terror or to poison has reinforced the sense that a taboo has been broken. The threat is therefore real, including on national soil, and it could be amplified by expected developments in synthetic biology.

In the nuclear field, the adoption by some States of opaque, or even use- oriented, nuclear postures seems increasingly at odds with the classic codes of deterrence, as it forms part of a strategy of intimidation or even blackmail that could provoke escalation. At the conventional level as well, we note the dissemination of effective anti-access / area denial (A2/ AD) capabilities, modern combat aircraft program or missiles of all types which, in becoming accessible, help to embolden regional powers.

Thus, Iran is pursuing its nuclear in violation of its commitments under the JCPOA, particularly with regard to its stockpiles of low enriched uranium and heavy water, authorized enrichment levels, R&D and the installation of centrifuges. In addition, Iran is failing to cooperate fully with the IAEA in verifying its nuclear obligations. Tehran is also pursuing the development of its ballistic and space programs, conducting numerous operational launches and tests aimed at improving the range, accuracy and penetration of its delivery systems — in violation of UN Security Council Resolution 2231. Iran also continues to transfer ballistic systems and technologies to regional non-state actors, both in Lebanon and Yemen.

Similarly, the strategic challenge posed by North Korea, which is disrupting regional and ultimately global strategic balances, has only increased since 2017: the United States failed to obtain concrete guarantees on the country's denuclearization at the 2018 and 2019 summits, while Pyongyang has shown its determination to develop an operational nuclear arsenal of intercontinental range and has made continuous, significant progress. Since May 2019, North Korea has resumed conventional and short-range tests and, at the end of December 2019, openly raised the possibility of resuming its long-range nuclear and ballistic tests, on which a moratorium had been agreed in 2018. Beijing and Pyongyang also appear to have realigned their regional ambitions. While China is still promoting the "denuclearization of the peninsula", it seems that neither the definition of the terms nor the purpose of the process satisfies the expectations of the international community.

Contestation of the international order is leading to multi-dimensional competition between the international powers extending to all domains of confrontation. The resumption of strategic and military competition, whether by Russia or China, is now acknowledged.

…Relying first and foremost on a range of non-military resources (instruments of disinformation and propaganda, capacity for clandestine action, etc.), the strategic intimidation posture developed by Russia is also based on the political priority given to the development and modernization of sophisticated military capabilities, whether conventional (A2/AD), non-conventional (private military contractors or proxies) or nuclear. The resurgence of Russia's military power, in contrast to the country's economic and demographic decline, is based on upgrading nuclear components, developing new weapon systems, some of which are destabilising5, and modernizing conventional forces. For example, by establishing anti-access and area denial (A2/AD) capabilities along its borders, designed to force any attacker into a major escalation, Moscow could pursue both defensive and coercive aims ("aggressive sanctuarization"), depending on the circumstances. Moscow can now project forces (occupation of the Crimea and the Donbass, intervention in Syria), deploy a strategy of intimidation throughout neighboring States and beyond (Arctic, Caucasus, Balkans, Mediterranean), degrade the Western powers' freedom of action and make itself a key player in the management of regional crises. As has been demonstrated, particularly in the Levant, Russia has become an opportunistic and agile power, with a rapid projection capability.

France: Strategic Update 2021 - II

The People's Republic of China, meanwhile, has doubled its defense budget since 2012, making it the second largest in the world, while expanding its nuclear arsenal and developing new systems. The deployment of a carrier battle group beyond the South China Sea illustrated these new ambitions in terms of power projection. In response, the United States, whose military budget had stabilized below $700 billion between 2012 and 2017, has since increased expenditures to $720 billion and has made competition between the major powers the main determinant of its defense policy.

This serious turn of events is evident in Europe, with the continuous weakening of the security architecture inherited from the Cold War. In addition to Russia's suspension of its participation in the Treaty on Conventional Forces in Europe (CFE) in 2007 and its violation of the Budapest Memorandum and the Helsinki Final Act in 2014, the American withdrawal from the Open Skies Treaty in 2020 and the current stalemate over revisions to the Vienna Document, confirm the gradual disintegration of the existing regulatory frameworks. The termination of the Intermediate-Range Nuclear Forces (INF) Treaty in August 2019, due to its violation by Russia, marked the disappearance of the only bilateral arms control instrument eliminating a category of missiles, increasing the risk of a new arms race in Europe, while uncertainties remain over the extension of New START beyond February 2021.

The partial obsolescence of the arms control instruments defined according to the strategic equation of the Cold War, coupled with the emergence of new domains for the expression of power (cyber, space) and now proven nuclear multipolarity, are producing cumulative effects that significantly increase instability on the European continent. Europeans are hoping to engage in a constructive dialogue with the new U.S. administration on the future of strategic stability in Europe in accordance with their own interests.

Finally, the prohibitionist dynamic, marked by the signing of the Treaty on the Prohibition of Nuclear Weapons (TPNW) in 2017 — which is due to enter into force shortly, despite the fact that it fails to fully represent the international community — is part of this contestation of the international order and of the balances enshrined in existing treaties, first and foremost the Non-Proliferation Treaty (NPT).

…In his speech on defense and deterrence strategy, the President of the Republic recalled why nuclear deterrence remains the "keystone of our security and the guarantee of our vital interests". In an environment mar- ked by the return of nuclear reality and strategic competition between powers, our armed forces are being deployed close to nuclear powers, in Europe but also in distant theatres. The function of nuclear forces — in their two complementary components, airborne and submarine-based — is to ensure deterrence and in particular to prevent a "major war", i.e. direct confrontation between great powers. They also guarantee the freedom of action of our conventional forces, in particular by preventing them from being circumvented "from above" through escalation. Robust conventional forces also force an aggressor to reveal his intentions quickly and prevent a possible bypass "from below", especially in the event that an aggressor seeks to quickly establish a "fait accompli". In this way they contribute to the exercise of deterrence. Thus, nuclear and conventional forces "support each other at all times".

After recalling France's commitment to the principle of strict sufficiency and to arms control, as well as to the need to reconcile ethics and strategy, the President of the Republic also stressed the European dimension of our deterrence – "France's vital interests now have a European dimension" – and proposed to interested European partners a strategic dialogue on deterrence. This approach is complementary to our efforts to promote a nuclear culture within the Alliance.

…A significant effort is devoted to renewing the two components of the nuclear deterrent. At the same time, the land, sea and air domain will benefit from the modernization of conventional capabilities, accompanied by sustained investment in intelligence and cyber capabilities as well as in the space domain.

…As a European nuclear power with global interests, France cannot define its interests solely in terms of geographical proximity to the homeland: it must imperatively maintain a geostrategic reach in line with current developments and its ambitions, which are first and foremost to protect its citizens and territories, but also to preserve its influence and freedom of action. France's defense strategy in the Indo-Pacific was presented by the Minister of the Armed Forces at the Shangri-La Dialogue 2019 in Singapore.

France: Strategic Update 2021 - III

France's action in the Indo-Pacific also aims to contribute to multilateral security efforts and to preserve the freedom of maritime and air navigation. This implies intensifying our cooperation efforts, by encouraging our European partners to become more involved in the Indo-Pacific, and by developing major strategic partnerships beyond Europe, in particular with India, Australia and Japan, as well as by supporting regional cooperation formats (ASEAN, IONS, IORA, SPDMM, etc.).

…However, in the light of lessons learned from the pandemic, among other things, the armed forces' capabilities need to be strengthened to deal with large-scale crises. In this respect, the implementation of a strategic "protection-resilience" function is now clearly necessary. Indeed, the notions of protection and resilience complement each other, as resilience is an essential prerequisite for ensuring the protection of the French people and the national territory and guaranteeing the continuity of the nation's essential functions. The rationale behind this function could moreover be extended to our European partners and our Allies.

…The geopolitical disruptions noted above are reflected at the military level by tougher operating environments and the multiplication of fields of confrontation. As a result of all these developments, the hypothesis of a direct confrontation between major powers can no longer be ignored. The engagement of the armed forces on home soil is also set to continue in the implementation of protection postures, for the benefit of civilian authorities and in all fields of confrontation. Between now and 2030 and beyond, current tensions and possible upheavals therefore require us to prepare ourselves for scenarios of "engagement (...) in a major conflict"37 and to continue to build up our capabilities and adapt our general posture.

In critical areas such as deterrence, intelligence, access to space, power projection or first and forcible entry capability, the objective of controlled sovereignty remains a priority. Our freedom of action thus requires us to ensure the credibility and renewal of our deterrent, and to guarantee our autonomy of assessment and decision-making, based on national intelligence and command capabilities with guaranteed resilience.

…The French armed forces will also have to gradually build up sufficient critical mass, in terms of manpower and equipment, in order to simultaneously rebalance the odds in their favor, endure by compensating for potentially high attrition, and engage in several theatres.

Finally, they will have to continue to diversify their offensive capabilities at the top end of the spectrum, particularly for deep penetration of anti-access /area denial (A2/AD) postures.

Source: Excerpted from Ministere des Armees, *Strategic Update, 2021*, https://www.stjornarradid.is/library/03-Verkefni/Almannaoryggi/Thjodaroryggismal/France%20-%20Strategic%20Review%202021.pdf.

France: Center for Arms Control and Non-Proliferation: 2020

- France a maintains an ambiguous nuclear use policy, as well as a “final warning” nuclear strike policy. This policy option, developed in the 1970s, states that France may use nuclear weapons first in order to defend its vital interests….While France is a member of the North Atlantic Treaty Organization (NATO), its nuclear forces are not part of the Alliance’s integrated military command structure. However, France may call upon its nuclear arsenal if there are threats to its neighbors or allies.
- France is estimated to possess 290 nuclear weapons, of which about 280 are deployed. The remaining weapons are thought to be in maintenance or storage. The vast majority, or approximately 240, are deployed by the French Navy, which maintains a continuous at-sea presence via its nuclear-powered submarines. This posture ensures a secure second-strike capability in the event of a nuclear attack.
- France engaged in a slow, but steady build-up of its nuclear arsenal and by 1980, it neared the threshold of what the Soviets considered posing the threat of “unacceptable damage” to the Soviet Union. The stockpile would grow from there, doubling in size, reportedly as a response to missile defense systems around Moscow. France had amassed around 540 nuclear weapons by the end of the Cold War. Since then, France has cut its nuclear arsenal in half, ceased explosive nuclear testing and eliminated its land- based missiles, deeming those systems as no longer necessary for its deterrent. France now maintains its nuclear arsenal at a level of strict sufficiency, meaning it does not have the capability to target all of an adversary’s deployed nuclear forces.
- France maintains 40 land-based aircraft and 10 carrier-based aircraft to deliver its air-launched cruise missiles, called the ASMP. The Rafale fighter-bomber has a range of 2,000 kilometers and is produced for the French Air Force and for carrier-based operations in the French Navy. There are 40 thermonuclear warheads available for French Strategic Air Forces and 10 warheads are available for the French Naval Nuclear Aviation Force.
- France has maintained a continuous at-sea presence since 1996 through its nuclear-powered ballistic missile submarines (SSBN). Four of the Triomphant-class SSBNs are kept on rotation to maintain this presence. Frequently, only one is at-sea at a time for an estimated period of 70 days. The French Navy has two submarine-launched ballistic missile (SLBM) types, the M51.1 & the M51.2. The M51 has a multiple independently-targetable reentry vehicle (MIRV) and both variances have a range of 9,000+ kilometers. Each submarine can carry sixteen M51 SLBMs and each SLBM is believed to carry five to six warheads. The Triomphant-class SSBNs will be replaced in the next two decades with the SNLE-3G.

- France used to deploy nuclear medium-range ballistic missiles (MRMB) in silos at Plateau d’Albion, but these missiles were deactivated in 1996. Initially, their mission was to respond to a surprise attack by striking Soviet territory as a “final warning,” but with the collapse of the Soviet Union, this capability was deemed unnecessary.

IISS Estimate of French Nuclear Forces in 2023

Strategic Nuclear Forces
Navy 2,200

SUBMARINES • STRATEGIC 4
SSBN 4 *Le Triomphant* with 16 M51 SLBM with 6 TN- 75 nuclear warheads, 4 single 533mm TT with SM39 *Exocet* AShM/F17 mod 2 HWT

AIRCRAFT • FGA 20 *Rafale* M F3 with ASMPA msl **Air Force** 1,800
Air Strategic Forces Command

FORCES BY ROLE
STRIKE
1 sqn with *Rafale* B with ASMPA msl
1 sqn with *Rafale* B with ASMPA msl (forming) **TANKER**
Paramilitary Gendarmerie 40
Space

SATELLITES 13
COMMUNICATIONS 4: 2 *Syracuse*-3 (designed to integrate with UK *Skynet* & ITA *Sicral*); 1 *Syracuse*-4; inte1 *Athena-Fidus* (also used by ITA)
ISR 6: 1 CSO-1; 1 CSO-2; 1 *Helios* 2A; 1 *Helios* 2B;
2 *Pleiades*
ELINT/SIGINT 3 CERES

Source: Adapted from IISS, *Military Balance, 2023*, "France " and United Kingdom"

France: Bulletin of Atomic Scientists 2019

Weapon System	No.	Year operational	Range (km)[a]	Warheads x yield	Warhead Type	Warheads
Land-based aircraft[b]						
Rafale BF3/ASMPA	40	2010[c]	2,000	1 x up to 300 kt	TNA	40
Carrier-based aircraft						
Rafale MF3/ASMPA	10	2011	2,000	1 x up to 300 kt	TNA	10
Submarine-launched ballistic missiles						
M51.1	32	2010	9,000+	4–6 x 100 kt MIRV	TN75	160
M51.2	16	2017	9,000+	4–6 x 100 kt MIRV[d]	TNO	80
Total	98					**300**[e]

[a]Range for aircraft is shown. The range of the ASMPA air-launched cruise missile is close to 600 km.
[b]The Mirage-2000N, which served the nuclear strike role, was retired in 2018. All nuclear Rafale F3s are currently at Saint-Dizier Air Base. France produced 54 ASMPA air-launched cruise missiles, including those used in test flights.
[c]The ASMPA air-launched cruise missile first entered service with the Mirage-2000N in 2009.
[d]There is considerable uncertainty regarding the yields of the new warheads. It appears that both the TNA and TNO are based on the same new design, which is different from that of their predecessors (Tertrais 2019). This design choice could potentially indicate that the new warheads might have the same yield. Some French sources, however, indicate that the TNA's yield is up to 300 kt, while the TNO's is approximately 100 kt (Groizeleau 2015). In the absence of more concrete information, however, these numbers should be treated as estimates.
[e]In addition to the 290 deployed, we estimate a small number of warheads (10) are spares or in maintenance.

The (Force Océanique Stratégique, or FOST), the French Navy operates four Triomphant-class nuclear-powered ballistic missile submarines (SSBNs) equipped with nuclear-armed long-range ballistic missiles All French SSBNs now carry the M51 SLBM, which was deployed starting in 2010 to replace the M45 SLBM (Tran 2018). The last M45 was offloaded in late 2016. The M51.1, which has greater range and better accuracy than the M45, can carry up to six 100-kiloton TN75 MIRV warheads, but probably only carries an average of five warheads each. Some missiles are thought to have been downloaded to carry fewer warheads, in order to increase targeting flexibility…An upgraded version of the M51.1, known as M51.2, was flight tested on July 1, 2016 from Le Triomphant and declared operational by the French Defense Minister in December 2017 (Partly 2017). The M51.2, which carries a new warhead – the tête nucléaire océanique, or TNO – has since been added to Le Téméraire (Willett 2018). The TNO is reportedly stealthier than the TN75 and is housed within a new reentry vehicle, with the entire package weighing approximately 500 kilograms (Kile and Kristensen 2017). The remaining boats will be upgraded to the M51.2 by 2020 (Willett 2018). A third iteration of the missile – the M51.3 – is in development and scheduled for completion by 2025 and will incorporate a new third stage for extended range and further improvement in accuracy (Partly 2017).

The Strategic Air Forces (Forces Aériennes Stratégiques or FAS) operate two squadrons of approximately 40 nuclear-capable Rafale BF3 aircraft organized into two squadrons, the EC 1/4 "Gascogne" and EC 2/4 "La Fayette" at Saint-Dizier Air Base (Air Base 113) about 190 kilometers east of Paris (Pintat and Lorgeoux 2017). EC 2/4 operated nuclear-capable Mirage 2000Ns at Istres Air Base until June 21, 2018, when the aircraft was officially retired from the French Air Force. After the Mirage 2000N's retirement, EC 2/4 moved from Istres to Saint-Dizier. Now both squadrons operate Rafale BF3 twin-seat strike fighters, leaving the Rafale the sole aircraft responsible for France's nuclear strike mission…The Naval Nuclear

France: Bulletin of Atomic Scientists 2019 - II

Aviation Force (Force Aéronavale Nucléaire or FANu) operates at least one, possibly two, nuclear squadrons (11F and possibly 12F)of Rafale MF3 aircraft for nuclear strike missions onboard France's sole aircraft carrier, the Charles de Gaulle. The FANu and its ASMPA missiles are not permanently deployed onboard the carrier but can be rapidly deployed by the president in support of nuclear operations. France has begun design development of a stealthier, extended-range replacement for the ASMPA, which will be called the ASN4G (air-sol nucléaire 4ème génération) and enter into service around 2035. Hypersonic technologies are among the potential ASN4G propulsion options, although this might increase the length of the missile beyond what the current Rafale aircraft can carry (Pintat and Lorgeoux 2017). If so, decisions regarding the ASN4G would have to be paired with decisions regarding France's next generation of nuclear-capable aircraft.

Given the Rafales' relatively short range, France's air-launched nuclear weapons capability depends on a support fleet of refueling aircraft. France currently operates a mixed fleet of Boeing C-135FR and KC-135R tanker aircraft. Replacing this aging fleet has been a strategic priority for nearly a decade, but was delayed significantly due to budget issues. Delivery of the new tankers – a fleet of 15 Airbus A330-200 "Phénix" Multi-Role Tanker Transport (MRTT) air- craft – has now been scheduled for completion by2023, and the first Phénix arrived at Istres, its future home base, on September 27, 2018…

Source: Hans M. Kristensen, Matt Korda,, *Nuclear Notebook: French nuclear weapons, 2019*, **https://www.tandfonline.com/doi/pdf/10.1080/00963402.2019.1556003?needAccess=true.**

SIPRI Estimate of French Nuclear Forces in 2022

All figures are approximate and some are based on assessments by the authors.

Type/designation	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield	No. of warheads
Land-based aircraft					
Rafale BF3[b]	40	2010–11	2 000	1 x <300 kt TNA[c]	40
Carrier-based aircraft					
Rafale MF3[b]	10	2010–11	2 000	1 x <300 kt TNA[c]	10[d]
Sea-based missiles (SLBMs)	*4/64*[e]				*240*
M51.2[f]	48[g]	2017	>9 000[h]	4–6 x 100 kt TNO	240
M51.3[i]	–	[2025]	>[9 000]	[up to 6] x [100 kt] TNO	–
Total stockpile					**290**[j]

[] = uncertain SIPRI estimate; – = nil or a negligible value; kt = kiloton; SLBM = submarine-launched ballistic missile; TNA = *tête nucléaire aéroportée* (air-launched nuclear warhead); TNO = *tête nucléaire océanique* (sea-based nuclear warhead).

[a] For aircraft, the listed range is for illustrative purposes only; actual mission range will vary according to flight profile, weapon payload and in-flight refuelling.

[b] The BF3 and MF3 aircraft both carry the ASMP-A (*air–sol moyenne portée–améliorée*) air-launched cruise missile (ALCM). Most sources report that the ASMP-A has a range of 500–600 kilometres, although some suggest that it might be over 600 km.

[c] The TN81 warhead for the original ASMP had an estimated yield of 300 kt, but the new TNA warhead has a so-called medium energy yield.

[d] The 10 warheads assigned to France's carrier-based aircraft are thought to be kept in central storage and are not normally deployed.

[e] The first figure is the total number of nuclear-powered ballistic missile submarines (SSBNs) in the French fleet; the second is the maximum number of missiles that they can carry. However, the total number of missiles carried is lower (see note g). Of the four SSBNs, one is in overhaul at any given time.

[f] The last M51.1 missiles were offloaded from *Le Terrible* in late 2020 in preparation for a one-year refuelling overhaul and upgrade to the more advanced M51.2 missile.

[g] France has 48 SLBMs in service—enough to equip the three operational SSBNs.

[h] The M51.2 has a 'much greater range' than the M51.1 according to the French Ministry of the Armed Forces.

[i] The M51.3 is under development and has not yet been deployed.

[j] In Feb. 2020 President Emmanuel Macron reaffirmed that the arsenal 'is currently under 300 nuclear weapons'. A few of the warheads are thought to be undergoing maintenance and inspection at any given time.

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 375-379,* https://www.sipri.org/yearbook/2022/10

France: Nuclear Weapons: House of Commons Library - I: 2022

- France first tested a nuclear weapon in 1960, eight years after the UK and four years before China. The last French tests took place in 1996, just prior to the conclusion of the Comprehensive Nuclear Test Ban Treaty (CTBT), which it signed and ratified in 1998.
  Since the end of the Cold War France has scaled back its nuclear arsenal by 50%, with a reduction in both its overall holdings but also the withdrawal of several weapons systems, including its land-based ballistic missile capability.
  France is the only nuclear weapon state to have dismantled, in its entirety, a ground-launched nuclear capability.
- In 1992, and again in 1996, France reduced its alert levels, in terms of both response times and the number of weapons systems on alert. All of France's nuclear forces have been de-targeted. France retains a first-use policy.
  France's nuclear stockpile is currently "fewer than 300" warheads, capable of being launched by combat aircraft and submarine, operating on a continuous at-sea basis. Both components have been modernized over the last decade.
  France does not participate in NATO's nuclear planning mechanisms and its forces are not formally assigned to NATO.
- France's official position is that it currently has "fewer than 300 nuclear warheads", all of which are deployed and operational.8 It is widely estimated among experts that there are 290 warheads in the French nuclear stockpile.
  Fissile material
- In February 1996 France announced that it had halted the production of fissile material for weapons purposes and that it would dismantle the production facilities dedicated to its weapons program. Like the other nuclear weapon states, however, France retains a stockpile of fissile material. According to the International Panel on Fissile Materials, France has an estimated 25 metric tons of HEU and 6 metric tons of plutonium, available for weapons purposes.
- The bulk of the French deterrent is maritime based, with the Navy having responsibility for around 80% of the arsenal. The majority of that capability is delivered through its fleet of four Triomphant-class ballistic missile submarines (SSBN) which are capable of carrying up to 16 M-51 submarine-launched ballistic missiles (SLBM) apiece. The Navy retains a total of 48 SLBM in its inventory. The new M-51 came into service in 2010 and provides greater range,12 accuracy and operational flexibility than its predecessor, the M-45. The process of replacing all the Navy's M-45 SLBM with the M51 was completed in August 2018.
- The French Navy also operates a single squadron of 10 Rafale MF3 aircraft, equipped with nuclear-armed, medium range, ASMP-A cruise missiles. Those aircraft are capable of being deployed aboard the French aircraft carrier Charles de Gaulle. The ASMP-A entered serviced in 2009 and has improved maneuverability, enhanced accuracy and an increased range of 600km. It is also equipped with the new Tête Nucléaire Aero-Portée (TNA) warhead. 7 A mid-life refurbishment program for the ASMP-A was approved in March 2022. That program will address obsolescence issues and maintain the missile in service until 2035.
- The French Air Force has two squadrons assigned to the nuclear role, comprising approximately 40 Rafale F3 aircraft (20 apiece). The Rafale F3 is equipped with the ASMP-A cruise missile and TNA warhead.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: France*, House of Commons Library, July 28, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9074/CBP-9074.pdf

France: Nuclear Weapons: House of Commons Library - II: 2022

- In 2018, funding for France's ongoing nuclear modernization program up to 2025 was approved. €37 billion was assigned to maintain and modernize France's nuclear forces and infrastructure, which was a significant increase from the €23 billion assigned for 2014-2019. In 2020 the French nuclear deterrent accounted for 12.5% of the defense budget,20 approximately €6 billion (£5.3 billion).
- Design work has therefore commenced on a new M-51.3 SLBM. According to the French Ministry of Defense it is scheduled to be operational and begin replacing the M-51.2 in 2025. Proposals for an M-51.4 SLBM are also on the table.
- Preliminary design work has also begun on a next generation SSBN to replace the Triomphant class, which is due to leave service in the 2030s. Designated the SNLE 3G, construction of the first of class is scheduled to start in 2023, and gradually enter service from 2035. The SNLE 3G will deploy with the new M-51.3 SLBM, and potentially the M-51.4 SLBM.
- The Rafale F3 are intended to be replaced by the Next Generation Fighter (NGF), which is being pursued under the framework of the Future Combat Air Nuclear weapons at a glance: That aircraft is expected to be operational in 2040.
- Research on a next generation nuclear-capable missile has also begun. Designated the ASN4G (air-to-surface nuclear fourth generation), it will provide enhanced stealth and maneuverability to counter potential improvements in air defense technologies. There is some debate as to whether the missile will be hypersonic. The ASN4G, equipped with the TNA warhead, is expected to replace the ASMP-A in 2035 and will arm both the Rafale F3 and the NGF once it enters service. The overlap in development and production timelines for the next generation SSBN, the Next Generation Fighter and the ASN4G is considered likely to present "budgetary issues for Paris".

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: France*, House of Commons Library, July 28, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9074/CBP-9074.pdf

France: Operational & Obsolete Missile Forces*

Missile Name	Class	Range	Status
ASMP	LACM	80 - 300 km	Operational
APACHE AP	ALCM	140 - 400 km	Operational
Black Shaheen	ALCM	290 km	Operational
Exocet	ASCM	40 - 180 km	Operational
Hadès	SRBM	480 km	Obsolete
M20	SLBM	2,500 km	Obsolete
M45	SLBM	6,000 km	Obsolete
M51	SLBM	8,000 km	Operational
Pluton	SRBM	120 km	Obsolete
S-3	IRBM	3,500 km	Obsolete
SCALP EG / Storm Shadow	ALCM	250-400 km	Operational
SCALP Naval	SLCM	1000-1400 km	Operational

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

North Korean Nuclear Forces

North Korea: ODNI's Summary Threat Analysis in 2023

North Korean leader Kim Jong Un is continuing efforts to enhance North Korea's nuclear and conventional capabilities targeting the United States and its allies, which will enable periodic aggressive actions to try to reshape the regional security environment in his favor. Kim probably is attempting to secure North Korea's position in what he perceives to be an international environment conducive to his brutal authoritarian system, as demonstrated by North Korea's repeated public support for Beijing and Moscow's foreign policy priorities.

Kim almost certainly views nuclear weapons and ICBMs as the ultimate guarantor of his autocratic rule and has no intention of abandoning those programs, believing that over time he will gain international acceptance as a nuclear power. In 2022, Kim reinforced that position by testing multiple ICBMs intended to improve North Korea's ability to strike the United States and revising his country's nuclear law, underscoring the nuclear forces as the backbone of North Korea's national defense.

North Korea is using its nuclear-capable missile program to try to establish strategic dominance over South Korea and U.S. forces in the region by pursuing missiles probably aimed at defeating missile defenses on the peninsula and the region and issuing threats to militarily respond to any perceived attacks against its sovereignty. Since September 2022, North Korea has timed its missile launches and military demonstrations to counter U.S.–South Korea exercises probably to attempt to coerce the United States and South Korea to change their behavior and counteract South Korean President Yoon's hardline policies toward the North. Pyongyang probably wants the alliance to decrease the pace and scale of the exercises with the ultimate goal of undermining the strength of the alliance.

Kim is continuing to prioritize efforts to build an increasingly capable missile force designed to evade U.S. and regional missile defenses. Kim probably will continue to order missile tests—from cruise missiles through ICBMs, and HGVs—to validate technical objectives, reinforce deterrence, and normalize Pyongyang's missile testing. To support development of these new missile systems, North Korea continues to import a variety of dual-use goods in violation of UN sanctions, primarily from China and Russia.

Kim remains strongly committed to expanding the country's nuclear weapons arsenal and maintaining nuclear weapons as a centerpiece of his national security structure. Public statements have reinforced North Korea's intent to enhance its ability to threaten both South Korea and the U.S. homeland. North Korea probably is preparing to test a nuclear device to further its stated military modernization goals to facilitate "tactical nuclear operations."

. In September 2022, North Korea codified a law reaffirming its self-proclaimed status as a nuclear power, establishing open-ended conditions for nuclear use, command and control, and rejecting denuclearization.

Office of the Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, 2/6/23, https://www.dni.gov/files/ODNI/documents/assessments/ATA-2023-Unclassified-Report.pdf

North Korea: STRATCOM Posture Statement in 2023

Democratic People's Republic of Korea The DPRK, an increasing security challenge to the U.S. and our Allies, is capable of striking regional Allies with nuclear weapons and is an emerging threat to CONUS. The DPRK's advancing missile and nuclear programs are destabilizing and highlight the critical role of USSTRATCOM's deterrence and assurance mission.

The DPRK's nuclear-capable ballistic missile research and development has continued with an unprecedented number of missile launches in 2022. The DPRK's continued development of ICBMs, SLBMs, and Intermediate Range Ballistic Missiles demonstrates its intention to bolster its nuclear delivery capability. The DPRK is also developing new capabilities such as HSWs and MIRVs, and its new Hwasong-17 ICBM has the potential to reach CONUS. The DPRK is also diversifying launch platforms, and has tested rail, submarine, and ground-mobile missiles. These advancing nuclear capabilities place pressure on Allied faith in our extended deterrence commitments. The DPRK illustrates that nuclear and weapons of mass destruction threats to the U.S. and our Allies are not limited to the PRC and Russia.

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Statement of Anthony J. Cotton . Commander, U.S. Strategic Command, before the House Armed Services Committee on Strategic Forces, March 8, 2023, https://www.stratcom.mil/Portals/8/Documents/2023%20USSTRATCOM%20Congressional%20Posture%20Statement.pdf?ver=bFFdbYI2D5Tju5nPNsebbw%3d%3d .

North Korea: Nuclear Weapons: CRS Estimate 2023

Nuclear Material Production: North Korea reportedly continues to produce fissile material (plutonium and highly enriched uranium) for weapons. North Korea restarted its plutonium production facilities after it withdrew from a nuclear agreement in 2009, and is operating centrifuge uranium enrichment plants at the Yongbyon nuclear complex and possibly at Kangson. A March 2022 IAEA report says that there were no indications of operations at its Radiochemical Laboratory (reprocessing) plant since its last reprocessing campaign from February to July 2021. The IAEA notes ongoing operation of the Yongbyon Experimental Light Water 5MW(e) Reactor since July 2021. Spent fuel from that reactor is reprocessed at the Radiochemical Laboratory to extract plutonium for weapons. In September 2022, the IAEA reported ongoing uranium mining, milling, and concentration activities at Pyongsan. Fissile material production in large part determines the number and type of nuclear warheads a country is able to build.

Nuclear Warheads: Outside experts estimate that North Korea has produced enough fissile material for between 20 to 60 warheads. A 2021 U.S. Defense Intelligence Agency (DIA) report says that North Korea "retains a stockpile of nuclear weapons." Another goal of a nuclear weapons program is to lower the size and weight of a nuclear warhead for deployment on missiles. A July 2017 DIA assessment and some outside observers asserted North Korea had achieved the level of miniaturization required to fit a nuclear device on weapons ranging from short-range ballistic missiles (SRBM) to intercontinental ballistic missiles (ICBM). Kim Jong-un in January 2021 said that the country was able to "miniaturize, lighten and standardize nuclear weapons and to make them tactical ones."

Nuclear Testing: North Korea has tested a nuclear explosive device six times since 2006. Each test produced underground blasts progressively higher in magnitude and estimated yield. North Korea conducted its most recent test on September 3, 2017. A North Korean press release stated it had tested a hydrogen bomb (or two-stage thermonuclear warhead) that it was perfecting for delivery on an intercontinental ballistic missile.

In April 2018, North Korea announced that it had achieved its goals, would no longer conduct nuclear tests, and would close down its Punggye-ri nuclear test site. It dynamited the entrances to two test tunnels in May 2018 prior to the first Trump-Kim summit. In an October 2018 meeting with then-Secretary of State Mike Pompeo, Kim Jong-un "invited inspectors to visit the [test site] to confirm that it has been irreversibly dismantled," but this did not occur. International Atomic Energy Agency (IAEA) reports say North Korea began restoring test tunnels in March 2022.

Source: adapted from: Mary Beth , ***North Korea's Nuclear Weapons and Missile Programs*, Congressional Research Service, IF10423, January 23, 2023**

IISS Estimate of North Korean (DPRK) Nuclear Forces in 2023

Strategic Forces ε10,000
North Korea describes its ballistic missile force as nuclear capable, although there is no conclusive evidence to verify the successful integration of a warhead with any of these systems.

SURFACE-TO-SURFACE MISSILE LAUNCHERS

ICBM 10+: 6+ *Hwasong*-14/-15/-15 mod 1 (all in test); 4+ *Hwasong*-17 mod 1 (in test); (Earlier *Hwasong*-13/-13 mod designs untested and presumed cancelled)

IRBM 10+ *Hwasong*-10 (*Musudan*) (status uncertain)/ *Hwasong*-12/-12 mod 1 (in test)

MRBM 17+: ε10 *Nodong* mod 1/mod 2 (ε90+ msl); some *Scud*-ER; 7+ *Pukgusong*-2 (in test)

SBRM 69+: 30+ *Hwasong*-5/-6 (RS-SS-1C/D *Scud*- B/C) (ε200+ msl); 1+ *Hwasong*-8/-8 mod 1 (in test); 9+ *Hwasong*-11 mod (in test); 6+ *Scud* (mod) (in test); 17+ KN-23 (road & rail mobile variants); 6+ KN-23 mod 1 (in test); some KN-23 mod 2 (in test)

GLCM some M-2021 (in test); some M-2021-2 (in test)

Source: Adapted from IISS, *Military Balance, 2023*, "North Korea/DPRK"

North Korea: Bulletin of Atomic Scientists in 2022 - I

Type/Name[a]	US/Other Designations	Year Displayed	Range (km)[b]	Stages (Fuel)	Payload x Capacity (kg)	Launchers[c]
Land-based ballistic missiles						
ICBMs (5,500+ km range)						
Hwasong-16	KN27	2020	12,000+	2 (liquid)	1 x 1,700[d]	TEL
Hwasong-15	KN22	2017	12,000+	2 (liquid)	1 x ?	TEL
Hwasong-14	KN20	2017	10,000+[e]	2 (liquid)	1 x ?	TEL
Hwasong-?	KN14	2017	? (9,000)	3 (liquid)	1 x ?	TEL
Hwasong-13	KN08[f]	Dev.	13,000+	3 (liquid)	1 x ?	TEL
(Taepo Dong-2)	Taepo Dong-2[g]	(2012)	12,000+	3 (liquid)	1 x 800+	Fixed
IRBMs (3,000-5,500 km range)						
Hwasong-12	KN17	(2017)	4,500+	1 (liquid)	1 x 1,000	TEL
Hwasong-10	Musudan[h]	(2016)	3,000+	1 (liquid)	1 x 1,000	<50 TEL
MRBMs (1,000-3,000 km range)						
Pukguksong-2	KN15	(2016)	1,000+	2 (solid)	1 x ?	TEL (C)
Hwasong-9	Scud ER, KN04	(2016)	1,000[i]	1 (liquid)	1 x 500	TEL
Hwasong-7	Nodong Mod 1/2[j]	(1993)	1,200+	1 (liquid)	1 x 1,000	<100 TEL
Submarine-launched ballistic missiles (SLBMs)						
Pukguksong-5	KN?	2021	?	2 (solid)?	1 x ?	SSB
Pukguksong-4	KN?	2020	3,500+	2 (solid)?	1 x ?[k]	SSB
Pukguksong-3	KN26	(2019)	1,000+[l]	2 (solid)	1 x ?	SSB
Pukguksong-1	KN11	Dev.	1,000+	2 (solid)	1 x ?	SSB

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Excerpted from Hans M. Kristensen, Matt Korda, "North Korean nuclear weapons, 2021," *Bulletin of Atomic Scientists*, 2021
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North Korea: Bulletin of Atomic Scientists in 2022 - II

Note: The status and capability of North Korea's missiles comes with significant uncertainty. The inclusion of the missiles in this table does not necessarily mean the authors conclude they are all equipped with nuclear warheads or assigned nuclear missions. Several may have been intended for development of technologies that eventually will become operational on a newer missile.

Keys: Dev = In development; ICBM = Intercontinental Ballistic Missile; km = kilometer; IRBM = Intermediate-Range Ballistic Missile; kt = kiloton; n.a. = Not Applicable; MRBM = Medium-Range Ballistic Missile; TEL = Transporter Erector Launcher; TEL (C) = Transporter Erector Launcher with missile canister; SLBM = Sea-Launched Ballistic Missile; SSB = Ballistic Missile Submarine.

A. For overviews of missile names and designations for North Korean ballistic missiles, see: Matt Korda's "The Hwasong That Never Ends" list on *Arms Control Wonk* (http://www.armscontrolwonk.com/archive/1203797/the- hwasong-that-never-ends/); the Center for Nonproliferation Studies "North Korea overview" on the Nuclear Threat Initiative (NTI) website (http://www.nti.org/learn/countries/north-korea/); Center for Strategic and International Studies missile threat project (https://missilethreat.csis.org/country/dprk/).

B. Ranges are uncertain and claims on the Internet about North Korean missile ranges should generally be viewed with considerable caution. Useful sources include: the US Air Force National Air and Space Intelligence Center (NASIC) report *Ballistic and Cruise Missile Threat* (https://www.nasic.af.mil/About-Us/Fact-Sheets/Article/2468137/2020-ballistic-and-cruise-missile-threat/); various studies by the US-Korea Institute at SAIS; articles on the 38North.org blog; the James Martin Center for Nonproliferation Studies' North Korean overview at the Nuclear Threat Initiative (http://www.nti.org/learn/countries/north-korea/); and articles by David Wright on the Union of Concerned Scientists allthingsnuclear.org blog (http://allthingsnuclear.org/author/dwright#.Wg9qZ7YrLzw).

C. Most launchers have one or more missile reloads. Anonymous intelligence sources in 2017 assessed that North Korea has produced sufficient fissile material to be able to produce 20-60 nuclear warheads. Authoritative sources estimate sufficient for around 45 warheads. The number of warheads assembled is likely smaller. Some North Korean launchers, including those for the Hwasong-12 and Hwasong-14, are equipped with detachable firing tables.

D. Speculations that Hwasong-15 can carry multiple warheads have not been confirmed.

E. Demonstrated range estimates based on highly lofted trajectory tests.

F. Many analysts used a photo from the 2015 parade to identify a modified two-stage version of the KN08, but NASIC identified the same image as the Hwasong-14, or KN20.

G. The Taepo Dong-2 (sometimes spelled as one word: Taepodong-2) is an ICBM modification of the Unha space launch vehicle that was used to place satellites in orbit in 2012 and 2016. The operational status of Taepo Dong-2 is uncertain. It will likely be replaced by the ICBMs currently in development.

H. The Hwasong-10 or Musudan is also known as BM-25. The missile has suffered many test launch failures.

I. The 1,000-km range Scud ER is sometime called an SRBM but NASIC lists it as an MRBM.

J. Other spellings are No-dong, No Dong, or Rodong.

K. Speculations that Pukguksong-4 can carry multiple warheads has not been confirmed.

· L. Some sources estimate a Pukguksong-3 range close to 2,500 km (United Nations 2021).

Excerpted from Hans M. Kristensen, Matt Korda, "North Korean nuclear weapons, 2021", Bulletin of Atomic Scientists, 2021.

SIPRI Estimate of North Korean Forces with Potential Nuclear Capability in 2022 - I

Type/ North Korean designation (US designation)[a]	Year first displayed	Range (km)	Description and status
Land-based missiles			
Hwasong-5/-6 (Scud-B/-C)	1984/1990	300/500	Single-stage, liquid-fuelled SRBMs launched from 4-axle wheeled TEL. NASIC estimates fewer than 100 Hwasong-5 and -6 launchers. Operational.
(KN18/KN21)	2017	250/450	Hwasong-5 and -6 variants with separating manoeuvrable warhead. Flight tested in May and Aug. 2017 from wheeled and tracked TELs. Status unknown; may have been superseded by newer solid-fuelled SRBMs.
(KN23/KN24[b]/KN25)	2018/2019	380–800	New generation of solid-fuelled SRBMs. Resemble Russia's Iskander-M, South Korea's Hyunmoo-2B, and the USA's ATACMS SRBMs. Successfully flight tested several times from wheeled, tracked and rail-based launchers since 2019. Status unknown; probably operational.
Hwasong-7 (Nodong/Rodong)	1993	>1 200	Single-stage, liquid-fuelled MRBM launched from 5-axle wheeled TEL. NASIC estimates fewer than 100 Hwasong-7 launchers. Operational.
Hwasong-9 (KN04/Scud-ER)	2016	1 000	Single-stage, liquid-fuelled Scud extended-range variant launched from 4-axle wheeled TEL. Flight tested in 2016. Probably operational.
Pukguksong-2 (KN15)	2017	>1 000	Two-stage, solid-fuelled MRBM launched from tracked TEL. Land-based version of Pukguksong-1 SLBM. Flight tested in 2017. Probably operational.
Land-attack cruise missile	2021	1 500	Flight tested multiple times in 2021 from wheeled TEL. Under development.
Hwasong-8/Unnamed 'Hypersonic Missile'	2021	>1 000	Two versions of HGV carried by a shortened Hwasong-12 booster. Hwasong-8 flight tested in Sep. 2021 with unknown result; unnamed missile successfully flight tested twice in Jan. 2022. Both systems displayed at exhibition in Oct. 2021. Under development.

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 410-423*, https://www.sipri.org/yearbook/2022/10

SIPRI Estimate of North Korean Forces with Potential Nuclear Capability in 2022 - II

Type/ North Korean designation (US designation)[a]	Year first displayed	Range (km)	Description and status
Hwasong-10 (BM-25/Musudan)	2010	>3 000	Single-stage, liquid-fuelled IRBM launched from 6-axle wheeled TEL. NASIC estimates fewer than 50 Hwasong-10 launchers. Several failed flight tests in 2016. Status unknown; may have been superseded.
Hwasong-12 (KN17)	2017	>4 500	Single-stage, liquid-fuelled MRBM launched from 8-axle wheeled TEL. Flight tested several times in 2017 with mixed success. Deployment status unknown.
Hwasong-14 (KN20)	2017	>10 000	Two-stage, liquid-fuelled ICBM launched from 8-axle wheeled TEL. First ICBM. Successfully flight tested twice in 2017. Deployment status unknown; may have been superseded.
Hwasong-15 (KN22)	2017	>12 000	Two-stage, liquid-fuelled ICBM launched from 9-axle wheeled TEL. Successfully flight tested in Nov. 2017. Displayed at parade in Oct. 2020 and at exhibition in Oct. 2021. Deployment status unknown.
Hwasong-17 (KN28)[c]	2020	14 000	Two-stage, liquid-fuelled ICBM launched from 11-axle wheeled TEL. Largest ICBM to date, possibly capable of carrying MIRVs and penetration aids. No known flight tests. Displayed at parade in Oct. 2020 and at exhibition in Oct. 2021. Under development.
Sea-based missiles			
Pukguksong-1 (KN11)	2014	>1 000	Two-stage, solid-fuelled SLBM. Flight tested several times in 2015 and 2016 with mixed success. Displayed at exhibition in Oct. 2021. Deployment status unknown; may have been superseded.
Pukguksong-3 (KN26)	2017	1 900–2 500	Two-stage, solid-fuelled SLBM. Successfully flight tested in Oct. 2019. Deployment status unknown.
Pukguksong-4	2020	3 500–5 400	Two-stage, solid-fuelled SLBM. Appears wider than Pukguksong-1 and shorter than Pukguksong-3. No known flight tests. Displayed at parade in Oct. 2020. Deployment status unknown.
Pukguksong-5	2021		Two-stage, solid-fuelled SLBM. Roughly same length as Pukguksong-3 with elongated shroud; possibly capable of carrying MIRVs and penetration aids. No known flight tests. Displayed at parade in Jan. 2021 and at exhibition in Oct. 2021. Deployment status unknown.

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 410-423*, https://www.sipri.org/yearbook/2022/10

Wikipedia Estimate of North Korea's Nuclear Forces

(See Original source for wide range of data on uncertainties in estimates of national weapons and delivery system developments)

North Korea has a military nuclear weapons program[7] and, as of early 2020, is estimated to have an arsenal of approximately 30 to 40 nuclear weapons and sufficient production of fissile material for six to seven nuclear weapons per year.[8] North Korea has also stockpiled a significant quantity of chemical and biological weapons. In 2003, North Korea withdrew from the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).[9] Since 2006, the country has been conducting a series of six nuclear tests at increasing levels of expertise, prompting the imposition of sanctions.[10]

There is evidence that North Korea has been able to miniaturize a nuclear warhead for use on a ballistic missile.[202][203] According to Japan's defense white paper North Korea does possess the ability to miniaturize nuclear weapons.[204] A defense white paper from South Korea in 2018 said North Korea's ability to miniaturize nuclear weapons has reached a considerable level. In a leaked report the American Defense Intelligence Agency also claims North Korea can miniaturize nuclear warheads for ballistic missiles.[205] Whether North Korea has technology to protect their missiles upon re-entry is unknown. Some analysts suggest North Korea's new missiles are fakes.[206] Various North Korean rocket tests continued into the 2010s, for example in 2013, in 2014, and in 2016. North Korea performed no tests of medium-range missiles sufficiently powerful to reach Japan in 2015, but South Korea's Yonhap news agency believes that at least one missile fired during North Korea's March 2016 missile tests is likely a medium-range Rodong missile.[207] North Korea appeared to launch a missile test from a submarine on April 23, 2016; while the missile only traveled 30 km, one U.S. analyst noted that "North Korea's sub launch capability has gone from a joke to something very serious".[208] An August 2016 North Korean missile test of a Rodong missile that flew 1,000 kilometres (620 mi) landed about 250 kilometres (160 mi) west of Japan's Oga Peninsula, in international waters but inside Japan's exclusive economic zone, prompting Japan to condemn the "ur

As of 2016, North Korea is known to have approximately 300 Rodong missiles whose maximum range is 1,300 km (800 mi).[210]

Operational or successfully tested [edit]

- **Hwasong-5** – initial Scud modification. Road-mobile, liquid-fueled missile, with an estimated range of 330 km. It has been tested successfully. It is believed that North Korea has deployed some 150–200 such missiles on mobile launchers.
- **Hwasong-6** – later Scud modification. Similar to the Hwasong-5, yet with an increased range (550–700 km) and a smaller warhead (600–750 kg). Apparently this is the most widely deployed North Korean missile, with at least 400 missiles in use.
- **Hwasong-7**[211] – larger and more advanced Scud modification. Liquid-fueled, road-mobile missile with a 650 kg warhead. First production variants had inertial guidance, later variants featured GPS guidance, which improves CEP accuracy to 190–250 m.[*citation needed*] Range is estimated to be between 1,300 and 1,600 km.
- **Hwasong-9** is also known as Scud-ER in rest of the world is further development of Hwasong-6 with range of (1000–1000+ km) and is capable of hitting Japan.[212][213][214]
- **Hwasong-10** – believed to be a modified copy of the Soviet R-27 Zyb SLBM. Originally believed to have been tested as the first or second stage of Unha, but debris analysis showed that the Unha used older technology than it is believed the Hwasong-10 uses.[191] Also known under the names Nodong-B, Taepodong-X, Musudan and BM25, predicted to have a range of 2,500–4,000 km.[215] A DoD report puts BM25 strength at fewer than 50 launchers.[216]
- **Hwasong-11** – a short-range, solid-fueled, highly accurate mobile missile, modified copy of the Soviet OTR-21. Unknown number in service, apparently deployed either in the late 1990s or early 2000s (decade).
- **Pukguksong-1** – a long-range, solid-fueled, SLBM. Also called the KN-11 by the Defense Department. Possibly derived from the Chinese JL-1 SLBM.[217]
- **Pukguksong-2** – a long-range, land based development of the solid fueled Pukguksong-1.[218] Also known as the KN-15.[219]
- **Hwasong-12** – a medium-range, liquid-fueled, mobile missile. First tested in May 2017.[220] also known as KN-17 outside of Korea, South Korean experts estimate range of 5000 to 6000 km based on successful test conducted in May.[221]
- **Hwasong-14** – Also known as the KN-20, a long-range, road transportable ICBM,[222] tested on July 4 and 29,[223] 2017, estimated range is 6,700–10,000 km (4,200–6,200 mi)[224][225][226][227][119][228][229][230] John Schilling estimates the current accuracy of the North's Hwasong-14 as poor at the mooted ranges which threaten US cities[118] (which would require more testing[120][231] to prove its accuracy).[232] Michael Elleman has pointed out that the NHK video[231] which captured the descent of the reentry vehicle (RV) shows its failure to survive reentry. If the RV had survived reentry, the video would have shown a bright image all the way to impact in the sea. However a recent CIA assessment notes that North Korea's ICBM reentry vehicles would likely perform adequately if flown on a normal trajectory to continental U.S. targets.[233]
- **Hwasong-15** – 13,000 km range, successfully tested on November 28, 2017.[234]
- **KN-23** – 700 km range, Successfully tested on May 4, 2019. Similar to 9K720 Iskander.[196] Demonstrated range of 800 kilometers on September 15, 2021.[235]
- **Hwasong-17** – potential range over 15,000 km depending on the warhead weight, according to initial Japanese estimate. The ICBM was believed to be first successfully tested on a full flight on November 18, 2022. The ICBM's long-range accuracy, and its ability to survive re-entry, are unknown as of 2022.[236][237]

Untested [edit]

- **KN-08** – Road-mobile ICBM. Also called the Hwasong-13 (HS-13). Maximum range >5,500 km (3,400 miles). The US Defense Department estimates at least 6 KN-08 launchers are in deployment.[216] A modified version, the KN-14, was unveiled at a parade marking the 70th anniversary of the Workers' Party of Korea. The missile development was halted due to engine problems.[238]

Source: Excerpted from " *North Korean and weapons of mass destruction*." WIKIPEDIA, https://en.wikipedia.org/wiki/North Korea_and_weapons_of_mass_destruction, accessed 19.4.23
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North Korea: Nuclear Delivery Systems - I: CRS Estimate 2023

North Korea conducted an unprecedented 63 ballistic missile test launches in 2022…North Korea is developing nuclear weapons and delivery systems that possess certain critical features: mobility, reliability, potency, precision, and survivability. Mobile weapons have increased survivability compared with fixed launch sites and static stockpiles. Reliability, potency, precision and in-flight maneuverability work together to maximize the impact of North Korea's limited quantity of weapons, launchers, and warheads.

Intercontinental Ballistic Missiles

North Korea improved its ability to strike the continental United States with an ICBM through a series of tests in 2017 and again in 2022. The DPRK first successfully test-launched two liquid-propellant, road- mobile ICBMs in 2017: the Hwasong-14 (U.S. designated KN-20) and Hwasong-15 (U.S. designated KN-22). North Korea displayed a larger new Hwasong-17 ICBM at an October 2020 military parade and began test launching it in 2022. The Defense Intelligence Agency assesses it is "probably designed to deliver multiple warheads." Analysts point to the larger diameter and propulsion capability, potentially allowing it to carry multiple warheads. In addition, in December 2022 North Korea static (or ground) tested an ICBM solid-propellant rocket motor, potentially for a land-based or submarine-based ICBM. Reliability of these systems remains uncertain. Without further testing, neither the North Koreans nor others can assess whether the missiles or components will function as designed.

Short- and Medium-Range Missiles

North Korean SRBMs and medium-range ballistic missiles (MRBM), precision-guided multiple launch rocket systems (MLRS), and artillery pose the most acute near-term threats to other nations. Advances in these systems demonstrate a shift toward solid propellants and satellite guidance systems; advances that could carry over to larger, more potent systems like the Hwasong series ICBMs. These developments provide the projectiles greater mobility and survivability prior to launch and greater precision on target.

In the MRBM category, the KN-15 poses the greatest threat to North Korea's regional adversaries and exhibits advanced technology. Known in North Korea as the Pukguksong-2, the KN-15 is a solid-propellant missile capable of striking mainland Japan and carrying a nuclear or conventional payload—known as dual capable. The North Koreans fire the missile from a tracked vehicle, which gives the system mobility and makes prelaunch targeting of the system difficult.

The KN-23 SRBM exemplified a notable advance to the North Korean inventory in the smaller category of weapons. The May 2019 tests of two KN-23 missiles revealed an atypical flight path. On terminal approach to its target, the KN-23 conducted a "pull-up" maneuver, intended to complicate the ability of ground-based interceptors to destroy the hostile missile in flight by increasing its speed and angle of attack to the target. The KN-23 can strike any location on the Korean peninsula with either a conventional or nuclear payload and uses a solid-propellant.

North Korea has committed to expanding the performance of its precision guided *tactical* weapons. The KN-24 and KN-25 pose significant threats to South Korea and U.S. assets on the peninsula. The KN-24 is a tactical system with a mobile launcher, solid propellant, and relatively large payload. The KN-24 demonstrates the guidance system and in-flight maneuverability to achieve precision strikes. Outside experts assess that the North Koreans may ultimately intend the KN-24 to serve as a dual capable system.

The KN-25 blurs the line between rocket and missile; however, it achieves the same effect as a traditional SRBM by delivering destructive effects on a precision target at significant range thanks to advanced avionics, inertial and satellite guidance systems, and aerodynamic structures.

- The newest missiles—including the Hwasong-14, Hwasong-15, Hwasong-17, KN-15, KN-23, KN-24, and KN-25—demonstrates mobility, potency, precision, and has characteristics that make the missiles difficult to defeat in flight. These traits suggest that the North Korean test program may be intended to increase the reliability, effectiveness, and survivability of their ballistic missile force.

Source: adapted from: Mary Beth D Nitikin, ***North Korea's Nuclear Weapons and Missile Programs*, Congressional Research Service, IF10423, January 23, 2023**

North Korea: Nuclear Delivery Systems - II: CRS Estimate 2023

The recent advances in North Korea's ballistic missile test program appear to be directed at developing capabilities to defeat or degrade the effectiveness of missile defenses deployed in the region: Patriot, Aegis Ballistic Missile Defense (BMD), and Terminal High Altitude Area Defense (THAAD). In addition, North Korea's progress with submarine-launched ballistic missiles (SLBM) suggests an effort to counter land-based THAAD missile defenses by launching attacks from positions at sea outside the THAAD's radar field of view, although local Aegis BMD systems could likely still track these projectiles. The Pukgugsong-3 SLBM was successfully tested beginning in late 2019. According to a 2021 DIA report, North Korea has said this SLBM, to be launched from a ballistic missile submarine, will be cold-launched, solid-fueled and "will carry a nuclear warhead." North Korea has also unveiled longer-range SLBMs, the Pukguksong-4 and Pukguksong- 5.

In addition, North Korea's progress with submarine-launched ballistic missiles (SLBM) suggests an effort to counter land-based THAAD missile defenses by launching attacks from positions at sea outside the THAAD's radar field of view, although local Aegis BMD systems could likely still track these projectiles. The Pukgugsong-3 SLBM was successfully tested beginning in late 2019. According to a 2021 DIA report, North Korea has said this SLBM, to be launched from a ballistic missile submarine, will be cold-launched, solid-fueled and "will carry a nuclear warhead." North Korea has also unveiled longer-range SLBMs, the Pukguksong-4 and Pukguksong- 5.

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Source: adapted from: Mary Beth D Nitikin, ***North Korea's Nuclear Weapons and Missile Programs*, Congressional Research Service, IF10423, January 23, 2023**

North Korea: Nuclear Weapons: House of Commons Library - I: 2022

- Since 2011 North Korea's nuclear program has accelerated. In summary:
  • Since 2006 North Korea has conducted six nuclear tests, the most recent in September 2017.
  • Opinions are divided on the size of its stockpile. SIPRI's most recent estimate places the number of assembled nuclear warheads at 20. Previous estimates suggested North Korea has the capacity to build between 40 and 50 warheads, based on its stocks of fissile material.
  • North Korea continues to produce fissile material for weapons purposes.
  • In July 2017 North Korea successfully tested, for the first time, an Intercontinental Ballistic Missile (ICBM) technically capable of striking the United States. Despite the imposition of UN Security Council resolutions prohibiting the development and testing of ballistic missiles/ ICBM, North Korea has continued its ICBM program. In early 2022 North Korea abandoned its self-declared moratorium on nuclear and ICBM testing and conducted an ICBM test in March 2022.
  • North Korea is thought to have achieved miniaturization of a nuclear warhead, a technological threshold in the attainment of a credible ICBM nuclear capability.
  • North Korea's nuclear doctrine appears to be shifting from one based solely on deterrence, to a posture that embraces the concept of preemptive first strikes.

…. North Korea has conducted six underground nuclear weapons tests, four of which have been authorized under current leader Kim Jong-un: 2006, 2009,2013, January 2016, September 2016, and on 2 September 2017.

…Since September 2021 North Korea has been conducting an accelerated campaign of missile testing. At the time of writing, North Korea has conducted 16 missile tests in the last four months alone, in contravention of UN Security Council resolutions. There are also indications that North Korea may be preparing to conduct a seventh nuclear test.

… Initial assessments of the last test on 2 September 2017 suggested that the nuclear device was potentially a thermonuclear/hydrogen bomb with a yield of approximately 100 kilotons, North Korea's most powerful nuclear explosion yet. Some analysts have since revised that estimate to up to 250 kilotons.

… the exact size of North Korea's nuclear stockpile is unclear. For a long time 8-10 plutonium-based nuclear weapons had been a common estimate, with some analysts suggesting that North Korea may be in possession of a small number of Highly Enriched Uranium (HEU)-based weapons. In July 2017, however, the US Defense Intelligence Agency was reported by The Washington Post to have significantly raised its official estimate of the number of nuclear warheads that North Korea possesses, to 60.

… In August 2017 the US Defense Intelligence Agency was reported to have concluded that North Korea had successfully produced a miniaturized nuclear warhead capable of being fitted on a ballistic missile.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: North Korea*, House of Commons Library, May 17, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9071/CBP-9071.pdf .

North Korea: Nuclear Weapons: House of Commons Library - II: 2022

… At the Eighth Party Congress of the WPK in January 2021, commitments were made to not only "push ahead the production of super-sized nuclear warheads" but to also focus on making "nuclear weapons smaller and lighter for more tactical uses".

…At the Eighth Party Congress of the Worker's Party of Korea in January 2021, Kim Jong-un pledged to continue developing advanced weapons, including weapons. Among the regime's nuclear priorities are the development of a nuclear-powered ballistic missile submarine, solid-fueled ICBM, multiple warhead ICBM, tactical nuclear weapons and a nuclear tipped hypersonic
glide vehicle (HGV).

The development of such capabilities would enhance the responsiveness and survivability of North Korea's nuclear force, supporting the view that North Korea's nuclear posture is moving away from one premised on deterrence and survival of the regime, to one that is more offensive and pre-emptory in nature.

Many of the new systems under development were subsequently displayed at a military parade to mark the 90th anniversary of the Korean People's Army in April 2022, the fourth such event in two years. In a speech to the parade, Kim Jong-un called for the continued enhancement of the country's nuclear forces, in terms of both quantity and scale. That parade coincided with an intensive campaign of missile testing that North Korea has been conducting over the last six months, and allegations that the country is preparing to conduct its seventh nuclear test.

… North Korea already possesses a significant arsenal of short and medium- range ballistic missiles. In the last few years North Korea has been augmenting that capability with the development of newer, more sophisticated missile systems. In 2019 North Korea tested the new solid-fueled KN-23 SRBM. Road mobile, with a range of 690km. North Korea already possesses a significant arsenal of short and medium-
range ballistic missiles.

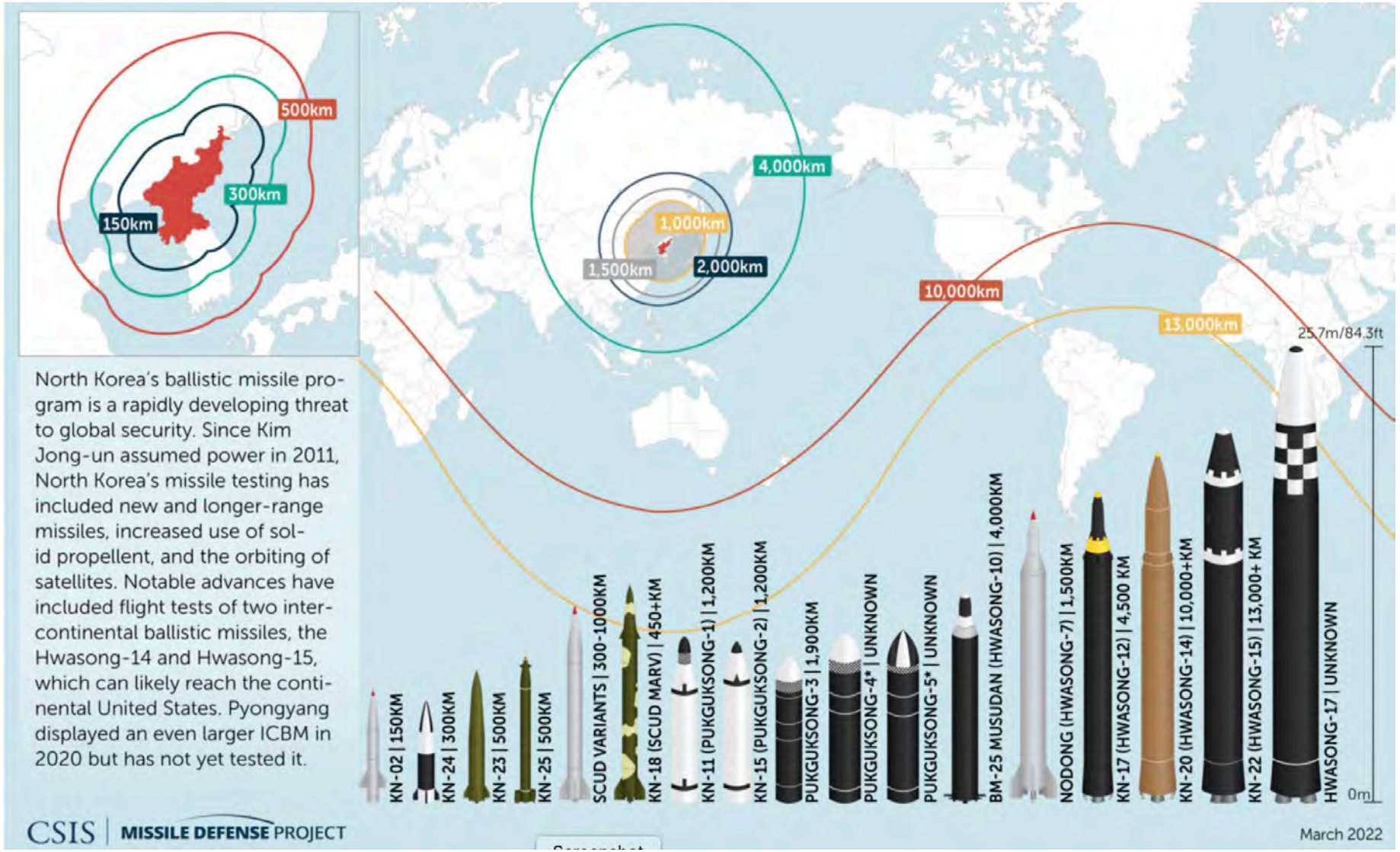
…In March 2022, and for the first time since lifting the self-imposed moratorium on ICBM and nuclear testing,79 North Korea flight tested what it claimed was a newer ICBM variant – the Hwasong-17. The first test of an ICBM in five years, and in contravention of UN Security
Council resolutions, the missile is reported to have travelled over 1,000km, at an altitude of more than 6,200km before landing in the East Sea. This is the furthest a North Korean ICBM has travelled under test conditions. However, North Korea's claims that it had successfully tested a Hwasong-17
have subsequently been disputed by the US and South Korean governments.

… In 2019 North Korea announced that it had conducted the first flight test of anew SLBM, designated the Pukguksong-3, with an estimated range of 1,900 kilometers. New variants of the Pukguksong SLBM have since been unveiled

. … The commitment in January 2021 to developing advanced nuclear weapons included reference to developing "hypersonic gliding flight warheads in a short period"

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: North Korea*, House of Commons Library, May 17, 2022, https://researchbriefings.files.parliament.uk/documents/CBP-9071/CBP-9071.pdf .

North Korea : Missile Forces*



North Korea claimed initial test of ICBM missile in April 2023

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential dual capability

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

North Korea : Missile Forces*

Missile Name	Class	Range	Status
BM-25 Musudan	IRBM	2,500 - 4,000 km	In Development
Hwasong-12	IRBM	4,500 km	In Development
Hwasong-13	ICBM	5,500 - 11,500 km	Never Deployed
Hwasong-14	ICBM	10,400 km	Operational
Hwasong-15	ICBM	8,500 - 13,000 km	In Development
Hwasong-5	SRBM	300 km	Operational
Hwasong-6	SRBM	500 km	Operational
Hwasong 7 (Nodong 1)	MRBM	1,200 - 1,500 km	Operational
Hwasong-9	MRBM	800 - 1,000 km	Operational
KN-01	ASCM	110 - 160 km	Operational
KN-02 (Toksa)	SRBM	120 - 170 km	Operational
KN-06 (Pon'gae-5)	SAM	150 km	Operational
KN-09 (KN-SS-9)	MLRS	200 km	In Development
KN-18 (Scud MaRV)	SRBM	450+ km	In Development
KN-23	SRBM	450 km	Unknown
KN-24	SRBM	410 km	In Development
KN-25	SRBM	380 km	Operational
Koksan M1978	Artillery	40 - 60 km	Operational
Kumsong-3 (KN-19)	ASCM	130 - 250 km	Likely operational
M1985/M1991	MLRS	40 - 60 km	Operational

Missile Name	Class	Range	Status
Pukguksong-1 (KN-11)	SLBM	1,200 km	In Development
Pukguksong-2 (KN-15)	MRBM	1,200 - 2,000 km	Operational
Pukguksong-3 (KN-26)	SLBM	1,900 km	Operational
Taepodong-1	IRBM	2,000 - 5,000 km	Obsolete
Taepodong-2 (Unha-3)	SLV	4,000 - 10,000 km	Operational

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

Iranian Nuclear Program

(For summary historical data see Wikipedia article on Nuclear Program of Iran (https://en.wikipedia.org/wiki/Nuclear_program_of_Iran) and reporting by the IAEA)

Iran: ODNI's Summary Threat Analysis in 2023

The Iranian regime sees itself as locked in an existential struggle with the United States and its regional allies, while it pursues its longstanding ambitions for regional leadership.

The regime engaged in detailed talks throughout last year toward the renewal of the 2015 Joint Comprehensive Plan of Action (JCPOA), but Iran's hardline officials' distrust of Washington and doubts that the United States would deliver or sustain any benefits of a renewed JCPOA have stood in the way of finalizing a deal. In addition, Iran has demanded resolution of the "Safeguards" issue, which concerns unexplained nuclear activity at several additional Iranian sites, as a primary condition for renewing the nuclear agreement.

Iran is not currently undertaking the key nuclear weapons-development activities that would be necessary to produce a testable nuclear device. Since the assassination in November 2020 of nuclear scientist Mohsen Fakhrizadeh, Iran has accelerated the expansion of its nuclear program, stated that it is no longer constrained by any JCPOA limits, and undertaken research and development activities that would bring it closer to producing the fissile material for completing a nuclear device following a decision to do so. If Tehran does not receive sanctions relief, Iranian officials probably will consider further enriching uranium up to 90 percent.

Iran consistently has cast its resumption of nuclear activities that exceed JCPOA limits as a reversible response to the U.S. withdrawal from the agreement. Iran continues to message that it would return to full compliance if the United States provided sanctions relief and fulfilled its JCPOA commitments, and if the IAEA closed its safeguards investigations related to three undeclared nuclear sites.

In 2021, the IAEA verified that Iran conducted research on uranium metal production and has produced small quantities of uranium metal enriched up to 20 percent. While Iran made this enriched uranium metal as part of its research and development for a new type of reactor fuel, the production of uranium metal was prohibited under the JCPOA as a key capability needed to produce nuclear weapons.

Iran continues to increase the size and enrichment level of its uranium stockpile beyond JCPOA limits. Iran continues to exceed JCPOA restrictions on advanced centrifuge research and development, and continues uranium enrichment operations at the deeply buried Fordow facility, which was prohibited under the JCPOA. Iran has been enriching and accumulating uranium hexafluoride (UF6) up to 60 percent U-235 since April 2021, and continues to accumulate UF6 enriched up to 20 percent.

Iran's ballistic missile programs, which already include the largest inventory of ballistic missiles in the region, continue to pose a threat to countries across the Middle East. Iran has emphasized improving the accuracy, lethality, and reliability of its missiles. Iran's work on space launch vehicles (SLVs)—including its Simorgh—shortens the timeline to an ICBM if it decided to develop one because SLVs and ICBMs use similar technologies

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Office of the Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, 2/6/23, https://www.dni.gov/files/ODNI/documents/assessments/ATA-2023-Unclassified-Report.pdf

Iran: Nuclear Weapons: CRS Estimate 2023

According to official U.S. assessments, Iran halted its nuclear weapons program in late 2003 and has not resumed it. This program's goal, according to U.S. officials, was to develop an implosion-style nuclear weapon for Iran's Shahab-3 ballistic missile. Iran has not made a decision to develop nuclear weapons, according to February and March public U.S. intelligence assessments.

The U.S. government assessed prior to the JCPOA that Tehran had not mastered all of the necessary technologies for building a nuclear weapon. Apparently confirming persisting gaps in Iran's nuclear weapons knowledge, the 2023 U.S. Intelligence Community Annual Threat Assessment observes that "Iran is not currently undertaking the key nuclear weapons-development activities that would be necessary to produce a testable nuclear device."

…Weaponization

At the time when the JCPOA negotiations concluded, the U.S. intelligence community assessed that Iran would have needed one year to complete the necessary steps for producing a nuclear weapon that do not involve fissile material production. This estimate assumed that Iran could complete fissile material production and weaponization in parallel, which meant that Iran would have needed about one year to produce a nuclear weapon.

The U.S. intelligence community assesses that Iran has not resumed work on its weaponization research. A State Department official told CRS in an April 2022 email that Iran would need approximately one year to complete the necessary weaponization steps. This timeline "takes into consideration assessed knowledge gaps and reflects" the intelligence community's "view of Iran's fastest reasonable path to overcome them," the official added. Milley testified in March 2023 that Iran would need "several months to produce an actual nuclear weapon." The assumptions underlying this estimate are unclear.

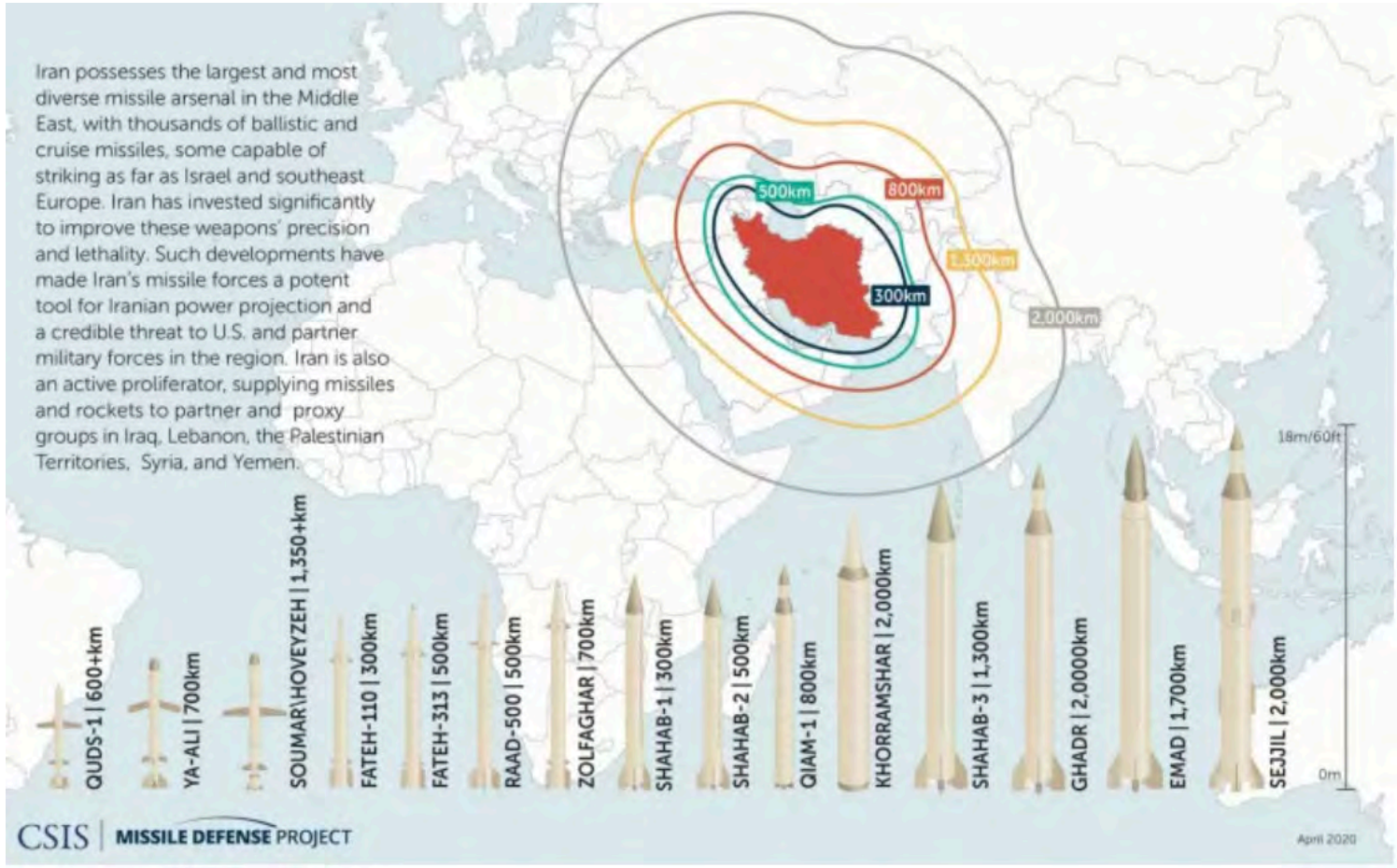
An implosion-style nuclear explosive device, according to the Office of Technology Assessment, uses "a shell of chemical high-explosive surrounding the nuclear material ... designed (for example, by being detonated nearly simultaneously at multiple points) to rapidly and uniformly compress the nuclear material to form a supercritical mass" necessary for a sustained nuclear chain reaction.

IAEA reports suggest that Iran does not yet have a viable nuclear weapon design or a suitable explosive detonation system. Tehran may also need additional experience in producing uranium metal; weapons-grade HEU metal for use in a nuclear weapon is first "cast and machined into suitable components for a nuclear core." ..The U.S. government continues to assess that Iran is more likely to use covert, rather than declared, facilities to produce the requisite fissile material. Neither the U.S. government nor the IAEA have publicly described any evidence that Iran is conducting such activities.

… During JCPOA negotiations, the breakout timeline was an unclassified proxy measure of Iranian nuclear weapons capabilities. A State Department official described the breakout "concept" in a September 2021 email as "a useful metric to help quantify" U.S. negotiating goals and as "a useful analytic framework to structure the negotiation of technical measures related to enrichment." The timeline was also "helpful in explaining the deal and selling it politically," the official noted, adding that the timeline has "become an important political yardstick" for evaluating the agreement's merits. In a February 2022 *Bulletin of the Atomic Scientists* article, Jon Wolfsthal, a National Security Council official during the Obama Administration, explained that the one-year breakout goal was meant to provide enough time "to generate an international response to any Iranian move to build weapons."

Source: Adapted from: Paul K/ Kerr, *Iran and Nuclear Weapons Production*, Congressional Research Service, IF121063, April 14, 2023

Iran: Missile Forces*



Missile Name	Class	Range	Status
Emad (Shahab-3 Variant)	MRBM	1,700 km	In Development
Ghadr-1 (Shahab-3 Variant)	MRBM	1,950 km	In Development
Fateh-110	SRBM	200 - 300 km	Operational
Fateh-313	SRBM	500 km	Operational
Khorramshahr	MRBM	2,000 km	In Development
Koksan M1978	Artillery	40 - 60 km	Operational
Qiam-1	SRBM	700 - 800 km	Operational
Ra'ad	Antiship Cruise Missile	350 km	Operational
Safir	SLV	350 km altitude	Operational
Sejjil	MRBM	2,000 km	Operational
Shahab-1	SRBM	285 - 330 km	Operational
Shahab-2	SRBM	500 km	Operational
Shahab-3	MRBM	1,300 km	Operational
Simorgh	SLV	500 km altitude	In Development
Soumar	Cruise Missile	2,000 - 3,000 km	Operational (presumed)
Tondar 69	SRBM	150 km	Operational
Ya-Ali	Land-Attack Cruise Missile	700 km	Operational
Zolfaghar	SRBM	700 km	Operational

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential dual capability

Missile Defense Project, "Iran," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/iran/

Israeli Nuclear Forces

IISS Estimate of Israeli Nuclear Forces in 2023

Strategic Forces

Israel is widely believed to have a nuclear capability – delivery means include F-15I and F-16I ac, *Jericho* 2 IRBM and, reportedly, *Dolphin*/*Tanin*-class SSKs with LACM

FORCES BY ROLE

SURFACE-TO-SURFACE MISSILE

3 IRBM sqn with *Jericho* 2 **EQUIPMENT BY TYPE**

SURFACE-TO-SURFACE MISSILE LAUNCHERS IRBM • Nuclear: ε24 *Jericho* 2

Strategic Defenses

FORCES BY ROLE

AIR DEFENCE

3 bty with *Arrow* 2 ATBM with *Green Pine/Super Green Pine* radar and *Citrus Tree* command post

10 bty with *Iron Dome* (incl reserve bty) 4 bty with M901 *Patriot* PAC-2
2 bty with *David's Sling*

Space

EQUIPMENT BY TYPE

SATELLITES 10
COMMUNICATIONS 3 *Amos*
ISR 7: 1 EROS; 5 *Ofeq* (5, 7, 9, 10 & 16); 1 TecSAR-1 (*Polaris*)

Source: Adapted from IISS, *Military Balance, 2023*, "Israel"

Israel: Bulletin of Atomic Scientists 2021-2022

Table 1: Israeli nuclear weapons, 2021

By Hans M. Kristensen and Matt Korda

Type	Year First	Range (km)	Comment
Aircraft			
F-16I	1980	1,600	Possible nuclear strike role. Nuclear bombs possibly stored disassembled at underground facility near Tel Nof Air base.
F-15I	1998	3,500	Potential nuclear strike role.
Land-based missies			
Jericho II	1984-1985	1,500+	Possibly 25-50 launchers in caves at Sdot Micha.
Jericho III	2011?	4,000?	Probably replacing Jericho II.
Sea-based missiles			
Popeye variant?	2003?	?	Rumored cruise missile for land-attack.

Absent official public information from the Israeli government or intelligence communities of other countries, speculations abound about Israel's nuclear arsenal. Over the past several decades, news media reports, think tanks, authors, and analysts have presented a wide range of possibilities for the size of the Israeli nuclear stockpile, from 75 warheads to more than 400 warheads. Delivery vehicles for the warheads have been listed as aircraft, ballistic missiles, artillery tactical or battlefield weapons such as artillery shells and landmines, and more recently sea-launched cruise missiles.[2] We believe that many of these rumors are inaccurate and that the most credible stockpile number is less than one hundred warheads, probably on the order of 90 warheads for delivery by aircraft, land-based ballistic missiles, and possibly sea-based cruise missiles.

If Israel was indeed behind the 1979 Vela incident, the country would have conducted only one known atmospheric nuclear test; this could indicate that Israel's nuclear weapons designs are not particularly sophisticated. It took other nuclear weapon states dozens of elaborate nuclear test explosion experiments to develop sophisticated weapon designs. According to some analysts, however, Israel had "unrestricted access to French nuclear test explosion data" in the 1960s …so much so that "the French nuclear test in 1960 made two nuclear powers not one" …Until France broke off deep nuclear collaboration with Israel in 1967, France conducted 17 fission warhead tests in Algeria, ranging from a few kilotons to approximately 120 kilotons of explosive yield …France did not conduct its first two-stage thermonuclear test until August 1968.

In sum, it remains highly challenging to assess Israel's design sophistication for its nuclear weapons. It is hypothetically possible that Israel developed two-stage thermonuclear weapons. Yet a more cautious analysis based upon Israel's plutonium production, testing history, design skills, force structure, and employment strategy suggests that its arsenal probably consists of single-stage, boosted fission warheads.

Excerpted from Hans M. Kristensen, Matt Korda, "Nuclear Notebook: Israeli nuclear weapons, 2022," *Bulletin of Atomic Scientists*, January 17, 2022, https://thebulletin.org/premium/2022-01/nuclear-notebook-israeli-nuclear-weapons-2022/.

SIPRI Estimate of Israeli Nuclear Forces in 2022

All figures are approximate and some are based on assessments by the authors.

Type/designation	No. of launchers	Year first deployed	Range (km)[a]	No. of warheads
Aircraft	*125/50*[b]			*30*
F-16I	100/25	1980	1 600	30
F-15	25/25	1998	4 450	..[c]
Land-based missiles	*50*			*50*[d]
Jericho II	25	1990	>1 500	25
Jericho III	25	[2011]	[>4 000]	25[e]
Sea-based missiles	*5/20*[f]			*10*
'Popeye' variant SLCM	20	[2002]	[<1 500]	10
Total stockpile	**120**			**90**[g]

.. = not available or not applicable; [ ] = uncertain SIPRI estimate; SLCM = sea-launched cruise missile.

[a] Aircraft range is for illustrative purposes only; actual range will vary according to flight profile, weapon payload and in-flight refuelling.

[b] The first figure is the total number of aircraft in the inventory; the second is the number of aircraft that might be adapted for a nuclear strike mission.

[c] The United States Air Force's F-15E Strike Eagle has been given a nuclear role. It is not known whether the Israeli Air Force has added nuclear capability to this aircraft, but when Israel sent half a dozen F-15s from Tel Nof Air Base to the United Kingdom in Sep. 2019, a US official privately commented that Israel had sent its nuclear squadron.

[d] Commercial satellite images show what appear to be 23 caves or bunkers for mobile Jericho launchers at Sdot Micha Air Base. High-resolution satellite imagery that became available in 2021 indicates that each cave appears to have two entrances, which suggests that each cave could hold up to 2 launchers. If all 23 caves are full, this would amount to 46 launchers.

[e] The Jericho III is gradually replacing the older Jericho II, if this has not happened already. A longer-range version of the Jericho ballistic missile with a new solid rocket motor may be under development.

[f] The first figure is the total number of Dolphin-class submarines in the Israeli fleet; the second is the estimated maximum number of missiles that they can carry. In addition to six standard 533 millimetre torpedo tubes, Israel's submarines are reportedly equipped with four additional, specially designed 650 mm tubes that could potentially be used to launch nuclear-armed SLCMs.

[g] Given the unique lack of publicly available information about Israel's nuclear arsenal, this estimate comes with a considerable degree of uncertainty.

Note: see original source for detailed explanation of estimates and uncertainties.
Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 404-409*, https://www.sipri.org/yearbook/2022/10

Wikipedia Estimate of Israeli Nuclear Forces: 2023

(See Original source for wide range of data on uncertainties in estimates of national weapons and delivery system developments)

The State of Israel is widely believed to possess nuclear weapons. Estimates of Israel's stockpile range between 80 and 400 nuclear warheads,[2][5][6][7][8][9] and the country is believed to possess the ability to deliver them in several methods, including by aircraft, as submarine-launched cruise missiles, and via the Jericho series of intermediate to intercontinental range ballistic missiles.[18][19] Its first deliverable nuclear weapon is thought to have been completed in late 1966 or early 1967; which would make it the sixth country in the world to have developed them.[2][20][21]

However, Israel maintains a policy of deliberate ambiguity, never officially denying nor admitting to having nuclear weapons, instead repeating over the years that "Israel will not be the first country to introduce nuclear weapons to the Middle East".[22][23][24] Israel has also declined to sign the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), despite international pressure to do so, saying that would be contrary to its national security interests.[25]

Additionally, Israel developed the Begin Doctrine of counter-proliferation and preventive strikes, denying other regional actors the ability to acquire their own nuclear weapons. The Israeli Air Force conducted Operation Opera and Operation Orchard, destroying the Iraqi and Syrian nuclear reactors in 1981 and 2007, respectively, and the Stuxnet malware that severely damaged Iranian nuclear facilities in 2010 is thought to have been developed jointly by the United States and Israel. As of 2019, Israel remains the only country in the Middle East believed to possess nuclear weapons.[21] The Samson Option refers to Israel's deterrence strategy of massive retaliation with nuclear weapons as a "last resort" against a country whose military has invaded and/or destroyed much of Israel.[26]

Israel began to investigate the nuclear field soon after it declared independence in 1948 and, with French co-operation, secretly began building the Negev Nuclear Research Center,[d] a facility near Dimona housing a nuclear reactor and reprocessing plant in the late 1950s. The first extensive details of the weapons program came on October 5, 1986, with media coverage of revelations from Mordechai Vanunu, a technician formerly employed at the center. Vanunu was soon kidnapped by the Mossad and brought back to Israel, where he was sentenced to 18 years in prison for treason and espionage.[27][28]

Source: Excerpted from " *Nuclear Weapons and Israel*." WIKIPEDIA, https://en.wikipedia.org/wiki/Nuclear_weapons_and_Israel. , accessed 19.4.23

Israel: Nuclear Weapons: House of Commons Library: 2022

…SIPRI estimates that Israel possesses a highly developed nuclear arsenal of approximately 90 warheads….It is not known how much fissile material Israel has produced. As the Arms Control Association has noted "it is assumed by some analysts that Israel has a uranium-enrichment program, although there is not enough evidence to support a credible estimate of how much highly enriched uranium (HEU) Israel might have produced".8 In its Global Fissile Material Report 2009, the International Panel on Fissile Materials (IPFM) concluded:

> 1.We continue to assign to Israel an inventory of 100kg of HEU, which may have been acquired covertly from the United States before 1966. Israel may also have produced enriched uranium with laser or centrifuge technology, but information on this program is very limited and it may have ended…
>
> 2.The IPFM currently estimates that Israel has 0.3 metric tons of HEU and 0.8 metric tons of plutonium stockpiled for weapons production…
>
> 3.Overall, it is estimated that Israel has enough stockpiled fissile material for the production of up to 200 second generation warheads…
>
> On the basis of unconfirmed reports, Israel could be in possession of the nuclear triad, i.e. capable of delivering a nuclear capability via land, air and sea.

Over the last few decades Israel has acquired several aircraft types capable of delivering a nuclear weapon, including US-sourced F-16 and F-15 fast jet aircraft. It is thought that approximately 30 of its 90 nuclear warheads are gravity bombs assigned to the F-16.

…Israel has also pursued the indigenous development of the Jericho family of ground-launched ballistic missiles.12 The Jericho 1, with a range of 1,200km was first deployed in the 1970s, although it is now believed to have retired from service. The Jericho 2, first deployed in 1990, is understood, after a series of improvements, to have a range of 1,500-1,800km.

That missile is now believed to be being incrementally replaced by the intermediate-range Jericho 3. The Jericho 3 was first tested in 2008 and became operational in 2011. It is thought to have a range in excess of 4,000km. That missile would enable Israel to target all of Iran, Pakistan and Russia west of the Urals.13 In 2013 it was reported that Israel had tested an upgraded version of the Jericho 3. Some analysts believe that this latest variant has a range exceeding 5,500km, thereby giving Israel an intercontinental ballistic missile capability. A series of tests in the last few years of an unspecified rocket propulsion system, has led to renewed speculation that Israel may now be developing the Jericho 4.

…Since 1999 Israel has procured five diesel-powered Dolphin-class submarines from Germany.15 In 2002 former Pentagon officials suggested that they were being armed with indigenously modified Harpoon cruise missiles capable of carrying nuclear warheads.16 If true, that development would provide Israel with a sea-based second-strike capability. Israeli officials have, however, consistently refused to comment publicly on those reports, which remain unconfirmed.

In January 2022, Israel announced that it would purchase three advanced Dakar-class submarines from German company Thyssenkrupp Marine Systems to replace three of its oldest Dolphin-class submarines. The first submarine is expected to be delivered by the end of the decade.

Source: Excerpted from Claire Mills: Nuclear Weapons at a Glance: Israel, House of Commons Library, July 28, 2022, https://commonslibrary.parliament.uk/research-briefings/cbp-9075/ .

Israel: Nuclear Weapons: FAS Estimate - I: As of ?

According to official U.S. assessments, Iran halted its nuclear weapons program in late 2003 and has not resumed it. This program's goal, according to U.S. officials, was to develop an implosion-style nuclear weapon for Iran's Shahab-3 ballistic missile. Iran has not made a decision to develop nuclear weapons, according to February and March public U.S. intelligence assessments.

The U.S. government assessed prior to the JCPOA that Tehran had not mastered all of the necessary technologies for building a nuclear weapon. Apparently confirming persisting gaps in Iran's nuclear weapons knowledge, the 2023 U.S. Intelligence Community Annual Threat Assessment observes that "Iran is not currently undertaking the key nuclear weapons-development activities that would be necessary to produce a testable nuclear device."

…Weaponization

By the late 1990s the U.S. Intelligence Community estimated that Israel possessed between 75-130 weapons, based on production estimates. The stockpile would certainly include warheads for mobile Jericho-1 and Jericho-2 missiles, as well as bombs for Israeli aircraft, and may include other tactical nuclear weapons of various types. Some published estimates even claimed that Israel might have as many as 400 nuclear weapons by the late 1990s. We believe these numbers are exaggerated, and that Israel's nuclear weapons inventory may include less than 100 nuclear weapons. Stockpiled plutonium could be used to build additional weapons if so decided.

The Dimona nuclear reactor is the source of plutonium for Israeli nuclear weapons. The number of nuclear weapons that could have been produced by Israel has generally been estimated on the basis of assumptions about the power level of this reactor, combined with estimates for the number of delivery vehicles (aircraft, missiles) assigned a nuclear mission.

Information made public in 1986 by Mordechai Vanunu indicated that at that time, weapons grade plutonium was being produced at a rate of about 40 kilograms annually. If this figure corresponded with the steady-state capacity of the entire Dimona facility, analysts suggested that the reactor might have a power level of at least 150 megawatts, about twice the power level at which is was believed to be operating around 1970. To accommodate this higher power level, analysts had suggested that Israel had constructed an enlarged cooling system. An alternative interpretation of the information supplied by Vanunu was that the reactor's power level had remained at about 75 megawatts, and that the production rate of plutonium in the early 1980s reflected a backlog of previously generated material.

The constraints on the size of Israel's stockpile include several potential variables, several of which are generic to any nuclear weapons program. The Dimona reactor may have operated an average of between 200 and 300 days annually, and produced approximately 0.9 to 1.0 grams of plutonium for each thermal megawatt day. Israel may have use between 4 and 5 kilograms of plutonium per weapon [5 kilograms is a conservative estimate, and Vanunu reported that Israeli weapons used 4 kg].

The key variable that is specific to Israel is the power level of the reactor, which is reported to be at least 75 MWt and possibly as high as 200 MWt. New high-resolution satellite imagery provides important insight this matter. The imagery of the Dimona nuclear reactor was acquired by the Public Eye Project of the

Source: Adapted from: **Nuclear Weapons**, FAS, https://nuke.fas.org/guide/israel/nuke/. No author or date listed.

Israel: Nuclear Weapons: FAS Estimate - II: As of ?

Federation of American Scientists from Space Imaging Corporation's IKONOS satellite. The cooling towers associated with the Dimona reactor are clearly visible and identifiable in satellite imagery. Comparison of recently acquired commercial IKONOS imagery with declassified American CORONA reconnaissance satellite imagery indicates that no new cooling towers were constructed in the years between 1971 and 2000. This strongly suggests that the reactor's power level has not been increased significantly during this period. This would suggest an annual production rate of plutonium of about 20 kilograms.

Based on plausible upper and lower bounds of the operating practices at the reactor, Israel could have thus produced enough plutonium for at least 100 nuclear weapons, but probably not significantly more than 200 weapons.

Some type of non-nuclear test, perhaps a zero yield or implosion test, occurred on 2 November 1966 [possibly at Al-Naqab in the Negev]. There is no evidence that Israel has ever carried out a nuclear test, although many observers speculated that a suspected nuclear explosion in the southern Indian Ocean in 1979 was a joint South African-Israeli test.

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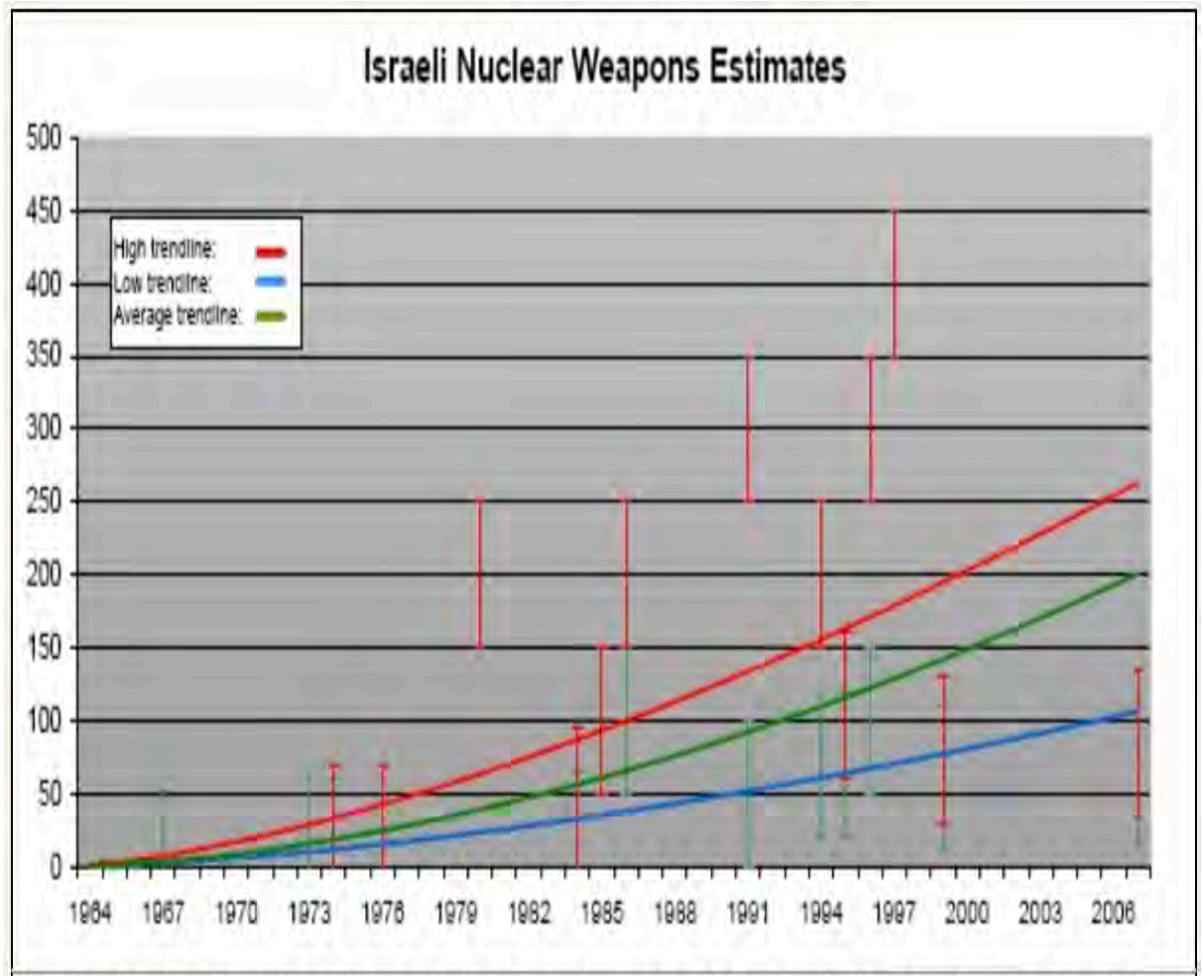


Estimates for Israel's nuclear weapons stockpile range from 70 to 400 warheads. The actual number is probably closer to the lower estimate. Additional weapons could probably be built from inventories of fissile materials.

Source: Adapted from: **Nuclear Weapons**, FAS, https://nuke.fas.org/guide/israel/nuke/. No author or date listed.

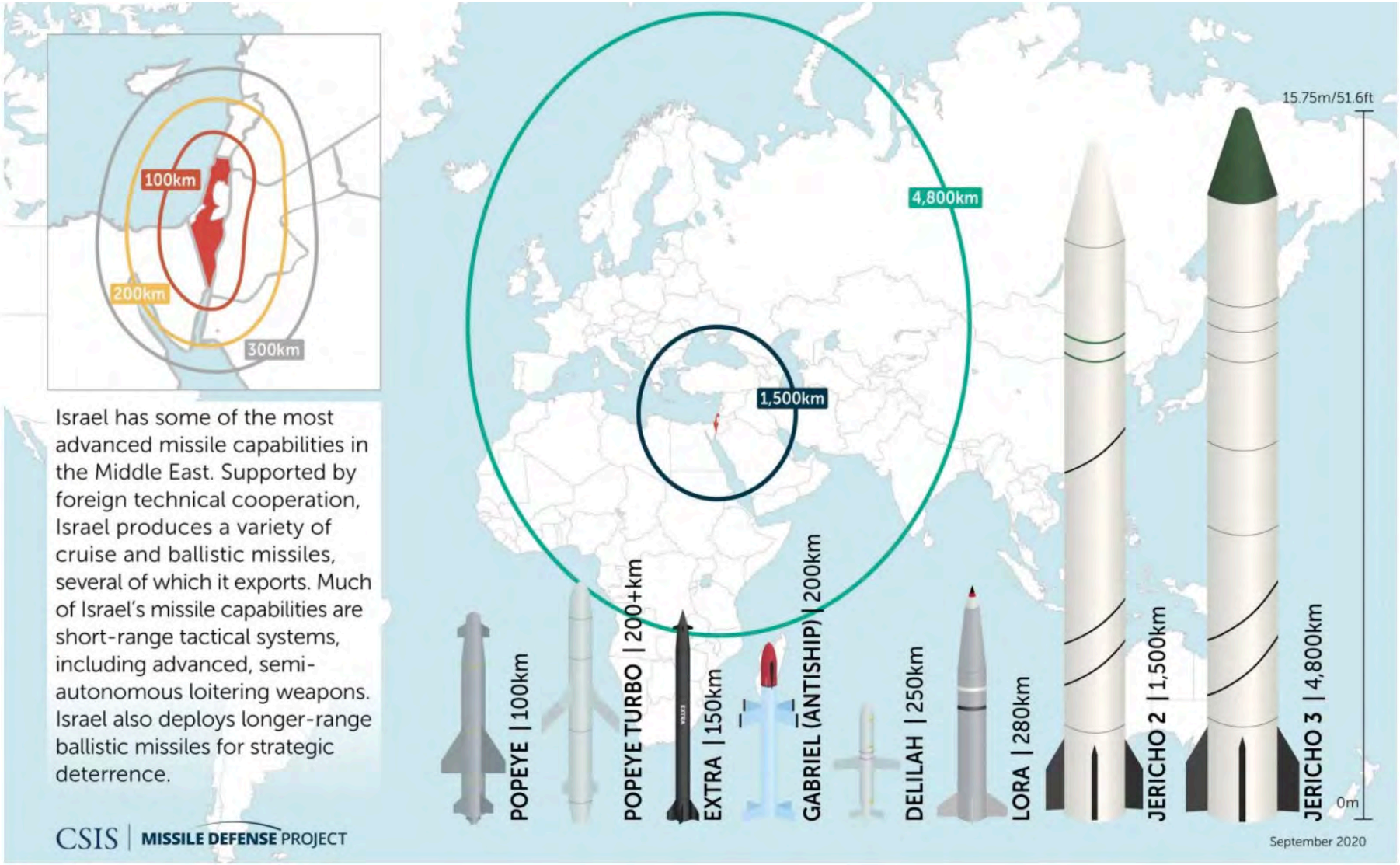
Israel: Operational & Obsolete Missile Forces*

Missile Name	Class	Range	Status
Delilah	LACM	250 - 300 km	Operational
EXTRA	Artillery Rocket	150 km	Operational
Gabriel	ASCM	35 - 400 km	Operational
Harpoon	ASCM	90 - 240 km	Operational
Jericho 1	SRBM	500 km	Obsolete
Jericho 2	MRBM	1,500 - 3,500 km	Operational
Jericho 3	IRBM	4,800 - 6,500 km	Operational
LORA	SRBM	280 km	Operational
Popeye	ALCM	75 - 100 km	Operational

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of Israel," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://thebulletin.org/premium/2022-07/nuclear-notebook-how-many-nuclear-weapons-does-india-have-in-2022/.

Israel: Ballistic and Cruise Missile Forces*



* All missiles listed in source, not just currently nuclear-armed. Illustrates potential dual capability.

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

Indian Nuclear Forces

IISS Estimate of India's Nuclear Forces in 2023

Strategic Forces Command

Strategic Forces Command (SFC) is a tri-service command established in 2003. The commander-in-chief of SFC, a senior three-star military officer, manages and administers all strategic forces through army, navy and air-force chains of command

SURFACE-TO-SURFACE MISSILE

1 SRBM bde with *Agni* I
1 IRBM bde with *Agni* II/III
2 SRBM bde with SS-250 *Prithvi* II

SURFACE-TO-SURFACE MISSILE LAUNCHERS
ICBM • 54 ICBM • Nuclear *Agni* V (in test)
IRBM • Nuclear ε4 *Agni* III; *Agni* IV (entering service)
MRBM • Nuclear ε8 *Agni* II
SRBM • Nuclear 54: ε12 *Agni* I; ε42 SS-250 *Prithvi* II; some SS-350 *Dhanush* (naval testbed)

SUBMARINES • STRATEGIC • SSBN 1 *Arihant* with 4 1-cell VLS with K-15 *Sagarika* SLBM, 6 533mm TT

AIR-LAUNCHED MISSILES • ALCM • Nuclear *Nirbhay* (likely nuclear capable; in development)
Some Indian Air Force assets (such as *Mirage* 2000H or Su- 30MKI) may be tasked with a strategic role

.

Source: Adapted from IISS, *Military Balance, 2023*, "India"

India: Bulletin of Atomic Scientists 2021-2022 - I

Type/designation	No. of launchers	Year deployed	Range (km)[a]	Warheads x yield[b]	No. of warheads
Aircraft	48[c]				48
Mirage 2000 H	32	1985	1,850	1 x 12 kt bomb	–
Jaguar IS	16	1981	1,600	1 x 12 kt bomb	–
Rafale	(32)	2022	2,000	[1 x 12 kt bomb][d]	–
Land-based missiles	64				64[e]
Prithvi-II	24	2003	250[f]	1 x 12 kt	24
Agni-I	16	2007[g]	700+	1 x 10–40 kt	16
Agni-P	–	(2025)	1,000–2,000	1 x 10–40 kt[h]	–
Agni-II	16	2011[i]	2,000+	1 x 10–40 kt	16
Agni-III	8	2018	3,200+	1 x 10–40 kt	8
Agni-IV	–	(2023)	3,500+	1 x 10–40 kt	–
Agni-V	–	(2023)	5,000+	1 x 10–40 kt	–
Agni-VI	–	(2026)	6,000+	1 x 10–40 kt	–
Sea-based missiles	3/14[j]				16
Dhanush	2	2013	400	1 x 12 kt	4[k]
K-15 (B-05)	1/12[l]	2018	700	1 x 12 kt	12
K-4	–	(2025)	3,500	1 x 10–40 kt	–
Total stockpile	128				128
Other stored warheads					32[m]
Total inventory					160

Excerpted from Hans M. Kristensen, Matt Korda, "Nuclear Notebook: How many nuclear weapons does India have in 2022?," *Bulletin of Atomic Scientists* , July 11, 2022, https://thebulletin.org/premium/2022-07/nuclear-notebook-how-many-nuclear-weapons-does-india-have-in-2022/.

India: Bulletin of Atomic Scientists 2021-2022 - II

[a]Range listed is unrefueled combat range with drop tanks, and is intended for illustrative purposes. Actual combat range will vary depending on flight profile, payload, and other circumstances.

[b]The yields of India's nuclear warheads are not known. The 1998 nuclear tests demonstrated yields of up to 12 kt. Since then, it is possible that boosted warheads have been introduced with a higher yield, perhaps up to 40 kt. There is no open-source evidence suggesting that India has developed two-stage thermonuclear warheads.

[c]Aircraft listed in this table are only those estimated to hold nuclear strike roles in the Indian Air Force. Indian Air Force squadrons typically include 18 aircraft per squadron; however, we estimate that not all of the available aircraft will necessarily be fully operational or assigned a nuclear strike role.

[d]The Rafale is used for the nuclear mission in the French Air Force, and India could potentially convert it to serve a similar role in the Indian Air Force, with an eye towards taking over the air-based nuclear strike role in the future. However, as of May 2022 there has been no official confirmation that the Rafale will be used for the nuclear strike role with the Indian Air Force.

[e]The missile and warhead inventory may be larger than the number of launchers, some of which can be reused to fire additional missiles. This table assumes an average of one warhead for each launcher.

[f]The US Air Force's National Air and Space Intelligence Center (NASIC) has estimated the range of the Prithvi-II as 250 kilometers (155 miles) but we assume the range has probably been increased to about 350 kilometers (217 miles) as stated by the Indian government.

[g]Agni-I first began induction with the 334th Missile Group in 2004 but did not become operational until 2007.

[h]The Agni-P test-launch in 2021 was rumored to carry two decoy warheads to simulate a MIRV payload; however, if true then this reflects a largely aspirational capability; India would still be many years away from equipping its ballistic missiles with MIRVs. Once the Agni-P becomes operational, it will likely take over the nuclear strike mission from India's Prithvi-II and Agni-I SRBMs, each of which can carry one warhead.

[i]Agni-II first began induction with the 335th Missile Group in 2008 but did not become operational until 2011.

[j]The first figure is the number of operational vessels – two ships and one nuclear-powered ballistic missile submarine (SSBN); the second is the maximum number of missiles that they can carry. India has launched three SSBNs, but only one – INS *Arihant* – was believed to be operational as of May 2022, and was believed to probably have only a limited operational capability.

[k]Each Sukanya-class patrol ship equipped with Dhanush missiles was thought to have possibly one reload. The effectiveness of these vessels in combat nuclear strike roles is highly questionable given their slow speed and relative vulnerability, and they will likely be retired once India's SSBN program matures.

[l]Each of India's first two SSBNs has four missile tubes, each of which can carry three K-15 submarine-launched ballistic missiles (SLBMs), for a total of 12 missiles per SSBN. India's subsequent SSBNs will likely have eight missile tubes. As of May 2022, we estimate that only one SSBN––the INS *Arihant*––is operational with the Indian Navy, although the INS *Arighat* will likely be operational within the next year.

[m]In addition to the 128 warheads estimated to be assigned to fielded launchers, approximately 32 warheads for K-15 SLBMs on the second SSBN, additional Agni-III MRBMs, and future Agni-IV MRBMs and Agni-V IRBMs are thought to have been produced or be in production for an estimated total stockpile of 160 warheads.

Excerpted from Hans M. Kristensen, Matt Korda, "Nuclear Notebook: How many nuclear weapons does India have in 2022?," *Bulletin of Atomic Scientists* , July 11, 2022, https://thebulletin.org/premium/2022-07/nuclear-notebook-how-many-nuclear-weapons-does-india-have-in-2022/.

SIPRI Estimate of Indian Nuclear Forces in 2022

All figures are approximate and some are based on assessments by the authors.

Type/designation	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield[b]	No. of warheads[c]
Aircraft[d]	*48*				*48*
Mirage 2000H	32	1985	1 850	1 x 12 kt bomb	32
Jaguar IS	16	1981	1 600	1 x 12 kt bomb	16
Rafale	–	[2022]	2 000	–	–
Land-based missiles	*64*				*64*
Prithvi-II	24	2003	250[e]	1 x 12 kt	24
Agni-I	16	2007	>700	1 x 10–40 kt	16
Agni-II	16	2011	>2 000	1 x 10–40 kt	16
Agni-III	8	2018	>3 200	1 x 10–40 kt	8
Agni-IV	–	[2022]	>3 500	1 x 10–40 kt	–
Agni-V	–	[2022]	>5 000	1 x 10–40 kt	–
Agni-VI	–	[2025]	>6 000	1 x 10–40 kt	–
Agni-P	–	[2025]	1 000–2 000	[2 x 10–40 kt MIRV]	–
Sea-based missiles	*3/14*[f]				*16*
Dhanush	2	2013	400	1 x 12 kt	4[g]
K-15 (B-05)[h]	12[i]	2018	700	1 x 12 kt	12
K-4	–[j]	[2025]	3 500	1 x 10–40 kt	–
Other stored warheads[k]					*32*
Total stockpile	**126**				**160**[k]

– = nil or a negligible value; [ ] = uncertain SIPRI estimate; kt = kiloton; MIRV = multiple independently targetable re-entry vehicle.

Note: see original source for detailed explanation of estimates and uncertainties.

Source: Hans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 391-397*, https://www.sipri.org/yearbook/2022/10

India: Nuclear Weapons: House of Commons Library – I: 2022

India has a no first use policy at the center of its nuclear doctrine. In 2003 the Indian Government announced it would not use nuclear weapons against states that do not possess such capability, although it reserves the right to use nuclear weapons in response to any weapons of mass destruction (WMD)attack, including a biological or chemical weapons attack..

In the last few years, doubts about India's commitment to a no first use policy have been expressed….In August 2019 Defense Minister, Rajnath Singh, reportedly suggested that "India's adherence to the principle of 'no first use' of nuclear weapons is not sacrosanct". In April 2019 Indian Prime Minister, Narendra Modi, caused further controversy after reportedly suggesting during a campaign rally that the Indian nuclear arsenal "was there to be used"…In March 2020, however, the Government confirmed that there has been no change in India's nuclear doctrine and that it is committed to maintaining credible minimum deterrence and a policy of no first use.

SIPRI currently estimates India to have a growing arsenal of 160 warheads, compared to 120 in 2016…There is some debate as to how many of those warheads are fully assembled, and how many are fully operational. Indian Government sources also claim the country has developed a range of fission warheads and more powerful, two-stage thermonuclear devices, although some observers have expressed doubts about the reliability of the latter claim.

In its most recent assessment, the International Panel on Fissile Materials estimated that India holds approximately 0.7 metric tons of military grade plutonium and 5 metric tons of highly enriched uranium (HEU). The latter is used for naval reactor fuel in India's nuclear submarine programme.18 The Nuclear Threat Initiative estimates that the Dhruva reactor is capable of producing 20-25kg of plutonium each year, the equivalent of 4-6 warheads…In 2017 the Indian Department of Atomic Energy also proposed plans to build six civilian fast breeder reactors, at three sites, by 2039. This would significantly increase India's capacity to produce civilian plutonium, which could be diverted for weapons purposes… India is also building a dual-use uranium enrichment facility at Challakere which would produce HEU for both military and civilian purposes.

India relies primarily upon its Mirage 2000H and Jaguar combat aircraft, equipped with nuclear-armed free-fall bombs, for the delivery of its nuclear capability. 48 nuclear bombs are estimated to be assigned to these aircraft. The Indian Air Force recently began a service-life extension program for the Mirage 2000H which will keep it in service until the 2040s.

India also has an extensive ballistic missile program, comprising an estimated 64 launchers. To date that inventory is limited to single warhead, short, medium and intermediate-range missiles (the Prithvi II, and the Agni-I, II and III). With a range of approximately 3,000-3,500km, the Agni III provides India with the ability to strike targets as far off as Shanghai.

The Indian Navy launched its first indigenous Arihant-class nuclear-powered ballistic missile submarine in 2014. The submarine completed its sea trials in early 2016 and was reported to have been commissioned into service later that year. It will initially be equipped with 12 K-15 short-range SLBM, although the longer-term aim is to additionally equip the SSBN with K-4 ballistic missiles with a range of up to 3,500km. The latter would put Pakistan and most of China within range if launched from the northern Indian Ocean. The K-4 is still undergoing testing and it is unclear when it will be ready for deployment.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: India and Pakistan*, House of Commons Library, July 29, 2022, https://commonslibrary.parliament.uk/research-briefings/cbp-9070/.

India: Nuclear Weapons: House of Commons Library – II: 2022

A second SSBN, the INS Arighat, was launched in November 2017 and is currently undertaking advanced sea trials. India also operates a ship launched nuclear-capable, short-range ballistic missile: the Dhanush. It is a ship-based variant of the Privthi-II, although its utility has been questioned since its range would mean that it could only be launched from very near to the Chinese or Pakistani coast in order to target facilities in either of those countries. Kristensen and Korda consider that it could be retired from service once India's SSBN program reaches maturity.

India has been developing additional ballistic missiles, including a new medium range Agni-P and the intermediate-range Agni-IV, which has a range in excess of 3,500km. Both missiles have been undergoing testing but are not yet operational…The Agni-P, with its advanced navigation and maneuverability allowing it to evade regional missile defenses, is expected to replace the Agni-I and potentially the Privthi II and Agni-II once it becomes operational. Once the Agni-IV is deployed, if launched from northeast India it will be capable of striking targets across almost all of China, including Beijing.

India's first intercontinental ballistic missile (the Agni-V), which is reported to be road and rail-mobile and has a reported range of over 5,000km, is also in development. The extra range would allow it to be deployed from central and southern India, away from the Chinese border. Its first user trial took place in October 2021,26 leading experts to conclude that it could enter service in2022/23…In 2013 the Indian Government suggested that the Agni-V would be deployed with multiple, independently targetable, re-entry vehicle (MIRV) capability…A second ICBM, the Agni-VI, with a range in excess of 6,000km, is also in the early design stages of development.

A further two SSBN of the Arihant class are expected over the next few years in line with the expansion of HEU production for India's naval propulsion program. A third submarine was reportedly launched in 2021, with a fourth scheduled for 2023.31 Both are expected to be larger than the first two vessels of class, capable of deploying with 24 K-15 missiles, compared to the current12 aboard the Arihant….A base for the SSBN is also believed to be under construction on India's east coast. Development has also reportedly started on two longer range SLBM: the K-5 and K-6 and a next generation SSBN: the S-5 class.

While India relies primarily on the air force for its nuclear mission at present, its original combat aircraft are ageing. In 2016 India and France agreed the sale of 36 Rafale aircraft to the Indian Air Force. Delivery of the aircraft is expected to be complete in 2022. The Rafale is already used in a nuclear role in the French air force and therefore conversion to a similar role within the Indian Air Force is widely expected. India's first intermediate-range land-attack cruise missile (the Nirbhay), which could be deployable from land, sea and air, is also understood to be in development. India tested the missile several times in 2013 and 2014, although the success of those tests was questionable. It is currently unclear whether the missile is nuclear-capable

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: India and Pakistan*, House of Commons Library, July 29, 2022, https://commonslibrary.parliament.uk/research-briefings/cbp-9070/.

Wikipedia Estimate of India's Nuclear Forces in 2023 – I

(See Original source for wide range of data on uncertainties in estimates of national weapons and delivery system developments)

Although India has not released any official statements about the size of its nuclear arsenal, recent estimates suggest that India has 160 nuclear weapons[1] and has produced enough weapons-grade plutonium for up to 200 nuclear weapons.[9] In 1999, India was estimated to have 800 kilograms (1,800 lb.) of separated reactor-grade plutonium, with a total amount of 8,300 kilograms (18,300 lb.) of civilian plutonium, enough for approximately 1,000 nuclear weapons.[10][11] India has conducted nuclear weapons tests in a pair of series namely *Pokhran I* and *Pokhran II*.[12]

India is a member of three multilateral export control regimes — the Missile Technology Control Regime, Wassenaar Arrangement and Australia Group. It has signed and ratified the Biological Weapons Convention and the Chemical Weapons Convention. India is also a subscribing state to the Hague Code of Conduct. India has signed neither the Comprehensive Nuclear-Test-Ban Treaty nor the Nuclear Non-Proliferation Treaty, considering both to be flawed and discriminatory.[13] India previously possessed chemical weapons, but voluntarily destroyed its entire stockpile in 2009 — one of the seven countries to meet the OPCW extended deadline.[14]

India maintains a "no first use" nuclear policy and has developed a nuclear triad capability as a part of its "Minimum Credible Deterrence" doctrine.[

Neutron bombs

R Chidambaram, who headed India's Pokhran-II nuclear tests, said in a 1999 interview with the Press Trust of India that India is capable of producing a neutron bomb.[36]

India's no-first-use policy

India has a declared nuclear no-first-use policy and is in the process of developing a nuclear doctrine based on "credible minimum deterrence." In August 1999, the Indian government released a draft of the doctrine[37] which asserts that nuclear weapons are solely for deterrence and that India will pursue a policy of "retaliation only". The document also maintains that India "will not be the first to initiate a nuclear first strike, but will respond with punitive retaliation should deterrence fail" and that decisions to authorize the use of nuclear weapons would be made by the Prime Minister or his 'designated successor(s)'.[37] According to the NRDC, despite the escalation of tensions between India and Pakistan in 2001–2002, India remained committed to its nuclear no-first-use policy.

India's Strategic Nuclear Command was formally established in 2003, with an Indian Air Force officer, Air Marshal Tej Mohan Asthana, as the Commander-in-Chief. The joint services SNC is the custodian of all of India's nuclear weapons, missiles and assets. It is also responsible for executing all aspects of India's nuclear policy. However, the civil leadership, in the form of the CCS (Cabinet Committee on Security) is the only body authorized to order a nuclear strike against another offending strike. The National Security Advisor Shivshankar Menon reiterated a policy of "no first use" against nuclear weapon states and "non use against non-nuclear weapon states" in a speech on the occasion of Golden Jubilee celebrations of National Defense College in New Delhi on 21 October 2010, a doctrine Menon said reflected India's "strategic culture, with its emphasis on minimal deterrence.[38][39] In April 2013 Shyam Saran, convener of the National Security Advisory Board, affirmed that regardless of the size of a nuclear attack against India, be it a miniaturized version or a "big" missile, India will retaliate massively to inflict unacceptable damage.[40]

Source: Excerpted from "*India and weapons of mass destruction.*" WIKIPEDIA, https://en.wikipedia.org/wiki/India_and_weapons_of_mass_destruction, accessed 19.4.23

Wikipedia Estimate of India's Nuclear Forces in 2023 - II

Air-launched nuclear weapons [edit]

Nuclear-armed fighter-bombers were India's first and only nuclear-capable strike force until 2003, when the country's first land-based nuclear ballistic missiles were fielded.[45]

In addition to their ground-attack role, it is believed that the Dassault Mirage 2000s and SEPECAT Jaguars of the Indian Air Force are able to provide a secondary nuclear-strike role.[46] The SEPECAT Jaguar was designed to be able to carry and deploy nuclear weapons and the Indian Air Force has identified the jet as being capable of delivering Indian nuclear weapons.[47] The most likely delivery method would be the use of bombs that are free-falling and unguided.[48]

Three airbases with four squadrons of Mirage 2000H (about 16 aircraft with 16 bombs from 1st and 7th squadrons of the 40th Wing at Maharajpur Air Force Station) and Jaguar IS/IB (about 32 aircraft with 32 bombs from one squadron each at Ambala Air Force Station and Gorakhpur Air Force Station) aircraft, are believed to be assigned the nuclear strike role.[45]

Land-based ballistic missiles [edit]

The estimated 68 nuclear warheads[45] of land-based nuclear weapons of India are under the control of and deployed by the Strategic Forces Command,[49] using a variety of both vehicles and launching silos. They currently consist of six different types of ballistic missiles, the Agni-I, the Agni-II, Agni-III, Agni-IV, Agni-V, Agni-P and the Army's variant of the Prithvi missile family – the Prithvi-I. However, the Prithvi missiles are less useful for delivering nuclear weapons because they have a shorter range and must be deployed very close to the India–Pakistan border.[26] Additional variants of the Agni missile series have recently been inducted including the most recent, the Agni-IV[50] and the Agni-V, which is currently being deployed.[51] Agni-VI is also under development, with an estimated range of 8,000–12,000 km and features such as Multiple independently targetable reentry vehicles (MIRVs) or Maneuverable reentry vehicles (MARVs).[52][53]

Land-based ballistic missiles

Name	Type	Range (km)	Status
Prithvi-I	Short-range ballistic missile	150	Deployed
Prithvi-II	Short-range ballistic missile	250–350	
Prithvi-III	Short-range ballistic missile	350–600	
Agni-I	Medium-range ballistic missile	700	
Shaurya	Medium-range ballistic missile	700-1900	
Agni-P	Medium-range ballistic missile	1,000–2,000	
Agni-II	Medium-range ballistic missile	2,000–3,000	
Agni-III	Intermediate-range ballistic missile	3,500–5,000	
Agni-IV	Intermediate-range ballistic missile	4000	
Agni-V	Intercontinental ballistic missile	5,000–8,000	
Agni-VI	Intercontinental ballistic missile & MIRV capable	8,000–12,000	Under development

Source: Excerpted from "*India and weapons of mass destruction*." WIKIPEDIA, https://en.wikipedia.org/wiki/India_and_weapons_of_mass_destruction, accessed 19.4.23
"

Wikipedia Estimate of India's Nuclear Forces in 2023 - III

Sea-based ballistic missiles [edit]

The Indian Navy has developed two sea-based delivery systems for nuclear weapons, completing Indian ambitions for a nuclear triad, which may have been deployed in 2015.[54][55]

The first is a submarine-launched system consisting of at least four 6,000 tonne (nuclear-powered) ballistic missile submarines of the *Arihant* class. The first vessel, INS *Arihant*, was commissioned in August 2016. She is the first nuclear-powered submarine to be built by India.[56][57] A CIA report claimed that Russia provided technological aid to the naval nuclear propulsion program.[58][59] The submarines will be armed with up to 12 Sagarika (K-15) missiles armed with nuclear warheads. Sagarika is a submarine-launched ballistic missile with a range of 700 km. This missile has a length of 8.5 meters, weighs seven tonnes and can carry a pay load of up to 500 kg.[60] Sagarika has already been test-fired from an underwater pontoon, but now DRDO is planning a full-fledged test of the missile from a submarine and for this purpose may use the services of the Russian Navy.[61] India's DRDO is also working on a submarine-launched ballistic missile version of the Agni-III missile, known as the Agni-III SL. According to Indian defence sources, the Agni-III SL will have a range of 3,500 kilometres (2,200 mi).[62] The new missile will complement the older and less capable Sagarika submarine-launched ballistic missiles. However, the *Arihant* class ballistic missile submarines will be only capable of carrying a maximum of four Agni-III SL.

The second is a ship-launched system based around the short range ship-launched Dhanush ballistic missile (a variant of the Prithvi missile). It has a range of around 300 km. In the year 2000 the missile was test-fired from INS *Subhadra* (a *Sukanya* class patrol craft). INS *Subhadra* was modified for the test and the missile was launched from the reinforced helicopter deck. The results were considered partially successful.[63] In 2004, the missile was again tested from INS *Subhadra* and this time the results were reported successful.[64] In December 2005 the missile was tested again, but this time from the destroyer INS *Rajput*. The test was a success with the missile hitting the land based target.[65]

Sea-based ballistic missiles

Name	Type	Range (km)	Status
Dhanush	Short-range ballistic missile	350	Operational[66]
Sagarika (K-15)	Submarine-launched ballistic missile	700	Operational
K-4	Submarine-launched ballistic missile	3,500	Tested[67]
K-5	Submarine-launched ballistic missile	5,000	Under Development[68]
K-6	Submarine-launched ballistic missile	6,000	Under Development[69]

Source: Excerpted from "*India and weapons of mass destruction*." WIKIPEDIA, https://en.wikipedia.org/wiki/India_and_weapons_of_mass_destruction, accessed 19.4.23
"

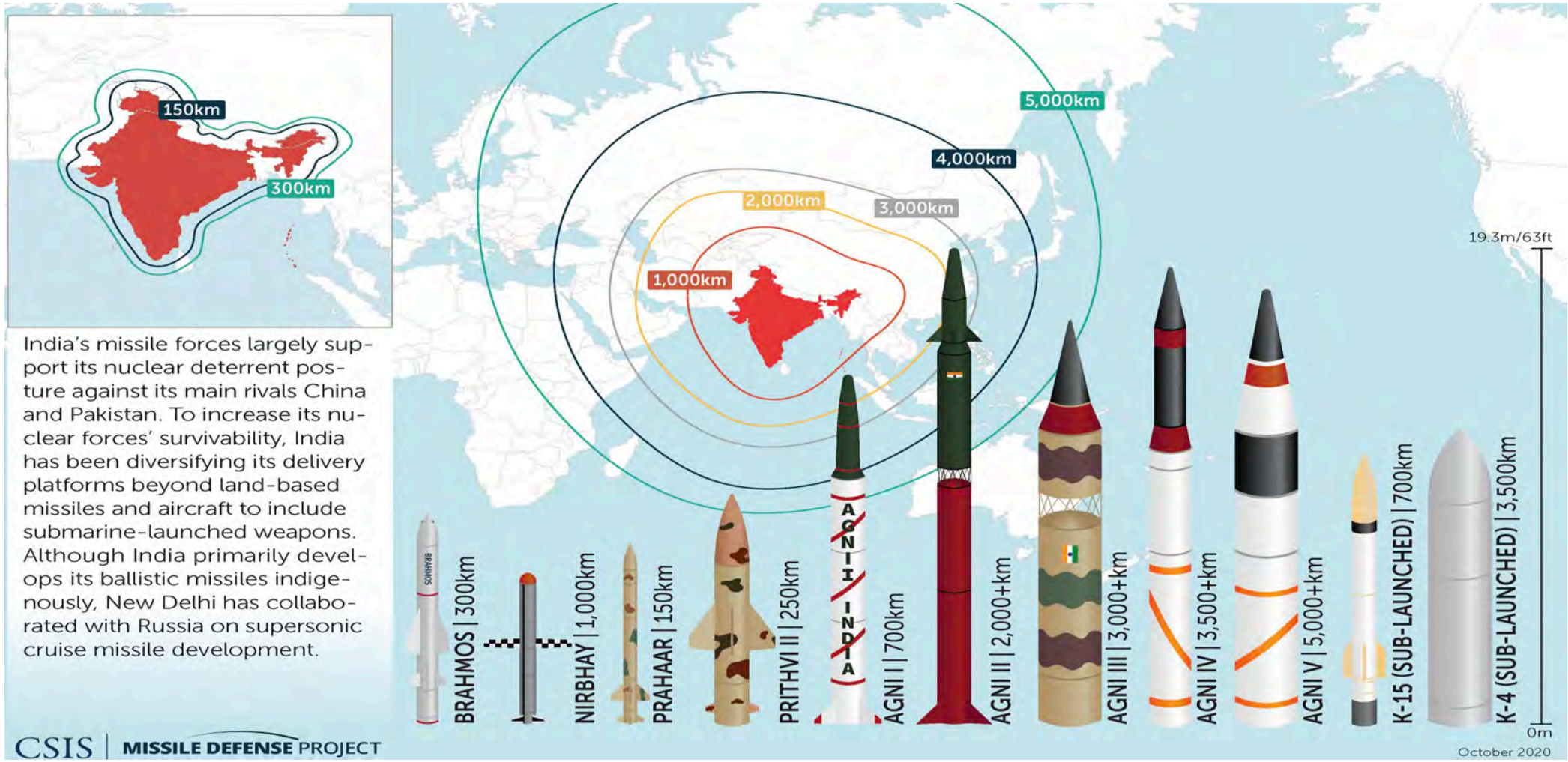
India: Operational, In Development, and & Obsolete Missile Forces*

Missile Name	Class	Range	Status
Agni-I	SRBM	700 - 1,200 km	Operational
Agni-II	MRBM	2,000 - 3,500 km	Operational
Agni-III	IRBM	3,000 - 5,000 km	Operational
Agni-IV	IRBM	3,500 - 4,000 km	In development
Agni-V	ICBM	5,000 - 8,000 km	In development
BrahMos	Cruise Missile	300 - 500 km	Operational
Dhanush	SRBM	250 - 400 km	Operational
Exocet	ASCM	40 - 180 km	Operational
Nirbhay	Cruise Missile	800 - 1,000 km	In development
Prahaar	SRBM	150 km	In development
Prithvi-I	SRBM	150 km	Obsolete
Prithvi-II	SRBM	350 km	Operational
Sagarika/Shaurya	SLBM	700 km / 3,500 km	In development

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential level of dual-capability

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

India: Ballistic and Cruise Missile Forces*



* All missiles listed in source, not just currently nuclear-armed. Illustrates potential level of dual-capability.

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

Pakistani Nuclear Forces

IISS Estimate of Pakistan's Nuclear Forces in 2023

Strategic Forces
Operational control rests with the National Command Authority. The Strategic Plans Directorate (SPD) manages and commands all of Pakistan's military nuclear capability. The SPD also commands a reportedly 25,000-strong military security force responsible for guarding the country's nuclear infrastructure

Army Strategic Forces Command 12,000– 15,000
Commands all land-based strategic nuclear forces **EQUIPMENT BY TYPE**

SURFACE-TO-SURFACE MISSILE LAUNCHERS

60+ **MRBM • Nuclear** 30+: ε30 *Ghauri/Ghauri* II (*Hatf*-V)/ *Shaheen*-II (*Hatf*-VI); *Shaheen*-III (in test)

SRBM • Nuclear 30+: ε30 *Ghaznavi* (*Hatf*-III – PRC M-11)/*Shaheen*-I (*Hatf*-IV); some *Abdali* (*Hatf*-II); some *Nasr* (*Hatf*-IX)

GLCM • Nuclear *Babur*-I/IA (*Hatf*-VII); *Ra'ad* (*Hatf*- VIII – in test)

Air Force
- 1–2 sqn of F-16A/B or *Mirage* 5 may be assigned a nuclear-strike role

Source: Adapted from IISS, *Military Balance, 2023*, "Pakistan"

Pakistan: Bulletin of Atomic Scientists 2021-2022 - I

Type	NATO designation	Number of launchers	Year deployed	Range[1] (kilometers)	Warhead x yield (kilotons)[3]	Number of warheads[2]
Aircraft[4]						
Mirage III/V		~36	1998	2,100	1 x 5-12 kt bomb (or Ra-ad)	~36
Subtotal:		***~36***				***~36***
Land-based ballistic missiles						
Abdali (Hatf-2)		10	2015	200	1 x 5-12 kt	10
Ghaznavi (Hatf-3)		~16	2004	300	1 x 5-12 kt	~16
Shaheen-1 (Hatf-4)		~16	2003	750	1 x 5-12 kt	~16
Shaheen-1A (Hatf-4)		-	(2022)	900	1 x 5-12 kt	-
Shaheen-2 (Hatf-6)		~16	2014	1,500	1 x 10-40 kt	~16
Shaheen-3 (Hatf-6)		-	(2022)	2,750	1 x 10-40 kt	-
Ghauri (Hatf-5)		~24	2003	1,250	1 x 10-40 kt	~24
NASR (Hatf-9)		~24	2013	60-70	1 x 12 kt	~24[5]
Ababeel (Hatf-?)		-	-	2,200	MIRV/MRV?	-
Subtotal:		***~106***				***~106***
Ground and air-launched cruise missiles						
Babur GLCM (Hatf-7)		~12	2014	350[6]	1 x 5-12 kt	~12
Babur-2/1(B) GLCM (Hatf-?)		-	-[7]	700	1 x 5-12 kt	-
Ra'ad ALCM (Hatf-8)		-	-	350	1 x 5-12 kt	-
Ra'ad-2 ALCM (Hatf-?)		-	(2022)	>350	1 x 5-12kt	-
Subtotal:		***~12***				***~12***
Sea-based cruise missiles						
Babur-3 SLCM (Hatf-?)		-	-[8]	450	1 x 5-12 kt	-
Total		**154**				**~165[9]**

Excerpted from Hans M. Kristensen, Matt Korda, ***Nuclear Notebook: How many nuclear weapons does Pakistan have in 2021?*** , September 7,, 2022, https://thebulletin.org/premium/2021-09/nuclear-notebook-how-many-nuclear-weapons-does-pakistan-have-in-2021/

Pakistan: Bulletin of Atomic Scientists 2021-2022 - II

We estimate that Pakistan now has a nuclear weapons stockpile of approximately 165 warheads (See Table 1). The US Defense Intelligence Agency projected in 1999 that Pakistan would have 60 to 80 warheads by 2020 (US Defense Intelligence Agency 1999, 38), but several new weapon systems have been fielded and developed since then, which leads us to the higher estimate.

With several new delivery systems in development, four plutonium production reactors, and an expanding uranium enrichment infrastructure, however, Pakistan's stockpile has the potential to increase further over the next 10 years. The size of this projected increase will depend on several factors, including how many nuclear-capable launchers Pakistan plans to deploy, how its nuclear strategy evolves, and how much the Indian nuclear arsenal grows. Speculation that Pakistan may become the world's third-largest nuclear weapon state—with a stockpile of some 350 warheads a decade from now—are, we believe, exaggerated, not least because that would require a buildup two to three times faster than the growth rate over the past two decades.

…We estimate that the country's stockpile could more realistically grow to around 200 warheads by 2025, if the current trend continues. But unless India significantly expands its arsenal or further builds up its conventional forces, it seems reasonable to expect that Pakistan's nuclear arsenal will not continue to grow indefinitely but might begin to level off as its current weapons programs are completed.

Analyzing Pakistan's nuclear forces is fraught with uncertainty, given that the Pakistani government has never publicly disclosed the size of its arsenal and media sources frequently embellish news stories about nuclear weapons. Therefore, the estimates made in the Nuclear Notebook are based on analysis of Pakistan's nuclear posture, observations via commercial satellite imagery, previous statements by Western officials, and private conversations with officials.

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Excerpted from Hans M. Kristensen, Matt Korda, **"Nuclear Notebook: How many nuclear weapons does Pakistan have in 2021?**," *Bulletin of Atomic Scientists* , September 7,, 2022, https://thebulletin.org/premium/2021-09/nuclear-notebook-how-many-nuclear-weapons-does-pakistan-have-in-2021/

SIPRI Estimate of Pakistani Nuclear Forces in 2022

All figures are approximate and some are based on assessments by the authors.

Type/designation	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield[b]	No. of warheads[c]
Aircraft[d]	*36*				*36*
Mirage III/V	36[e]	1998	2 100	1 x 5–12 kt bomb or Ra'ad ALCM (in development)[f]	36
Land-based missiles	*118*[g]				*118*
Abdali (Hatf-2)	10	2015	200	1 x 5–12 kt	10
Ghaznavi (Hatf-3)	16	2004	300	1 x 5–12 kt	16
Shaheen-I (Hatf-4)	16	2003	750	1 x 5–12 kt	16
Shaheen-IA[h]	–	..	900	1 x 5–12 kt	–
Shaheen-II (Hatf-6)	16	2014	2 000	1 x 10–40 kt	16
Shaheen-III[i]	–	[2023]	2 750	1 x 10–40 kt	–
Ghauri (Hatf-5)	24	2003	1 250	1 x 10–40 kt	24
Nasr (Hatf-9)	24	2013	70	1 x 5–12 kt	24
Ababeel	–	..	2 200	MRV or MIRV[j]	–
Babur/-1A GLCM (Hatf-7)[k]	12	2014/[early 2020s]	350/ 450	1 x 5–12 kt	12
Babur-2 GLCM[l]	–	..	900	1 x 5–12 kt	–
Sea-based missiles					
Babur-3 SLCM	–	[2025]	450	1 x 5–12 kt	–
Other stored warheads[m]					*11*
Total stockpile	**154**				**165**[m]

Note: see original source for detailed explanation of estimates and uncertainties.

Source: **H**ans M. Kristensen and Matt Korda, "10. World Nuclear Forces**,"** *SIPRI Yearbook 2022, pp 398-403*, https://www.sipri.org/yearbook/2022/10

Pakistan: Congressional Research Service: 2016

According to public estimates, Pakistan has about 110-130 nuclear weapons, although it could have more.45 Dr. Samar Mubarakmand, a scientist closely involved with the country's nuclear weapons program, stated in a 2016 interview that only China, France, Russia, and the United States have more nuclear weapons than Pakistan.

…Islamabad continues to produce both HEU and plutonium for nuclear weapons and is developing and deploying a variety of weapons. A 2014 press report citing Dr. Mubarakmand states that "Pakistan has over 15 types of nuclear weapons, from large weapons that can be carried on fighter jets to small ones that can be loaded onto ballistic missiles, and even smaller warheads for cruise missiles and tactical nuclear weapons."… Pakistan's HEU-based nuclear warheads use an implosion design with a solid core of approximately 15-20 kilograms of HEU…Pakistan has also produced plutonium-based warheads,… which likely contain approximately 4-6 kilograms of plutonium, according to one expert estimate…. Pakistan has reportedly addressed issues of survivability through pursuing a second-strike capability, possibly building hard and deeply buried storage and launch facilities, deploying road-mobile missiles, deploying air defenses around strategic sites, and utilizing concealment measures.

…Pakistan has "aircraft and land-based missiles capable of delivering nuclear weapons," according to a 2013 State Department report. Pakistan has two types of delivery vehicles for nuclear weapons: aircraft controlled by the Pakistan Air Force and surface-to-surface missiles controlled by the Pakistan Army…. Pakistan is developing what the Director of the Defense Intelligence Agency described in February 2015 as "close-range 'battlefield' nuclear weapons to augment its existing ballistic missiles.

…The United Kingdom's Foreign and Commonwealth Office has argued that "Pakistan's strategic posture, including nuclear, is clearly framed around its perception of the threat from India."83 Similarly, then-DIA Director Burgess told the Senate Armed Services Committee on March 10, 2011, that the "persistent India-Pakistan rivalry drives Islamabad to develop its nuclear infrastructure, expand nuclear weapon stockpiles ... and seek more advanced nuclear warheads and delivery systems, including cruise missiles."84 Pakistan has repeatedly described its strategic doctrine as "credible minimum deterrence."85 Islamabad has pledged no-first-use against non- nuclear-weapon states, but has not ruled out first-use against a nuclear-armed aggressor, such as India

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Excerpted from Paul K. Kerr and Mary Beth Nitikin,, *Pakistan's Nuclear Weapons*, Congressional Research Service, RL34248, August 1, 2016,,

Pakistan: Nuclear Weapons: House of Commons Library – I: 2022

Pakistan's nuclear program began in the early 1970s, following the 1971 war with India that led to East Pakistan becoming Bangladesh. It was spurred on by India's first nuclear test in 1974, although it was not until the late 1980s that the US concluded that Pakistan had acquired the capability to build a primitive nuclear device…US officials believe the Pakistani nuclear program originally received material and technical assistance from China, although key information on uranium enrichment was also illegally obtained during the mid-1970s by Abdul Qadeer Khan, a Pakistani scientist who became a leading figure in. Pakistan's illicit nuclear weapons establishment… In line with India, Pakistan conducted a series of publicized nuclear tests in May 1998 which established its status as a self-declared nuclear weapon state.

…In 2013,Pakistan's National Command Authority declared that it "would not remain oblivious to the evolving security dynamics in South Asia and would maintain a full spectrum deterrence capability to deter all forms of aggression"…Pakistan has pledged to retain a general position of "no first use" against non-nuclear weapon states. However, it retains a position of first use against a nuclear-armed aggressor, such as India. In July 2016, the Pakistani Defense Minister also suggested that it would use nuclear weapons for defensive purposes in any armed conflict with India.

Like India, the Pakistani Government occasionally makes statements about missile tests, but it is not transparent about the size and status of its nuclear stockpile. SIPRI estimates Pakistan's nuclear weapons inventory to be approximately 165 nuclear warheads. In 2016 Pakistan had 130 warheads.

Pakistan has finished constructing a fourth heavy water reactor at its plutonium production complex at Khushab and is expanding uranium enrichment facilities at Kahuta and Gadwal, near to Islamabad. In anticipation of increased capacity, Pakistan has also been expanding its reprocessing capabilities.

The International Panel on Fissile Materials estimates Pakistan's current stockpile of HEU to be in the region of 4 metric tons; while its stockpile of plutonium for weapons purposes is 0.5 metric tons. On the basis of current annual fissile material production rates, warhead design choices and figures on the size of its overall inventory, Pakistan is thought to be producing 10-12 new nuclear warheads each year.

Pakistan's ability to deliver a nuclear weapon remains largely focused on its short to medium-range ballistic missile and cruise missile capabilities:

- The short-range Abdali, Ghaznavi, and Shaheen-I ballistic missiles.
- The medium-range Ghauri and Shaheen-II ballistic missiles.
- The ground launched Babur cruise missile which was deployed in 2014.
- The air launched Ra'ad cruise missile. An upgraded version of the Ra'ad, the Ra'ad-II, was displayed in 2017 and tested in February 2020. The missile is thought to have entered service, but the number of operational missiles is not known.

Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: India and Pakistan*, House of Commons Library, July 29, 2022, https://commonslibrary.parliament.uk/research-briefings/cbp-9070/.

Pakistan: Nuclear Weapons: House of Commons Library – II: 2022

Pakistan is also considered among some observers to have "dangerously lowered the threshold for nuclear weapons" by developing very short-range tactical nuclear weapon capabilities to counter India's conventional superiority on the battlefield and to deter the likelihood of any conventional attack by India…. The Nasr ballistic missile has a range of only 60km and is thought to have been deployed in 2014 after a series of successful tests. In 2015 one Pakistani military official said the Nasr missile was the result of "some people on the other side toying with the idea of finding space for conventional war, despite Pakistan's nuclear weapons"

… Investment in the Nasr missile program continues; while a new medium- range ballistic missile (the Shaheen 1-A) and a new road-mobile, intermediate range ballistic missile (the Shaheen-III) are under development. The Shaheen III was last tested in April 2022 and once it becomes operational, it will give Pakistan the ability to reach targets throughout India for the first time.50 A variant of the Shaheen-III, the Ababeel, which is possibly equipped with MIRV technology, is also under development. It was last successfully flight tested in 2017.

Speculation that Pakistan is developing an ICBM with a range of 7,000km, codenamed Taimur, continues. However, many analysts have refuted this, suggesting that it would be contrary to the regional focus of Pakistan's nuclear doctrine.

The Pakistani Air Force also has a nuclear role. In 2008 and 2011 its Mirage III combat aircraft was used for developmental test flights of the nuclear-capable Ra'ad air-launched cruise missile. Its Mirage V combat aircraft is also believed capable of deploying with nuclear gravity bombs. Pakistan's fleet of US purchased F-16 combat aircraft are thought, by some analysts, to have been modified to a dual-use role, thereby making them potentially nuclear capable. It is unclear, however, whether the F-16 has an official nuclear role.

In 2019 Pakistan was reportedly planning to purchase an additional 36 Mirage V aircraft from Egypt. In the longer term, the Mirage is expected to be replaced by the JF-17, which Pakistan is jointly developing with China. It is unclear whether the aircraft will be configured to carry the dual capable Ra'ad ALCM.

Pakistan is also thought to be seeking to complete the nuclear triad by developing submarine-launched capabilities. After India announced its Nuclear intention to develop an SSBN capability in 2009, Pakistan followed suit and in 2012 the Pakistani Navy established Headquarters Naval Strategic Forces, for the development and deployment of that sea-based strategic nuclear force. The Pakistani government said that it would provide the nation's "second strike capability" and would "strengthen Pakistan's policy of credible minimum deterrence and ensure regional stability"…The Pakistani Navy conducted the first test launch of a Babur-3 submarine- launched cruise missile in January 2017, and again in March 2018. The missile is intended to be deployed aboard Pakistan's three Agosta class submarines. Pakistan also has eight submarines (the Hangor class) on order from China, the first of which is expected to be delivered in 2022-23. It is possible that the Babur-3 may be deployed aboard, giving the submarines a nuclear role.

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Source: Excerpted from Claire Mills: *Nuclear Weapons at a Glance: India and Pakistan*, House of Commons Library, July 29, 2022, https://commonslibrary.parliament.uk/research-briefings/cbp-9070/.

Wikipedia Estimate of Pakistan's Nuclear Forces (Dated)- I

(See Original source for wide range of data on uncertainties in estimates of national weapons and delivery system developments)

Stockpile [edit]

Estimates of Pakistan's stockpile of nuclear warheads vary. The most recent analysis, published in the Bulletin of the Atomic Scientists in 2010, estimates that Pakistan has 70–90 nuclear warheads.[122] In 2001, the US-based Natural Resources Defense Council (NRDC) estimated that Pakistan had built 24–48 HEU-based nuclear warheads with HEU reserves for 30–52 additional warheads.[123][124] In 2003, the US Navy Center for Contemporary Conflict estimated that Pakistan possessed between 35 and 95 nuclear warheads, with a median of 60.[125] In 2003, the Carnegie Endowment for International Peace estimated a stockpile of approximately 50 weapons. By contrast, in 2000, US military and intelligence sources estimated that Pakistan's nuclear arsenal may be as large as 100 warheads.[126] In 2018, the Federation of American Scientists estimated that the arsenal was about 120-130 warheads.[127]

The actual size of Pakistan's nuclear stockpile is hard for experts to gauge owing to the extreme secrecy which surrounds the program in Pakistan. However, in 2007, retired Pakistan Army's Brigadier-General Feroz Khan, previously second in command at the Strategic Arms Division of Pakistans' Military told a Pakistani newspaper that Pakistan had "about 80 to 120 genuine warheads."[128][129]

Pakistan's first nuclear tests were made in May 1998, when six warheads were tested under codename Chagai-I and Chagai-II. It is reported that the yields from these tests were 12 kt, 30 to 36 kt and four low-yield (below 1 kt) tests. From these tests Pakistan can be estimated to have developed operational warheads of 20 to 25 kt and 150 kt in the shape of low weight compact designs and may have 300–500 kt[130] large-size warheads. The low-yield weapons are probably in nuclear bombs carried on fighter-bombers such as the Dassault Mirage III and fitted to Pakistan's short-range ballistic missiles, while the higher-yield warheads are probably fitted to the Shaheen series and Ghauri series ballistic missiles.[130]

Land [edit]

As of 2011, Pakistan possesses a wide variety of nuclear-capable medium range ballistic missiles with ranges up to 2750 km.[182] Pakistan also possesses nuclear-tipped Babur cruise missiles with ranges up to 700 km. In April 2012, Pakistan launched a Hatf-4 Shaheen-1A, said to be capable of carrying a nuclear warhead designed to evade missile-defense systems.[183] These land-based missiles are controlled by Army Strategic Forces Command of Pakistan Army.

Pakistan is also believed to be developing tactical nuclear weapons for use on the battlefield with ranges up to 60 km such as the Nasr missile. According to Jeffrey Lewis, director of the East Asia Non-proliferation Program at the Monterey Institute of International Studies, citing a Pakistani news article,[184] Pakistan is developing its own equivalent to the Davy Crockett launcher with a miniaturised warhead that may be similar to the W54.[185]

Source: Excerpted from "*Pakistan and weapons of mass destruction*." WIKIPEDIA, https://en.wikipedia.org/wiki/Pakistan_and_weapons_of_mass_destruction, accessed 19.4.23

Wikipedia Estimate of Pakistan's Nuclear Forces (Dated)- II

Sea [edit]

The Pakistan Navy was first publicly reported to be considering deployment of nuclear weapons on submarines in February 2001. Later in 2003 it was stated by Admiral Shahid Karimullah, then Chief of Naval Staff, that there were no plans for deploying nuclear weapons on submarines but if "*forced to*" they would be. In 2004, Pakistan Navy established the Naval Strategic Forces Command and made it responsible for countering and battling naval-based weapons of mass destruction. It is believed by most experts that Pakistan is developing a sea-based variant of the Hatf VII Babur, which is a nuclear-capable ground-launched cruise missile.[191]

On 9 January 2017, Pakistan conducted a successful launch of the Babur III missile from an underwater mobile platform. The Babur-III has a range of 450 km and can be used as a second-strike capability.[192][193][194][195] It has been speculated that the missile is ultimately designed to be incorporated with the Agosta 90B class submarine which has been reported to have been modified. However no such tests have been carried out yet.[196][197] On 29 March 2018, Pakistan reported that the missile had again been successfully tested.[198]

With a stockpile of plutonium, Pakistan would be able to produce a variety of miniature nuclear warheads which would allow it to nuclear-tip the C-802 and C-803 anti-ship missiles as well as being able to develop nuclear torpedoes, nuclear depth bombs and nuclear naval mines.[*citation needed*]

Nuclear submarine [edit]

In response to INS *Arihant*, India's first nuclear submarine, the Pakistan Navy pushed forward a proposal to build its own nuclear submarine as a direct response to the Indian nuclear submarine program.[199][200] Many military experts believe that Pakistan has the capability of building a nuclear submarine and is ready to build such a fleet.[199] In February 2012, the Navy announced it would start work on the construction of a nuclear submarine to better meet the Indian Navy's nuclear threat.[201] According to the Navy, the nuclear submarine is an ambitious project, and will be designed and built indigenously. However, the Navy stressed that "the project completion and trials would take anywhere from between 5 to 8 years to build the nuclear submarine after which Pakistan would join the list of countries that has a nuclear submarine."[199][201]

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Source: Excerpted from "*Pakistan and weapons of mass destruction*." WIKIPEDIA, https://en.wikipedia.org/wiki/Pakistan_and_weapons_of_mass_destruction, accessed 19.4.23

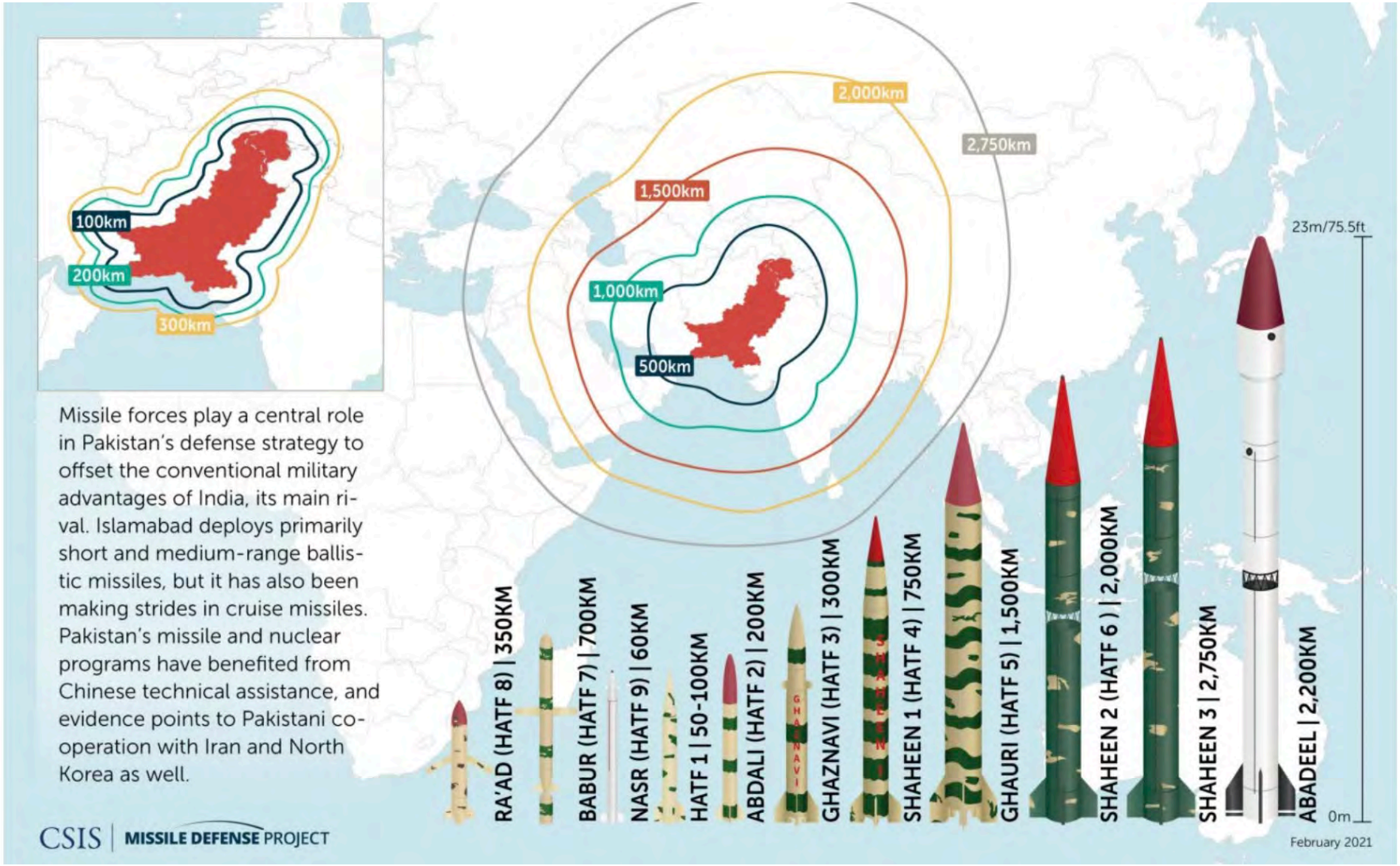
Pakistan: Operational & In-Development Missile Forces*

Missile Name	Class	Range	Status
Ababeel	MRBM	2,200 km	In development
Abdali (Hatf 2)	SRBM	180 - 200 km	Operational
Babur (Hatf 7)	Cruise Missile	350 - 700 km	Operational
Exocet	ASCM	40 - 180 km	Operational
Hatf 5 "Ghauri"	MRBM	1,250 - 1,500 km	Operational
Ghaznavi (Hatf 3)	SRBM	290 km	Operational
Hatf 1	SRBM	70 - 100 km	Operational
Nasr (Hatf 9)	SRBM	70 km	In service
Ra'ad (Hatf 8)	Cruise Missile	350 km	In development
Shaheen 1 (Hatf 4)	SRBM	750 - 900 km	Operational
Shaheen 2 (Hatf 6)	MRBM	1,500 - 2,000 km	Operational
Shaheen 3	MRBM	2,750 km	In development

* All missiles listed in source, not just currently nuclear-armed. Illustrates potential level of dual-capability

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

Pakistan: Ballistic and Cruise Missile Forces*



* All missiles listed in source, not just currently nuclear-armed.

Missile Defense Project, "Missiles of France," *Missile Threat*, Center for Strategic and International Studies, June 14, 2018, last modified March 3, 2021, https://missilethreat.csis.org/country/france/.

U.S Strategic Command Summary of U.S. Nuclear Modernization Priorities

Adapted from statement of Anthony J. Cotton, Commander, U.S. Strategic Command, before the House Armed Services Committee on Strategic Forces, March 8, 2023.

NUCLEAR COMMAND, CONTROL, AND COMMUNICATIONS (NC3): The NC3 enterprise is essential to the President's ability to command and control the Nation's nuclear forces. Acknowledgement of this vital mission and the unique challenges facing NC3 modernization were the impetus behind the Secretary of Defense's establishment of my role as the DoD NC3 Enterprise Lead in 2018. With these responsibilities and authorities, we are taking a holistic enterprise approach to develop and deliver the next generation of NC3— a flexible, resilient, and assured architecture spanning all domains and enhancing strategic deterrence.

NC3 Next Generation / Modernization: The modernization of the NC3 enterprise underpins the nuclear triad and sustains assured command and control capabilities in the evolving threat environment. We are partnering with NC3 stakeholders in the Office of the Secretary of Defense and levying requirements on the Services to modernize all NC3 capability areas, integrating global nuclear forces with the means to provide strategic deterrence.

In the next five years, we will transition from Milstar to the Advanced Extremely High Frequency satellite constellation, gaining greater capacity, survivable worldwide NC3 reach, and the ability to provide direction to our forces in degraded environments. Our national leadership conferencing, currently using a voice-only legacy technology, will transition to voice and video displays. In our warning layer, we are moving away from the Defense Support Program and towards the Space Based Infrared System to maximize warning time. Efforts are already underway on our submarines, E-6B aircraft, and bombers to replace previous generation radios with improved systems that are more resilient to jamming and other electromagnetic effects.

In the next ten years, the launch and use of Next Generation Overhead Persistent Infrared geosynchronous and polar satellites will replace legacy systems with a space-based missile warning constellation to detect and track threats around the globe. The Space Development Agency's Proliferated Warfighting Space Architecture is aimed at building a constellation of satellites in low and medium earth orbit that can monitor maneuvering hypersonic missiles flying below the range of today's ballistic missile detection satellites and above the radar of terminal-phase targeting systems. These satellites will complement other efforts to detect and track maneuvering hypersonic missiles that are difficult targets for current missile warning capabilities.

Finally, we will use polar satellite communications capability with the Enhanced Polar System Recapitalization program to provide message relay. Our submarines, E-6B aircraft, bombers, and missile fields will receive communication systems that increase survivability of weapon systems in a crisis situation. We are focused on achieving our vision—a modernized NC3 *enterprise that remains resilient, reliable, and available at all times and under the worst conditions.*

NC3 Cybersecurity and Technological Improvements: We have confidence in our ability to protect, defend, and execute the nuclear deterrent mission. The resilience and redundancies of the systems comprising the Nuclear Command and Control System, combined with ongoing cybersecurity enhancements, ensure our ability to respond under adverse cyber conditions.

E-4B Nightwatch: The E-4B Nightwatch aircraft serves as the National Airborne Operations Center and is a key component of the National Military Command System for the President, Secretary of Defense, and Joint Chiefs of Staff. The E-4B recapitalization program—the Survivable Airborne Operations Center—will serve as the next generation airborne command center platform. In case of national emergency or destruction of ground command and control centers, the aircraft provides a highly survivable command, control and communications center to direct U.S. forces, execute emergency war orders and coordinate actions by civil authorities. For these reasons, we must continue to develop and deliver this platform on time to prevent any capability gaps associated with this important national asset.

***E-6B Mercury*:** The E-6B Mercury accomplishes two missions: Emergency Action Message (EAM) relay to all legs of the nuclear triad (Take Charge and Move Out/TACAMO) and an alternate USSTRATCOM command center providing EAM origination and ICBM secondary launch capability (Looking Glass). E-XX is the follow-on platform to the E-6B airframe and will execute the TACAMO mission only. In coordination with the Office of the Undersecretary of Defense for Acquisition and Sustainment and the Joint Staff, USSTRATCOM and the NC3 Enterprise Center are conducting an evaluation of alternatives (EoA) to consider all missions and platforms to deliver the Looking Glass capabilities currently performed by the E-6B. Recommendations from the EoA should be available by mid-summer. We must complete recapitalization by the E-6B's projected end of service life in FY38.

RECAPITAIZATION OF TRIAD is a once in every-other-generation event that will ensure we have capable forces into the 2080s to defend the U.S. homeland and deter strategic attack globally. I am closely monitoring the transition of our major programs: OHIO to COLUMBIA, D5 LE to D5 LE2, Minuteman III to Sentinel, B-2 to B-21, Air Launched Cruise Missile (ALCM) to LRSO, and modernization of NC3 capabilities. It is essential to sustain our current platforms until new systems are at full operational capability. Correspondingly, we are coordinating with the Services on efforts to mitigate operational impacts should delays occur in the delivery timeline for new capabilities.

LAND-BASED TRIAD COMPONENT: The ICBM remains our country's most responsive option for strategic deterrence. The Minuteman III (MMIII) force provides a responsive, highly reliable deterrent capability, supported by a secure command and control system. Geographically dispersed ICBMs deny potential adversaries the possibility of a successful first strike.

MMIII's weapon system replacement, the LGM-35A Sentinel ICBM, will deliver MMIII's key attributes while enhancing platform security, streamlining maintenance processes, and delivering greater operational capability needed for the evolving threat environment. Sentinel's program scope and scale cannot be overstated—our first fully integrated ICBM platform includes the flight system, weapon system, C2, ground launch systems, and facilities.

The Sentinel program is pursuing mature, low-risk technologies, design modularity, and an open system architecture using state-of-the-art model-based systems engineering. Sentinel will meet our current needs, while allowing affordable future technology insertion to address emerging threats. USSTRATCOM is actively supporting the Sentinel engineering and manufacturing development process and looks forward to the first Sentinel developmental flight test. Sentinel will deploy with numerous advantages over MMIII and will provide a credible deterrent late into this century. Sentinel fielding is a whole of government endeavor. We appreciate continued Congressional support, both for Sentinel and sustainment of MMIII.

SEA-BASED TRIAD COMPONENT: The Navy's OHIO-class SSBN fleet, equipped with the Trident II D5 SLBM, patrols the world's oceans undetected, providing an assured second strike capability in any scenario. Our SSBN fleet continues to provide a resilient, reliable, and survivable deterrent. However, the life of the OHIO-class SSBN fleet has been extended from a planned 30 years to an unprecedented 42 years. The average age of the SSBN fleet is now 32 years. As the hulls continue to age, the OHIO-class will face sustainment and readiness challenges until it is replaced by the COLUMBIA-class. Similar to Minuteman III, we must maintain OHIO-class hulls until the COLUMBIA is available. The Navy has already invested in the Integrated Enterprise Plan to shorten construction timelines for COLUMBIA hulls two through twelve to meet USSTRATCOM at-sea requirements. Continued investment in revitalizing our shipbuilding industry is a national security imperative.

The first COLUMBIA-class submarine must achieve its initial strategic deterrent patrol in FY31 with an initial loadout of D5 LE missiles and a steady transition to the D5 LE2. The program of record delivers at least twelve SSBNs—the absolute minimum required to meet sustainment requirements. A life-of-hull reactor and shorter planned major maintenance periods are intended to deliver greater operational availability. COLUMBIA will deliver improved tactical and sonar systems, electric propulsion drive, and advanced hull coating to maintain U.S.
undersea dominance.

The Trident II D5 LE2 program will field a modern, reliable, flexible, and effective missile capable of adapting to emerging threats and is required to meet COLUMBIA-class SLBM loadout requirements. Stable funding for D5LE2 is vital to maintaining program benchmarks and ensuring a viable SSBN deterrent through the 2080s. COLUMBIA's ultimate success depends on a missile that is both capable and flexible.

Additionally, shore infrastructure readiness is fundamental to supporting current OHIO-class SSBN and future COLUMBIA-class SSBN operations. Provision of military construction and operation & maintenance funding facilitates the Navy's modernization of shore infrastructure supporting the nuclear deterrence mission. One immediate example is the modernization and expansion of the SSBN training and maintenance facilities in Kings Bay. These facilities are critical for maximizing the combat readiness of SSBNs and their crews daily, requiring a commitment to multiple years of funding.

Anti-Submarine Warfare: Anti-submarine warfare threats continue to evolve. The Navy's Integrated Undersea Surveillance System (IUSS) provides vital information concerning adversary submarine and surface ship operations, enabling U.S. forces to maintain favorable tactical and strategic positions while supporting deterrent patrol operations. Surveillance performed by IUSS also provides the theater undersea warfare commander situational awareness required for maritime defense of the homeland. Advances in adversary submarine stealth underscore the importance of IUSS recapitalization.

Our submarines are formidable weapon systems; however, we must address potential adversaries' anti-submarine warfare advances to maintain an effective and viable SSBN fleet well into the future. Adversary investments in submarine quieting, acoustic arrays, and processing capabilities may challenge our acoustic superiority in the future and consequently, SSBN survivability. Development and employment of advanced sonar sensors, advanced materials science and coatings, and other efforts within the Navy's Acoustic Superiority Program are vital to maintain our undersea advantage.

AIR-BASED TRIAD COMPONENT: The bomber fleet is our most flexible and visible leg of the triad. We are the only country with the capability to provide long-range bombers in support of our Allies and partners, enabling the U.S. to signal resolve while providing a flexible option to de-escalate a conflict or crisis. In a force employment model known as the Bomber Task Force (BTF), USSTRATCOM supports global deterrence and assurance objectives. BTFs allow dynamic employment of the Joint Force and clear messaging as potential adversaries watch these missions closely. As bombers conduct missions throughout the globe, they enhance national objectives by demonstrating unity with Allies and partners, and testing interoperability. As a complement to the Air Force's Agile Combat Employment (ACE) concept, we must consider increasing forward-based maintenance capability to support persistent, episodic global presence while retaining the ability to increase nuclear readiness posture as needed. As we sustain legacy systems and field new capabilities, it will be important to invest in bomber support forces and infrastructure to adequately sustain flexibility and effective nuclear deterrence posture.

***B-52H Sustainment**:* The B-52H continues on as the workhorse of our bomber fleet. The B-52's longevity is a testament to its engineers and maintenance professionals, but it must be modernized to remain in service into the 2050s. Essential B-52 upgrades include the Commercial Engine Replacement Program (CERP), Radar Modernization Plan, global positioning system military code signal integration, and survivable NC3 communications equipment. These improvements will keep the B-52 flying and able to pace the evolving threat. CERP will replace the B-52's 1960s-era TF-33 engines, which will enable longer unrefueled range, reduce emissions, and address supply chain issues afflicting the legacy engines. The B-52's very low frequency and advanced extremely high frequency modernization programs will provide mission critical, beyond-line-of-sight connectivity.

B-2 Sustainment: The B-2 fleet remains the world's only low-observable bomber, able to penetrate denied environments while employing a wide variety of munitions against high-value strategic targets. The DoD must protect this unique operational advantage as the Air Force transitions from the B-2 to the B-21 fleet. Successful transition requires full funding for B-2 sustainment and modernization programs until the B-21 completes development and certification for both conventional and nuclear missions, and is fielded in sufficient numbers to preclude any capability gap.

***B-21**:* The B-21 Raider will provide both a conventional and nuclear-capable bomber supporting the triad with strategic and operational flexibility across a wide range of military objectives. The program is on track to meet USSTRATCOM operational requirements, and continues to successfully execute within cost, schedule, and performance goals. The B-21 will be the backbone of our future bomber force, providing a penetrating platform with the range, access, and payload to go anywhere needed in the world. Consistent funding of the Air Force's B-21 program is required to prevent operational shortfalls in the bomber force and ensure delivery of this critical combat capability.

Air-Delivered Weapons: The air-delivered weapons portfolio consists of the ALCM, the B83-1 gravity bomb, and the B61 family of weapons, providing a mix of standoff and direct attack munitions to meet near-term operational requirements. The ALCM provides current stand-off capability to the strategic bomber force, but is reaching its end-of-life. LRSO will replace the ALCM as our country's sole air-delivered standoff nuclear capability. It will provide the President with flexible and scalable options, and is capable of penetrating and surviving against advanced air defenses—a key attribute and important component in USSTRATCOM operational plans. The LRSO is complementary to the ICBM and SSBN recapitalization programs and an important contribution to strategic stability. The B61-12 will soon replace most previous versions of the B61, providing a modernized weapon with greater accuracy and increased flexibility. Finally, USSTRATCOM is actively supporting the National Defense Authorization Act requirement to conduct a study on options to hold at risk hard and deeply buried targets.

***Tanker Support*:** A robust tanker fleet is essential to sustaining global reach for all USSTRATCOM missions. The 65 year-old KC-135 is the backbone of the Air Force's air refueling force but is facing increasing maintenance and sustainment issues. Limited air-refueling aircraft increases bomber response timing and constrains bomber deterrence posture agility. Concurrent mission demands between strategic, theater, and homeland defense require continued tanker modernization and expansion efforts. USSTRATCOM fully endorses and supports the Air Force's effort to modernize and sustain the tanker fleet, including certification of the KC-46 to support the nuclear mission. A conflict with a peer adversary would put previously unseen demands on the tanker force.

WEAPONS INFRASTRUCTURE AND NUCLEAR SECURITY ENTERPRISE (NSE): Today's nuclear weapon stockpile remains safe, secure, and effective. However, our country has not conducted a large-scale weapons modernization in over two decades. Stockpile and infrastructure modernization must ensure our systems are capable of pacing and negating adversary threats to our Nation, Allies, and partners. Over the past five years we have made significant investments in the NSE, but most programs take a decade or longer to field a meaningful capability.

The NNSA, as part of and informed by the Nuclear Weapons Council (NWC), has developed a comprehensive plan to put these identified capacities and capabilities in-place. When realized, it will enable our country to sustain and modernize the nuclear weapons stockpile to meet strategic deterrence needs. In the interim, I look forward to working with NNSA and other NWC partners to find the best solutions to mitigate operational risks. I commend Congress for its support of the NNSA's budget for weapons activities for FY23. Stockpile and NSE programs can take a decade or more to deliver and will require consistent, uninterrupted funding to provide the needed capacities and capabilities on time to sustain and modernize the strategic deterrent force. We must continue to look for ways to accelerate our stockpile and NSE modernization and recapitalization programs.

As we shift focus beyond life extension to modernizing existing weapons and fielding new systems, we must overcome challenges that delay program execution. There are many NSE programs with just-in-time schedules or that are late-to-need, including pit production, uranium processing, and radiation case manufacturing. Failure to execute and deliver timely NSE modernization programs results in accumulation of operational risk by requiring the retention of aging weapons and components in the stockpile decades longer than intended. In FY22, the NSE took action on a number of issues impacting the readiness and modernization of the nuclear deterrent force. Some areas—for example, the W93, B61-12, and W88 Alt 370—saw progress, while others such as the W80-4 and W87-1 stockpile modernization programs are experiencing milestone delays and increased schedule risk. I look forward to working with NNSA and other NWC partners to improve our rates of success in these latter areas.

Production of essential components is a critical issue. NNSA has identified critical capability gaps affecting components essential for stockpile modernization. It is also vital that the NSE re-establishes a plutonium pit manufacturing capability of no less than 80 pits per year as close to 2030 as possible. Weapon production is a multi-decade task that must address current enterprise limitations as we simultaneously modernize the stockpile, infrastructure, and platforms while sustaining the current force until it can be replaced. For over a decade, our adversaries have dedicated significant resources to modernizing and expanding their nuclear capabilities. As our systems continue to age, funding a modern stockpile, supporting infrastructure, and a robust science, technology, and engineering base is essential.

NUCLEAR SECURITY: Nuclear security continues to be one of my top priorities; we will commit the resources required to protect our fielded weapons, weapon platforms, and personnel. Adhering to the Nuclear Weapon Security Standard ensures denial of unauthorized access to nuclear weapons and prevents loss of custody. A defense-in-depth strategy starts at every nuclear weapon and builds outward with a cohesive design to deter, detect, delay, deny, and defeat security threats.

MH-139A Grey Wolf Replacement Helicopter The Joint Force achieved a significant ICBM security milestone with the Air Force's award of a contract to replace the UH-1N helicopter fleet with the new MH-139A "Grey Wolf." The MH-139A offers enhanced speed, range, endurance, payload, and survivability versus the UH-1N. We will continue to work with the Services to deliver this capability.

Countering Small Unmanned Systems: The rapid proliferation and growing technological sophistication of small unmanned systems is an increasing threat to the nuclear enterprise. To counter the threat, the Department continues to field Counter-small Unmanned Aircraft Systems (C-sUAS) capabilities and is refining tactics, techniques, and procedures. Similarly, the advancement of unmanned surface and underwater vehicles may soon emerge as a threat to our SSBNs and supporting infrastructure, requiring a comprehensive force protection system to defend both pier-side and in-transit SSBNs.

Weapon Generation Facility (WGF): As we modernize nuclear weapons and platforms, the Air Force will replace aging weapon storage areas with new WGFs which are vital to security, sustainment, and fielding of the Sentinel, B-21, and LRSO triad modernization programs, and their associated weapons. The Air Force will conduct weapon maintenance, storage operations, and (as required) weapons generation activities in a single reinforced WGF facility at each strategic base. This will further increase security, recapitalize aging infrastructure, and enhance efficiency throughout the mission. The WGFs are a critical part of the larger nuclear modernization effort and must be fully funded to deliver on time in support of each program of record delivery schedule.

JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS (JEMSO) Per the Unified Command Plan (UCP), CDRUSSTRATCOM is responsible for advocating for JEMSO and electromagnetic warfare capabilities, providing contingency electronic warfare support to other CCMDs, and supporting CCMD joint training and planning related to controlling the EMS. Potential adversaries understand our dependency upon the EMS and have developed technology to effectively contest our use of it. Additionally, increased civil and commercial use of spectrum bandwidth significantly congests the EMS and constrains DoD use. Multiple USSTRATCOM assessments have identified JEMSO readiness shortfalls, which are growing. Our adversaries have dramatically increased their offensive and defensive capabilities in recent years; the DoD must similarly improve our ability to operate in a degraded electromagnetic warfare environment.

We must continue to pursue a DoD-wide effort to achieve EMS superiority and mission. To support the goals of the DoD EMS Superiority Strategy, USSTRATCOM is executing twelve assigned tasks, including establishing an organization, led by a 2-star, called the Joint Electromagnetic Spectrum Operations Center (JEC). The JEC will lead execution of the eleven other USSTRATCOM assigned DoD EMS Superiority Strategy tasks. Additionally, USSTRATCOM has led development of JEMSO cells at other CCMDs to enable these functions. We are also working with the DoD Chief Information Officer to develop a software system for use by CCMD JEMSO cells in planning, coordinating, and controlling the EMS. Following multiple assessments from Northern Edge—USINDOPACOM's tier 1 exercise—USSTRATCOM is pursuing accreditation authorities for Joint Force EMSO readiness that will help close capability gaps. USSTRATCOM is also establishing an EMSO training and education capability to coordinate DoD EMS joint training, streamline training processes, and promote standardization.

MISSILE DEFENSE: Missile defense capabilities are a key part of integrated deterrence to deny our potential adversaries coercive abilities or the benefit of attacks against the homeland, Allies, and partners. The proliferation of missile technology and employment techniques designed to circumvent missile defenses demands a Department-wide missile defeat approach with continued investment in systems integration and collaboration with Allies and partners. This comprehensive approach uses the entire range of available activities to counter the development, acquisition, proliferation, and use of adversary offensive missiles of all types, as well as limiting damage from such use. An important element of this approach is integration of space- and terrestrial-based sensors for warning, attribution, and tracking of ballistic, maneuvering, hypersonic, cruise missile, and UAS threats to optimize the effectiveness of our limited inventory of kinetic interceptors. A comprehensive sensor architecture that gives commanders and civilian leaders situational awareness over all threats and incursions to our air and space domains is imperative.

MMIII's weapon system replacement, the LGM-35A Sentinel ICBM, will deliver MMIII's key attributes while enhancing platform security, streamlining maintenance processes, and delivering greater operational capability needed for the evolving threat environment.
Sentinel's program scope and scale cannot be overstated—our first fully integrated ICBM platform includes the flight system, weapon system, C2, ground launch systems, and facilities.

The Sentinel program is pursuing mature, low-risk technologies, design modularity, and an open system architecture using state-of-the-art model-based systems engineering. Sentinel will meet our current needs, while allowing affordable future technology insertion to address emerging threats. USSTRATCOM is actively supporting the Sentinel engineering and manufacturing development process and looks forward to the first Sentinel developmental flight test. Sentinel will deploy with numerous advantages over MMIII and will provide a credible deterrent late into this century. Sentinel fielding is a whole of government endeavor. We appreciate continued Congressional support, both for Sentinel and sustainment of MMIII.

HYPERSONIC WEAPONS: Long-range conventional hypersonic weapons will provide senior leadership additional strike options to hold distant and/or defended high-value, time-sensitive targets at risk without crossing the nuclear threshold. Conventional HSWs ensure long-range power projection in contested environments and enables more efficient and effective application of the nuclear force. While HSWs are not a replacement for nuclear weapons, these systems show promise as the conventional complement that the nuclear force needs to expand integrated deterrence options.

The ability to quickly strike defended targets at long range is an important capability that the Joint Force and multiple CCMDs require. Rapid development and fielding of conventional HSWs is a top USSTRATCOM priority. The goal of fielding the first offensive hypersonic strike system is on the horizon with the Army scheduled to field a Long-Range Hypersonic Weapon battery in late 2023, followed by the Navy Conventional Prompt Strike program beginning in the mid-2020s. The Air Force has demonstrated successes in the Air-launched Rapid Response Weapon program and hypersonic cruise missile technology pathfinder efforts. A robust scientific and industrial base is vital to ensure that HSWs are fielded in sufficient quantities. Additionally, a program for continuous technological improvement is important to meet the evolving security environment over the coming decades.

USSTRATCOM is committed to ensuring HSWs are ready to employ on day one of fielding as these weapons directly contribute to USSTRATCOM's UCP-assigned strategic deterrence and global strike responsibilities. To operationalize these new capabilities in the near term, we are working across the Department to develop a concept of operation for HSW support to integrated deterrence.

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USSTRATCOM is working through policy, planning, and C2 processes, and—in conjunction with the Services and other CCMDs—is testing HSWs through a rigorous exercise program. Hypersonic weapons will have an immediate impact to operational plans by deterring and holding adversaries at risk while providing the nation with credible, strategic, non-nuclear response options when faced with armed conflict. Additionally, HSW- related agreements with Allies will further reinforce collective security, promote interoperability, and facilitate optimal deployment of these capabilities.

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U.S. Nuclear Strategy and Missile Defense

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As outlined in the NDS, integrated deterrence is a framework weaving together all instruments of national power – with diplomacy at the forefront – to work seamlessly across warfighting domains, theaters, the spectrum of conflict, and our network of alliances and partnerships. Tailored to specific circumstances, integrated deterrence applies a coordinated, multifaceted approach to reducing competitors' perceptions of the net benefits of aggression relative to restraint. Integrated deterrence is enabled by combat-credible forces and backstopped by a safe, secure, and effective nuclear deterrent.

Missile defenses, as one component of this integrated, multilayered framework, are critical to the top priority of defending the homeland and deterring attacks against the United States. Whether protecting the homeland, deployed U.S. forces, or our Allies and partners, missile defenses deny the benefits of an attack by adversaries and limits damage should deterrence fail. The continued evolution and progress of missiles as a principal means by which adversaries seek to project conventional or nuclear military power makes missile defense a core deterrence-by- denial component of an integrated deterrence strategy. Missile defense capabilities add resilience and undermine adversary confidence in missile use by introducing doubt and uncertainty into strike planning and execution, reducing the incentive to conduct small-scale coercive attacks, decreasing the probability of attack success, and raising the threshold for conflict. Missile defenses also reinforce U.S. diplomatic and security posture to reassure Allies and partners that the United States will not be deterred from fulfilling its global security commitments. In the event of crisis or conflict, missile defenses offer military options that help counter the expanding presence of missile threats, and may be less escalatory than employing offensive systems. Damage limitation offered by missile defenses expands decision making space for senior leaders at all levels of conflict, and preserves capability and freedom of maneuver for U.S. forces.

Within the framework of integrated deterrence, missile defense and nuclear capabilities are complementary. U.S. nuclear weapons present a credible threat of a robust response and overwhelming cost imposition, while missile defenses contribute to deterrence by denial. If deterrence fails, missile defenses can potentially mitigate some effects from an attack. Missile defense contributes directly to tailored U.S. deterrence strategies to dissuade attacks on the United States from states like North Korea, and contributes to extended deterrence for U.S. Allies and partners, and our respective forces abroad.

To address intercontinental-range, nuclear threats from Russia and the PRC, the United States will continue to rely on strategic deterrence – underwritten by safe, secure, and effective nuclear forces – to deter such threats as outlined in the 2022 Nuclear Posture Review (NPR). Ensuring the continued credibility of this deterrent will require investments in missile warning, missile tracking, and resilient NC3 to keep pace with the evolving PRC and Russian threats, and avoid the possibility of evading U.S. sensor networks in a surprise attack. For states like North Korea, missile defenses and the U.S. nuclear arsenal are complementary and mutually reinforcing, as both capabilities contribute to deterring an attack against the United States and our Allies and partners.

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Homeland Missile Defense. The Department's top priority is to defend the homeland and deter attacks against the United States. For the purposes of this review, homeland missile defense refers to the defense of the 50 states, all U.S. territories, and the District of Columbia against missile attacks. Missile defenses can raise the threshold for initiating nuclear conflict by denying an aggressor the ability to execute small-scale coercive nuclear attacks or demonstrations. Further, the presence of missile defense complicates adversary decision-making by injecting doubt and uncertainty about the likelihood of a successful offensive missile attack.

Missile defense systems such as the GMD offer a visible measure of protection for the U.S. population while reassuring Allies and partners that the United States will not be coerced by threats to the homeland from states like North Korea and potentially Iran. In the event of crisis, globally integrated domain awareness capabilities increase warning and allow for flexible decision-making to respond, as necessary and appropriate, with escalatory options such as kinetic strike. Should deterrence fail, missile defenses can help mitigate damage to the homeland and help protect the U.S. population.

The U.S. homeland ballistic missile defense architecture centers on the GMD system, consisting of interceptors emplaced in Alaska and California, a network of space-based and terrestrial-based sensors, and an integrated C2 system. Together, these U.S. homeland defense capabilities provide the means to address ballistic missile threats from states like North Korea and Iran. Though the United States maintains the right to defend itself against attacks from any source, GMD is neither intended for, nor capable of, defeating the large and sophisticated ICBM, air-, or sea- launched ballistic missile threats from Russia and the PRC.

The United States relies on strategic deterrence to address those threats. As part of an integrated approach to deterrence, the United States recognizes the interrelationship between strategic offensive arms and strategic defensive systems. Strengthening mutual transparency and predictability with regard to these systems could help reduce the risk of conflict.

As North Korean ballistic missile threats to the U.S. homeland continue to evolve, the United States is committed to improving the capability and reliability of the GMD system. This includes development of the Next Generation Interceptor (NGI) to augment and potentially replace the existing Ground-Based Interceptors (GBI). In addition to the GMD system, the United States will leverage and improve its full spectrum of missile defeat capabilities, complemented by the credible threat of direct cost imposition through nuclear and non-nuclear means, to continue to counter North Korean missile threats to the homeland. To deter attempts by adversaries to stay under the nuclear threshold and achieve strategic results with conventional capabilities, the United States will examine active and passive defense measures to decrease the risk from any cruise missile strike against critical assets, regardless of origin.

Within the context of homeland defense, an attack on Guam or any other U.S. territory by any adversary will be considered a direct attack on the United States, and will be met with an appropriate response. Additionally, Guam is home to key regional power projection platforms and logistical nodes, and is an essential operating base for U.S. efforts to maintain a free and open Indo-Pacific region. The architecture for defense of the territory against missile attacks will

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therefore be commensurate with its unique status as both an unequivocal part of the United States as well as a vital regional location. Guam's defense, which will include various active and passive missile defense capabilities, will contribute to the overall integrity of integrated deterrence and bolster U.S. operational strategy in the Indo-Pacific region.

Regional Missile Defense. The United States will continue to strengthen defenses for U.S. forces, and with Allies, and partners against all regional missile threats from any source. As part of an integrated, interoperable, and multi-layered approach to deterrence, IAMD capabilities need to keep pace with expanding regional missile threats, while protecting and enabling U.S., Allied, and partner maneuver forces to conduct operations.

Regional missile threats continue to expand in capability, capacity, and complexity, challenging existing U.S., Allied, and partner regional IAMD capabilities and placing all at risk. Likely designed for employment below the U.S. nuclear threshold, adversaries are pursuing and demonstrating advanced, long-range space and missile systems capable of traversing entire Combatant Command Areas of Responsibility (AORs). Attacks from these systems could increasingly blur the line between regional and homeland defense and challenge existing IAMD architectures. In addition to missile threats, U.S. forces, Allies and partners also face the proliferation of lower-tier threats (e.g., rockets, armed UAS, etc.) as adversaries seek to take advantage of these relatively inexpensive, flexible, and expendable systems while exploiting inherent difficulties with attribution and its implications for deterrence.

Cooperation with like-minded nations is crucial. The United States will continue to seek ways to integrate and interoperate with Allies and partners as well as encouraging greater integration among Allies and partners to fill gaps against the increasing spectrum of regional threats. Additionally, as the ability to share sensor information and data is critical to regional defense, the United States will continue to streamline processes for information and data sharing, while encouraging Allies and partners to enhance their information protection posture and cyber security.

The United States will also continue to develop active and passive defenses against regional hypersonic missile threats, and pursue a persistent and resilient sensor network to characterize and track all hypersonic threats, improve attribution, and enable engagement. Acquisition strategies for new sensors, interceptors, and C2 systems must be fully aligned – with sensors as the priority. As appropriate, the United States will pursue joint research and development on hypersonic defense programs with key Allies and partners.

IAMD. Nested within our broader missile defeat approach, IAMD is the integration of capabilities and overlapping operations to defend the homeland, Allies and partners, protect the Joint and combined forces, and enable freedom of action by negating an adversary's ability to create adverse effects with air and missile capabilities. IAMD represents an effort to move beyond platform-specific missile defense toward a broader approach melding all missile defeat capabilities – defensive, passive, offensive, kinetic, non-kinetic – into a comprehensive joint and combined construct.

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Developing and fielding IAMD systems is a complex problem set. To address the rapidly evolving threat, the acquisition community must continue to exploit adaptive acquisition approaches to ensure the timely and cost-effective development, procurement, sustainment, and improvement of IAMD systems, while providing a clear investment strategy over the near-, medium-, and long-terms. The Department must develop, design, acquire, and maintain Joint IAMD systems that are integrated, interoperable, and sufficiently mobile, flexible, and affordable to protect the homeland and dispersed joint and combined maneuver forces from the full spectrum of air and missile threats. Interoperability breeds efficiency and economy of resources. To enhance this effect in IAMD, the Department must develop and exercise innovative combinations of Service, national, and Allied and partner capabilities to meet mission needs.

One area of importance related to IAMD is the increasing challenge of counter-UAS (C-UAS). UAS are an inexpensive, flexible and plausibly deniable way for adversaries endeavoring to carry out tactical-level attacks below the threshold for major response, making them an increasingly preferred capability for state and non-state actors alike. UAS capabilities are also growing in variety, quality, and quantity. The homeland and regionally forward deployed forces require the fielding of technical and integrated C-UAS solutions with cross-DoD and interagency synchronization to ensure they can meet the range of threats and appropriately hedge against future advancements. Within the homeland, protecting the population from UAS threats is a combined interagency mission.

Future Technologies. The United States requires responsive, persistent, resilient, and cost- effective joint IAMD sensor capabilities to detect, characterize, track, and engage current and emerging advanced air and missile threats regionally, and to improve early warning, identification, tracking, discrimination, and attribution for missile threats to the homeland. Sensors must be integrated into a cohesive architecture with increasingly capable C2 in order to provide leaders with a maximized decision space for informed actions.

Sensors should be able to seamlessly transition from theater-level threats, to homeland defense, to global threats, by sharing and transmitting data with C2 as threats move in and out of the atmosphere. Because of their global nature, persistence, and greater access to denied regions, resilient space-based infrared, radar, and associated data transport systems will be critical to any future integrated sensor network. Likewise, modern over-the-horizon radar capabilities are essential to improving warning and tracking against cruise missile and other threats to the homeland.

Advanced sensor capabilities need to facilitate different mission areas simultaneously. These include strategic and theater missile warning and tracking to: alert national leadership and cue missile defenses in the event of a missile launch; offer space domain awareness to provide indications and warning of threats; support mission assurance of the space architecture; and prompt ISR to provide persistent, and often unwarned, global information essential to the whole of government. Therefore, the ability to operate these sensors through common, joint and combined all-domain integrated and survivable C2 networks and architectures is paramount. The United States will continue to leverage industry, academia, government, and allied and partner solutions to augment existing Department of Defense capabilities and foster rapid future capability employment.

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Advanced and innovative technologies and more effective battle management will be crucial to moving the United States towards a cost-effective and integrated set of offensive and defensive capabilities. To cope with rapidly increasing adversary development of missile-centric Anti-Access/Area-Denial (A2/AD) threats, the Department must seek new technologies and hedge against continuing adversary missile developments and emerging capabilities such as hypersonic weapons, multiple and maneuvering warheads, and missile defense countermeasures. Future air and missile defense capabilities must also be more mobile, flexible, survivable, and affordable, and emphasize disaggregation, dispersal, and maneuver to mitigate the threat from adversary missiles. Finally, these technologies and platforms – including those enabling NC3 – must be inherently cyber-secure, joined by resilient, redundant and hardened networks, and monitored by an agile defensive cyber force operating under a clear, unified C2 construct.

Source: Department of Defense: *2022 Missile Defense Review*, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF