



Slowing nuclear weapon reductions and endless nuclear weapon modernizations: A challenge to the NPT

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Abstract

The nuclear-armed states have large residual nuclear arsenals, and post-Cold War reductions of nuclear weapons have slowed. Meanwhile, the nuclear nations have undertaken ambitious nuclear weapon modernization programs that threaten to prolong the nuclear era indefinitely. These trends present a challenge to the Nuclear Non-Proliferation Treaty community, appearing to contradict the promises by the five NPT nuclear-weapon states to pursue a halt to the nuclear arms race and to seek nuclear disarmament. The NPT does not explicitly place limitations on modernizations, but the 2015 NPT Review Conference will have to address whether extending the nuclear arsenals in perpetuity is consistent with the obligations under NPT's Article VI and the overall purpose of the treaty.

Keywords

disarmament, Nuclear Non-Proliferation Treaty, nuclear weapon modernization

Every five years the parties to the Nuclear Non-Proliferation Treaty (NPT) gather in New York to review progress and challenges related to the treaty. Every time, the five nuclear weapons states and permanent members of the United Nations Security Council, their non-nuclear allies, and the non-aligned non-nuclear countries that have renounced possession of nuclear weapons debate often argue about whether or to what extent the obligations under the treaty's Article VI are being met.

NPT's Article VI states: "Each of the Parties to the Treaty undertakes to

pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control."

In May 2015, the 190 countries that have signed the NPT will gather once more for the eighth review conference. This time many non-nuclear weapon states will likely express their frustration with the slow progress on nuclear reductions since the 2010 review conference. Back then, the United States and Russia

had just signed the New START treaty, but progress since has been slim. Although its goals are very modest, the treaty has not yet been implemented, and no follow-on has emerged—that is, there has been no additional treaty, significant reductions in nuclear forces, or broadening of the arms control process to other nuclear-armed countries.

Instead, nuclear reductions appear to be slowing: The US nuclear weapons stockpile decreased by only 309 warheads in the five years from 2009 through 2013, an order of magnitude less than the 3,287 warheads retired in the preceding five-year period. Unlike the United States, Russia has not published official nuclear stockpile numbers, but we estimate that Russia retired approximately 1,000 warheads in the 2009 to 2013 period, compared with roughly 2,500 in the preceding five-year period. Instead of heading toward zero, the world’s largest nuclear arsenals appear to be leveling out for the long haul.

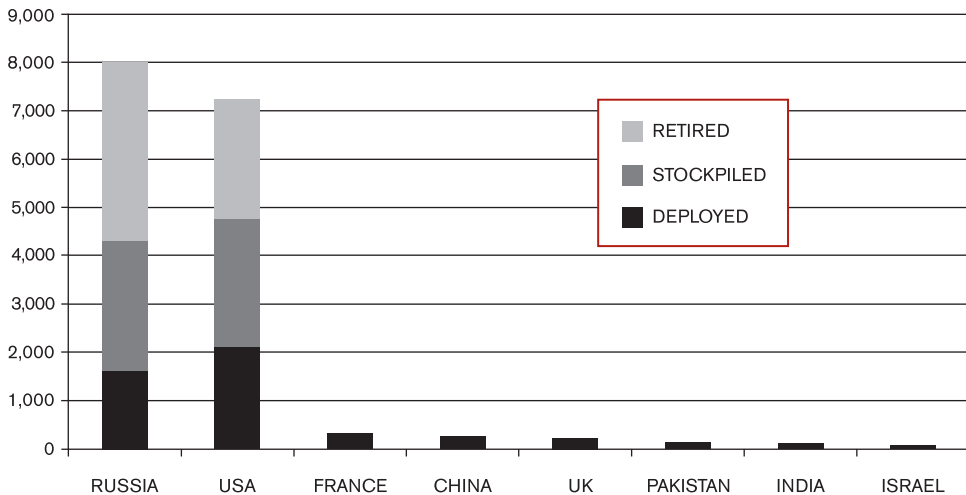
The United Kingdom has not declared additional stockpile numbers

since its statement in 2010 that its stockpile would not exceed 225 warheads, but has said that its stockpile will shrink to 180 by the mid-2020s. France has not disclosed any nuclear numbers since 2008 and appears to reject additional reductions for now. China has not made any announcements since 2004, when it declared that it “possesses the smallest nuclear arsenal” of the five nuclear weapons states in the NPT (People’s Republic of China, 2004: 2), but it appears to be slightly increasing its nuclear arsenal.

As of 2014—nearly five decades after the NPT entered into effect and more than two decades after the end of the Cold War—the world’s nine nuclear-armed states possess an estimated 16,400 nuclear warheads, enough to arm every nation on Earth with 85 nuclear weapons, roughly the size of the Israeli arsenal¹ (see Figure 1).

The P5—the five nuclear weapon states party to the NPT—possess more than 98 percent of the world’s nuclear weapons. In other words, despite growing nuclear arsenals in countries outside the NPT,

Figure 1. Estimated global nuclear warhead inventories, 2014



the task of reducing the world's nuclear weapons is overwhelmingly and predominantly the responsibility of the P5.

Moreover, more than 93 percent of the world's nuclear weapons belong to just two countries: Russia and the United States. And their warhead inventories are still roughly 25 times larger than that of the third-largest nuclear-armed state (France). At their current growth rate, the two fastest growing nuclear arsenals in the world (Pakistan and India) would take 760 years to reach the size of the arsenals of Russia and the United States.

The overwhelming and disproportionate size of the Russian and US arsenals indicates that they predominantly are shaped by each other rather than other nuclear-armed states, and that the sizes of their current arsenals are more an indication of how far the Cold War drawdown has progressed (and how far it still has to go) rather than an expression of how many warheads the two countries actually need for their national security. In other words, were it not for their own large inventories, Russia and the United States could probably reduce their warhead inventories by a factor of 10. Doing so would put significant pressure on the other nuclear-armed states to limit their nuclear arsenals as well.

In addition to the large residual nuclear arsenals and the slowing of reductions of nuclear weapons, all the nuclear-armed states have ambitious nuclear weapon modernization programs in progress that appear intended to prolong the nuclear era indefinitely. New or improved nuclear weapon programs underway worldwide include at least 27 ballistic missiles, nine cruise missiles, eight naval vessels, five bombers, eight warheads, and eight weapons factories (see Table 1). The slowing

of nuclear reductions combined with a dynamic technological nuclear arms race present a particular challenge to the NPT community.

United States

Although President Barack Obama took office with a strong recommitment of the United States to reducing the numbers and role of nuclear weapons and to taking concrete steps toward a world without nuclear weapons, the Obama administration may eventually be remembered more for its commitment to modernizing the US nuclear arsenal. Partly building on programs from the Bush administration, the Obama administration has drawn up plans for modernizing all aspects of the entire nuclear enterprise, including development of new nuclear delivery systems, and life extension and modernization of all its enduring nuclear warhead types and nuclear weapons production facilities. Moreover, rather than constraining the role of nuclear weapons, the Obama administration's 2013 nuclear weapons employment strategy reaffirmed the existing posture of a nuclear triad of forces on high alert.

In the previous two decades, the US approach to modernizations mainly consisted of upgrading existing weapons instead of fielding new or significantly enhanced types. The Minuteman III intercontinental ballistic missile (ICBM) force is the final phase of a decade-long, \$8 billion modernization to extend its service life until 2030. And beginning in 2017, the Navy will begin deploying a life-extended version of the Trident II D-5 submarine launched ballistic missile on the existing class of ballistic missile submarines, whose service lives have also been extended. Similarly, the Air Force

Table 1. Nuclear notebook, nuclear modernizations

COUNTRY	EXISTING WEAPONS	NEW OR MODERNIZED WEAPONS	STATUS	
UNITED STATES	<i>Strategic land</i>			
	Minuteman III ICBM	GBSD: Modified or new solid-fuel ICBM with MIRV	Under development; deployment from 2025	
	W87/W78 warheads	IW-1 interoperable warhead based on W78 and W88	Under development (design uncertain); production in 2030-2040	
	<i>Strategic sea</i>			
	Ohio SSBN	SSBNX: 16 SLMBs each	Under development; 12 boats planned; first patrol in 2031	
	Trident II D5 SLBM	Trident IID5LE: life-extended version of current SLBM with new guidance system	Deployment from 2017 on US and UK SSBNs	
	W76/Mk4 warhead	W76-1/Mk4A: warhead and reentry body	Production underway (completion in 2019); being deployed on US and UK SSBNs	
	W88/Mk5 warhead	W88-1/Mk5A: reentry body with new Arming, Fuzing & Firing unit	Under development; production in 2020-2024	
	<i>Strategic air</i>			
	B-2A bomber	B-2A bomber: new aviation suite and bomb bay	Being upgraded	
	B-52H bomber	LRS-B: long-range, penetrating bomber	Under development; 80-100 planned from 2025	
	ALCM	LRSO: long-range, enhanced land-attack ALCM	Under development; production in 2026-2031	
	B61-7/11 bombs	B61-12: guided standoff strategic and tactical gravity bomb	Under development; production of ~480 in 2020-2024 (half strategic)	
	<i>Tactical</i>			
	F-15E fighter-bomber			
	F-16 fighter-bomber	F-35A: stealthy fighter-bomber	Under development; deliver from 2024 (number of nuclear aircraft unknown)	
	B61-3/4/10 bombs	B61-12: guided standoff strategic and tactical gravity bomb	(same production as above)	
	RUSSIA	<i>Strategic land</i>		
		SS-18 ICBM	Sarmat: liquid-fuel, silo-based ICBM with MIRV	Under development; deployment from 2018-2020, possibly at Dombrovsky and Uzhur
SS-19 ICBM		SS-27 Mod 2 (RS-24): solid-fuel, silo-based ICBM with MIRV	Deployment begun in 2014 at Kozelsk	
SS-25 ICBM		SS-27 Mod 2 (RS-24): solid-fuel, road-mobile ICBM with MIRV	Deployment started in 2010 at Teykovo; underway at Novosibirsk and Tagil	
SS-27 Mod 1 ICBM				
SS-27 Mod 2 ICBM		New (RS-26): solid-fuel, road-mobile ICBM with MIRV	Under development; deployment possibly from 2015-2016	
Various warheads		Possibly new warheads for Sarmat and RS-26	Possibly under development or in production	
<i>Strategic sea</i>				
Delta III SSBN				
Delta IV SSBN		Borei SSBN: 8 boats, each with 16 SLBMs	2 delivered, 3 building; not yet operational	
SS-N-18 SLBM				
SS-N-23 SLBM		SS-N-32 (Bulava) SLBM with MIRV	Failed half of test launches; more scheduled	
Various warheads		Possibly new warhead for SS-N-32	Probably completed	
<i>Strategic air</i>				
Tu-95MS bomber			Being upgraded	
Tu-160 bomber		PAK-DA: subsonic long-range bomber with ALCM	Under development; possibly deployment from 2025; intended to replace Tu-95, Tu-160, and Tu-22M3	
AS-15 (Kh-55) ALCM		Kh-102: long-range air-launched cruise missile	Under development; deployment expected soon	
<i>Tactical</i>				
Tu-22M3 bomber		(PAK-DA; see above)	(PAK-DA; see above)	
AS-4 Kitchen ALCM				
Su-24M fighter-bomber	Su-34 Fullback: ground-attack fighter-bomber	Deployment underway; 70 planned by 2015		

(continued)

Table 1. Continued

COUNTRY	EXISTING WEAPONS	NEW OR MODERNIZED WEAPONS	STATUS
	Tu-142 ASW aircraft		
	Il-38 ASW aircraft	Il-38N ASW aircraft	In production
	Akula I/II SSN	Severodvinsk (Yasen) SSN	1 delivered; 8 planned
	Oscar II SSGN		Being upgraded
	Sierra I/II SSN	Sierra I/II SSN	Being upgraded
	Victor III SSN		
	Kilo SS	Kilo SS	Being upgraded
	Kuznetsov CV	Kuznetsov CV	Being upgraded
	Kirov CGN	Kirov CGN	Being upgraded
	Kara CG		
	Slava CG	Slava CG	Being upgraded
	Sovremenny DDG	New DDG (Project 21956)	
	Udaloy I/II DDG		
	Krivak I/III FF	Gorshkov FFG	1 delivered; 3 building
	Neustrashimyy FFG		
	Nanuchka I/III PFM		
	Tarantul III PFM		
	Dergach (Bora) PHM		
	SS-N-9 SLCM		
	SS-N-12 SLCM		
	(SS-N-14) ¹		
	SS-N-19 SLCM		
	SS-N-21 SLCM	SS-N-30 (Kaliber); long-range land attack SLCM	Designation and status uncertain
	SS-N-22 SLCM		
	(SA-N-3 SAM)		
	SA-N-20 SAM		
	SS-N-15 ASROC		
	SS-N-16 ASROC		
	533-mm Torpedo		
	650-mm Torpedo		
	Ka-27/28, Mi-14 ASW helos		
	Depth bomb		
	SS-21 Scarab SRBM	SS-26 Iskander-M; SRBM on road-mobile launcher	2 brigades (24 launchers) deployed; 10 brigades planned
	S-300/SA-10/20 SAM	S-400/SA-21 SAM (?)	Nuclear capability unclear
	A-135 ABM system	A-135 ABM: 68 short-range and 16 long-range launchers	Upgrade of existing short-range interceptors at five sites and reactivation of 16 long-range interceptors at two sites
	SSC-1B Sepal CDM		
FRANCE	<i>Strategic sea</i>		
	Triumphant SSBN		
	M51.1 SLBM	M51.2: Modified M51.1 SLBM with new TNO MIRV warhead	Deployment from 2015

(continued)

Table 1. Continued

COUNTRY	EXISTING WEAPONS	NEW OR MODERNIZED WEAPONS	STATUS
		M51.3: Modified M51.2 SLBM	Unknown
	TN75 warhead	TNO warhead	New warhead on M51.1 SLBM
	<i>Tactical^B</i>		
	Mirage-2000N fighter-bomber	Rafale K3 fighter-bomber	Schedule unknown
	Rafale K3 fighter-bomber		
	Rafale M3 fighter-bomber		
	ASMPA ALCM		
CHINA	<i>Strategic land</i>		
	DF-3A IRBM		
	DF-4 ICBM	DF-31: solid-fuel, road-mobile ICBM with single warhead	Deployment in progress but might have stalled
	DF-5A ICBM	DF-31A: extended-range, solid-fuel, road-mobile ICBM with single warhead	Deployment underway
	DF-21A/B MRBM	DF-21A/B: solid-fuel, road-mobile MRBM	Deployment possibly continuing
	DF-31 ICBM		
	DF-31A ICBM	(DF-41: extended-range, solid-fuel, road-mobile ICBM)	Status unclear; possible with single-warhead but might be capable of MIRV
	Various warheads	Potentially MIRV warhead	Potential option to deploy MIRV in future if so decided
	<i>Strategic sea</i>		
	Xia SSBN	Jin (Type 094) SSBN: each with 12 SLBMs	3 delivered; 4-5 planned
		? (Type 096) SSBN	Possibly under development
	JL-1 SLBM	JL-2: long-range, solid-fuel, SLBM with single warhead	Under development; deployment soon
	Warhead	New warhead for JL-2 SLBM	Production underway or completed
	<i>Strategic air</i>		
	H-6 bomber	H-6K: modified intermediate-range bomber with land-attack ALCM	Production underway
		CJ-20: long-range, land-attack ALCM ^A	Nuclear status uncertain
	<i>Tactical</i>		
	DF-15 SRBM		
	DH-10 GLCM	DH-10: long-range, land-attack GLCM ^B	Deployment underway
	(Fighter-bomber) ^C		
UNITED KINGDOM	<i>Strategic land</i>		
	Vanguard SSBN	New SSBN	Under development; deployment from 2030
	Trident II D5 SLBM	Trident II D5LE: long-range, solid-fuel SLBM with MIRV	Deployment from 2017
	Modified W76/Mk4 warhead	Modified W76-1/Mk4A warhead	Deployment underway; possibly modified version of US W76-1/Mk4A
PAKISTAN	<i>Strategic land^D</i>		
		Hatf-2 Abdali: solid-fuel, road-mobile SRBM with single warhead	Under development
	Hatf-3 Ghaznavi SRBM		
	Hatf-4 Shaheen I SRBM	Hatf-4 Shaheen IA: extended-range, solid-fuel, road-mobile MRBM with single warhead	Under development
	Hatf-5 Ghauri MRBM		
	Hatf-6 Shaheen II MRBM	Hatf-6 Shaheen II: solid-fuel, road-mobile MRBM with single warhead	Under development; deployment imminent
		Hatf-7 Babur: short-range, ground-launched GLCM with single warhead	Under development

(continued)

Table 1. Continued

COUNTRY	EXISTING WEAPONS	NEW OR MODERNIZED WEAPONS	STATUS
	Various warheads	Smaller plutonium warheads	Under development for Abdali and Babur
	<i>Strategic air</i>		
	F-16 fighter-bomber		
	Mirage V fighter-bomber		
	One or more bombs		
		Hatf-8 Ra'ad: short-range ALCM with single warhead	Under development; delivered by Mirage V
		Smaller warhead	Under development for Ra'ad
	<i>Tactical</i>		
		Hatf-9 NASR: solid-fuel, road-mobile SRBM with single warhead	Under development
		Smaller warhead	Under development for NASR
INDIA	<i>Strategic land</i>		
	Prithvi II SRBM		
	Agni I SRBM		
	Agni II MRBM		
		Agni III: solid-fuel, rail-mobile IRBM with single warhead	Under development; deployment soon
		Agni IV: solid-fuel, rail-mobile IRBM with single warhead	Under development
		Agni V: solid-fuel, rail-mobile IRBM with single warhead	Under development
		(Agni VI ICBM)	Status unclear
		Nirbhay: short-range, land-attack GLCM with single warhead	Under development; nuclear status unclear
	Various warheads	Existing or modified warheads; potentially MIRV warhead	Possibly in production
	<i>Strategic sea</i>		
		Arihant SSBN with 12 SLBMs	Sea trials scheduled; potentially deployment from 2016
		K-15 Sagatika: solid-fuel, short-range SLBM with single warhead	Under development for deployment on Arihant
		K-4: solid-fuel, intermediate-range SLBM with single warhead	Under development for deployment on Arihant; possibly modified Agni III
	Dhanush SRBM	Dhanush: liquid-fuel, ship-based SRBM with single warhead	Under development; modified Prithvi II
		Existing or modified warhead	Possibly in production
	<i>Strategic air</i>		
	Jaguar IS fighter-bomber	(Rafale fighter-bomber)	Status unclear
	Mirage 2000H fighter-bomber		
	One or more bombs		
ISRAEL	<i>Strategic land</i>		
	Jericho II IRBM	Jericho III: solid-fuel, road-mobile or roll-out-to-launch MRBM with single warhead	Status unclear
	Warhead	Existing or modified warhead	Status unclear
	<i>Strategic sea^a</i>		
	(Dolphin SSG)		Removed nuclear capability; status unclear
	(Popeye Turbo SLCM)		Removed nuclear capability; status unclear
	(Warhead)		
	<i>Strategic air</i>		
	F-16I fighter-bomber	(F-35A fighter-bomber)	Status unclear
	One or more bombs		

(continued)

Table 1. Continued

COUNTRY	EXISTING WEAPONS	NEW OR MODERNIZED WEAPONS	STATUS
NORTH KOREA	<i>Strategic land</i>		
	(No Dong MRBM)		Nuclear status uncertain
		Musudan: liquid-fuel, road-mobile IRBM with single warhead	Nuclear status uncertain
		Hwasong-13 (KN-08): possibly liquid-fuel, road-mobile ICBM	Nuclear status uncertain
		Taepo Dong-2: liquid-fuel, fixed, space launch vehicle	Nuclear status uncertain; would need to be converted to ICBM
	One or two test devices	(One or more warheads) ⁹	Status unknown
<hr/>			
NATO ¹⁰			
BELGIUM	<i>Tactical</i>		
	F-16 fighter-bomber	(F-35A: stealthy fighter-bomber) ²	
	B61-3/B61-4 bomb	B61-12 guided standoff bomb	Deployment from 2020
GERMANY	<i>Tactical</i>		
	Tornado fighter-bomber		
	B61-3/B61-4 bomb	B61-12 guided standoff bomb	Deployment from 2020
ITALY	<i>Tactical</i>		
	Tornado fighter-bomber	F-35A: stealthy fighter-bomber	<90 planned from 2016
	B61-3/B61-4 bomb	B61-12 guided standoff bomb	Deployment from 2020
NETHERLANDS	<i>Tactical</i>		
	F-16 fighter-bomber	F-35A: stealthy fighter-bomber	~55 planned from 2019
	B61-3/B61-4 bomb	B61-12 guided standoff bomb	Deployment from 2020
TURKEY	<i>Tactical</i>		
	F-16 fighter-bomber	F-35A: stealthy fighter-bomber	~100 planned from 2019
	B61-3/B61-4 bomb	B61-12 guided standoff bomb	Deployment from 2020

1. Some sources consider the SS-N-14 to be nuclear-capable, but US intelligence apparently does not.
 2. Belgium has not yet selected its next-generation fighter-bomber but is likely to follow the Netherlands.
 3. France considers its 500-km cruise missile delivered by short-range fighter bombers a strategic weapon but neither the missile nor fighter-bombers have the range of US and Russian strategic weapons.
 4. The CJ-20 is listed by a USAF Global Strike Command briefing as nuclear-capable. See: Lt. Gen. James M. Kowalski, Commander, Air Force Global Strike Command, May 7, 2013, page 5, available at Hans M. Kristensen, "Air Force Briefing Shows Nuclear Modernizations But Ignores US and UK Programs," FAS Strategic Security Blog, May 29, 2013, <http://blogs.fas.org/security/2013/05/afgsc-brief2013/>.
 5. The DH-10 is listed by the USAF as "conventional or nuclear," the same designation used for Russian and Pakistani nuclear-capable cruise missiles. See: U.S. Air Force National Air and Space Intelligence Center, Ballistic and Cruise Missile Treat, NA-SIC-1031-0985-13, May 2013, p. 29, available at Hans M. Kristensen, "Air Force Intelligence Report Provides Snapshot of Nuclear Missiles," FAS Strategic Security Blog, July 10, 2013, <http://blogs.fas.org/security/2013/07/nasic2013/>.
 6. China conducted a nuclear test in 1972 using a Q-5 fighter-bomber, but it is unknown if one of its current fighter-bombers has a secondary nuclear mission.
 7. None of Pakistan's land-based ballistic missiles have intercontinental range but are considered strategic weapons in the deterrence relationship with India.
 8. There are unconfirmed but persistent rumors that Israel has equipped a submarine-launched cruise missile with nuclear capability.
 9. Despite three nuclear tests, there is no public confirmation that North Korea has developed and test flown an operational nuclear warhead for its ballistic missiles.
 10. US B61 bombs intended for delivery by NATO aircraft are under the custody of US Air Force personnel in peacetime but would be handed over to the NATO allies for potential use in a war.

ABM: antiballistic missile
 ALCM: air-launched cruise missile
 ASROC: anti-submarine rocket
 ASW: anti-submarine warfare
 CDM: coastal defense missile
 CV: aircraft carrier;
 CGN: nuclear-powered guided-missile cruiser
 CG: guided-missile cruiser
 DDG: guided-missile destroyer
 FF: frigate
 FFG: guided-missile frigate
 GBSD: ground-based strategic deterrent
 GLCM: ground-launched cruise missile
 ICBM: intercontinental ballistic missile
 IRBM: intermediate-range ballistic missile
 LE: life-extended
 MIRV: independently targetable reentry vehicle
 MRBM: medium-range ballistic missile
 PFM: guided-missile patrol (corvette)
 PHM: guided-missile hovercraft patrol (corvette)
 SAM: surface-air missile
 SLBM: sea-launched ballistic missile
 SRBM: short-range ballistic missile
 SSBN: nuclear-powered ballistic missile submarine
 SSGN: nuclear-powered guided-missile attack submarine
 SSN: nuclear-powered attack submarine

has begun life extension programs for the air-launched cruise missile and the B-2 and B-52 bombers.

But under the Obama administration, the nuclear weapons establishment has presented plans for more fundamental modernization programs with development and deployment of new or significantly modified weapon systems. The Navy is designing a new class of 12 ballistic missile subs, and the Air Force is examining options for a next-generation ICBM. The Air Force has begun development of a new stealthy long-range bomber and a new nuclear-capable tactical fighter-bomber. Production of a new, guided “standoff” nuclear bomb (B61-12), the first such bomb in the US inventory, is underway, and the Air Force is developing a new long-range nuclear cruise missile.

As is often the case with modernizations, many of these programs will introduce improved or new military capabilities to the weapon systems. For example, the life extension program for the B61 gravity bomb will add a guided tail kit to one of the existing B61 types to increase its accuracy. The new type, known as the B61-12, will be able to strike targets more accurately with less explosive yield and reduce the radioactive fallout from a nuclear attack. Other modifications under consideration, such as interoperable warheads that could be used on both land- and sea-based ballistic missiles, would significantly alter the structure of existing nuclear warheads and potentially introduce uncertainties about reliability and performance into the stockpile. These uncertainties, in turn, could increase the risk that the United States would need to conduct a nuclear test explosion in the future and thus break the testing moratorium that has been in place for two decades.²

According to the US Congressional Budget Office, the United States plans to spend approximately \$355 billion on the maintenance and modernization of its nuclear enterprise over the next decade (Congressional Budget Office, 2013), an increase of \$142 billion from the \$213 billion the administration projected just three years ago (Miller, 2011). According to available information, it appears that the nuclear enterprise will cost at least \$1 trillion over the next 30 years (Wolfsthal et al., 2014).

These sums are enormous by any standard and some programs may be curtailed by fiscal realities. Nevertheless, they indicate a commitment to a scale of nuclear modernization that appears to be at odds with the Obama administration’s arms reduction and disarmament agenda. Combined with the slowing of the reduction of the still large nuclear stockpile, the extensive modernization plans designed to prolong indefinitely the existence of a large US nuclear arsenal challenge the US performance under the NPT’s disarmament article.

Russia

Within the next decade, all Soviet-era nuclear weapon systems will be phased out and replaced with new ones—albeit at a lower level. On land, development of three missiles is underway: the SS-27 ICBM, the RS-26 (possibly another SS-27 modification), and the “heavy” ICBM known as the Sarmat. At sea, construction of eight Borei class ballistic missile submarines is scheduled and equipped with the SS-N-32 (Bulava) SLBM.

Despite the modernization, the Russian ICBM force already has declined to approximately 300 missiles and could drop further to roughly 250 missiles

over the next decade, depending on production and deployment of new missiles. What seems clear is that the Russian missile force level will not be able to keep parity with the US arsenals, so to keep some level of parity, Russia is deploying relatively more warheads on each of its missiles than the United States.

The Russian bomber force of Tu-160 Blackjack, Tu-95MS Bear, and Tu-22M Backfire bombers is undergoing various upgrades to extend their service lives and improve their military capabilities. And work is underway on design of a subsonic replacement bomber to enter service early in the next decade. A new nuclear cruise missile, known as the KH-102 ALCM, has been under development for a long time and may become operational soon.

On tactical forces, the new SS-26 Iskander-M short-range ballistic missile is replacing the nuclear-capable SS-21s in 10 brigades, mostly in western and southern military districts. The Su-34 Fullback fighter-bomber is gradually replacing the old Su-24M Fencer in the tactical nuclear strike role, and the Severodvinsk or Yasen SSGN (nuclear-powered guided-missile attack submarine) is about to enter service with the new long-range Kalibr cruise missile, which might have nuclear capability.

China

China is the only member of the P5 that is increasing its nuclear arsenal—albeit slowly. The modernization plan is in the final phase of a two-decade-long upgrade that has included deployment of new land-, sea-, and air-based nuclear delivery vehicles.

Although China does not seem to plan a significant increase of its nuclear

forces, it is changing the composition of those forces and putting more emphasis on mobile systems. The ICBM component of the arsenal is expanding with deployment of the solid-fuel, road-mobile DF-31 and DF-31A missile in limited numbers, to complement the old silo-based liquid-fuel DF-5A. The DF-31 does not appear to have been very successful with only 5–10 launchers deployed, and there are reports that a newer solid-fuel, road-mobile ICBM may be under development (Defense Department, 2013).

Another new development is the Jin-class ballistic missile submarine with the JL-2 SLBM, a significant improvement over the old Xia/JL-1 weapons system, which never became fully operational. It is difficult to understand the role of the small fleet of Jin/JL-2 subs under construction, given the reluctance of the Chinese leadership to allow deployment of nuclear warheads on missiles under normal circumstances. Given the geographical constraints and the superiority of US attack submarines, it will be a challenge for China to operate its missile subs effectively.

There are also unconfirmed rumors that China is adding nuclear capability to ground and air-launched cruise missiles. If so, it would represent an important addition to the Chinese nuclear posture, particularly in light of Beijing's stated adherence to a doctrine of minimum deterrence.

France

France is in the final phase of a comprehensive modernization of its nuclear forces intended to extend the arsenal into the 2050s. Most significant is the deployment during the 2010 to 2018 span of the new M-51 SLBMs on the

Triumphant-class submarines. The new missile has greater range, payload capacity, and accuracy than its predecessor, the M-45. Starting in 2015, the same year the NPT delegates meet in New York for the NPT Review Conference, the current TN75 warhead will be replaced with the new TNO (*Tête Nucléaire Océanique*) warhead.

The modernization of the sea-based leg of the arsenal follows the completion in 2011 of the replacement of the ASMP (*Air-Sol Moyenne Portée*) air-launched cruise missile, which has a range of 300 kilometers, with the new ASMPA (*Air-Sol Moyenne Portée Amélioré*), which has a range of 500 kilometers. The missile has been integrated onto two fighter-bomber squadrons—on Mirage 2000N K3 aircraft at Istres on the Mediterranean coast and Rafale F3 aircraft at Saint Dizier northeast of Paris. Eventually, the Istre wing will also be upgraded to Rafale, and a naval version of the Rafale deployed on the Charles de Gaulle aircraft carrier has also been quipped with the ASMPA. The missile carries the new TNA (*Tête Nucléaire Aéroportée*) warhead.

The United Kingdom

The United Kingdom is planning to build a new class of three to four ballistic missile submarines, scheduled to replace the current class of four Vanguard-class subs. The current stockpile of approximately 225 British nuclear weapons is scheduled to decline to about 180 by the mid-2020s.

The UK leases its Trident II D5 SLBMs from the United States. These missiles are currently being equipped with the W76-1/Mk4A, a life-extended version of the existing warhead that has increased targeting capabilities. The W76-1

is believed to have been modified by UK warhead designers for use on UK missiles.

Pakistan

Pakistan has, for its size, the world's most quickly expanding nuclear arsenal. New systems under development include the Shaheen II medium-range ballistic missile, Ra'ad air-launched cruise missile, Babur ground-launched cruise missile, and Nasr short-range rocket. Infrastructure upgrades include third and fourth plutonium production reactors and upgrades of uranium-enrichment and spent-fuel-reprocessing facilities. Pakistan's current arsenal is estimated at around 120 weapons.

The Shaheen II missile has been under development for a long time, but its slow introduction might be a sign of technical difficulties in the road-mobile, solid-fuel, medium-range ballistic missile. But although India has embarked on a ballistic missile submarine program, there is—so far—no indication that Pakistan is following the same course. There are rumors that the Babur cruise missile will be deployed in a sea-based version, but there is no confirmation of this.

The most significant new development in the Pakistani nuclear arsenal is the development of the Nasr short-range missile, whose estimated range of 60 kilometers makes it a tactical weapon system. The weapon appears intended for potential sub-strategic use in the early phases of a military conflict.

India

Pakistan's primary nuclear adversary, India, is entering an important new phase of its nuclear modernization program with development of longer-range

missiles focused on targeting China. Moreover, India has launched its first ballistic missile submarine that is expected to begin sea trials later this year, perhaps to be followed by two to four additional boats with a new 700-kilometer-range SLBM. A longer-range SLBM is also under development.

India's nuclear weapons production complex is undergoing important upgrades, including construction of a new plutonium production reactor as well as un-safeguarded fast breeder reactors that can increase India's stockpile of weapon-grade plutonium. India's un-safeguarded reprocessing facilities are also being upgraded.

Israel

The Israeli nuclear arsenal appears to be relatively steady in size but is also rumored to be undergoing modernization. One rumor concerns an upgrade of the land-based ballistic missile force, from the current Jericho-II to a longer-range Jericho-III missile, which is based on the Shavit space launch vehicle.

There are also persistent rumors that Israel may have converted a cruise missile to nuclear capability for its new Dolphin-class attack submarines. The rumors have focused on the Popeye Turbo or Harpoon missiles, but it remains unclear what the status of the weapon is.

North Korea

Little is known about the nuclear capability of North Korea's military forces. Potential nuclear-capable missiles include the Scud C and Nodong (Rodong) short-range missiles, the Musudan medium-range missile, and the Hwasong-13 (KH-08) and Taepo Dong long-

range missiles. The KH-08 and Musudan have yet to be test-flown; the Taepo Dong has been successfully flown only as a space launch vehicle. Although the country has conducted three nuclear tests, there is no authoritative public information that North Korea has yet test-flown a re-entry vehicle intended to deliver a nuclear warhead.

NATO

Although NATO itself is not building nuclear weapons, its Strategic Concept from 2010 and Deterrence and Defense Posture Review from 2012 reaffirm that NATO is a nuclear alliance that will continue to rely on nuclear weapons for as long as nuclear weapons exist. Moreover, some non-nuclear weapon states are heavily involved in detailed nuclear planning and even equip their national aircraft to deliver US nuclear weapons.

Approximately 180 U. nuclear B61 bombs are currently deployed at six bases in five European countries. These weapons are all slated to be returned to the United States and upgraded to the new B61-12 guided standoff nuclear weapon. The first new B61-12 is scheduled to be deployed in Europe around 2020 and will be back-fitted onto existing F-15E, F-16, and Tornado NATO aircraft. From around 2024, nuclear-capable F-35A stealthy fighter-bombers will start arriving in Europe and gradually take over the nuclear strike role from the F-16 and Tornado aircraft.

About half of the bombs in Europe are earmarked for delivery by the national aircraft of five non-nuclear-weapon states: Belgium, Germany, Italy, the Netherlands, and Turkey. All of these non-nuclear weapon states are parties to the NPT and therefore obliged "not

to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly, or indirectly.” In peacetime the weapons at the national bases are under the control of a US Air Force munitions support squadron, but in wartime the United States would hand over control of the weapons to the national pilots who would deliver the weapons and at that moment effectively violate the NPT.

The combination of a B61-12 guided standoff nuclear bomb and an F-35A fifth-generation stealthy fighter-bomber will significantly enhance the military capability of NATO’s nuclear posture in Europe.³ The upgrade contradicts the Obama administration’s pledge that life extension programs “will not . . . provide for new military capabilities” (Defense Department, 2010: xiv) and NATO’s conclusion that “the Alliance’s nuclear force posture currently meets the criteria for an effective deterrence and defence posture” (NATO, 2012). Neither the administration nor NATO has officially addressed this contradiction, but officials privately insist, incorrectly, that the B61-12 will not add military capabilities to NATO’s nuclear posture in Europe. Some NATO countries scheduled to receive the B61-12 have recently begun to ask questions about the B61-12 program via diplomatic channels.

The extension and modernization of the US nuclear deployment in Europe competes with increasingly scarce resources needed for more important conventional forces and operations. Conventional forces would be much more credible than tactical nuclear weapons in providing security assurance to eastern NATO allies.

Upshot of the slowing reductions and new weapon upgrades

The Nuclear Non-Proliferation Treaty community is facing a dilemma. After decades of reductions from Cold War nuclear warhead levels, that trend appears to be slowing, and all the nuclear-armed states are busy modernizing their remaining nuclear arsenals for the long haul. There is no indication that any of the nuclear-armed states are planning to give up nuclear weapons in the foreseeable future. On the contrary, all speak of the continued importance of nuclear weapons to national and international security.

Economic crises and budget cuts have forced some delays and restructuring of nuclear weapons modernization programs. But all the nuclear-armed states appear committed to spending at least hundreds of billions of dollars over the next decade on modernizing their nuclear forces.

After decades of focusing on reducing nuclear arsenals, how is the NPT community going to deal with the slowing of nuclear reductions and the apparent determination of all the nuclear-armed states to modernize their nuclear forces for the long haul?

Slowing of reductions and open-ended nuclear modernizations appear to contradict the promises made by the five NPT nuclear-weapon states nearly five decades ago to “pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament”—promises that have been reaffirmed every five years at the NPT review conferences.

The NPT does not explicitly place limitations on modernizations and has accepted them in the past. But with the

generational modernizations currently underway or planned, the 2015 Review Conference will have to address whether extending the nuclear arsenals in perpetuity is consistent with the obligations under NPT's Article VI and the overall purpose of the treaty.

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Notes

1. For an estimate of worldwide inventories of nuclear weapons, see: *Status of Nuclear Forces*, Federation of American Scientists, April 30, 2014. Available at: www.fas.org/programs/ssp/nukes/nuclearweapons/nukestatus.html.
2. The fiscal year 2015 defense budget request delays the design and production of the first interoperable warhead (W78/W88-1) by five years because there are considerable cost and design uncertainties and no urgent aging-related issues affecting the current warheads.
3. For analysis of the implications of the guided tail kit, see Hans M. Kristensen, "B61-12: Increasing NATO Nuclear Capabilities and Prevision Low-Yield Strikes," FAS Strategic Security Blog, June 15, 2011. Available at: <http://blogs.fas.org/security/2011/06/b61-12/>

References

- Congressional Budget Office (2013) Projected Costs of U.S. Nuclear Forces, 2014 to 2023, December 20. Available at: www.cbo.gov/sites/default/files/cbofiles/attachments/12-19-2013-NuclearForces.pdf.
- Defense Department (2010) Nuclear Posture Review Report, Office of the Secretary of Defense. Available at: www.defense.gov/npr/docs/2010%20Nuclear%20Posture%20Review%20Report.pdf.
- Defense Department (2013) Office of the Secretary of Defense, Military and Security Developments Involving the People's Republic of China 2013, Annual Report to Congress.
- Miller J (2011) Principal deputy under secretary of defense for policy, prepared statement before the Senate Committee on Armed Services, Subcommittee on Strategic Forces. May 4.

NATO (2012) Deterrence and Defence Posture Review. Section II.8. Available at: www.nato.int/cps/en/SID-193D7980-4A881D9C/natolive/official_texts_87597.htm.

People's Republic of China (2004) *Fact Sheet: China: Nuclear Disarmament and Reduction of [sic]*, Ministry of Foreign Affairs. April 27, p. 2, Available at: www.fas.org/nuke/guide/china/doctrine/fso42704.pdf.

Wolfsthal JB, Lewis J, and Quint M (2014) *The Trillion Dollar Nuclear Triad: US Strategic Nuclear Modernization Over the Next Thirty Years*. James Martin Center for Nonproliferation Studies. January. Available at: http://cns.miis.edu/trillion_dollar_nuclear_triad/.

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