

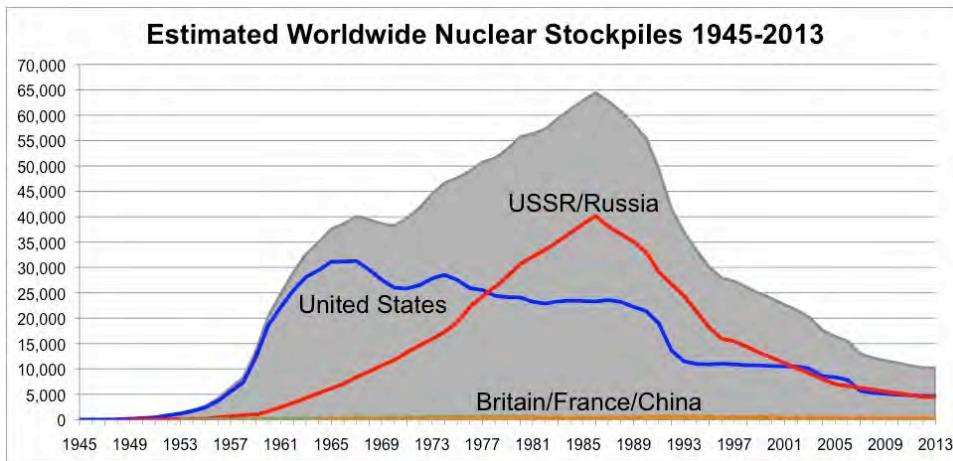
Nuclear Weapon Modernization Programs of Nuclear-Armed States



Hans M. Kristensen
Director, Nuclear Information Project
Federation of American Scientists
Phone: 202-454-4695
Email: hkristensen@fas.org

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Status of nuclear forces



More than 125,000 warheads produced since 1945

Peak of 64,500 stockpiled warheads in 1986 (70,300 if including retired)

- US stockpile peaked early (1967)
- Russian stockpile peaked late (1986)

Enormous progress since 1986 peak:

- ~54,000 warhead stockpile reduction
- ~47,000+ warheads dismantled

Trend: pace of reductions slowing

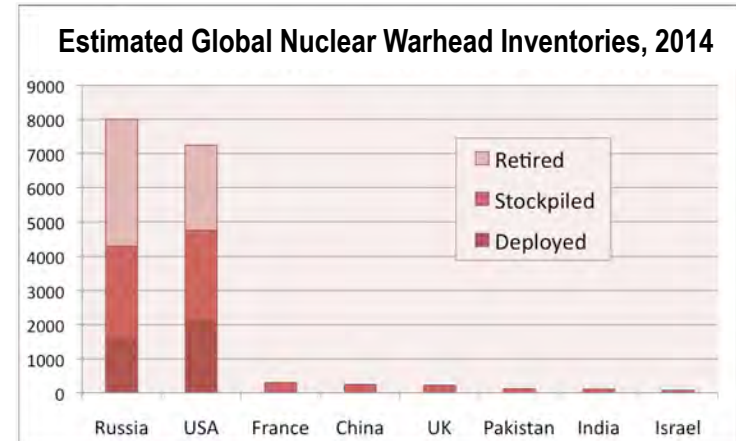
Today: ~ 10,000 warheads in stockpiles (16,000 if counting retired intact warheads awaiting dismantlement)

US and Russia possess 90% of global inventory (94% if counting retired intact warheads): each has 4 times more warheads than rest of world combined; 15 times more than third-largest stockpile (France)

Decreasing: US, Russia, Britain, France

Increasing: China, Pakistan, India

Israel relatively steady; North Korea trying



Modernizations: United States

ICBM

- Minuteman III life-extension fielding
- GBSD replacement ICBM planning
- W78 warhead life-extension/upgrade planning

SSBN / SLBM

- Ohio SSBN life-extension fielding
- Trident II SLBM life-extension planning
- SSBN(X) planning (12)
- W76-1 warhead life-extension fielding
- W88-1 warhead life-extension planning

Bombers

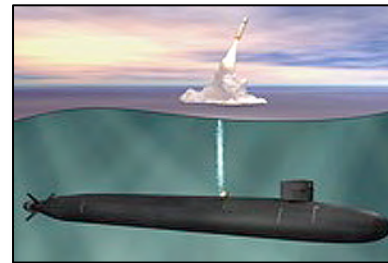
- B-2 upgrade planning
- B-52 upgrade planning
- LRS-B next-generation bomber planning
- B61 bomb life-extension/upgrade planning
- LRSO (ALCM) replacement planning

Tactical

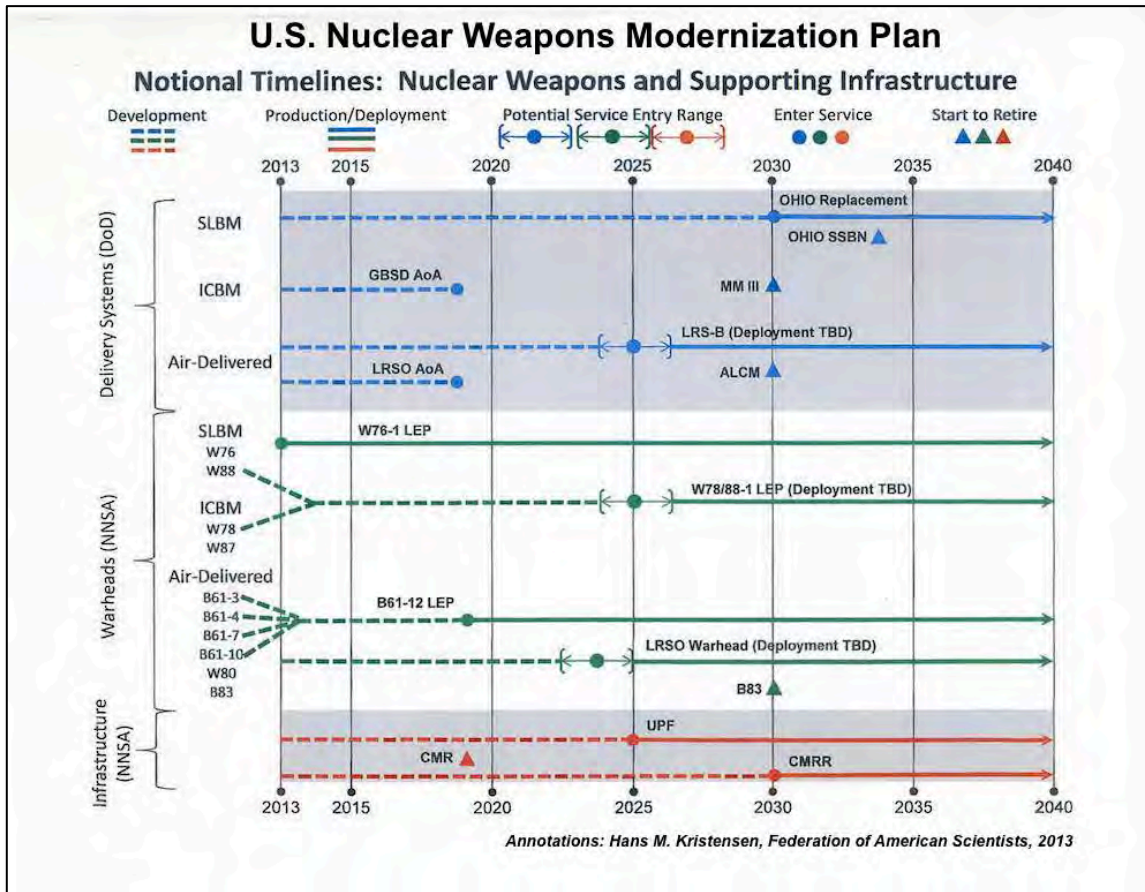
- F-35 nuclear capability planning
- B61 life-extension/upgrade planning

Infrastructure

- Uranium Processing Facility (secondaries) planning
- Plutonium production facility (primaries) planning
- National Ignition Facility planning



Modernizations: United States



Next 10 years:

\$355 billion for maintaining and modernizing nuclear forces and infrastructure

Comprehensive modernization:

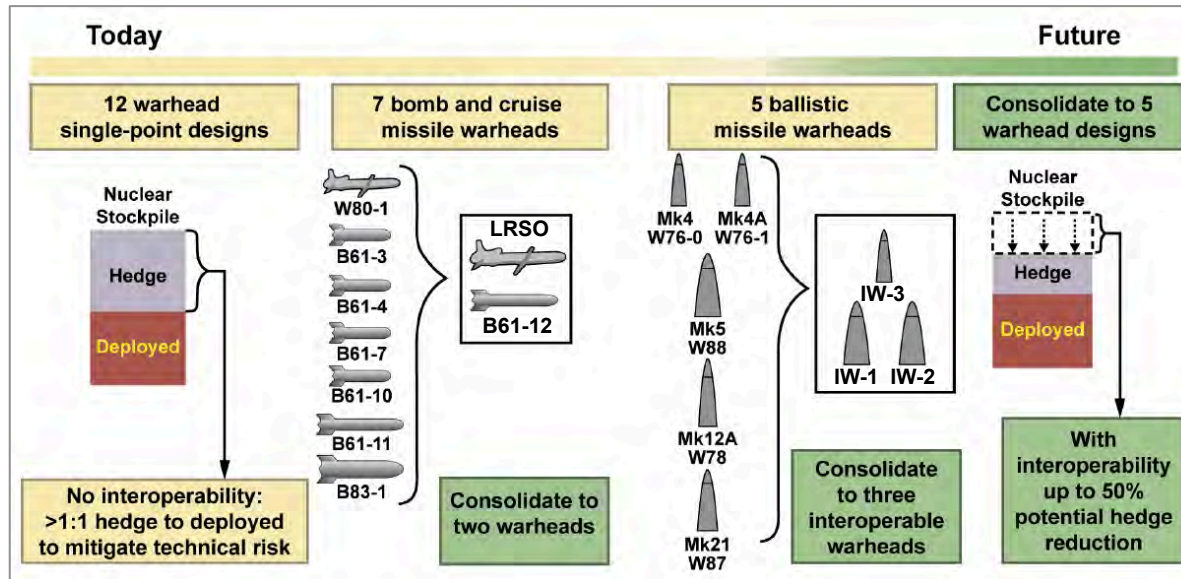
- All three legs of strategic triad
- Tactical dual-capable aircraft
- Warhead production complex

Consolidation and modification of warhead types

Some delays happening; more expected

Extending nuclear deterrent through 2080

Modernizations: United States



Alleged advantages:

- Fewer warhead types permit reduction of hedge
- Modified warheads with increased safety, use control, and performance margin
- Fewer warheads will be cheaper to maintain and deploy

Possible risks:

- Modified warheads further from tested designs; reliability issues?
- Reduced stockpile diversity
- Complex and expensive programs prone to delays and cost overruns
- Modified warheads “new”?
- Costs highly uncertain and estimates probably underrated

Fundamental questions:

- Why is hedging necessary for missile warheads but not bomber weapons?
- Why must US hedge when Britain and France do not?
- Why is “deployed” warheads the same in the future?

3+2 strategy: reduction from 12 warhead versions (8 basic designs) to 5 types:

3 “Interoperable” or “adaptable” warheads on ICBM and SLBM

IW-1 (W78/W88-1), IW-2 (W87/W88-1), IW-3 (W76-1)

2 non-interoperable warheads on bombers and fighters

ALCM (LRSO) with W80-1 or W84

B61-12 guided standoff bomb

Modernizations: NATO

Belgium

- F-16 replacement not yet decided
- B61-12 deployment after 2020

Germany

- Tornado bomber life-extension planning
- B61-12 deployment after 2020

The Netherlands

- F-35 replacement of F-16 planning
- B61-12 deployment after 2020

Italy

- F-35 replacement of Tornado planning
- B61-12 deployment after 2020

Turkey

- F-35 replacement of F-16 planning
- B61-12 deployment after 2020



Modernizations: France

SSBN / SLBM

- M51.1 SLBM (TN75) fielded
- M51.2 SLBM (TNO) deployed from 2015
- M51.3 SLBM planning

Bombers

- Mirage 2000NK3 fielded Istres
- Rafale K3 fielded at Saint-Dizier
- Rafale MK3 fielded on Charles de Gaulle
- ALCM (ASMPA/TNA) fielded

Infrastructure

- Megajoule at CESTA planning
- Airix/Epure hydrodynamic test center at Valduc planning (partly Joint French-UK warhead surveillance testing center)



Modernizations: Britain

SSBN / SLBM

- SSBN (Vanguard replacement) planning (3+)
- SLBM (Trident II D5LE) planning
- Mk4A/W76-1 type warhead fielding

Infrastructure

- Joint UK-French warhead surveillance testing technology center planning



Modernizations: Russia

ICBM

- SS-27 Mod 1 (silo) completed (Tatishchevo: 60) fielded
- SS-27 Mod 1 (mobile) completed (Teykovo: 18) fielded
- SS-27 Mod 2 (mobile: Teykovo (18); Novosibirsk; Irkutsk; Tagil) planning
- SS-27 Mod 2 (silo: Kozelsk; Dombarovsky) planning
- New ICBMs (Sarmat “heavy”; modified SS-27 (RS-26)) planning



SSBN / SLBM

- Delta IV SSBN fielded
- SS-N-23 SLBM life-extension (Sineva/Layner) fielding
- Borei SSBN fielding (8)
- SS-N-32 (Bulava) fielding



Bombers

- Tu-160 (Blackjack) upgrade planning
- Tu-95 (Bear) upgrade planning
- New bomber (PAK PA) planning
- ALCM (Kh-102) fielding?



Tactical

- Tu-22M (Backfire) life-extension
- Su-34 (Fullback) fielding
- Yasen (Sverodvinsk) SSGN planning
- SLCM (SS-N-30, Kaliber) planning
- SSM (SS-26, Iskander) fielding
- SAM (S-400/SA-21) fielding (nuclear ?)
- ABM (A-135) planning





Modernizations: Russia



Novosibirsk: Replacement of SS-25 with SS-27 Mod 2 (RS-24). 2008 image (left) shows old garrison layout with SS-25 TEL garages. 2013 image (right) shows TEL garages removed, upgrade of service buildings, and expansion of fence perimeter. Third of 7 missile divisions to receive SS-27 by mid-2020s.

Modernizations: China

ICBM / MRBM

- DF-31 (CSS-10 Mod 1) mobile ICBM
- DF-31A (CSS-10 Mod 2) mobile ICBM fielding
- DF-21 (CSS-5 Mod 1/2) mobile MRBM fielding
- DF-41 mobile ICBM planning (MIRV)?

SSBN / SLBM

- Jin (Type-094) SSBN fielding (3+)
- Type-096 SSBN planning
- JL-2 (CSS-N-14) SLBM fielding

Cruise Missiles:

- ALCM (CJ-20 on H-6 bomber) planning*
- GLCM (DH-10/CJ-10) fielding**



* Listed in 2013 AFGSC briefing but not in 2013 NASIC report.

** Listed by NASIC as “conventional or nuclear,” the same designation as the Russian nuclear-capable AS-4 Kitchen ALCM.

Modernizations: Pakistan

MRBM / SRBM

- Shaheen II MRBM (Hatf-6) planning
- NASR SRBM (Hatf-9) planning
- Abdali SRBM (Hatf-2) planning*

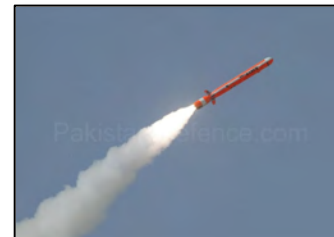
Cruise Missiles

- GLCM (Babur/Hatf-7) planning
- ALCM (Ra'ad/Hatf-8 on Mirage) planning
- SLCM (naval version of Babur) planning?

Infrastructure

- Khushab-IV reactor planning

* Listed by Pakistani ISPR but not by 2013 NASIC report.



Modernizations: India

ICBM / IRBM / MRBM

- Agni VI ICBM planning (MIRV)?
- Agni V ICBM planning
- Agni IV IRBM planning
- Agni III IRBM planning
- Agni II MRBM fielding

SSBN / SLBM

- Arihant SSBN planning (3+)
- Sagarika/K-15 SLBM planning
- Dhanush SLBM planning

Cruise Missiles

- GLCM (Nirbhay) planning*

Infrastructure

- Two plutonium production reactors planning

* Reported by news media but not listed in 2013 NASIC report.



Modernizations: Israel

IRBM

- Jericho III IRBM planning?

SSG / SLBM

- Dolphin SSG fielding
- SLCM (Popeye Turbo/Harpoon) fielding?*

Bomber

- F-35 acquisition?

- Reported by news media but denied by officials. US public intelligence reports omit references to Israeli nuclear forces.



Modernizations: North Korea

ICBM / IRBM / MRBM

- No Dong MRBM planning?
- Musudan IRBM planning?
- Hwasong-13 (KN-08) ICBM planning?
- Taepo Dong 2 SLV/ICBM planning?

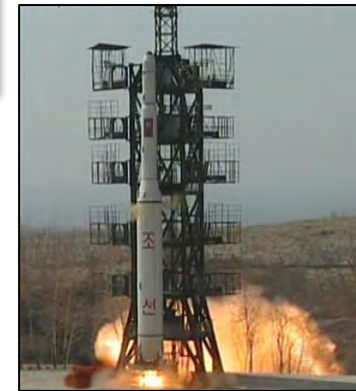
Cruise Missiles

- KN-09 coastal defense cruise missile?*

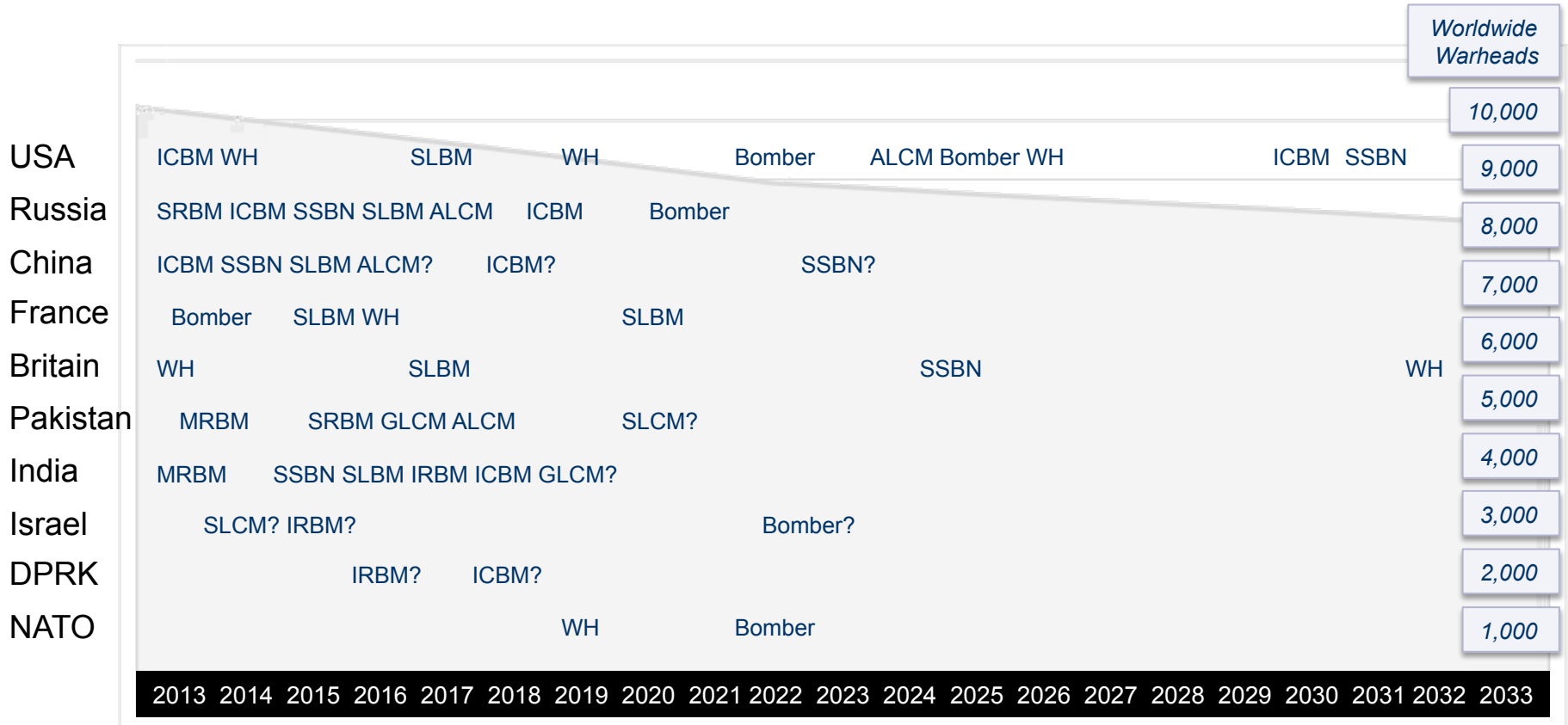
Infrastructure

- Yongbyon plutonium production reactor re-start
- Uranium enrichment production

* Listed by 2013 AFGSC briefing but not in 2013 NASIC report. 2014 update of AFGSC does not list KN-09.



Modernizations: Outlook



Key: ALCM = Air-Launched Cruise Missile; GLCM = Ground-Launched Cruise Missile; ICBM = Intercontinental Ballistic Missile; IRBM = Intermediate Range Ballistic Missile; SLBM = Sea-Launched Ballistic Missile; SLCM = Sea-Launched Cruise Missile; SRBM = Short Range Ballistic Missile; SSBN = Nuclear-Powered Ballistic Missile Submarine; WH = warhead



Conclusions

- Significant reductions in numbers and types of nuclear weapons since Cold War, but pace of reduction is slowing
- All nuclear weapon states have extensive and expensive nuclear weapons modernization programs underway spanning next two decades
- Programs underway include at least: 27 ballistic missiles, 8 warships, 5 bombers, 9 cruise missiles, 8 warheads, 8 factories
- Warhead inventories are decreasing in US, Russia, France and Britain but increasing in China, Pakistan, India and North Korea
- Modernizations drive suspicion, worst-case planning, and nuclear competition
- Modernizations slow or hinder nuclear disarmament efforts
- Continued modernizations contradict NPT Article VI
- Numerical warhead reductions have served primary role until now, but constraints on modernizations are needed to avoid undercutting arms control process