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Nuclear Notebook: Worldwide deployments of nuclear weapons, 2009

As the United States and Russia continue to consolidate their nuclear arsenals, the number of sites in the world that host nuclear weapons also has decreased.

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As of the end of 2009, we estimate that there are approximately 23,360 nuclear weapons located at some 111 sites in 14 countries. Nearly one-half of these weapons are active or operationally deployed.

By far the largest concentrations of nuclear weapons reside in Russia and the United States, which possess 96 percent of the total global inventory (91 percent if you count only *operational* nuclear weapons). (See "Estimated Global Nuclear Weapon Inventories, 2009," p. 87) In addition to the seven other countries with nuclear weapon stockpiles (Britain, China, France, India, Israel, North Korea, and Pakistan), five non-nuclear NATO allies (Belgium, Germany, Italy, the Netherlands, and Turkey) host about 200 U.S. nuclear bombs at six air bases. (For a listing of all the sites worldwide, see "Estimated Worldwide Locations of Nuclear Weapons, 2009," p. 90; it includes sites where there is reason to believe that nuclear weapons are deployed or stored.[1])

The United States. At the end of the Cold War, the United States maintained thousands of nuclear weapons outside of its borders on land and on the high seas.[2] Ever since, however, Washington has significantly consolidated its arsenal—a trend that is likely to continue. For example, the single remaining nuclear weapons storage facility in Germany is in stark contrast to the estimated 75 distinct nuclear weapons storage facilities that were located there in the mid-1980s. Today, U.S. weapons are stored at a total of 21 locations in 13 states and 5 European countries.

Russia. We estimate that Russia stores nuclear weapons permanently at 48 domestic locations, a dramatic reduction compared to the roughly 500 storage facilities it used before the breakup of

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ESTIMATED GLOBAL NUCLEAR WEAPONS INVENTORIES, 2009

Russia	13,000*
United States	9,400**
France	300
China	240
Britain	180
Israel	80–100
Pakistan	70–90
India	60–80
North Korea	?
TOTAL	**~23,360**

* Approximately 4,850 of the Russian warheads are operational or active. The status of the other 8,150 warheads is unclear. Some portion may be in reserve with the balance retired and awaiting dismantlement.

** Approximately 5,200 of the U.S. warheads are in the military stockpile (about 2,700 deployed); 4,200 retired warheads are awaiting dismantlement.

the Soviet Union in 1991. The Soviet Union's collapse and the end of the Cold War triggered a withdrawal of Soviet nuclear weapons from forward locations in Eastern Europe, Belarus, Kazakhstan, and Ukraine. In all, Moscow consolidated to less than 250 sites by the mid-1990s, fewer than 100 sites by 1997, and about 90 sites by 1998.[3] Since then, additional consolidation has taken place because of (1) the declared completion of the movement of all nonstrategic warheads to central storage locations by 2002; (2) consolidation of warhead production at two facilities; and (3) additional strategic force reductions under the Moscow Treaty.[4] (Russia provides information about the location of deployed strategic nuclear weapons accountable under the 1991 START treaty. The locations of other categories of nuclear weapons and their warheads, however, are not disclosed.)

Many sites that once stored weapons are still maintained because a nearby base—such as bases for Tu-22M Backfire and Su-24 Fencer bombers or Il-38 anti-submarine aircraft—continues to have a nuclear strike mission. The Russian Black Sea Fleet based in Ukraine also has a nuclear capability, but the weapons probably have been withdrawn to central storage in Russia. If the fleet relocates to Novorossiysk when the lease of the Sevastopol area expires in 2017, a nuclear weapons storage facility might be built there as well.

Russian permanent nuclear weapon storage locations fall into three main categories: operational warheads at Strategic Rocket Force, air force, and navy bases; reserve/retired warheads at national-level storage sites; and warheads at assembly/disassembly factories.[5]

One uncertainty when counting Russian nuclear weapons storage

sites is whether the number includes overall sites or individual storage facilities co-located within a site. For example, the Defense Department's Threat Reduction Program statement in 2000 indicated that Russia had 123 nuclear weapons storage locations where it has requested security assistance, apparently counting separately fenced areas within large national storage facilities. As a result, a large storage site with eight separately fenced areas would have been counted as eight sites instead of one.[6] Using similar counting methods, the National Nuclear Security Administration recently listed 73 Russian warhead sites, including 39 navy sites, 25 Strategic Rocket Force sites (on 11 bases), and nine 12th Main Directorate sites.[7] Our best estimate is 48 permanent nuclear weapons storage sites, many of which include several individually fenced storage bunkers.

Britain and France. London and Paris have reduced the size of their arsenals and limited where their weapons are deployed. Britain only has one type of nuclear weapon, the Trident II submarine-launched ballistic missile (SLBM), since nuclear-powered ballistic submarines located at two facilities in Scotland. Facilities that previously housed navy strike and depth bombs and air force bombs have been closed. France has retained two types of nuclear weapons: SLBMs at a submarine base in Bretagne and air-to-surface missiles for aircraft located at three air force bases and one naval base.

China, Pakistan, and India. Beijing, Islamabad, and New Delhi are quantitatively and qualitatively increasing their arsenals and deploying weapons at more sites, yet the locations are difficult to pinpoint. Thus, we have used commercial satellite images, expert studies, and local news reports and articles to make the assumption that nuclear weapons are likely to be at, or near, wherever nuclear-capable weapon systems are deployed. Since all three countries are expanding their arsenals, new bases and storage sites probably are under construction.

None of China's nuclear warheads are thought to be mated with their delivery vehicles. Instead, it is believed that they are kept in storage facilities controlled by the Central Military Commission. For reasons related to survivability and readiness, we assume regional storage sites exist near each of the six major base units that operate nuclear missile brigades and that additional warheads are in central storage. Whether storage sites exist at the two missile submarine bases is unknown, but we assume they might, for a total of 8-14 storage sites. (It is probably closer to the lower number, which would include six regional sites, one central site, and two industry sites; some storage for submarine and bomber weapons seems plausible, although co-location might occur.)

In the case of Pakistan and India, we have found no credible in-

formation that identifies where nuclear weapons are produced or stored. Neither country's nuclear weapons are believed to be fully operational under normal circumstances. It is thought that they are stored in central storage locations rather than on bases with operational forces. We estimate that each country has about half a dozen storage sites.

Israel and North Korea. Israel is a wild card because of the opacity of its nuclear weapons program. In other words, it's difficult to know whether or not there are any changes in its nuclear arsenal. If so, they seem to be modest and probably rely on existing facilities. Either way, Israel's nuclear weapons are not believed to be fully operational under normal circumstances.

We are not aware of credible information on how North Korea has weaponized its nuclear weapons capability, much less where those weapons are stored. We also take note that a recent U.S. Air Force intelligence report did not list any of North Korea's ballistic missiles as nuclear-capable.[8] ■

ESTIMATED WORLDWIDE LOCATIONS OF NUCLEAR WEAPONS, 2009

COUNTRY	LOCATION	REGION	WEAPON SYSTEM	REMARKS
BELGIUM	Kleine Brogel Air Base	Limburg	B61-3/4	U.S. bombs for delivery by Belgian F-16s of the 10th Fighter Wing. Weapons in custody of U.S. 701st Munitions Support Squadron.
SUBTOTAL	**1**			
CHINA[9]	Baoji area	Shaanxi	Various	Regional warhead storage site.
	Danyang Air Base area	Hubei	Bombs	For H-6 bombers. Potential weapons storage facility for nuclear bombs 10 kilometers northwest of base.[10]
	Huaihua area	Hunan	DF-4 SSMs	Regional warhead storage site for 803, 805, and 814 Missile Brigades subordinate to 55 Base headquarters.
	Huangshan area	Anhui	DF-3A/DF-21 SSMs	Regional warhead storage site for 807, 811, 815, and 817 Missile Brigades subordinate to 52 Base headquarters.
	Kunming area	Yunnan	DF-3A/DF-21 SSMs	Regional warhead storage site for 802 and 808 Missile Brigades subordinate to 53 Base headquarters.
	Jianggezhuang Naval Base area	Shandong	JL-1 SLBMs	Possible warhead storage site.
	Luoyang area	Henan	DF-4/DF-5A and possibly DF-31 SSMs	Regional warhead storage site for 801, 804, and 813 Missile Brigades subordinate to 54 Base headquarters.
	Mianyang	Sichuan	Various	Warhead design. Chinese Academy of Engineering Physics.
	Pingtung area	Sichuan	Various	Nuclear weapons fabrication. Possible underground storage site deep in the mountains near Mianyang and Institute of Materials.
	Shenyang area	Liaoning	DF-3A/DF-21 SSMs	Regional storage site for 806, 810, 816, and 818 Missile Brigades subordinate to 51 Base headquarters.
	Xining area	Qinghai	DF-3A/DF-4/DF-21 SSMs	Regional storage site for 806, 809, and 812 Missile Brigades subordinate to 56 Base headquarters.
	Yidu area	Shandong	DF-21	Possible warhead storage site.
	Yulin Naval Base area	Hainan	JL-2 SLBMs	Possible warhead storage site.
	Zitong	Sichuan	Various	Warhead assembly, disassembly, and dismantlement. Possibly China's "Pantex Plant."[11]
SUBTOTAL	**8-14**			
FRANCE	Île Longue Naval Base	Bretagne	M45 (M51) SLBMs	TN75 warheads on Le Triomphant-class SSBNs. Next year, it will store new TNO warheads for new M51 SLBMs.
	Istres Air Base	Provence	ASMP (ASMP-A)	TN81 warheads for Mirage 2000N. Next year, it will store new TNO warheads for the new M51 SLBMs.
	Lery	Bourgogne, 25 kilometers north of Dijon	TN75, TN81, TNA, TNO	Centre d'Études de Valduc. Warhead assembly, disassembly, and dismantlement.

ESTIMATED WORLDWIDE LOCATIONS OF NUCLEAR WEAPONS, 2009

COUNTRY	LOCATION	REGION	WEAPON SYSTEM	REMARKS
FRANCE (CONT.)	Luxeuil-les-Bains Air Base	Franche-Comté	ASMP (ASMP-A)	TN81 warheads for Mirage 2000N. Next year, it will store new TNO warheads for new M51 SLBMs.
	Saint-Dizier Air Base	Champagne-Ardenne	ASMP-A	Deployment of ASMP-A for Rafale K3 begins this year.
	Toulon Naval Base or vicinity	Côte d'Azur	ASMP (ASMP-A)	TN81 warheads for Super Étendard on *Charles de Gaulle* aircraft carrier. Starting in 2011, it will store TNA warheads on ASMP-As for the Rafale MK3. An alternative location might be Istres Air Base.
	West of Saint-Jean, south of Île Longue	Bretagne	TN75 (TNO)	Warhead storage site for M45 SLBMs at nearby SSBN base. Next year, it will store new TNO warheads for new M51 SLBMs.
SUBTOTAL	**7**			
GERMANY	Büchel Air Base	Rheinland-Pfalz	B61-3/4	U.S. bombs for delivery by German PA-200 Tornados of the 33rd Fighter-Bomber Wing. Weapons in custody of U.S. 702nd Munitions Support Squadron.
SUBTOTAL	**1**			
INDIA	Chandighar Plant	Punjab	Various	Possible warhead production.
	Jodhpur Storage Facility	Rajasthan	Prithvi/Agni SSMs	Potential underground storage facility for Prithvi and/or Agni missile launchers.
	Unknown air force facility	Unknown	Bombs	For possible use by Jaguar IS at Gorakhpur and Lohegaon Air Bases and Mirage 2000H at Ambala and Gwalior Air Bases.
	Unknown army facility[12]	Unknown	Prithvi/Agni SSMs	For use by 222nd and 333rd Missile Groups (Prithvi), and 334th and 335th Missile Groups (Agni).
	Unknown navy facility	Unknown	Dhanush SSMs	For Dhanush ship-launched SSMs.[13]
SUBTOTAL	**5**			
ITALY	Aviano Air Base	Friuli-Venezia Giulia	B61-3/4	U.S. bombs for delivery by U.S. F-16s of the 31st Fighter Wing. Weapons in custody of U.S. 704th Munitions Support Squadron.
	Ghedi Torre Air Base	Lombardia	B61-3/4	U.S. bombs for delivery by Italian PA-200 Tornados of the 6th Fighter Wing. Weapons in custody of U.S. 704th Munitions Support Squadron.
SUBTOTAL	**2**			
ISRAEL[14]	Dimona	Negev Desert	Various	Negev Nuclear Research Center. Plutonium, tritium, and warhead production.
	Four kilometers south of Palmachim	Central Israel	Various	Soreq Nuclear Research Center. Possible site of warhead design and fabrication.
	Sdot Micha Air Base and/or Tirosh Depot	Central Israel	Jericho II SSMs	Warheads for approximately 50 MRBMs in caves.
	Tel Nof Air Base	Several miles southeast of Tel Aviv	Bombs	Bombs for F-16Is possibly in adjacent weapon storage areas northwest or southeast of base.
SUBTOTAL	**4**			

ESTIMATED WORLDWIDE LOCATIONS OF NUCLEAR WEAPONS, 2009

COUNTRY	LOCATION	REGION	WEAPON SYSTEM	REMARKS
NETHERLANDS	Volkel Air Base	Noord-Brabant	B61-3/4	U.S. bombs for delivery by Dutch F-16s of the 1st Fighter Wing. Weapons in custody of U.S. 703rd Munitions Support Squadron.
SUBTOTAL	**1**			
PAKISTAN	Fatehjang National Defense Complex	Punjab	SSMs	Missile development and potential warhead storage capability.
	Masroor Weapons Depot	Sindh	Various	Possible storage of bombs for Mirage Vs at Masroor Air Base and/or warheads for SSMs.
	Sargodha Weapons Depot	Punjab	Various	Possible storage site of bombs for F-16s at nearby Sargodha Air Base and warheads for SSMs.[15]
	Shanka Dara Missile Complex	Punjab	SSMs	Missile development and potential warhead storage capability.
	Three kilometers north of Quetta Air Base	Balochistan	Bombs	Possible storage site with underground facilities in high-security weapons storage area.
	Wah Ordnance Facility	Punjab	Various	Possible warhead production, disassembly, and dismantlement facility.[16]
	Unknown air force facility	Unknown	Bombs	Central air force storage facility with bombs for F-16s at Sargodha Air Base and Mirage Vs at Kamra Air Base.
	Unknown army facility	Unknown	SSMs/GLCMs	Central army storage facility with warheads for SSMs and Babur cruise missiles.
SUBTOTAL	**8**			
RUSSIA[17]	Barnaul Missile Division	Altai Krai	SS-25 ICBMs	Warheads for 36 ICBMs.
	Belaya Air Base	Irkutsk	AS-4 ASMs, bombs	For Tu-22M3 Backfire bombers. Weapons possibly stored in remote weapons storage area west of base.
	Borisoglebsk (Voronezh-45)	Voronezh	Various	National-level weapons storage site.
	Chazma (Abrek) Bay SLBM Storage Facility	Primorsky	SLBMs/SLCMs/ ASWs	Possible storage site of warheads for SLBMs and other naval weapons. Located near Yuzhnorechensk.
	Chebsara (Vologda-20)	Vologda	Various	National-level weapons storage site.
	Dodonovo (Krasnoyarsk-26, sometimes referred to as Shivera)	Krasnoyarsk	Various	National-level weapons storage site.
	Dombarovskiy-Yasnyy Missile Division	Orenburg	SS-18 ICBMs	Warheads for 31 ICBMs.
	Engels Air Base	Saratov	AS-15 ASMs, bombs	For Tu-160 Blackjack and Tu-95 Bear bombers. Possible weapons storage area south of base.
	Golovchino (Belgorod-22)	Belgorod	Various	National-level weapons storage site.
	Irkutsk Missile Division	Irkutsk	SS-25 ICBMs	Warheads for 27 ICBMs.

ESTIMATED WORLDWIDE LOCATIONS OF NUCLEAR WEAPONS, 2009

COUNTRY	LOCATION	REGION	WEAPON SYSTEM	REMARKS
RUSSIA (CONT.)	Karabask (Chelyabinsk-115)	Chelyabinsk	Various	Possible national-level weapons storage site for adjacent Chelyabinsk-70.
	Korfovskiy (Khabarovsk-47)	Khabarovsk	Various	National-level weapons storage site.
	Korolev area	Moscow	Gazelle ABMs	Warheads for 12 interceptors.
	Kozelsk Missile Division	Kaluga	SS-19 ICBMs	Warheads for 29 ICBMs.
	Krasnoarmeyskoye (Saratov-63)	Saratov	Various	National-level weapons storage site.[18]
	Lakhta-Kholm Air Base	Arkhangelsk	AS-4 ASMs, bombs	For Tu-22M3 Backfire bombers. Possible weapons storage area south of base.
	Lesnoy (Sverdlovsk-16/45)	Sverdlovsk	Various	One of Russia's two warhead production plants. National-level weapons storage site about 8 kilometers west of the plant. Located near Nizhnyaya Tura.
	Lytkarino area	Moscow	Gazelle ABMs	Warheads for 16 interceptors.
	Mongokhto (Alekseyevka) Air Base	Khabarovsk	AS-4 ASMs, bombs	For Tu-22M3 Backfire bombers. Possible weapons storage area south of base.
	Mozhaysk-10	Moscow	Various	National-level weapons storage site.
	Nerpichya Weapons Storage Facility	Kola	Various	Potential storage facility for naval weapons, including for nearby Bolshaya Lopatka Naval Base.
	Nizhniy Tagil Missile Division	Sverdlovsk	SS-25 ICBMs	Warheads for 27 ICBMs.
	Novosibirsk Missile Division	Novosibirsk	SS-25 ICBMs	Warheads for 36 ICBMs.
	Okolnaya Storage Facility	Kola	SLBMs	Possible storage facility for SLBMs and other naval weapons.
	Olenegorsk Storage Facility	Kola	Various	Possibly two national-level storage sites, Olenegorsk-2 near Ramozero and Olenegorsk-8 near Vysokiy.
	Rybachiy Naval Base	Kamchatka	SS-N-18 SLBMs	Warheads on SS-N-18s onboard Delta III-class SSBNs.
	Rzhanitsa (Bryansk-18)	Bryansk	Various	National-level weapons storage site.
	Sarov (Arzamas-16)	Nizhni Novgorod	Various	Former Soviet "Los Alamos." Possible limited warhead storage, but assembly and dismantlement reportedly ended in 2003.
	Sebezh-5	Pskov	Various	National-level weapons storage site.
	Selikhino (Komsomolsk-31)	Khabarovsk	Various	National-level weapons storage site.
	Shaykovka Air Base	Kaluga	AS-4 ASMs, bombs	For Tu-22M3 Backfire bombers. Weapons storage area northeast of base, the safety perimeter of which appears to have been upgraded sometime prior to May 2007.
	Skhodnya area	Moscow	Gazelle ABMs	Warheads for 16 interceptors.
	Snezhinsk (Chelyabinsk-70)	Chelyabinsk	Various	Nuclear warhead design laboratory and national-level weapons storage site. Located near Voskresenskoye.

ESTIMATED WORLDWIDE LOCATIONS OF NUCLEAR WEAPONS, 2009

COUNTRY	LOCATION	REGION	WEAPON SYSTEM	REMARKS
RUSSIA (CONT.)	Sofrino area	Moscow	Gazelle ABMs	Warheads for 12 interceptors.
	Soltsy Air Base	Novgorod	AS-4 ASMs, bombs	For Tu-22M3 Backfire bombers. Possible weapons storage area north of base.
	Tatishchevo Missile Division	Saratov	SS-19, SS-27 ICBMs	Warheads for 90 ICBMs.
	Teykovo Missile Division	Ivanovo	SS-25, SS-27 ICBMs	Warheads for 18 ICBMs.
	Trekhgorny (Zlatoust-36)	Chelyabinsk	Various	One of Russia's two warhead production plants. Located near Yuryuzan.
	Ukrainka Air Base	Amur	AS-15 ASMs, bombs	For Tu-95 Bear bombers. Possible weapons storage area east of base.
	Uzhur Missile Division	Krasnoyarsk	SS-18 ICBMs	Warheads for 28 ICBMs.
	Vidyaevo Naval Base	Kola	Various	Warheads for naval forces in central storage.
	Vilyuchinsk Storage Facility	Kamchatka	SLBMs	Warheads for SS-N-18 SLBMs and possibly other naval weapons.
	Vnukovo area	Moscow	Gazelle ABMs	Warheads for 12 interceptors.
	Vozdvizhenka Air Base	Primorsky	AS-4 ASMs, bombs	For Tu-22M3 Backfire bombers. Possible weapons storage area north of base.
	Vypolzovo Missile Division	Novogorod/Tver	SS-25 ICBMs	Warheads for 18 ICBMs.
	Yagelnaya Naval Base	Kola	SS-N-23 SLBMs	Warheads on SLBMs on Delta IV-class SSBNs. Possible weapons storage area near base. Might also store other naval weapons.
	Yoshkar-Ola Missile Division	Mari El	SS-25 ICBMs	Warheads for 27 ICBMs.
	Zalari (Irkutsk-45)	Transbaikal	Various	National-level warhead storage site.
SUBTOTAL	**48**[19]			
TURKEY	Incirlik Air Base	Adana	B61-3/4	U.S. bombs for delivery by rotational F-16s from other U.S. bases. Turkey doesn't permit permanent deployment of U.S. F-16 squadrons.
SUBTOTAL	**1**			
BRITAIN	Aldermaston Atomic Weapons Establishment	England	British Trident System	Warhead design. Possibly a few warheads present.
	Burghfield Atomic Weapons Establishment	England	British Trident System	Warhead assembly, disassembly, and dismantlement.
	Coulport Royal Navy Ammunition Depot	Scotland	British Trident System	National-level warhead storage site.
	Faslane Royal Navy Base	Scotland	Warheads and Trident II D5 SLBMs	On deployed Vanguard-class SSBNs.
SUBTOTAL	**4**			

ESTIMATED WORLDWIDE LOCATIONS OF NUCLEAR WEAPONS, 2009

COUNTRY	LOCATION	REGION	WEAPON SYSTEM	REMARKS
UNITED STATES	Bangor (Kitsap) Naval Submarine Base	Washington	W76, W76-1, W88, Trident II D5 SLBMs	On deployed Ohio-class SSBNs.
	Barksdale Air Force Base	Louisiana	B61-7, B83-1, W80-1/ALCMs	For B-52Hs of the 2nd Bomb Wing.
	Kings Bay Naval Submarine Base	Georgia	W76, W76-1, W88, Trident II D5 SLBM	On deployed Ohio-class SSBNs.
	Kirtland Air Force Base	New Mexico	B61, W62, W80, B83, W78, W87	National-level air force warhead storage site. The underground weapons storage facility might also store naval warheads.
	Lawrence Livermore National Laboratory	California	W62, W83, W87	Warhead design, surveillance, and maintenance.
	Los Alamos National Laboratory	New Mexico	B61, W76, W78, W80, W88	Warhead design, surveillance, and maintenance.
	Malmstrom Air Force Base and Missile Field	Montana	W62, W78, W87	Warheads for 150 Minuteman III ICBMs. The W62 is scheduled to be retired this year.
	Minot Air Force Base and Missile Field	North Dakota	B61-7, W62, W78, B83-1, W87	Warheads for 150 Minuteman III ICBMs and bombs for B-52Hs of the 5th Bomb Wing. The W62 is scheduled to be retired this year.
	Nellis Air Force Base	Nevada	B61, W62, W80, B83, W78, W87	National-level air force warhead storage site (might also store some naval warheads). The military's largest above-ground weapons storage area and one of the largest concentrations of nuclear weapons in the world.
	Pantex Plant	Texas	Various	Assembly, disassembly, and dismantlement of all warhead types.
	Seymour-Johnson Air Force Base	North Carolina	B61-3/4	For F-15Es of the 4th Fighter Wing.
	Strategic Weapons Facility Atlantic (Kings Bay)	Georgia	W80-0/TLAM-N, W76, W76-1, W88, Trident II D5 SLBMs	National-level navy warhead storage site.
	Strategic Weapons Facility Pacific (Bangor)	Washington	W80-0/TLAM-N, W76, W76-1, W88, Trident II D5 SLBMs	National-level navy warhead storage site.
	Warren Air Force Base and Missile Field	Colorado, Nebraska, Wyoming	W62, W78, W87	Warheads for 150 Minuteman III ICBMs. The W62 is scheduled to be retired this year.
	Whiteman Air Force Base	Missouri	B61-7/11, B83-1	For B-2s of the 509th Bomb Wing.
SUBTOTAL	**15**			
TOTAL	**111**			

Abbreviations: (ABM) antiballistic missile; (ALCM) air-launched cruise missile; (ASM) air-to-surface missile; (ASW) anti-submarine warfare; (GLCM) ground-launched cruise missile; (ICBM) intercontinental ballistic missile; (MRBM) medium-range ballistic missile; (SAM) surface-to-air missile; (SLBM) submarine-launched ballistic missile; (SLCM) sea-launched cruise missile; (SRBM) short-range ballistic missile; (SSBN) nuclear-powered ballistic missile submarine; (SSM) surface-to-surface missile; (TLAM/N) Tomahawk land-attack missile/nuclear.

NOTES

1. Valuable open-source reference material for estimated deployments of nuclear weapons include: William M. Arkin and Richard Fieldhouse, *Nuclear Battlefields: Global Links in the Arms Race* (Harper Collins, 1985); William M. Arkin et al., *Taking Stock: Worldwide Nuclear Deployments 1998* (Natural Resources Defense Council, 1998); Thomas B. Cochran et al., *The U.S. Nuclear War Plan: A Time for Change* (Natural Resources Defense Council, 2001); Joseph Cirincione et al., *Deadly Arsenals: Nuclear, Biological, and Chemical Threats* (Carnegie Endowment for International Peace, 2005); *SIPRI Yearbook*, various issues; and the Monterey Institute for International Studies open-source research database on the Nuclear Threat Initiative website available at http://www.nti.org/e_research/profiles/index.html.

2. For the period of 1951–1977, see Robert S. Norris, William M. Arkin, and William Burr, "Where They Were," *Bulletin of the Atomic Scientists*, November/December 1999, pp. 26–35, 66–67, and "How Much Did Japan Know?" *Bulletin of the Atomic Scientists*, January/February 2000, pp. 11–13, 78–79.

3. Defense Department, "Proliferation: Threat and Response," November 1997 (sheet 54 of web version); *Taking Stock: Worldwide Nuclear Deployments 1998*, pp. 33, 81–87. According to *Securing the Bomb 2008* by Matthew Bunn (Project on Managing the Atom, November 2008), "The total number of warhead sites in Russia is not publicly known, but appears to be in the range of 110–130, including both permanent and temporary sites, but not counting the front-line tactical sites that may no longer have warheads day-to-day." In Charles L. Thornton's December 2003 presentation, "U.S. Efforts to Secure Russia's Nuclear Warheads: Background and Issues," before the Russian-American Nuclear Security Advisory Council, he estimated a total of 150–210 sites of which 110–150 were permanent storage sites.

4. In 2002, the Russian government announced, "All nonstrategic nuclear munitions have been transferred to the central storage facilities of the Ministry of Defense." See Ministry of Foreign Affairs of the Russian Federation, "Statement of the delegation of the Russian Federation at the First Session of the Preparatory Committee for the 2005 NPT Review Conference under Article VI of the Treaty," April 24, 2002.

5. Weapons are also occasionally present at an unknown number of temporary storage sites when in transit between bases and production facilities.

6. We're indebted to Bunn for this insight. For reference to the 123 sites, see Senate Armed Services Committee Subcommittee on Emerging Threats and Capabilities, "Statement of Dr. Susan Koch, U.S. Deputy Assistant Secretary of Defense For Threat Reduction Policy," March 6, 2000, p. 2.

7. National Nuclear Security Administration, "NNSA: Working to Prevent Nuclear Terrorism," September 2009, p. 1; National Nuclear Security Administration, "FY 2010 Congressional Budget Request," May 2009, p. 390. Note that the press release lists 25 Strategic Rocket Force "sites" out of 73 upgraded Russian nuclear warheads "sites," while the budget request explains that the 25 Strategic Rocket Force "sites" are at 11 bases. In other words, individual base locations can contain multiple sites.

8. U.S. Air Force, National Air and Space Intelligence Center, *Ballistic and Cruise Missile Threat*, June 2009. Available at http://www.fas.org/blog/ssp/2009/06/nasic09.php.

9. Estimated locations listed here for Chinese land-based missile forces are mainly based on Thomas C. Reed and Danny B. Stillman, *The Nuclear Express: A Political History of the Bomb and Its Proliferation* (Zenith Press, 2009), pp. 84–113, 220–234, 354–363; Bates Gill et al., "The Chinese Second Artillery Corps: Transition to Credible Deterrence," in James C. Mulvenon and Andrew N. D. Yang, eds., *The*

People's Liberation Army as Organization: Reference Volume v. 1.0 (RAND, 2002); Mark A. Stokes, *China's Military Modernization: Implications for the United States* (U.S. Army War College, September 1999); *Taking Stock: Worldwide Nuclear Deployments 1998*, pp. 45–48, 89; Robert S. Norris et al., *Nuclear Weapons Databook Volume V: British, French, and Chinese Nuclear Weapons* (Westview Press, 1994).

10. China also deploys about 120 H-6 bombers at Anqing Air Base, Leiyang Air Base, Nanjing Air Base, Qili Air Base, and Xian Air Base. Any of these bases could potentially have a secondary nuclear mission, but Danyang is the only air base with an external igloo-type storage facility nearby. Anqing and Leiyang Air Bases both have underground facilities that potentially could store nuclear bombs, and several of the bases are undergoing modernizations that might be associated with adding a cruise missile capability to some of the H-6 bombers.

11. This might be the nuclear weapon production and storage facility reported in *The Nuclear Express* on p. 358 as located two-and-a-half hours north of Mianyang near the city of Pingtung.

12. Locations of nuclear Prithvi/Agni garrisons are not known. Potential Prithvi host candidates include Bhatinda and Jullundur in Punjab. A potential new, but unconfirmed, Prithvi and/or Agni underground storage facility might be located near Daijar, north of Jodhpur, in Rajasthan. The facility includes a dozen tunnels with what appear to be roll-out-and-launch pads and missile-handling buildings.

13. The Indian Navy also is developing a submarine-launched nuclear capability in the form of a ballistic missile and possibly a cruise missile; warhead design for these systems probably is underway.

14. Claims of a nuclear capability for Israeli Harpoon or Popeye cruise missiles on Dolphin-class submarines remain ambiguous.

15. In response to reports about terrorist attacks on suspected nuclear facilities, including Sargodha Depot, Pakistani military spokesman Maj. Gen. Athar Abbas stated, "These are nowhere close to any nuclear facility." Ishtiaq Mahsud, "Pakistani Officials: Militant Clashes Kill about 70," Associated Press, August 12, 2009.

16. Ibid.

17. Locations listed here are based on "U.S. Efforts to Secure Russia's Nuclear Warheads: Background and Issues"; Oleg Bukharin et al., *New Perspectives in Russia's Ten Secret Cities* (Natural Resources Defense Council, October 1999); Joshua Handler, *Russian Nuclear Warhead Dismantlement Rates and Storage Site Capacity: Implications for the Implementation of START II and De-alerting Initiatives* (Princeton University, February 1999); *Taking Stock: Worldwide Nuclear Deployments 1998*, pp. 26–38, 81–87; Thomas B. Cochran et al., *Nuclear Weapons Databook Volume IV: Soviet Nuclear Weapons* (Harper & Row, 1989). Other valuable resources include Defense Department, "Cooperative Threat Reduction Program Annual Report to Congress Fiscal Year 2009" (and previous years); *Securing the Bomb 2008*, pp. 47–49, 93–95; Gunnar Arbman and Charles Thornton, *Russia's Tactical Nuclear Weapons Part II: Technical Issues and Policy Recommendations* (Swedish Defence Research Agency, February 2005); Pavel Podvig, ed., *Russian Nuclear Forces* (MIT Press, 2001).

18. Gen. Eugene Habiger, the former commander of STRATCOM, visited Saratov, the Russian national storage site, in 1998 and later described being shown strategic and tactical nuclear weapons: "We went to Saratov, a national nuclear weapons storage site, where I saw not only strategic weapons, but tactical weapons. . . . And they took me into the side of a mountain, a hill, where we went behind two doors that were each several thousands of tons in weight. And you had to open up one door at a time, these sliding, massive doors, in order to get into the inner sanctum. In the inner sanctum, there were five nuclear weapon storage bays. They took me into one of those bays, and we had an interesting discussion." Defense Department news briefing, June 16, 1998.

19. In addition to these permanent storage locations, a significant number of temporary storage sites include railhead and transfer stations. Nuclear-capable bases where weapons have been moved to central storage include air bases with Su-24 Fencer bombers (Chernyakhovsk, Dzhida, Eysk, Khurba, Lebyazhye, Morozovsk, Pereyaslavka, Siverskiy, Smuravyevo, Voronezh, and Vishnevka), naval bases with Tu-22M Backfire bombers and Il-28 anti-submarine warfare aircraft, and air bases with nuclear-capable SA-10 Grumble surface-to-air missiles. U.S. government lists tend to have a higher number for Russian nuclear weapon storage locations, apparently because they include many temporary sites, particularly navy sites, and sometimes also count individual fenced sites within larger facilities. For a recent example of this, see the fact sheet "NNSA: Working to Prevent Nuclear Terrorism," p. 1; and "FY 2010 Congressional Budget Request," pp. 390–391.

Robert S. Norris & Hans M. Kristensen, "Nuclear Notebook: Worldwide deployments of nuclear weapons, 2009," *Bulletin of the Atomic Scientists*, November/December 2009, vol. 65, no. 6, pp. 86–98.

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