Appendix 8A. World nuclear forces, 2008

SHANNON N. KILE, VITALY FEDCHENKO and HANS M. KRISTENSEN

I. Introduction

While world attention in 2007 focused on the nuclear test by the Democratic People’s Republic of Korea (DPRK, or North Korea) and Iran’s uranium enrichment programme, eight nuclear weapon states possess almost 10,200 operational nuclear weapons (see table 8A.1). Several thousand of these nuclear weapons are kept on high alert, ready to be launched within minutes. If all nuclear warheads are counted—operational warheads, spares, those in both active and inactive storage, and intact warheads scheduled for later dismantlement—the United States, Russia, the United Kingdom, France, China, India, Pakistan and Israel together possess a total of more than 25,000 warheads.

All of the five legally recognized nuclear weapon states, as defined by the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (Non-Proliferation Treaty, NPT),1 appear determined to remain nuclear powers for the foreseeable future and are in the midst or on the verge of modernizing their nuclear forces. At the same time, Russia and the USA are in the process of reducing their operational nuclear forces from cold war levels as a result of two bilateral treaties—the 1991 Treaty on the Reduction and Limitation of Strategic Offensive Arms (START I Treaty) and the 2002 Strategic Offensive Reductions Treaty (SORT).2 Sections II and III of this appendix discuss the composition of the deployed nuclear forces of the USA and Russia, respectively. The nuclear arsenals of the UK, France and China are considerably smaller than those of the USA and Russia, but those three lesser nuclear powers are either deploying new nuclear weapons or have announced their intention to do so in the future. Data on their delivery vehicles and warhead stockpiles are presented in sections IV–VI.

Reliable information about the operational status of the nuclear arsenals of the three states that are not parties to the NPT—India, Pakistan and Israel—is difficult to find. In the absence of official declarations, the information that is available is often contradictory or incorrect. India and Pakistan are expanding their nuclear strike capabilities, while Israel appears to be waiting to see how the situation in Iran develops. Sections VII–IX provide information about the status of the Indian, Pakistani and Israeli nuclear arsenals. North Korea’s military nuclear capabilities are discussed in section X.

The figures presented here are estimates based on public information and contain some uncertainties, as reflected in the notes to the tables.

1 According to the NPT, only states that manufactured and exploded a nuclear device prior to 1 Jan. 1967 are recognized as nuclear weapon states. By this definition, China, France, Russia, the UK and the USA are the nuclear weapon states parties to the NPT. For a summary of the NPT see annex A in this volume.

2 For summaries of the START I and SORT treaties see annex A in this volume.
II. US nuclear forces

As of January 2008, the USA maintained an estimated arsenal of approximately 4075 operational nuclear warheads, consisting of roughly 3575 strategic and 500 non-strategic warheads (see table 8A.2).3 In addition to this operational arsenal, approximately 1260 warheads are held in reserve, for a total stockpile of approximately 5300 warheads. Over 5100 other warheads were removed from the US Department of Defense (DOD) stockpile at the end of 2007, destined to be dismantled by 2023.

This force level is a significant change compared with the estimate presented in SIPRI Yearbook 2006, and is precipitated by the announcement by the administration of President George W. Bush on 18 December 2007 that it would meet the goal of the 2004 Nuclear Weapons Stockpile Plan of reducing the total stockpile ‘by nearly 50 percent from the 2001 level’ five years early, in 2007 instead of 2012.4 The

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Table 8A.1. World nuclear forces, January 2008

All figures are approximate.

<table>
<thead>
<tr>
<th>Country</th>
<th>Strategic warheads</th>
<th>Non-strategic warheads</th>
<th>Total number of warheads</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>3 575</td>
<td>500</td>
<td>4 075b</td>
</tr>
<tr>
<td>Russia</td>
<td>3 113</td>
<td>2 076</td>
<td>5 189c</td>
</tr>
<tr>
<td>UK</td>
<td>185d</td>
<td>–</td>
<td>185</td>
</tr>
<tr>
<td>France</td>
<td>348</td>
<td>–</td>
<td>348</td>
</tr>
<tr>
<td>China</td>
<td>161</td>
<td>15</td>
<td>176</td>
</tr>
<tr>
<td>India</td>
<td>–</td>
<td>–</td>
<td>60–70c</td>
</tr>
<tr>
<td>Pakistan</td>
<td>–</td>
<td>–</td>
<td>60e</td>
</tr>
<tr>
<td>Israel</td>
<td>–</td>
<td>–</td>
<td>80e</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>10 183</td>
</tr>
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</table>

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Table 8A.2. US nuclear forces, January 2008

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>No. deployed</th>
<th>Year first deployed</th>
<th>Range (km)a</th>
<th>Warhead loading</th>
<th>No. of warheads</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategic forces</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bombers(^b)</td>
<td></td>
<td>104/72</td>
<td></td>
<td></td>
<td></td>
<td>3 575</td>
</tr>
<tr>
<td>B-52H</td>
<td>Stratofortress</td>
<td>94/56</td>
<td>1961</td>
<td>16 000</td>
<td>ALCM 5–150 kt</td>
<td>528(^c)</td>
</tr>
<tr>
<td>B-2</td>
<td>Spirit</td>
<td>20/16</td>
<td>1994</td>
<td>11 000</td>
<td>B61-7, -11, B83-1 bombs</td>
<td>555(^d)</td>
</tr>
<tr>
<td><strong>ICBMs(^e)</strong></td>
<td>LGM-30G Minuteman III</td>
<td>488</td>
<td>1970</td>
<td>13 000</td>
<td>1–3 x 170 kt</td>
<td>764</td>
</tr>
<tr>
<td>Mk-12</td>
<td></td>
<td>138</td>
<td></td>
<td></td>
<td></td>
<td>214</td>
</tr>
<tr>
<td>Mk-12A</td>
<td></td>
<td>250</td>
<td>1979</td>
<td>13 000</td>
<td>1–3 x 335 kt</td>
<td>450</td>
</tr>
<tr>
<td>Mk-21 SERV</td>
<td></td>
<td>100</td>
<td>2006</td>
<td>13 000</td>
<td>1 x 300 kt</td>
<td>100</td>
</tr>
<tr>
<td><strong>SSBNs/SLBMs(^f)</strong></td>
<td>UGM-133A Trident II (D-5)</td>
<td>228</td>
<td></td>
<td></td>
<td></td>
<td>1 728</td>
</tr>
<tr>
<td>Mk-4</td>
<td></td>
<td>. .</td>
<td>1992</td>
<td>&gt;7 400</td>
<td>6 x 100 kt</td>
<td>1 344</td>
</tr>
<tr>
<td>Mk-5</td>
<td></td>
<td>. .</td>
<td>1990</td>
<td>&gt;7 400</td>
<td>6 x 475 kt</td>
<td>384</td>
</tr>
<tr>
<td><strong>Non-strategic forces</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>B61-3, -4 bombs</td>
<td></td>
<td>. .</td>
<td>1979</td>
<td>. .</td>
<td>0.3–170 kt</td>
<td>400(^g)</td>
</tr>
<tr>
<td>Tomahawk SLCM</td>
<td></td>
<td>320</td>
<td>1984</td>
<td>2 500</td>
<td>1 x 5–150 kt</td>
<td>100(^h)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 075(^i)</td>
</tr>
</tbody>
</table>

\(^{a}\) Aircraft range is given for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

\(^{b}\) The first figure in the No. deployed column is the total number of B-52Hs in the inventory, including those for training, test and reserve. The second figure is for primary mission inventory aircraft, i.e. the number of operational aircraft assigned for nuclear and conventional wartime missions.

\(^{c}\) Approximately 860 ALCMs may have been withdrawn in 2007 due to early implementation of the 2004 Nuclear Weapons Stockpile Plan. All advanced cruise missiles have also been retired.

\(^{d}\) These warheads are available for both the B-52H and the B-2A, but the B-2A is thought to be the main bomb delivery vehicle.

\(^{e}\) The 2006 Quadrennial Defense Review decided to reduce the ICBM force to 450 missiles by 2008. The download of most Minuteman ICBMs to 1 warhead to meet the warhead ceiling mandated by the 2002 Strategic Offensive Reductions Treaty (SORT) is under way, but c. 25 missiles will continue to carry 3 warheads each.

\(^{f}\) Although D-5 missiles are counted under the 1991 Treaty on the Reduction and Limitation of Strategic Offensive Arms (START I Treaty) as carrying 8 warheads each, the US Navy completed a preliminary download in 2005 (to an average of 6 warheads per missile) and will conduct an additional download to an average of 4 warheads per missile to meet the SORT-mandated warhead ceiling by 2012.

\(^{g}\) Approximately 350 B61 bombs are deployed in Europe at 7 airbases in 6 NATO countries.

\(^{h}\) The 2006 Quadrennial Defense Review decided to reduce the ICBM force to 450 missiles by 2008. The download of most Minuteman ICBMs to 1 warhead to meet the warhead ceiling mandated by the 2002 Strategic Offensive Reductions Treaty (SORT) is under way, but c. 25 missiles will continue to carry 3 warheads each.

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stockpile reduction has so far occurred largely on paper, because it consists of transferring ownership of the warheads from the DOD to the Department of Energy (DOE). In practical terms, the weapons will mostly remain at their bases for several years because the DOE does not have capacity to store them.

The stockpile announcement accompanied the National Nuclear Security Administration’s publication of the Draft Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS) for modernizing the US nuclear weapon complex. Complex Transformation, a scaled-down version of the 2006 plan known as Complex 2030, evaluates how the nuclear weapon complex should be structured to meet nuclear weapon production and maintenance requirements at force levels below those imposed by SORT. The plan proposes consolidating the complex and increasing the capacity to produce plutonium ‘pits’ (cores) from the current 10 annually to up to 200.

The Bush Administration’s proposal to begin production, in 2014, of the first of a series of Reliable Replacement Warheads (RRWs) ran into opposition in the US Congress, which rejected the administration’s funding request for 2008. Instead, the Congress delayed a decision on RRW funding until after the completion of a new assessment of future US strategic nuclear deterrence requirements.

In an effort to ‘ensure that stockpile and infrastructure transformation is not misperceived by other nations as “restarting the arms race”’, the Bush Administration announced in 2007 that dismantlement of retired warheads had increased by 146 per cent. Although the percentage increase looks impressive, the actual number of warheads dismantled appears to be modest compared with the rate of dismantlement during the 1990s. On the basis of previously declassified or released dismantlement information, it is possible to estimate that the 146 per cent increase means roughly 260 warheads. For comparison, the average number of warheads dismantled per year


during the 1990s was nearly 1200. Dismantlement is not currently a priority at the Pantex Plant in Texas, where the focus is on life extension of the warheads that are slated to remain in the enduring stockpile. As a result, dismantling the current backlog of retired warheads will not be completed until 2023.8

In parallel with reducing the nuclear arsenal, the DOD has upgraded its nuclear strike plans to reflect new presidential guidance and a transition in war planning from the Single Integrated Operational Plan (SIOP) of the cold war to a set of smaller and more flexible strike plans designed to defeat today’s adversaries. In March 2003 a new series of executable scenario-based strike options against regional states armed with weapons of mass destruction (WMD) was added to the strategic war plan, which is now known as OPLAN (Operations Plan) 8044. This was refined in October 2004 and resulted in an updated war plan known as OPLAN 8044 Revision 05. In February 2005 General Richard B. Meyers, chairman of the Joint Chiefs of Staff, described some of the characteristics of the plan: ‘[US Strategic Command] has revised our strategic deterrence and response plan that became effective in the fall of 2004. This revised, detailed plan provides more flexible options to assure allies, and dissuade, deter, and if necessary, defeat adversaries in a wider range of contingencies’.9

In mid-2004 a controversial plan for striking regional adversaries pre-emptively with conventional and nuclear weapons, called CONPLAN (Concept Plan) 8022, entered into effect as the combat employment part of a new Global Strike mission. The plan was withdrawn in the fall of 2004, however, and the strike options incorporated into OPLAN 8044.

**Land-based ballistic missiles**

The US intercontinental ballistic missile (ICBM) force is undergoing significant change as part of the USA’s implementation of SORT. Approximately 764 warheads were deployed on 488 ICBMs as of January 2008, a reduction of 136 warheads compared with 2007 due to offloading of W62 warheads and downloading of W78 warheads. The last W62 is scheduled to be offloaded in 2009, and additional downloading of W78s will reduce the total loading to 500 warheads in 2011. As the 170-kiloton W62 is removed from the missiles, the modern 300-kt Mk-21/W87 security-enhanced re-entry vehicle (SERV) is being installed. The increased power of the W87 will broaden the range of targets of the Minuteman force. A previous plan to convert the ICBM force to single-warhead configuration has been modified: 25 missiles will continue to carry three warheads. Several hundred additional warheads will be kept in storage for upload to increase the warheads on the ICBM force if necessary in the future. Work is continuing on designing a new ICBM to begin replacing the Minuteman III missile from 2018.

Only one Minuteman III missile flight test was launched in 2007, compared to four in 2006. That missile was launched from Vandenberg Air Force Base (AFB) in California on 7 February and delivered a single, unarmed warhead approximately 6760 kilometres, with impact on a water target east of Kwajalein in the Marshall Islands.

Ballistic missile submarines

The conversion of Pacific-based nuclear-powered ballistic missile submarines (SSBNs, from 'ship submersible ballistic nuclear') from Trident I C-4 missiles to the longer-range and more accurate Trident II D-5 missile is nearing completion with the USS Alabama scheduled to complete conversion in 2008. Twelve operational Ohio Class SSBNs carry a total of 228 D-5 submarine-launched ballistic missiles (SLBMs), each of which is estimated to be armed with an average of six warheads. Two additional SSBNs are undergoing overhaul at any given time, and their 48 missiles and 288 warheads are not included in the total. In the future, eight SSBNs will be based in the Pacific and six in the Atlantic, focusing the US sea-based deterrent against targets in China and elsewhere in the Pacific region.

In 2008 the US Navy will begin production of a modified D-5 missile. A total of 108 missiles are planned by 2011, at a cost of more than $4 billion, with initial deployment scheduled for 2013. The modified D-5 SLBM will arm the Ohio Class SSBNs for the rest of their service lives, which have been extended from 30 to 44 years. The oldest submarine is scheduled to retire in 2029, at which point a new SSBN class is planned to become operational. Development studies for the new class, known as SSBN(X), have begun.

Three Trident II D-5 missiles were test-launched during 2007 in two events. The USS Tennessee launched two missiles from the eastern test range off the Florida coast on 15 May. The missiles were the first to carry the new Lockheed low-cost test missile kit, which converts an operational missile into test configuration and contains range safety devices and flight telemetry instrumentation. On 29 November the USS Henry M. Jackson test-launched a single missile from the western test range in an operation to certify the submarine for deployment after a lengthy retrofit from C-4 to D-5 SLBMs.

The deployment of the W76-1/Mk4A warhead, a modernized version of the existing W76/Mk4, was scheduled to begin in March 2008, but owing to a technical production problem the programme has been delayed. The programme involves production of approximately 2000 W76-1 warheads up to 2021. The W76-1/Mk4 is equipped with a new fuse that will give military planners more flexibility in setting the height of burst to ‘enable W76 to take advantage of [the] higher accuracy of the D-5 missile’ and hold at risk a wider range of targets including hard targets. The increased lethality of the W76-1 warhead may also permit a reduction of the explosive yield.

Another potential upgrade, proposed by the US Strategic Command (STRATCOM), involves the ‘accuracy adjunct’, a manoeuvring attachment that was developed for the Mk4 re-entry vehicle to give the weapon ‘GPS-life accuracy’. The US Congress has refused to approve the upgrade, which would enable STRATCOM to deploy conventional warheads on the D-5 SLBM.12

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12 The 2006 Quadrennial Defense Review directed STRATCOM to replace nuclear warheads on 24 Trident II (D-5) missiles with 96 conventional warheads for deployment in 2008. The Congress has
The first of a series of RRWs is designed to replace a portion of the W76 warheads currently deployed on the D-5 missiles. The Nuclear Weapons Council has approved a preliminary RRW-1 design, which is based on the two-stage thermonuclear SKUA-9 design developed by Lawrence Livermore National Laboratory. The high-yield design was tested several times during the early 1970s, prior to the 1974 Threshold Test-Ban Treaty (TTBT). If funded by the Congress, the warhead would be incorporated into the Mk5 re-entry body originally designed for the W88 warhead.

**Long-range bombers**

A B-2 bomber crashed on Guam on 23 February 2008, the first loss of the $1.2 billion stealth bomber. Of the remaining 20 B-2s, 16 have nuclear missions. Both the bomber fleet and their nuclear weapons continued to be upgraded. Approximately 1000 nuclear warheads are earmarked for delivery by B-52H and B-2 bombers, including W80-1 warheads on air-launched cruise missiles and B61-7, B61-11, and B83-1 gravity bombs. The US Air Force is studying options for a new long-range strike aircraft to begin replacing the current bomber force from 2018.

The advanced cruise missile (ACM) was retired in 2007, and approximately half of the air-launched cruise missiles (ALCMs) were withdrawn from the stockpile as part of a plan to reduce by nearly 50 per cent the size of the stockpile by the end of 2007. The life extension of the W80-1 warhead has been put on hold and the Air Force is designing a next-generation nuclear-armed cruise missile known as the enhanced cruise missile.

**Non-strategic nuclear weapons**

As of January 2008, the USA retained approximately 500 active non-strategic nuclear warheads. These consisted of 400 B61 gravity bombs and 100 W80-0 warheads for Tomahawk cruise missiles (TLAM/Ns, from Tomahawk land attack missiles, nuclear). Another 800 non-strategic warheads are in inactive storage. Approximately 350 B61 bombs are deployed in Europe at seven airbases in six North Atlantic Treaty Organization (NATO) member states (Belgium, Germany, Italy, the Netherlands, Turkey and the UK). The bombs were apparently withdrawn from Ramstein Air Base, Germany, in 2005. The aircraft of non-nuclear weapon NATO countries that are assigned nuclear strike missions with US nuclear weapons include Belgian and Dutch F-16 and German and Italian Tornado combat aircraft. The US arsenal in Europe may include inactive bombs. A portion of the new Joint Strike Fighter force will be nuclear-capable.

been unwilling to fund the programme and has expressed concern about the implications for crisis stability of mixing nuclear- and conventionally armed ballistic missiles.

13 For a summary of the Treaty on the Limitation of Underground Nuclear Weapon Tests see annex A in this volume.

14 Neither START nor SORT place limits on Russian and US inventories of non-strategic nuclear weapons. The US Nuclear Posture Review also did not address this category of weapons.


Only 100 W80-0 warheads for the TLAM/N are active; another 200 are in inactive storage. TLAM/Ns are earmarked for deployment on selected Los Angeles, Improved Los Angeles and Virginia Class nuclear-powered attack submarines (SSNs, from ship submersible nuclear). TLAM/Ns are not deployed at sea under normal circumstances but can be redeployed within 30 days of a decision to do so. All are stored at strategic weapon facilities at Bangor, Washington, and Kings Bay, Georgia. The W80-0 may be retired in the near future.

Nuclear warhead stockpile management and modernization

The total US stockpile of roughly 5300 warheads is organized in two categories: active and inactive warheads. The active category includes intact warheads with all components that are either deployed on operational delivery systems, are part of the ‘responsive force’ of reserve warheads that can be deployed on operational delivery systems in a relatively short time, or are spare warheads. The inactive category includes warheads that are held in long-term storage as a reserve with their limited life components (tritium) removed. In addition to these warheads, more than 5100 other warheads are awaiting dismantling.

The USA keeps nearly 5000 plutonium pits in storage at the Pantex Plant in Texas as a strategic reserve. Another 10,000 pits at Pantex make up most of the 43 tonnes of weapon-grade plutonium previously declared in excess of military needs by the administrations of President Bill Clinton and President George W. Bush. All of these nearly 15,000 pits come from retired warheads. Approximately 5000 canned assemblies (thermonuclear secondaries) are kept at the Oak Ridge Y-12 Plant in Tennessee.

III. Russian nuclear forces

As of January 2008, Russia had an estimated 5189 nuclear warheads (see table 8A.3). In 2007 Russia continued to reduce its strategic nuclear forces in accordance with its commitments under SORT and as part of a doctrinal shift away from a ‘substantially redundant’ (suschestvenno izbytochnyi) and towards a ‘minimally sufficient’ (garantirovanno dostatochnyi) deterrence posture. According to a senior Russian military planner, Russia’s strategic nuclear forces can still guarantee ‘minimally sufficient’ deterrence until 2015–20 within the force ceilings imposed by SORT, even if the USA develops a ballistic missile defence (BMD) system. However, he said that the strategic forces would need qualitative improvements to enhance their survivability and ability to penetrate missile defences in the future. Russia has prioritized the procurement of the land-based SS-27 (RS12-M2/1 Topol-M) ICBMs and the development of sea-launched SS-NX-30 Bulava missile systems, while continuing to extend the service lives of older missiles as an interim measure. In 2007 Russia began flight tests of a new road-mobile missile with multiple independently targetable re-entry vehicles (MIRVs) and missile defence penetration aids, continued to upgrade its sea-based strategic force and resumed regular long-range patrols of strategic aviation.

17 Umnov, S., ‘SYaS Rossi: naraschivaniye vozmozhnostey po preodoleniyu protivoraketnoy oborony’ [Russia’s SNF: building up ballistic missile defence penetration capacities], Voenny-Promyshlennyi Kur’er, 8–14 Mar. 2006. On US BMD programmes see appendix 8C.
Table 8A.3. Russian nuclear forces, January 2008

<table>
<thead>
<tr>
<th>Type and Russian designation (NATO designation)</th>
<th>No. deployed</th>
<th>Year first deployed</th>
<th>Range (km)</th>
<th>Warhead loading</th>
<th>No. of warheads</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategic offensive forces</strong></td>
<td>685</td>
<td>3</td>
<td>113</td>
<td>6 x AS-15A ALCMs, bombs</td>
<td>3 113</td>
</tr>
<tr>
<td>Bombers</td>
<td>313</td>
<td>3</td>
<td>113</td>
<td>6 x AS-15A ALCMs, bombs</td>
<td>3 113</td>
</tr>
<tr>
<td>Tu-95MS6 (Bear-H6)</td>
<td>32</td>
<td>1981</td>
<td>6 500–10 500</td>
<td>16 x AS-15A ALCMs, bombs</td>
<td>512</td>
</tr>
<tr>
<td>Tu-95MS16 (Bear-H16)</td>
<td>32</td>
<td>1981</td>
<td>6 500–10 500</td>
<td>12 x AS-15B ALCMs, bombs</td>
<td>180</td>
</tr>
<tr>
<td>Tu-160 (Blackjack)</td>
<td>15</td>
<td>1987</td>
<td>10 500–13 200</td>
<td>10 500 bombs</td>
<td>15 000</td>
</tr>
<tr>
<td>ICBMs[^b]</td>
<td>430</td>
<td>1</td>
<td>605</td>
<td>1 x 1000 kt</td>
<td>1 605</td>
</tr>
<tr>
<td>RS-20 B/V (SS-18 Satan)</td>
<td>75</td>
<td>1979</td>
<td>11 000–15 000</td>
<td>10 x 500–750 kt</td>
<td>750</td>
</tr>
<tr>
<td>RS-18 (SS-19 Stiletto)</td>
<td>100</td>
<td>1980</td>
<td>10 000</td>
<td>6 x 500–750 kt</td>
<td>600</td>
</tr>
<tr>
<td>RS-12M (SS-25 Sickle)</td>
<td>201</td>
<td>1985</td>
<td>10 500</td>
<td>1 x 550 kt</td>
<td>201</td>
</tr>
<tr>
<td>RS-12M2 Topol-M (SS-27)</td>
<td>48</td>
<td>1997</td>
<td>10 500</td>
<td>1 x 550 kt</td>
<td>48</td>
</tr>
<tr>
<td>RS-12M1 Topol-M (SS-27)</td>
<td>6</td>
<td>2006</td>
<td>10 500</td>
<td>1 x 550 kt</td>
<td>6</td>
</tr>
<tr>
<td>SLBMs</td>
<td>176</td>
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<td></td>
<td></td>
<td>624</td>
</tr>
<tr>
<td>RSM-50 (SS-N-18 M1 Stingray)</td>
<td>80</td>
<td>1978</td>
<td>6 500</td>
<td>3 x 200 kt</td>
<td>240</td>
</tr>
<tr>
<td>RSM-54 (SS-N-23 Skiff/Sineva)</td>
<td>96</td>
<td>1986</td>
<td>9 000</td>
<td>4 x 100 kt</td>
<td>384</td>
</tr>
<tr>
<td>ICBMs[^b]</td>
<td>430</td>
<td>1</td>
<td>605</td>
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<td>2006</td>
<td>10 500</td>
<td>1 x 550 kt</td>
<td>6</td>
</tr>
<tr>
<td><strong>Strategic defensive forces</strong></td>
<td>2 000</td>
<td></td>
<td></td>
<td></td>
<td>733</td>
</tr>
<tr>
<td>Anti-ballistic missiles[^b]</td>
<td>51T6 (SH-11 Gorgon)</td>
<td>32</td>
<td>1989</td>
<td>1 x 1000 kt</td>
<td>32</td>
</tr>
<tr>
<td>Anti-ballistic missiles[^b]</td>
<td>53T6 (SH-08 Gazelle)</td>
<td>68</td>
<td>1986</td>
<td>1 x 10 kt</td>
<td>68</td>
</tr>
<tr>
<td>Anti-ballistic missiles[^b]</td>
<td>S-300 (SA-10/20 Grumble)</td>
<td>1900</td>
<td>1980</td>
<td>low kt</td>
<td>633</td>
</tr>
<tr>
<td><strong>Non-strategic forces</strong></td>
<td>1 343</td>
<td></td>
<td></td>
<td></td>
<td>1 343</td>
</tr>
<tr>
<td>Land-based non-strategic bombers</td>
<td>524</td>
<td></td>
<td></td>
<td></td>
<td>524[^c]</td>
</tr>
<tr>
<td>Tu-22M Backfire</td>
<td>124</td>
<td>1974</td>
<td>2 x AS-4 ASM, bombs</td>
<td>124[^c]</td>
<td>124[^c]</td>
</tr>
<tr>
<td>Su-24 Fencer</td>
<td>400</td>
<td>1974</td>
<td>2 x bombs</td>
<td>400[^c]</td>
<td>400[^c]</td>
</tr>
<tr>
<td>Naval non-strategic attack aircraft</td>
<td>179</td>
<td></td>
<td></td>
<td></td>
<td>295</td>
</tr>
<tr>
<td>Tu-22M Backfire</td>
<td>58</td>
<td>1974</td>
<td>2 x AS-4 ASM, bombs</td>
<td>116</td>
<td>116</td>
</tr>
<tr>
<td>Su-24 Fencer</td>
<td>58</td>
<td>1974</td>
<td>2 x bombs</td>
<td>116</td>
<td>116</td>
</tr>
<tr>
<td>Be-12 Mail/Il-38 May</td>
<td>63</td>
<td>1967/68</td>
<td>1 x depth bomb</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Sea-launched cruise missiles</td>
<td>276</td>
<td></td>
<td></td>
<td></td>
<td>276</td>
</tr>
<tr>
<td>SS-N-9, SS-N-12, SS-N-19, SS-N-21, SS-N-22</td>
<td>248</td>
<td></td>
<td></td>
<td></td>
<td>248</td>
</tr>
<tr>
<td>Anti-submarine warfare and surface-to-air missile weapons</td>
<td>2 076</td>
<td></td>
<td></td>
<td></td>
<td>2 076</td>
</tr>
<tr>
<td>Total strategic defensive and non-strategic forces</td>
<td>5 189[^d]</td>
<td></td>
<td></td>
<td></td>
<td>5 189[^d]</td>
</tr>
</tbody>
</table>

[^a]: Aircraft range is given for illustrative purposes only; actual mission range will vary.

[^b]: ALCM = air-launched cruise missile; ASM = air-to-surface missile; kt = kiloton; ICBM = intercontinental ballistic missile; NATO = North Atlantic Treaty Organization; SLBM = Submarine-launched ballistic missile; SRAM = short-range attack missile.
Land-based ballistic missiles

The Russian Strategic Rocket Forces (SRF) consist of three missile armies: the 27th Guards Missile Army (Vladimir, five divisions), the 31st Missile Army (Orenburg, three divisions) and the 33rd Guards Missile Army (Omsk, five divisions).\(^1\)

As of January 2008, Russia had on combat duty 75 SS-18 Satan (R-36M) heavy ICBMs in two versions: the R-36MUTTKh (RS-20B) and the R-36M2 Voevoda (RS-20V), deployed in Dombarovsky (41 missiles) and Uzhur (34 missiles).\(^2\) The RS-20B was first deployed in 1979–83 and the RS-20V in 1988–92. Both are silo-based, two-stage, liquid-propellant ICBMs designed and produced in Ukraine.\(^3\)

Russia intends to keep RS-20V missiles in service until 2016–18, but the RS-20B missiles are being gradually retired from service.\(^4\) Instead of dismantlement, the SRF sometimes refurbishes them as Dnepr space launch vehicles (SLVs). In 2007 Russia conducted three successful launches of Dnepr SLVs: on 17 April and 15 June from Baikonur, Kazakhstan, and on 28 June from Yasnyi launch site in Orenburg region.\(^5\)

As of January 2008, Russia had a total of 100 SS-19 Stiletto (RS-18) missiles deployed at Kozelsk (50 missiles) and Tatischevo (50 missiles).\(^6\) The SS-19 is a silo-based, two-stage, liquid-propellant ICBM designed and produced in Ukraine.\(^7\)

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\(^6\) US Department of State (note 18), pp. 20, 24.
based, two-stage, liquid-propellant ICBM capable of carrying up to six warheads, which entered into service in 1980.24 On 29 October 2007 the SS-19 missile was successfully test-launched from Baikonur to its target at the Kura test range. As a result of the test, the SS-19’s service life was extended to 31 years.25

Russia has 201 SS-25 Sickle (RS-12M Topol) ICBMs deployed in eight missile divisions across the country.26 The SS-25 is a road-mobile, three-stage solid-propellant ICBM that carries a single warhead. It was first deployed in 1985.27 According to Russian press reports, the SS-25 is expected to be in service until 2015.28 On 18 October and 8 December 2007 the SRF successfully launched SS-25 missiles from the Plesetsk and the Kapustin Yar test site launch sites, respectively. The service life of the weapon was reported to have been extended to 21 years.29

The SS-27 Topol-M missile is a three-stage solid-propellant ICBM that has been developed in both road-mobile (RS-12M1) and silo-based (RS-12M2) versions, which the missile’s designers say use standardized and interoperable components. Russia plans to deploy 40 RS-12M1 and 114 RS-12M2 missiles by 2015.30 As of January 2008 Russia had 48 RS-12M2 missiles at the 60th Missile Division in Tatischevo, Saratov oblast, and 6 RS-12M1 missiles at the 54th Missile Division in Teikovo, Ivanovo region.31 Deployment of the silo-based RS-12M2 will be completed in 2010.32

On 7 May 2007 the SRF Commander, Nikolai Solovtsov, announced that Russia will start to install MIRVs on SS-27 Topol-M missiles ‘in two or three years’, probably referring to the expiry of START I in December 2009.33 The treaty prohibits the installation of MIRVs on existing missiles but does not restrict the development of new ones.34

On 29 May 2007 a MIRVed missile, designated the ‘RS-24’, was test-fired for the first time. It was launched from a specially modified transporter-erector-launcher (TEL) vehicle at the Plesetsk launch site and successfully hit its target at the Kura test range.35 On 25 December 2007 the second launch of the RS-24 was conducted at

24 ed. Lennox (note 20), pp. 130–32.
26 US Department of State (note 18).
33 Nikol’skii, A. (note 30).
Plesetsk, with three test warheads successfully reaching the Kura range.\textsuperscript{36} Russian officials stated that the RS-24 is not an entirely new missile but a ‘new version’ of the SS-27 Topol-M, with the MIRVs as the main difference from the SS-27 Topol-M.\textsuperscript{37} In order to declare the missile as a new type under START I, Russia will have to make other treaty-specified modifications, such as altering the diameter or length of the missile’s first stage or changing the launch weight. Alternatively, the missile could be maintained as a ‘prototype’ (not accountable under START I) until the treaty’s expiry date.\textsuperscript{38}

After the first launch Solovtsov announced that the RS-24 test programme would require no more than five additional launches, and the missile could be placed in service by 2010. He also stated that advanced missile defence penetration capability would be added to the RS-24 and probably to the single-warhead SS-27 Topol-Ms as well.\textsuperscript{39} In February 2008, however, Solovtsov declared that the RS-24 would enter service in 2009 and that two flight tests were planned in 2008.\textsuperscript{40}

**Ballistic missile submarines and sea-launched ballistic missiles**

The Russian Navy operates 14 SSBNs in its Northern and Pacific Fleets. Of these, six are Delta III Class (Project 667BDR Kalmar) submarines. The Petropavlovsk-Kamchatskii, the Svyatoi Georgii Pobedonosets, the Zelenograd and the Podolsk are deployed with the Pacific Fleet, and the Ryazan’ and the Borisoglebsk with the Northern Fleet. On 21 September 2007 the Ryazan’ completed a two-year overhaul at the Zvezdochka shipyard in Severodvinsk, and it began sea trials in December 2007.\textsuperscript{41}

The Russian Navy also operates six Delta IV Class (Project 667BDRM Delfin) submarines, all part of the Northern Fleet. Four of them—the Bryansk, the Tula, the Verkhotur’e and the Yekaterinburg—are currently in service after returning from an overhaul.\textsuperscript{42} In November 2006 two Delta IV submarines—the Kareliya and the Novo-


\textsuperscript{37} Richardson (note 35), p. 1; and Gertsev, O., ‘Rabota po “Bulave” idet po planu’ [Development of ‘Bulava’ is proceeding according to plan], Voenno-Promyshlennyi Kurier, 5–11 Sep. 2007.

\textsuperscript{38} For more discussion see Sokov (note 34).


moskovsk—started service life-extension overhauls.\textsuperscript{43} The Delta IV submarines are scheduled to remain in service for 10 years after these overhauls.\textsuperscript{44}

The Soviet Union built six Typhoon Class (Project 941 Akula) SSBNs in 1976–89. Russia decommissioned three of them in 1996. One of them, renamed the Dmitrii Donskoi, was relaunched in June 2002 after an overhaul and is used as a test platform for the new SS-NX-30 Bulava (RSM-56) missile, which is under development. Russian military officials have indicated that in future the Dmitrii Donskoi may be equipped with the full complement of Bulava missiles. The two remaining submarines—the Arkhangelsk and the Severstal’—were withdrawn from service in 2004 for financial reasons, and a decision on their future was not taken in 2007.\textsuperscript{45}

Russia is building three SSBNs of a new class, the Project 955 Borei. The first in the class, the Yuri Dolgorukii, was launched on 15 April 2007 and is expected to enter service in 2008.\textsuperscript{46} The second and third submarines, the Aleksandr Nevskii (to enter service in 2009) and the Vladimir Monomakh (to enter service in 2011) were laid down at the Sevmash shipyard in March 2004 and March 2006, respectively.\textsuperscript{47} Each Borei SSBN is equipped with 16 RSM-56 missiles.\textsuperscript{48} The Russian Government plans to have eight Borei SSBNs by 2015.\textsuperscript{49} In July 2007 the Russian Navy announced plans to build a new submarine base for Borei Class submarines at Viluchinsk on the Kamchatka peninsula.\textsuperscript{50}

Russia’s SLBM force currently consists of two types of missile—the SS-N-18 M1 Stingray (RSM-50) and the SS-N-23 Skiff (RSM-54). The SS-N-18 M1 first entered service in 1978 and is deployed on Delta III Class submarines. It has two liquid-fuelled stages and carries three warheads.\textsuperscript{51} On 7 August 2007 a Delta III Class SSBN, the Petropavlovsk-Kamchatskii, launched an SS-N-18 M1 SLBM from the Pacific that successfully hit the target at the Chizha test range.\textsuperscript{52}

The SS-N-23 Skiff SLBM, a successor to the SS-N-18, was first test-launched in 1983 and is deployed on Delta IV Class submarines.\textsuperscript{53} It has since been modified twice. In 1996–2002 an improved re-entry vehicle was added,\textsuperscript{54} and in 2002–2005, the missile was modernized to extend its service life and a new satellite guidance


\textsuperscript{44} ARMS-TASS (note 42).


\textsuperscript{47} ‘Iz-pod vody dostali’ [Reached from under water], Kommersant Business Guide, 4 July 2006.

\textsuperscript{48} US Department of State (note 18), p. 55.

\textsuperscript{49} Isachenkov, V., ‘Russia plans new ICBMs, nuclear subs’, Washington Post, 7 Feb. 2007.


\textsuperscript{51} ed. Lennox (note 20), pp. 149–50.


\textsuperscript{53} ed. Lennox (note 20), pp. 155–56.

system was added.\textsuperscript{55} The upgraded version of the missile is called the Sineva (‘the Blue’) in Russian. According to the US Air Force, the Sineva has the same range as the SS-N-23 Skiff but can carry up to 10 warheads.\textsuperscript{56} However, the START I information exchange memorandum does not make a distinction between the two versions.\textsuperscript{57}

On 9 July 2007 President Vladimir Putin signed a decree accepting the Sineva SLBM into service.\textsuperscript{58} Serial production of the missile is under way.\textsuperscript{59} Four Sineva SLBMs were delivered in 2006 and another 12 were procured in 2007.\textsuperscript{60} On 25 December 2007 a Delta IV SSBN, the \textit{Tula}, test launched a Sineva from an underwater position in the Barents Sea that hit a simulated target at the Kura test range.\textsuperscript{61} Russia also continues to test the SS-N-23 Skiff. On 17 December the \textit{Tula} launched an 18-year-old SS-N-23 missile, whose service life certification was set to expire shortly thereafter, from a submerged position in the Barents Sea.\textsuperscript{62}

Russia is giving high priority to the development of the SS-NX-30 Bulava, a new three-stage, solid-propellant SLBM. President Putin has declared that Borei Class SSBNs, equipped with the new Bulava SLBM, will form the backbone of Russia’s strategic deterrent force together with the Topol-M ICBM.\textsuperscript{63} The missile will reportedly have a maximum range of 8300 km.\textsuperscript{64} Russia has declared that the Bulava will be attributed under START I counting rules as carrying six warheads,\textsuperscript{65} although some of the capacity may instead be used for carrying missile-defence penetration aids or for other purposes.

As of December 2007 six Bulava test launches had been conducted. Two tests in 2005 were successful, but the three in 2006 ended in failure.\textsuperscript{66} On 28 June 2007 the \textit{Dmitrii Donskoi} SSBN fired a Bulava missile from a location in the White Sea, and

\begin{footnotes}
\item[57] US Department of State (note 18), p. 1.
\item[58] Makeyev Design Bureau, ‘President RF V. V. Putin podpisyal ukaz o prinятии на вооружение VMF raketnogo kompleksa “Sineva”’ [Russian President V. V. Putin has signed a decree accepting the missile complex ‘Sineva’ into the Navy’s arsenal], News release, 16 July 2007, <http://www.makeyev.ru/news.php?extend.27>.
\item[59] Richardson, D., ‘Russian SLBMs should see out 2030’, \textit{Jane’s Missiles and Rockets}, vol. 11, no. 5 (May 2007), p. 10.
\item[64] ed. Lennox (note 20), p. 166.
\item[65] US Department of State (note 18), p. 1.
\end{footnotes}
the simulated warhead hit the target at the Kura test range. Shortly after the test Russian military officials announced plans to start large-scale production of Bulava components and to complete missile testing in 2008 after conducting launches to determine the maximum range of the missile.

In November and December 2007 the Russian press reported that another test launch of Bulava had been conducted on 10 November. The missile reportedly failed immediately after launch.

Strategic aviation

Russia’s strategic aviation units are grouped under the 37th Air Army of the Supreme High Command (Strategic) of the Russian Air Force. They include the 22nd Guards Heavy Bomber Division based in Engels and Ryazan, with 14 Blackjack (Tu-160), 17 Bear-H16 (Tu-95MS16) and 7 Bear-H6 (Tu-95MS6) aircraft; and the 326th Heavy Bomber Division based in Ukrainka, Khabarovsk kray, with 15 Tu-95MS16 and 25 Tu-95MS6 aircraft. The 37th Air Army also comprises four divisions of Backfire C (Tu-22M3) bombers. The Russian Minister of Defence, Sergei Ivanov, announced in February 2007 that Russia plans to have a total of 50 Tu-160 and Tu-95MS bombers in service by 2015. This would probably be accomplished by retiring some Tu-95MSs and completing the production of a limited number of Tu-160s. In 2007 the Kazan Aviation Plant completed the production of a new Tu-160 bomber, which began flight testing on 28 December 2007 and is expected to enter service in 2008.

In 2007 Russia’s decision to resume regular long-range strategic bomber patrols resulted in several encounters with British, Norwegian and US fighter aircraft.

Non-strategic nuclear weapons

There is considerable uncertainty in estimates of Russia’s inventory of non-strategic nuclear weapons, which continues to be characterized by a high degree of secrecy and a lack of transparency. Since the end of the cold war, Russia has significantly reduced this inventory pursuant to President Boris Yeltsin’s 1992 unilateral initiative on non-strategic nuclear weapons. In 2007 the top Ministry of Defence official responsible

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69 Lantratov, K. and Gritskova, A., ‘Den’gi est’, oruzhiya net’ [There is money, but no weapon], Kommersant, 21 Nov. 2007.
70 US Department of State (note 18), pp. 62–63.
71 Khudoleev, V., ‘37-ya derzhit kurs’ [37th Army is following the course], Krasnaya Zvezda, 23 Dec. 2005.
75 As part of a series of reciprocal unilateral presidential initiatives on nuclear weapons between the Soviet Union or Russia and the USA, Yeltsin announced on 29 Jan. 1992 that the production of nuclear
for nuclear weapon custody, Colonel General Vladimir Verkhovtsev, reported on the progress made in reducing this inventory but did not give specific numbers of warheads. On the basis of the number of available delivery platforms, it can be estimated that Russia has approximately 2100 warheads that are operational for delivery by anti-ballistic missiles, air-defence missiles, tactical aircraft and naval cruise missiles, depth bombs and torpedoes. In addition, Russia is believed to have up to several thousand non-strategic warheads held in reserve or awaiting dismantlement.

IV. British nuclear forces

The United Kingdom’s nuclear deterrent consists of a sea-based component only, namely, Vanguard Class Trident SSBNs, Trident II (D-5) SLBMs and associated warheads (see table 8A.4). The UK possesses an operational stockpile of about 185 nuclear warheads available for use by a fleet of four Vanguard Class Trident SSBNs. All British nuclear warheads are designed and manufactured at the Atomic Weapons Establishment, Aldermaston, Berkshire. The UK leases 58 Trident II (D-5) SLBMs, including spares, from the US Navy. Under a system of ‘mingled asset ownership’ Trident II (D-5) missiles to be loaded onto British submarines are randomly selected from the stockpile at the US Navy’s Trident facility in Kings Bay, Georgia. The submarines then go to the Royal Naval Armaments Depot at Coulport, Argyll and Bute, where the missiles are fitted with warheads that are designed and manufactured at the Atomic Weapons Establishment.

Each SSBN is equipped with 16 Trident II (D-5) missiles carrying up to 48 warheads. The warhead is similar to the US W76 warhead and has an explosive yield of about 100 kt. As part of a reduced force-loading option, it is believed that a number of the Trident II (D-5) missiles are deployed with only one warhead instead of three; this warhead may also have a greatly reduced explosive yield, possibly produced by the detonation of only the fission primary.

The British Ministry of Defence’s 1998 Strategic Defence Review added a ‘sub-strategic’ role to the Trident fleet. The review states that ‘the credibility of deterrence also depends on retaining an option for a limited strike that would not automatically lead to a full scale nuclear exchange’ as a means of demonstrating resolve or conveying a political message. A 2002 addendum to the Strategic Defence Review warheads for land-based tactical missiles, artillery shells and landmines had ceased and that Russia had begun eliminating one-third of its naval non-strategic warheads and one-half of its nuclear surface-to-air missile warheads. He stated that tactical air force weapons would be reduced by one-half and proposed placing the remaining weapons in centralized storage bases on a reciprocal basis with the USA. Excerpts from the text of Yeltsin’s statement are reproduced in SIPRI Yearbook 1992: World Armaments and Disarmament (Oxford University Press: Oxford, 1992), pp. 89–92.

67 Volgin, V., ‘Strategicheskii monitoring’ [Strategic monitoring], Rossiiskaya Gazeta, 31 Oct. 2007. According to Verkhovtsev, in 2007 Russia had eliminated the following percentages of its non-strategic nuclear warheads compared with 1992: 100% of the ground forces’ warheads, 60% of surface-to-air missile warheads, 50% of the Air Force’s warheads, 30% of the Navy’s warheads.

77 Warheads for ships and submarines are stored on land in depots and can be deployed if necessary.


extendes the role of nuclear weapons to include deterring ‘leaders of states of concern and terrorist organizations’.

In a posture known as continuous at sea deterrence (CASD), one British SSBN is on patrol at all times. The second and third SSBNs can be put to sea fairly rapidly, but there are not enough missiles in the British inventory to arm the fourth submarine. Since the end of the cold war, the SSBN on patrol has been kept at a level of reduced readiness with a ‘notice to fire’ measured in days and its missiles de-targeted. Some patrol coordination may take place with France. The 300th British deterrent patrol was completed in 2007.

The four Vanguard Class SSBNs were each designed to reach the end of their nominal service lives from the early 2020s. The British Government concluded in its December 2006 White Paper, after ‘an exhaustive review of possible future threats and deterrent options’ that ‘renewing the Trident system, by replacing the existing submarines and extending the life of the Trident missiles, is the best and most cost effective way to maintain our ability to deter future threats to the UK’. It also proposed starting, in the near future, the design and construction work on a successor SSBN to the Vanguard Class that would enter service in the 2020s. On 14 March 2007 the British House of Commons approved the government’s plan to replace the Vanguard SSBNs with a fleet of new Trident submarines.

The 2006 White Paper also proposed that the new SSBN might be equipped with the modified Trident II D5LE SLBMs that the USA is building, thereby keeping the Trident II (D-5) missile in service until the early 2040s. To assuage concerns that

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**Table 8A.4. British nuclear forces, January 2008**

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>No. deployed</th>
<th>Year first deployed</th>
<th>Range (km)*</th>
<th>Warhead loading</th>
<th>No. of warheads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submarine-launched ballistic missiles</td>
<td>D-5 Trident II</td>
<td>48</td>
<td>1994</td>
<td>&gt;7 400</td>
<td>1–3 x 100 kt</td>
<td>185*</td>
</tr>
</tbody>
</table>

*kt = kiloton.

* Range is given for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

* Fewer than 160 warheads are operationally available, c. 144 to arm 48 missiles on 3 of 4 nuclear-powered ballistic missile submarines. The operational stockpile may consist of c. 185 warheads, with additional warheads in reserve. Only 1 boat is on patrol at any time, with up to 48 warheads.


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83 British Ministry of Defence and British Foreign and Commonwealth Office (note 81).
the UK was not complying with its commitment under Article VI of the NPT to work in good faith towards nuclear disarmament, the government proposed a small reduction in the British nuclear stockpile. It deferred a decision until the next parliament (due to be elected by 2010) on whether to refurbish or replace the current warheads. On 15 November 2007 in a written answer to a parliamentary question, the Secretary of State for Defence, Des Browne, confirmed that the UK’s inventory of ‘operationally available warheads’ had been reduced ‘from fewer than 200 to fewer than 160’.84 A small inventory of non-operational reserve warheads presumably also exists.

According to the 2006 White Paper, the procurement costs of the new submarines and associated infrastructure would be about £15–20 billion ($28.5–38 billion), at 2006 prices, for a four-boat fleet. Most of this cost (c. £1 billion, or $1.9 billion, per annum) would be incurred during the period 2012–27.85

V. French nuclear forces

There has been a gradual evolution in France’s nuclear doctrine since the end of the cold war. French officials have emphasized the need for greater flexibility in meeting a widening range of plausible deterrence scenarios. In 2006 President Jacques Chirac stated that France’s nuclear deterrent remained the fundamental guarantor of its security, including against the dangers of regional instability growing extremism and the proliferation of WMD. Chirac threatened to retaliate with nuclear weapons against any state found to be supporting terrorism against France or considering the use of WMD and revealed that French nuclear forces had already been reconfigured accordingly (see table 8A.5). This involved reducing the number of nuclear warheads on SLBMs to allow more precisely targeted strikes.86

France’s sea-based strategic force consists of a fleet of four operational SSBNs, of which three are of the new Triomphant Class and one is of the L’Inflexible Class. The remaining L’Inflexible Class SSBN will be retired when the fourth and final vessel of the Triomphant Class, Le Terrible, enters service in 2010. Laid down in 2002, Le Terrible is due to be launched in 2008, beginning sea trials in 2009.87

All French SSBNs are armed with 16 Aérospatiale M45 missiles, which carry up to six TN-75 warheads.88 In 2010–15, beginning with the Le Terrible, the Triomphant Class SSBNs will be retrofitted with the longer-range M51.1 SLBM, which is a three-stage solid-propellant missile armed with up to six TN-75 warheads. It is estimated to have a maximum range of 6000–8000 km.89

85 British Ministry of Defence and British Foreign and Commonwealth Office (note 81).
As of January 2008 the M51.1 missile had been flight-tested twice, on 9 November 2006 and 21 June 2007. Both times an unarmed M51.1 missile was launched from the Landes Missile Launch Test Centre at Biscarrosse, Aquitaine. Simulated underwater launches are due to start in late 2008 at Toulon, Provence-Alpes-Côte d’Azur. The first underwater launch from a submarine is planned for 2010. A total of 10 test launches are planned. A follow-on version of the missile, the M51.2, may be under development for possible deployment in 2015–17.

The air component of the French nuclear force consists of two types of aircraft: approximately 60 Mirage 2000N aircraft, equipping three Air Force squadrons with nuclear strike roles; and about 24 Super Étendard aircraft deployed on the aircraft carrier Charles de Gaulle. Both types of aircraft carry the Air–Sol Moyenne Portée (ASMP) cruise missile. A total of 90 ASMP missiles were produced, along with 80 TN81 300-kt warheads for them. France may have about 60 operational ASMP missiles with nuclear warheads deployed, with additional missiles in storage.

Table 8A.5. French nuclear forces, January 2008

<table>
<thead>
<tr>
<th>Type</th>
<th>No. deployed</th>
<th>Year first deployed</th>
<th>Range (km)</th>
<th>Warhead loading</th>
<th>No. of warheads</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land-based aircraft</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mirage 2000N</td>
<td>60</td>
<td>1988</td>
<td>2750</td>
<td>1 x 300 kt ASMP</td>
<td>50</td>
</tr>
<tr>
<td><strong>Carrier-based aircraft</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super Étendard</td>
<td>24</td>
<td>1978</td>
<td>650</td>
<td>1 x 300 kt ASMP</td>
<td>10</td>
</tr>
<tr>
<td><strong>Submarine-launched ballistic missiles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M45</td>
<td>48</td>
<td>1996</td>
<td>6000 b</td>
<td>6 x 100 kt</td>
<td>288</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>348 c</td>
</tr>
</tbody>
</table>

ASMP = Air–Sol Moyenne Portée; kt = kiloton.

a Aircraft range is given for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

b The range of the M45 submarine-launched ballistic missile is listed as only 4000 km in a 2001 report from the National Defence Commission of the French National Assembly.

c France may also have a small inventory of reserve warheads.


As of January 2008 the M51.1 missile had been flight-tested twice, on 9 November 2006 and 21 June 2007. Both times an unarmed M51.1 missile was launched from the Landes Missile Launch Test Centre at Biscarrosse, Aquitaine. Simulated underwater launches are due to start in late 2008 at Toulon, Provence-Alpes-Côte d’Azur. The first underwater launch from a submarine is planned for 2010. A total of 10 test launches are planned. A follow-on version of the missile, the M51.2, may be under development for possible deployment in 2015–17.

The air component of the French nuclear force consists of two types of aircraft: approximately 60 Mirage 2000N aircraft, equipping three Air Force squadrons with nuclear strike roles; and about 24 Super Étendard aircraft deployed on the aircraft carrier Charles de Gaulle. Both types of aircraft carry the Air–Sol Moyenne Portée (ASMP) cruise missile. A total of 90 ASMP missiles were produced, along with 80 TN81 300-kt warheads for them. France may have about 60 operational ASMP missiles with nuclear warheads deployed, with additional missiles in storage.
A follow-on cruise missile, the ASMP-A (Air–Sol Moyenne Portée Améliorée), is planned to gradually replace the ASMP.\textsuperscript{93} The ASMP-A is expected to enter service in 2008. The nuclear-capable missile will initially equip one Mirage 2000N squadron, and then a second squadron in September 2010. An Air Force Rafale F3 squadron is reportedly scheduled to receive the ASMP-A in December 2009, and the Navy’s Rafale F3 combat aircraft will receive the missile in 2010.\textsuperscript{94}

VI. Chinese nuclear forces

According to its 2006 Defence White Paper, China ‘upholds the principles of counterattack in self-defence and limited development of nuclear weapons, and aims at building a lean and effective nuclear force’. Chinese nuclear forces are stated to have the purpose of deterring ‘other countries from using or threatening to use nuclear weapons against China’.\textsuperscript{95} The 2006 White Paper reiterates commitment to ‘the policy of no first use of nuclear weapons at any time and under any circumstances’.

China is estimated to have an arsenal of approximately 176 operational nuclear weapons for delivery mainly by ballistic missiles and aircraft (see table 8A.6). Additional warheads may be in reserve, giving a total stockpile of about 240 warheads.\textsuperscript{96} The Chinese Foreign Ministry stated in 2004 that China possessed ‘the smallest nuclear arsenal’ among the nuclear weapon states.\textsuperscript{97} China has a long-term nuclear force modernization programme under way. It is still unclear whether China intends to significantly expand its ballistic missile force or to deploy newer, more survivable missiles in approximately the same numbers as today.\textsuperscript{98}

As of early 2008, China had four types of deployed ICBMs: the solid-fuel mobile DF-31 and DF-31A; the silo-based, liquid fuel DF-5A (CSS-4); and the smaller liquid-fuel DF-4 (CSS-3).\textsuperscript{99} A 2007 US DOD report suggested that the DF-31 achieved ‘initial threat availability’ in 2006 and probably had achieved ‘operational

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\textsuperscript{94} Isby (note 91).


### Table 8A.6. Chinese nuclear forces, January 2008

<table>
<thead>
<tr>
<th>Type and Chinese designation (US designation)</th>
<th>No. deployed</th>
<th>Year first deployed</th>
<th>Range (km)$^a$</th>
<th>Warhead loading</th>
<th>No. of warheads</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategic weapons</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Land-based missiles$^b$</strong></td>
<td>~121</td>
<td>~121</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DF-3A (CSS-2)</td>
<td>17</td>
<td>1971</td>
<td>3 100$^c$</td>
<td>1 x 3.3 Mt</td>
<td>17</td>
</tr>
<tr>
<td>DF-4 (CSS-3)</td>
<td>17</td>
<td>1980</td>
<td>5 500</td>
<td>1 x 3.3 Mt</td>
<td>17</td>
</tr>
<tr>
<td>DF-5A (CSS-4)</td>
<td>20</td>
<td>1981</td>
<td>13 000</td>
<td>1 x 4–5 Mt</td>
<td>20</td>
</tr>
<tr>
<td>DF-21 (CSS-5)</td>
<td>~55</td>
<td>1991</td>
<td>2 100$^c$</td>
<td>1 x 200–300 kt</td>
<td>~55</td>
</tr>
<tr>
<td>DF-31 (CSS-X-10)</td>
<td>&lt;10</td>
<td>2007</td>
<td>&gt;7 200</td>
<td>1 x . .</td>
<td>&lt;10</td>
</tr>
<tr>
<td>DF-31A (?)</td>
<td>&lt;10</td>
<td>(2008–10)</td>
<td>&gt;11 200</td>
<td>1 x . .</td>
<td>&lt;10</td>
</tr>
<tr>
<td><strong>SLBMs</strong></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>JL-1 (CSS-N-3)</td>
<td>(12)</td>
<td>1986</td>
<td>&gt;1 770</td>
<td>1 x 200–300 kt</td>
<td>(12)</td>
</tr>
<tr>
<td><strong>Aircraft$^d$</strong></td>
<td>&gt;20</td>
<td></td>
<td></td>
<td></td>
<td>~40</td>
</tr>
<tr>
<td>H-6 (B-6)</td>
<td>20</td>
<td>1965</td>
<td>3 100</td>
<td>1 x bomb</td>
<td>20</td>
</tr>
<tr>
<td>Attack (Qian-5, others?)</td>
<td>. .</td>
<td>1972–?</td>
<td></td>
<td>1 x bomb</td>
<td>~20</td>
</tr>
<tr>
<td><strong>Non-strategic weapons$^e$</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cruise missiles (DH-10)</td>
<td>50–250</td>
<td>2007</td>
<td>&gt;2000</td>
<td>1 x . .</td>
<td>~15$^f$</td>
</tr>
<tr>
<td>Short-range ballistic missiles (DF-15 and DF-11)</td>
<td>250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>~176$^g$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

($) = not fully operational; kt = kiloton; Mt = megaton; SLBM = submarine-launched ballistic missile; . . = unknown.

$^a$ Aircraft range is given for illustrative purposes only; actual mission range will vary.

$^b$ China defines missile ranges as short-range <1000 km; medium-range 1000–3000 km; long-range 3000–8000 km; and intercontinental range >8000 km.

$^c$ The range of the DF-3A and the DF-21A may be longer than is normally reported.

$^d$ The figures for aircraft are for nuclear-configured versions only.

$^e$ Other than the DH-10, the existence of tactical warheads is uncertain but possible.

$^f$ Can be delivered from H-6 bomber and ground-based launcher.

$^g$ Additional warheads are thought to be in storage. The total stockpile is believed to comprise c. 240 warheads.

status’ by May 2007.\footnote{US Department of Defense (note 96), p. 56; and US Department of Defense (DOD), \textit{Military Power of the People’s Republic of China 2007} (DOD: Washington, DC, 25 May 2007), <http://www.defenselink.mil/pubs/china.html>, p. 42.} China deploys one type of medium-range ballistic missile (MRBM)\footnote{Although China has its own system for defining missile ranges, the US DOD definitions are used here: short-range = <1100 km; medium-range = 1100–2750 km; intermediate-range = 2750–5500 km; and intercontinental range = >5500 km. See Kristensen, Norris and McKinzie (note 98), p. 218.}—the solid-fuel, road-mobile DF-21 (CSS-5)—and one type of intermediate-range ballistic missile (IRBM)—the liquid-fuel DF-3A (CSS-2). The DF-3A and the DF-4 are expected to be completely replaced by the DF-21 and DF-31.

China operates a single Type 092 (Xia Class) SSBN armed with 12 intermediate-range solid-fuel, single-warhead JL-1 (CSS-N-3) SLBMs. The submarine has never conducted a deterrent patrol and is not thought to be fully operational.\footnote{Kristensen, Norris and McKinzie (note 98), pp. 77–80.} The 2006 White Paper states that the Chinese Navy ‘aims at . . . enhancing its capabilities in integrated maritime operations and nuclear counterattacks’.\footnote{Chinese State Council (note 95).} To this end, China is developing the Type 094 (Jin Class) SSBN. It will carry the intercontinental-range JL-2 SLBM with a range of more than 7200 km. The US DOD estimates that the JL-2 will reach an ‘initial operational capability’ in 2009–2010.\footnote{US Department of Defense (note 96), p. 3.}

Commercial satellite imagery analysed by the Federation of American Scientists in 2007 showed the existence of at least two Type 094 submarines and confirms that each has 12 launch tubes for JL-2 SLBMs.\footnote{Kristensen, H. M., ‘A closer look at China’s new SSBNs’, FAS Strategic Security Blog, 15 Oct. 2007, <http://www.fas.org/blog/ssp/2007/10/post_4.php>; and Kristensen, H. M., ‘Two more Chinese SSBNs spotted’, FAS Strategic Security Blog, 4 Oct. 2007, <http://www.fas.org/blog/ssp/2007/10/two_more_chinese_ssbns_spotted.php>.} The US Office of Naval Intelligence projected in December 2006 that ‘a fleet of probably five TYPE 094 SSBNs will be built in order to provide more redundancy and capacity for a near-continuous at-sea SSBN presence’.\footnote{US Navy, Office of Naval Intelligence, Answers to questions obtained by Hans M. Kristensen under the Freedom of Information Act, 20 Dec. 2006, <http://www.fas.org/nuke/guide/china/ONI2006.pdf>.} This projection was somewhat confirmed by the DOD in 2008, which stated that ‘by 2010, China’s nuclear forces will likely comprise . . . up to five Jin-class SSBNs’.\footnote{US Department of Defense (note 96), p. 25.} The first Jin (Type 094) Class SSBN was launched in 2004 and is currently being fitted out. A second vessel was launched in 2006,\footnote{Saunders, S. (ed.), \textit{Jane’s Fighting Ships} 2006–2007 (Jane’s Information Group: Coulsdon, 2006), p. 120.} and a third vessel may be under construction.

It is thought that China has a small stockpile of nuclear bombs earmarked for delivery by aircraft as a contingency mission. The most likely aircraft to have a nuclear role today are the H-6 bombers. China has also started deploying the DH-10 land-attack cruise missile, which exists in a nuclear and conventional version for delivery by the H-6 and ground forces.

VII. Indian nuclear forces

Most published estimates of the size of the Indian nuclear stockpile are based on calculations of the total amount of weapon-grade plutonium that India has produced. There is considerable uncertainty in these calculations. There have also been numer-

**Table 8A.7. Indian nuclear forces, January 2008**

<table>
<thead>
<tr>
<th>Type</th>
<th>Range (km)</th>
<th>Payload (kg)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land-based ballistic missiles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prithvi I (P-I)</td>
<td>150</td>
<td>800</td>
<td>Entered service in 1994; widely believed to have a nuclear delivery role; fewer than 50 launchers have been deployed; most recent flight test on 9 May 2007</td>
</tr>
<tr>
<td>Agni I&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&gt;700</td>
<td>1 000</td>
<td>Test-launched on 5 Oct and 24 Oct. 2007&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Agni II</td>
<td>&gt;2 000</td>
<td>1 000</td>
<td>Last test-launched on 29 Oct. 2004&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Agni III</td>
<td>&gt;3 500</td>
<td>1 500</td>
<td>Under development; test-launched on 12 Apr. 2007</td>
</tr>
<tr>
<td><strong>Sea-based ballistic missiles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Danush</td>
<td>400</td>
<td>1 000</td>
<td>Last test-launched on 30 Mar. 2007; induction under way</td>
</tr>
<tr>
<td><strong>Aircraft&lt;sup&gt;d&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mirage 2000H Vajra</td>
<td>1 850</td>
<td>6 300</td>
<td>Has reportedly been certified for delivery of nuclear gravity bomb</td>
</tr>
<tr>
<td>Jaguar IS Shamsher</td>
<td>1 400</td>
<td>4 760</td>
<td>Some of 4 squadrons may have a nuclear delivery role</td>
</tr>
</tbody>
</table>

<sup>a</sup> Missile payloads may have to be reduced in order to achieve maximum range. Aircraft range is given for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

<sup>b</sup> The original Agni I, now known as the Agni, was a technology demonstrator programme that ended in 1996.

<sup>c</sup> Media reports in late 2007 and early 2008 indicated that the Agni I and the Agni II had achieved operational status.

<sup>d</sup> Other aircraft in the Indian Air Force’s inventory that are potentially suitable for a nuclear role are the MiG-27 (Bahadur) and the Su-30MKI. The Su-30MKI can be refuelled in-flight by the IL-78 aerial tanker.

ous media and government reports suggesting that India has not manufactured as many nuclear weapons as it otherwise could owing to material constraints. On the basis of an upper bound estimate of its inventory of weapon-grade plutonium—650 kg as of December 2006—India would have the material capacity to build an arsenal exceeding 100 nuclear weapons. The conservative estimate presented here is that the Indian arsenal holds about 60–70 nuclear weapons. The figure is based on the lower range of a widely-cited estimate of India’s military plutonium inventory as well as on unclassified assessments made by the US intelligence community. It is not publicly known whether India has produced high enriched uranium (HEU) for weapon purposes, in particular for thermonuclear devices.

India’s nuclear doctrine, which was published as a draft document in 1999, is ‘based on the principle of a minimum credible deterrent and no-first-use’. However, additional guidelines published in January 2003 stated that India would use nuclear weapons to deter or retaliate against the use of chemical or biological weapons. There have been no official statements specifying the size of the arsenal required for ‘minimum credible deterrence’ but, according to the Indian Ministry of Defence, it involves ‘a mix of land-based, maritime and air capabilities’.

**Strike aircraft**

At present, aircraft are the core of India’s nuclear strike capabilities (see table 8A.7). The Indian Air Force (IAF) has reportedly certified the Mirage 2000H Vajra (‘Divine Thunder’) multi-role aircraft for delivery of nuclear gravity bombs. The IAF deploys two squadrons of Mirage 2000H aircraft at the Gwalior Air Force Station in north-central India. In addition to the Mirage 2000H, some of the IAF’s four squadrons of Jaguar IS Shamsher (‘Sword’) fighter-bombers may have a nuclear delivery role. Other aircraft which are suitable for a nuclear role are the MiG-27 and the Su-30MKI.

**Land-based ballistic missiles**

The Prithvi (‘Earth’) was India’s sole operational ballistic missile for many years. A number of Prithvi I missiles are widely believed to have been modified to deliver nuclear warheads, although this has not been officially confirmed. The Prithvi I (SS-150) is a single-stage, road-mobile ballistic missile capable of delivering a 1000-kg warhead to a maximum range of 150 km. The missile was first flight-tested in 1988 and entered service with the Indian Army in 1994. It is currently deployed

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109 See appendix 8B, table 8B.2.
with the Army’s 333, 444 and 555 missile groups. On 9 May 2007 a Prithvi I missile was successfully test-launched at the Integrated Test Range (ITR) at Chandipur-on-Sea, Orissa, on the Bay of Bengal. Officials at India’s Defence Research and Development Organisation (DRDO) described the test as a ‘user trial’ for production quality control involving a missile selected at random from the Army’s inventory. The two newer versions of the Prithvi missile—the Prithvi II (SS-250), which has entered into service with the Air Force, and the Prithvi III (SS-350)—with improved range, accuracy and handling characteristics. Both are capable of carrying nuclear warheads but are not believed to be assigned a nuclear delivery role.

Indian defence sources indicate that the family of longer-range Agni (‘Fire’) ballistic missiles, which are designed to provide a short reaction time nuclear capability, has largely taken over the Prithvi’s nuclear role. The short-range Agni I is a single-stage solid-fuel missile that can deliver a 1000-kg warhead to a maximum range of 700–800 km. The two-stage Agni II can deliver a similar payload to a range of up to 2000–2500 km. The missiles are road and rail mobile, and both can carry nuclear as well as conventional warheads. In April 2007 the Indian Defence Minister, A. K. Antony, indicated that the Agni I and the Agni II missiles had yet to be inducted into the armed forces but stated that this would be done in a ‘reasonable time’ and without ‘unnecessary delay’. On 4 February 2008, however, three days after Pakistan launched an IRBM, the Indian Government reportedly announced that the Agni I and the Agni II were operationally deployed with India’s Strategic Forces Command’s 334th and 335th rocket regiments.

On 5 October 2007, army personnel from the Strategic Forces Command successfully test-launched an Agni I missile at the Chandipur-on-Sea facility. The test was described as a ‘training trial’ for the Indian Army. It was followed, on 24 October, by the test launch of an Agni I missile equipped with improved re-entry technology. The Agni II has not been test-launched since October 2004.

On 12 April 2007 the DRDO conducted the second test flight of the intermediate-range Agni III. The missile was launched from a fixed platform at the ITR on Wheeler Islands in the Bay of Bengal. The first flight test, in July 2006, failed after the missile crashed into the sea reportedly due to problems with its heat shield. The missile is expected to be able to deliver a 1500-kg payload to a range of up to 3500 km. This would put large areas of China within range of launch points in eastern India, although Indian defence officials have denied that the missile was


119 Pubby, M., ‘Nuclear-capable Agni-I missile is all set for army’s first training trial’, India Express, 2 Oct. 2007.


121 ‘India successfully test fires Agni III test ballistic missile’, The Hindu, 12 Apr. 2007; and Srivastava, S., ‘India has China in its range’, Asia Times, 14 Apr. 2007.

designed with China in mind. The DRDO is developing a longer-range version of the Agni III missile, sometimes referred to as Agni III* (Agni Three Star), which may begin flight tests in 2009.123

In June 2007 there were unconfirmed media reports that the Indian Government had decided not to proceed with the development of an ICBM with a range exceeding 5000 km.124 The decision to impose a 5000-km range limit, or ‘cap’, on strategic missiles was reportedly intended as a ‘goodwill gesture’ aimed at facilitating implementation of the Indian–US Civil Nuclear Cooperation Initiative (CNCI) as well as an effort to forestall additional sanctions on exports of critical material for India’s missile programme.125 However, in December 2007 DRDO officials stated that design work was under way on a three-stage, nuclear-capable Agni missile with a range of up to 6000 km.126

There has been speculation in recent years that India is developing a 10 000 km-range ICBM, known as the Surya (‘Sun’), based on India’s Polar Space-Launch Vehicle (PSLV).127 In 2007 there were no authoritative statements indicating that India is actively pursuing such a programme.

Sea-launched ballistic missiles

India continues efforts to develop the naval component of its planned ‘triad’ of nuclear forces. The converted Prithvi II missile, the Dhanush (‘Bow’), was test-launched on 30 March 2007 from the Indian Navy ship Rajput. This was the fourth flight test of the Dhanush, which the Indian Ministry of Defence (MOD) has stated will be capable of carrying both conventional and nuclear warheads.128 The MOD stated in 2006 that the ‘process of weaponisation of INS Suvarna and Subhadra with the Dhanush missile is under progress’.129

India’s first test launch of an SLBM occurred on 26 February 2008, when the K-15 was launched from a submerged pontoon near Visakhapatnam on India’s east coast. An MOD spokesperson said that the test ‘was successful’, and the media reported that the missile has a range of 700 km, similar to that of the Agni I.130 MOD officials disclosed in 2007 that the DRDO had tested components of an underwater missile

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125 See Joshi, S., ‘India and Pakistan missile race surges on’, WMD Insights, Oct. 2007. After the flight test of the Agni III in Apr. 2007, the USA and a number of other exporters suspended the sale to India of polyacrylonitrile (PAN) carbon fibre, which is used to make missile engine casings. On the CNCI see chapter 8, section IV.
launch system and was developing a two-stage ballistic missile, designated the K-15, to be launched from a submerged submarine using a gas booster.\textsuperscript{131} The K-15 is expected to be deployed on an indigenous nuclear-powered submarine, the Advanced Technology Vessel (ATV), which has been under development since the 1970s. Government officials have stated the ATV is scheduled to be launched in the spring of 2009 and to begin sea trials.\textsuperscript{132} There has been considerable speculation that India was developing an SLBM known as the Sagarika (‘Oceanic’), and some reports of the K-15 launch also called it the Sagarika. However, the Indian MOD stated in 2006 that ‘There is no missile project by the name “Sagarika”’.\textsuperscript{133}

VIII. Pakistani nuclear forces

The estimate presented here—that Pakistan possesses approximately 60 nuclear weapons—is conservative. On the basis of recent estimates of the size of Pakistan’s military inventory of HEU and separated plutonium, the country could theoretically produce 70–100 nuclear weapons.\textsuperscript{134} However, Pakistan is believed to have used only part of this inventory to manufacture warheads, and thus the actual number of warheads is likely to be lower than this. Pakistani officials claim that the country has already produced more warheads than needed to satisfy its current ‘minimum deterrence requirement’ but note that this requirement is subject to review ‘according to situation’.\textsuperscript{135} Pakistan’s Prime Minister, Shaukat Aziz, asserted in January 2007 that since the Indian–US CNCI could result in more fissile material becoming available for India’s military stockpile, and since India has expressed interest in acquiring missile defences, Pakistan ‘would need to take measures to ensure the credibility of our deterrence’.\textsuperscript{136}

Pakistan’s current nuclear arsenal is based primarily on HEU, which is produced by a gas centrifuge uranium enrichment facility at the Kahuta Research Laboratories (also called the A. Q. Khan Research Laboratories). There is evidence that Pakistan is moving towards a plutonium-based arsenal.\textsuperscript{137} Pakistan is currently operating the 50-megawatt thermal (MW(t)) Khushab I reactor, completed in 1998, which is cap-

\textsuperscript{134} Pakistan possessed an estimated 1.4 ± 0.3 tonnes of HEU and about 80 kg of separated plutonium as of 2007. See also appendix 8B. It is assumed that Pakistan’s HEU weapons are of solid core, implosion-type designs requiring 15–20 kg of HEU each, and its plutonium weapons require at the very least 4.5 kg of plutonium.
\textsuperscript{135} Interview with Gen. Ehsanul Haq, Chairman of Joint Chiefs of Staff Committee, Today with Kamran Khan, Karachi Geo News TV, 24 Nov. 2006, Translation from Urdu, World News Connection, National Technical Information Service (NTIS), US Department of Commerce.
\textsuperscript{137} Plutonium-based nuclear warheads would normally be lighter and more compact than those using HEU to achieve the same yield. Such warheads could either be fitted onto smaller missiles, possibly including cruise missiles, or give already deployed ballistic missiles longer ranges.
able of producing about 10–12 kg of weapon-grade plutonium annually.\textsuperscript{138} It is building a second heavy-water reactor at the Khushab nuclear complex, Punjab. According to one estimate by non-governmental experts, the new reactor is likely to be in the ‘40 to 100 MWt range’.\textsuperscript{139} In 2007 commercial satellite images indicated that Pakistan had begun construction of a new reactor, identical to the second, at Khushab.\textsuperscript{140} This would enable Pakistan to significantly increase its plutonium production capability, provided that the country has sufficient spent fuel-reprocessing capacity. Plutonium separation takes place at the pilot-scale New Labs reprocessing plant at Rawalpindi, Punjab. A new chemical separation facility appears to be nearing completion at Chashma, Punjab.\textsuperscript{141}

**Strike aircraft**

The aircraft of the Pakistani Air Force that is most likely to be used in the nuclear weapon delivery role is the F-16 (see table 8A.8). Other aircraft, such as the Mirage V or the Chinese-produced A-5, could also be used. Pakistan currently maintains 32 F-16 aircraft in service, deployed in three squadrons. In September 2006 Pakistan signed a deal with the USA, worth $5.1 billion, to buy 18 Block 52 F-16C/D aircraft, with an option for 18 more. Pakistan will also receive 24 used USAF F-16s at a later date.\textsuperscript{142} As part of the agreement, the 32 F-16A/Bs already in Pakistani service are to receive a midlife update.\textsuperscript{143} The USA delivered the first two F-16s in July 2007.\textsuperscript{144}

**Ballistic missiles**

Pakistan has begun deployment of two types of short-range ballistic missiles (SRBMs) which are believed to have nuclear delivery roles. The Ghaznavi (Hatf-3) is a single-stage, solid-propellant, road-mobile SRBM which was formally inducted into service in 2004. It is believed to be a domestically produced copy of the M-11 missile that was acquired from China in the 1990s. The Pakistani Army test-launched a Ghaznavi missile on 13 February 2008.\textsuperscript{145} The other short-range ballistic missile, the


\textsuperscript{143} Schanz (note 142).


\textsuperscript{145} ‘Ghaznavi missile launched’, *Dawn*, 14 Feb. 2008. See also President of the Islamic Republic of Pakistan, Office of the Press Secretary, ‘Pakistan successfully test fires short range ballistic missile’,
### Table 8A.8. Pakistani nuclear forces, January 2008

<table>
<thead>
<tr>
<th>Type</th>
<th>Range (km)</th>
<th>Payload (kg)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-16A/B</td>
<td>1 600</td>
<td>4 500</td>
<td>32 aircraft, deployed in 3 squadrons; most likely aircraft to have a nuclear delivery role</td>
</tr>
<tr>
<td>Ballistic missiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghaznavi (Hatf-3)</td>
<td>~400</td>
<td>500</td>
<td>Entered service with the Pakistani Army in 2004; fewer than 50 launchers have been deployed; last test-launched on 13 Feb. 2008</td>
</tr>
<tr>
<td>Shaheen I (Hatf-4)</td>
<td>&gt;450&lt;sup&gt;b&lt;/sup&gt;</td>
<td>750–1 000</td>
<td>Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed; last test-launched on 25 Jan. 2008</td>
</tr>
<tr>
<td>Shaheen II (Hatf-6)</td>
<td>&gt;2 000</td>
<td>~1 000</td>
<td>Under development; fourth test launch on 23 Feb. 2007</td>
</tr>
<tr>
<td>Ghauri I (Hatf-5)</td>
<td>&gt;1 200</td>
<td>700–1 000</td>
<td>Entered service with the Pakistani Army in 2003; fewer than 50 launchers deployed; test-launched on 1 Feb. 2008</td>
</tr>
<tr>
<td>Ghauri II</td>
<td>2 300</td>
<td>. .</td>
<td>Under development; status uncertain</td>
</tr>
<tr>
<td>Cruise missiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Babur (Haft 7)</td>
<td>700&lt;sup&gt;c&lt;/sup&gt;</td>
<td>. .</td>
<td>Under development; ground-launched version tested 3 times in 2007 (Mar., June and Dec.); sea- and air-launched versions also under development</td>
</tr>
</tbody>
</table>

<sup>a</sup> Missile payloads may have to be reduced in order to achieve maximum range. Aircraft range is given for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

<sup>b</sup> Some unofficial sources claim a range of 600–1500 km.

<sup>c</sup> Since 2006 the range of flight tests have been increased from 500 to 700 km.

Shaheen I (Hatf-4), entered into service with the Pakistani Army in 2003. It was most recently test-launched on 25 January 2008 during a troop training exercise. There are rumors that the short-range Abdali may also be nuclear-capable. After a test launch in March 2007, the president’s office stated in a press release that the missile ‘can carry all types of warheads’.

Pakistan’s only MRBM currently in service is the Ghauri I (Hatf-5), which is a road-mobile, liquid-propellant, single-warhead missile. Pakistani defence officials have declared it to have a nuclear delivery role. In addition to the Ghauri MRBM, Pakistan continues to develop the two-stage road-mobile solid-propellant Shaheen II (Hatf-6) MRBM. On 23 February 2007 the Pakistani military announced that an upgraded Shaheen II missile had been successfully test-launched to a range of 2000 km. The launch, which was described as being ‘part of a continuous process of validation and technical improvement’, was the fourth test of the Shaheen II, which may soon become operational. The Shaheen II’s range of 2000–2500 km means that it can reach targets across India. Pakistani military officials have denied that the country was seeking to develop long-range ballistic missiles that could strike targets outside the region.

Pakistan is continuing to develop its arsenal of cruise missiles. On 11 December 2007, Pakistan test-fired a nuclear-capable cruise missile, designated the Babur (Hatf-7), from a ground launcher This marked the missile’s fourth ground-launched test flight since 2005. According to a statement issued by the military, the range of the low-flying, subsonic cruise missile had been increased from 500 to 700 km, and efforts are under way to increase the range further to 1000 km. Pakistan is developing an air-launched version of the Babur, which will reportedly be carried by F-16 and JF-17 aircraft. It is also developing a sea-launched version, to be deployed on the Agosta Class attack submarine, that is intended to give Pakistan a second-strike capability. Pakistani officials have insisted that the Babur is an entirely indigenous programme. However, some non-governmental analysts have noted that the missile appears to be similar to the new Chinese DH-10 air-launched cruise missile, which is suspected to be a reverse-engineered US Tomahawk cruise missile.
IX. Israeli nuclear forces

Israel continues to maintain its long-standing policy of nuclear ambiguity, neither officially confirming nor denying that it possesses nuclear weapons. However, in December 2006 the Israeli Prime Minister, Ehud Olmert, made a statement that was widely interpreted as tacitly acknowledging that Israel possessed a nuclear arsenal. Speaking to German television, Olmert included Israel in a list of countries that possess nuclear weapons.154 Olmert and other Israeli officials quickly disavowed the remark and reiterated that Israel ‘will not be the first country that introduces nuclear weapons to the Middle East’.155

The size of the Israeli nuclear weapon stockpile is unknown but is widely believed to consist of roughly 100 plutonium warheads. According to one estimate, Israel possessed 340–560 kg of military plutonium as of December 2006, or the equivalent

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Table 8A.9. Israeli nuclear forces, January 2008

<table>
<thead>
<tr>
<th>Type</th>
<th>Range (km)</th>
<th>Payload (kg)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraftb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-16A/B/C/D/I Falcon</td>
<td>1 600</td>
<td>5 400</td>
<td>205 aircraft in the inventory; some are believed to be certified for nuclear weapon delivery</td>
</tr>
<tr>
<td>Ballistic missilesc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jericho II</td>
<td>1 500–1 800</td>
<td>750–1 000</td>
<td>c. 50 missiles; first deployed in 1990; test-launched on 27 June 2001</td>
</tr>
<tr>
<td>Jericho III</td>
<td>&gt;4 800</td>
<td>.</td>
<td>Test launched on 17 Jan. 2008</td>
</tr>
<tr>
<td>Submarines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dolphin</td>
<td></td>
<td></td>
<td>Rumoured to be equipped with nuclear-capable cruise missiles; denied by Israel</td>
</tr>
</tbody>
</table>

*a* Missile payloads may have to be reduced in order to achieve maximum range. Aircraft range is given for illustrative purposes only; actual mission range will vary.

*b* Some of Israel’s 25 F-15I aircraft may also have a long-range nuclear delivery role.

*c* The Shavit space launch vehicle, if converted to a ballistic missile, could deliver a 775-kg payload a distance of 4000 km. The Jericho I, first deployed in 1973, is no longer operational.


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of up to 110 warheads, assuming that each contains 5 kg of plutonium. Only part of this plutonium may have been used to produce warheads. It is estimated here that Israel may have approximately 80 intact warheads, of which 50 are re-entry vehicles for delivery by ballistic missiles and the rest bombs for delivery by aircraft (see table 8A.9). Many analysts believe that Israel has a recessed nuclear arsenal (i.e. one that is stored but not fully armed, requiring some preparation before use). There has been speculation that Israel may have produced non-strategic nuclear weapons, including artillery shells and atomic demolition munitions, but this has never been confirmed.

On 17 January 2008 Israel conducted a test launch reportedly of a long-range ballistic missile from the Palmahim AFB. The Israeli Ministry of Defence did not provide details of the type or purpose of the missile but stated that the experiment tested the missile’s rocket propulsion system and was successful. Israeli radio speculated that the missile was a Jericho III IRBM. The Jericho III is believed to be a three-stage solid-propellant missile, with a probable maximum range of 4800–6500 km and an estimated payload of 1000–1300 kg. It is reported to be in development, with an estimated in-service date in 2008.

X. North Korea’s military nuclear capabilities

North Korea demonstrated a nuclear weapon capability in October 2006 by carrying out an underground nuclear test explosion. However, the unexpectedly low explosion yield led many experts to believe that it had been a ‘fizzle’ (an inefficient detonation releasing less explosive energy than expected). This has raised doubts about whether North Korea has mastered the design and engineering skills needed to manufacture an operational nuclear weapon. On 28 March 2007 the US Central Intelligence Agency Director, Michael Hayden, stated that the North Korean nuclear test was a ‘failure’.

North Korea is believed to have produced and separated enough plutonium from the spent fuel of its 5-megawatt-electric graphite-moderated research reactor at Yongbyon to be able to build a small number of nuclear warheads. In December 2007, as part of its ‘complete and correct’ declaration of past and present nuclear activities, North Korea reportedly informed the United States that it had a separated a total of 30 kg of plutonium; of this, it had used 6 kg for its nuclear test in October 2006. The declared amount was at the lower end of estimates by US Government experts of how much plutonium North Korea could have separated and has raised

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156 See appendix 8B, table 8B.2.
doubts about the correctness of North Korea’s declaration. These estimates are based on calculations of how long the Yongbyon reactor operated to build up plutonium in the fuel rods and how much plutonium was chemically extracted from the spent fuel at the adjacent reprocessing plant. Two US non-governmental experts estimated that, as of February 2007, North Korea had a total plutonium stock of 46–64 kg of plutonium, of which about 28–50 kg was in separated form and usable in nuclear weapons. This would be sufficient to produce 6–10 nuclear weapons, assuming that each weapon used 4.5–5.0 kg of weapon-grade plutonium.

North Korea deploys approximately 500–600 road-mobile SRBMs of three types—Hwasong-5 (Scud B), Hwasong-6 (Scud Mod-C) and Hwasong-7 (Scud Mod-D)—and 50–200 road-mobile Nodong MRBMs. It is also developing the longer-range Taepodong-1 and Taepodong-2 missiles. On 25 April 2007 North Korea held a large military parade in Pyongyang featuring ballistic missiles, reportedly including the Hwasong-6 (Scud C), Hwasong-7 (Scud D) and a new short-range KN-02, a North Korean version of the Russian 9K79 Tochka (SS-21 ‘Scarab’) surface-to-surface missile. Most analysts consider it unlikely that North Korea has developed a nuclear warhead that is light and compact enough to fit onto a ballistic missile.


