

1. Nuclear weapons

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I. Introduction

It is difficult to characterize 1989. It was a year during which the entire foundation of the cold war seemed to crumble and the most fundamental assumptions about East-West relations and military strategy required a complete reappraisal. Even a narrow assessment of the nuclear weapon developments of 1989 must take into account the extraordinary political changes in Eastern Europe, the overwhelming economic and political pressures to reduce military expenditure and forces, and the unprecedented level of co-operation between the USA and the USSR. It appears that these developments may permit a fundamental change in the nuclear postures and practices of the nuclear weapon states. Against this backdrop, future historians may see 1989 as the year in which the post-World War II era ended and a new era began.

Even without this new situation the defence budgets of the five nuclear weapon nations in general and the budgets for nuclear weapons in particular are becoming severely constrained. For the fifth year in a row the US military budget declined, as measured in constant dollars. The Soviet Government stated, and the US Government apparently agrees, that Soviet military spending was less in 1989 than it was in 1988. France is now feeling the effect of its economic constraints, especially visible in the nuclear weapon programme. Nevertheless, nuclear weapon modernization continued in all five of the acknowledged nuclear weapon states: the USA, the USSR, the UK, France and China.

In the USA there was a decrease in the strategic arsenal because of bomb and submarine retirements. Further decreases are likely in coming years, irrespective of the prospective US-Soviet Strategic Arms Reduction Talks (START) agreement. US strategic nuclear capabilities, however, are not declining. The first B-2 'stealth' bomber was unveiled for its test-flights, and decisions were taken concerning the MX missile. Despite much NATO debate on nuclear weapon modernization, by the end of 1989 it appeared that the chances of introducing new types of US nuclear weapon into the Federal Republic of Germany were almost nil. Mounting domestic pressures to cut the military budget and the prospect of a conventional arms reduction agreement in Europe promise to reduce US military forces considerably in the 1990s. The nuclear weapons complex run by the Department of Energy

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(DOE) faced new problems throughout 1989 and may have been unable to produce any nuclear weapons at the end of the year.

The events of 1989 make it clear that *perestroika* is making a difference to Soviet military and nuclear forces. Although the USSR is producing several models of new strategic missiles, as well as new bombers, the overall rate of production has declined. The nuclear stockpile appears to have reached a peak and is now headed gradually downward. Non-strategic nuclear forces are being reduced, unilaterally as well as in accordance with the INF Treaty (the 1987 US-Soviet Treaty on the Elimination of Intermediate-Range and Shorter-Range Missiles), apparently as part of a de-emphasis on nuclear capabilities. In the midst of declining defence spending and production, the Soviet military was busy during 1989 removing forces from Europe and elsewhere, including nuclear weapons, and restructuring or re-integrating remaining forces.

During 1989 the UK continued towards modernization of its submarine force, amid doubts about the Trident II missile to be purchased from the USA and about the ability of the British nuclear weapons complex to make warheads in time for the missiles. Although the UK has not yet decided whether to build a nuclear air-to-surface missile, it appears that warheads cannot be produced simultaneously for such a missile and the Trident II.

Economic constraints in France are forcing reduced military spending and thus the delay of several nuclear weapon programmes. The strategic submarine modernization programme is on schedule, but the next-generation intermediate-range ballistic missile (IRBM) is now expected four years later than planned. President François Mitterrand indicated that 300-400 strategic nuclear warheads were considered sufficient for France, although the French arsenal is planned to grow well above this level by 1993.

The dominant events in China in 1989 were the first Sino-Soviet summit meeting in 30 years and the harsh military and political reaction to popular demonstrations for political reform. China reportedly agreed in May to sell short-range ballistic missiles (SRBMs) to Syria, suggesting that these missiles may have been added to China's nuclear arsenal. Although little information was available on Chinese nuclear developments during 1989, China is continuing with its gradual modernization of its nuclear forces.

The tables showing the nuclear forces of all five nations as of January 1990 (tables 1.1-1.7) appear on pages 14-22 of this chapter. Table 1.8 (page 23) provides historical figures for the strategic forces of the five nations.

II. US nuclear weapon programmes

Because of fiscal constraints, changing operational requirements, tritium shortages and an impending START agreement, it is evident that the size of US strategic forces will not grow beyond the peak years of 1987 and 1988. It is also clear that the stockpile of non-strategic nuclear weapons will decrease as well. Budgetary pressures at the end of 1989 indicated that large

cuts will be made in future military budgets, a prospect which will have some effect on both nuclear and conventional forces.

The year 1989 witnessed the first significant decline in numbers of strategic weapons, from about 13 000 to about 12 100. This was mainly due to the retirement of old gravity bombs from the Strategic Air Command (SAC) arsenal and the withdrawal of one strategic submarine. The bombs removed were for the 69 B-52Gs allocated in late 1988 for exclusively conventional missions. Numerous B28 bombs in the SAC stockpile were also removed, ahead of schedule, to help ease a potential tritium shortage. As the B-52Gs fully complete the transition to a stand-off role, fewer gravity bombs are needed for targets inside the Soviet Union. Irrespective of the pending START treaty, decreases are likely to continue in the number (although not the capability) of US strategic weapons for the next few years.

ICBMs

During 1989 the US operational intercontinental ballistic missile (ICBM) force remained at 1000 missiles with 2450 warheads, unchanged from 1988. Attention was focused on how to proceed with the rail-based MX missiles (officially designated MGM-118A)¹ and the Small ICBM. Decisions had been postponed because of the 1988 presidential election, the delay in confirming a new Secretary of Defense and the lengthy policy review by the Bush Administration. Finally, in late April President Bush decided to pursue both missile programmes, with initial deployment of the MX rail garrison in June 1992 followed by the Small ICBM in FY 1997. An important change, however, from the Reagan Administration was to stop MX deployment at 50 missiles and drop the request for an additional 50. The current plan is to re-base the silo-based MXs on railcars. On 29 November the Air Force announced its selection of six Air Force Bases (AFBs) as sites for MX rail garrison: Barksdale AFB, Bossier City, Louisiana; Dyess AFB, Abilene, Texas; Fairchild AFB, near Spokane, Washington; Grand Forks AFB, Grand Forks, North Dakota; Little Rock AFB, Little Rock, Arkansas; and Wurtsmith AFB, Oscoda, Michigan.

An accident that occurred at MX silo Q-10, at F. E. Warren AFB, Wyoming, on 12 June 1988 was disclosed early in the year.² Because of a weak epoxy bond, the 90-ton missile fell 6-8 inches (15-20 cm) from its support in its canister, pulling electrical cords from their housing. As a safety precaution the 10 warheads were removed on 19 June, as were those from five other missiles.

In the first test-flight in two years, an MX missile with seven re-entry vehicles was launched from Vandenberg AFB on 19 March by a SAC air-

¹ General Accounting Office, *ICBM Modernization: Status of the Peacekeeper Rail Garrison Missile System*, GAO/NSLAD-89-64, Jan. 1989.

² Smith, R. J., 'MX warheads are removed after mishap', *Washington Post*, 25 Jan. 1989, p. A1; 'Probe blames MX failure on fault in stage 1 joint', *Aviation Week & Space Technology*, 20 Feb. 1989, p. 22; Whipple, D., 'MX missile silo collapse examined in air force investigation report', *Capitol Star-Tribune*, 21 May 1989, p. A1.

crew aboard a modified EC-135 aircraft. The aircraft and crew from Ellsworth AFB, South Dakota, used the Airborne Launch Control System to launch the MX for the first time. During a second flight on 14 September, the first in the operational programme, the missile was destroyed three minutes after launch from Vandenberg AFB, California.

The MX operational test and evaluation programme was to have been conducted in two phases over a 15-year period. Phase I was supposed to begin shortly after initial operational capability (IOC) date of December 1986 and was to have consisted of 24 missile tests over three years (eight per year). The new plan is to conduct only three Phase I tests per year until the MX is fully deployed in rail garrison basing in fiscal year (FY) 1994 (assuming congressional approval). Phase I testing would not be completed until about mid-1995, six years later than originally planned. Phase II will consist of 84 test-flights over 12 years (seven per year).³

The first Small ICBM (now officially designated MGM-134A and dubbed 'Midgetman') test-flight was made on 11 May from Vandenberg AFB. The cold-launch from an above-ground silo appeared normal through first-stage separation. After about 70 seconds, however, the missile began to tumble end-over-end and was destroyed by the range safety officer. The test failure further jeopardized the future of the costly missile, which has never been popular with the Air Force or the Reagan or Bush Administrations. Secretary of Defense Richard Cheney told the House Armed Services Committee that the SICBM 'provides greater targeting flexibility and efficiency than highly MIRVed [equipped with multiple independently targetable re-entry vehicles] systems. It may be preferred over highly MIRVed systems for striking targets or newly emergent targets that require retargeting'.⁴

Strategic submarine programmes

The US Navy continues to retire older SSBNs either because they have been ordered to by Congress or to save money. During 1989 one submarine which carried Poseidon missiles was withdrawn from service. The *USS James Monroe* (SSBN-622) was decommissioned on 14 October. Two other submarines are scheduled for withdrawal early in 1990. The *USS Henry Clay* (SSBN-625) will begin deactivation in February 1990, and the *USS Daniel Webster* (SSBN-626) will be converted to a training vessel beginning in April 1990. Over the period from September 1985 to the spring of 1990 seven submarines with 112 SLBMs and approximately 1280 warheads will have been retired.

The commissioning of the *USS Pennsylvania* (SSBN-735) took place on 9 September. It will be the second submarine to carry Trident II SLBMs when it is deployed, scheduled for 1990. The third submarine to carry the

³ General Accounting Office, *ICBM Modernization: Availability Problems and Flight Test Delays in Peacekeeper Program*, GAO/NSIAD-89-105, Mar. 1989.

⁴ Statement of Secretary of Defense Richard B. Cheney before the House Armed Services Committee, 13 July 1989, p. 3.

new missiles, the *USS West Virginia* (SSBN-736), was launched on 14 October.

The FY 1990 defence budget requested funds for the seventeenth Trident submarine, and the five-year plan projects one submarine per year for the next four fiscal years. The Navy continues to evade the question of how many submarines it plans to have. The question will have to be resolved soon to decide the composition of US strategic forces under a START treaty. One proposal is to fill 6 of the 24 launchers on each submarine with concrete. This would permit 21 Trident submarines under the ballistic missile warhead counting rules agreed in the START negotiations (see also chapter 11).

The FY 1990 budget also requested funds for the purchase of 63 Trident II missiles, at a cost of \$1.8 billion, bringing the number purchased so far to 216. The latest cost estimate of the Trident II submarine-launched ballistic missile (SLBM) programme is \$35.5 billion for 899 missiles,⁵ or almost \$40 million apiece.

The final two (of 19) flat-pad test-flights were conducted on 9 and 26 January. The first of a scheduled nine Performance Evaluation Missile launches took place on 21 March, fired from the submerged *USS Tennessee*, off Cape Canaveral, Florida. The test was a failure.⁶ Four seconds after the missile broke the surface of the water, it began to pinwheel uncontrollably and was destroyed. According to one account, the missile then entered the water and almost hit the launching submarine, which was at a depth of 90 feet (27 m). 'Chunks of live . . . solid propellant were found on the deck of the submarine when it docked after the test'.⁷ This and several component delivery problems⁸ caused the initial deployment date of the Trident SLBM to slip from December 1989 to the end of March 1990.

Although the Navy described the test on 2 August as a success, missile performance was erratic, with the missile leaning over after it surfaced, before stabilizing and heading down range. Safety officers were seconds away from destroying the missile.

The third test, on 15 August, also ended with the missile exploding soon after surfacing. The failures may be caused by a fundamental design flaw.⁹ Apparently when the 130 000-lb (59 000-kg) missile pushes through the water after launch, it creates more turbulence than originally thought. As it travels through the water it creates a vacuum or bubble. Water rushes into

⁵ DOD, *Selected Acquisition Report*, 31 Dec. 1988.

⁶ Halloran, R., 'Navy Trident 2 missile explodes in its first underwater test firing', *New York Times*, 22 Mar. 1989, p. A1; Kolum, E. H., 'Navy assesses failure of first Trident 2 underwater launch', *Aviation Week & Space Technology*, 27 Mar. 1989, pp. 18-19.

⁷ Kolum, E. H., 'US Navy conducts successful underwater launch of Lockheed Trident 2 missile off Florida coast', *Aviation Week & Space Technology*, 7 Aug. 1989, p. 19.

⁸ Propellant casting for the second-stage motors was halted after an explosion on 29 Mar. at the Hercules Magna, Utah, plant. A strike at the Kaiser plant in San Leandro, California, has halted delivery of nozzles for the second- and third-stage motors.

⁹ Rosenthal, J., 'Trident failures in tests are tied to flawed design', *New York Times*, 17 Aug. 1989, p. A1; Rosenthal, A., 'Trident 2 failures laid to early success', *New York Times*, 18 Aug. 1989, p. A10; Morocco, J. D., 'Second Trident 2 test failure points to missile design flaw', *Aviation Week & Space Technology*, 21 Aug. 1989, p. 26.

the bubble, and as the missile surfaces it creates a plume or column of water which continues to follow the missile.

The fourth test, on 4 December, was considered a success, although five design changes had been made to the missile since the previous test to compensate for earlier problems.¹⁰ A fifth test was held on 13 December and a sixth test on 15 December, both of which were considered successful.

The Defense Nuclear Agency and the Department of Energy conducted a weapons effect test, code-named Disko Elm, at the Nevada test site on 14 September. It was the fourth and final Trident II missile system proof test. It demonstrated systems survivability while operating in a simulated boost-phase flight profile.

Strategic bomber programmes

After years of almost total secrecy about the B-2 'stealth' bomber an enormous amount of data became available during the year.¹¹ This occurred because the bomber made its maiden flight and because its high cost came under close scrutiny by Congress.¹² Almost everything about the aircraft is highly controversial. Charges and counter-charges abounded over its cost, mission, capabilities, history of secrecy, lack of oversight and likely role under a START treaty.

In an effort to win congressional support for the bat-winged aircraft Northrop Corporation, the prime contractor, released a list of 156 subcontractors in 46 states where tens of thousands of employees work on the aircraft. Approximately 14 000 Northrop employees work on the B-2.¹³ Northrop also released data on how the \$70.2 billion cost will be spent in 46 states and 383 (of 435) congressional districts. This makes it difficult for members of Congress to threaten cuts in the programme, as it would affect their constituents.¹⁴ Approximately \$23 billion has already been spent.

Eight test-flights took place during 1989. On 17 July a B-2 made a successful two-hour maiden flight from Palmdale, California, to Edwards AFB.¹⁵ After takeoff the aircraft climbed to 10 000 feet (3000 m). The second test-flight, on 16 August, was cut short after 69 minutes (of a

¹⁰ Schmalz, J., 'After skirmish with protesters, Navy tests missile', *New York Times*, 5 Dec. 1989, p. A1.

¹¹ Atkinson, R., 'Project Senior C. I. the story behind the B-2 bomber', *Washington Post*, 8 Oct. 1989, and 'Stealth: from 18-inch model to \$70-billion muddle', p. A1; 'Unraveling stealth's "black world"', *Washington Post*, 9 Oct. 1989, p. A1; 'Slow stealth's consensus crumbled', *Washington Post*, 10 Oct. 1989, p. A1.

¹² Vartabedian, R., 'Why did AF end stealth on stealth?', *Los Angeles Times*, 2 Aug. 1989, p. 1.

¹³ Northrop Corporation, *1988 Annual Report*, p. 21; Northrop Press Release, 'The B-2 nationwide industrial team', July 1989.

¹⁴ The figures show that the money is not spread very evenly. Four states, California (\$32.1 billion), Washington (\$11.1 billion), Texas (\$5.3 billion) and New York (\$1.1 billion), account for over \$50 billion of the total. Northrop would receive \$16.2 billion. At the other end nine states got under \$1 million apiece with West Virginia getting only \$200 000, and four states, Alaska, Hawaii, North Dakota and Wyoming, getting nothing at all.

¹⁵ Scott, W. B. and Dornheim, M. A., 'Post-flight review indicates airworthiness of B-2 design', *Aviation Week & Space Technology*, 24 July 1989, pp. 22-25.

planned 3- to 4-hour flight) because of a low oil pressure reading.¹⁶ A third test-flight, of 4 hours and 36 minutes, was conducted on 26 August. The fourth and fifth flights occurred on 21 September (2 hours and 53 minutes), and 23 September (1 hour and 17 minutes).¹⁷ The sixth flight, on 9 November, featured the first aerial refuelling of the aircraft. The seventh flight occurred on 18 November and lasted seven hours and 17 minutes, the longest to date. An eighth test-flight, of five hours and 48 minutes, was made on 22 November.

Official estimates of the cost keep rising. The most recent is \$70.2 billion (in FY 1999 dollars) for 132 aircraft or \$532 million per aeroplane,¹⁸ making it the most expensive aeroplane ever built. Some Department of Defense (DOD) officials say \$750 million per unit is a possibility. Cost estimates often overlook the cost of the nuclear weapons it will carry. According to Air Force Chief of Staff General Larry Welch, the 'stealth' fleet will be able to carry a total of 2000 nuclear warheads, or 16-18 per plane on average. These will include modern B83 and B61 bombs and SRAM IIs (short-range attack missiles). At a minimum this will add another \$4 billion to the bill. Military construction costs and operating expenses must also be counted in the total life cycle costs.¹⁹

Specific details about yearly budget requests have been divulged. The proposed funding is \$4.7 billion for FY 1990, \$5.3 billion for FY 1991, \$7.8 billion for FY 1992, \$8.4 billion for FY 1993, \$7.7 for FY 1994, and \$13.6 billion to the conclusion of the programme. Prior year funding through FY 1989 totals \$22.7 billion. Ten B-2 aircraft are in various stages of production. The second B-2 production aircraft (there are no prototypes) is scheduled to make its maiden flight in the spring of 1990.

By the end of the year Congress put a tight rein on the programme in the Defense Authorization bill. It authorized funds for two aircraft in the FY 1990 budget (instead of three), cutting the overall sum to \$4.3 billion. The bill demanded various reports, certifications, notifications and assessments from the Air Force so as to keep better track of the aircraft's cost and test performance. Air Force generals put heavy pressure on Congress by claiming that they would oppose a future START treaty if the B-2 were cancelled or scaled back.

Controversy emerged over the range of the aircraft. The *Washington Post* reported that a leaked budget document revealed that the B-2 had an unrefuelled range of 6000 miles (9650 km), while the B-1B range is 6400

¹⁶ 'B-2 flies with gear retracted on shortened second flight', *Aviation Week & Space Technology*, 21 Aug. 1989, p. 27.

¹⁷ 'No. 1 B-2 completes first phase of flight envelope expansion tests', *Aviation Week & Space Technology*, 2 Oct. 1989, pp. 30-31. The fourth test-flight was scheduled for five hours but was cut short due to a crack in an engine gearbox which caused an oil pressure problem. High winds cut short the fifth flight.

¹⁸ Smith, B. A. 'B-2 peak production delays drive up program costs', *Aviation Week & Space Technology*, 24 July 1989, pp. 26-27; Greve, F., 'How B-2 cost soared and soared in secret', *Miami Herald*, 20 Mar. 1989, p. 1.

¹⁹ Cohen, Senator W. S., 'The B-2 bomber: mission questionable, cost impossible', *Arms Control Today*, Oct. 1989, pp. 3-8.

miles (10 300 km).²⁰ To counter the embarrassing leak, at a crucial time of congressional budget deliberations, the Air Force quickly declassified fresh details about the B-2's range and weapon loads, and urged that 'apples versus apples' be compared.²¹ It stated that the lighter B-2 could fly 6600 nautical miles (nm) (12 223 km) on a high-altitude unrefuelled mission with a 24 000-lb (10 886-kg) weapon load (eight 2250-lb [1020-kg] SRAMs and eight 750-lb [340-kg] B61 bombs), compared with 5600 nm (10 371 km) for the B-1B similarly loaded. Increasing the load to 37 300 lb (16 783 kg) by substituting eight 2400-lb (1095-kg) B83 bombs for the B61s limits the range on a high-low-high-altitude mission to 4400 nm (8149 km) versus 4000 nm (7408 km) for the B-1B. If the extra 18 000 lb (8165 kg) of fuel is not carried by the B-1B, the ranges cited above decrease by another 400 nm. The 'low' portion assumes descending to a few hundred feet for a gas-consuming 1000 nm (1852 km) when penetrating the Soviet Union and dropping its weapons. Overall, says the Air Force, the B-2's fuel efficiency is nearly 50 per cent higher than the B-1B's and needs less than half the aerial refuelling support for its nuclear strike missions.

The Air Force declared the B-1B operational in September 1986 and received the 100th aircraft in April 1988. The force has been reduced to 97 aircraft due to crashes. There were no crashes during 1989. Although the fleet did achieve a higher utilization rate and experienced fewer problems, certain deficiencies in performance remain. According to the General Accounting Office (GAO) an additional \$9.1 billion might have to be spent on 'potential enhancements and modifications' beyond the \$31 billion already incurred.²² The Air Force expects the B-1B to reach system maturity in 1994 after completing 200 000 cumulative flying hours.²³

In an important development the Air Force decided in early 1989 not to make the B-1B a cruise missile launcher for the foreseeable future. The previous plan had been to use the B-1B in a mixed role as penetrating bomber and stand-off cruise missile carrier as the B-2 entered the inventory.

The hour of truth is fast approaching for the trouble-plagued AGM-129A Advanced Cruise Missile (ACM). A picture of the missile was released, and the first test-flight to occur in Canada took place on 2 March 1989, carried by a B-52 on a four-hour flight. Early in the year, the ACM test-flight failure rate hovered around 50 per cent, not a low enough level for congressional approval. Beginning with the FY 1987 Authorization Act, and subsequent acts, obligation of procurement funds were linked to the satisfactory completion of a set of developmental testing milestones. The Senate Armed Services Committee report on the Authorization Act, dated

²⁰ Wilson, G. C. 'B-2 "stealth" bomber has shorter cruising range than older, cheaper B-1', *Washington Post*, 6 Oct. 1989, p. A14; Biddle, W., 'B-2 comes up short', *Science*, 20 Oct. 1989, p. 322. A LTV Aircraft Products Group brochure, dated Sep. 1989, on the B-2 claims it can fly '6,000 nautical miles at high altitude unrefueled and 10,000 nautical miles with one air refueling'.

²¹ Bond, D. F., 'USAF says B-2's range exceeds B-1B's with varied payloads, flight profiles', *Aviation Week & Space Technology*, 23 Oct. 1989, pp. 30-31.

²² General Accounting Office, *Strategic Bombers: B-1B Cost and Performance Remain Uncertain*, GAO/NSIAD-89-55.

²³ General Accounting Office, *Strategic Bombers: Logistics Decisions Impede B-1B Readiness and Supportability*, GAO/NSIAD-89-129, p. 8.

19 July 1989, noted that: 'Those testing milestones have still not yet been successfully accomplished' and that 'its patience with this programme, the Air Force, and the two contractors is exhausted'.²⁴ New criteria were set, with programme termination threatened for early 1990 if the goals were not met. Soon after the harsh report, Defense Secretary Cheney told Congress that the ACM had 'recently completed three consecutive successful test flights and has now met the test-flight criteria previously put forth' and thus full-rate production funding should be granted.²⁵ The final Authorization language provides that FY 1990 funds may not be used to buy ACMs until there have been at least 10 successful developmental test-flights. Two more successful tests were conducted by the end of the year, with four more planned for early 1990.²⁶ The future of the missile, however, remains uncertain because of budgetary and arms control considerations.

Strategic defence

The importance and prominence of the Strategic Defense Initiative (SDI) waned during 1989 owing to a combination of factors.²⁷ The Bush Administration is less enthusiastic about SDI than was the Reagan Administration. The multi-billion dollar requests are an attractive target for a Congress under heavy pressure to cut the military budget. It seems possible that the five-year budget projected for SDI will be cut in half. Any bargaining leverage in the START negotiations was undermined by the Bush Administration when it agreed with the USSR in June to defer the issue until after a START treaty. It is reported that at the US-Soviet summit meeting in Malta on 2-3 December the previously contentious issue of SDI was barely discussed and that President Mikhail Gorbachev did not even mention it.²⁸

Non-strategic nuclear forces

The US non-strategic stockpile is also decreasing. The process of withdrawal and destruction of missiles under provisions of the INF Treaty continued throughout the year, with little fanfare or problem (see also chapter 12). By the end of the year, with slightly over half of the time period expired, about half of the US missiles had been destroyed: 220 of 443 ground-launched cruise missiles (GLCMs) and 62 of 234 Pershing II

²⁴ US Congress, Senate Armed Services Committee (SASC), *National Defense Authorization Act for Fiscal Years 1990 and 1991*, Report 101-81, p. 71.

²⁵ Scarborough, R., 'Stealth deserves funding, Cheney says, citing tests', *Washington Times*, 25 Aug. 1989, p. 6.

²⁶ 'Advanced cruise missile flight tests successful; production to resume', *Aviation Week & Space Technology*, 1 Jan. 1990, p. 34.

²⁷ Gordon, M. R., 'Star Wars' fading as major element of US strategy', *New York Times*, 28 Sep. 1989, p. A1.

²⁸ Oberdorfer, D. and Hoffman, D., 'SDI given low priority at summit, aides say', *Washington Post*, 6 Dec. 1989, p. A25.

missiles had been destroyed. It is estimated that 70 Pershing II missiles and 212 GLCMs remained deployed at that time (see table 1.2). The last of 169 US Pershing 1A missiles were destroyed on 6 July at the Longhorn Army Ammunition Plant in Texas.

The question of whether or not to replace the Lance missile with a longer-range missile (known as Follow-on to Lance, or FOTL) generated a great deal of discussion during the first part of the year (see also chapter 18). The USA and the UK favoured a new missile while Belgium, the Netherlands and especially the Federal Republic of Germany opposed it. Also contentious was the issue of whether to enter into negotiations about reductions of short-range nuclear forces, the so-called 'third zero'. An elaborate compromise was reached at the NATO Brussels summit meeting at the end of May, whereby the USA agreed that it was 'prepared to enter into negotiations to achieve a partial reduction of American and Soviet land-based nuclear missile forces of shorter range to equal and verifiable levels' once implementation of the conventional arms treaty was 'underway'.²⁹ With regard to Lance, the joint summit communiqué stated that the 'question of the introduction and deployment of a follow-on system for the Lance will be dealt with in 1992, in the light of overall security developments'. After the extraordinary political developments in Eastern Europe the issue took on a different character, especially as seen by the West Germans. One FRG official said in late November, 'The question of nuclear modernization makes us laugh. I don't think there is any possibility of it being implemented'.³⁰

Naval nuclear forces

In April it was revealed that the Navy was quietly phasing out three types of short-range nuclear missile: the SUBROC, ASROC and Terrier.³¹ The number of nuclear warheads for the three systems is estimated to be 1100. In December it was learned that the schedule of warhead retirements was further ahead than anticipated.³² All W45 Terrier warheads were retired by the Department of Energy by September 1988. The W44 ASROC warheads had been completely retired in September 1989. All W55 warheads for the nuclear-only SUBROC system are scheduled to be completely retired in FY 1990, no later than September 1990. Consequently, all these warheads were already removed from Navy vessels and returned to the DOE for final disassembly and disposal before 1990.

²⁹ Text is from the NATO 'Comprehensive concept of arms control and disarmament' report attached to the joint communiqué of NATO leaders, Brussels, 30 May 1989, excerpted in 'Excerpts from joint communiqué by leaders at NATO summit meeting', *New York Times*, 31 May 1989, p. A15.

³⁰ Freidman, T. L., ' Bonn aides, in Washington, say modernizing missile is dead issue', *New York Times*, 21 Nov. 1989, p. A8.

³¹ Gordon, M. R., 'Navy phasing out nuclear rockets for close combat', *New York Times*, 30 Apr. 1989, p. A1.

³² Warhead retirement dates are from Department of Energy, Albuquerque Operations Office, letter to the authors, 30 Nov. 1989.

According to Navy officials the move reflects changed Navy thinking about nuclear combat at sea, as well as difficulties in replacing the warheads. Furthermore, non-nuclear weapons perform better than they did when these nuclear weapons were first introduced. Additionally, nuclear weapons require special logistic, security and maintenance procedures that consume extensive personnel and resources.³³ The decision was not made public nor was it used to gain an arms control advantage. In January 1990, Admiral William J. Crowe, Jr, recently retired Chairman of the Joint Chiefs of Staff, publicly suggested that the United States should consider negotiating the elimination of all US and Soviet tactical nuclear weapons at sea.³⁴

As a result of this partial denuclearization the US Navy will have a predominantly land-attack orientation and capability with its non-strategic nuclear weapons: Tomahawk sea-launched cruise missiles (SLCMs) aboard surface ships and submarines, and gravity bombs aboard aircraft-carriers. The only other remaining nuclear weapon will be the B57 nuclear depth bomb for anti-submarine warfare (ASW). It is carried aboard aircraft-carriers and stored at land bases for ASW aircraft. The FY 1990 budget requested \$572 million for 400 conventional and nuclear Tomahawk SLCMs.

It is clear that the Navy will not reach its goal of 600 ships, and it may be that the figure of 568 ships at the end of 1989 will be the modern peak. In FY 1988 Congress appropriated full funding for two Nimitz Class aircraft-carriers, CVN 74 and CVN 75. Two other carriers approved in the FY 1983 budget are being built at the Newport News Shipbuilding and Drydock Company. The first of these, the *USS Abraham Lincoln* (CVN-72), was commissioned on 11 November. The *USS Coral Sea* (CV-43) will be decommissioned on 30 April 1990.

The lead ship of the Arleigh Burke Class guided missile destroyer (DDG 51) was commissioned on 16 September. It was funded in the FY 1985 budget. The Navy eventually wants to have 33 DDG 51 ships. It will carry the nuclear Tomahawk SLCM. The FY 1990 budget requested \$3.6 billion for five DDG 51s in addition to the eight funded in prior years.

The first improved Los Angeles Class attack submarine was the *USS San Juan* (SSN-751) which was commissioned in June 1988. The improved versions, of which 21 are under construction, are 'Arctic-capable' and have the new AN/BSY-1 combat system. One submarine was removed from the FY 1990 budget and two in the FY 1991 budget. Funds for the 63rd and final Los Angeles Class submarine were requested in the FY 1990 budget. The Navy hopes to purchase two of its new SSN 21 Seawolf Class submarines in the FY 1991 budget.

³³ For a discussion of these procedures, see Fieldhouse, R. (ed.), SIPRI, *Security at Sea: Naval Forces and Arms Control* (Oxford University Press: Oxford, 1990), pp. 106-107, 165-67.

³⁴ Smith, R. I., 'Crowe suggests new approach on naval nuclear arms cuts', *Washington Post*, 8 Jan. 1990, p. A1.

Table 1.1. US strategic nuclear forces, January 1990

Weapon system		Warheads					
Type	No. deployed	Year deployed	Range (km)	Warhead x yield	Type	No. deployed	
<i>ICBMs</i>							
Minuteman II	450	1966	12 500	1 x 1.2 Mt	W56	450	
Minuteman III (Mk 12)	200	1970	13 000	3 x 170 kt	W62	600	
Minuteman III (Mk 12A)	300	1979	13 000	3 x 335 kt	W78	900	
MX	50	1986	11 000*	10 x 300 kt	W87	500	
Total	1 000					2 450	
<i>SLBMs</i>							
Poseidon (13 SSBNs)	208	1971	4 600	10 x 50 kt	W68	2 080	
Trident I (20 SSBNs)	384	1979	7 400	8 x 100 kt	W76	3 072	
Total	592					5 152	
<i>Bombers†</i>							
B-1B	90	1986	9 800	ALCM	} W80-1	1 600	
B-52G/H	173	1958/61	16 000	SRAM		W69	1 100
FB-111A	48	1969	4 700	Bombs		b	1 800
Total	311					4 500	
<i>Refuelling aircraft</i>							
KC-135 A/R/E	615	1957	..	..	..	..
KC-10A	60	1981	..	..	..	..

* Numbers reflect Primary Authorized Aircraft. An additional 7 B-1Bs, 21 B-52s and 10 FB-111s are in the total inventory. B-52Gs at Andersen, AFB, Guam; Loring AFB, Maine; and Burkesdale AFB, Louisiana, some 47 aircraft, have exclusively conventional missions. Bombers are loaded in a variety of ways, depending on mission. B-1Bs normally carry up to 16 weapons (SRAMs and either B83 or B61 bombs). B-52s can carry a mix of 8-24 weapons. FB-111s can carry up to 6 weapons (SRAMs or B61 or B43 bombs).

† Bomber weapons include four different nuclear bomb designs (B83, B61-0, -1, -7, B53, B43) with yields from low-kt to 9 Mt, ALCMs with selectable yields from 5 to 150 kt, and SRAMs with a yield of 170 kt.

Sources: Cochran, T. B., Arkin, W. M. and Norris, R. S., *Nuclear Weapons Databook, Volume I: US Forces and Capabilities*, 2nd edn (Harper & Row: New York, forthcoming); authors' estimates.

The Navy and Marine Corps continue to buy various attack and ASW aircraft, although it is likely that the number of carrier air wings will be reduced because of future budget cuts. A new ASW plane, called the P-7A (formally known as Long-Range Air ASW Capability Aircraft or LRAACA), is a planned replacement for the older P-3A/Bs. Procurement would begin in FY 1992. In an effort to save money the Navy will retire 73 older P-3A/Bs early and temporarily reduce Primary Aircraft Authorization in active and reserve P-3 squadrons.

Table 1.2. US theatre nuclear forces, January 1990

Weapon system		Warheads				
Type	No. deployed	Year deployed	Range (km)	Warhead x yield	Type	No. in stockpile
Land-based systems						
<i>Aircraft^a</i>	2 250	..	1 060– 2 400	1–3 x bombs	Bombs ^a	1 800
<i>Missiles</i>						
Pershing II	70	1983	1 790	1 x 0.3–80 kt	W85	125 ^b
GLCM	212	1983	2 500	1 x 0.2–150 kt	W84	325 ^b
Pershing IA	72	1962	740	1 x 60–400 kt	W50	100 ^c
Lance	100	1972	125	1 x 1–100 kt	W70	1 282
Nike Hercules	0	1958	160	1 x 1–20 kt	W31	0 ^d
<i>Other systems</i>						
Artillery ^e	4 700	1956	30	1 x 0.1–12 kt	*	1 540
ADM (special)	150	1964	..	1 x 0.01–1 kt	W54	150
Naval systems						
<i>Carrier aircraft^f</i>	1 100	..	550– 1 800	1–2 x bombs	Bombs ^f	1 350
Tomahawk SLCM	300	1984	2 500	1 x 5–150 kt	W80-0	300
ASW aircraft ^g	710	..	1 160– 3 800	1 x <20 kt	B57	850

^a Aircraft include the US Air Force F-4D/E, F-15E, F-16A/B/C/D and F-111A/D/E/F. Bombs include three types (B43, B57 and B61) with yields from sub-kt to 1.45 Mt.

^b Warheads will likely be placed in inactive reserve in the US stockpile.

^c Missiles are deployed with FRG forces. Warheads are in US custody.

^d The few remaining missiles deployed with the FRG will be retired in 1990.

^e Total inventory of US Army and Marine Corps nuclear-capable artillery. There are two types of nuclear artillery (155-mm and 203-mm) with four different warheads: a 0.1-kt W48, 155-mm shell; a 1- to 12-kt W33, 203-mm shell; a 0.8-kt W79-1, enhanced-radiation, 203-mm shell; and a variable-yield (up to 1.1 kt) W79-0 fission warhead. The enhanced-radiation warheads will be converted to standard fission weapons.

^f Aircraft include the US Navy A-6E, A-7E, F/A-18A/B and Marine Corps A-6E and AV-8B. Bombs include three types with yields from 20 kt to 1 Mt.

^g Aircraft include US Navy P-3A/B/C, S-3A/B and SH-3D/H helicopters. Some US B57 nuclear depth bombs are allocated for British Nimrod, Italian Atlantic and Netherlands P-3 aircraft.

Sources: Cochran, T. B., Arkin, W. M. and Norris, R. S., *Nuclear Weapons Databook, Volume 1: US Forces and Capabilities*, 2nd edn (Harper & Row: New York, forthcoming); Collins, J. M. and Rennack, D. E., *US/Soviet Military Balance*, Library of Congress/Congressional Research Service, Report no. 89-4665, 8 Aug. 1989; International Institute for Strategic Studies, *The Military Balance 1989–1990* (IISS: London, 1989); authors' estimates.

Table 1.3. Soviet strategic nuclear forces, January 1990

Weapon system		Warheads				
Type	NATO code-name	No. deployed	Year deployed	Range (km)	Warhead x yield	No. deployed
<i>ICBMs</i>						
SS-11 Mod. 2		150	1973	13 000	1 x 1.1 Mt	150
Mod. 3	Sego	210	1973	10 600	3 x 350 kt (MRV)	210*
SS-13 Mod. 2	Savage	60	1973	9 400	1 x 750 kt	60
SS-17 Mod. 2	Spanker	100	1979	10 000	4 x 750 kt (MIRV)	400
SS-18 Mod. 4/5	Satan	296/12	1979	11 000	10 x 550/750 kt (MIRV)	3 080
SS-19 Mod. 3	Stiletto	300	1979	10 000	6 x 550 kt (MIRV)	1 800
SS-24 Mod. 1/2	Scalpel	18/40	1987	10 000	10 x 550 kt (MIRV)	580
SS-25	Sickle	170	1985	10 500	1 x 550 kt	170
Total		1 356				6 450
<i>SLBMs</i>						
SS-N-6 Mod. 3	Scrb	192	1973	3 000	2 x 1 Mt (MRV)	192*
SS-N-8 Mod. 1/2	Sawfly	286	1973	7 800	1 x 1.5 Mt	286
SS-N-17	Snipe	12	1980	3 900	1 x 1 Mt	12
SS-N-18 Mod. 1/3	Stingray	224	1978	6 500	7 x 500 kt	
Mod. 2			1978	8 000	1 x 1 Mt	1 568
SS-N-20	Sturgeon	120	1983	8 300	10 x 200 kt	1 200
SS-N-23	Skiff	96	1986	8 300	4 x 100 kt	384
Total		930				3 642
<i>Bombers</i>						
Tu-95	Bear B/C	20	1962	12 800	4 bombs or 1 AS-3	80
Tu-95	Bear G	45	1984	12 800	4 bombs and 2 AS-4	270
Tu-95	Bear H	80	1984	12 800	8 AS-15 ALCMs or bombs	640
Tu-160	Blackjack	17	1988	14 600	6 AS-15 ALCMs, 4 AS-16 SRAMs and 4 bombs	238
Total		162				1 228
<i>Refuelling aircraft</i> ..		140-170	..	..	..	..
<i>ABMs</i>						
ABM-1B	Galosh Mod.	32	1986	320	1 x unknown	32
ABM-3	Gazelle	68	1985	70	1 x low yield	68
Total		100				100

* SS-11 and SS-N-6 MRV warheads are counted as one.

Sources: Authors' estimates derived from: Cochran, T. B., Arkin, W. M., Norris, R. S. and Sands, J. I., *Nuclear Weapons Databook, Volume IV, Soviet Nuclear Weapons* (Harper & Row: New York, 1989); US Department of Defense, *Soviet Military Power*, 1st-8th edns; DIA, *Force Structure Summary-USSR, Eastern Europe, Mongolia, and Afghanistan*, DDB-2680-170-89, Feb. 1989; Borman, R. P. and Baker, J. C., *Soviet Strategic Forces*:

Requirements and Responses (Brookings Institution: Washington, DC, 1982); Congressional Budget Office, *Trident II Missiles: Capability, Costs, and Alternatives*, July 1986; Collins, J. M. and Reannack, D. E., *U.S./Soviet Military Balance*, Library of Congress/Congressional Research Service, Report no. 88-466S, 8 Aug. 1989; Background briefing on SMP, 1986, 24 Mar. 1986; SASC/SAC, *Soviet Strategic Force Developments, Senate Hearing 99-335*, June 1985; Polmar, N., *Guide to the Soviet Navy*, 4th edn (US Naval Institute, Annapolis, Md., 1986); TASS news agency report, 15 Dec. 1989.

The Navy plans to replace its A-6 attack aircraft with a new aircraft, designated the A-12, to serve as an all-weather carrier-based attack aircraft. The A-12 will incorporate stealth characteristics and will be nuclear-capable. For its part, the Marine Corps will have an attack aircraft force consisting entirely of AV-8B vertical/short take-off and landing (V/STOL) aircraft by early 1992, following the conversion of the VMA-214, the last active A-4M aircraft squadron. The planned number of AV-8Bs is 282 aircraft, organized in eight active squadrons of 20 plus those for training, spares and maintenance.

Department of Energy problems

The extensive safety and pollution problems with the Department of Energy nuclear weapons complex revealed in 1988 (see *SIPRI Yearbook 1989*, chapter 1) continued without relief in 1989. Seven plants were either shut down or encountered new difficulties in the second half of the year.³⁵ President Bush chose Admiral James D. Watkins, a former Chief of Naval Operations, to be the Secretary of Energy. Secretary Watkins ordered a full review of the problems and has taken some steps to begin the long and expensive process of cleaning up. The Rocky Flats plant in Colorado, where critical plutonium components are manufactured, was temporarily closed, beginning in November 1989.³⁶ This closure makes it likely that the USA could not produce any nuclear weapons at the end of the year. Plans to build a new plutonium production plant in Idaho were put on hold by Secretary Watkins because the DOE now expects to build only half as many nuclear weapons as had been assumed previously.³⁷

III. Soviet nuclear weapon programmes

The year 1989 ended with a growing recognition and acceptance in the West that Soviet President Gorbachev's *perestroika* was having a major impact on Soviet nuclear forces. Modernization and growth of Soviet strategic offensive forces began to show signs of stabilization and slowing down, both in

³⁵ Wald, M., 'Promise of change in bomb program not yet fulfilled', *New York Times*, 7 Dec. 1989, p. A1.

³⁶ Schneider, K., 'A plant is closing for safety review', *New York Times*, 30 Nov. 1989, p. B20.

³⁷ Smith, J., 'DOE may not build plutonium plant', *Washington Post*, 28 Nov. 1989, p. A6.

Table 1.4. Soviet theatre nuclear forces, January 1990

Weapon system		Warheads				
Type	NATO code-name	No. deployed ^f	Year first deployed	Range ^g (km)	Warhead x yield	No. deployed ^h
Land-based systems						
<i>Aircraft</i>						
Tu-26	Backfire A/B/C	190	1974	4 000	1-3 x bombs or ASMs	380
Tu-16	Badger A/G	200	1954	3 100	1-2 x bombs or ASMs	200
Tu-22	Blinder A/B	75	1962	2 400	1-2 x bombs or 1 ASM	75
Tactical aircraft ^e		2 485	..	700-1 300	1-2 x bombs	2 500
<i>Missiles</i>						
SS-20	Saber	190	1977	5 000	3 x 250 kt	570
SS-1c	Scud B	661	1965	300	1 x 1-10 kt	1 370
..	FROG 3/5/7	370	1965	70	1 x 1-25 kt	1 450
SS-21 ^d	Scarab	289	1978	70	1 x 10-100 kt	310
SSC-1b	Sepal	50	1962	450	1 x 50-200 kt	50
SAMs ^a	..	5 900	1958-80	50-300	1 x low kt	2 400
<i>Other systems</i>						
Artillery ^d	..	6 760	1973-80	10-30	1 x low kt	2 000
ADMs	..	?	?	?	?	?
Naval systems						
<i>Ballistic missiles</i>						
SS-N-5	Sark	18	1963	1 400	1 x 1 Mt	18
<i>Aircraft</i>						
Tu-26	Backfire A/B/C	160	1974	4 000	1-3 x bombs or ASMs	320
Tu-16	Badger A/C/G	135	1955	3 100	4 x bombs or ASMs	540
Tu-22	Blinder A	20	1962	2 400	4 x bombs	80
ASW aircraft ^e	..	365	1966-82	..	1 x depth bombs	400
<i>Anti-ship cruise missiles^b</i>						
SS-N-3 b/a,c	Shaddock/Sepal	228	1960	450	1 x 350 kt	120
SS-N-7	Starbright	64	1968	65	1 x 200 kt	32
SS-N-9	Siren	250	1969	280	1 x 200 kt	86
SS-N-12	Sandbox	216	1976	550	1 x 350 kt	80
SS-N-19	Shipwreck	160	1980	550	1 x 500 kt	72
SS-N-22	Sunburn	120	1981	100	1 x 200 kt	40
<i>Land-attack cruise missiles</i>						
SS-N-21	Sampson	15	1987	3 000	1 x 200 kt	90
<i>ASW missiles and torpedoes</i>						
SS-N-15	Starfish	375	1973	37	1 x 10 kt	375
SS-N-16	Stallion		1979	120	1 x 10 kt	
FRAS-1	..	25	1967	30	1 x 5 kt	25

Table 1.4 cont.

Weapon system		Warheads				
Type	NATO code-name	No. deployed ^a	Year first deployed	Range ^b (km)	Warhead x yield	No. deployed ^a
Torpedoes ^c	Type 65	475	1965	16	1 x low kt	475
	ET-80		1980	>16	1 x low kt	
<i>Naval SAMs</i>						
SA-N-1	Goa	65	1961	22	1 x 10 kt	220
SA-N-3	Goblet	43	1967	37	1 x 10 kt	

^a For missile systems, the number is for operational or deployed missiles on launchers (see the Memorandum of Understanding of the INF Treaty, in *SIPRI Yearbook 1988*, appendix 13B).

^b Range for aircraft indicates combat radius, without refuelling.

^c Nuclear-capable tactical aircraft models include 130 MiG-21 bis Fishbed L, 855 MiG-27 Flogger D/J, 750 Su-17 Fister C/D/H, and 750 Su-24 Fencer A/B/C/D/E. New estimate reflects distinction between ground attack and counter-air; see DIA, *Force Structure*, p. 18.

^d Includes SS-21s in GDR and Czechoslovak units.

^e Nuclear-capable land-based surface-to-air missiles probably include SA-2 Guideline, SA-5 Gammon and SA-10 Grumble.

^f Nuclear-capable artillery include systems of the three calibres: 152-mm (D-20, M-1976, 2S3 and 2S5), 203-mm (M55, 2S7 and M-1980) and 240-mm (2S4 and M-240). Some older systems may also be nuclear-capable.

^g Includes 90 Be-12 Mail, 45 Il-38 May and 60 Tu-142 Bear F patrol aircraft. Land- and sea-based helicopters include 95 Ka-25 Hormone and 75 Ka-27 Helix models.

^h Number deployed is total launchers on nuclear-capable ships and submarines. Warheads based on an average of 2 nuclear-armed cruise missiles per nuclear-capable surface ship, except for 4 per Kiev and Kirov Class ships, and 4 per nuclear-capable cruise missile submarine, except for 12 on the Oscar Class.

ⁱ The two types of torpedo are the older and newer models, respectively, with the ET-80 probably replacing the Type 65.

Sources: Cochran, T. B., Arkin, W. M., Norris, R. S. and Sands, J. L., *Nuclear Weapons Databook, Volume IV, Soviet Nuclear Weapons* (Harper & Row: New York, 1989); Polmar, N., *Guide to the Soviet Navy*, 4th edn (US Naval Institute: Annapolis, Md., 1986); Department of Defense, *Soviet Military Power*, 1st-8th edns; DIA, *Force Structure Summary—USSR, Eastern Europe, Mongolia, and Afghanistan*, DDB-2680-170-89, Feb. 1989; Collins, J. M. and Rennack, D. E., *US/Soviet Military Balance*, Library of Congress/Congressional Research Service, Report No. 89-4665, 8 Aug. 1989; PISS, *The Military Balance 1989-1990* (Brassey's: London, 1989); NATO, *Conventional Forces in Europe: The Facts*, 25 Nov. 1988; interviews with US DOD officials, Apr. and Oct. 1986; Handler, J. and Arkin, W. M., *Nuclear Warships and Naval Nuclear Weapons: A Complete Inventory*, Neptune Paper no. 2 (Greenpeace/Institute for Policy Studies: Washington, DC, 1988).

preparation for the completion of the START treaty and in response to a generally lower level of defence spending. Non-strategic nuclear forces also showed major signs of reduction, particularly in those weapons with nuclear-only capabilities such as long-range sea-launched cruise missiles

Table 1.5. British nuclear forces, January 1990*

Weapon system			Warheads			
Type	No. deployed	Year deployed	Range (km) ^b	Warhead x yield	Type	No. in stockpile
<i>Aircraft</i>						
Tornado GR-1	220	1982	1 300	1-2 x 400/200 kt bombs ^c	WE-177A/B	155-175 ^d
Buccaneer S2B	25	1962	1 700	1 x 400/200 kt bomb	WE-177A/B	
<i>SLBMs</i>						
Polaris A3-TK	64	1982 ^e	4 700	2 x 40 kt	MRV	96 ^f
<i>Carrier aircraft</i>						
<i>Sea Harrier</i>						
FRS.1 ^g	42	1980	450	1 x 10 kt bomb	WE-177C	
<i>ASW helicopters</i>						
Sea King HAS 5	56	1976	-	1 x 10 kt depth bomb	WE-177C	25 ^h
Lynx HAS 2/3	78	1976	-	1 x 10 kt depth bomb	WE-177C	

* British systems certified to use US nuclear weapons include 31 Nimrod ASW aircraft based in the UK, and 20 Lance launchers (1 regiment of 12 launchers, plus spares) and 135 artillery guns in 5 regiments (120 M109 and 15 M110 howitzers) based in FR Germany.

^b Range for aircraft indicates combat radius, without refuelling.

^c The US Defense Intelligence Agency (DIA) has confirmed that the RAF Tornados 'use two types of nuclear weapons, however, exact types are unknown'. The DIA further concludes that each RAF Tornado is capable of carrying 2 nuclear bombs, on the 2 outboard fuselage stations.

^d The total stockpile of WE-177 tactical nuclear gravity bombs is about 180-200, of which 155-75 are versions A and B. All three weapons use the same basic 'physics package', and the yield is varied by using different amounts of tritium.

^e The two-warhead Polaris A3-TK (Chevaline) was first deployed in 1982 and has now completely replaced the original three-warhead Polaris A-3 missile (first deployed in 1968).

^f In previous SIPRI Yearbooks the British strategic stockpile was estimated at 128 warheads: 64 two-warhead Polaris A3-TK SLBMs on four SSBNs. It is now thought that Britain produced only enough warheads for three full boat-loads of missiles, or 48 missiles, with a total of 96 warheads. In Mar. 1987 French President Mitterrand confirmed that Britain had '90 to 100 [strategic] warheads'.

^g The US DIA has concluded that the Sea Harrier is not nuclear-capable, even though every British Defence White Paper since 1981 states that it is.

^h The C version of the WE-177 bomb is believed to be assigned to selected Royal Navy (RN) Sea Harrier FRS.1 aircraft and ASW helicopters. The WE-177C exists in both a free-fall and depth bomb modification, by varying the fuze and casing options. There are an estimated 25 WE-177Cs, each with a yield of approximately 10 kt (possible variable yield).

Sources: British Ministry of Defence, *Statement on the Defence Estimates, 1980-89* (Her Majesty's Stationery Office: London, annual); Campbell, D., 'Too few bombs to go round', *New Statesman*, 29 Nov. 1985, pp. 10-12; Nott, J., 'Decisions to modernise UK's nuclear contribution to NATO strengthen deterrence', *NATO Review*, vol. 29, no. 2 (Apr. 1981); US Defense Intelligence Agency, various reports released under the Freedom of Information Act; Urban, M., *The Independent*: including Urban, M., 'Outdated nuclear bomb's credibility in question', *The Independent*, 16 May 1988, p. 5; Urban, M., 'Clarification', *The Independent*, 17 May 1988. Additional sources: François Mitterrand, French President, an interview translated by the Service de Presse et d'Information of the French Embassy, London, 29 Mar. 1987, p. 6.

Table 1.6. French nuclear forces, January 1990

Weapon system				Warheads		
Type	No. deployed	Year deployed	Range (km) ^a	Warhead x yield	Type	No. in stockpile
<i>Aircraft</i>						
Mirage IVP/ASMP	18	1986	1 500	1 x 300 kt	TN-80	18
Mirage 2000N/ASMP ^b	42	1988	1 570	1 x 300 kt	TN-81	24
Jaguar A	45	1974 ^c	750	1 x 6-8/25 kt bomb ^d	AN-52 ^e	45
<i>Refuelling aircraft</i>						
C-135/FR	11	1965	..	..	..	..
<i>Land-based missiles</i>						
S3D	18	1980	3 500	1 x 1 Mt	TN-61	18
Pluton	44	1974	120	1 x 10/25 kt	AN-51 ^f	70
<i>Submarine-based missiles</i>						
M-20	48	1977	3 000	1 x 1 Mt	TN-61	48
M-4A	16	1985	4 000-5 000	6 x 150 kt (MIRV)	TN-70 ^g	96
M-4B	32	1987	6 000	6 x 150 kt (MIRV)	TN-71	192
<i>Carrier-based aircraft</i>						
Super Etendard/ASMP ^h	36	1978 ^c	650	1 x 6-8/25 kt bomb or 1 x 300 kt ASMP	AN-52 ^e	24

^a Range for aircraft indicates combat radius, without refuelling, and does not include the 90- to 350-km range of the ASMP air-to-surface missile (where applicable).

^b The Mirage 2000/ASMP has completely replaced the Mirage IIIE in the tactical nuclear role and will replace one Jaguar A squadron (15 aircraft) in July 1990. 75 Mirage 2000N aircraft are planned.

^c The Jaguar A and Super Etendard aircraft were first deployed in 1973 and 1978, respectively, although they did not carry nuclear weapons (the AN-52) until 1974 and 1981, respectively.

^d Two-thirds of the AN-52 stockpile reportedly consists of the low-yield variant, and one-third the high-yield variant. The AN-52 has an estimated weight of 455 kg, length of 4.2 m, diameter of 0.6 m and span of 0.8 m.

^e The same nuclear device is used for both the AN-52 warhead (gravity bomb) and the AN-51 warhead (Pluton). Both warheads have the same higher yield of 25 kt (thus said to have the MR-50 charge in common), yet have lower yields of 6-8 kt and 10 kt, respectively.

^f The *Inflexible* was the only SSBN to receive the TN-70. All subsequent refits of the M-4 into Redoutable Class SSBNs will incorporate the improved TN-71 warhead.

^g The Super Etendard can carry either 1 AN-52 bomb or 1 ASMP missile. At full strength the AN-52 equipped 2 squadrons (24 aircraft) of Super Etendard: Flotilles 11F and 17F, based at Landvisiau and Hyères, respectively. From mid-1989 these two squadrons began receiving the ASMP missile. By mid-1990, all 20 aircraft (to be configured to carry the ASMP) will be operational. Although originally about 50-55 Super Etendard aircraft were to receive the ASMP, because of budgetary constraints the number of aircraft so configured dropped to 20.

Source: Commissariat à l'Énergie Atomique (CEA), 'Informations non classifiées sur l'armement nucléaire français', 26 June 1986; US Defense Intelligence Agency (DIA), *A Guide to Foreign Tactical Nuclear Weapon Systems under the Control of Ground Force Commanders*, DST-1040S-541-83, 9 Sep. 1983, with CHG 1 and 2 (secret, partially declassified), 17 Aug. 1984 and 9 Aug. 1985; Boucheron, J. M., *L'Équipement Militaire pour les Années 1990-1993* (Assemblée Nationale: Paris, 1989); Prime Minister, *L'Organisation de la Défense de la France*, no. 15 (Nov. 1985), p. 32.

Table 1.7. Chinese nuclear forces, January 1990

Weapon system			Warheads		
Type	No. deployed	Year deployed	Range (km)	Warhead x yield	No. in stockpile
<i>Aircraft^a</i>					
H-5 (Il-28 Beagle)	20	1974	1 850	1 x bomb ^b	20
H-6 (Tu-16 Badger)	120	1965	5 900	1-3 x bombs	130
<i>Land-based missiles</i>					
DF-2 (CSS-1)	20-30	1966	1 450	1 x 20 kt	20-30
DF-3 (CSS-2)	60-80	1970	2 600	1 x 1-3 Mt	60-80
DF-4 (CSS-3)	-10	1971	4 800-7 000	1 x 1-3 Mt	10
DF-5 (CSS-4)	-10	1979	13 000	1 x 4-5 Mt	10
M9/SST 600	..	1989	600	1 x low kt	..
<i>Submarine-based missiles^c</i>					
JL-1 (CSS-N-3)	24	1986	3 300	1 x 200 kt-1 Mt	26-38

^a All figures for these bomber aircraft refer to nuclear-configured versions only. Hundreds of these aircraft are also deployed in non-nuclear versions.

^b Yields of bombs are estimated to range from below 20 kt to 3 Mt.

^c Two missiles are presumed to be available for rapid deployment on the Golf Class submarine (SSB). Additional missiles are being built for new Xia Class submarines.

Sources: SIPRI Yearbook 1989; Defense Intelligence Agency, *Handbook of the Chinese People's Liberation Army*, DDB-2680-32-84, Nov. 1984; Defense Intelligence Agency, 'A guide to foreign tactical nuclear weapon systems under the control of ground force commanders', DST-1040S-541, 4 Sep. 1987; Lewis, J. W. and Xue, L., *China Builds the Bomb* (Stanford University Press: Stanford, Calif., 1988); Jencks, H. W., 'PRC nuclear and space programs', in ed. R. Yang, *SCPS Yearbook on PLA Affairs, 1987* (Sun Yat-sen Center for Policy Studies: Kaohsiung, Taiwan, 1988), chapter 8; author's estimates.

and the INF (intermediate-range nuclear force) missiles. The fate of certain dual-capable nuclear delivery systems, particularly modern tactical fighter aircraft and self-propelled artillery, was uncertain, although their continued introduction did not necessarily denote additional nuclearization of conventional forces. The Soviet nuclear arsenal seems to have reached a peak in 1988 at some 33 000 nuclear warheads³⁸ and is beginning to undergo a gradual numerical decline. Soviet nuclear forces appear to be following a pattern similar to that of the USA for the past 10-20 years: certain military missions that once prominently relied on nuclear weapons are being phased out and replaced with conventional weapons. This has meant the retirement of many nuclear weapons which are the original first-generation warheads produced in the 1960s and 1970s.

The retirement of nuclear systems is thus beginning to play a role in the overall production and retirement capacity of the military industry and the

³⁸ See Norris, R. S. and Arkin, W. A., 'Nuclear Notebook: estimated Soviet nuclear stockpile, July 1989', *Bulletin of the Atomic Scientists*, July/Aug. 1989, p. 56.

Table 1.8. Strategic nuclear weapon arsenals of the USA, the USSR, the UK, France and China, 1946-89

Year*	USA		USSR		UK		France		China	
	L	W	L	W	L	W	L	W	L	W
1946	125	9	-	-	-	-	-	-	-	-
1947	270	13	-	-	-	-	-	-	-	-
1948	473	50	-	-	-	-	-	-	-	-
1949	447	200	-	-	-	-	-	-	-	-
1950	462	400	-	-	-	-	-	-	-	-
1951	569	569	-	-	-	-	-	-	-	-
1952	660	660	-	-	-	-	-	-	-	-
1953	720	878	-	-	-	-	-	-	-	-
1954	1 035	1 418	-	-	-	-	-	-	-	-
1955	1 260	1 755	-	-	8	-	-	-	-	-
1956	1 470	2 123	22	84	48	-	-	-	-	-
1957	1 605	2 460	28	102	73	-	-	-	-	-
1958	1 620	2 610	56	186	88	40	-	-	-	-
1959	1 551	2 496	108	283	96	70	-	-	-	-
1960	1 559	3 127	138	354	120	105	-	-	-	-
1961	1 532	3 110	187	423	120	163	-	-	-	-
1962	1 653	3 267	235	481	144	180	-	-	-	-
1963	1 812	3 612	302	589	144	207	-	-	-	-
1964	2 012	4 180	425	771	128	204	4	4	1	-
1965	1 888	4 251	463	829	88	199	32	32	2	2
1966	2 139	4 607	570	954	88	194	36	36	20	10
1967	2 268	4 892	947	1 349	88	189	36	36	25	20
1968	2 191	4 839	1 206	1 605	80	232	36	36	33	30
1969	2 109	4 736	1 431	1 815	48	144	36	36	48	45
1970	2 100	4 960	1 835	2 216	64	144	36	36	73	75
1971	2 087	6 064	2 075	2 441	64	144	45	45	97	102
1972	2 167	7 601	2 207	2 573	64	144	70	70	113	118
1973	2 133	8 885	2 339	2 711	64	144	86	86	130	125
1974	2 106	9 324	2 423	2 795	64	144	86	86	150	140
1975	2 106	9 828	2 515	3 217	64	144	102	102	165	155
1976	2 092	10 436	2 545	3 477	64	144	98	98	176	170
1977	2 092	10 580	2 562	4 242	64	144	114	114	186	176
1978	2 086	10 832	2 557	5 516	64	144	114	114	211	201
1979	2 086	10 800	2 548	6 571	64	144	114	114	238	230
1980	2 022	10 608	2 545	7 480	64	144	130	130	255	250
1981	1 966	10 688	2 593	8 296	64	144	130	130	262	262
1982	1 921	10 515	2 545	8 904	64	128	130	130	267	272
1983	1 905	10 802	2 543	9 300	64	112	126	126	279	284
1984	1 943	11 500	2 540	9 626	64	112	126	126	286	296
1985	1 965	11 974	2 538	10 012	64	96	142	222	298	308
1986	1 957	12 386	2 506	10 108	64	96	138	218	295	300
1987	2 001	13 002	2 535	10 442	64	96	138	298	280	290
1988	1 926	13 000	2 553	10 834	64	96	132	292	282	292
1989	1 903	12 100	2 448	11 320	64	96	132	372	274	284

L: Launchers; W: Warheads

* Figures are given as at the end of each year.

Sources: Cochran, T. B., Arkin, W. M. and Norris, R. S., *Nuclear Weapons Databook, Volume I*, forthcoming (for the USA), *Volume IV*, 1989 (for the USSR) and *Volume V*, forthcoming (for the UK, France and China).

nuclear weapons complex, and the production of nuclear systems and warheads also seems to have slowed generally. Series production of fourth-generation ICBMs (the SS-17, SS-18 and SS-19) was previously reported as having been concluded,³⁹ although in 1989, with the production of SS-24, SS-25 and SS-18 Mod. 5 ICBMs, there was again an increase in ICBM production ('after a dip in 1984-86').⁴⁰ The US intelligence community has reported 'production phase-out of older [submarine-launched ballistic] missiles and . . . slower production of two new missiles [the SS-N-20 and SS-N-23]'.⁴¹ Fighter aircraft production has also declined significantly,⁴² as has the production of long-range SLCMs, ships and submarines.⁴³ In addition, the USSR has closed three plutonium production reactors, the third on 12 August 1989.⁴⁴

The status of Soviet R&D for future nuclear weapon systems remains unclear. In contrast to earlier practice, the Pentagon's most recent edition of *Soviet Military Power*, released in late September 1989, neglected to report on the status of Soviet 'stealth' technology developments,⁴⁵ an SS-18 follow-on (called the SS-X-26 in the press), an SS-24 follow-on, a MIRVed version of the SS-25,⁴⁶ a new class of SSBNs beyond the Typhoon and Delta IV, a new SLBM which previously had been reported under development, a missile to replace the Scud in ground forces,⁴⁷ the SA-X-12B Giant surface-to-air missile with anti-cruise and anti-tactical ballistic missile capabilities, a next-generation air-superiority fighter or counter-air fighter to follow the Su-27 and MiG-29, the supersonic SS-NX-24 SLCM, the Utkha Class wing-in-ground effect vehicle, or a nuclear tactical air-to-surface missile (TASM). All of these weapons were featured in previous editions of the Pentagon's assessment of the Soviet threat.

Strategic offensive forces

At the end of 1989, Soviet strategic forces comprised 1356 ICBMs with 6450 warheads, 930 SLBMs with 3642 warheads, and 142 bombers with 1228 warheads. The trend seen in the past two years—equal deployments

³⁹ US Department of Defense (DOD), *Soviet Military Power 1989* (hereafter cited as DOD, *SMP 1989*), p. 39.

⁴⁰ DOD, *SMP 1989*, p. 32. The yearly average level of ICBM production remained constant in the 1982-84 and 1986-88 periods; DOD, *SMP 1989*, p. 34. According to DOD, *SMP 1989*, 'Total ICBM output was very low in 1984-1985, but production now has returned to the levels of the early 1980s', p. 35.

⁴¹ DOD, *SMP 1988*, p. 40.

⁴² DOD, *SMP 1989*, p. 34.

⁴³ DOD, *SMP 1989*, p. 34.

⁴⁴ TASS, 11 Aug. 1989.

⁴⁵ 'The Soviets are developing reduced-signature technologies and may be testing these technologies in aircraft and other military weapon systems. They may soon begin limited operational deployment of some "stealth" technologies. The Soviets are believed to have built several test facilities to support their research and development activities'; DOD, *SMP 1988*, p. 149.

⁴⁶ DOD, FY 1988 Annual Report, p. 25; DOD, FY 1988 Air Force Report, p. 15.

⁴⁷ According to the 1989 Joint Military Net Assessment, 'The Soviets will probably develop a new system to replace the aging [300-km range] SCUDs [missiles] for use at front and army level'; DOD, 1989 Joint Military Net Assessment, p. 4-3. DOD, *SMP 1989* makes no mention of such a missile.

and retirements of systems—continued, and the number of delivery vehicles and warheads remained about the same but with modest growth because of SLBM MIRVing. Between the end of 1987 and the end of 1988, the Soviet strategic nuclear forces grew from 10 442 to 10 834 warheads, and by the end of 1989 to 11 320 warheads (see table 1.8).⁴⁸

The USSR deployed a new modification of the SS-18 heavy ICBM (the SS-18 Mod. 5) during 1989, as well as a new missile, the bomber-delivered AS-16 Kickback short-range attack missile (SRAM). Full-scale production of the AS-15 Kent air-launched cruise missile (ALCM) and the SS-24 Scalpel and SS-25 Sickle mobile ICBMs continued, although at a slower rate than anticipated. There are also indications that the SS-19 ICBM may be in the process of being retired *in toto*.

Continued deployment of new fifth-generation mobile ICBMs, and the appearance of a new heavy ICBM modification of the SS-18, were tempered by reports of the end of serial production of the Typhoon Class ballistic missile submarine (with the sixth and final submarine) and technical problems being experienced with the Blackjack bomber and the SS-N-23 Skiff SLBM. A general decrease in defence spending was also being reported at the end of the year.⁴⁹ One report also tabulated a 47 000-man reduction in strategic offensive forces manpower from 1980 to 1 January 1989, with much of the reduction occurring in the years of the Gorbachev Administration.⁵⁰

ICBMs

The Soviet ICBM force stabilized at 6450 warheads in 1989, while new, and presumably more accurate, missiles replaced older ICBMs. The number of launchers declined by 22, to 1356, owing to retirement of older ICBMs. During 1989 the USSR deployed approximately 20 new road-mobile single-warhead SS-25s (adding to about 150 deployed the previous year) and some 50 additional 10-warhead SS-24s, for a total force of 18 in rail-garrison basing and some 40 in silos.⁵¹ The deployment of SS-24s and SS-25s was offset by the retirement of 10 SS-11, 20 SS-17 and 50 SS-19 missiles.⁵² The

⁴⁸ See Norris, R. S. and Arkin, W. M., 'Nuclear Notebook', *Bulletin of the Atomic Scientists*, Jan./Feb. 1988, p. 56 and Mar. 1989, p. 52. There may be some confusion over the number depending on whether one counts the warheads on the SS-11 Mod. 3 ICBMs and SS-N-6 SLBMs as single warheads or as three and two multiple re-entry vehicles (MRVs), respectively. The SS-11 Mod. 1 has been deactivated, according to the US Defense Intelligence Agency; DIA, *Force Structure Summary—USSR, Eastern Europe, Mongolia, and Afghanistan*, DDB-2680-170-89, Feb. 1989, p. 1.

⁴⁹ According to the US DOD, in 1988 the Soviet Union spent about \$20 billion on strategic offensive forces; DOD, *SMP 1988*, p. 44.

⁵⁰ Collins, J. M. and Rennack, D. E., *U.S./Soviet Military Balance*, Library of Congress/Congressional Research Service, Report No. 89-466 S, 8 Aug. 1989, p. 5.

⁵¹ The improved SS-24 Mod. 2, reported under development in 1988, turned out to be the silo-based version of the missile; DOD, *SMP 1988*, p. 101. New SS-25 bases have been identified at Irkutsk and Toykovo, in addition to the bases which already existed at Venkhnaya Salda, Yoshkar Ola and Yurya. The SS-24 is being deployed at Knstroma and Pervomaysk; DIA, *Force Structure Summary* (note 48), p. 1.

⁵² DOD, *SMP 1989*, p. 15; Cochran, T. B., Arkin, W. M., Norris, R. S. and Sands, J. L., *Nuclear Weapons Databook, Volume IV, Soviet Nuclear Weapons* (Harper & Row: New York, 1989), p. 99.

SS-19 Stiletto ICBM will be removed from the operational inventory as silo-based SS-24 missiles are deployed;⁵³ and since SS-19 silo conversion continues to accommodate the SS-24, the number of SS-19s which are actually out of the active inventory may be higher than reported.

By far the most significant nuclear news of the year appeared in *Soviet Military Power 1989*, which reported the deployment of the new SS-18 Mod. 5 missile, with greater accuracy, higher warhead yield and more throw-weight than the SS-18 Mod. 4.⁵⁴

Strategic submarine programmes

The Soviet SLBM force stabilized in 1989 as well, despite the launching of the sixth units of the Typhoon and Delta IV Class submarines.⁵⁵ According to the US Department of Defense, the submarines 'are expected to join the operational force later in the year'.⁵⁶ Although five Delta IVs are assessed as being operational at the end of the year, the sixth is counted as having its missiles.

It is unclear whether the Soviet Union continues to have problems with the Delta IV and the SS-N-23 missile. As of mid-1988, none of the submarines had gone on patrol,⁵⁷ and no mention was made of Delta IV patrols in the Pentagon's *Soviet Military Power 1989* report. In addition, the report claimed that the Soviet Union deployed a modified version of the SS-N-23 missile in 1988.⁵⁸ It is assumed that this modified version corrected the problems encountered in the earlier missile.

The Soviet Navy continues to retire older Yankee Class submarines at an average rate of one each year. Thirty-four Yankee Class submarines were built in 1967-74; 12 remained at the end of the year.⁵⁹ Regular Yankee submarine patrols off the US coasts ceased in late 1987, and by mid-1989 all patrols outside of European and home waters had ended. The US Navy stated in June 1988 that deployment patterns changed as units of that class, and their older missile systems, reach the end of their active operational lives.

⁵³ DOD, *SMP 1989*, p. 45.

⁵⁴ DOD, *SMP 1989*, preface, p. 45.

⁵⁵ The fifth Typhoon Class submarine was launched in 1986, and the fifth Delta IV Class submarine was launched in early 1988; Statement of Rear Admiral William O. Studeman, Director of Naval Intelligence, US Congress, House Armed Services Committee, *Hearing FY 1989, Department of Defense Authorization*, hearing no. 100-70, p. 27.

⁵⁶ DOD, *SMP 1989*, p. 47.

⁵⁷ In Mar. 1988, the Director of Naval Intelligence testified before Congress that, 'Four DELTA IVs are assessed to be operational, although none has gone on patrol. SS-N-23, a highly sophisticated missile that probably pushes Soviet state of the art, apparently has suffered reliability problems. The missile is assessed to be operational, however, and work to improve its reliability continues'; see note 55, pp. 27-28.

⁵⁸ DOD, *SMP 1989*, p. 44.

⁵⁹ See also Cochran *et al.* (note 52), p. 138.

Strategic bomber programmes

Earlier reports that the Soviet intercontinental bomber force may take on a more central role in the future strategic force structures appears to be premature. The bomber force grew modestly in 1989, and there was an estimated 110-weapon increase in bomber-delivered weapons, but the rate of growth and projections in the future do not augur a massive shift in Soviet priorities. Three bomber types continued in production in 1989: the Bear G (a modification of older Bear B/C aircraft), the Bear H and the Blackjack—but two of the three had a diminished strategic nuclear capability.

The Blackjack A supersonic bomber programme was experiencing developmental and testing problems at the end of the year. Although declared operational in mid-1988, years behind schedule at that time, only about 15 had been deployed at the end of 1989.⁶⁰ One significant development was the deployment of a short-range attack missile, the AS-16 Kickback, similar to the US SRAM, on Blackjack bombers in 1989.⁶¹ Virtually all of the increase in nuclear weapons within the bomber force in 1989 was accounted for by the addition of ALCMs and SRAMs on the Blackjack force. Sluggish deployment of the Blackjack will significantly limit the bomb-carrying capacity of the bomber force. On 20 August, at Tushino, north-west of Moscow, a Blackjack bomber was flown in public for the first time.

Bear G bombers, while accountable under START, have been reassigned to theatre and maritime roles, rather than continuing their intercontinental bomber roles, in a move similar to the US reassignment of B-52Gs to conventional missions.⁶² Bear H bomber production appears to have ended (80 were deployed at the end of 1988); the USSR announced that about 90 Bear Hs will be produced.

Intercontinental training missions and long-range anti-shipping operations by Bear G and Bear H bombers, long an irritant in US-Soviet relations, also experienced a significant drop in 1989. An Icelandic report detailed a steep drop in interceptions by US F-15 fighters stationed on Iceland, and a drop has been experienced by Alaska-based interceptors.⁶³

Strategic defence developments

One of the main components of the Soviet nuclear arsenal, the large force of strategic defence surface-to-air missiles (SAMs) deployed in the Soviet Union, is undergoing a gradual process of denuclearization as older nuclear-armed missiles are replaced by dual-capable or conventional-only missiles. The ongoing retirements of surface-to-air missiles follow a move made by the United States in the 1960s and 1970s, when thousands of nuclear-armed

⁶⁰ DOD, *SMP 1989*, p. 46.

⁶¹ DOD, *SMP 1989*, p. 46. It is assumed that Blackjack bombers carry four AS-16 Kickback SRAMs per bomber.

⁶² DOD, *SMP 1989*, p. 46; DOD, *SMP 1988*, pp. 51, 79.

⁶³ Diehl, D., 'Soviet intrusions into Iceland airspace dropping dramatically, expert says', *European Stars & Stripes*, 15 Oct. 1989, p. 2.

Nike Hercules SAMs, and Genie and Falcon air-to-air missiles, were also retired.

It is estimated that during 1989 the number of nuclear-armed SAMs in the Soviet strategic defence forces declined from 7000 to 5900 and that the number of nuclear warheads declined from 4000 to 2400.⁶⁴ The SA-10 continued in production and was deployed both around Moscow and in the Far East, replacing older SA-1, SA-2 and SA-3 missiles. Older nuclear-armed SA-1 SAMs, deployed around Moscow, appear to have been completely retired and replaced by the SA-10 during the past year.⁶⁵ TASS reported on 2 August 1989 that 60 'units' of the Air Defence Forces will be disbanded in 1989 and 1990, although it is unclear whether this includes nuclear-capable SAM units.⁶⁶

The Pentagon also reported during 1989 that the upgrading of the anti-ballistic missile system around Moscow is still not completed, despite earlier reports of completion years ago.⁶⁷ The SA-X-12B Giant mobile SAM, which had been reported earlier as having some capability against cruise and ballistic missiles, was also not deployed in 1989.⁶⁸

Long-range cruise missile programmes

During 1988, there was a significant slow-down in Soviet long-range cruise missile programmes, a trend which appeared to continue in 1989.⁶⁹ While some 690 AS-15 Kent air-launched cruise missiles have been deployed on Bear H and Blackjack bombers (660 AS-15s were estimated to be deployed at the end of 1988), the level will probably remain fairly stable, as the Bear H is completing production and the Blackjack is slow in introduction.⁷⁰

The other cruise missile programmes seem to be progressing at much slower rates.⁷¹ According to *Soviet Military Power 1989*: 'Since Gorbachev came to power, production of long-range (3,000 kilometres) cruise missiles, designed to be launched from bombers and submarines, rose by a factor of three'.⁷² From a production rate of fewer than 50 missiles per year, this increase seems to be primarily ALCMs.

⁶⁴ DOD, *SMP 1989* shows a reduction of over 1000 surface-to-air missile launchers in strategic defence forces since 1988, p. 15.

⁶⁵ DOD, *SMP 1989*, pp. 50-51.

⁶⁶ Vladimir Chernyshev, TASS, 2 Aug. 1989, as quoted in Karber, P. A. and Amer, W. G., *The Gorbachev Unilateral Reductions and the Restructuring of Soviet Warsaw Pact Forces*, Testimony before the House Armed Services Committee, 13 Sep. 1989, p. 2.

⁶⁷ DOD, 1989 Joint Military Net Assessment, p. 3-3; DOD, *SMP 1988*, pp. 44, 55-56.

⁶⁸ The SA-12A 'Gladiator' variant, intended for deployment in non-strategic forces, is already being fielded.

⁶⁹ DOD, *SMP 1988* did not even mention cruise missiles until page 40 of the report.

⁷⁰ According to *SMP 1989*, 'the majority of the current strategic air-delivered weapons inventory comprises AS-15s...'; DOD, *SMP 1989*, p. 46.

⁷¹ According to the 1989 Joint Military Net Assessment, 'the Soviets are expected to deploy a number of sophisticated cruise missiles in the near future [emphasis added]'; DOD, 1989 Joint Military Net Assessment, p. 4-3.

⁷² DOD, *SMP 1989*, p. 35.

Soviet Military Power 1989 reports that an annual average of 200 long-range SLCMs were produced in 1986–88.⁷³ However, the SS-N-21 Sampson SLCM is still not widely deployed. It continues to undergo flight-testing from Yankee Notch Class submarines⁷⁴ and 'can probably be launched from any modern nuclear-powered class submarine. Specific candidates for employment are Yankee-Notch, Akula and Victor Class SSNs'.⁷⁵

Referring to a new supersonic air-launched missile, designated AS-X-19 Koala, *Soviet Military Power 1989* states that such a missile is 'under development and when operational in the early 1990s could be deployed on the Bear H aircraft'.⁷⁶ The 1989 *Joint Military Net Assessment* issued in June 1989 is even more cautious in predicting the deployment of this missile. It states that 'estimates are that work has probably begun on a new bomber-launched cruise missile'.⁷⁷

The new supersonic SS-NX-24 SLCM is just beginning to be tested, and its development has been slowed. After years of declaring the missile imminently operational, *Soviet Military Power 1989* states that, 'Test activity for a sea-launched version [of the AS-X-19 air-launched cruise missile], the SS-NX-24, is continuing at a slow pace'.⁷⁸

Non-strategic nuclear forces

The rapid elimination of four Soviet missiles under the INF Treaty—SS-20 Saber, SS-4 Sandal, SS-12M Scaleboard B and SS-23 Spider missiles—will have a significant impact on the size of the Soviet nuclear stockpile, with as many as 2000 warheads retired. As of 16 September 1989, according to Defence Minister Dmitri Yazov, the Soviet Union had eliminated 1259 INF missiles and 469 launchers, representing 68 and 57 per cent respectively of the totals to be eliminated (see also chapter 12).⁷⁹ The Minister also said that the Strategic Rocket Forces (SRF) would be reduced by 68 000 troops. These are assumed to be mostly personnel associated with the SS-4 and SS-20 missile systems (both assigned to the SRF).⁸⁰ As of the end of the year, 1498 of 1846 Soviet missiles had been eliminated (81 per cent), including all 80 SSC-X-4, all 6 SS-5, all 239 SS-23, all 718 SS-12, 116 of 149 SS-4 and 339 of 654 SS-20 missiles.⁸¹ As of January 1990 it is estimated that 190 SS-20 missiles and no SS-4 missiles are deployed (see table 1.4).

⁷³ DOD, *SMP 1989*, p. 34.

⁷⁴ DOD, 1989 *Joint Military Net Assessment*, p. 3-5.

⁷⁵ DOD, *SMP 1989*, p. 47 [emphasis added]. Later in the report, it says that 'The SS-N-21, which is launched from torpedo tubes, may be carried by specific classes of properly equipped current-generation or reconfigured submarines [emphasis added]'; DOD, *SMP 1989*, p. 76.

⁷⁶ DOD, *SMP 1989*, p. 47.

⁷⁷ DOD, 1989 *Joint Military Net Assessment*, p. 3-2; emphasis added.

⁷⁸ DOD, *SMP 1989*, p. 47.

⁷⁹ *Leventia*, 16 Sep. 1989.

⁸⁰ Collins and Rerneck (note 50) report that 110 000 personnel are associated with INF weapons as of 1 Jan. 1989, a reduction of 40 000 personnel since 1988, and 68 000 since 1981, when manpower associated with IRBM/MRBM/GLCM forces peaked at 184 000.

⁸¹ Data from US On-Site Inspection Agency, communication with the authors, 4 Jan. 1990.

The INF Treaty also means that follow-on missiles to the eliminated weapons—an SS-20 follow-on reported to be under development in 1987, and a long-range follow-on to the ageing SS-1c Scud missile—will now be impossible. The 24-year-old SS-1c Scud missile, currently assigned to Army formations, was reported in 1988 as taking on 'the ground force's primary nuclear fire support means',⁸² as shorter-range FROG missiles reached the end of their useful life and began to be retired. However, the use of the Scud for primary nuclear duties might also reflect a shift in emphasis in artillery and rockets at the Army level and below, a trend which mirrors US moves of 20 years ago, when short-range Honest John rockets were removed from the division and replaced by modern 155-mm and 203-mm artillery guns (US divisions today have no nuclear missile systems assigned). The Lance missile, when deployed in the mid-1970s, was assigned to the Corps (equivalent to the Soviet Army), and the Pershing was assigned to the primary nuclear fire-support unit at the Army and Theater level.

The Soviet SS-21 Scarab missiles are being consolidated at Army level for general conventional fire-support roles. With the organizational change, the signs of decreases in short-range missiles in Soviet Ground Forces begins to make more sense to foreign observers. Over the long term, both the FROG and the Scud will probably be retired (they are reaching obsolescence and will be 25 years old in 1990) and will make way for the SS-21 and artillery.⁸³ The Soviet Union has been downplaying the capabilities of the SS-21. Maj.-General Yuri Lebedev, Deputy Department head in the Soviet General Staff, told *Novosti* in May 1989 that the range of the SS-21 and the FROG-7 it is replacing 'practically coincide'.⁸⁴

Shifts in short-range missiles may help to explain the continued deployment of large numbers of heavy, longer-range, self-propelled artillery, replacing towed artillery and mortar systems. Production of nuclear-capable self-propelled artillery was reported by the US Department of Defense in 1988 as being at 'an all-time high',⁸⁵ and a new 152-mm towed howitzer may now be in production.⁸⁶ *Soviet Military Power 1989* reports that, 'Newer 122mm howitzers may have a nuclear capability . . .'⁸⁷

The unilateral Soviet cuts announced by President Gorbachev at the United Nations on 7 December 1988 included reduction of 8500 artillery guns, some of which are thought to be nuclear-capable.⁸⁸ The only nuclear-capable artillery of the six tank divisions being eliminated in Eastern Europe includes 152-mm self-propelled artillery guns assigned to the division level artillery regiment. The disposition of the guns is unclear, and some concern has been raised as to whether the artillery will be totally withdrawn from

⁸² DOD, *SMP 1988*, p. 55.

⁸³ According to *SMP 1989*, 'The inaccurate FROG artillery, with a range of about 70 kilometers, is being replaced by SS-21 systems, with vastly improved reliability, accuracy, and range'; DOD, *SMP 1989*, p. 67.

⁸⁴ 'SS-21 "no improvement" over Fmg-7', *Jane's Defence Weekly*, 20 May 1989, p. 951.

⁸⁵ DOD, *SMP 1988*, p. 38.

⁸⁶ DOD, *SMP 1989*, p. 34.

⁸⁷ DOD, *SMP 1989*, p. 67.

⁸⁸ Karber and Amer (note 66), p. 15.

Eastern Europe with the six divisions, or whether they will be redistributed to the 24 'restructured' divisions remaining behind.⁸⁹

Artillery withdrawals are, however, taking place. Defence Minister Yazov told *Izvestia* on 16 September 1989 that 1070 artillery systems 'have been reduced' over the past six months.⁹⁰ *Pravda* reported on 20 August 1989 that 169 guns had been withdrawn from the German Democratic Republic.⁹¹ As of 1 July, 20 artillery pieces had also been withdrawn from Czechoslovakia, and artillery was reported withdrawn from Hungary in April 1989 with the 13th Tank Division.⁹² General V. N. Lobov, First Deputy Chief of the Soviet General Staff and Chief of Staff of the Combined Forces of the Warsaw Pact, told a US congressional delegation in the GDR in August 1989 that the 'Soviet Union does not plan to increase the artillery strength of the Soviet forces deployed in Eastern Europe'.⁹³ Chief of the General Staff, General Mikhail A. Moiseyev, stated in *Krasnaya Zvezda* on 23 February 1989 that division restructuring will result in a '30 to 35 per cent reduction in the number of tanks, artillery systems and assault crossing means', suggesting additional artillery reductions.⁹⁴

In May 1989, President Gorbachev announced that the USSR would unilaterally withdraw 500 'tactical nuclear weapons' from Eastern Europe, including 284 missile warheads, 166 nuclear bombs and 50 nuclear artillery shells. The bombs are assumed to be associated with the Su-24 Fencer aircraft that were withdrawn in 1989 (see below). The nuclear artillery shells are thought to be part of the pledge that the artillery associated with withdrawing divisions will be withdrawn.

The 284 missile warheads are assumed to be associated with the SS-12M Scafeboard B and SS-23 Spider missiles which have already been eliminated under the INF Treaty. They are also thought to be associated with the 24 SS-21 Scarab short-range missile launchers which will be withdrawn from Eastern Europe by the end of 1989.⁹⁵ In October, while visiting Helsinki, Gorbachev also stated that the Soviet Union had withdrawn all of its short-range nuclear missiles to sites beyond range of northern Europe.⁹⁶

Tactical aircraft

The unilateral cuts announced by President Gorbachev at the UN in December 1988 included reduction of 800 combat aircraft, many of which

⁸⁹ Note 88.

⁹⁰ Note 79.

⁹¹ On 1 June 1989, Col. General Omelichev, First Deputy Chief of Staff of the Soviet General Staff, was quoted by TASS as stating that 120 artillery pieces had been withdrawn from the GDR as of 1 June; quoted in Karber and Arner (note 66), p. 6.

⁹² *Rude Pravo*, 1 July 1989; quoted in Karber and Arner (note 66), p. 11. See also *Jane's Defence Weekly*, 6 May 1989.

⁹³ Statement of Edward L. Warner III, Rand Corporation, 13 Sep. 1989, House Armed Services Committee, pp. 54-5.

⁹⁴ Gouze, L., 'The Soviet strategic view', *Strategic Review*, spring 1989, p. 85.

⁹⁵ Interview with Defence Minister Yazov, *Izvestia*, 16 Sep. 1989.

⁹⁶ Keller, B., 'Gorbachev plans to destroy his A-armed subs in Baltic', *New York Times*, 27 Oct. 1989, p. A10.

are thought to be nuclear-capable.⁹⁷ Air Force reorganizations already under way may also be dissolving nuclear-capable units. TASS reported on 2 August 1989 that two air units, four air divisions and 19 air wings will be demobilized in 1989 and 1990.⁹⁸ On 16 September 1989, Defence Minister Yazov told *Izvestia* that 591 combat aircraft had been reduced in the past six months.⁹⁹ Moscow World Service reported on 26 August 1989 that one Air Force regiment had been disbanded in Poland and that one fighter unit was scheduled to be withdrawn from Hungary by 1 December 1989.¹⁰⁰

Although the number of nuclear-capable fighter-bombers in the Soviet Air Forces increased by 800 aircraft in the 1980s (mostly Su-24 Fencers), many older aircraft and medium bombers are being retired, and the emphasis in aircraft production has shifted to non-nuclear fighter interceptors.¹⁰¹ According to *Soviet Military Power 1989*, production of fighter aircraft in the Gorbachev years is now averaging 680 annually, compared with 950 in the pre-Gorbachev years.¹⁰² Production of the nuclear-capable Flogger ended in the mid-1980s, and production of the nuclear-capable Fitter was 'cut drastically over the past several years'.¹⁰³ The number of nuclear-capable fighters is estimated to have declined from 3230 to 2500 in the past year, mostly as a result of the reassessment of the roles of 875 MiG-23 Floggers.¹⁰⁴

The Soviet Union continues to build Backfire medium-range bombers, assigning them to the Strategic Air Armies and Soviet Naval Aviation (SNA) in place of Badger and Blinder bombers, which are being retired. Some 350 Backfires were in service in 1989 (190 in theatre forces and 160 assigned to naval aviation). None the less, the number of theatre bombers and SNA bombers in 1989 is at the lowest level of the 1980s.¹⁰⁵ The number of Badger and Blinder bombers retired in 1989 was approximately 145 aircraft.¹⁰⁶

The Su-24 Fencer continues in production, replacing older Badger bombers and fighters.¹⁰⁷ Two regiments of Su-24 Fencer fighter-bombers were withdrawn from the GDR in 1989, and nuclear-capable MiG-23/27 fighters have also been withdrawn from Eastern Europe.¹⁰⁸

⁹⁷ Defence Minister Yazov stated in *Izvestia* on 28 Feb. 1989 that reductions in Europe among the 'Warsaw Pact' countries include 930 warplanes; Goure, L., 'The Soviet strategic view', *Strategic Review*, spring 1989, p. 88.

⁹⁸ Vladimir Chernyshev, TASS, 2 Aug. 1989, quoted in Karber and Arner (note 66), p. 2. Defence Minister Yazov stated in *Izvestia* on 28 Feb. 1989 that 'our entire air grouping will be withdrawn from the Mongolian People's Republic'; Goure (note 96), p. 88.

⁹⁹ *Izvestia*, 16 Sep. 1989.

¹⁰⁰ Karber and Arner (note 66), p. 9. See also *Jane's Defence Weekly*, 6 May 1989.

¹⁰¹ DOD, *SMP 1988*, p. 80.

¹⁰² DOD, *SMP 1989*, p. 34.

¹⁰³ DOD, *SMP 1988*, p. 39.

¹⁰⁴ DIA, *Force Structure Summary* (note 48), p. 18.

¹⁰⁵ Collins and Rennack (note 50), pp. 39, 88.

¹⁰⁶ DOD, *SMP 1989*, p. 15; DOD, *SMP 1988*, p. 15.

¹⁰⁷ TASS reported on 17 July 1989 that one Bomber regiment had been replaced with Su-24 fighters, and that another was replaced with MiG-27 fighters, as quoted in Karber and Arner (note 66), p. 6.

¹⁰⁸ Karber and Arner (note 66), p. 15.

There were numerous reports in 1988 of a new nuclear-capable short-range tactical air-to-surface missile assigned to fighter aircraft, particularly the Su-24 Fencer. Although little information is available, the weapon referred to was possibly the AS-9 Kyle, the AS-11 Kilter anti-radiation missile or the AS-14 Kedge.¹⁰⁹ However, little was heard about the supposed development in 1989.

Naval nuclear forces

The Soviet Navy has become an increasingly important part of Gorbachev's public disarmament initiatives, and by the end of 1989 it was clear that a general and visible denuclearization process had begun. During a trip to Helsinki in the end of October, Gorbachev announced the planned elimination of the remaining four Golf II Class ballistic missile submarines from the Baltic Fleet by the end of 1990, and more important, stated that the USSR would remove certain types of sea-launched nuclear weapons from the Baltic Fleet.¹¹⁰ In November, TASS reported the first test-flights aboard the Soviet Navy's new aircraft-carrier, and made a point of stating that: 'The Tblisi will not carry nuclear weapons'.¹¹¹ This followed the removal of nuclear-capable anti-submarine rockets and surface-to-air missiles from the fourth aviation ship of the Kiev Class, which was commissioned in 1988.

The growing pressure from the Soviet Union for the United States to meet it at the naval arms control negotiating table was constant, and with completion of START and CFE (Conventional Armed Forces in Europe) agreements looming, the likelihood of such talks in the future appeared more likely. At the 2-3 December US-Soviet summit meeting in Malta, President Gorbachev proposed eliminating non-strategic nuclear weapons from the US and Soviet Navies after the CFE treaty is reached.¹¹² Details of the proposal were not clear from US sources, who interpreted it differently, but President Bush did not agree to the proposal.¹¹³

The size of the Soviet naval force continued to decline in 1989 as the ageing and obsolescent fleet was being retired. Soviet naval activities out of home waters remained at their new low rate, and construction of new platforms (ships and submarines that would have been started under Gorbachev, as opposed to before him) showed signs of slowing.

During 1988, according to the US Navy, 'the Soviets scrapped or otherwise took out of active service more ships than any year in recent history'.¹¹⁴ This development followed the retirement of a significant number of diesel-

¹⁰⁹ DOD, *SMP 1988*, p. 79; Collins and Rennaack (note 50), p. 28, credit the AS-9 with a nuclear capability, but not the AS-11.

¹¹⁰ Note 95; Associated Press Report, 'USSR mixing Baltic aimed arms', 26 Oct. 1989.

¹¹¹ TASS, Moscow, 'Aircraft take off from new Soviet Tblisi carrier', 22 Nov. 1989.

¹¹² Gordon, M. R., 'Gorbachev said to seek end of naval nuclear weapons', *New York Times*, 6 Dec. 1989, p. A16.

¹¹³ Smith, R. J., 'Soviets urged ban on some nuclear arms at sea', *Washington Post*, 6 Dec. 1989, p. A25.

¹¹⁴ Statement of Rear Admiral Thomas A. Brooks, Director of Naval Intelligence, before HASC, 22 Feb. 1989, p. 8.

powered submarines in the 1980s¹¹⁵ and the retirement of at least 20 major surface combatants (4 cruisers and 16 destroyers) since 1987.¹¹⁶ In 1989 and 1990, according to TASS, 24 more submarines and 45 naval surface ships will be 'scrapped'.¹¹⁷ Defence Minister Yazov stated on 16 September 1989 that 40 warships had been reduced in the previous six months alone.¹¹⁸ The Soviet Pacific Fleet was reported reduced by about 50 ships during the period 1984-88.¹¹⁹

Soviet shipbuilding levels have also declined. Submarine production levels have diminished since the mid-1980s.¹²⁰ In 1987 and 1988 the Soviet Navy launched eight attack submarines for its own use (excluding three Kilo Class submarines each year intended for export).¹²¹ While *Soviet Military Power 1989* reports that a second production line for the Akula Class submarine was opened,¹²² the Victor III and Akula, and possibly the Sierra attack submarine classes, remain in production.¹²³ A new Oscar Class cruise missile submarine, designated Oscar II, was observed in March in the Norwegian Sea.

Ship production levels are also showing signs of reduction, a sign that new orders have declined under Gorbachev. Four types of major surface combatant continued in production in 1989: the fourth Kirov Class cruiser and destroyers of the Udaloj and Sovremennii Classes. A new cruiser to follow the Kirov may also be in the early stages of construction.¹²⁴ Major warships being retired or decommissioned included Sverdlov Class cruisers, and Kashin, Kildin, Kotlin and Skoryy Class destroyers. The last Kanin Class destroyers were reported decommissioned in 1988.¹²⁵

¹¹⁵ DOD, *SMP 1988*, p. 129. Collins and Rennack (note 50), p. 109, report the retirement of 2 Echo II SSGN, 20 Foxtrot SS, 3 Golf SS, 8 Romeo SS, 16 Whiskey (four SSG and 12 SS), and 15 Zulu SS submarines in the 1980s.

¹¹⁶ These ships 'have been either scrapped or stripped of weapons and electronics while awaiting scrapping...'; DOD, *SMP 1989*, p. 75.

¹¹⁷ Vladimir Chernyshev, TASS, 2 Aug. 1989; as quoted in Karber and Amer (note 66), p. 2. The US Defense Intelligence Agency (DIA) reported that seven submarines had been scrapped by the USSR between Nov. 1987 and Feb. 1989; DIA, *Force Structure Summary* (note 48).

¹¹⁸ *Izvestia*, 16 Sep. 1989.

¹¹⁹ These ships include older Roman diesel-powered submarines and Skoriy, Kotlin and Kanin Class destroyers; Statement of Rear Admiral Thomas A. Brooks (note 114), p. 9.

¹²⁰ Brooks (note 114), p. 9.

¹²¹ Brooks (note 114), p. 10; Studeman (note 55), pp. 32, 34; *SMP 1989*, p. 35. In 1988, the Soviet Navy launched one Akula (the fourth), one Victor III (the 23rd), one Oscar II (the fourth Oscar and the first Oscar II), one Delta IV (the fifth), and four Kilo class submarines (three of which were for export). In 1987, the Soviet Navy launched one Victor III (the 22nd), one Akula (the third), one Oscar (the third), one Beluga experimental submarine and four Kilo Class submarines (three of which were also for export).

¹²² DOD, *SMP 1989*, preface.

¹²³ An Akula Class submarine was spotted by Norwegian intelligence in the Barents Sea in Oct., indicating that the submarines may be assigned to the Northern Fleet as well as the Pacific Fleet, where the first four submarines are home-ported. Admiral Thomas A. Brooks, Director of Naval Intelligence, stated in US Naval Institute *Proceedings* in Nov. 1989, p. 139, that there were 'apparently more nuclear submarines launched in 1989 than in any other year this decade.'

¹²⁴ DOD, *SMP 1989*, p. 35; Starr, B., 'Soviets building new cruiser', *Jane's Defence Weekly*, 15 July 1989, p. 57.

¹²⁵ Collins and Rennack (note 50), p. 101.

Soviet production of shorter-range cruise and anti-ship missiles to arm these new ships, according to the US DOD, has also declined slightly in the Gorbachev years.¹²⁶

At the end of 1989, the first of the new Tbilisi Class of aircraft-carriers was conducting initial at-sea trials, while the second was being fitted out at the Nikolayev shipyard in the Black Sea. A follow-on carrier is in the early stage of construction at the same shipyard.¹²⁷ Because of problems of integrating and perfecting the catapult and arresting-gear system for use by conventional take-off and landing aircraft, the carrier is now accepted as being 'designed for ramp-assisted aircraft launch'.¹²⁸ In November TASS reported that aircraft trials had begun on the *Tbilisi*.¹²⁹

There have been continuing significant reductions in naval operations, including drawing back on naval deployments outside of home waters. In 1988, Soviet ships 'spent more time in port and at anchor and less time at sea than in previous years'.¹³⁰ According to the US Navy: 'Most Soviet Navy exercises in 1988 continued to be relatively short, were conducted in ocean areas contiguous to the Soviet landmass and emphasized defense of the homeland and submarine bastions'.¹³¹ In 1989 it was reported that all submarine patrols off the UK and western Africa had ceased, that patrols had been cut back in the Indian Ocean and that naval operations in the North Sea had continued to decline.¹³²

Badger bombers assigned to Soviet Naval Aviation continue to be retired and replaced by Backfire bombers on a less than one-for-one basis.¹³³ In 1988, other than deployment of Backfire C bombers with the SNA, 'little SNA deployment activity occurred during the year. No new aircraft types were introduced'.¹³⁴

Perestroika and the Soviet military

Among other things, 1989 will be remembered as the year that demonstrated that Mikhail Gorbachev could deliver on his promises of *perestroika* and unilateral changes in military forces. The role of Marshal Sergey Akhromeyev in an important advisory post and Defence Minister Yazov's leading role in speaking out in favour of military reforms were important achievements for the Soviet leader and exemplified the successful balancing act Gorbachev was able to maintain during the year with the opponents and critics of his bold programme.

¹²⁶ DOD, *SMP 1989*, p. 34.

¹²⁷ DOD, *SMP 1989*, p. 35.

¹²⁸ DOD, *SMP 1988*, preface.

¹²⁹ TASS, Moscow, 'Aircraft take off from new Soviet Tbilisi carrier', 22 Nov. 1989.

¹³⁰ Brooks (note 114), p. 13.

¹³¹ Brooks (note 114), p. 15.

¹³² Starr, B., 'Soviets building new cruiser', *Jane's Defence Weekly*, 15 July 1989, p. 57; 'Soviet North Sea sightings continue to fall', *Jane's Defence Weekly*, 7 Oct. 1989, p. 730.

¹³³ Brooks (note 114), p. 15.

¹³⁴ DOD, *SMP 1989*, p. 77.

The effects of *perestroika* on the military establishment, however, continued to be a problem for the Soviet President. The Soviet specialist press published numerous articles detailing the military's internal difficulties, particularly deficiencies in training, efficiency and morale. Dissatisfaction continued to be voiced about the reduction in military spending, but these complaints were not so much disagreement with the disarmament process *per se* or with military reductions. They were largely concerns about the conditions of the military profession, and the treatment of demobilized officers, particularly the availability of jobs and housing.¹³⁵

Although the generals and admirals continued to debate what *perestroika* meant for the armed forces, the military was occupied with real and immediate demands, most notably the monumental effort of withdrawing troops and equipment from Eastern Europe, reincorporating forces withdrawn from Afghanistan and other reorganization efforts.¹³⁶ Between April, when the first troops and equipment were withdrawn from Hungary, and August, three divisions, 2700 tanks, 380 artillery guns, 120 combat aircraft and 24 500 personnel were removed from Eastern Europe.¹³⁷ This is a major logistical achievement even by Western standards, and such changes clearly have a major impact on short-term combat readiness. By the end of 1989, the Soviet military found themselves observing the many rapid changes going on in Eastern Europe as well as the accelerated arms negotiations that would soon spell even further reductions, in the process of implementing the INF Treaty—with declining defence spending and production.

IV. British nuclear weapon programmes

The British Trident strategic submarine programme is still on schedule, yet uncertainties remain over the performance of the US Trident D5 missile to arm these boats, and the ability of the UK to produce the warheads in time for the missile. Britain continues to be plagued by indecision over its choice of a nuclear-armed stand-off missile to replace its ageing stock of WE-177 gravity bombs.

According to the latest defence White Paper, Britain proposed to spend \$33.84 billion for the 1989–90 defence budget. Of this amount, the strategic

¹³⁵ When concerns relating to the effects of *perestroika* and turmoil in Soviet society on combat readiness of the armed forces were raised, criticism was largely reserved for lower-ranking officers, for the lack of integration of new technology in training and administration, and for the inefficiency of Soviet society, all problems being addressed in civil *perestroika* as well. See, e.g., Royal United Service Institute, *The RUSI Soviet Warsaw Pact Yearbook 1989* (Jane's Defence Data: Coulson, 1989), pp. 22–55.

¹³⁶ These other reorganization efforts, presumably intended to save money, reduce administrative headquarters and streamline command relationships, included the announcement in Sep. that two military districts were being eliminated. Commentary about both reorganizations included references to the fact that thousands of former officers and their families has no place to live; see Meyer, S. M., 'Soviets eliminate two military districts', *Soviet Defense Notes*, Oct. 1989.

¹³⁷ US Congress, House Armed Services Committee, *Status of the Soviet Union's Unilateral Force Reductions and Restructuring of its Forces, Report of the Committee Delegation to West Berlin, East Germany and the Soviet Union, 6–18 Aug. 1989*, 16 Oct. 1989, p. 4.

nuclear force will require 5.7 per cent, but only 0.6 per cent of service manpower and 1.3 per cent of civilian manpower.¹³⁸

Continuing problems at Aldermaston

Problems at the Atomic Weapons Establishment (AWE) at Aldermaston, the hub of all British nuclear weapon research and production, are causing serious concern about the ability of the UK to develop and produce the warheads for the Trident D5 missile and the tactical air-to-surface missile.

The British Ministry of Defence (MOD) has given a qualified assurance that sufficient warheads would be ready to meet the in-service date of all four Vanguard Class SSBNs, 'provided that the new capital facilities come into operation as planned and that the difficulties caused by the current staffing shortfall can be overcome'.¹³⁹

However, both staff shortages and construction problems at AWE Aldermaston are continuing to threaten to delay the deployment of *HMS Vanguard*, the first Trident SSBN. To help resolve these problems, the MOD appointed Rolls Royce Chairman Sir Francis Tombs to review the Trident programme. Tombs will focus on staff shortages in key areas¹⁴⁰ and on concern over the A90 warhead production facility at AWE Aldermaston.¹⁴¹

These problems could also threaten the development of the warhead for the TASM, thus possibly delaying the replacement of the RAF's WE-177 nuclear bomb (expected to be replaced about the turn of the century). Sir Michael Quinlan, Permanent Under Secretary of State for Defence, stated that the MOD 'might have to face awkward priorities' when allocating AWE staff between the production of Trident D5 warheads and a TASM warhead.¹⁴²

Trident

Construction is in progress at the Vickers Shipyard at Barrow-in-Furness on the first two Vanguard Class SSBNs, *HMS Vanguard* and *HMS Victorious*. *HMS Vanguard* is due to be operational in 1994 and to enter service in the mid-1990s.

During 1989 the MOD negotiated with Vickers Shipbuilding and Engineering Ltd (VSEL) the contract for the third SSBN (SSBN 07). The contract for the final Trident submarine, SSBN 08, is not expected to be

¹³⁸ Fishlock, D., 'Britain plans defense spending increase; new financial moves', *Defense Week*, 8 May 1989, p. 9.

¹³⁹ 'UK Trident faces delay', *Jane's Defence Weekly*, 20 May 1989, p. 910; emphasis added.

¹⁴⁰ As of 1 Mar. 1989, AWE Aldermaston had a shortfall of 359 employees, compared to a shortfall of 216 on 1 Mar. 1988; 'UK Trident faces delay', *Jane's Defence Weekly*, 20 May 1989, p. 910.

¹⁴¹ 'Rolls-Royce head to review UK's Trident', *Jane's Defence Weekly*, 9 Sep. 1989, p. 425.

¹⁴² Quinlan was testifying before the UK House of Commons Defence Committee on the 1989-90 defence budget; 'Staff shortages threaten to delay UK nuclear bomb replacement', *Jane's Defence Weekly*, 27 May 1989, p. 985.

signed for a few years, as it will not need to be operational until SSBN 05 is withdrawn from service for its first refit.¹⁴³

The latest official estimate of the cost of the Trident programme is £9.089 billion (\$15.451 billion).¹⁴⁴ According to MOD estimates, 32 per cent (£2.923 billion, or \$4.969 billion) of the Trident expenditure will be in the USA, compared to a November 1981 estimate of 44 per cent spent in the USA.¹⁴⁵ As of October 1989, Britain has spent \$20 million on 'Trident missile production and advance procurement', with a further \$42 million authorized for FY 1990.¹⁴⁶ Peak expenditure is expected in 1990-95.

The serious design flaws of the US Trident D5 missile, discovered during two failed test-flights from a submerged US Navy SSBN (see section II), have been of great concern to the UK. The British Ambassador in Washington, Sir Antony Acland, lobbied the US Senate to restore funding for the Trident D5 SLBM in the FY 1990 budget.¹⁴⁷ Acland was concerned that withholding of production funding could delay the arrival of the first missiles for the Royal Navy and would 'continue to impose time and cost penalties on the British Trident programme'.¹⁴⁸ Uncertainty over the future of the Trident missile is now so high that the UK regularly contributes money to a US Navy trust fund entitled 'Termination Liability', first introduced in FY 1989. Although Britain has so far committed only \$2.755 million to this account, a further \$9.925 million is authorized for FY 1990.¹⁴⁹

Tactical air-to-surface missile

Pursuant to Staff Requirement (Air) 1244, the UK is seeking to acquire a nuclear-armed TASM with a range of approximately 500 km to replace its ageing WE-177 A/B free-fall nuclear bombs.¹⁵⁰ The new weapon is to be installed on RAF Tornado and Buccaneer strike aircraft, and RN Sea Harrier aircraft, by the turn of the century. The British decision on this nuclear

¹⁴³ Note 139.

¹⁴⁴ The figure is from the British Information Service, New York, Jan. 1990.

¹⁴⁵ Note 143. Most of this money is spent through the US Navy's Strategic Systems Program Office (SSPO). Since the inception of the Polaris Sales Agreement (1963) and through FY 1989, the UK has spent \$2638 billion through the SSPO on Polaris, Chevaline and Trident weapon systems. The authors estimate that, as of Oct. 1989, roughly 74 per cent of this amount has been spent on Polaris and Chevaline, and 26 per cent on Trident.

¹⁴⁶ According to documents from the US Navy SSPO pertaining to the Polaris Sales Agreement.

¹⁴⁷ The Senate Appropriations Committee terminated funding for production of the missile in the FY 1990 budget following the two dramatic test failures. The House Appropriations Committee voted for \$1791.5 million in Trident production funds; Starr, B., 'UK Ambassador joins Trident funding fight', *Jane's Defence Weekly*, 14 Oct. 1989, p. 754.

¹⁴⁸ Starr, B., 'UK Ambassador joins Trident funding fight', *Jane's Defence Weekly*, 14 Oct. 1989, p. 754.

¹⁴⁹ According to documents from the US Navy SSPO pertaining to the Polaris Sales Agreement.

¹⁵⁰ The MOD is expected to decide 'within a year' on the replacement of the RN's nuclear depth charges. Sir Michael Quinlan, Permanent Under Secretary of State for Defence, stated that the development of 'smart' homing torpedoes might eliminate the need for nuclear depth charges. Quinlan was testifying before the British House of Commons Defence Committee on the 1989-90 defence budget; 'Staff shortages threaten to delay UK nuclear bomb replacement', *Jane's Defence Weekly*, 27 May 1989, p. 985.

stand-off missile was initially expected in 1989, although it is now not expected until the end of 1990. A full-scale development decision would follow in late 1992.

Since the UK does not wish (and cannot afford) to develop the TASM unilaterally, the delays to date have centred around the decision of which foreign country to co-operate with, and also which foreign company.

Britain has three choices at present; all are based on existing or planned foreign weapon systems. Two US companies are competing for this contract. Boeing Aerospace is proposing the tactical Short Range Attack Missile, or SRAM-T. The SRAM-T is a tactical variant of the SRAM II now in development for introduction on US strategic bombers in 1993-94. Boeing is already under contract with the US Air Force to perform design concept studies on the SRAM-T for possible application to NATO aircraft. An off-the-shelf purchase of the SRAM-T is possible on cost grounds, although Britain would manufacture its own nuclear warhead, and possibly the engine or guidance system.¹⁵¹ Martin Marietta is proposing a TASM based on the company's Supersonic Low-Altitude Target (SLAT).¹⁵²

The French manufacturer Aérospatiale is also competing for this contract, offering joint development of the ASLP (Air-Sol Longue Portée) missile. France is already studying the ASLP, a successor to its 90- to 350-km range ASMP (Air-Sol Moyenne Portée) missile.¹⁵³ To co-operate with Britain, and to meet its timetable, France would have to accelerate the development of the 500- to 700-km range ASLP long-range air-to-ground missile. It is expected that a joint ASLP missile would feature an enlarged fuel cell and new guidance suite.¹⁵⁴

In early 1989 the possibility of an Anglo-French TASM appeared to wane after Britain signed a Memorandum of Understanding (MOU) with the USA sanctioning US contractors to help Britain develop a TASM missile.¹⁵⁵ A British Aerospace/Hunting Engineering evaluation team conducted feasibility studies into the SRAM-T and SLAT options.¹⁵⁶ These included the signing of an agreement for a 'concept formulation phase' with Martin Marietta, to look at the feasibility of developing Martin Marietta's SLAT into a missile for deployment on RAF aircraft.¹⁵⁷

This agreement seemed to spell an end to hopes of any Anglo-French co-operation on this missile. Furthermore, the MOD still seemed dissatisfied with the ASMP performance (range and accuracy) and timetable, and in May 1989 former British Defence Secretary George Younger stated that it

¹⁵¹ Cook, N., 'USA, UK sign nuclear missile deal', *Jane's Defence Weekly*, 24 June 1989, p. 1285.

¹⁵² Cook, N. and Leonard, J., 'UK stand-off missile choice delay', *Jane's Defence Weekly*, 4 Nov. 1989, p. 949.

¹⁵³ As the ASMP has an estimated life of 20 years, France is seeking a replacement (ASLP) for introduction around 2005-2006, on the Mirage 2000N and ACT Rafale aircraft; Boucheron, J. M., *L'Équipement Militaire pour les Années 1990-1993* (Assemblée Nationale: Paris, 2 Oct. 1989), report no. 897, p. 428.

¹⁵⁴ Note 152.

¹⁵⁵ The MOU authorized the USA to release SLAT and SRAM-T data to the UK; Barrie, D., 'UK/France revive nuclear dialogue', *Jane's Defence Weekly*, 23 Sep. 1989, p. 541.

¹⁵⁶ Note 152.

¹⁵⁷ Cook, N., 'USA, UK sign nuclear missile deal', *Jane's Defence Weekly*, 24 June 1989, p. 1285.

seemed unlikely that Britain would co-operate with France.¹⁵⁸ Nevertheless, in May 1989 the MOD was still discussing with France the possibility of development of a joint missile.¹⁵⁹

By September Britain had renewed interest in France's offer of joint development of a nuclear-armed TASM. During a meeting in London that month, British Secretary of State for Defence Tom King and French Defence Minister Jean-Pierre Chevènement made it clear that, from a political standpoint, an Anglo-French nuclear weapon is still very much under consideration. King described this a 'serious option'.¹⁶⁰ The British MOD is now expected to award Aérospatiale a FFr 10 million (\$1.6 million) pre-feasibility study for the ASLP, which should be completed in early 1990.¹⁶¹

Comparative analysis of the three options will continue through September 1990, leading to a British decision towards the end of 1990. The whole programme could cost less than £1 billion (\$1.7 billion).¹⁶²

Britain and arms control

Although the USA has reversed its objections to Soviet demands that combat aircraft be included in conventional arms reduction talks, Britain and France both voiced reservations over the inclusion of all aircraft types; French President Mitterrand ruled out the inclusion of its strategic Mirage IVP bombers (along with associated Boeing C-135FR tanker aircraft), while Prime Minister Margaret Thatcher ruled out inclusion of British dual-role aircraft such as the Tornado strike aircraft, which can carry both nuclear and conventional weapons. Among the older aircraft that can be expected to be scrapped are French and British Jaguars.¹⁶³

Secretary of State for Defence King reiterated in September 1989 that the UK's strategic nuclear stockpile is 'not negotiable'.¹⁶⁴ This stockpile at present totals some 96 warheads (see table 1.3), enough for three full boat-loads of Chevaline SLBMs.¹⁶⁵

¹⁵⁸ 'Britain backs away from joining France in producing air-launched nuclear missile', *Aviation Week & Space Technology*, 8 May 1989, p. 25.

¹⁵⁹ According to Quintan (note 150).

¹⁶⁰ Barrie, D., 'UK/France revive nuclear dialogue', *Jane's Defence Weekly*, 23 Sep. 1989, p. 541.

¹⁶¹ Note 152.

¹⁶² Note 152.

¹⁶³ 'Britain, France raise concerns about cuts in combat aircraft', *Aviation Week & Space Technology*, 5 June 1989, p. 20.

¹⁶⁴ Dodds, H., 'UK's nuclear deterrent is "not negotiable", says King', *Jane's Defence Weekly*, 16 Sep. 1989, p. 479.

¹⁶⁵ In Mar. 1987 French President Mitterrand confirmed that Britain had enough warheads for only three SSBNs (out of four) with the statement that the UK has '90 to 100 [strategic] warheads'; President Mitterrand, an interview translated by the Service de Presse et d'Information of the French Embassy, London, 29 Mar. 1987, p. 6.

V. French nuclear weapon programmes

Substantial cost overruns have plagued most of the nuclear weapon programmes covered by France's 1987-91 defence budget. Long-anticipated defence budget cuts are finally being implemented, as reflected in the revised 1990-93 defence budget. Although no major nuclear programmes have been cancelled, the net result is yet further delays in the introduction of these systems.

Defence budget

France's defence budget for 1990 totals FFr 189.44 billion (\$30.3 billion), a 3.88 per cent growth over the previous year. FFr 102.1 billion (\$16.3 billion) is devoted to the equipment budget, approximately one-third of which covers strategic and 'pre-strategic' nuclear armaments (this figure is a reduction in the original estimates).¹⁶⁶ The Parliament accepted the defence procurement programme for 1990-93, totalling FFr 437.8 billion (\$70.1 billion).

Several major nuclear weapon programmes are to be delayed: the *Charles de Gaulle* aircraft-carrier will enter service in 1998, two years later than originally planned; the Rafale carrier-borne aircraft could be delayed until the year 2002; and the S4 IRBM will enter service at the end of the century, four years later than planned.

Force Océanique Stratégique

The programme to update the existing SSBN force continued in 1989 with the delivery of the second SSBN refitted to carry the M-4 missile system (to replace the M-20 missile), the *L'Indomptable*.

After completion of its refit at the DCAN Naval dockyard at Brest in December 1988,¹⁶⁷ the SSBN *L'Indomptable* launched an M-4B missile on the Centre d'Essais des Landes (CEL) range on 11 April 1989, and then entered active service on 15 June 1989.¹⁶⁸

With the *L'Inflexible* and *Le Tonnant*, the Force Océanique Stratégique (FOST) now has three SSBNs carrying the M-4, each with 96 warheads apiece. These refits will bring the SSBNs up to the standard of *L'Inflexible*, enabling them to remain operational until 2005-2010.¹⁶⁹

Two further SSBNs will exchange their M20 missiles for the M-4B missile system, *Le Terrible* and *Le Foudroyant*. The defence budget allocated FFr 2.8 billion (\$0.45 billion) for these refits between 1990 and

¹⁶⁶ Inard, J., 'France details \$29.6b FY90 defence budget', *Jane's Defence Weekly*, 28 Oct. 1989, p. 894.

¹⁶⁷ The refit began in Oct. 1988; 'DCN', *DGA Info*, no. 20 (Mar. 1989), p. 7.

¹⁶⁸ *DGA Info*, no. 22 (June 1989), p. 8. The SSBN was submerged in the Gulf of Gascogne at the time of the launch (23:16 local time); 'Missiles', *Air et Cosmos*, 26 Aug. 1989, p. 9.

¹⁶⁹ Boucheron (note 153), p. 220.

1993.¹⁷⁰ The SSBN *Le Terrible* began its refit at Cherbourg on 1 February 1988 after completing 49 patrols since entering service in 1973.¹⁷¹ The boat will be readmitted into active service in June 1990 armed with M-4B missiles. The SSBN *Le Foudroyant* will finish its refit at Brest in 1993, thus completing the M4 refit programme.¹⁷²

The SSBN *Le Redoutable* will not undergo refit to receive the M-4, as it is due for retirement in 1991.¹⁷³ At that time, all of the three submarines that France keeps on patrol at any one time will be equipped with the M-4 missile, ensuring a total of 288 warheads at sea, all targeted on 'the Capital and the principal cities of the Soviet Union'.¹⁷⁴

France plans to acquire six 'new generation' SSBNs of the Triomphant Class to replace the six ageing Redoutable Class boats.¹⁷⁵ Two new SSBNs have been ordered to date; funding for their construction was provided in the 1987-91 defence programme law.

A special shipyard was built at Cherbourg for the construction of the Triomphant Class SSBNs. On 9 June 1989 construction began on the first boat in the series, *Le Triomphant*. The construction programme for the six 14 335-tonne boats is due to continue through 2008.¹⁷⁶ *Le Triomphant* is due to undergo sea trials in 1993 before entering service at the end of 1994. The second boat, to be called *Le Téméraire*, will enter service at the beginning of 1997.¹⁷⁷ The sixth and final submarine is planned to enter service in 2008.

Development costs of the new Triomphant Class SSBN are 42 per cent higher than the original estimate, while production costs are expected to be 12.1 per cent higher.¹⁷⁸ The 1990-93 defence budget allocated FFr 26 billion (\$4.2 billion) for this programme during the period and anticipates the ordering of the third boat in the series.¹⁷⁹

The first three Triomphant Class boats will initially carry an intermediate type of missile known as the M-45, since the M-5 (the successor to the M-4) will not be ready in time. Although the missile will still have six warheads, the M45 will have improved penetration aids and a new warhead, the TN 75.¹⁸⁰

Under the 1987-91 defence programme the 12-warhead M-5 missile was forecast to enter service in 1999. Under the new law, the date has been pushed back to 'the beginning of the next century'.¹⁸¹ The 1990-93 budget

¹⁷⁰ Boucheron (note 153), p. 220.

¹⁷¹ Moirand, R., 'Réarmement du SNLE *Le Terrible* un an avant ses essais à la mer,' *Cote Bleue*, 18 Mar. 1989, p. 21.

¹⁷² Boucheron (note 153), p. 220.

¹⁷³ Boucheron (note 153), p. 220, 737.

¹⁷⁴ Boucheron (note 153), p. 418. This target set is to remain unchanged for the M45 SLBM system.

¹⁷⁵ The fact that the boats would be replaced on a one-for-one basis was first disclosed by the official French Navy periodical *Cote Bleue* in mid-Feb. 1989.

¹⁷⁶ Boucheron (note 153), p. 415.

¹⁷⁷ 'Missiles', *Air et Cosmos*, 13 May 1989, p. 7.

¹⁷⁸ As of July 1989; Boucheron (note 153), p. 173.

¹⁷⁹ Boucheron (note 153), p. 221.

¹⁸⁰ Boucheron (note 153), p. 223. The Commissariat à l'Énergie Atomique (CEA) is still defining the parameters of the TN-75 warhead; CEA, *Rapport Annuel 1988* (CEA: Paris, 1989), p. 61. These three SSBNs will be equipped to carry the M5 SLBM after 2005.

¹⁸¹ Boucheron (note 153), p. 222.

thus delays the introduction of the M-5 SLBM to 2005, on the fourth boat in the series (previously planned for the third boat).¹⁸²

S3D/S4 IRBM

In 1989 France celebrated the 20th anniversary of the completion of the silo construction programme of the Plateau d'Albion. These silos currently house 18 S3D IRBMs. Each year one operational S3D is withdrawn from alert and launched (without warhead) from an experimental silo at the CEL test range. The most recent launch on 21 March 1989 marked the 50th launch of a French IRBM.¹⁸³

The S3D is to be operational up until the year 2000, according to General Maurice Schmitt, French Army Chief of Staff.¹⁸⁴ According to Aérospatiale, the prime contractor for all French IRBMs, the Plateau d'Albion is due to undergo a modernization process in the late 1990s, with the upgraded weapon system making 'maximum use of the existing facilities and ensure continuity of the land-based leg of the French nuclear triad'.¹⁸⁵

Although the 1990 defence budget allocates approximately FFr 800 million (\$128 million) for continued research and development work on the S4 missile, the IOC continues to be delayed, this time by as many as four years, to the 'turn of the century'.¹⁸⁶

The two-stage S4 missile is envisioned to carry one TN-35 warhead of about 300-kt yield. However, several other options are also being considered for the missile to replace the S3D, including: new warheads for the S3D missiles; installing M-45 SLBM missiles (and later the M5) in the underground silos; and the development of an S45 missile, which would be both mobile and fixed-based, like the S4, but carrying improved penetration aids.¹⁸⁷

Hadès missile

The Hadès is a semi-ballistic missile (i.e., manoeuvrable after the boost phase) with a range which will approach 500 km.¹⁸⁸ The CEA is developing several different nuclear warheads for the single-warhead Hadès missile, including a neutron warhead.¹⁸⁹ One of these warheads is called the TN-90, with a yield reportedly no higher than 80 kt.¹⁹⁰

¹⁸² 'Loi de programmation 1990-1993: adoptée', *Air et Cosmos*, 14 Oct. 1989, p. 7.

¹⁸³ 'Operation NAJA' une réussite', *Air Actualités*, no. 421 (May 1989), p. 34. This figure includes those missiles used for developmental purposes.

¹⁸⁴ Boucheron (note 153), p. 737.

¹⁸⁵ Aérospatiale, 'Twenty candles for the Plateau d'Albion', *Revue Aérospatiale*, Oct. 1989, p. 45.

¹⁸⁶ Note 182; 'France to delay S-4 missile program', *Aviation Week & Space Technology*, 23 Oct. 1989, p. 25; note 166, p. 895.

¹⁸⁷ 'Défense: budget 1990 et Loi de Programme', *Air et Cosmos*, 30 Sep. 1989, p. 9; Boucheron (note 153), p. 232.

¹⁸⁸ Boucheron (note 153), p. 242.

¹⁸⁹ CEA (note 180), p. 95.

¹⁹⁰ Boucheron (note 153), pp. 242, 246; Isard, J., 'French missile's yield revealed', *Jane's Defence Weekly*, 23 Dec. 1989, p. 1359.

Although the fate of the Hadès missile remained uncertain for most of 1989, the adoption of the revised military programme act of 1990-93 ensured continued funding for the programme and confirms the planned 1992 deployment date with the French Army.

The French Army announced that the Hadès nuclear missile division is to comprise three artillery regiments (all of which currently operate the Pluton missile). The 15th Artillery Regiment at Suippes (Marne) will be the first unit to be equipped with the Hadès, at the end of 1992. The second Hadès unit will be located at the 3rd Artillery Regiment at Mailly (Aube).¹⁹¹ The final regiment is thought to be the 74th, stationed at Belfort.

To date three experimental firings of Hadès have been undertaken at the CEL range, the most recent on 20 July 1989.¹⁹² In the near future the 15th Artillery Regiment will conduct a tactical evaluation at CEL.

General Schmitt stated that, although the Hadès missiles are to be stationed in France in peacetime, there would be no prohibition against their transfer to FR Germany in time of crisis (as is presently the case with the Pluton missiles).¹⁹³

French President François Mitterrand stated that since 'Hadès can be weapons only of final warning, they cannot be theatre or battle weapons',¹⁹⁴ and: 'On that premise there's no need to have masses of them'.¹⁹⁵ The programme of 90 missiles (mounted in pairs on mobile firing platforms) is estimated to cost FFfr 15 billion (\$2.4 billion), of which about half has already been spent on production development.¹⁹⁶

Mirage 2000N

The Tactical Air Force (FATAC) now commands two Mirage 2000N/ASMP nuclear strike squadrons at the Luxeuil air base. Following the arrival of the aircraft at EC 1/4 'Dauphiné' in July 1988, the Mirage 2000N/ASMP became operational with the 2/4 'La Fayette' squadron on 1 July 1989.¹⁹⁷ Each squadron was provided with an initial allocation of 12 ASMP missiles, each with one TN-81 warhead.¹⁹⁸

¹⁹¹ 'Missiles', *Air et Cosmos*, 9 Sep. 1989, p. 5.

¹⁹² The launches were conducted on 22 Nov. 1988, 8 Mar. 1989 and 20 July 1989; Boucheron (note 153), p. 242.

¹⁹³ 'Missiles', *Air et Cosmos*, 24 June 1989, p. 5.

¹⁹⁴ President Mitterrand, press conference, translated by the Service de Presse et d'information of the French Embassy, London, document no. Sp.Su/LON/61/89, 18 May 1989, p. 16.

¹⁹⁵ President Mitterrand, press conference in Brussels, translated by the Service de Presse et d'information of the French Embassy, London, document no. Sp.Su/LON/69/89, 30 May 1989, p. 3.

¹⁹⁶ Isnard, J., 'Rocard casts doubt over Hadès, despite second test success', *Jane's Defense Weekly*, 25 Mar. 1989, pp. 496-97. As of July 1989, the development cost of Hadès was 6 per cent higher than the original forecast, while the development costs of the computerized command and control elements of the Hadès missile programme rose by 16 per cent; Boucheron (note 153), p. 173.

¹⁹⁷ A ceremony on 10 Nov. 1988 at Luxeuil marked the departure of the Mirage III from EC 4. As of July 1989 the Mirage 2000N had completely taken over the nuclear role of the Mirage III/AN-52 aircraft at the Fourth Fighter Wing (EC 4); 'Novembre en bref', *Air Actualités*, no. 416 (Dec. 1988), p. 8.

¹⁹⁸ CEA (note 180), p. 94.

The Mirage 2000N/ASMP aircraft has overrun its original costing by 23 per cent.¹⁹⁹ French defence budget cuts have reduced the number of Mirage 2000N/ASMP squadrons from five to three. The French Air Force Chief of Staff, Jean Fleury, said that he accepts the reduction in the number of Mirage 2000N/ASMP squadrons because such a decision will not affect the pre-strategic nuclear strike capabilities of the French Air Force.²⁰⁰

Nevertheless the FATAc still plans to acquire 75 Mirage 2000N aircraft.²⁰¹ As of October 1989, all 75 had been ordered, 24 had been delivered, with 18 more to follow before the end of 1989. All the aircraft are to be delivered by the end of 1992.²⁰²

According to retired Air Force General Roger Pessidou, the third and final fighter squadron to receive the Mirage 2000N/ASMP will be EC 4/7 at Istres (Bouches-du-Rhône) on 1 July 1990, replacing the Jaguar A in the pre-strategic nuclear role.²⁰³ After that time, two Jaguar A squadrons will still remain in the nuclear role with the AN-52 gravity bomb.

Naval aviation

Following the last 'technico-operationnelle' launch of the ASMP missile from a Super Etendard aircraft at the CEL range on 10 October 1988,²⁰⁴ the ASMP became operational in 1989 on the Super Etendards embarked on the aircraft-carrier *Foch*.²⁰⁵ The total development cost of updating the 20 Super Etendard aircraft to carry the ASMP missile is 56 per cent higher than the original estimate.²⁰⁶

The French Navy plans for two nuclear-powered aircraft-carriers to replace the Clemenceau Class carriers. Construction of the first ship, the *Charles de Gaulle*, began at the Brest Naval Dockyard (DCAN) on 14 April 1989.²⁰⁷ The *Charles de Gaulle* is scheduled for sea trials in mid-1997 and to enter service in late 1998.²⁰⁸

According to the official French Navy periodical *Cols Bleus*, the *Charles de Gaulle*'s power will total 82 000 hp, compared to the 126 000 hp produced by the six oil-fired boilers of France's conventional Clemenceau Class carriers. This will translate to a maximum speed of 27 knots with both

¹⁹⁹ As of July 1989; Boucheron (note 153), p. 177.

²⁰⁰ 'Perspectives pour l'Armée de l'Air', *Air et Cosmos*, 28 Oct. 1989, p. 32.

²⁰¹ Up until May 1989, the Air Force had planned to acquire 112 Mirage 2000Ns for five squadrons. France decided to equip two of those squadrons with the Mirage 2000N variant, leaving only three FATAc squadrons in the nuclear role. Although it originally seemed clear that this change would entail the reduction in the number of Mirage 2000N/ASMP aircraft from 75 to 45, this is not now the case; 'French cut ASMP Mirages to 45', *Jane's Defence Weekly*, 17 June 1989, p. 1209; 'Armée de l'Air: programmes d'armement', *Air et Cosmos*, 7 Oct. 1989, p. 31.

²⁰² Note 200; Boucheron (note 153), p. 427.

²⁰³ 'La guerre électronique en vedette', *Air et Cosmos*, 29 Apr. 1989, p. 32; Boucheron (note 153), p. 240.

²⁰⁴ 'Missiles', *Air Actualités*, Dec. 1988, p. 43.

²⁰⁵ *Aérospatiale, Tactical Mixtilers* (Aérospatiale: Paris, 1989), brochure DIC/P no. 093/89, p. 15.

²⁰⁶ As of July 1989; Boucheron (note 153), pp. 175, 429.

²⁰⁷ 'DCN', *DGA Info*, no. 22 (June 1989), p. 9.

²⁰⁸ Capitain Feuilloley, 'Le porte-avions *Charles de Gaulle*', *Cols Bleus*, 9 Sep. 1989, pp. 4-5; *Air et Cosmos* (note 185).

shafts and 20 knots using a single shaft. The *Charles de Gaulle* will be powered by two compact pressurized water reactors (PWRs), derived from the propulsion unit of France's new Triomphant Class SSBN.²⁰⁹ Initially (from 1998 to 2004) it will carry the nuclear-capable Super Etendard/ASMP aircraft. In the long term (after 2004), it will embark Avion de Combat Marine (ACM) aircraft, or Rafale, in nuclear strike, interception and reconnaissance roles.²¹⁰ The French Navy plans to acquire 86 Rafale ACMs.

France and arms control

In May 1989 President Mitterrand provided an indication of the current French definition of 'sufficient [strategic nuclear] weaponry for our French defence'; he placed it at 'between 300 and 400 nuclear warheads'.²¹¹ He further stated that as of May 1989, France had 'fewer than four hundred [strategic nuclear warheads]'.²¹² Although France currently has approximately 372 strategic nuclear warheads,²¹³ this total will jump to 452 in mid-1990, and to 516 in 1993 (upon completion of the M4 refit programme).

In April 1989 Defence Minister Jean-Pierre Chevènement rejected the suggestion by Soviet arms control official Viktor Karpov that the 44 Pluton missiles be included in any arms control negotiations concerning SRBMs.²¹⁴ In May 1989, Mitterrand ruled out the inclusion of the Hadès missile (which will replace the Pluton in 1992) in arms control negotiations, since the range of Hadès is 'still less than the 500 km that might put them, in the view of our partners even if not in ours, within the ambit of the negotiations that have just concluded on medium-range nuclear weapons'.²¹⁵ Despite this unwillingness to include French nuclear weapons in arms control talks, France and the USSR did sign an agreement in July 1989 which will 'lead to exchanges of personnel both from operational formations and at staff officer and lower levels'.²¹⁶ On 4 July the two nations also signed an agreement designed to prevent incidents at sea between their navies. The French-Soviet Incidents at Sea Agreement is similar to those signed by the USSR with the USA, the UK and the FRG.

VI. Chinese nuclear weapon programmes

Two important political events dominated 1989 in China: the Sino-Soviet summit meeting between President Gorbachev and Chinese leaders on 15–18 May, and the popular 'pro-democracy' demonstrations that led to a brutal

²⁰⁹ Feuilloy (note 208), pp. 4–6.

²¹⁰ Feuilloy (note 208), p. 5.

²¹¹ Note 191.

²¹² Note 192, p. 5.

²¹³ 336 warheads on M20 and M4 missiles, 18 on the S3D missiles and 18 on the Mirage IVP/ASMP aircraft.

²¹⁴ 'Missiles', *Air et Cosmos*, 22 Apr. 1989, p. 8.

²¹⁵ Note 191.

²¹⁶ Isnard, J., 'Chevènement visit paves way for Soviet treaty', *Jane's Defence Weekly*, 22 Apr. 1989, p. 689.

military reaction against demonstrators in Beijing and in other cities in China. As a consequence of these developments, little information about Chinese nuclear weapon developments during 1989 was available. It was reported during the year that China agreed to sell nuclear- and chemical-capable SRBMs to Syria, although no missiles were delivered in 1989. If this is true, non-export versions of the missiles may be in service with the nuclear forces of the Chinese People's Liberation Army (PLA). This could possibly be the only hardware addition to China's nuclear arsenal in 1989. The final noteworthy development of the year was the announcement on 9 November that Deng Xiaoping had resigned from his post as Chairman of the Central Military Commission (CMC) of the Chinese Communist Party and appointed Jiang Zemin as his successor (see below).²¹⁷

The Sino-Soviet summit meeting

On 15 May President Gorbachev arrived in Beijing for an historic summit meeting with China's senior leaders, the first such meeting in 30 years. The two sides stated that the meetings 'normalized' relations between them and between their Communist Parties. The meetings produced several significant results. In a speech of 17 May to the Chinese public, President Gorbachev outlined changes to Soviet military forces in the Soviet Far East, stating that 436 intermediate- and shorter-range missiles based in the eastern USSR would be eliminated under the terms of the US-Soviet INF Treaty.²¹⁸ He announced the reduction in 1989-90 of 200 000 troops in Soviet Asia, including the reduction of 12 ground force divisions, 13 air force regiments and 16 warships from the Pacific Fleet. Gorbachev also announced the reduction of 75 per cent of Soviet forces in Mongolia, including three ground divisions and 'all air units'.

Moreover, President Gorbachev stated that the USSR is restructuring its military forces deployed along the Sino-Soviet border, but is also 'prepared to work for the withdrawal, on terms to be agreed with China, of military units and armaments from the border areas, leaving only personnel required for performing routine border duties'.²¹⁹ As stated in their joint communiqué of 18 May, 'both sides agreed to take measures to reduce armed forces in the area of the Sino-Soviet border to a minimum level in line with normal and good neighbourly relations between the two countries'.²²⁰ This proposed demilitarization of the Sino-Soviet border would represent a radical change from the military situation that has existed for nearly 30 years and could lead to possibilities for other measures of military restraint or arms control involving China. If Sino-Soviet relations continue to improve and the military competition between them diminishes further, it would offer China

²¹⁷ Southerland, D., 'Deng resigns his last Party post', *Washington Post*, 10 Nov. 1989, p. A-1.

²¹⁸ For the text of Gorbachev's speech, see 'Mikhail Gorbachev's Address to Representatives of the Chinese Public', in *Visit of Mikhail Gorbachev to China, May 15-18, 1989: Documents and Materials* (Novosti Press Agency Publishing House, Moscow, 1989), pp. 10-26.

²¹⁹ Note 218, p. 13.

²²⁰ Note 218, p. 62.

an opportunity to reduce its military and nuclear weapon programmes correspondingly.

Tiananmen Square

Ironically, Gorbachev's visit served as a source of inspiration for the students in Tiananmen Square who were advocating political reform and increased democracy in China. After a long confrontation and a growing mass of demonstrators, the Chinese leadership decided to quash the demonstrations with brutal force on 4 June. Hundreds of unarmed demonstrators were killed by soldiers of the PLA, an act that shook the faith of many Chinese people. The consequent upheaval and crackdown, including the imposition of martial law in Beijing, occupied the Chinese leaders and the PLA for much of the year and thus delayed some previously scheduled military activities, such as the testing of conventional weapons.²²¹ It is not known whether the nuclear weapon programme was affected by the military and political response to the demonstrations.

Missile sales

During 1989 there were continuing reports that Syria was trying to acquire Chinese M-Type SRBMs known in the West as the M-9.²²² In 1988, after the sale of Chinese DF-3A ballistic missiles to Saudi Arabia was revealed, several US officials expressed concern about Chinese missile sales to Chinese leaders in Beijing and believed they had an understanding from the Chinese Government that it would not sell ballistic missiles to other Middle Eastern nations.²²³ It is reported that Syrian officials reached an agreement with China in Beijing in May and, according to an official of the Israeli Defence Ministry, deliveries of the first missiles are expected to begin in mid-1990.²²⁴

China has offered the M-9 for sale at arms exhibitions and advertised its capabilities (see table 1.7).²²⁵ Its 600-km range puts it in the class of shorter-range missiles eliminated under the US-Soviet INF Treaty.²²⁶ The missile is 9.1 metres long, 1 metre wide, is carried and launched by a truck and has a

²²⁰ Note 218, p. 62.

²²¹ For example, a Beijing TV broadcast of 2 Aug. reported that the Baohong weapon testing centre had accelerated its test schedule to make up for time lost during the military reaction to the demonstrations. See 'Conventional weapons tested after delay', in US Department of Commerce, Foreign Broadcast Information Service (FBIS), *China Daily* (hereafter referred to as FBIS-CHI-89-), 3 Aug. 1989, p. 36.

²²² See Senator Helms's speech 'Red China's ballistic missile sales to Syria', with related articles in *Congressional Record*, vol. 135, no. 164 (20 Nov. 1989), pp. S16261-62.

²²³ See SIPRI, *SIPRI Yearbook 1989: World Armaments and Disarmament* (Oxford University Press: Oxford, 1989), pp. 36-37.

²²⁴ Reported on the NBC Nightly News, with Tom Brokaw, 21 Nov. 1989.

²²⁵ US Defense Intelligence Agency, *A Guide to Foreign Tactical Nuclear Weapon Systems Under the Control of Ground Force Commanders*, DST-1040S-541-87, 4 Sep. 1987, p. 79, shows a photo of the missile, labelled 'M-9/SST-600', on display and presents a table of its advertised characteristics.

²²⁶ Syria is said to have taken an interest in the M-9 when the USSR refused to sell Syria its SS-23 missiles, all of which have been destroyed under the INF Treaty.

lift-off weight of 6.2 tons. It is the first Chinese land-based ballistic missile to use solid fuel.²²⁷ Using an inertial guidance system, its accuracy is advertised to be less than 0.1 per cent of the range used, or about 600 m at maximum range. Thus it is well suited to carry a nuclear warhead, as it may be designed to do for Chinese use, or a chemical warhead. It is possible that the missile is already or will be in service with the PLA before being sold to foreign nations, as has been previous Chinese practice. China is not involved in the Missile Technology Control Regime effort to stem the proliferation of ballistic missile capabilities (see also chapter 9). It is reported that Libya is also interested in acquiring M-9 missiles.

On 8 December President Bush sent two high-level aides to Beijing on a secretive and controversial trip to improve US-Chinese relations. The US officials raised the subject of Chinese missile sales with Chinese leaders and reportedly received non-proliferation assurances from the Chinese.²²⁸ Following the one-day visit, the Chinese Foreign Ministry issued a statement saying that, except for the sale of DF-3A missiles to Saudi Arabia, 'China has never sold, nor is planning to sell missiles to any Middle East country'.²²⁹ It was later revealed that the same two aides had already visited China in July on a secret mission, about which little was acknowledged.

Other developments

Besides the possible addition of M-9 SRBMs to China's nuclear forces, no other significant Chinese nuclear weapon developments are known to have taken place in 1989, although it appears that gradual modernization of the nuclear forces continued.

Some previously unreported facts were revealed during 1989 about China's nuclear submarine force. In a series of newspaper articles, China's ballistic missile submarine unit was identified as 'Unit 09', commanded by Rear Admiral Yang.²³⁰ The articles reported that from late 1985 to early 1986 a Chinese SSBN navigated more than 20 000 nautical miles (37 000 km) and 'broke the 84-day record of continuous underwater navigation set by an American submarine'. In the spring of 1988 a Chinese nuclear submarine reportedly navigated the Taiwan Strait into the South China Sea and conducted a 'successful test voyage at extreme depths'.

In April it was reported that a new degaussing ship had become operational in the Chinese Navy.²³¹ The large ship, named *Dongqin No. 863*, is designed to reduce or remove the magnetic signature of submarines and ships before they go on patrol, thus making them more difficult to detect by

²²⁷ See SIPRI, *SIPRI Yearbook 1988: World Armaments and Disarmament* (Oxford University Press: Oxford, 1988), p. 53.

²²⁸ Sciolino, E., 'President defends aides' China visit', *New York Times*, 12 Dec. 1989, p. A9.

²²⁹ Oberdorfer, D. and Hoffman, D., 'Scowcroft warned China of new Hill sanctions', *Washington Post*, 15 Dec. 1989, pp. A1, A39.

²³⁰ 'Ta Kung Pao on nuclear submarine base', FBIS-CHI-89-091, 12 May 1989, pp. 32-33. Two articles appeared in *Ta Kung Pao*, by Chung Ti, 'Visit to China's nuclear submarine unit', 7 May 1989, p. 1, and 8 May 1989, p. 2.

²³¹ 'Large degaussing ship operational in PLA Navy', FBIS-CHI-89-070, 13 Apr. 1989, pp. 22-23.

magnetic means and less susceptible to magnetically fuzed mines. This would be especially important for China's SSBN force because it has a relatively small number of submarines.

It was reported in a Chinese newspaper that the Institute of Engineering of the Second Artillery Corps—China's nuclear weapon command—had completed a 'large, integrated guided missile training simulator' for training missile launch techniques.²³² Given the high costs of missiles and missile testing, the simulator is intended to permit training military personnel in missile launch operations without firing actual missiles. This would give nuclear missile launch officers an affordable training option.

Deng's resignation

Despite resigning from his last official Communist Party position as Chairman of the CMC, it is widely believed that Deng will maintain his predominant influence in making Chinese policy for the foreseeable future and may thus continue to be regarded as China's paramount leader. Nevertheless, his resignation opens the question of who has political control of China's nuclear forces. Traditionally, the Chairman of the Communist Party Central Military Commission has been the only individual who could authorize the use of nuclear weapons. Without his personal approval, no nuclear weapons are to be launched. Since the founding of the People's Republic of China in 1949 there have been only four Chairmen of the CMC: Mao Zedong, Hua Guofeng, Deng Xiaoping and now Jiang Zemin. Deng might manage to retain his personal authority regarding the military and nuclear weapons—a *de facto* nuclear command authority—which would mean that the CMC could not act without his approval, even though he is no longer its Chairman. In any event, it should prove interesting to observe the evolution of political control over Chinese nuclear forces within the CMC, absent Deng.

²³² 'Scientists complete missile training simulator', FBIS-CHI-89-079, 26 Apr. 1989, p. 30.