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Missile Survey: Ballistic and Cruise Missiles of Selected Foreign Countries

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Summary

This report provides a current summary of ballistic and cruise missile activity in selected countries and discusses implications for U.S. national security policy. The Defense Threat Reduction Agency's Weapons of Mass Destruction Terms of Reference Handbook defines a **ballistic missile** as "a missile that is guided during powered flight and unguided during free flight when the trajectory that it follows is subject only to the external influences of gravity and atmospheric drag" and a **cruise missile** as "a long-range, low-flying guided missile that can be launched from air, sea, and land." Ballistic and cruise missile development and proliferation continue to pose a threat to U.S. national security interests both at home and abroad. Approximately 35 countries currently possess operational ballistic missiles of various ranges and approximately 25 countries have operational cruise missiles with a range greater than 150 km (90 miles). Some analysts consider cruise missile proliferation to be of more concern than that of ballistic missile proliferation, primarily due to their low threshold of use, availability, affordability, and accuracy. This report will be updated annually.

With the fall of Iraq and the voluntary termination of Libya's ballistic missile program, many view North Korean and Iranian missile and WMD programs as the primary "rogue nation" long-range ballistic missile threat to U.S. national security. Russia and China continue to be the only two countries that could conceivably attack the United States with intercontinental ballistic missiles armed with nuclear weapons, but improved relationships with both countries have done a great deal to diminish this threat over past decades. India's and Pakistan's ongoing missile development programs are viewed by many as highly aggressive and even provocative, but are generally viewed in a regional context as opposed to a direct threat to the United States. The renewal of dialogue between these two countries in an attempt to settle their disputes by diplomatic means may also help in slowing proliferation as well as preventing their potential use in this region.

The implications of ballistic and cruise missile proliferation to the United States has necessitated both nonproliferation and counterproliferation approaches in trying to stem the development, deployment, and export of missiles. Past Administrations have been characterized as nonproliferation-oriented by some analysts while the current Bush Administration is viewed by some as having abandoned traditional nonproliferation for a more action-oriented approach towards missile proliferation. Other experts have suggested that the United States must somehow find the right balance between missile nonproliferation and counterproliferation policies if meaningful, long-term progress is to be made. While some believe that missile proliferation can be "rolled back" by some combination of these approaches, others note that both ballistic and cruise missiles have become such an integral part of many countries' national security frameworks, that it is highly unlikely that countries will abandon their programs in deference to U.S. pressure.

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Introduction

Foreign ballistic and cruise missiles pose a potential threat to the national security interests of the United States. While weapons of mass destruction (WMD) can be delivered by a variety of means including aircraft, artillery, and asymmetric means, it is missile-delivered WMDs that garner the most domestic and international attention. Countries with a WMD missile capability have the potential to influence the actions of other countries in their regions or even countries on another continent and, in some cases, destroy population centers and national infrastructure. At the present time, the United States is within range of the ballistic missiles of Russia, China, and perhaps North Korea, as well as France and the United Kingdom. Several other countries have missiles within range of U.S. overseas facilities and interests. A number of countries are attempting to either procure or develop longer-range ballistic missiles to accurately deliver WMDs over great distances and many fear that one day such an attack may be launched against the United States by a regional power or rogue state where stringent political and military controls over these weapons are not exercised.

Estimates of the missile threat to the United States continue to be controversial for a number of reasons. One is that many missile programs have moved underground and can also be hidden in a country's civilian space or aerospace industry, making it much harder for intelligence organizations to track development. There is also some controversy still surrounding the 1995 National Intelligence Estimate and 1998's Report of the Commission to Assess the Ballistic Missile Threat to the United States (P.L. 104-201) also known as the Rumsfeld Commission Report. Despite numerous recent developments in missile programs world-wide, the Rumsfeld Commission Report continues in 2005 to be the open source benchmark for missile proliferation. While there is still disagreement about the extent of the missile threat, the Bush Administration's unwavering commitment to ballistic missile defense has resulted in the deployment of ballistic missile interceptors at Ft. Greely, Alaska and Vandenberg Air Force Base in California.[1]

Estimates released by the U.S. Intelligence Community vary little from those issued in the late 1990s by the Rumsfeld Committee. Iran is still assessed as being capable of developing an intercontinental ballistic missile (ICBM)[2] capable of reaching the United States by 2015[3] although in the 1995 National Intelligence Estimate (NIE) most intelligence agencies believed that this could happen before 2015. The NIE also cites North Korea as posing an ICBM threat to the United States before 2015. Likewise, North Korea's ballistic missile development time lines

[1] For detailed information on U.S. missile defense see CRS Report RL31111: *Missile Defense: The Current Debate,* Mar. 23, 2005.

[2] Ballistic missiles are classified by their range as follows:
SRBM = Short-range ballistic missile, 70-1,000 km (43-620 mi.)
MRBM = Medium-range ballistic missile, 1,000-3,000 km (620-1,860 mi.)
IRBM = Intermediate-range ballistic missile, 3,000-5,500 km (1,860-3,410 mi.)
ICBM = Intercontinental ballistic missile, 5,500 km + (3,410 mi. +)
SLBM = Submarine launched ballistic missile, can be any range but tend to be in the intermediate to intercontinental range.

Cruise missile abbreviations:
ALCM = Air-launched cruise missile.
ASM = Anti-ship missile.
CM = Cruise missile (generic).
LACM = Land attack cruise missile.
SLCM = Submarine-launched cruise missile.

[3] "Ballistic and Cruise Missile Threat," *National Air Intelligence Center*, Sept. 2000, p. 15.

may need to be re-evaluated as new missile programs are apparently underway. While not posing a direct threat to the United States, the proliferation of shorter range ballistic missiles and cruise missiles has resulted in heightened regional tensions in the Middle East, between India and Pakistan, and between China and Taiwan.

A Declining Ballistic Missile Threat?

Some maintain that the long-range ballistic missile threat has decreased significantly since the Cold War, primarily due to nonproliferation treaties and arrangements.[4] The most significant reduction, they argue, are in ICBMs, SLBMs, IRBMs, and MRBMs, and that even SRBMs are "beginning to decrease as aging inventories are retired."[5] Given these decreases, the threat is characterized by some as follows:

- There is a widespread capability to launch short-range missiles;
- There is a slowly growing, but limited, capability to launch medium-range missiles;
- A decreasing number of long-range missiles from Cold War levels that will continue to drop significantly over the next fifteen years;
- A possibility that one or two new nations could acquire a limited capability to launch long-range missiles over the next two decades;
- Likelihood of a nation attacking the United States or Europe with a ballistic missile is exceptionally low.[6]

Others also note the increase in SRBMs - particularly in the 100 to 200 km range - as well an increase in programs that modify existing surface-to-surface unguided rockets with guidance and control sections, which adds a further low-cost SRBM capability.[7] Ballistic missiles are also considered "less expensive to maintain than an air force," and since "technologies can be transferred across to satellite launch vehicles, earning hard currency," some analysts suggest that these factors will insure the continued proliferation of ballistic missiles.[8] Given this possibility of increased proliferation, some conjecture that the "ballistic missile and nuclear warhead threat situation is going to become more complex and international in nature, with whole regions likely to be involved rather than just individual countries."[9]

Missile Production and Development Facilities

One significant trend is the increasing number of missile production and development facilities. Fifteen countries are known to produce ballistic missiles: the United States, France, Russia, China, North Korea, South Korea, Taiwan, India, Pakistan, Iran, Israel, Egypt, Syria, Ukraine, and Argentina. Several other countries, including Germany, Japan, Great Britain, South Africa, and Brazil could produce ballistic missiles but have chosen not to. When a country has a missile production facility, its ability to produce large quantities of missiles is limited only by its ability to obtain certain critical materials and components. When a country acquires a large number of

[4] Joseph Cirincione, *The Declining Ballistic Missile Threat, 2005,* Carnegie Endowment for International Peace, Feb. 2005.

[5] Ibid., p. 5

[6] Ibid., p. 10.

[7] Jane's Strategic Weapons Systems, Issue 42, Jan. 2005, p. 15.

[8] Ibid.

[9] Ibid., pp. 15-16.

missiles and launchers, it may be able to launch sustained attacks and to overwhelm missile defense systems. Production and research facilities also enable these regional powers to enhance the range, accuracy, destructiveness, and missile defense penetration aids of their missiles. Another important factor is that countries with an indigenous missile production capability also avoid export control restrictions when trying to import missiles and missile technology from outside sources. Finally, once a country produces missiles it can consider exporting them as well as the production technology to still more countries for financial, political, or ideological rewards. North Korea has been exporting missiles and missile production facilities for a number of years, and there is concern that more countries will enter the missile market as suppliers. Russian and Chinese organizations have been primary sources of missile technology and, in the past, Western firms also have transferred missile technology.

Nuclear, Biological, and Chemical Warheads[10]

The primary cause for concern with missile proliferation is that missile systems can provide countries an effective vehicle for delivering nuclear, chemical, or biological weapons over long distances. The most worrisome trend is the growing number of countries with both long-range missile and WMD programs. India and Pakistan have tested MRBMs and nuclear explosive devices. North Korea, Iran, and Israel are suspected to have nuclear, chemical, and biological weapons programs as well as a variety of short and medium range missiles.

Over the last several years, nuclear weapons programs have declined in number. South Africa reportedly dismantled the nuclear weapons and missiles that it had developed. Argentina, Brazil, South Korea, and Taiwan also abandoned earlier nuclear weapon programs. Belarus, Kazakhstan, and Ukraine transferred to Russia the nuclear weapons they inherited from the Soviet Union. Recent revelations about the possibility of North Korea's development of nuclear weapons and Iran's revitalized nuclear program could reverse this favorable trend.[11]

Several other countries that have missiles also have chemical weapons, and some have chemical warheads for their missiles. Bulk filled chemical warheads for shorter-range ballistic missiles are considered relatively easy to develop while chemical submunitions are considered somewhat more challenging. Biological warheads are considered fairly difficult to develop because of the difficulties associated with working with biological agents in terms of their sensitivity to environmental conditions during missile flight and upon dispersal.It has been reported that during the 1991 Gulf War, Iraq had missile warheads filled with a variety of nerve agents and others with botulinum toxin and anthrax. China, Egypt, India, Iran, Israel, North Korea, Pakistan, Russia, Saudi Arabia, Serbia, South Korea, Syria, Taiwan, and Vietnam, all have missiles and reportedly have chemical weapons. Several countries reportedly have biological weapons programs, including China, Egypt, Iran, Israel, North Korea, Pakistan, and Russia.[12]

Ballistic missiles armed with conventional high-explosive warheads proved to be important weapons of terror when used against cities in the Iran-Iraq war and the 1991 Gulf War. The development of advanced conventional warheads, such as cluster bombs and fuel-air explosives, and enhanced missile reliability and accuracy will increase the military effectiveness of missiles armed with conventional warheads. The United States has demonstrated the military effectiveness

[10] See also CRS Report RL30699, *Nuclear, Biological, and Chemical Weapons and Missiles: Status and Trends*.

[11] See also CRS Report RS21391, *North Korea's Nuclear Weapons: How Soon an Arsenal?* and CRS Report RS21592, *Iran's Nuclear Program: Recent Developments.*

[12] See also CRS Report 98-103, *Nuclear, Biological, and Chemical Weapons and Ballistic Missiles: The State of Proliferation.* (Out of print; available to congressional clients from author by request.)

of cruise missiles in several conflicts and a new generation of stealthy, more capable cruise missiles is presently in development in a number of countries.[13]

The Demand for Missiles and WMD

As missiles and missile production technology have become widely available, the demand for longer-range missiles and nuclear, biological, and chemical warheads has increased. Because of their relatively low cost, ability to penetrate defenses, strike deep into an enemy's homeland, and to deliver nuclear or biological weapons that could threaten the survival of an enemy country, missiles have become a delivery system of choice and a symbol of national might for some countries.

The technological and military prowess of the United States was demonstrated for the world during the 1991 Gulf War and again in Afghanistan and Operation Iraqi Freedom (OIF). As a result, adversarial countries and non-state groups may be more likely to avoid direct conventional military confrontation with the United States. Some potential adversaries, such as Iran and North Korea, continue to develop missiles and WMD as means to counter U.S. military strength in their region and to intimidate or deter their neighbors. At the same time, several allies and neutral countries are also building missiles and developing WMD to promote their perceived national security interests.

Any stigma associated with the possession or use of missiles was significantly reduced by the Iran-Iraq War, the Afghan War, the Gulf War, Chinese intimidation of Taiwan, Russian use in its Chechen conflicts, and by U.S. use of cruise missiles in Iraq, Bosnia, Afghanistan, and Sudan. In regional wars, missile attacks and artillery fire on civilian population centers have become a standard form of combat, as the use of standoff weapons (usually cruise missiles or air-to-surface guided weapons) against hostile military units, intelligence centers, terrorist camps, and WMD facilities has become a commonly-accepted U.S. military practice.

Status of Missile Proliferation

About three dozen countries have been publicly identified as having ballistic missiles, and half of those countries are in Asia and the Middle East (see Table 1). About 30 of these countries have, or are developing, ballistic missiles that can deliver a 500-kilogram warhead 300 kilometers or further.[14] Of the non-European countries, fourteen have produced ballistic missiles (Argentina, China, Egypt, India, Iran, Iraq, Israel, North Korea, Pakistan, South Korea, Syria, Taiwan, Ukraine, and South Africa which no longer produces missiles). In addition to these regional powers, which are often discussed as missile proliferators, several Western and Eastern European countries and republics of the former Soviet Union have missiles.

International pressures and domestic policy decisions have eliminated certain missile programs in Brazil, Egypt, South Africa, Poland, Hungary, and former Soviet Republics. While the long-

[13] "Ballistic and Cruise Missile Threat," p. 23.

[14] Countries that adhere to the Missile Technology Control Regime agree to restrict transfers of missiles that can deliver a 500 kg warhead 300 kilometers, and related technology, components, and material. A relatively crude, early generation nuclear warhead is estimated to weigh about 500 kg. Countries other than the United States that are currently reported to have missiles that meet the MTCR thresholds are: Afghanistan, Algeria, Armenia, Belarus, Bulgaria, China, Egypt, France, Iran, Israel, North Korea, Pakistan, Romania, Russia, Saudi Arabia, Slovakia, Syria, Ukraine, United Arab Emirates, United Kingdom, Vietnam, and Yemen. Additionally, India, South Korea, and Taiwan are in the advanced stages of developing indigenous missiles with a range of 300 km or more.

standing Missile Technology Control Regime (MTCR) is credited with slowing missile proliferation, it is not known what effect—if any—the International Code of Conduct Against Ballistic Missile Proliferation (ICOC) will have on proliferators.[15]

MTCR

The United States, Canada, France, Germany, Italy, Japan, and the United Kingdom established the Missile Technology Control Regime (MTCR) on April 16, 1987. The MTCR was designed to slow the proliferation of ballistic and cruise missiles, rockets, and unmanned air vehicles (UAV) capable of delivering weapons of mass destruction. It is an informal arrangement, not a treaty, consisting of guidelines for transfers of missiles and related technology, and an annex listing items to be controlled. The Regime is based on the premise that foreign acquisition or development of delivery systems can be delayed and made more difficult and expensive if major producers restrict exports. The MTCR has no independent means to monitor or enforce its guidelines. Nations adopt the guidelines as national policy and are responsible for restraining their own missile-related transfers.

ICOC

On November 25, 2002, ICOC was inaugurated at the Hague, the Netherlands. The ICOC, like the MTCR, is not a treaty but instead a set of "fundamental behavioral norms and a framework for cooperation to address missile proliferation." The ICOC focuses on addressing the demand side of proliferation and is viewed as complementing the supply side oriented MTCR. It seeks to achieve transparency by using confidence building measures, such as information transfer on ballistic missile programs. It also calls for pre-launch notification of ballistic missile flight tests. Unlike the MTCR, the ICOC intends to establish a formal standing organization to collect information and oversee the development of its confidence building measures and information control mechanisms.

Table 1. Missiles by Categories of Range

Range	Country
Intercontinental and/or Submarine-Launched Ballistic Missiles (>5,500 km)	China, France, Russia, United Kingdom, United States, possibly North Korea (Taepo Dong 2 or Taepo Dong ICBM)
Intermediate-Range Ballistic Missiles (3,000 - 5,500 km)	India, Iran, possibly North Korea
Medium-Range Ballistic Missiles (1,000 - 3,000 km)	Israel, North Korea, Saudi Arabia, China, India, Pakistan, Iran
Short-Range Ballistic Missiles (70 - 1,000 km)	Afghanistan, Algeria, Argentina, Armenia, Belarus, Bulgaria, China, Czech Republic, Egypt, Greece, India, Iran, Iraq, Israel, Kazakhstan, Netherlands, North Korea, Pakistan, Romania, Russia, Serbia, Slovakia, South Korea, Syria, Taiwan, Turkey, Turkmenistan, Ukraine, United Arab Emirates, Vietnam, and Yemen.

[15] See also CRS Report RL31848, *Missile Technology Control Regime (MTCR) and International Code of Conduct Against Ballistic Missile Proliferation (ICOC): Background and Issues for Congress.*

Note: See the Missile Inventory Appendix at the end of this report for a listing of each missile program by country.

Russia

Russia's ICBM force - although greatly diminished in size over the years - continues to pose a significant threat to U.S. national security. Russia reportedly plans to reduce the number of ICBMs on active duty from 496 at present to 313 by 2010.[16] Some experts estimate that by 2010, these 313 ICBMs will consist of 154 silo-based missiles and 159 mobile land versions, and the number of ICBM nuclear warheads will be cut from 1,770 to 923.[17] At the end of 2004, Russia reportedly made a number of claims about impending deployments in 2005 of new generations of Russian missiles.[18] While specifics were lacking, some speculate that the Russian government was referring to the following four systems:

Topol-M (SS-27 "Sickle")

Russia is phasing in the silo and mobile versions of the Topol-M to replace a variety of older ICBMs—some of which were developed in the mid to late 1960s. The Topol-M—which began development in the late 1980s—is widely believed to have a maneuverable reentry vehicle—possibly including countermeasures—which Russia claims negates U.S. missile defenses.[19] The silo-based version of the Topol-M is currently operational with four regiments (each regiment has 10 launchers) and a fifth regiment of silo-based missiles is due to be commissioned in 2005.[20] The production of the mobile version is scheduled to begin in 2005, with between three to nine systems scheduled to enter service in 2006 and a similar number of systems being developed annually in the following years.[21] Press reports that Russia will develop a new heavy ICBM successor to the Topol-M are viewed by many as unlikely to be true, given Russia's limited defense budget - a budget that supposedly was responsible for slowing Topol-M production to only four missiles in 2005.[22]

Bulava (SS-N-30)

The Bulava is a submarine-launched ballistic missile (SLBM) that has been in design since 1986.[23] This 10 warhead missile is intended to be used with the new Borey-class nuclear powered ballistic missile submarine, the first of which is scheduled for launch in 2006.[24] The Bulava is also believed to have a maneuverable warhead and a relatively short burn time, which is intended to make it less susceptible to boost-phase intercept.[25]

[16] Nikolai Novichkov, "Russia Cuts Arsenal of Strategic Missiles, *Jane's Defense Weekly*, Apr. 13, 2005, p. 15.

[17] Ibid.

[18] Mark Galeotti, "Putin Puts Confidence in New Generation of Missiles," *Jane's Intelligence Review*, Feb. 2005, p. 54.

[19] Jane's Strategic Weapons Systems, Issue 42, Jan. 2005, pp. 162-163.

[20] "Mobile Topol-M Cleared for Production," *Jane's Missiles and Rockets*, Feb. 1, 2005.

[21] Ibid.

[22] "Russia Plans New Strategic Missiles," *Jane's Missiles and Rockets*, Jan. 1, 2005.

[23] Mark Galeotti, p. 54.

[24] Ibid.

[25] "Mobile Topol-M Cleared for Production," *Jane's Missiles and Rockets*, Feb. 1, 2005.

Iskander (SS-26 "Stone")

The Iskander, which is reportedly currently being brought into frontline service in Russia, was designed to defeat Western ballistic missile defense systems—particularly the U.S. Patriot 2/3 system.[26] It comes in two versions, the "M" version for domestic use with a 400 km range and the "E" or export version with a reported 200 km range.[27] According to the Russian press, the Iskander has four principal countermeasures: boost phase maneuvering, depressed trajectory, low radar signature due to construction with composite materials, and terminal phase maneuvering. Syria expressed interest in acquiring Iskander-Es from Russia in early 2005[28] but strong protests from Israel—who was supposedly concerned that the highly accurate and stealthy Iskanders would be used to either destroy or evade Israel's Arrow ballistic missile defense system—have reportedly kept the acquisition from proceeding as intended.[29]

Conventional Cruise Missiles

Russia has reportedly deployed its first conventional air launched cruise missile.[30] The Kh-555 is a derivative of its Kh -55SM nuclear cruise missile and reportedly has a range of between 3,000 and 3,500 km, an accuracy of between 5 to 10 meters, and a 400 kg conventional warhead capacity.[31] These missiles, designed to be carried on Russian long-range strategic bomber aircraft, are described by Russian press as a weapon for use in "local conflicts and counter-terrorist operations."[32]

A number of unarmed Kh-55 cruise missiles—left in the Ukraine after the withdrawal of Russian forces—were reportedly illicitly transferred to Iran and China.[33] According to Ukrainian government officials, 12 missiles were supplied to Iran and six missiles to China in 2001. Some Western analysts believe that more missiles could have been supplied than the 18 acknowledged by the Ukrainian government and that North Korea might have also received missiles. Some are concerned that these Kh-55s could be modified into precision guided Kh-555s and that they could be modified to be fired from smaller aircraft—such as SU-24s—which would increase the utility of the missile among nations that do not have large, long-range bomber aircraft.

China

Chinese military modernization has been called "a threat to the United States" which could conceivably "alter the regional balance of power" in the Pacific.[34] As part of this overall program, China is putting significant emphasis on missile programs.

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[26] Alon Ben-David, "Iskander-E Designed to Counter Western TMDs," *Jane's Defense Weekly,* Apr. 6, 2005.

[27] Ibid.

[28] Ibid.

[29] Nikolai Gulko and Maksim Grgorev "Russian Missiles Chill Russian-Israeli Relations,"*Kommersant Daily,* Jan. 12, 2005.

[30] Robert Hewson, "Russian Conventional Cruise Missile Enters Service, *Jane's Defense Weekly,* Dec. 15, 2004.

[31] Ibid.

[32] Ibid.

[33] Information in this paragraph is taken from Robert Hewson, "Ukrainian Cruise Missile Transfer Under Scrutiny, *Jane's Defense Weekly,* Mar. 30, 2005 and Bill Gertz, "Missiles Sold to China and Iran," *Washington Times,* Apr. 6, 2005.

[34] Bill Gertz, "Chinese Military Buildup Assessed as Threat to the U.S.," *Washington Times,* Feb. 18, 2005 and Edward Cody, "China Builds a Smaller, Stronger Military," *Washington Post,* Apr. 12, 2005.

China's ICBMs

China is believed to have a relatively small arsenal of nuclear-armed, liquid propellant[35] ICBMs capable of reaching portions of the United States.[36] Some experts believe that China has between 20 to 30 CSS-4—also known as Dong Feng (DF)-5—and DF-5A nuclear ICBMs in service and in storage, although it is possible that these numbers may be low due to the commonality between these missiles and similar Chinese space launch vehicles.[37] It is believed that the DF-5 series of missiles will be taken out of action starting in 2005 in favor of newer, solid propellant missiles.[38]

China is continuing its development of its DF-31 road-mobile ICBM, a three-stage, solid propellant missile carried inside of a canister on a transporter-launcher vehicle.[39] According to the Department of Defense (DOD), the DF-31 will achieve an initial operational capability (IOC) in 2005-2006.[40] The DF-31 is assessed as being capable of striking targets throughout Europe and Asia, parts of Canada, and the northwestern United States.[41] A longer range DF-31A road mobile version also is reportedly under development with a projected IOC of 2007-2009.[42] The DF-31A will enable China to strike almost the entire United States as well as Australia and New Zealand.[43] Some reports suggest that an even longer range DF-41, which could conceivably range the entire United States, is under development for both road mobile and silo use.[44] Although there have been a number successful test flights of the DF-31, the DF-31 is not yet believed to be fully in service and some experts maintain that China will have from 75-100 nuclear warheads on ICBMs capable of threatening the United States by 2018.[45] Some suggest, however, that the main purpose of China's ICBM program is not so much the ability to attack and defeat the United States but instead to "throw a monkey wrench into the decision-making process in Washington," particularly in terms of U.S. intervention in Taiwan.[46]

Chinese SLBMs

The Chinese are continuing to develop their JL-2 SLBM for use in China's new Type 094 ballistic missile submarine. The JL-2's range is estimated to be approximately 12,000 kilometers

[35] Solid propellants are generally favored as they are safer to store and easier and quicker to put into action than liquid propellant-filled missiles. Countries that produce solid propellant missiles are generally considered to have a more technologically-advanced missile program than those countries who produce strictly liquid propellant missiles.

[36] "Ballistic and Cruise Missile Threat (Unclassified)," National Air and Space Intelligence Center (NASIC), Wright Patterson Air Force Base, Ohio, Aug. 2003, p. 14. According to NASIC officials, this is the most current version of this unclassified report but NASIC hopes to publish an update some time later in 2005.

[37] Jane's Strategic Weapons Systems, Issue 42, Jan. 2005, p. 42.

[38] Ibid.

[39] "Ballistic and Cruise Missile Threat (Unclassified)," National Air and Space Intelligence Center (NASIC), Wright Patterson Air Force Base, Ohio, Aug. 2003, p. 12.

[40] Office of the Secretary of Defense, *Annual Report to Congress: The Military Power of the People's Republic of China 2005*, publically released on July 19, 2005, p. 28.

[41] "Ballistic and Cruise Missile Threat (Unclassified)," National Air and Space Intelligence Center (NASIC), Wright Patterson Air Force Base, Ohio, Aug. 2003, p. 12.

[42] Office of the Secretary of Defense, *Annual Report to Congress: The Military Power of the People's Republic of China 2005*, publically released on July 19, 2005, p. 28.

[43] Ibid.

[44] "Ballistic and Cruise Missile Threat (Unclassified)," National Air and Space Intelligence Center (NASIC), Wright Patterson Air Force Base, Ohio, Aug. 2003, p. 12.

[45] Ibid., p. 14.

[46] Edward Cody, "China Builds a Smaller, Stronger Military," *Washington Post,* Apr. 12, 2005.

and will likely have multiple warheads.[47] The Japanese press reported that China had test-fired what was believed to be a JL-2 on June16, 2005 from a ballistic missile submarine off the coast of China near Qingdao to a test area in the western Chinese desert several thousand kilometers away.[48] The Type-094 submarine is believed to be capable of carrying 16 JL-2 SLBMs and, according to one expert, when both systems become fully operational it will be "China's first truly intercontinental strategic nuclear delivery system."[49] The U.S. Defense Intelligence Agency (DIA) reportedly expects China to put its first Type-094 submarine with JL-2 SLBMs into service by 2010 with the second entering service by 2020.[50] China currently has a single XIA-class ballistic missile submarine which can carry 12 CSS-NX-3 SLBMs (range of 1,600 km)[51] but the XIA submarine is considered so "noisy" to underwater detection systems that its chances of evading attack submarines is considered "limited."[52] According to U.S. intelligence officials, the Type-094/JL-2 combination will permit China, for the first time, to target portions of the United States from operating areas near the Chinese coast.[53]

Chinese Missiles and Taiwan

In testimony to the Senate Armed Services Committee on March 17, 2005, on Current and Projected National Security Threats to the United States, the Director of the DIA, Vice Admiral Lowell E. Jacoby stated:

> China also is developing new SRBMs, Medium Range Ballistic Missiles (MRBMs), and Intermediate Range Ballistic Missiles (IRBMs). They are a key component of Beijing's military modernization program. Many of these systems will be fielded in military regions near Taiwan. In 2004, it added numerous SRBMs to those already existing in brigades near Taiwan. In addition to key Taiwanese military and civilian facilities, Chinese missiles will be capable of targeting U.S. and allied military installations in the region to either deter outside intervention in a crisis or attack those installations if deterrent efforts fail.[54]

There are numerous unclassified estimates of how many ballistic missiles China has arrayed against Taiwan, with many of these estimates originating from Taiwanese government officials. According to DOD[55] China has deployed between 650-730 mobile CSS-6 and CSS-7 SRBMs to garrisons opposite Taiwan, with deployments of these systems increasing by about 100 missiles per year. Although virtually all of China's SRBMs are garrisoned opposite Taiwan, they are mobile and can deploy throughout China to take up firing positions to support other regional contingencies.

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[47] Bill Gertz, "China Tests Ballistic Missile Submarine," *Washington Times*, Dec. 3, 2004.

[48] "China Test-Fires New Submarine Launched Missile," *Daily Yomiuri*, Japan, June 21, 2005.

[49] Ibid.

[50] Ibid.

[51] "Ballistic and Cruise Missile Threat (Unclassified)," National Air and Space Intelligence Center (NASIC), Wright Patterson Air Force Base, Ohio, Aug. 2003, p. 18.

[52] Bill Gertz, "China Tests Ballistic Missile Submarine," *Washington Times*, Dec. 3, 2004.

[53] "Ballistic and Cruise Missile Threat (Unclassified)," National Air and Space Intelligence Center (NASIC), Wright Patterson Air Force Base, Ohio, Aug. 2003, p. 18.

[54] Testimony of Vice Admiral Lowell E. Jacoby, U.S. Navy, Director, Defense Intelligence Agency to the Senate Armed Services Committee, Mar. 17, 2005, on Current and Projected National Security Threats to the United States.

[55] Information in this section is taken from the Office of the Secretary of Defense, *Annual Report to Congress: The Military Power of the People's Republic of China 2005*, publically released on July 19, 2005, pp. 4,12.

Newer versions of these missiles that are being deployed feature improved range and accuracy and is believed to be exploring how these and other ballistic missiles can be used for anti-access and sea-denial purposes.

Chinese Land-Attack Cruise Missiles

In April 2005, a Taiwanese intelligence source reported that China would soon begin to deploy a new, subsonic land-attack cruise missile (LACM).[56] This missile is "expected to approximate the performance and tactical flexibility of the U.S. RGM/UGM-109 Tomahawk and will eventually be fielded in ground, submarine, ship and air-launched versions."[57] This missile, known as the "Hong Niao" or HN-class LACM comes in three versions with the HN-2 version having a 1,800 km range from ground or ships and a 1,400 km range when fired from a submarine.[58] It is also believed that this LACM can carry both nuclear and conventional payloads.[59] According to Taiwanese press reports, China is expected to deploy some 200 additional LACMs - including the new HN series - within striking distance of Taiwan by the end of 2006.[60]

Satellite Guidance

China's participation in the European Union's (EU) Galileo satellite navigation system reportedly has some Western defense experts concerned that China could significantly enhance the accuracy of its ballistic and cruise missiles and precision-guided munitions.[61] The Galileo system is expected to consist of a network of 30 satellites and ground navigation systems that are intended to provide a highly accurate navigational system for both civilian and military use and is expected to enter service in 2008.[62] By increasing the accuracy of its missiles, China would be able to strike more targets with its missile force with significantly enhanced accuracy and would not have to employ multiple missiles to insure that each target is sufficiently covered.

North Korea[63]

North Korea's ballistic missile program continues to trouble both the United States and its allies from a variety of perspectives. Despite international pressure and trade sanctions, North Korea is continuing to increase, diversify, and improve its missile fleet. In conjunction, North Korea publically declared itself a nuclear power in 2003 and many analysts believe that its nuclear program is focused on developing nuclear warheads for both short, medium, and longer-range ballistic missiles. North Korea is also widely believed to have either acquired or developed chemical and possibly biological warheads for its ballistic missiles. North Korea has allegedly exported ballistic missiles and associated technologies to a number of countries and some analysts suggest that these transfers have advanced the recipient's missile programs by many

[56] Richard Fisher Jr., "China's New Strategic Cruise Missiles: From the Land, Sea, and Air, International Strategy and Assessment Center, Washington, June 3, 2005.

[57] Ibid.

[58] Jane's Strategic Weapons Systems, Issue 42, Jan. 2005, p. 69.

[59] Ibid., p. 70.

[60] "1,000 Chinese Missiles Near Taiwan by 2006," *Taepi Times*, April 24, 2005.

[61] David Lague, "Guiding China's Missiles: EU Satellite Project Could Improve Accuracy," *International Herald Tribune*, Apr. 19, 2005.

[62] Ibid.

[63] For additional information see CRS Report RS21473, *North Korean Ballistic Missile Threat to the United States*.

years. Finally, North Korea has conducted a number of missile test firings during and between negotiations, which many analysts feel were intended to influence the United States and countries in the region. North Korea's March 2005 announcement that it was no longer observing a self-imposed moratorium on long-range missile testing[64] has fueled speculation that North Korea may be preparing to test its longer range missiles.

North Korea's Missiles

North Korea's arsenal consists primarily of shorter-range Scuds, and a number of longer range No Dong and Taepo Dong missiles. North Korea is believed to have approximately 700 Scud C (Hwasong 6) SRBMs with a 500 km range and some analysts believe that a considerable portion of North Korea's estimated 250 tons of chemical and biological agents would be delivered by these missiles.[65] North Korea's Scud-Cs have sufficient range to strike targets throughout South Korea. North Korea's estimated 100, 1,300 km range, No Dong missiles enable North Korea to strike U.S. military bases in Japan with both conventional and WMD warheads.[66] North Korea launched a version of its Taepo Dong missile in August 1998 over the Japanese islands, allegedly to put a satellite into orbit. Since this launch there has been speculation that other Taepo Dong versions were under development.

Prior to September 9, 2003—the 55th anniversary of the founding of the Democratic People's Republic of Korea—U.S. and international press speculated that North Korea might display a new, longer-range version of the Taepo Dong missile, as well as an unnamed intermediate range missile, during military parades held in Pyongyang. U.S. government officials referred to the allegedly longer-range version of the Taepo Dong as "Taepo Dong X."[67]

According to U.S. intelligence officials, the Taepo Dong X is believed to be based on the former Soviet Navy SS-N-6 submarine launched ballistic missile that North Korea may have possibly obtained from Russia between 1992 and 1998.[68] An unnamed congressional source reportedly noted that the Russian Pacific Fleet, which deployed the SS-N-6, was "desperately disorganized and underfunded" during the period between 1992 and 1998, suggesting that North Korea might have obtained SS-N-6 technology from the Russian Navy or the missile's designer, the Makeyev Design Bureau, without the knowledge or approval of the Russian government.

The South Korean press reported on September 8, 2003, that South Korean intelligence officials had identified what they believed were 10 new intermediate range ballistic missiles and five launch pads at North Korea's Mirim Aerodrome.[69] South Korean officials also suggested that this new missile had been under development since the early 1990s and could have a maximum range of 3,600 kms.[70] According to the report, Japanese, South Korean, and U.S. intelligence officials inferred from the shape of the missile that the new North Korean missiles were based on the Soviet-designed SS-N-6.[71] According to one U.S. press report, unnamed U.S. officials confirmed

[64] "North Korea Makes Missile Test Threat," *BBC News*, Mar. 3, 2005.

[65] Yihong Chang and James Folely, "Pyongyang Goes for Broke," *Jane's Intelligence Review*, Mar. 1, 2003, p. 8.

[66] Ibid.

[67] Bill Gertz," North Korea to Display New Missiles," *Washington Times*, Sept. 9, 2003.

[68] Information in this paragraph is from Sonny Efron, "N. Korea Working on Missile Accuracy," *Los Angeles Times*, Sept. 12, 2003.

[69] "North Said to Deploy Longer Range Missiles," *Joong Ang Daily*, Sept. 9, 2003.

[70] Ibid.

[71] Ibid.

the accuracy of South Korean press reports and further elaborated by stating that the unnamed intermediate range ballistic missile was road mobile[72], making these missiles more difficult to locate and destroy. With the capability to accommodate a reentry vehicle weighing approximately 1,500 lbs (680 kgs)[73] a North Korean missile derived from the SS-N-6 could conceivably accommodate a heavier and less sophisticated nuclear weapon—the type which many experts believe North Korea is capable of producing.

While there appears to be some disagreement in the ranges for the SS-N-6 and the possible North Korean SS-N-6 variant (3,000 to 3,600 kilometers, depending on the source) a missile with a 2,500 kilometer range would enable North Korea to strike U.S. military forces in Japan and Okinawa and with a 3,500 kilometer range to strike Guam, a U.S. territory with a substantial and growing U.S. military presence.[74] If this is the case, such a missile would represent a significant increase in North Korea's ability to deliver a nuclear weapon at extended ranges.

Current Assessments

While specifics on North Korea's missile development programs continue to be vague, statements by U.S. military officials in early 2005 suggest that North Korea's missile programs continue to evolve. U.S. Army General Leon LaPorte, Commander of U.S. Forces in Korea, reportedly stated in March 2005 that "the regime's continued development of a three-stage variant of the Taepo Dong missile, which could be operational within the next decade, could also provide North Korea with the capability to directly target the United States."[75] General LaPorte also expressed his concerns over North Korea's medium and intermediate range missiles and their potential to strike Okinawa, Guam, and possibly Alaska.[76] In open testimony before the Senate Armed Services Committee on April 28, 2005, Vice Admiral Lowell Jacoby, Director, DIA stated in response to questions on North Korean missile capabilities that North Korea had the capability to arm a missile with a nuclear device and that a two-stage nuclear missile which could reach portions of the United States was also within North Korean capabilities.[77] Admiral Jacoby qualified these controversial statements during the hearing, saying that without flight testing, these attributed capabilities were theoretical in nature.[78] These statements, suggesting that North Korea had achieved a nuclear missile capability, resulted in a great deal of controversy - reportedly "stunning senators" at the hearing and eliciting a response from the Pentagon later that day suggesting that Admiral Jacoby had overstated North Korea's nuclear missile capabilities.[79]

While most experts agree that North Korea's ballistic missile program is progressing, others suggest that the North Korean missile program suffers from a number of significant problems. Peter Hayes, the Director of the Nautilus Institute for Security and Sustainability, in Berkeley, California, who specializes in North Korean nuclear and energy issues, notes that North Korean

[72] "North Korea to Display New Missiles," p. 1.

[73] "R-27/SS-N-6 SERB," *Federation of American Scientists,* July 13, 2000, p. 1.

[74] Joseph S. Bermudez, *North Korea's Long-Range Missiles,* p. 5.

[75] "NK's Taepodong Missiles Could be Operational by 2015: LaPorte," *Korea Times,* Mar. 11, 2005.

[76] Ibid.

[77] Reuters Transcript of Testimony to the Senate Armed Services Committee on the Defense Intelligence Budget, Apr. 28, 2005.

[78] Ibid.

[79] Bradley Graham and Glenn Kessler, "N. Korean Nuclear Advance is Cited," *Washington Post,* Apr. 29, 2005 and Greg Miller and Mark Mazzetti, "U.S. Downplays Remarks on N. Korea's Arms Ability, *Los Angeles Times,* Apr. 30, 2005.

missiles are unreliable.[80] In terms of reliability, he suggests that the combined probability that a North Korean missile would both take off and then stage as intended was around 49 percent and that any hostile North Korean launch guaranteed an almost 100 percent retaliatory strike by the United States.[81] Hayes also maintains that "the North Koreans are terrible at systems engineering," and that each new missile type becomes "a new type of unknown operating characteristic" suggesting that a North Korean missile attack might look like an "uncontrolled fireworks display."[82] Although there are a variety of assessments as to the state and viability of North Korea's long-range missile program, some suggest that these missiles serve another purpose. The London-based International Institute for Strategic Studies (IISS) offers the possibility that North Korea's longer range missiles are:

> designed more for bargaining leverage and trading for political and economic benefits than for military use. In a sense, both are probably true - by developing greater missile capabilities, North Korea can drive up the price for agreeing to restrain or abandon parts of its missile programme and at the same time be in a stronger position to test and deploy such systems if negotiations fail.[83]

Missile Proliferation

North Korea has been called "the world's most prolific exporter of ballistic missiles and related equipment, materials and technology."[84] Over the past 20 years, North Korea is credited with having sold several hundred Scuds and NoDong missiles, components, related technologies, and production facilities, primarily to Middle Eastern countries such as Egypt, Iran, Syria, Libya, Pakistan, Yemen, and the United Arab Emirates. These missile sales - possibly amounting to several hundred million dollars - constituted a significant portion of North Korea's hard currency earnings over the years and likely were also exchanged with Iran for oil and with Pakistan for nuclear technology. There is speculation, however, that revenues from missile sales have been declining in recent years as some of North Korea's traditional customers, Iran for example, have developed an indigenous missile production capability and others such as Yemen, Egypt, Pakistan, and the United Arab Emirates have been pressured by Washington to end their missile-related dealings with North Korea.

A Resumption of Ballistic Missile Test Flights?

On March 3, 2005, North Korea announced an end to their 1999 self-imposed moratorium on test firing long-range missiles.[85] On May 1, 2005, North Korea launched a short-ranged ballistic missile - believed to be an upgraded version of a Soviet-era SS-21 - with a range of about 75 miles into the Sea of Japan, short of the Japanese coast.[86] A similar test in April 2004 of an SS-21 reportedly failed and South Korean defense experts speculate the this upgraded SS-21 has the capability to reach south of Seoul where U.S. military bases are to be relocated.[87] While some do

[80] Peter Hayes, "Defense Intelligence Agency Says North Korea has Nuclear Armed Missiles," Nautilus Organization, May 3, 2005, http://www.nautilus.org/napsnet/sr/2005/0537AHayes.html.

[81] Ibid.

[82] Ibid.

[83] *North Korea's Weapons Programmes: A Net Assessment*, International Institute for Strategic Studies, London, Jan. 2004, p. 83.

[84] Information in this paragraph, unless otherwise footnoted, is taken from *North Korea's Weapons Programmes: A Net Assessment*, International Institute for Strategic Studies, London, Jan. 2004, p. 81.

[85] "North Korea Ends Missile-Test Moratorium, Raising Nuclear Stakes," *Agence Francee Presse*, Mar. 3, 2005.

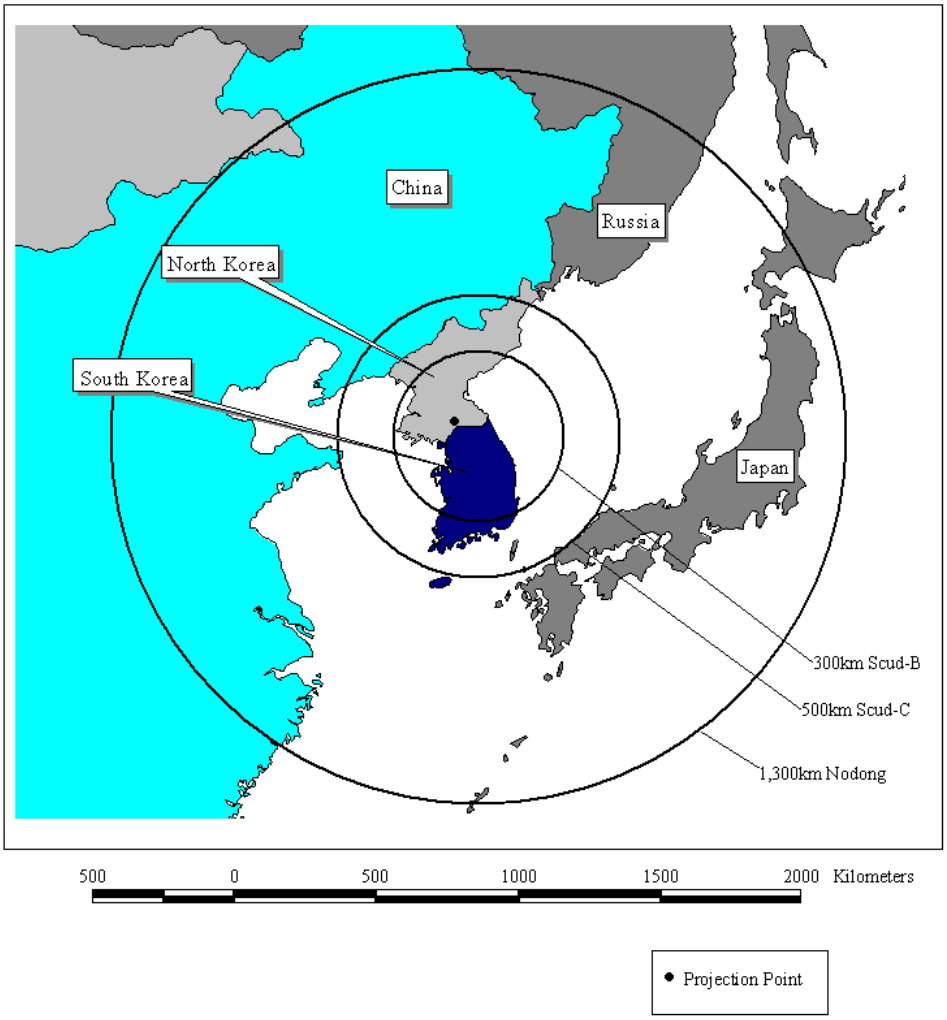
[86] Brian Knowlton, "N. Korea is Said to Test Missile," *International Herald Tribune*, May 2, 2005.

[87] "North's Missile a Modified SS-21," *Joongang Ilbo*, May 4, 2005.

not expect that North Korea will test longer-range ballistic missiles such as 1998's Taepo Dong missile test over the island of Japan due to the political fallout, the possibility exists that North Korea could conduct such a test if they feel that its nuclear or missile program is threatened by Western pressure.

Figure 1.

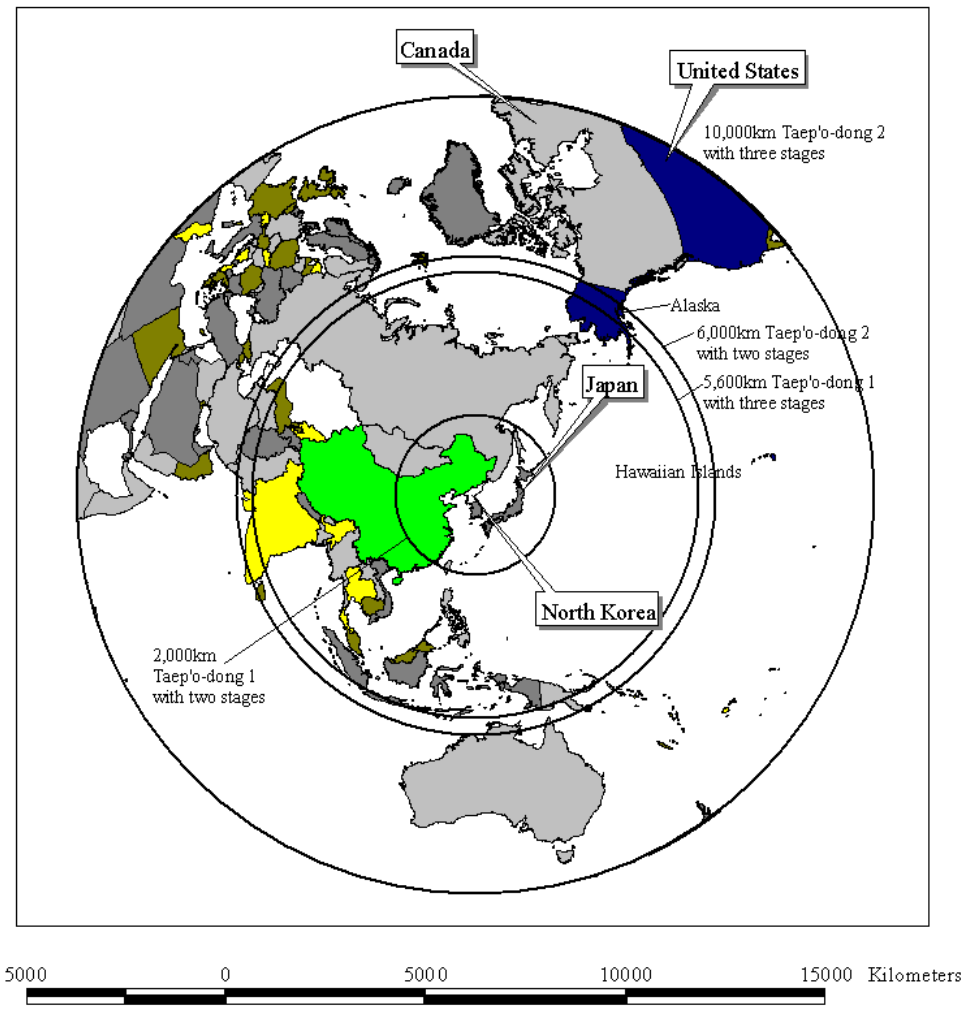
North Korean Short and Medium Range Missile Capabilities
(Launched from areas near the demilitarized zone)



Library of Congress, Geography and Map Division
October 1999

Figure 2.

Potential North Korean Long-Range Missile Capabilities



Library of Congress, Geography and Map Division
October 1999

Iran

Iran's long-range ballistic missile program is the focus of significant interest, largely due to Iran's resurgent nuclear program.[88] Some experts are concerned that Iran may develop nuclear-armed

[88] For additional information on Iran's nuclear program see CRS Report RS21592, *Iran's Nuclear Program: Recent*

ballistic missiles that can not only strike targets throughout the Middle East - Israel, in particular - but also parts of Europe and beyond.[89]

Iran's Space Program?

On January 5, 2004, Iran's Defense Minister reportedly announced that Iran would launch a satellite within the next 18 months.[90]

Although this deadline has passed without a launch, some U.S. intelligence analysts remain concerned that such a launch - likely involving a modified Shahab-3 missile - would not only elevate Iran's stature but also serve as a "Trojan Horse" "to help Iran develop both range and warhead improvements to the already upgraded Shahab-3 under the cover of a civilian space program.[91] This upgraded Shabab-3, which was flight tested three to four times between July and October 2004, reportedly has a number of modifications that suggest that this missile is being modified to accommodate a nuclear warhead.[92] The upgraded Shahab-3, with a more bulbous nose and up to 15% more propellant capacity, suggests a reentry vehicle similar to the Russian SS-9 ICBM.[93] Experts also maintain that this new configuration could facilitate additional modification for the addition of a small solid propellant upper stage and satellite payload.[94] This Shahab version could therefore become a "dual-use" missile, thereby making it more difficult for intelligence analysts to separate ballistic missile development activities from space launch ones.

Nuclear Warhead Development

Iran is reportedly also developing a missile reentry vehicle containing a small nuclear warhead for use in its Shahab missiles.[95] U.S. officials, commenting after former Secretary of State Colin Powell's November 17, 2004, disclosure that Iran was developing nuclear warheads for its missiles, stated that the warhead is based on an indigenous Iranian design and includes the "physics package" - the nuclear weapons components designed to fit inside of the reentry vehicle.[96] The anonymous U.S. officials stated the information on Iranian warhead development "came from reliable intelligence sources" and not from Iranian opposition groups that have provided unreliable information in the past.[97] Another report suggests that Iran is smuggling ceramic matrix composite (CMC) - a composite graphite material that, in addition to a variety of commercial uses, is considered ideal for use as heat shields on missile reentry vehicles.[98] International CMC trading for use in reentry vehicles and missile warheads is controlled under the Missile Technology Control Regime—a voluntary arrangement on the export of missiles and associated technologies.[99]

Developments.

[89] For additional information see CRS Report RS21548, *Iran's Ballistic Missile Capabilities.*

[90] "Iran Plans to Launch Satellite Within 18 Months," *CNN.com,* Jan. 6, 2004.

[91] Craig Covault, "Iran's "Sputnik"," *Aviation Week & space Technology,* Nov. 29, 2004, p. 36.

[92] Ibid.

[93] Ibid.

[94] Ibid.

[95] Bill Gertz, "U.S. Told of Iranian Effort to Create Nuclear Warhead," *Washington Times,* Dec. 2, 2004.

[96] Ibid.

[97] Ibid.

[98] Tyler Marshall and Sonni Efron, "Iran Said to Smuggle Material for Warheads," *Los Angeles Times,* May 21, 2005.

[99] For additional information see CRS Report RL31848, *Missile Technology Control Regime (MTCR) and the*

Solid Propellant Tests

On May 31, 2005, Iran reportedly announced that it had successfully tested a new solid-fuel motor which could be incorporated into the upgraded Shahab-3, which is currently based on liquid-fuel technology.[100] If these claims are true, this could represent a significant breakthrough for Iran's ballistic missile program. Solid propellant-based missiles, unlike liquid propellant ones, can be kept in storage for years, require less maintenance, and are generally more reliable and accurate. In addition, a solid propellant capability is generally considered a pre-requisite for developing longer range missiles. The maximum range for a single stage missile is approximately 2,000 kms and in order to achieve greater ranges, a two or three stage missile is required. The in-flight separation and ignition of these additional stages are considered a very complex scientific and engineering processes and "in order to maintain the accuracy of the missile, it needs to be using solid fuel."[101]

Shahab 4/5?

There has been a great deal of speculation surrounding upgraded versions of the Shahab 3 - the so-called Shahab-4/5. On October 3, 2002, Iranian Brigadier General Ahmad Vahid, the chairman of the Iranian Aerospace Industries Organization, told journalists that Iran "had no plans to develop long-range missiles in order to strike the United States, since the U.S. is not one of Iran's strategic defense targets and instead had oriented its ballistic missile development against its principal regional adversary - Israel."[102] Some believe that this statement suggests that Iran will not pursue specific Shahab-4/5 programs as the upgraded Shahab-3 is capable of striking Israel and regional targets. One expert postulates that Iran's previously discussed "improved Shahab-3" might in fact be Iran's way of developing more capable, longer range Shahab missiles without hanging politically contentious Shahab-4 or 5 labels on such programs.[103]

International Code of Conduct Against Ballistic Missile Proliferation (ICOC): Background and Issues for Congress.

[100] Stefan Smith, "Iran Makes Ballistic Missile Breakthrough," *Agence France Presse*, May 31, 2005.

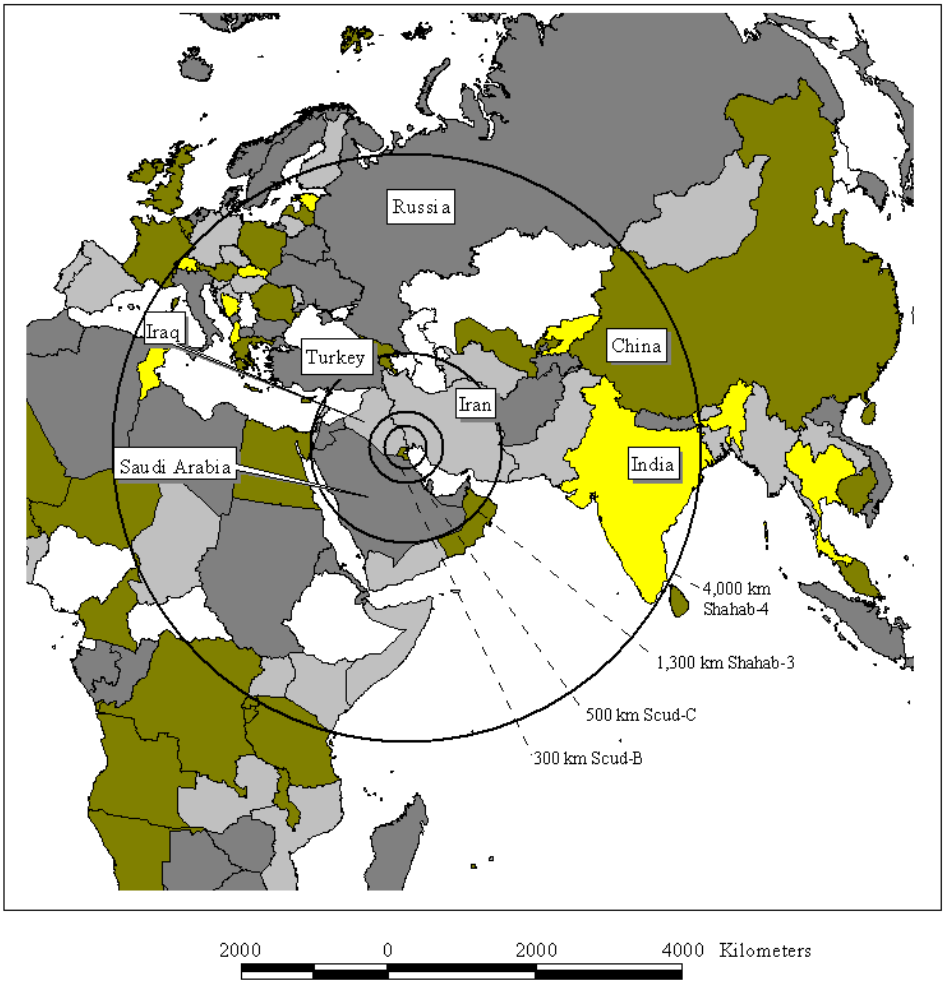
[101] Ibid.

[102] *Missile Defense Briefing Report No. 74*, American Foreign Policy Council, Oct. 8, 2002, p. 1.

[103] Paul Hughes.

Figure 3.

Ranges of Iran's Missiles



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January 2000

India[104]

India has an extensive missile and space program. In addition to antitank, surface-to-air, and air-to-air missiles, it produces SRBMs and is developing MRBMs and IRBMs. India's test of nuclear devices in 1998, its possibly arming some missiles with nuclear warheads, and its long-running conflict with Pakistan over Kashmir make its missile force a cause of concern. The Prithvi series

[104] **See also CRS Report RL32115,** ***Missile Proliferation and the Strategic Balance in South Asia.***

of liquid fuel theater missiles includes a 150 km and a 250 km model that are in production and a 350 km model currently in development. The Dhanush is reportedly a naval version of the Prithvi with a range of 250 km. The Agni I reportedly has a 700 - 750 km range and is both rail and road-mobile.[105] The Agni II, also rail and road-mobile, is said to have a range of at least 1,500 km, much more range than necessary to reach all of Pakistan.[106] India has long refused to sign the Nuclear Non-Proliferation Treaty as a non-weapon state, has not signed the Comprehensive Test Ban Treaty, and is not a partner of the Missile Technology Control Regime or other multilateral export control mechanisms. While India claims it needs these strategic weapons to deter China, many analysts believe that they are a destabilizing factor in South Asia. India also obtained the lease of a Russian submarine capable of carrying nuclear-capable cruise missiles with a 300 km range in December 2002.[107] This capability will likely not only further destabilize the region but will also greatly enhance the survivability of India's nuclear weapons by providing them with a triad—a land, air, and sea-based nuclear weapons delivery capability.

India reportedly tested an Agni I missile on January 9, 2003.[108] In September 2003, the Indian government announced that they would create two additional Prithvi missile groups armed with conventional warheads and an Agni I regiment and an Agni II regiment which could be armed with nuclear warheads.[109] There was also speculation that India was preparing to test their 3,000 km Agni III missile. The Indian government reportedly hinted in October 2003 that they would test the Agni III as early as November 2003[110] but government statements later that month suggested that a test flight would be postponed until 2004 pending the completion of additional testing.[111] In March 2005, it was reported that the first Agni III test fight was expected by the end of 2005 and some believe that developmental difficulties as well as pressure from the United States have caused delays in the test launch.[112] India also successfully test-fired its supersonic, 290 km range, Brahmos cruise missile on October 30, 2003. [113] India is also testing its Dhanush naval variant, with a reported test launch in October 2004 from an underwater container simulating a ballistic missile submarine launch tube.[114] India jointly developed the supersonic Brahmos, which can carry a 200 kg payload, with Russia.[115] In December 2004, Russia and India agreed to build between 360 and 370 missiles annually, with first deliveries going to the Indian Armed Forces.[116] India reportedly also plans to export the Brahmos.[117]

[105] Rose Gordon, "India Conducts Four Missile Tests," *Arms Control Today,* Mar. 2003.

[106] Ibid.

[107] *India to Lease Nuclear Sub*, Moscow Times, Dec. 3, 2002, p.3.

[108] Rose Gordon.

[109] "Army Takes its Agni and the Nuclear Age," *Indian Express,* Sept. 24, 2003.

[110] David C. Isby, "India Prepares to Test 3,000 km-Range Agni III," *Jane's Missiles and Rockets,* Nov. 1, 2003.

[111] "Test Put Off for Agni-III, Brahmos Takes Off," *Financial Times,* Oct. 30, 2003.

[112] "First Test of India's Agni III Missile Due this Year," *Aviation Week & Space Technology,* Mar. 7, 2005.

[113] See "Test Put Off for Agni-III, Brahmos Takes Off" and "India Test Fires Supersonic BrahMos Missile," *Deutsche Presse-Agentur,"* Nov. 9, 2003.

[114] "India Tests Naval Missile," *Statesman,* Oct. 9, 204.

[115] "India Test Fires Supersonic Brahmos Missile."

[116] Rahul Bedi, "Indian Defense Industry," *Jane's Defense Weekly,* Feb. 2, 2005, p. 29.

[117] Ibid.

Pakistan[118]

While it says it is not in an arms race with India, Pakistan has reacted to India's missile programs with its own and has tested nuclear devices following India's nuclear tests. It has received extensive help from China and North Korea in developing and producing missiles. China also helped Pakistan with the development of nuclear weapons. The Hatf-2 and 3 are solid fuel SRBMs that are probably based on the Chinese M-11 and M-9 respectively. The Ghauri-I and Ghauri-II are reportedly based on (or copies of) North Korea's Nodong or even its Taepo Dong-1 missile. The Shaheen/Ghaznavi series are reportedly solid fuel missiles of uncertain origin. The Pakistani missiles and nuclear weapons are said to constitute a deterrent force against India's numerically-superior conventional forces, but are seen by many as greatly increasing the possibility of nuclear warfare.

Pakistan and India have been characterized by some analysts as having conducted routine flight tests of their missiles in 2004 - 2005 and in March 2004, Pakistan made its first flight test of its Shaheen-II missile, a two-stage, solid propellant missile with a reported range of 2,000 km.[119] The Shaheen-II was reportedly successfully test fired again in March 2005.[120]

On November 7, 2003, during a meeting in Seoul with South Korean government officials, Pakistani President, General Pervez Musharraf, reportedly stated that Pakistan had obtained short-range missiles and technology from North Korea but that Pakistan could now make the missiles itself.[121] During the same meeting, he stated that Pakistan had not traded nuclear technology for missiles and that there was currently "no interaction with North Korea whatsoever on any defense related matters."[122] Analysts suggest that this statement may indicate that Pakistan is now capable of producing Ghauri missiles, considered by many experts to be copies of the North Korean No Dong, indigenously and that publically severing ties with North Korea might lessen U.S. pressure regarding Pakistani-North Korean cooperation. Having publically proclaimed the end to this relationship, Pakistan would assume considerable risk if they re-initiated missile-related dealings with North Korea.

Cruise Missiles[123]

According to the latest published unclassified assessment from the DOD's National Air and Space Intelligence Center:

> Proliferation of land attack cruise missiles will expand in the next decade. At least nine countries will be involved in producing these weapons. The majority of new LACMs will be very accurate, conventionally armed, and available for export. The high accuracy of many LACMs will allow them to inflict serious damage on important targets, even when the missiles are armed only with conventional warheads. U.S. defense systems could be severely stressed by low-flying stealthy cruise missiles that can simultaneously attack a target from several directions.[124]

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[118] See also CRS Report RL32115, *Missile Proliferation and the Strategic Balance in South Asia.*

[119] Jane's Strategic Weapons Systems, Issue 42, Jan. 2005, p. 15.

[120] "Pakistan Test Fires Longest Range Missile," *Associated Press,* Mar. 20, 2005.

[121] "Musharraf Says N Korea Links Over", *BBC News,* Nov. 7, 2003.

[122] Ibid.

[123] For additional information see CRS Report RS21252, *Cruise Missile Proliferation.*

[124] "Ballistic and Cruise Missile Threat (Unclassified)," National Air and Space Intelligence Center (NASIC), Wright Patterson Air Force Base, Ohio, Aug. 2003, p. 25.

U.S. vulnerability to cruise missile attack was highlighted during the 2003 Iraq War. During the conflict, U.S. and Kuwaiti Patriot theater missile defense batteries intercepted and destroyed all nine Iraqi ballistic missiles launched against the Coalition but failed to detect or intercept the five HY-2/CSSC-3 Seersucker cruise missiles launched against Kuwait.[125] All the more troubling was the fact that the HY-2/CSSC-3 missiles were developed in the 1970s and are considered large and slow compared to more modern cruise missiles. This demonstrated vulnerability could further the attractiveness of cruise missiles to countries looking for a means to strike U.S. targets.

Developmental and Acquisition Efforts [126]

As already discussed, China is developing the HN series of land attack cruise missiles as well as a number of other anti-ship, and air, ground, submarine and ship-launched cruise missiles. China is also reportedly developing a ram-jet powered[127] cruise missile (FF-1 and YJ-91) and has sold YJ-1 and YJ-2 missiles to Iran, where these missiles are now being indigenously produced under license to the Chinese government. It is not unreasonable to assume that China will export more cruise missiles in the future and that more countries will, in turn, begin building cruise missiles under license, with some eventually achieving self-sufficiency in cruise missile production.

India has reportedly purchased the Russian SS-N-27 cruise missile for land, ship, and submarine use in addition to its joint Brahmos program. There have also been reports that Taiwan has tested a ramjet powered Hsiung-Feng 3 cruise missile and that Israel is developing a nuclear armed cruise missile, reports which the Israeli government denies. France, Germany, Sweden, Italy, South Africa, and the United Kingdom all have either individual or cooperative land attack cruise missile programs ongoing and, like the Chinese, some of these advanced missiles could be exported to other countries, further complicating the security environment.

Implications

Based on reported program progress, it is reasonable to conclude that the development and acquisition of ballistic and cruise missiles continues to remain a central security goal for a number of countries of concern to the United States. While shorter-range ballistic missiles are of concern, particularly in terms of their use on the battlefield, a number of combat proven and developmental ballistic missile defense systems—such as the U.S. Patriot and the Israeli Arrow—provide a means to counter these systems. China, a country that has had long-range ballistic missiles and nuclear warheads for a number of decades, appears to be modernizing and upgrading its capability, not necessarily to directly rival or surpass the United States but, as some suggest, as a means to obtain even greater strategic "freedom of action." Some speculate that Iran and North Korea—countries with a significant U.S. military presence near their borders—are attempting to achieve a basic nuclear missile capability in order to deter U.S. military action. Some believe that these countries in various stages of nuclear missile development can be deterred from further progress, either through diplomacy or some form of coercion. Others say that, short of physical destruction of their programs, countries like North Korea and Iran will eventually achieve the capability to deliver nuclear weapons to various ranges with ballistic missiles. Cruise missile programs are far more widespread than ballistic missile programs, largely due to their relative

[125] Thomas G. Mahnken, "The Cruise Missile Challenge," Center for Strategic and Budgetary Assessments, Washington, March 2005, p. 1.

[126] Information in this paragraph is taken from Jane's Strategic Weapons Systems, Issue 42, Jan. 2005, p. 16.

[127] Ramjet engines provide increased speed and performance over the more commonly used turbojet cruise missile engines and are generally lower volume and weight than turbojets, but ramjet engines are not considered particularly fuel efficient.

affordability and the dual use nature of their technology. While cruise missiles may not be able to deliver significant payloads over great distances, their stealth and accuracy afford their possessors a potential asymmetric advantage.

In order to address the implications of progressively improving and diversified ballistic and cruise missile threats, the United States has relied on nonproliferation and counterproliferation activities in various combinations and in varied degrees of application. Some analysts contend that past Administrations relied too heavily on nonproliferation activities (which are considerably less expensive and controversial than many counterproliferation programs) and blame this imbalance for the current state of missile proliferation. The current Bush Administration is accused by other experts as being too heavily skewed in the direction of counterproliferation, as witnessed by the National Missile Defense Program and the Proliferation Security Initiative, but still other experts note that much of the emphasis on counterproliferation is an inevitable result of the events of September 11, 2001.

U.S. Counter and Nonproliferation Policy[128]

The National Security Strategy of the United States of America published in September 2002 calls for "proactive counterproliferation efforts" and "strengthened nonproliferation efforts" against terrorist and hostile states.[129] While missiles are not singled out in the strategy, they are implicitly part of the Administration's definition of WMD. The December 2002 National Strategy to Combat Weapons of Mass Destruction goes into far greater detail on how the threat of WMDs and missiles will be dealt with.[130] This strategy explicitly states that "The United States, our friends and allies, and the broader international community must undertake every effort to prevent states and terrorists from acquiring WMD and missiles." The primary means by which this goal is to be achieved is through counterproliferation and nonproliferation activities. The strategy states that "effective interdiction is a critical part of the U.S. strategy to combat WMD and their delivery means." Another approach is the widely publicized concept of preemption. While preemption has been an underlying assumption in previous national security strategies, it has assumed a prominent role in the current strategy. Some have called for preempting WMD and missile programs in North Korea and Iran, but the use of eliminating Iraq's WMDs as the basis for going to war in Iraq in 2003 and the subsequent revelation that Iraq had previously eliminated these programs, has likely eliminated preemption from further practical consideration.

In the area of nonproliferation, the strategy calls for the "strengthening of the Missile Technology Control Regime (MTCR), including the support for universal adherence to the International Code of Conduct Against Ballistic Missile Proliferation." Also part of this strategy is the implementation of bilateral and multilateral agreements to stop the spread of missile proliferation.

The Proliferation Security Initiative (PSI), announced by President Bush on May 31, 2003, is an international initiative which focuses on the interdiction of shipment of WMD and associated delivery systems and technology.[131] More than 60 countries currently support the PSI and while details surrounding its implementation are few—largely attributed to intelligence and security considerations—U.S. Secretary of State Rice noted that the PSI was responsible for stopping 11

[128] See also CRS Report RL31559, *Proliferation Control Regimes: Background and Status.*

[129] *National Security Strategy of the United States of America,* Sept. 2002, p. 14.

[130] *National Strategy to Combat Weapons of Mass Destruction,* Dec. 2002.

[131] For additional information see CRS Report RS21881, *Proliferation Security Initiative (PSI).*

WMD-related transfers since 2004 - although it is unclear how many of these transfers were missile-related.

On June 29, 2005, President Bush issued an unclassified Executive Order titled "Blocking Property of Weapons of Mass Destruction Proliferators and Their Supporters"[132] intended to freeze assets of individuals or companies in the United States that are doing business with entities in Iran, North Korea, an Syria suspected to be involved in WMD proliferation. The Executive Order Annex contains the name of eight companies and freezes their U.S. assets and prohibits U.S. citizens or companies from conducting business transactions with them.

While there appears to be little emphasis placed on the MTCR and Code of Conduct by the Administration, the PSI and moves to freeze assets of companies involved in WMD proliferation suggest that the Administration is embarking on a more aggressive form of nonproliferation. While some may consider these moves confrontational and, in the case of the PSI, somewhat questionable from a legal perspective, others suggest that traditional treaties and agreements—which generally are not subscribed to by nations of concern—have done little to deter more aggressive countries such as North Korea and Iran from advancing their missile programs.

[132] See http://www.whitehouse.gov/news/releases/2005/06/print/20050629.html.

Appendix A. Ballistic and Land Attack Cruise Missile Inventory[133]

(See Footnote 3 on page CRS-2 for abbreviations - blank spaces indicate data unknown)

Table A-1.

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
REPUBLICS OF THE FORMER SOVIET UNION								
Armenia	SS-1 Scud	SRBM	8	32	300	1,000	Liquid	
Belarus	SS-1 Scud	SRBM	<50		300	1,000	Liquid	
	SS-21 Scarab	SRBM	<100		120	482	Solid	
	SS-25 Sickle	ICBM	0	0	10,500	1,000	Solid	All moved to Russia
Kazakhstan	SS-1 Scud	SRBM	<50		300	1,000		
	SS-21 Scarab	SRBM	<50		120	482	Solid	
	SS-18 Satan	ICBM	0	0	11,000	8,800	Liquid	All Deactivated
Russia	SS-1, SS-1C Scud Mod 2	SRBM	>250		300+	1,000	Liquid	
	SS-11 Sego	ICBM	0	0	13,000/ 10,600	1,100	Liquid	All Deactivated
	SS-13 Savage	ICBM	0	0	9,400	1,800	Solid	All Deactivated
	SS-17 Spanker	ICBM	0	0	10,000	400	Liquid	All Deactivated
	SS-18 Satan	ICBM	186	186	9,000/ 11,000	8,800	Liquid	24 Deactivated
	SS-19 Stiletto	ICBM	170	170	10,000	43,500	Liquid	3 Deactivated
	SS-21 Scarab	SRBM	>200		120	482	Solid	
	SS-24 Scalpel	ICBM	46	46	10,000	40,500	Solid	Modernized w/ one warhead
	SS-25 Sickle	ICBM	360	360	10,500	1,000	Solid	In Service, One Warhead

[133] Information from this chart is taken from the Carnegie Endowment for World Peace Missile Chart, http://www.ceip.org/files/projects/npp/resources/ballisticmissilechart.htm , March 4, 2004 and Cruise Missiles: Potential Delivery Systems for Weapons of Mass Destruction, U.S. Government Publication, April 2000, and the Office of the Secretary of Defense, Annual Report to Congress: The Military Power of the People's Republic of China 2005, publically released on July 19, 2005.

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
	SS-27 Topol M	ICBM		~10	10,500		Solid	Modified SS-25, former SS-X-29, In Production
	AS-2 Kipper	ALCM			120	1,000	Turbojet	
	AS-3 Kangaroo	ALCM			650	2,300	Turbojet	
	AS-15 Kent (Kh-65SE/Kh-101)	ALCM	782	782	600/3,000	410/150	Turbofan	Two Versions In Development
	AS-19 Koala	ALCM			4000	875?		Terminated
	Alfa	Supersonic CM			600			In Development
	SS-N-6 Serb	SLBM	16	16	3,000	680	Liquid	All Removed from Subs
	SS-N-8 Sawfly	SLBM	208	208	7,800/ 9,100	3,600	Liquid	All Removed from Subs
	SS-N-17 Snipe	SLBM	0	0	3,900	1,135	Solid	12 Deactivated
	SS-N-18 Stingray	SLBM	208	208	6,500/ 8,000	1,315	Liquid	All Removed from Subs
	SS-N-20 Sturgeon	SLBM	120	120	8,300	2,270	Solid	
	SS-N-21 Sampson	SLCM			3,000	150	Turbofan	
	SS-N-23 Skiff	SLBM	112	112	8,300	1,360	Liquid	
	SS-N-24 Scorpion	SLCM			4,000		Turbofan	Canceled
Turkmenistan	SS-1 Scud	SRBM	<50	100+	300	1,000	Liquid	Possible
Ukraine	SS-1 Scud	SRBM	<100	100+	300	1,000	Liquid	
	SS-19 Stiletto	ICBM	0	0	10,000	43,500	Liquid	60 Being Dismantled
	SS-21 Scarab	SRBM	<100		120	482	Solid	
	SS-24 Scalpel	ICBM	0	0	10,000	40,500	Solid	46 Deactivated
	AS-15 Kent	ALCM			600/3,000	410/150	Turbofan	Reported Sent to Russia
EUROPE								
Bulgaria	SS-1 Scud	SRBM	36		300	1,00		

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
	SS-23 Spider	SRBM		8	500	450	Solid	
Czech Republic	SS-1 Scud	SRBM	0	0	300	1,000		
	SS-21 Scarab	SRBM			70/120	482		
	SS-23 Spider	SRBM	0	0	500	450	Solid	Scrapped
France	SSBS S3D	IRBM	0	0	3,500		Solid	18 Deactivated Sept 1996
	S45/S5	IRBM			4,500+			Canceled
	Hades	SRBM	15	500	480			In Storage
	M-20/M-4	SLBM	80	80	3,000/ 5,000		Solid	In Service
	M-45 (variant of M-4)	SLBM			5,000		Solid	In Service
	M-51	SLBM			8,000		Solid	In Development
	Apache/ Apache AI	ALCM			140/ 250-400	520/ 400	Turbojet	In Service
	SCALP (formerly Super Apache)	CM			500-800	400		In Development
	ASMP	CM			300		Rkt/ Ramjet	In Service
	ASLP	CM			1,300		Rkt/ Ramjet	In Development
	Teseo Mk3	Dual Role			300	145	Turbojet	In Development
Germany	Taurus (KEPD-350)	CM			350	500	Turbojet	In Dev. with Sweden
Greece	ATACMS	SRBM		40	160	1,670	Solid	In Service
Hungary	SS-1 Scud	SRBM	0	0	300	1,000		Destroyed or Transferred
Italy	Teseo	Dual Role			300+	160	Turbojet	In Development, Stealth Otomat
Netherlands	ATACMS	SRBM			160	1,670	Solid	In Service
Poland	SS-1 Scud	SRBM	0	0	300	1,000	Liquid	Transferred

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
Romania	SS-1 Scud	SRBM	13		300	1,000	Liquid	Storage
Serbia	K-15 Krajina (perhaps modified SA-2)	SRBM			150			
Slovakia	SS-1 Scud	SRBM			300	1,000		
	SS-21 Scarab	SRBM	<50		70/120	482		
	SS-23 Spider	SRBM	<50		500			
Spain	Alada	CM			200+	500	Turbojet	Proposed
	Capricornio	MRBM			1300	500	Solid	Postponed in 1994, Reportedly an SLV
Turkey	ATACMS	SRBM		120	160+	1,670	Solid	In Service
United Kingdom	Trident D-5, UGM 133	SLBM	48		12,000	Nuclear	Solid	3 Boats In Service
	Tomahawk BGM-109	SLCM			1,600	320	Solid	
	Storm Shadow	CM		500-2,000	250-400	400	Turbojet	In Service
CHINA								
	CSS-2 (DF-3/3A)	MRBM	6-10	14-18	2,790 +	2,150	Liquid	In Service
	CSS-3 (DF-4)	ICBM	10-14	20-24	5,470+	2,200	Liquid	In Service
	CSS-4 (DF-5/5A)	ICBM	20	20	8,460+	3,200	Liquid	In Service
	CSS-5 (DF-21)	MRBM	34-38	19-23	1,770+	600	Solid	In Service
	CSS-N-3 (JL-1)	SLBM	10-14	10-14	1,770+	600	Solid	In Service
	CSS-6 (DF-15/M-9)	SRBM	70-80	230-240	600	500	Solid	In Service
	CSS-7 (DF-11/M-11)	SRBM	100-120	420-460	300	500	Solid	In Service
	CSS-8 (M-7/8610)	SRBM			150	190	Solid	In Service
	DF-25	MRBM			1,700	2,000	Solid	May be 2 stages of DF-31
	DF-31/JL-2	ICBM/ SLBM			8,000-11,840	700	Solid	In Development

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
	DF-41	ICBM			12,000	800	Solid	In Development
	Xiong Ying ?	LACM			1,500-2,000		Turbofan	In Development
REST OF THE WORLD								
Afghanistan	SS-1 Scud-B	SRBM	<50		300	1,000	Liquid	Status unknown
Algeria	SS-1 Scud-B	SRBM			300	1,000	Liquid	
Argentina	Alacran	SRBM			200	500	Solid	
Brazil	MB/EE-150	SRBM			150	500	Solid	Terminated
	SS-300	SRBM			300	1,000	Solid	Terminated
	SS-600	SRBM			600	500	Solid	Terminated
Congo, Dem. Rep. Of	SS-1 Scud-B	SRBM			300	1,000	Liquid	Possibly Received from Iran
Egypt	SS-1 Scud-B	SRBM	<50	100+	300	1,000	Liquid	In Service
	Scud derivative (Project T)	SRBM			450		Liquid	In Service?
	Scud-C	SRBM			500	700	Liquid	?
	Vector (Condor II)	SRBM			800-1,000		Solid	Possibly in Development
India	Prithvi-150	SRBM		75	150	800-1,000	Liquid	In Service
	Prithvi-250	SRBM			250	500-750	Liquid	In Production
	Prithvi-350	SRBM			350	750-1,000	Liquid	In Development
	Dhanush- Naval Prithvi	SLBM			250		Liquid	In Development
	Agni	MRBM			1,400- 2,500	1,000	Solid/ Liquid	In Development/ Tested
	Agni II	IRBM			3,000	1,000		In Development
	Agni III	IRBM			3,500-5,000			In Development
	Surya	MRBM-ICBM			2,000-5,000			In Development

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
	Sagarika	SLCM or SLBM			300	500	Solid	In Development
Iran	CSS-8 (M-7/8610)	SRBM	<50	200	150	190	Solid	In Service
	CSS-6 (M-9)	SRBM			600	500	Solid	Possible
	CSS-7 (M-11) variant	SRBM			300	500		Possible Development
	Mushak-120 (Iran-130, Nazeat)	SRBM			130	500 or 190	Solid	In Service
	Mushak-160	SRBM			160	190	Solid	In Service
	Mushak-200	SRBM			200	500	Solid	In Development
	NP-110				170		Solid	In Development with Chinese help
	Shahab-3/Nodong Variant	MRBM			1,300-1,500	750	Liquid	Tested 2004 Similar to Nodong
	Shahab-4	MRBM			2,000-2,500 (or 4,000)	1000		Possibly in Development
	Shahab-5	ICBM			10,000			Possibly in Development
	SS-1 Scud-B	SRBM	<50	200+	300	1,000	Liquid	In Service
	Iran 7000 (Scud-C variant)	SRBM	<50	100+	600/ 700	500	Liquid	In Service
	Zelzal (Earthquake) 1	SRBM			100-150		Solid	In Production
	Zelzal 2	SRBM			350-400		Solid	In Production
	Zelzal 3	MRBM			1,000-1,500		Solid	In Development
	Two unnamed programs	ICBM?			5,500/ 10,000	750		In Development, Unconfirmed
Israel	Jericho 1 (YA-1)	SRBM		~50	500	750	Solid	In Service
	Jericho 2 (YA-3)	MRBM		~100	1,500	1,000	Solid	In Service
	Jericho 3 (extended range)	MRBM/ IRBM/ ICBM			2,000-4,800-11,500	1,000	Solid/ liquid	In Development

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
	Popeye Turbo	ASM			350	895	Turbojet	
	Delilah Derivative (Star-1)	ALCM			400	450	Turbojet	In Development
	Modular Stand-Off Vehicle	ALCM			100	675	None	In Development
Korea, North	Scud-B variant	SRBM	12	100+	300	1,000	Liquid	In Service
	Scud-C	SRBM		100+	500	700	Liquid	In Service
	Nodong	MRBM			1,000-1300	1,000	Liquid	In Service
	Taepo Dong-1	MRBM			1,500- 2,000	1,000	Liquid	Used with solid fuel third stage in satellite launch attempt 8/31/98
	Taepo Dong-2	IRBM			4,000-6,000		Liquid?	In Development
	SS-N-6 Variant	MRBM/ IRBM	5	<10	3,000 - 3,600	680	Liquid	In Development
	Taepo Dong X	ICBM						Possibly in Development w/ SS-N-6 as first stage
Korea, South	NHK-1 (Baekgom)	SRBM			180	300	Solid	In Service
	NHK-A (Hyon Mu)	SRBM			180	300		In Service
	NHK Extended Range	SRBM			300			Tested at reduced range
	ATACMS	SRBM		111	160	1,670	Solid	
Pakistan	Hatf-1	Rocket			80-100	500	Solid	In Service
	Hatf-2	SRBM			280	500	Solid	In Development
	Hatf-3 (Possibly the Tarmuk, a version of M-9)	SRBM			750-800	500	Solid	Indian press reports M-9-type project
	M-11 (CSS-7/DF11)	SRBM		40?	300	500	Solid	Missiles or parts and factory from China. May be basis for Hatf-2

Designation		Type	Launchers	Missiles	Range (km)	Payload (kg)	Motors	Status
	Ghauri (or Mk III or HATF-V)	MRBM			1,000-1,500	600 or 700	Liquid	In Development with China and North Korea; similar to Nodong;
	Ghauri II (or HATF-VI	MRBM			1,500-2,300	700	Liquid	In Development
	Shaheen I (HATF-4)	SRBM			600-700	320	Solid	In Development
	Shaheen II/ Ghaznavi/ Ghazni	MRBM			2,000-3,000		Solid?	In Development May be related to NK Taepo Dong Tested in 2004-2005
	Abdali	MRBM			2,500			In Development
Saudi Arabia	CSS-2 (DF-3)	MRBM	30	~50	2,400/ 2,800	2,150	Liquid	Possibly not operational
South Africa	Arniston	MRBM	4+/0?		1,450	1,000	Solid	Suspended
	Torgos (Multi-Purpose Standoff Weapon)	LACM			300		Turbojet	In Development
Syria	SS-21	SRBM		36+	70	482	Solid	In Service
	SS-1 Scud-B	SRBM		100s	300	1,000	Liquid	In Service
	Scud-C	SRBM		50+	600	500	Liquid	In Service
Taiwan	Hsiung Feng-3	CM			300			In Development
	Ching Feng (Green Bee)	SRBM			130	400	Liquid	In Service
	Tien Chi (Sky Halberd)	SRBM			300	500		SSM version of Sky Bow II SAM. Tested 2/97
	Tien Ma (Sky Horse)	SRBM			600-1,000	500		In Development
United Arab Emirates	SS-1 Scud-B	SRBM	6		300	1,000		
	Black Shahine (Version of Apache)	ALCM			140-300	520		Bought From Matra Bae Dynamics
Vietnam	SS-1 Scud-B	SRBM	<50		300	1,000	Liquid	In Service
Yemen	SS-21	SRBM	<50	24?	70	482	Solid	In Service
	SS-1 Scud-B	SRBM	<50	18?	300	1,000	Liquid	In Service

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