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Iran and Nuclear Weapons

A Working Draft

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Part One

Iran's Search for Nuclear Weapons

The US has long expressed deep and continuing concern regarding Iran's search for nuclear weapons. In early 1995, President Clinton's first Secretary of State, Warren Christopher, stated:¹

“In terms of its organization, programs, procurement, and covert activities, Iran is pursuing the classic route to nuclear weapons which has been followed by almost all states that have sought a nuclear weapon.... Iran's efforts to acquire nuclear weapons also pose enormous dangers. Every responsible member of the world community has an interest in seeing those efforts fail. There is no room for complacency. Remember Iraq....”

This statement came at a time when a number of western intelligence sources were leaking reports that Iran was trying to establish a secret gas centrifuge uranium-enrichment program. Iran had approached German and Swiss firms to purchase balancing machines, as well as diagnostic and monitoring equipment—all dual-use items potentially valuable for laboratory-scale centrifuge development. In addition, Iranian agents were said to have contacted a British company to obtain samarium-cobalt magnetic equipment, potentially useful in the development of centrifuge top bearings.²

Christopher was also quoted as saying that Iran has tried for years to buy heavy water reactors to produce plutonium, is “devoting resources” to enriching uranium to weapons grade levels, and has “scoured” the states of the former Soviet Union for nuclear materials, technology, scientists, and technicians.³

President Clinton's new Secretary of State, Madeleine Albright, renewed this warning on her trip to Europe in February, 1997. She expressed particular concern that Europe and Russia cease the supply of dual-use and nuclear weapons-related technology to Iran.⁴ Similarly, John Holum, the Director of the US Arms Control and Disarmament Agency, testified in March 1997, that Iran was actively developing nuclear weapons, although he indicated that the effort was proceeding slowly and that Iran would not have a bomb using Iranian-produced weapons grade material until 2005-2007.⁵

The European Union has also expressed concerns of its own. On January 16, 1998, officials of the EU presented the United States with a list of 15 steps they were taking to prevent Iran from acquiring weapons of mass destruction and spoke out strongly on the need to oppose Tehran's sponsorship of terrorism. British Foreign Secretary Robin Cook, whose country just assumed the EU's rotating presidency, and Sir Leon Brittan, vice president of the European Commission, presented the US Secretary of State Madeleine Albright with a memo “covering all the things the European countries are doing to halt the equipment and material for weapons of mass destruction from getting into the hands of Iran.”⁶

No details were available, but the memo supplemented one given to the United States in 1997. Brittan stated that the memo, “shows the continuing resolution and determination of the European Union ... to take vigorous action ... against both the development of weapons of mass destruction and the use of Iran as a terrorist base.” Asked if there might be some flexibility in approaching Iran, Cook said: “There must be no room for flexibility in our resolve to halting Iran getting weapons of mass destruction or preventing Iran from acquiring missile capability or

stopping Iran from sponsoring state terrorism....On all these fronts we must be quite clear that these are unacceptable dangers based on unacceptable behavior by elements within the government of Iran.”⁷

Cook did state, however, that the US effort to isolate the Islamic state would not work. “We must respond to the dangers posed by Iran as well as the opportunities. But isolating Iran is not the right response.” Cook condemned the Iran-Libya Sanctions Act, under which Washington punishes foreign companies trying to invest in Iran's oil and gas sectors, saying it was unacceptable to European states and counterproductive. “Isolating Iran won't hit the target we want -- economic measures will not have any serious effects on Iran's attempts to acquire weapons of mass destruction...There are the first signs of Glasnost appearing in Iran and we must do what we can to encourage it.”⁸

Iranian Statements and Denials Regarding Nuclear Weapons

Iran has never confirmed these charges and suspicions. Iran's Deputy President Ayatollah Mohajerani did state in October, 1991, that Iran should work with other Islamic states to create an “Islamic bomb.” However, the Iranian government has normally denied that it is seeking nuclear weapons and has repeatedly made proposals to create a nuclear-free zone in the Middle East.⁹ Iran has countered such charges by repeatedly denying that it has a nuclear weapons program. For example, President Rafsanjani was asked if Iran had a nuclear weapons program in an interview in the CBS program *60 Minutes* in February 1997. He replied, “Definitely not. I hate this weapon.”¹⁰ As has been noted earlier, President Khatami, his foreign minister, and his new head of the Iranian Atomic Energy Organization have repeated similar denials ever since Khatami became president.

The Iranian media has been equally consistent in making such denials. The Iranian government-run Voice of the Islamic Republic of Iran has described such charges as “baseless,” and has referred to various articles about the transfer of weapons-related technology as, “a propaganda ploy by Western media affiliated to the Zionist regime.” It has stated that, “Iran's efforts to reach nuclear energy are centered around the axis of the creation of electricity, which is required for the country's developing industry, and using this energy for medical and agricultural objectives,” and the IAEA has found Iran's nuclear programs “respect all the technical and legal aspects of non-proliferation.” It has claimed in contrast that, “The Zionist regime has more than 200 nuclear warheads.”¹¹

The Atomic Energy Organization of Iran (AEOI) issued another denial that it had a nuclear weapons program on August 19, 1997, and that Amrollahi had sought aid from South Africa in obtaining items for its nuclear weapons program during a meeting in March, 1995 with Dr. Waldo Stumpf, the chief executive of South Africa's Atomic Energy Commission.¹² The AEOI also stated that all nuclear activities in Iran were peaceful. that Iran was a signatory to the Non-Proliferation Treaty, the nuclear safety program agreement, and the test ban; that all Iranian activities were under the supervision of the International Atomic Energy Agency (IAEA) and that recent inspection reports showed that Iran fully cooperated; and that the charges against Iran were a Zionist plot. Stumpf issued an equally firm denial, although it was a bit ironic he indicated that that the only Iranian official he had ever met with was Gholamreza Aghazadeh -- whom he described as the oil minister but who was soon to become the new head of Iran's nuclear program.¹³

The timing of these denials is interesting because they came only days after President Khatami replaced Reza Amrollahi, the head of the Atomic Energy Organization, with Gholamreza Aghazadeh, Iran's former oil minister. The reasons for Gholamreza Aghazadeh's appointment are not clear. Some experts believe that that it represented an effort to improve the administration of Iran's nuclear programs (Amrollahi had developed a reputation as an awful administrator and manager). Others feel it might be part of an effort to make Iran's nuclear power program more efficient, and still others feel that it might have been part of an effort to review whether such a program was cost-effective at all, or even a down-playing of Iran's nuclear weapons program.¹⁴

Iran's new Foreign Minister, Kamal Kharrazi, stated on October 5, 1997, that,¹⁵

"We are certainly not developing an atomic bomb, because we do not believe in nuclear weapons... We believe in and promote the idea of the Middle East as a region free of nuclear weapons and other weapons of mass destruction. But why are we interested to develop nuclear technology? We need to diversify our energy sources. In a matter of a few decades, our oil and gas reserves would be finished and therefore, we need access to other sources of energy...Furthermore, nuclear technology has many other utilities in medicine and agriculture. The case of the United States in terms of oil reserve is not different from Iran's. The United States also has large oil resources, but at the same time they have nuclear power plants. So there is nothing wrong with having access to nuclear technology if it is for peaceful purposes..."

Some Western experts outside government agree with Iran's claims that it does not have a nuclear weapons program. For example, Eric Arnett of the Stockholm Institute of Peace Research Institute argues that Iran has offered to open any site to IAEA inspection, has agreed to accept improved safeguards for such inspections if they are universally adopted, and has been a strong supporter of regional arms control measures.¹⁶

In contrast, most Western experts with direct access to their government's intelligence data do believe that Iran has a nuclear weapons program. They base such conclusions largely on human intelligence and on the analysis of the long history of Iranian efforts to acquire nuclear weapons-related technology and dual-use equipment which has little other value to Iran. What they do not believe is that Iran has been able to establish the kind of massive nuclear program that Iraq established.

Most such experts feel that Iran has lacked the funds to establish such a program, and Iran has found it difficult to obtain much of the nuclear technology it desires because of various export control and intelligence efforts. Few Western experts seem to support a report by a former member of the US National Security Council staff that Iran had developed a \$10 billion strategy for acquiring nuclear weapons.¹⁷ Iran also does not have anything approaching Iraq's manpower base of several thousand nuclear technicians. Some estimates indicated that Iran had less than 500 nuclear physicists, engineers, and senior technicians in the late 1980s -- compared to around 7,500 in Iraq.

Iran's nuclear weapons program seems to be slow and evolutionary. In fact, US estimates of Iran's progress in acquiring nuclear weapons have become more conservative with time. In 1992, the CIA estimated that Iran would have the bomb by the year 2000. In 1995, John Holum testified that Iran could have the bomb by 2003. In 1997, after two years in which Iran might

have made progress, he testified that Iran could have the bomb by 2005-2007.¹⁸ As a result, US experts increasingly refer to Iran's efforts as "creeping proliferation" -- *although this description must be carefully caveated as one based on the assumption that Iran cannot buy weapons grade material from any outside source.*

Nuclear Weapons Efforts Under the Shah

Iran's nuclear effort was much more ambitious when it first began. It began no later than the early 1970s, when the Shah acquired Iran's first nuclear reactor from the US. for the Amirabad Nuclear Research Center (now called the Amirabad Technical College) in Tehran. The five megawatt reactor started up in 1967, and has operated ever since. It is regularly inspected by the IAEA, but it uses a core with 93% enriched uranium, which is suitable for some forms of nuclear weapon.¹⁹

The Shah established the Atomic Energy Organization of Iran in 1974, and rapidly began to negotiate for nuclear power plants. He concluded an extendible ten year nuclear fuel contract with the US in 1974, with Germany in 1976, and France in 1977. In 1975, he purchased a 10% share in a Eurodif uranium enrichment plant being built at Tricastin in France that was part of a French, Belgian, Spanish, and Italian consortium. Under the agreement the Shah signed, Iran was to have full access to the enrichment technology Eurodif developed, and agreed to buy a quota of enriched uranium from the new plant.²⁰

He created an ambitious plan calling for a network of 23 power reactors throughout Iran that was to be operating by the mid-1990s, and sought to buy nuclear power plants from Germany and France. By the time the Shah fell in January, 1979, he had six reactors under contract, and was attempting to purchase a total of 12 nuclear power plants from Germany, France, and the US. Two 1,300 megawatt German nuclear power plants at Bushehr were already 60% and 75% completed, and site preparation work had begun on the first of two 935 megawatt French plants at Darkhouin that were to be supplied by Framatome.²¹ Thousands of Iranians were training in nuclear technology in France, the Germany, India, the UK, and the US.

Iran signed the Nuclear Non-Proliferation Treaty and followed nuclear safeguard procedures. Nevertheless, US experts believe that Shah began a low-level nuclear weapons research program, centered at the Amirabad Nuclear Research Center.²² This research effort included studies of weapons designs and plutonium recovery from spent reactor fuel. It also involved a laser enrichment program which began in 1975, and led to a complex and highly illegal effort to obtain laser separation technology from the US. This latter effort, which does not seem to have had any success, continued from 1976 until the Shah's fall, and four lasers operating in the critical 16 micron band were shipped to Iran in October, 1978.²³ At the same time, Iran worked on other ways to obtain plutonium, created a secret reprocessing research effort to use enriched uranium, and set up a small nuclear weapons design team.²⁴

In 1976, Iran signed a secret contract to buy \$700 million worth of yellow cake from South Africa, and appears to have reached an agreement to buy up to 1,000 metric tons a year.²⁵ It is unclear how much of this ore South Africa shipped before it agreed to adopt IAEA export restrictions in 1984, and whether South Africa really honored such export restrictions. Some sources indicate that South Africa still made major deliveries as late as 1988-1989.²⁶ Iran also

tried to purchase 26.2 kilograms of highly enriched uranium; the application to the US for this purchase was pending when the Shah fell.

The Revitalization of Iran's Nuclear Weapons Effort

The new Khomeini government let much of the Shah's nuclear program collapse during 1978-1980. It terminated the French and German contracts supporting the program. In March, 1979, Iran refused the request of KWU in Germany to mothball the Bushehr reactor projects, rather than simply turn them immediately over to Iran. As a result, KWU turned the reactor sites over to Iran in late August 1979, and Iran fully abrogated all past agreements with KWU in late November, 1979. According to one report, the scientific cadre was reduced to only 13 people.²⁷

The Iran-Iraq War, however, soon led the Khomeini government to revive Iran's nuclear program and interest in nuclear weapons. The Iranian government provided new funds to the research teams operating the US-supplied reactor at the Amirabad Nuclear Research Center, although it continued to operate the reactor under IAEA safeguards. At least one senior official of the new government, the Ayatollah Mohammed Hussein Beheshti; stated to officials managing the nuclear research effort in 1981, that the mandate of Iran's nuclear program had become the development of a nuclear weapon. Khamenei implied the same thing in a speech to Iran's Atomic Energy Organization of Iran (AEOI) in 1987.

Some experts feel that the IRGC moved experts and equipment from the Amirabad Nuclear Research Center to a new nuclear weapons research facility near Isfahan in the mid-1980s, and formed a new nuclear research center at the University of Isfahan in 1984 -- with French assistance.²⁸ Unlike many Iranian facilities, the center at Isfahan was not declared to the IAEA until February 1992, when the IAEA was allowed to make a cursory inspection of six sites that various reports had claimed were the location of Iran's nuclear weapons efforts.²⁹

Further, these Western experts believe that Iran's efforts to acquire nuclear weapons accelerated in the late 1980s -- although it is not possible to separate such efforts definitively from efforts to acquire nuclear power generating facilities. Iran's Yazd Province has significant uranium deposits (at least 5,000 tons) in the Shagand region, and Iran announced in 1987 that it had plans to set up a yellow cake plant in Yazd Province.³⁰ This facility was under construction by 1989 and Iran may have begun to build a uranium processing or enrichment facility.³¹

Iran may also have opened a new uranium ore processing plant close to its Shagand uranium mine in March, 1990, and it seems to have extended its search for uranium ore into three additional areas. Iran may have also begun to exploit stocks of yellow cake that the Shah had obtained from South Africa in the late 1970s while obtaining uranium dioxide from Argentina by purchasing it through Algeria.³²

Iran began to show a renewed interest in laser isotope separation (LIS) in the mid-1980s, and held a conference on LIS in September, 1987.³³ On February 7, 1990, the speaker of the Majlis publicly toured the Atomic Energy Organization of Iran and opened the new Jabir Ibn al Hayyan laboratory to train Iranian nuclear technicians.³⁴ Reports then surfaced that Iran had at least 200 scientists and a work force of about 2,000 devoted to nuclear research.³⁵

Iran opened a new nuclear research center in Isfahan in 1984, located about four kilometers outside the city and between the villages of Shahrida and Fulashans. This facility was built at a scale far beyond the needs of peaceful research, and Iran sought French and Pakistani help for a new research reactor for this center. The Khomeini government may also have obtained several thousand pounds of uranium dioxide from Argentina by purchasing it through Algeria. Uranium dioxide is considerably more refined than yellow cake, and is much easier to use in irradiating material in a reactor to produce plutonium.³⁶

Iran sought foreign support from a range of sources. Pakistan signed a nuclear cooperation agreement with Iran in 1987. Specialists from the Atomic Energy Organization of Iran began to train in Pakistan, and Dr. Abdul Kadr Khan, who has directed much of Pakistan's effort to develop nuclear weapons material, visited Tehran and Bushehr in February 1986, and January 1987.³⁷

Iran also strengthened its nuclear research ties to the People's Republic of China. The two countries signed a formal nuclear research cooperation agreement in 1990, although cooperation had begun as early as 1985 -- after Iran had suffered its first major chemical attacks from Iraq and had started to give its nuclear effort high priority. Iranian nuclear engineers appear to have begun training in China, and China seems to have transferred nuclear research technology for reactor construction and other projects, and possibly some technology for LIS, to an Iranian facility at Isfahan.³⁸

While Iran proved unable to get a reactor from France or Pakistan, it had more success with China. It obtained a subcritical research reactor from the People's Republic of China in 1985, and a small Calutron to use in enrichment research in 1987. This Calutron was only a one milliamp machine, versus the 600 milliamp machines used by Iraq in its weapons enrichment efforts, and was so small that it was suitable only for research purposes -- specifically to test insulators and liners and to produce stable isotopes of zinc for pharmaceutical purposes.

Iran recruited Iranian nuclear scientists living overseas and tried to renew its power reactor program as a way of getting enriched material. In 1984, the Khomeini government began to restart work at the Bushehr reactor complex. The two 3,765 megawatt reactors were located on the Gulf about 18 kilometers southwest of the city. While most estimates indicate they were about 60% complete, others indicate that 85% of the construction work, and 65% of the electrical and mechanical work, were complete.³⁹

These Iranian efforts suffered major set backs, however, when Iraq repeatedly bombed Iran's reactor projects at Bushehr. These Iraqi bombings occurred on March 24, 1984, February 12, 1985, March 4, 1985, July 12, 1986, November 17, 1987, November 19, 1987, and July 19, 1988. At least some foreign technicians died during these bombings, and work on the reactors was often suspended. It is interesting to note that the 1987 and 1988 raids may have been a response to the fact that Iran had begun to move IAEA safeguarded material to the area in February, 1987.⁴⁰

Creeping Proliferation Under Rafsanjani

The course of the Iranian nuclear program has become harder to trace since the end of the Iran-Iraq War. It has been the source of many unconfirmed rumors which exaggerate the size and progress of Iran's effort -- more than a few inspired by untrustworthy extremist opponents of the Iranian regime like the Iraqi-financed Iranian People's Mujahideen.⁴¹

Most Western experts believe, however, that Iran's program has a far lower scale than Iraq's program before the Gulf War. One key source of such estimates is the character of Iran's imports of dual-use technology, and continuing covert Iranian attempts to illegally import controlled technologies from the West. The details of such import efforts are often classified, but Iran's imports follow a pattern that is clearly part of a nuclear weapons program and Iran's efforts over any given period of time provide a rough picture of its progress.⁴²

Those aspects of Iran's program that are visible indicate that Iran has had only uncertain success. Argentina agreed to train Iranian technicians at its Jose Balaseiro Nuclear Institute, and sold Iran \$5.5 million worth of uranium for its small Amirabad Nuclear Research Center reactor in May 1987. A CENA team visited Iran in late 1987 and early 1988, and seems to have agreed to sell Iran the technology necessary to operate its reactor with 20% enriched uranium as a substitute for the highly enriched core provided by the US, and possibly uranium enrichment and plutonium reprocessing technology as well.⁴³

Changes in Argentina's government, however, made it much less willing to support proliferation. The Argentine government announced in February, 1992, that it was canceling an \$18 million nuclear technology sale to Iran because it had not signed a nuclear safeguards arrangement. Argentine press sources suggested, however, that Argentina was reacting to US pressure.⁴⁴

In February, 1990 a Spanish paper reported that Associated Enterprises of Spain was negotiating the completion of the two nuclear power plants at Bushehr. Another Spanish firm called ENUSA (National Uranium Enterprises) was to provide the fuel, and Kraftwerke Union (KWU) would be involved. Later reports indicated that a 10 man delegation from Iran's Ministry of Industry was in Madrid negotiating with the Director of Associated Enterprises, Adolfo Garcia Rodriguez.⁴⁵ Iran also negotiated with Spain to repair and complete the reactors that the Shah had begun at Bushehr, as well as with Kraftwerke Union and CENA of Germany in the late 1980s and early 1990s. Iran attempted to import reactor parts from Siemens in Germany and Skoda in Czechoslovakia.⁴⁶ None of these efforts solved Iran's problems in rebuilding its reactor program, but all demonstrate the depth of its interest.

Iran took other measures to strengthen its nuclear program during the early 1990s. It installed a cyclotron from Ion Beam Applications in Belgium at a facility in Karzaj in 1991. It signed an agreement with China's Commission on Science, Technology, and Industry for National Defense on January 21, 1991, to build a small 27-kilowatt research reactor at Iran's nuclear weapons research facility at Isfahan. This reactor was evidently to be plutonium fueled, and may have come on-line in 1994.⁴⁷ On November 4, 1991, China stated that it had signed commercial cooperation agreements with Iran in 1989 and 1991, and that it would transfer an electromagnetic isotope separator (Calutron) and a smaller nuclear reactor, for "peaceful and commercial" purposes.

The Chinese reactor and Calutron were small research-scale systems and had no direct value in producing fissile material. They did, however, give Iran more knowledge of reactor and enrichment technology, and US experts believe that China provided Iran with additional data on chemical separation, other enrichment technology, the design for facilities to convert uranium to uranium hexafluoride to make reactor fuel, and help in processing yellowcake.⁴⁸

Iran conducted experiments in uranium enrichment and centrifuge technology at its Sharif University of Technology in Tehran. Sharif University was also linked to efforts to import cylinders of fluorine suitable for processing enriched material, and attempts to import specialized magnets that can be used for centrifuges, from Thyssen in Germany in 1991. It is clear from Iran's imports that it has sought centrifuge technology ever since. Although many of Iran's efforts have never been made public, British customs officials seized 110 pounds of maraging steel being shipped to Iran in July 1996.

Iran seems to have conducted research into plutonium separation and Iranians published research on uses of tritium that had applications to nuclear weapons boosting. Iran also obtained a wide range of US and other nuclear literature with applications for weapons designs.⁴⁹ Italian inspectors seized eight steam condensers bound for Iran that could be used in a covert reactor program in 1993, and high technology ultrasound equipment suitable for reactor testing at the port of Bari in January, 1994.

Other aspects of Iran's nuclear research effort had potential weapons applications. Iran continued to operate an Argentine-fueled five megawatt light water highly enriched uranium reactor at the University of Tehran. It is operated by a Chinese-supplied neutron source research reactor, and subcritical assemblies with 900 grams of highly enriched uranium, at its Isfahan Nuclear Research Center. This Center has experimented with a heavy water zero-power reactor, a light water sub-critical reactor, and a graphite sub-critical reactor. In addition, it may have experimented with some aspects of nuclear weapons design.⁵⁰

Chinese Reactor Deals

After its failures in the West, Iran turned to China and Russia. On September 10, 1992, Rafsanjani made a visit to Beijing where he is reported to have finished negotiations to purchase one or two 300-330 megawatt reactors from the People's Republic of China. A tentative agreement to sell one such reactor was announced by Iran's Minister of Defense during the visit. Further, the Atomic Energy Organization of Iran seems to have tried to unilaterally transfer the reactor site from Darkovin to less seismically stable sites in Bushehr, and then refused to allow China to fully survey the site or pay for the increased cost of the move.⁵¹ Interestingly enough, this was the same general period in which China joined the Nuclear Non-Proliferation Treaty (it had joined the IAEA in 1988.)

This announcement led to immediate US protests to the People's Republic of China.⁵² As a result the sale was deferred, and China's willingness to sell to Iran has since fluctuated with the quality of Chinese-US relations. For example, Iran and the PRC announced that they had signed an agreement for the PRC to build a 300 megawatt reactor near Tehran on July 4, 1994.⁵³ Since that time, Iran has expressed an interest in buying two 300 megawatt pressurized water nuclear reactors from China, similar to the Chinese plant at Qinshan in Zhejiang Province. At least one of these reactors was evidently to be sited near Esteghial, which is near Bushehr on the Gulf Coast.⁵⁴

Iranian officials indicated in mid-May 1995, that Iran had already made an \$800-\$900 million down payment on the deal. Reports also surfaced in September 1995 that China was helping Iran develop Calutron production facilities at Karaij, about 160 kilometers northeast of Tehran, and the State Department indicated that China was helping Iran develop gas diffusion facilities near Isfahan in April 1996. Other reports surfaced that China might have revitalized its reactor deal with Iran in November 1996 and early 1997, and the CIA reported that Iran had made large -- but unspecified -- nuclear-related purchases from China.⁵⁵

Each of these announcements has been followed, however, by new exchanges between the US and China that have delayed or blocked Chinese-Iranian deals. For example, discussions with the US helped lead China to pledge not to provide any assistance to a facility that was not under IAEA safeguards on May 11, 1996. China then issued detailed regulations to implement this pledge on September 11, 1996 -- after further talks with the US.⁵⁶

According to US reports, China also agreed not to sell Iran a Uranium Hexafluoride conversion plant in December, 1996.⁵⁷ Similarly, China's Prime Minister Li Lanqing is reported to have assured Israel's Prime Minister Benjamin Netanyahu that China would not supply Iran with reactor technology or other technology that could be used in a nuclear weapons program during Netanyahu's visit to China in August, 1997.⁵⁸ The Chinese Foreign Ministry also issued a statement on October 21, 1997, that, "Our peaceful use of nuclear energy with Iran has not been carried out because of some disputes over the contract."⁵⁹

President Clinton gave the issue high priority during President Jiang Zemin's visit to the US in late October, 1997. In spite of protests by its own National Nuclear Corporation, China agreed to halt nuclear assistance to Iran in return for a US agreement to allow US firms to sell China the technology it needed for nuclear power plants. While China did not agree to join the Nuclear Supplier's Group -- because of its nuclear sales to India and Pakistan -- it did agree not to provide further nuclear support of any kind to Iran, regardless of whether it was permitted under the terms of the NPT.

The Clinton Administration also stated during the visit that China had not provided any assistance to a facility that was not under IAEA safeguards once it had pledged not to do so on May 11, 1996. John Holum, the Acting Under Secretary of State for Arms Control and International Security Affairs repeated these claims on March 26, 1998, during a visit to China. President Clinton repeated them when he visited China in June.⁶⁰

These statements are interesting because China only really seems to have suspended the sale of hundreds of tons of anhydrous hydrogen fluoride (AHF or hydrofluoric acid), a chemical used in enriching Uranium by the China Nuclear Energy Industry to the Isfahan Nuclear Research Center in February 1998. China only did so three years after US intelligence had first detected the sale, and nearly two years after it had agreed not to make such sales of this kind. The sale was so large that it would have given Iran half a decade worth of material for an ambitious nuclear program. Furthermore, China was still contracted for the sale although AHF is also listed as a precursor to nerve gas.⁶¹

China has limits on what it can sell. Its nuclear industry is still in the developmental stage, and China has had serious problems in bringing some of its reactors on line and keeping them operating. The Chinese reactor at Qinshan uses a Japanese-made reactor vessel and German primary cooling pumps, and it is not clear if this technology will be exportable to Iran.⁶² When

these uncertainties are coupled with Iran's financial problems, they make any major Chinese deal with Iran a continuing uncertainty, particularly if China does become a major importer of nuclear technology from the US.⁶³

Nevertheless, Iran may still be getting nuclear technology from China. Iran denied that China had halted nuclear cooperation on March 15, 1998, and called US claims "unsubstantiated propaganda." There are some indications that China also continues to supply maraging steel to Iran and components that can be used for centrifuges.⁶⁴

Russian Reactor Deals

Iran first began to seek nuclear reactors from Russia in the mid-1980s, and has conducted negotiations with Russia ever since.⁶⁵ Reports surfaced in the late 1980s that Russia had signed a contract to sell two nuclear reactors to Iran -- although the existence of any such contracts was not made public and no tangible steps seemed to follow. Reporting by the Atomic Energy Organization of Iran indicates that the deal may have broken down because Iran proposed a site at Gorgan that was not properly stable and then attempted to move the site back to Bushehr without proper coordination.⁶⁶

Iran's negotiations with Russia resumed, however, and had more success. On November 20, 1994, Iran announced that Russia had agreed to a \$780 million deal to complete a reactor at Bushehr that German companies had begun during the time of the Shah.⁶⁷ Iran signed this agreement with Russia on January 8, 1995, by which time its cost had escalated to \$850 million.⁶⁸ The nuclear facility at Bushehr is about 730 miles south of Tehran, and 15 miles from the city of Bushehr. It is the site of the two incomplete 1200 megawatt reactors that Siemens had begun to construct in 1976.

Although work stopped at the site in 1979, after the fall of the Shah, Iran kept the facility active, and some 300-400 Iranians normally lived on the site and maintained it during the period before Russia agreed to sell Iran a reactor. Iran had invested about \$6 billion in the facility by the time the Shah fell. Construction of the main buildings and steel containment vessel for one of the reactors at Bushehr had reached 85% of completion at the time of the Shah's fall, and construction for the other was partially finished.⁶⁹ Facilities existed to house some 2,000 workers at the site, with a capacity to support up to 2,000 more. As a result, Russia was able to quickly deploy some 150 technicians to the reactor site once it signed an agreement with Iran. It began begin shipments of material in 1995, and announced that it planned to deploy up to 2,000 Russian workers and train some 500 Iranian technicians.⁷⁰

The deal originally called for Russia to complete work on the first reactor by the year 2000.⁷¹ The completion date and the cost of the contract depend, however, on whether Russia will be able to make the desired use of the existing facilities at the site, and whether Russia can tailor its VVER-1000 reactor design to fit these facilities.⁷²

Both reactor facilities were damaged during the Iran-Iraq War, and the Russian VVER-1000 is physically different from a Siemens 1,300 megawatt reactor. Further, Siemens had not yet installed the reactors themselves and the steam generators which produce steam for the turbines.⁷³ Russian technicians and experts inspected the site in September 1994, and concluded that corrosion was extensive, that their work would be hampered by the absence of the German

technical documentation, and that it would be necessary to modify the outdated 1970s design and redesign the buildings to take a Russian water-moderated water-cooled reactor with a capacity of 1,000 megawatts, the VVER-1000.⁷⁴

As a result, Russia is at best able to use some of the remaining buildings and control facilities and bringing the reactor fully on-line will probably lag until at least 2005, although Reza Amrollahi, the head of the Atomic Energy Organization of Iran, still claimed in July 1997 that it would come on-line during the year 2000.⁷⁵ Past efforts to export reactor designs have led to significant delays and cost escalation -- without the complications inherent in Russia's attempt to make use of facilities designed for Germany's very different reactors.

On March 18 1996, Anatoliy Zhilinsky, the head of the Tehran office of Zarubezhatomenergostroy, is reported to have said that the Bushehr plant would be completed on schedule, some 55 months from the signing of the January 1995 nuclear cooperation accord between Russia and Iran. He also said that Iranian subcontractors would spend about a year restoring existing facilities at Bushehr, after which Russian specialists would take over., and that one key problem in meeting the schedule was that the technical documentation for the German made equipment originally installed at Bushehr was not available, and that Russia would have to provide replacement equipment if Iran could not obtain the documentation because Germany was unwilling to provide it. Zhilinsky went on to state that it would have been easier to build a new power station "from scratch," but Iran insisted on completion of the existing station.⁷⁶

There are reports of other problems and delays. Iran is reported to have objected to the fact that some of the Russians in the bank financing the project were Jewish. There seem to be unanticipated problems with vulnerability to earthquakes that could delay progress by a year, and it is far from clear that Iran and Russia have established an efficient method of transferring payments and measuring progress. There is also considerable friction between the Iranian and Russian workers at Bushehr, and the Russians have experienced problems in getting visas and decent living and working conditions for the Russian workers at the reactor site.⁷⁷

The US has tried to create problems by persuading the Ukraine to keep its state-owned AOA Turboatom from supplying the turbines for Bushehr. On March 6, 1998, the US and the Ukraine initialed an accord allow US firms to bid on work on Ukrainian nuclear power plants, after the Ukraine promised not to supply nuclear technology to Iran. This agreement meant that the Ukraine had to give up a \$45 million contract for the turbines, but it also allowed it to obtain US bids on badly needed work to revitalize the Soviet supplied nuclear power plants in the Ukraine, work worth some \$1.2 billion.⁷⁸

It is doubtful that these US efforts have had much impact on Iran. Iran converted many of its subcontracts to "turn key" Russian projects on February 2, 1998. It did so in an effort to eliminate consistent delays and quality control problems in the work done by Iranian subcontractors, and give the Russian team greater control over the entire project effort and systems integration. Iranians were originally supposed to build the reactor hall, and the resulting delays were so serious that the project had only accomplished five months of work over a 25 month period -- putting the project some 20 months behind. In November 1998, Iran is reported to have called for speeding up the construction of the Bushehr Nuclear Power Plant earlier than the scheduled date of the middle of May 2003. Russian Minister of Atomic Energy Yevgeniy

Adamov confirmed during a visit to Iran that Russia was continuing the construction of the Bushehr NPP with one VVER-1000 reactor despite US and Israeli opposition.

In February 1999, Iran agreed to buy turbines from a Russian factory in St. Petersburg and increased the cost of its contracts with Russia by a significant, although unstated, amount above the \$850 million contracts that had previously been agreed to. Russian sources also report that Iran has improved the flow of its payments. ITAR-TASS has since reported that Izhorskiye Zavody in St. Petersburg had started producing equipment for the Bushehr nuclear power plant. The order was placed by Atomstroyeksport in December 1998, and the first advance payment has already been made. Nikolay Domichev, a spokesman for Izhorskiye Zavody, said that the equipment for the primary circuit of the reactor would be supplied to Iran in late 2001, and that the sanctions imposed by the United States on Russian institutions have had no impact on the project. In fact, a decision was made to speed up the work on the Iranian order. The reactor vessel, the steam generator vessel, the reactor vessel head, and the equipment inside the vessel will be assembled in St. Petersburg. Experts from Izhorskiye Zavody are expected to take part in the installation of the equipment on site. The senior managers of the facility believe that there is no reason for Iran to confine itself to one 1,000MW reactor in Bushehr. Intergovernmental protocols have been signed on intentions to deliver three VVER-610 reactor units to Iran.⁷⁹

Iran seems to have obtained the training support it needs from Russia. In January 1999, the Iranian Atomic Energy Organization advertised for engineers to receive training in Russia for the Bushehr nuclear power plant. The advertisement stated that a total of 225 engineers were needed, with expertise in physics, nuclear physics, mechanical engineering, or computer science, that applicants must be Iranian nationals, and that successful candidates would be sent to Russia after a short period of training in Iran. In February 1999, the Russian Ministry of Atomic Energy reported that 30 Iranian specialists were scheduled to arrive in Moscow in early February 1999 to receive training for operation of the Bushehr nuclear power plant. The Iranians were to be trained at a training center at the Novovoronezh nuclear power plant; and that the training center had received assistance from Japan in upgrading its equipment. The terms of a Russian-Iranian contract signed in 1995 call for several hundred Iranians will be trained in Russia, and Minister of Atomic Energy Yevgeniy Adamov said that the Bushehr plant will be fully staffed by 2000-2001. One thousand Russians were reported to be working at the Bushehr site, and the first unit of the plant to be 30 to 40 percent complete.⁸⁰

Iran seems deeply committed to completing the project regardless of its problems in repaying foreign loans and the exact status of its oil revenues.⁸¹

Longer-term Reactor Programs

The purchase of Russian support may also prove to be the first step in a far more ambitious Iranian effort. Iran has shown an interest in purchasing another VVER-1000 reactor for use at Bushehr. Various sources also indicate that Iran is seeking to purchase two V-213 VVER 440 power reactors and another large research reactor, or that it is seeking to purchase a total of five large 1,300 megawatt reactors.⁸²

At least one speech by Reza Amrollahi indicated that Iran eventually expected to build up to 20 nuclear power plants, although he later stated that his views had been misinterpreted and

that Iran also expected to get 5% of its electricity from nuclear power plants by the year 2000.⁸³ Georgi Kaurov, a spokesman for the Russian Atomic Energy Ministry confirmed in a public statement on March 6, 1998 that Russia was willing to sell such reactors in spite of US pressure not to do so.⁸⁴

US experts believe that Iran is now seeking to buy four to five light water reactors from Russia, including two 1000 megawatt reactors and two 463 megawatt reactors (at a cost in excess of \$5 billion) that can be used to produce substantial amounts of fissile material for nuclear weapons. They also believe that Iran has aggressively sought to buy highly enriched and/or fissile material from the former Soviet Union, as well as the services of Soviet nuclear weapons designers.⁸⁵

These conclusions have been supported by recent developments in Iran. Shortly after President Khatami replaced Reza Amrollahi, the head of the Atomic Energy Organization of Iran, with Gholamreza Aghazadeh, Aghazadeh reaffirmed Iran's commitment to a massive nuclear power program. On October 3, 1997, Reza Amrollahi, the head of the Atomic Energy Organization of Iran indicated during a meeting with Hans Blix, the head of the International Atomic Energy Agency (IAEA), that Iran planned to eventually produce 20% of Iran's electric power needs from nuclear units. This meant adding a second 1,000 megawatt generating unit to its existing efforts to build a 1,000 megawatt unit in Bushehr. He indicated that Iran had approached Russia to buy two more 440 megawatt reactors and was seeking an eventual total of six, and that it was still seeking two 300 megawatt nuclear reactors from China.⁸⁶

Russia has indicated on numerous recent occasions that it will continue nuclear cooperation with Iran, although it has repeatedly denied that it is giving Iran technology that can be used for nuclear weapons.

In November 1998, Russian Minister of Atomic Energy Yevgeniy Adamov confirmed during a visit to Iran that Iran had asked Russia to build up to three more 1,000MW reactors. He said that the contract on this project, if signed, would be worth \$2-3 billion.⁸⁷ On November 30, 1998, First Deputy Minister of Atomic Energy Viktor Mikhailov discussed the history of cooperation with Iran in the nuclear industry and answered questions at a press conference on nuclear and missile contacts between Russia and Iran being held at the National Press Institute. Mikhailov said he believed it was important to complete the construction of the Bushehr NPP, and that cooperation with Iran was important for Russia both in terms of politics and economics. He said that in 1992-1997 Russia had designed a uranium mine for Iran with an annual output of 100 to 200MT, and that Iran was currently seeking Russian assistance in uranium and isotope enrichment.⁸⁸

On January 20, 1999, Adamov said at a meeting with Yabloko party deputies that the United States had not produced any evidence of violations of international agreements by Russian nuclear enterprises over the past year and a half, and that the Russian special services exercised close daily supervision over organizations working with nuclear technology. Adamov reaffirmed that Russia does not want neighboring states to acquire nuclear weapons, and hoped that the current controversy over Iran would not adversely affect Minatom's constructive dialogue with the US Department of Energy.⁸⁹ In March 1999, Adamov again stated that Russia

would continue close nuclear cooperation with Iran and support the construction of the reactors in Bushehr.⁹⁰

In early January 2000, the Russian Minister of Defense, Igor Sergeyev, met with the Secretary of the Iranian Security Council, Khasan Roukhani, and pledged Russian cooperation with Iran in developing its military and technical capabilities. Sergeyev stated that "Russia intends to maintain the dynamics of its bilateral ties with Iran in the military, military-technical, scientific technical, and energy fields." The Russian Foreign Minister, Igor Ivanov, made a similar commitment during the same visit, and Vice Prime Minister, Ilya Klebanov, announced a possible Russian-Iranian deal that would sell Iran three additional nuclear reactors.⁹¹ According to other reports, the Russian State Commission for Military-Industrial Affairs, which is chaired by Prime Minister and Acting President Vladimir Putin, decided to build three reactors for Iran's Bushehr nuclear power station on 14 January 2000. The Deputy Prime Minister Ilya Klebanov said that Russia's new contract with Iran did not involve the supply of military hardware and that the agreement to build additional reactors would meet all international obligations.⁹²

Reactors and Proliferation

It is not clear that Iran's reactor purchases are meant to be an integrated part of Iran's nuclear weapons effort, as distinguished from a way of acquiring the necessary nuclear technology. The reactor design Russia is selling Iran produces only very limited amounts of plutonium, and no country has as yet used a similar reactor design to acquire fissile material. Iran has also justified its reactor program by claiming that it needs to provide electric power from nuclear generators to reduce its use of exportable oil and gas. There are some experts who argue that Iran is seriously seeking to pursue this goal, that power reactors are an extremely inefficient way to obtain fissile material, and that Iran is more likely to support its weapons programs with specially designed smaller reactors, purchases of fissile material from the FSU, or other methods of enrichments.

The US intelligence community does not officially link Iran's efforts to acquire reactors to its effort to acquire fissile material, but it does express deep concern over Iran's ties to Russia. The Non-Proliferation Center of the Directorate of Central Intelligence summarized Iran's efforts to acquire nuclear weapons technology from Russia and China as follows in its February 2000 report:⁹³

...China joined the Zangger Committee-which clarifies certain export obligations under the NPT-in October 1997 and participated in the Zangger Conversion Technology Holders meeting in February 1999. This was China's first opportunity to participate in a discussion of this type.

China pledged in late 1997 not to engage in any new nuclear cooperation with Iran but said it would complete work associated with two remaining nuclear projects-a small research reactor and a zirconium production facility-in a relatively short period of time. The Intelligence Community will continue to monitor carefully Chinese nuclear cooperation with Iran. During the reporting period, firms in China provided missile-related items, raw materials, and/or assistance to several countries of proliferation concern-such as Iran. China also was a supplier of ACW to Iran through the first half of 1999.

Prior to the reporting period, Chinese firms had supplied CW-related production equipment and technology to Iran. The US sanctions imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's CW program remain in effect. In June 1998, China announced that it had expanded its chemical export controls to include 10 of the 20 Australia Group chemicals not listed on the CWC schedules. China has provided extensive support in the past to Pakistan's WMD and ballistic missile programs, and some ballistic missile assistance continues. In May 1996, Beijing promised to stop assistance

to unsafeguarded nuclear facilities, but we cannot preclude ongoing contacts. China's involvement with Pakistan will continue to be monitored closely.

... Russian entities during the reporting period continued to supply a variety of ballistic missile-related goods and technical know-how to Iran and were expanding missile-related assistance to Syria and India. For example, Iran's earlier success in gaining technology and materials from Russian companies accelerated Iranian development of the Shahab-3 MRBM, which was first flight-tested in July 1998. Russian entities during the first six months of 1999 have provided substantial missile-related technology, training, and expertise to Iran that almost certainly will continue to accelerate Iranian efforts to build new indigenous ballistic missile systems.

During the first half of 1999, Russia also remained a key supplier for civilian nuclear programs in Iran. With respect to Iran's nuclear infrastructure, Russian assistance enhances Iran's ability to support a nuclear weapons development effort. By its very nature, even the transfer of civilian technology may be of use in Iran's nuclear weapons program. In addition, Russia supplied India with material for its civilian nuclear program during this reporting period.

Russian entities remain a significant source of biotechnology and chemicals for Iran. Russia's world-leading expertise in biological and chemical weapons would make it an attractive target for Iranians seeking technical information and training on BW and CW agent production processes.

Russia also was an important source of conventional weapons and spare parts for Iran, which is seeking to upgrade and replace its existing conventional weapons inventories.

Following intense and continuing engagement with the US, Russian officials took some positive steps to enhance oversight of Russian entities and their interaction with countries of concern. Russia has reiterated previous commitments to observe certain limits on its nuclear cooperation with Iran, such as not providing militarily useful nuclear technology, although-as indicated above-Russia continues to provide Iran with nuclear technology that could be applied to Iran's weapons program. President Yel'tsin in July 1999 signed a federal export control law, which formally makes WMD-related transfers a violation of law and codifies several existing decrees-including catch-all controls-yet may lessen punishment for violators.

Despite these decrees, the government's commitment, willingness, and ability to curb proliferation-related transfers remain uncertain. Moreover, economic conditions in Russia continued to deteriorate, putting more pressure on Russian entities to circumvent export controls. Despite some examples of restraint, Russian businesses continue to be major suppliers of WMD equipment, materials, and technology to Iran. Monitoring Russian proliferation behavior, therefore, will remain a very high priority.

Nevertheless, Iran's claims relating to its need for nuclear power present serious economic credibility problems that are the subject of debate within Iran as well as within the West. One Iranian newspaper, for example, referred to the efforts of the Atomic Energy Organization of Iran in September, 1997, by stating that, "the construction of a nuclear power plant in Iran is more like a joke."⁹⁴

Reactors that cost billions of dollars in hard currency seem to make limited economic sense in a country with vast supplies of natural gas that can be used to generate electricity at 25% to 33% of the cost of nuclear electricity at market price conditions. This is particularly true since Iran faces a major problem in terms of spending hard currency, and will have to pay at least twice per installed kilowatt what it would have to pay for the capital cost of a gas-fired power plant. US intelligence studies have found that Iran has little hope of ever breaking even on an investment in nuclear power relative to the consumption of domestic natural gas, and that it makes limited economic sense for Iran to concentrate all of the reactors in one area so far away from Iran's cities and industrial facilities in the north.⁹⁵

The credibility of such claims are further undermined by the long history of problems with the nuclear weapons programs in other countries, by Iran's policy of underpricing oil and gas to the point where the increase in domestic consumption is cutting into its export capacity, and by Iran's acute hard currency problems. For example, President Rafsanjani undercut the

argument that Iran needed nuclear power to allow gas to be exported by announcing that Iran had “endless” gas reserves and over 150 years of oil reserves in a speech to the Majlis on June 1, 1996. Rafsanjani announced the discovery of a new gas field of at least 9 trillion cubic feet and estimated Iran’s oil reserves at 93 billion barrels.⁹⁶ US and European studies confirm these estimates and indicate that Iran’s gas reserves are probably substantially larger.

Some experts argue that Iran does not plan in economic terms and that Russia has priced its initial contracts so far below the normal world market price for such reactors that they might be economical, even for a nation with Iran’s gas resources. Such experts also argue that Iran has little experience with the real-world life cycle cost of nuclear reactors, and may be reacting to price quotes that give it a false impression of the economics involved.

Russia is selling light water reactors which are less suited to producing plutonium than the heavy water reactors Iran sought initially. Russia has repeatedly denied that it will give Iran any assistance in developing nuclear weapons, has repeatedly indicated that it will take back the plutonium-bearing spent fuel in the reactor, and has announced that Iran has signed a \$30 million deal with Iran to provide fuel for the reactors and reprocess spent fuel in Russia.⁹⁷

Nevertheless, these Russian denials need to be put in context. The US put intense pressure on Russia immediately after its deal with Iran when the US received strong indications that Russia had agreed to provide centrifuge and other enrichment technology as part of the deal. The US claimed that Victor Mikhailov, the head of Russia’s Atomic Energy Ministry, had proposed the sale of a centrifuge plant in April, 1995. The US also indicated that it had persuaded Russia not to sell Iran centrifuge technology as part of the reactor deal during the summit meeting between President’s Clinton and Yeltsin in May, 1995. According to some reports, Russia was to reprocess the fuel at its Mayak plant near Chelyabinsk in the Urals, and could store it at an existing facility, at Krasnoyarsk-26 in southern Siberia.⁹⁸

It was only after US pressure that Russia publicly stated that it never planned to sell centrifuge and advanced enrichment technology to Iran, and Iran denied that it had ever been interested in such technology.⁹⁹ For example, the statement of Mohammed Sadeq Ayatollahi, Iran’s representative to the IAEA, stated that, “We’ve had contracts before for the Bushehr plant in which we agreed that the spent fuel would go back to the supplier. For our contract with the Russians and Chinese, it is the same.”¹⁰⁰

Iran may have given up little by making overt agreements not to reprocess Plutonium. Moving forward with the reactor deal means that Iran will end up with enough technology transfer to build reactors on its own. While the Russian reactor design is scarcely ideally suited to producing Plutonium, it is a large facility that can be used to produce plutonium if Iran changes its mind. Once the reactor is in operation, it is far from clear what the world would do about any Iranian violation of the IAEA. Plutonium reprocessing technology is not particularly challenging and no country that has so far attempted such reprocessing has failed. Iran can also go on with an overt reactor program while it pursues low-level or covert efforts to acquire Uranium enrichment capabilities.

There are still major uncertainties as to how many scientists and technicians from the Former Soviet Union may be supporting Iran. Few US intelligence experts seem to believe the recurrent press reports of a large presence of FSU technical experts in Iran. At the same time, US, British, French and Israeli experts do indicate that Iran has sought to buy nuclear technology

on the black market in a number of FSU countries, and attempted to buy stocks of fissile material from one. There also are reports that some FSU nuclear scientists and technicians are working in Iran in areas that have nothing to do with its Russian-supported nuclear power program. There are also serious questions as to whether Russian scientists might work with Iranian experts to use the reactor at Buser to covertly produce Plutonium isotopes, if the reactor begins operation.¹⁰¹

Furthermore, private and state-owned Russian firms may not be fully honoring the agreements of the Russian government. The CIA indicates that Russia provided important transfers of nuclear technology to Iran in 1996. The Clinton Administration quietly complained to President Yeltsin about such transfers in July 1997. It expressed concern that Russia had broadened its technology transfers and might not be limiting its aid to Iran in setting up a plutonium reprocessing capability.¹⁰²

These problems and uncertainties led Israel to claim in early 1997 that Russia was providing Iran with nuclear weapons technology. Israeli Prime Minister Benjamin Netanyahu raised the issue during a March 10-12 visit to Moscow. He received assurances from President Yeltsin that, "the nuclear cooperation (with Iran) was at a very rudimentary level and that (cooperation on) ballistic missiles, he said, was not taking place and will not take place." Israel and Russia also reported to have reached an agreement to cooperate in countering the illegal traffic in such technology on March 12, 1997.¹⁰³

Interestingly enough, Russian officials are privately ambiguous about the character of the Russian effort. Discussions with senior Russian officials from the MVD, Foreign Intelligence Service, and diplomatic service in June, 1998, indicated that the officials involved felt that the Russian reactor would have little direct value in helping Iran build a bomb. At the same time, Russian intelligence officers stated that Iran had sought other nuclear technology in Russia that seemed to be part of a nuclear weapons program, and that Russia had arrested Russian citizens involved in the transfer of such technology. They also stated that Russia had only dropped Iran from its public list of proliferators after the reactor sale, and that this was only done as the result of political direction.

Proliferation and the Nuclear Non-Proliferation Treaty

Iran has firmly and repeatedly denied that it is seeking nuclear weapons. Some of these Iranian denials have been cited earlier, but there are many others. For example, Khamenei stated on July 13, 1992, that charges that Iran was proliferating were the result of "American and Zionist loudspeakers...obviously false....They know it is a lie....You are mistaken if you think that the Islamic Republic's strength lies in the obtaining or domestic manufacture of an atomic bomb....the power of faith will foil all the conspiracies and ploys of the enemy."

Reza Amrollahi, the former head of the Atomic Energy Organization of Iran has said that, "Our nuclear program is peaceful...My country has signed the NPT and has repeatedly expressed its willingness to honor it...Also, we are an active member of the IAEA."¹⁰⁴ The Iranian official news agency declared on January 8, 1995 that, "Iran simply does not have the ambition to become a nuclear weapons state. Iran does not, and will not, in light of its own interest, engage in a nuclear weapons program."¹⁰⁵ President Rafsanjani answered a question relating to Iran's desire to proliferation on the US program in an interview on the program "60 Minutes" in April 1997 in which he stated that, "Definitely not. I hate this weapon."¹⁰⁶

The problem with such statements is that they often seem to be contradicted by Iran's purchase and acquisition programs, and are tied to the assumption that proliferation can be tracked by identifying key facilities and using the IAEA to inspect them.

Iranian Nuclear Weapons Facilities

It is far easier to know that a nation is proliferating than it is to know specifically where it is proliferating. The location of several key declared Iranian nuclear facilities and known nuclear transshipment centers is well known. It is also clear that Iran has a large nuclear research program.¹⁰⁷ However, little credible data is available on the exact size and nature of Iran's nuclear weapons effort, the specific facilities involved, or the exact nature of Iran's imports of nuclear weapons related and dual-use technology.

Iran has demonstrated that it is capable of copying the sheltering and satellite deception techniques used by Iraq before the Gulf War, and a small, well-dispersed nuclear weapons program is very difficult to detect and characterize without on-site inspection and continuing monitoring.¹⁰⁸ Without such an effort, there is no way to publicly validate the existence of a low level Iranian nuclear weapons effort at given facilities, or to describe the current level of effort and its probable results. In fact, one reason that Iran's nuclear weapons program is so difficult to analyze is that Iran seems to be building its program so slowly. "Creeping proliferation" produces far fewer signs of activity than Iraq's massive investments.¹⁰⁹

This allows a potential exporter to deny the existence of Iran's efforts. While British, French, German, Israeli, and US experts are convinced that an Iranian nuclear weapons effort exists, exporting nations like China and Russia have effectively rejected this claim when it has been convenient. For example, Yevgeny Primakov, Russia's most senior intelligence official, stated on March 23, 1995, "We have not found convincing evidence of the existence in the country of a coherent nuclear program." Lt. General Gennady Yevstafiyev declared on the same day, "We are keeping track of developments...But so far, we see no grounds for sharing the official US position..."

These Russian statements would be much more credible if they were not so different from ones that other Russian officials had made a year earlier. They contradicted statements made by Russians like Alexei Yablokov, an advisor to Yeltsin, who stated, "Thanks to Russia, Iran will be in a position to get the nuclear bomb in a few years.... By signing this contract, Russia is arming Iran." They do, however, illustrate the fact there is no international consensus regarding Iran's activities.¹¹⁰

Scare Reports and Deliberate Misinformation

The situation has not been helped by scare reports and deliberate misinformation. For example, Israeli sources have claimed that Iran sought to buy the nuclear enrichment facilities that South Africa developed for its nuclear weapons program, although there is little evidence to support these reports.¹¹¹ Similarly the People's Mujahideen, a violent anti-regime group, has made a long series of detailed claims. At various times, the People's Mujahideen has reported that:

- Iran's facilities include a weapons site called Ma'alleh Kelayah, near Qazvin on the Caspian. This is said to be an IRGC-run facility established in 1987, which has involved an Iranian investment of \$300 million. Supposedly, the site was to house the 10 megawatt reactor Iran tried to buy from India.
- Two Soviet reactors were to be installed at a large site at Gorgan on the Caspian, under the direction of Russian physicists.
- The People's Republic of China provided uranium enrichment equipment and technicians for the site at Darkhouin, where Iran once planned to build a French reactor.
- A nuclear reactor was being constructed at Karaj; and that another nuclear weapons facility exists in the south central part of Iran, near the Iraqi border.
- The ammonia and urea plant that the British firm M. W. Kellogg was building at Borujerd in Khorassan province, near the border with Turkestan, might be adapted to produce heavy water.
- The Amir Kabir Technical University, the Atomic Energy Organization of Iran (AEOI) (also known as the Organization for Atomic Energy of Iran or AEOI), Dor Argham Ltd., the Education and Research Institute, GAM Iranian Communications, Ghods Research Center, Iran Argham Co., Iran Electronic Industries, Iranian Research Organization, Ministry of Sepah, Research and Development Group, Sezeman Sanaye Defa, the Sharif University of Technology, Taradis Iran Computer Company, and Zakaria Al-Razi Chemical Company are all participants in the Iranian nuclear weapons effort.¹¹²

Other sources based on opposition data have listed the Atomic Energy Organization of Iran, the Laser Research Center and Ibn-e Heysam Research and Laboratory Complex, the Bonab Atomic Energy Research Center (East Azerbaijan), the Imam Hussein University of the Revolutionary Guards, the Jabit bin al-Hayyan Laboratory, the Khoshomi uranium mine (Yazd), a possible site at Moallem Kalayeh, the Nuclear Research Center at Tehran University, the Nuclear Research Center for Agriculture and Medicine (Karaj), the Nuclear Research Center of Technology (Isfahan), the Saghand Uranium mine (Yazd), the Sharif University (Tehran) and its Physics Research Center.¹¹³

The problem with such lists of weapons facilities is that they have never been confirmed as accurate and end in discrediting more cautious and balanced reports. They also tend to include virtually all the major publicly-known research centers in Iran, and to ignore the fact that much of Iran's effort may take place in facilities that do not have a name relating to nuclear research or consist of purchasing efforts made through Iran's vast network of cutouts and purchasing officers abroad.

Iran's present purchasing network is the product of more than fifteen years of covert efforts to end-run Western and other foreign controls, and Iran has systematically lied about its activities ever since it set this network up following the beginning of the Iran hostage crisis. It is almost impossible to track all the various fronts and covers Iran uses, but the German Ministry of

Economics has circulated a wide list of such Iranian fronts which are known to have imported or attempted to import controlled items. These fronts include the:¹¹⁴

- Bonyad e-Mostazafan;
- Defense Industries Organization (Sazemane Sanaye Defa);
- Pars Garma Company, the Sadadja Industrial Group (Sadadja Sanaye Daryae);
- Iran Telecommunications Industry (Sanaye Mokhaberet Iran);
- Shahid Hemat Industrial Group, the State Purchasing Organization, Education Research Institute (ERI);
- Iran Aircraft Manufacturing Industries (IAI);
- Iran Fair Deal Company, Iran Group of Surveyors;
- Iran Helicopter Support and Renewal Industries (IHI);
- Iran Navy Technical Supply Center;
- Iran Tehran Kohakd Daftar Nezarat, Industrial Development Group;
- Ministry of Defense (Vezerate Defa).

There is no question that Iran has a large enough research and industrial base to hide a nuclear weapons effort of moderate size, and has a highly sophisticated purchasing network. The problem is to determine exactly what organizations and facilities are or are not “guilty.”

The NPT, IAEA Inspections, and Deniability

The Treaty on the Non-Proliferation of Nuclear Weapons (NNPT) and International Atomic Energy Agency (IAEA) provide a set of controls and an inspection capability that has significant value, but they can also legitimize the import of “peaceful” nuclear technology that can be used to develop a weapons program, and can be exploited to provide a cover for proliferation. As a signator to the NPT, Iran has had to permit the IAEA to inspect its nuclear facilities. Under the initial inspection regime, the scope of these inspections was limited.

Under Article V of the NPT, Iran was also entitled to import nuclear reactors and substantial amounts of nuclear technology, as long as they allow IAEA inspection of the reactors in their declared facilities. This transfer of “peaceful” nuclear technology is giving Iran a steadily improving nuclear technology base which, in turn, improves Iran’s capability to build covert reactor facilities, centrifuge facilities, and/or chemical separation facilities.

While the IAEA can and did regularly inspect Iran’s declared nuclear facilities after Iran accepted the terms of the NNPT, this did not necessarily provide a guarantee that Iran was not using nuclear technology to proliferate.. Before the 93+2 revisions to the NNPT, the IAEA only

fully inspected declared Iranian facilities that had reactors or declared nuclear material. Visits to other Iranian facilities were limited and did not normally involve the kind of intrusive inspection that could differentiate between a legitimate nuclear facility, and one dedicated to a covert weapons program. As a result, the IAEA efforts to date can neither confirm nor deny the existence of an Iranian nuclear weapons program. For example, the IAEA repeatedly certified that Iraq's three declared reactors were in compliance with the NNPT, but it was unable to inspect other facilities under the older NNPT inspection regime.

Even those Iranian facilities that are subject to IAEA inspection can present risks. As North Korea has demonstrated, a country can fully comply with the safeguards affecting reactor sales and then reject IAEA safeguards once the reactor or reactors are complete. It can then process the used reactor rods for plutonium, and a nation like Iran could refuel its reactors with locally made uranium rods. The types of light water reactors that Iran is buying are scarcely optimal designs for either plutonium irradiation or massive "cannibalization" of the reactor fuel, but Iran cannot buy other kinds of reactors. No one is selling the kind of research reactors with highly enriched uranium fuel that France offered to Iraq at the time of the initial Osiraq deal.¹¹⁵

Some sources have charged that Iran has use the IAEA to confuse or obfuscate its activities, and cite the fact that the IAEA has made special visits to Iranian facilities rather than full inspections. Other experts state, however, that the IAEA conducted these visits only after considerable background briefings from Western intelligence. It then made a limited pre-arranged visit to six of 10 suspected sites in February, 1992, and found no sign of weapons activity at any of these sites. It found that the uranium mining site at Saghand was at least five years away from production and had no uranium concentration plant. It also found the facility at Ma'allem Kelayah, which was said to be a nuclear weapons research center, to be little more than a motel-sized training and conference center. Further, it found that the People's Republic of China-supplied Calutron at Shiraz was found to be so small that it could only be used to produce isotopes for medical research.¹¹⁶

There have been other charges that the IAEA only conducted a "familiarization tour" during its 1992 visit, and that the IAEA was led to a decoy site, when it thought it was investigating a facility called Ma'allem Kelayah. IAEA spokesman David Kydd vehemently denied such reports that the IAEA was led to the wrong site, however, and US experts confirm his statements.¹¹⁷

Iran let a new team from the IAEA visit in October-November, 1993.¹¹⁸ This IAEA team was also given detailed briefings by the US and other Western countries, and was allowed to visit suspected buildings at three main nuclear research complexes near Tehran, Isfahan, and Karaj. Like the previous IAEA mission, however, it was a visit, not a full or special inspection mission. The IAEA was not equipped or organized to find covert Iranian activities or examine all of the activities in the research facilities it was allowed to visit. Further, the IAEA team did not have adequate access to soil and particle samples in the facilities it was allowed to visit.¹¹⁹

Meaningful enforcement of the Nuclear Non-Proliferation Treaty will requires that all Iranian facilities to be subject to full IAEA challenge inspection under the revised terms of the NNPT, and the IAEA be supported by extensive national intelligence efforts to "target" suspected undeclared facilities. Even then, there could still be serious problems in determining what Iranian activities are and are not part of a weapons effort.

Nuclear weapons research and development efforts are becoming steadily smaller in scale and easier to hide and disperse. Much of the data is now public. Computer simulation and pilot-scale testing can now be substituted for the large-scale efforts of the past, and permit much smaller efforts than those of Israel, India, Pakistan, and South Africa. It would require continuing IAEA inspection of all mining, processing, and enrichment related research efforts, and the analysis of weapons system delivery programs to firmly determine whether Iran's programs proved it was acquiring nuclear weapons.

Iran can also compartmentalize its efforts so the researchers involved may not know the real purpose of the effort or to achieve "deniability." For example, Austrian scientists were discovered in 1997 to have spent a year working on a cyclotron at Iran's Karaj nuclear research center that some experts felt might be used as a prototype for processing uranium, and which other experts felt might be legitimate medical research. Only on-site inspection could hope to resolve such issues, provided that the ultimate intent of the program was clear from the physical evidence, its records, or interviews.¹²⁰

Similarly, British customs officials seized 50 kilograms (110 pounds) of maraging steel in June, 1996. Maraging steel is a controlled export that can be used for some conventional weapons, including ballistic missiles, although its most likely use is the manufacture of centrifuges. The smuggler was identified as Ali Asghar Manzarpour, a British citizen of Iranian origin living in Brighton. Manzarpour was charged in a Brighton court on July 31, 1996. The Iranian effort to import maraging steel could not be linked to a specific end-user facility, and only intrusive challenge inspection could have hoped to identify the true end use of the material - provided that sufficient intelligence existed to identify the precise facility in Iran.¹²¹ These same problems arose much earlier when Iran bought extensive amounts of nuclear centrifuge technology from Germany -- although it denied doing so -- and other specialized equipment that could be used to design and manufacture nuclear weapons, and simulate nuclear tests.¹²²

The question is how this situation can be changed in the future. The Governors of the IAEA took up a proposal in May 1997, that allows the IAEA to inspect any facility in an NPT country, whether it was declared or not. The proposal also allows routine environmental monitoring to detect the small amounts of isotopes that are likely to escape from any industrial scale plant or process, and use spectrometry to identify the isotopic ratio of a sample containing a billionth of a gram of material. This monitoring would probably detect any unusual ratio of U-235 to U-238, and the presence of any element involved in Plutonium processing in unusual amounts, as well as the products of nuclear fission like radioactive iodine and krypton isotopes. Small samples from the surface of walls and equipment, along with soil, water, air, and vegetation samples might reveal a great deal.¹²³ The IAEA does not currently carry out such an intrusive inspection regime in Iran, and still might not find a well-dispersed covert programs if it did.¹²⁴

Furthermore, fully effective cooperation is dependent on the existence of some kind of secure forum for exchanging data that prevented the leakage of sensitive intelligence material. It has become clear to US intelligence professionals that there are severe limits on how much detail on Iran's efforts can be briefed to other states. Classified briefings to nations in the Gulf, some European countries, and Japan have led to extensive leaks, and because the foreign ministries of export-oriented countries tend to ignore the advice on their own national intelligence services.

Meaningful enforcement of a non-proliferation inspection effort also requires better international cooperation in reporting the export of dual-use technology, and arrangements that allowed the IAEA to directly interrogate countries as to the purpose of such exports and their end user, and to then inspect the resulting supplier facilities. Only a few countries really cooperate in pooling sensitive export data, and none allow foreign inspection of possible suppliers. Most countries also carefully compartmentalize their efforts to control nuclear proliferation so that only a few officials know the full details.

In summary, the IAEA effort to date, and Iranian denials, scarcely mean that Iran does not have a clandestine nuclear program. Many Western experts believe that the fact that Iran has clandestinely sought the material needed for a nuclear weapons effort for more than a decade and that the inability to target given facilities is simply a reflection of Iran's success in carrying out a covert program.

Possible Dates for Iran's Acquisition of Nuclear Weapons

There is no way to estimate when Iran will get nuclear weapons or to be certain that Iran will push its nuclear programs forward to the point where it has actual weapons. As has been noted earlier, President Khatami replaced Reza Amrolahi -- the long-serving head of the Atomic Energy Organization of Iran -- in early September 1997. He replaced Amrolahi with Iran's former Oil Minister, Gholamreza Aghazadeh, who was also appointed a Vice President and a member of the Expediency Council. Such an appointment could mean that Khatami was emphasizing the effective management of Iran's nuclear power program, seeking new direction for its nuclear weapons effort, or simply be part of the normal process of bureaucratic rotation and change.¹²⁵

If Iran does push forward with nuclear weapons, it seems unlikely that it will acquire them in the near-term, unless it can somehow buy fissile material from an outside source. As Lt. General Binford Peay, the commander of USCENTCOM, stated in June, 1997, "I would predict to you that it would be some time at the turn of the next century...I wouldn't want to put a date on it. I don't know if its 2010, 2007, 2003. I am just saying its coming closer. Your instincts tell you that that's the kind of speed they are moving at."¹²⁶

Some sources have indicated that Iran may be able to build a weapon relatively quickly, but they have generally proved pessimistic. Robert Gates, then Director of Central Intelligence, testified to Congress in February 1992, that Iran was "building up its special weapons capability as part of a massive...effort to develop its military and defense capability."¹²⁷ In 1992 press reports by the US Central Intelligence Agency (CIA), National Intelligence Estimates (NIE) on this subject indicated that the CIA estimated Iran could have a nuclear weapon by the year 2000. Reports coming out of Israel in January 1995, also claimed that the US and Israel estimated Iran could have a nuclear weapon in five years.¹²⁸

Other sources believe it may take Iran substantially longer to obtain nuclear weapons. US intelligence sources denied the reports coming out of Israel and estimated that it might take seven to fifteen years for Iran to acquire a nuclear weapon.¹²⁹ As has been mentioned earlier, John Holum testified to Congress in 1995 that Iran could have the bomb by 2003. In 1997, he testified that Iran could have the bomb by 2005-2007.¹³⁰ Although two years had passed in which

Iran might have made substantial progress, the US estimate of the earliest date at which Iran could make its own bomb slipped by two to four years.

Such estimates are inherently uncertain. US Secretary of Defense William Perry stated on January 9, 1995, "We believe that Iran is trying to develop a nuclear program. We believe it will be many, many years until they achieve such a capability. There are some things they might be able to do to short-cut that time."¹³¹ In referring to "short cuts," Secretary Perry was concerned with the risk that Iran could obtain fissile material and weapons technology from the former Soviet Union or some other nation capable of producing fissile material.

This risk creates is perhaps the greatest single serious uncertainty regarding Iran's nuclear capabilities. For example, reports during 1992 and 1993 that Iran had hired large numbers of Soviet nuclear weapons scientists which proved to be unreliable.¹³² At the same time, there is no doubt that the whereabouts of significant numbers of FSU scientists and technicians cannot be accounted for, that some have gone to Iran, and that a large technology transfer effort may have taken place.

Similarly, reports of Iran's real efforts to acquire nuclear materials and technology had led to exaggerated reports, Iran made a major effort to buy beryllium from a storage site in Kazakhstan in 1992 that then also stored some 600 kilograms of highly enriched uranium. In 1994, the secretly bought the fuel and flew it out of the country.¹³³ It is clear that it did so because of the fear it might fall into Iranian hands. At the same time, the US has never stated the exact nature of Iran's efforts to buy the material and far more dramatic reports that Iran had succeeded in buying weapons-grade material from the former Soviet Union, or nuclear armed missiles from Kazakhstan proved to be unsubstantiated.

In 1996, John M. Deutch – then the Director of Central Intelligence, testified to Congress that: "We judge that Iran is actively pursuing an indigenous nuclear weapons capability. . . . Specifically, Iran is attempting to develop the capability to produce both plutonium and highly enriched uranium. In an attempt to shorten the timeline to a weapon, Iran has launched a parallel effort to purchase fissile material, mainly from sources in the former Soviet Union." He indicated that Iran's indigenous uranium-enrichment program seemed to be focused on the development of gas centrifuges, and that Iran's nuclear weapons program was still at least eight to ten years away from producing nuclear arms although this time could be shortened significantly with foreign assistance.¹³⁴

A detailed Department of Defense report on proliferation was issued in 1997. It did not comment on the timing of Iran's nuclear efforts. It did, however, draw broad conclusions about the scale of the Iranian nuclear program and how it fit into Iran's overall efforts to acquire weapons of mass destruction. These conclusion still seem to broadly reflect the Department's views:¹³⁵

Iran's national objectives and strategies are shaped by its regional political aspirations, threat perceptions, and the need to preserve its Islamic government. Tehran strives to be a leader in the Islamic world and seeks to be the dominant power in the Gulf. The latter goal brings it into conflict with the United States. Tehran would like to diminish Washington's political and military influence in the region. Iran also remains hostile to the ongoing Middle East peace process and supports the use of terrorism as an element of policy. Within the framework of its national goals, Iran continues to give high priority to expanding its NBC weapons and missile programs. In addition, Iran's emphasis on pursuing independent production capabilities for NBC weapons and missiles is driven by its experience during the 1980-1988 war with Iraq,

during which it was unable to respond adequately to Iraqi chemical and missile attacks and suffered the effects of an international arms embargo.

Iran perceives that it is located in a volatile and dangerous region, virtually surrounded by potential military threats or unstable neighbors. These include the Iraqi government of Saddam Hussein, Israel, U.S. security agreements with the Gulf Cooperation Council (GCC) states and accompanying U.S. military presence in the Gulf, and instability in Afghanistan and the Central Asian states of the former Soviet Union.

Iran still views Baghdad as the primary regional threat to the Islamic Republic, even though Iraq suffered extensive damage during the Gulf War. Further, Iran is not convinced that Iraq's NBC programs will be adequately restrained or eliminated through continued UN sanctions or monitoring. Instead, the Iranians believe that they will face yet another challenge from their historical rival.

Tehran is concerned about strong U.S. ties with the GCC states because these states have received substantial amounts of modern Western conventional arms, which Tehran seeks but cannot acquire, and because U.S. security guarantees make these states less susceptible to Iranian pressure. While Tehran probably does not believe GCC nations have offensive designs against the Islamic Republic, it may be concerned that the United States will increase mistrust between Iran and the Arab states. It also likely fears that the sizable U.S. military presence in the region could lead to an attack against Iran. Iran may also be concerned by Israel's strategic projection capabilities and its potential to strike Iran in a variety of ways. For all these reasons, Tehran probably views NBC weapons and the ability to deliver them with missiles as decisive weapons for battlefield use, as deterrents, and as effective means for political intimidation of less powerful neighboring states.

In recent years, Iran's weak economy has limited the development of its NBC weapons and missile programs, although oil price increases in 1996 may have relieved the pressure at least temporarily. Tehran's international debt exceeds \$30 billion, although Iran is meeting its debt repayment obligations. Iran also is facing a rapidly growing population which will exact greater future demands from its limited economy. Despite these internal problems, Iran assigns a high priority to attaining production self-sufficiency for NBC weapons and missiles. Therefore, funding for these efforts is likely to be a high priority for the next several years.

Tehran has attempted to portray U.S. containment efforts as unjust, in an attempt to convince European or Asian suppliers to relax export restrictions on key technologies. At the same time, foreign suppliers must consider the risk of sanctions or political embarrassment because of U.S.-led containment efforts.

Iran's nuclear program, focusing on electric power production, began during the 1970s under the Shah. Research and development efforts also were conducted on fissile material production, although these efforts were halted during the Iranian revolution and the Iran-Iraq war. However, the program has been restarted, possibly in reaction to the revelations about the scope of Iraq's nuclear weapons program.

Iran is trying to acquire fissile material to support development of nuclear weapons and has set up an elaborate system of military and civilian organizations to support its effort. Barring outright acquisition of a nuclear weapon from a foreign source, Iran could pursue several other avenues for weapon development. The shortest route, depending on weapon design, could be to purchase or steal fissile material. Also, Iran could attempt to produce highly enriched uranium if it acquired the appropriate facilities for the front-end of the nuclear fuel cycle. Finally, Iran could pursue development of an entire fuel cycle, which would allow for long-term production of plutonium, similar to the route North Korea followed.

Iran does not yet have the necessary infrastructure to support a nuclear weapons program, although is actively negotiating for purchase of technologies and whole facilities to support all of the above strategies. Iran claims it is trying to establish a complete nuclear fuel cycle to support a civilian energy program, but this same fuel cycle would be applicable to a nuclear weapons development program. Iran is seeking foreign sources for many elements of the nuclear fuel cycle. Chinese and Russian supply policies are key to whether Iran will successfully acquire the needed technology, expertise, and infrastructure to manufacture the fissile material for a weapon and the ability to fashion a usable device. Russian or Chinese supply of nuclear power reactors, allowed by the NPT, could enhance Iran's limited nuclear infrastructure and advance its nuclear weapons program.

Iran has had a chemical weapons production program since early in the Iran-Iraq war. It used chemical agents to respond to Iraqi chemical attacks on several occasions during that war. Since the early 1990s, it has put a high priority on its chemical weapons program because of its inability to respond in kind to Iraq's chemical attacks and the discovery of substantial Iraqi efforts with advanced agents, such as the highly persistent nerve agent VX. Iran ratified the CWC, under which it will be obligated to eliminate its chemical

program over a period of years. Nevertheless, it continues to upgrade and expand its chemical warfare production infrastructure and munitions arsenal.

Iran manufactures weapons for blister, blood, and choking agents; it is also believed to be conducting research on nerve agents. Iran has a stockpile of these weapons, including artillery shells and bombs, which could be used in another conflict in the region.

Although Iran is making a concerted effort to attain an independent production capability for all aspects of its chemical weapons program, it remains dependent on foreign sources for chemical warfare-related technologies. China is an important supplier of technologies and equipment for Iran's chemical warfare program. Therefore, Chinese supply policies will be key to whether Tehran attains its long-term goal of independent production for these weapons.

Iran's biological warfare program began during the Iran-Iraq war. The pace of the program probably has increased because of the 1995 revelations about the scale of Iraqi efforts prior to the Gulf War. The relative low cost of developing these weapons may be another motivating factor. Although this program is in the research and development stage, the Iranians have considerable expertise with pharmaceuticals, as well as the commercial and military infrastructure needed to produce basic biological warfare agents. Iran also can make some of the hardware needed to manufacture agents. Therefore, while only small quantities of usable agent may exist now, within 10 years, Iran's military forces may be able to deliver biological agents effectively. Iran has ratified the BWC.

Iran has an ambitious missile program, with SCUD B, SCUD C, and CSS-8 (a Chinese surface-to-surface missile derived from a surface-to-air missile) missiles in its inventory. Having first acquired SCUD missiles from Libya and North Korea for use during the Iran-Iraq war, the Iranians are now able to produce the missile themselves. This has been accomplished with considerable equipment and technical help from North Korea. Iran has made significant progress in the last few years toward its goal of becoming self-sufficient in ballistic missile production.

Iran produces the solid-propellant 150 kilometer range Nazeat 10 and 200 kilometer range Zelzal unguided rockets. Iran also is trying to produce a relatively short-range solid-propellant missile. For the longer term, Iran's goal is to establish the capability to produce medium range ballistic missiles to expand its regional influence. It is attempting to acquire production infrastructure to enable it to produce the missiles itself. Like many of Iran's other efforts, success with future missile capabilities will depend on key equipment and technologies from China, North Korea, and Russia.

Iran's missiles allow it to strike a wide variety of key economic and military targets in several neighboring countries, including Turkey, Saudi Arabia, and the other Gulf states. Possible targets include oil installations, airfields, and ports, as well as U.S. military deployment areas in the region. All of Iran's missiles are on mobile launchers, which enhance their survivability. Should Iran succeed in acquiring or developing a longer range missile like the North Korean No Dong, it could threaten an even broader area, including much of Israel.

Iran has purchased land-, sea, and air-launched short range cruise missiles from China; it also has a variety of foreign-made air-launched short range tactical missiles. Many of these systems are deployed as anti-ship weapons in or near the Gulf. Iran also has a variety of Western and Soviet-made fighter aircraft, artillery, and rockets available as potential means of delivery for NBC weapons.

In the future, as Iran becomes more self-sufficient at producing chemical or biological agents and ballistic missiles, there is a potential that it will become a supplier. For example, Iran might supply related equipment and technologies to other states trying to develop capabilities, such as Libya or Syria. There is precedent for such action; Iran supplied Libya with chemical agents in 1987.

Martin Indyck, the Assistant Secretary of State for Near East Affairs, testified to the Senate Foreign Relations Committee on July 28, 1998, that Iran's Shihab-3 and Shihab-4 programs were clearly linked to its efforts to acquire nuclear weapons. He made it clear that the missiles would give Iran the range to hit targets in Israel, Turkey, and Saudi Arabia. In regard to Iran's nuclear program, Indyck stated that Iran had a "clandestine nuclear weapons program. People tend to say that a nuclear weapons capability is many years off. Our assessments vary. I

would want to be a bit cautious about that because I believe there are large gaps in our knowledge of what is going on there because it's a clandestine program."¹³⁶

There has been relatively little new formal testimony on the nature of US estimates of the timing of Iran's nuclear program, and the Director of the CIA did not address this subject in his testimony to Congress on the "world Wide Threat" on February 2, 2000. US intelligence has, however, continued to flag the Iranian nuclear threat as part of its broader assessments of Iran's efforts to proliferate. Since 1997, the Non-Proliferation Center of the office of the Director of Central Intelligence has issued a series of unclassified reports on Iran's efforts to acquire nuclear weapons technology. The latest version of the report was issued in February 2000, and focuses on developments in Iran since 1998,¹³⁷

Iran remains one of the most active countries seeking to acquire WMD and ACW technology from abroad. In doing so, Tehran is attempting to develop an indigenous capability to produce various types of weapons—nuclear, chemical, and biological—and their delivery systems. During the reporting period, Iran focused its efforts to acquire WMD- and ACW- related equipment, materials, and technology primarily on entities in Russia, China, North Korea and Western Europe.

For the first half of 1999, entities in Russia and China continued to supply a considerable amount and a wide variety of ballistic missile-related goods and technology to Iran. Tehran is using these goods and technologies to support current production programs and to achieve its goal of becoming self-sufficient in the production of ballistic missiles. Iran already is producing Scud short-range ballistic missiles (SRBMs) and has built and publicly displayed prototypes for the Shahab-3 medium-range ballistic missile (MRBM), which had its initial flight test in July 1998 and probably has achieved "emergency operational capability"- i.e., Tehran could deploy a limited number of the Shahab-3 prototype missiles in an operational mode during a perceived crisis situation. In addition, Iran's Defense Minister last year publicly acknowledged the development of the Shahab-4, originally calling it a more capable ballistic missile than the Shahab-3, but later categorizing it as solely a space launch vehicle with no military applications. Iran's Defense Minister also has publicly mentioned plans for a "Shahab 5."

For the reporting period, Tehran continued to seek considerable dual-use biotechnical equipment from entities in Russia and Western Europe, ostensibly for civilian uses. Iran began a biological warfare (BW) program during the Iran-Iraq war, and it may have some limited capability for BW deployment. Outside assistance is both important and difficult to prevent, given the dual-use nature of the materials, the equipment being sought, and the many legitimate end uses for these items.

Iran, a Chemical Weapons Convention (CWC) party, already has manufactured and stockpiled chemical weapons, including blister, blood, and choking agents and the bombs and artillery shells for delivering them. During the first half of 1999, Tehran continued to seek production technology, expertise, and chemicals that could be used as precursor agents in its chemical warfare (CW) program from entities in Russia and China. It also acquired or attempted to acquire indirectly through intermediaries in other countries equipment and material that could be used to create a more advanced and self-sufficient CW infrastructure.

Iran sought nuclear-related equipment, material, and technical expertise from a variety of sources, especially in Russia, during the first half of 1999. Work continues on the construction of a 1,000-megawatt nuclear power reactor in Bushehr, Iran, that will be subject to International Atomic Energy Agency (IAEA) safeguards. In addition, Russian entities continued to interact with Iranian research centers on various activities. These projects will help Iran augment its nuclear technology infrastructure, which in turn would be useful in supporting nuclear weapons research and development. The expertise and technology gained, along with the commercial channels and contacts established—even from cooperation that appears strictly civilian in nature—could be used to advance Iran's nuclear weapons research and developmental program.

Russia has committed to observe certain limits on its nuclear cooperation with Iran. For example, President Yel'tsin has stated publicly that Russia will not provide militarily useful nuclear technology to Iran. Beginning in January 1998, the Russian Government took a number of steps to increase its oversight of entities involved in dealings with Iran and other states of proliferation concern. In 1999, it pushed a new export control law through the Duma. Russian firms, however, faced economic pressures to circumvent these controls and did so in some cases. The Russian Government, moreover, failed in some cases regarding Iran to enforce its export controls. Following repeated warnings, the US Government in January 1999 imposed administrative measures against Russian entities that had engaged in nuclear- and missile-

related cooperation with Iran. The measures imposed on these and other Russian entities (which were identified in 1998) remain in effect.

China pledged in October 1997 not to engage in any new nuclear cooperation with Iran but said it would complete cooperation on two ongoing nuclear projects, a small research reactor and a zirconium production facility at Esfahan that Iran will use to produce cladding for reactor fuel. The pledge appears to be holding. As a party to the Nuclear Nonproliferation Treaty (NPT), Iran is required to apply IAEA safeguards to nuclear fuel, but safeguards are not required for the zirconium plant or its products.

Iran is attempting to establish a complete nuclear fuel cycle for its civilian energy program. In that guise, it seeks to obtain whole facilities, such as a uranium conversion facility, that, in fact, could be used in any number of ways in support of efforts to produce fissile material needed for a nuclear weapon. Despite international efforts to curtail the flow of critical technologies and equipment, Tehran continues to seek fissile material and technology for weapons development and has set up an elaborate system of military and civilian organizations to support its effort.

Unofficial or leaked estimates, however, have appeared to grow more pessimistic. The New York Times and Washington Post published reports in January 2000 that the CIA now estimated that it could not characterize the timing of the Iranian nuclear weapons program, and that Iran might already have a bomb. These reports, however, seem to have dealt with an intelligence report that focused on the inherent uncertainties in estimating Iranian capabilities, rather than to have been the result of any radical change in an estimate of how rapidly Iran could produce a weapon.¹³⁸

Further background leaks following the New York Times report indicated that the CIA had concluded that Iran was capable of completing the design and manufacture of all aspects of a nuclear weapon except the acquisition of fissile material – a accomplishment that Iraq had also mastered by 1990. While the details of the report were never leaked, it seems likely that it concluded that Iran could now design medium sized plutonium and uranium weapons, and manufacture the high explosive lens, neutron initiators, high speed capacitors, and other components of the weapon. It could conduct not fissile simulations of the explosive behavior of such designs using modern test equipment in ways similar to the Iraqi and Pakistani nuclear programs, and could rapidly assemble a weapon from these components if it could obtain illegal fissile material. It seems likely that the report concluded that Iran now had the technology for processing highly enriched Plutonium simply because no country that has ever seriously attempted such processing has failed, but that Iran would need fissile or borderline fissile uranium to make a bomb. As a result, the key uncertainty was whether the US could monitor all potential sources of fissile material with enough accuracy to ensure that Iran did not have a weapon and the answer was no.,

Although any such conclusions are speculative, it also seems likely that the US intelligence community has concluded that it is not possible to perfectly identify the level of Iranian nuclear weapons efforts, the specific organizations involved, the location and nature of all facilities, the foreign purchasing offices, and Iran's technical success. US intelligence certainly knows far more than it makes public, but Iran has been carrying out a covert program since the Shah without one known case of a major defector or public example of a reliable breakthrough in Humint. It also learned during the Iran-Iraq War that it needed to ensure its facilities were not centralized and vulnerable, and had to conceal its activities as much as possible from any kind of intelligence surveillance. The strengthening of the NPT inspection regime, and Iran's search for a more moderate effort, has almost certainly reinforced these efforts to conceal its programs.¹³⁹

CIA Deputy Director for Intelligence, John McLaughlin, made the following broad comments on the uncertainties in estimating the nature of efforts to proliferate in an interview in January 2000.¹⁴⁰

"I would say the problem of proliferation of weapons of mass destruction is becoming more complex and difficult, ... We're starting to see more evidence of what I might call kind of secondary proliferation. That is more evidence of sharing of information and data among countries that are striving to obtain weapons... As the systems mature in the obvious countries like North Korea and Iran, they themselves have the potential to start becoming sources of proliferation as distinct from aspirants. And that begins to complicate the whole picture ... In the intelligence business (denial and deception) is an art form unto itself, it is how do you deny information to the other side and how do you deceive the other side?... Countries that are building such weapons are learning more and more about how to do that, making our job harder,... So if there is an issue that is to me personally worrying, it's the increasing complexity of the proliferation challenge... To some degree we're dealing with problems that are fuelled by hundreds of years of history. At the same time this past is colliding with the future, because you have these same people now using laptop computers and commercial encryption... You're not going to find that information on their Web sites. You're going to have to go out and get it somewhere clandestinely, either through human collection or through technical means,"

At present, most experts feel that Iran has all the basic technology to build a bomb, but lacks any rapid route to getting fissile uranium and plutonium unless it can steal or buy it from another country. They also believe that Iran is increasingly worried about preemptive strikes by Israel or the US. As a result, Iran deliberately has lowered the profile of its activities and only conducts a low-to-moderate level weapons design and development effort.¹⁴¹ No serious expert has claimed that a major weapons grade production effort has yet been detected. As a result, many feel that Iran is at least to five to seven years away from acquiring a nuclear device using its own enriched material, and be six to nine years away from acquiring the ability to design a nuclear weapon that can be fitted in the warhead of a long-range missile system.

The "wild card" in all these estimates is that the deadlines would change so radically if Iran could buy fissile material from another nation or source -- such as the 500 kilograms of fissile material the US airlifted out of Kazakhstan in 1994. This was enough material to make up to 25 nuclear weapons, and the US acted primarily because Iran was actively seeking to buy such material.¹⁴² If Iran could obtain weapons grade material, a number of experts believe that it could probably develop a gun or simple implosion nuclear weapon in nine to 36 months.

The risk of such a transfer of fissile material is significant. US experts believe that all of the weapons and fissile material remaining in the former Soviet Union are now stored in Russian facilities. The security of these facilities is still erratic, however, and there is a black market in nuclear material. While the radioactive material sold on the black market by the CIS and Central European citizens to date has consisted largely of plutonium 240, low grade enriched uranium, or isotopes of material which have little value in a nuclear weapons program, this is no guarantee for the future. There are also no guarantees that Iran will not be able to purchase major transfers of nuclear weapons components and nuclear ballistic missile warhead technology.

Iran's Nuclear Warfighting Doctrine and Capabilities

It is possible to speculate at vast length on what Iran would do with nuclear weapons. However, it is impossible to determine how aggressively Iran would exploit such a capability in terms of threatening or intimidating its neighbors, or putting pressure on the West. Trying to guess at Iran's nuclear warfighting doctrine and actions is as speculative as guesses about how it

would use biological weapons. It is quite possible that Iran has not yet looked far enough beyond its nuclear weapons acquisition efforts to work out detailed plans for possession. There is no way to know if Iran would choose a relatively stable model of deterrence or aggressively exploit its possession politically. It is equally difficult to guess whether Iran would develop an aggressive doctrine for use, consider developing a launch on warning/launch under attack capability, or reserve the use of such a weapon as a last resort.¹⁴³

What is clear is that if Iran acquired a working nuclear device, this would suddenly and radically change perceptions of the military balance in the region. Iran is likely to acquire such weapons at about the same time it acquires MRBMs and this would be a volatile combination. Iran could destroy any hardened target, area target, or city within the range of its delivery systems. Iran's Southern Gulf neighbors are extremely vulnerable to attacks on a few cities, and even one successful nuclear attack might force a fundamental restructuring of their politics and/or economy. They are effectively "one bomb" countries.

Iranian nuclear capabilities would raise major mid-term and long-term challenges to the Southern Gulf states and to the West in terms of deterrence, defense, retaliation, and arms control. It would almost certainly accelerate efforts to deploy theater missile defenses -- although such systems seem more likely to be "confidence builders" than leak proof. It would almost certainly lead the US to consider counter-proliferation strikes on Iran, and to work with its Southern Gulf allies in developing an adequate deterrent. Given the US rejection of biological and chemical weapons, this raises the possibility of creating a major US theater nuclear deterrent, although such a deterrent could be sea and air based and deployed outside the Gulf.

If the US failed to provide such a deterrent, it seems likely that the Southern Gulf states would be forced to accommodate Iran or seek weapons of mass destruction of their own. Further, such Iranian possession would almost certainly trigger a major new Iraqi effort to acquire such weapons, and make any efforts at arms control meaningless for some years to come.

It is also impossible to dismiss the possibility that Iran or Iraq would chose to develop and use a "radiological weapon." Such a weapon could take three forms -- all of which would interact with its potential use of chemical and biological weapons.

- *The first would be a "dirty weapon" using fissile material with contaminated or low enrichment levels that would have limited heat and blast effects, but still produce yields of 3 to 5 kilotons, and which would effectively poison a city if detonated near the ground. Such a device would reduce some of the manufacturing and design problems inherent in creating clean or efficient nuclear weapons.*
- *The second would be to use a weapon that had not been tested, which was felt to be unreliable, or which was on an inaccurate missile and detonate it near the ground so that radiation effects compensate for a failure to reach design efficiency or accuracy of the delivery system.*
- *The third would be to use radioactive material in micro-powder or liquid form as a terror or unconventional weapon. It would be very difficult to get substantial lethality from the use of radioactive material, and such a weapon would be less efficient than*

biological weapons in terms of weight and lethality. It would, however, have the capacity to contaminate a key area and to create panic.

While the US and Russia have rejected radiological weapons because they have the ability to precisely control the yield from their nuclear weapons, such options might be attractive to Iran or Iraq. As is the case with chemical and biological weapons, even the prospect of Iran's acquiring any such nuclear weapons has increased its ability to intimidate its neighbors.

As for warfighting capability, the actual yield and effects of any Iranian nuclear weapon are probably not key issues. Any working nuclear device Iran is likely to develop will be sufficient to destroy any hardened target, area target, or city in the Middle East. Nuclear weapons do, however, differ sharply in their effect as they grow in size. It is not possible to quantify these effects in terms of fallout, and the data on prompt radiation are controversial in terms of their lethal effect.

Iran's nuclear programs will also be heavily interactive with its biological and chemical programs and its efforts to improve its delivery capabilities. By the time Iran has significant nuclear capability, it also should have significant missile, cruise missile, and long-range strike aircraft capability -- although it may not have cruise missiles capable of carrying a nuclear weapon. It should have rebuilt much of its conventional capabilities to the point where it has significant warfighting capabilities, and it will pose a major threat to other nations in the region - possibly as far away as Israel.

Part Two

A Summary Outline of Iran's Past Efforts to Proliferate

Delivery Systems

- The Soviet-designed Scud B (17E) guided missile currently forms the core of Iran's ballistic missile forces -- largely as a result of the Iran-Iraq War.
- Iran only acquired its Scuds in response to Iraq's invasion. It obtained a limited number from Libya and then obtained larger numbers from North Korea. It deployed these units with a special Khatam ol-Anbya force attached to the air element of the Pasdaran. Iran fired its first Scuds in March, 1985. It fired as many as 14 Scuds in 1985, 8 in 1986, 18 in 1987, and 77 in 1988. Iran fired 77 Scud missiles during a 52 day period in 1988, during what came to be known as the "war of the cities." Sixty-one were fired at Baghdad, nine at Mosul, five at Kirkuk, one at Takrit, and one at Kuwait. Iran fired as many as five missiles on a single day, and once fired three missiles within 30 minutes. This still, however, worked out to an average of only about one missile a day, and Iran was down to only 10-20 Scuds when the war of the cities ended.
- Iran's missile attacks were initially more effective than Iraq's attacks. This was largely a matter of geography. Many of Iraq's major cities were comparatively close to its border with Iran, but Tehran and most of Iran's major cities that had not already been targets in the war were outside the range of Iraqi Scud attacks. Iran's missiles, in contrast, could hit key Iraqi cities like Baghdad. This advantage ended when Iraq deployed extended range Scuds.
- The Scud B is a relatively old Soviet design which first became operational in 1967, designated as the R-17E or R-300E. The Scud B has a range of 290-300 kilometers with its normal conventional payload. The export version of the missile is about 11 meters long, 85-90 centimeters in diameter, and weighs 6,300 kilograms. It has a nominal CEP of 1,000 meters. The Russian versions can be equipped with conventional high explosive, fuel air explosive, runway penetrator, submunition, chemical, and nuclear warheads.
- The export version of the Scud B comes with a conventional high explosive warhead weighing about 1,000 kilograms, of which 800 kilograms are the high explosive payload and 200 are the warhead structure and fusing system. It has a single stage storable liquid rocket engine and is usually deployed on the MAZ-543 eight wheel transporter-erector-launcher (TEL). It has a strap-down inertial guidance, using three gyros to correct its ballistic trajectory, and uses internal graphite jet vane steering. The warhead hits at a velocity above Mach 1.5.
- Most estimates indicate that Iran now has 6-12 Scud launchers and up to 200 Scud B (R-17E) missiles with 230-310 KM range.
- Some estimates give higher figures. They estimate Iran bought 200-300 Scud Bs from North Korea between 1987 and 1992, and may have continued to buy such missiles after that time. Israeli experts estimate that Iran had at least 250-300 Scud B missiles, and at least 8-15 launchers on hand in 1997.
- US experts also believe that Iran can now manufacture virtually all of the Scud B, with the possible exception of the most sophisticated components of its guidance system and rocket motors. This makes it difficult to estimate how many missiles Iran has in inventory and can acquire over time, as well as to estimate the precise performance characteristics of Iran's missiles, since it can alter the weight of the warhead and adjust the burn time and improve the efficiency of the rocket motors
- Iran has new long range North Korean Scuds - with ranges near 500 kilometers.
 - The North Korean missile system is often referred to as a "Scud C." Typically, Iran formally denied the fact it had such systems long after the transfer of these missiles became a reality. Hassan Taherian, an Iranian foreign ministry official, stated in February, 1995, "There is no missile cooperation between Iran and North Korea whatsoever. We deny this."
 - In fact, a senior North Korean delegation traveled to Tehran to close the deal on November 29, 1990, and met with Mohsen Rezaei, the former commander of the IRGC. Iran either bought the missile then,

or placed its order shortly thereafter. North Korea then exported the missile through its Lyongaksan Import Corporation. Iran imported some of these North Korean missile assemblies using its B-747s, and seems to have used ships to import others.

- Iran probably had more than 60 of the longer range North Korean missiles by 1998, although other sources report 100, and one source reports 170.
- Iran may have 5-10 Scud C launchers, each with several missiles. This total seems likely to include four new North Korean TELs received in 1995.
- Iran seems to want enough missiles and launchers to make its missile force highly dispersible.
- Iran has begun to test its new North Korean missiles. There are reports it has fired them from mobile launchers at a test site near Qom about 310 miles (500 kilometers) to a target area south of Shahroud. There are also reports that units equipped with such missiles have been deployed as part of Iranian exercises like the Saeqer-3 (Thunderbolt 3) exercise in late October, 1993.
- The missile is more advanced than the Scud B, although many aspects of its performance are unclear. North Korea seems to have completed development of the missile in 1987, after obtaining technical support from the People's Republic of China. While it is often called a "Scud C," it seems to differ substantially in detail from the original Soviet Scud B. It seems to be based more on the Chinese-made DF-61 than on a direct copy of the Soviet weapon.
- Experts estimate that the North Korean missiles have a range of around 310 miles (500 kilometers), a warhead with a high explosive payload of 700 kilograms, and relatively good accuracy and reliability. While this payload is a bit limited for the effective delivery of chemical agents, Iran might modify the warhead to increase payload at the expense of range and restrict the using of chemical munitions to the most lethal agents such as persistent nerve gas. It might also concentrate its development efforts on arming its Scud C forces with more lethal biological agents. In any case, such missiles are likely to have enough range-payload to give Iran the ability to strike all targets on the southern coast of the Gulf and all of the populated areas in Iraq, although not the West. Iran could also reach targets in part of eastern Syria, the eastern third of Turkey, and cover targets in the border area of the former Soviet Union, western Afghanistan, and western Pakistan.
- Accuracy and reliability remain major uncertainties, as does operational CEP. Much would also depend on the precise level of technology Iran deployed in the warhead. Neither Russia nor the People's Republic of China seem to have transferred the warhead technology for biological and chemical weapons to Iran or Iraq when they sold them the Scud B missile and CSS-8. However, North Korea may have sold Iran such technology as part of the Scud C sale. If it did so, such a technology transfer would save Iran years of development and testing in obtaining highly lethal biological and chemical warheads. In fact, Iran would probably be able to deploy far more effective biological and chemical warheads than Iraq had at the time of the Gulf War.
- Iran may be working with Syria in such development efforts, although Middle Eastern nations rarely cooperate in such sensitive areas. Iran served as a transshipment point for North Korean missile deliveries during 1992 and 1993. Some of this transshipment took place using the same Iranian B-747s that brought missile parts to Iran. Others moved by sea. For example, a North Korean vessel called the *Des Hung Ho*, bringing missile parts for Syria, docked at Bandar Abbas in May, 1992. Iran then flew these parts to Syria. An Iranian ship coming from North Korea and a second North Korean ship followed, carrying missiles and machine tools for both Syria and Iran. At least 20 of the North Korean missiles have gone to Syria from Iran, and production equipment seems to have been transferred to Iran and to Syrian plants near Hama and Aleppo.
- Iran has created shelters and tunnels in its coastal areas which it could use to store Scud and other missiles in hardened sites and reduce their vulnerability to air attack.
- Iran can now assemble Scud and Scud C missiles using foreign-made components. It may soon be able to make entire missile systems and warhead packages in Iran.
- Iran is developing an indigenous missile production capability with both solid and liquid fueled missiles. Seems to be seeking capability to produce MRBMs.

- The present scale of Iran's production and assembly efforts is unclear. Iran seems to have a design center, at least two rocket and missile assembly plants, a missile test range and monitoring complex, and a wide range of smaller design and refit facilities.
- The design center is said to be located at the Defense Technology and Science Research Center, which is a branch of Iran's Defense Industry Organization, and located outside Karaj -- near Tehran. This center directs a number of other research efforts. Some experts believe it has support from Russian and Chinese scientists.
- Iran's largest missile assembly and production plant is said to be a North Korean-built facility near Isfahan, although this plant may use Chinese equipment and technology. There are no confirmations of these reports, but this region is the center of much of Iran's advanced defense industry, including plants for munitions, tank overhaul, and helicopter and fixed wing aircraft maintenance. Some reports say the local industrial complex can produce liquid fuels and missile parts from a local steel mill.
- A second missile plant is said to be located 175 kilometers east of Tehran, near Semnan. Some sources indicate this plant is Chinese-built and began rocket production as early as 1987. It is supposed to be able to build 600-1,000 Oghab rockets per year, if Iran can import key ingredients for solid fuel motors like ammonium perchlorate. The plant is also supposed to produce the Iran-130.
- Another facility may exist near Bandar Abbas for the assembly of the Seersucker. China is said to have built this facility in 1987, and is believed to be helping the naval branch of the Guards to modify the Seersucker to extend its range to 400 kilometers. It is possible that China is also helping Iran develop solid fuel rocket motors and produce or assemble missiles like the CS-801 and CS-802. There have, however, been reports that Iran is developing extended range Scuds with the support of Russian experts, and of a missile called the Tondar 68, with a range of 700 kilometers.
- Still other reports claim that Iran has split its manufacturing facilities into plants near Pairzan, Seman, Shiraz, Maghdad, and Islaker. These reports indicate that the companies involved in building the Scuds are also involved in Iran's production of poison gas and include Defense Industries, Shahid, Bagheri Industrial Group, and Shahid Hemat Industrial Group.
- Iran's main missile test range is said to be further east, near Shahroud, along the Tehran-Mashhad railway. A telemetry station is supposed to be 350 kilometers to the south at Taba, along the Mashhad-Isfahan road. All of these facilities are reportedly under the control of the Islamic Revolutionary Guards Corps.
- There were many reports during the late 1980s and early 1990s that Iran had ordered the North Korean No Dong missile, which was planned to have the capability to carry nuclear and biological missile warheads of up to 900 kilograms. This range would allow the missile to reach virtually any target in the Gulf, Turkey, and Israel. The status of the No Dong program has since become increasingly uncertain, although North Korea deployed some developmental types at test facilities in 1997.
 - The No-Dong underwent flight tests at ranges of 310 miles (500 kilometers) on May 29, 1993. Some sources indicate that Iranians were present at these tests. Extensive further propulsion tests began in August 1994, and some reports indicate operational training began for test crews in May 1995. Missile storage facilities began to be built in July 1995, and four launch sites were completed in October 1995.
 - The progress of the program has been slow since that time, and may reflect development problems. However, mobile launchers were seen deployed in northeast North Korea on March 24, 1997. According to some reports, a further seven launcher units were seen at a facility about 100 kilometers from Pyongyang.
 - The No-Dong 1 is a single-stage liquid-fueled missile, with a range of up to 1,000 to 1,300 kilometers (810 miles), although longer ranges may be possible with a reduced warhead and maximum burn. There are also indications that there may be a No-Dong 2, using the same rocket motor, but with an improved fuel supply system that allows the fuel to burn for a longer period.

- The missile is about 15.2 meters long -- four meters longer than the Scud B -- and 1.2 meters in diameter. The warhead is estimated to weigh 770 kilograms (1,200-1,750 pounds) and a warhead manufacturing facility exists near Pyongyang. The No-Dong has an estimated theoretical CEP of 700 meters at maximum range, versus 900 meters for the Scud B, although its practical accuracy could be as wide as 3,000-4,000 meters. It has an estimated terminal velocity of Mach 3.5, versus 2.5 for the Scud B, which presents added problems for tactical missile defense. The missile is be transportable on a modified copy of the MAZ-543P TEL that has been lengthened with a fifth axle and which is roughly 40 meters long. The added support stand for the vertical launch modes brings the overall length to 60 meters, and some experts questioned whether a unit this big is practical.
- Other reports during the later 1980s and early 1990s indicated that Iran was also interested in two developmental North Korean IRBMs called the Tapeo Dong 1 and Tapeo Dong 2
 - The Tapeo Dong 1 missile has an estimated maximum range of 2,000 kilometers, and the Tapeo Dong 2 may have a range up to 3,500 kilometers.
 - Both Tapeo Dongs are liquid fueled missiles which seem to have two stages.
 - Unlike the No-Dong, the Tapeo Dongs must be carried to a site in stages and then assembled at a fixed site. The No-Dong transporter may be able to carry both stages of the Tapeo Dong 1, but some experts believe that a special transporter is needed for the first stage of the Tapeo Dong 1, and for both stages of the Tapeo Dong 2.
- Since the early 1990s, the focus of reports on Iran's missile efforts have shifted, and it has since become clear that Iran is developing its own longer-range variants of the No Dong for indigenous production with substantial Russian and some Chinese aid:
 - As early as 1992, one such missile was reported to have a range of 800-930 miles and a 1,650 pound warhead. Reports differ sharply on its size. Jane's estimates a launch weight up to 16,000 kilograms, provided the system is derived from the No Dong. It could have a launch weight of 15,000 kilograms, a payload of 600 kilograms, and a range of 1,700-1,800 kilometers if it is based on a system similar to the Chinese CSS-5 (DF-21) and CSS-N3 ((JL-1). These systems entered service in 1983 and 1987.
 - A longer-range missile was said to have improved guidance components, a range of up to 1,240 miles and a warhead of up to 2,200 pounds.
 - IOC dates were then estimated to be 1999-2001.
 - Russia agreed in 1994 that it would adhere to the terms of the Missile Technology Control Regime and would place suitable limits on the sale or transfer of rocket engines and technology. Nevertheless, the CIA has identified Russia as a leading source of Iranian missile technology, and the State Department has indicated that President Clinton expressed US concerns over this cooperation to President Yeltsin. This transfer is one reason the President appointed former Ambassador Frank Wisner, and then Robert Galluci, as his special representatives to try to persuade Russia to put a firm halt to aid support of the Iran.
 - These programs are reported to have continuing support from North Korea, and from Russian and Chinese firms and technicians. One such Chinese firm is Great Wall Industries. The Russian firms include the Russian Central Aerohydrodynamic Institute, which has provided Iran's Shahid Hemmat Industrial Group (SHIG) with wind tunnels for missile design, equipment for manufacturing missile models, and the software for testing launch and reentry performance. They may also include Rosvoorouzhnie, a major Russian arms-export agency; NPO Trud, a rocket motor manufacturer; a leading research center called the Bauman Institute, and Polyus (Northstar), a major laser test and manufacturing equipment firm.
 - The CIA reported in June 1997 that Iran obtained major new transfers of new long-range missile technology from Russian and Chinese firms during 1996. Since that time, there have been many additional reports of technology transfer from Russia.

- The reports on Chinese technology transfers involve the least detail:
 - There have been past reports that Iran placed orders for PRC-made M-9 (CSS-6/DF-15) missile (280-620 kilometers range, launch weight of 6,000 kilograms).
 - It is more likely, however, that PRC firms are giving assistance in developing indigenous missile R&D and production facilities for the production of an Iranian solid fueled missile.
 - The US offered to provide China with added missile technology if it would agree to fully implement an end of technology transfer to Iran and Pakistan during meetings in Beijing on March 25-26, 1998.
- Recent reports and tests have provided more detail on the Shahab system:
- Some US experts believe that Iran tested booster engines in 1997 capable of driving a missile ranges of 1,500 kilometers. Virtually all US experts believe that Iran is rapidly approaching the point where it will be able to manufacture missiles with much longer ranges than the Scud B.
 - It is less clear when Iran will be able to bring such programs to the final development stage, carry out a full range of suitable test firings, develop highly lethal warheads, and deploy actual units. Much may still depends on the level of foreign assistance.
 - Eitan Ben Eliyahu -- the commander of the Israeli Air Force -- reported on April 14, 1997 that Iran had tested a missile capable of reaching Israel. The background briefings to his statement implied that Russia was assisting Iran in developing two missiles -- with ranges of 620 and 780 miles. Follow-on intelligence briefings that Israel provided in September, 1997, indicated that Russia was helping Iran develop four missiles. US intelligence reports indicate that China has also been helping Iran with some aspects of these missile efforts.
 - These missiles included the Shahab ("meteor") missiles, with performance similar to those previously identified with Iranian missiles adapted from North Korean designs.
 - The Israeli reports indicated that the Shahab 3 was a liquid-fueled missile with a range of 810 miles (1,200-1,500 kilometers) and a payload of 1550 pounds (700 kilograms).
 - Israel claimed the Shahab might be ready for deployment as early as 1999.
- Iran tested the Sahab 3 on July, 21 1998, claiming that it was a defensive action to deal with potential threats from Israel.
 - The missile flew for a distance of up to 620 miles, before it exploded about 100 seconds after launch. US intelligence sources could not confirm whether the explosion was deliberate, but indicated that the final system might have a range of 800-940 miles (a maximum of 1,240 kilometers), depending on its payload. The test confirmed the fact the missile was a liquid fueled system.
 - Gen. Mohammad Bagher Qalibaf, head of the Islamic Revolutionary Guards Corps' air wing publicly reported on August 2, 1998 that the Shahab-3 is 53-foot-long ballistic missile that can travel at 4,300 mph and carry a one-ton warhead at an altitude of nearly 82,000 feet. He claimed that the weapon was guided by an Iranian-made system that gives it great accuracy: "The final test of every weapon is in a real war situation but, given its warhead and size, the Shahab-3 is a very accurate weapon."
 - Other Iranian sources reported that the missile had a range of 800 miles. President Mohammad Khatami on August 1, 1998 stated that Iran was determined to continue to strengthen its armed forces, regardless of international concerns: "Iran will not seek permission from anyone for strengthening its defense capability."
 - Martin Indyck, the US Assistant Secretary for Near East Affairs testified on July 28, that the US estimated that the system needed further refinement but might be deployed in its initial operational form between September, 1998 and March, 1999.

- Iran publicly displayed the Shahab 3 on its launcher during a parade on September 25, 1998. The missile carrier bore signs saying, “The US can do nothing” and “Israel would be wiped from the map.”
- There are some reports of a Shahab-3B missile with extended range and a larger booster.
- The resulting system seems to be close to both the No-Dong and Pakistani Ghauri or Haff-5 missile, first tested in April 1998, raising questions about Iranian-North Korean-Pakistani cooperation.
- North Korean parades exhibiting the Tapeo Dong in September 1999 exhibited a missile with rocket motor and nozzle characteristics similar to those of the Sahab 3.
- In September 1999, the Revolutionary Guard exhibited another missile called the Zelzal, which it stated was “now in mass production.” The missile was said to have taken four and one-half years to develop and to be derived from the Zelzal 2, which the IRGC had exhibited earlier. Some estimates indicate that it can carry a warhead of 500 kilograms for up to 900 kilometers. However, the missile exhibited in Tehran was a rocket on a truck-mounted launch rail that seemed more likely to have a range of 150-200 kilometers.
- There have been growing reports that Iran might be using Russian technology to develop long-range missiles with ranges from 2,000 to 6,250 kilometers.
- Israeli and US intelligence sources have reported that that Iran is developing the Shahab 4, with a range of 2,000 kilometers (1,250 miles), a payload of around 2,000 pounds, and a CEP of around 2,400 meters. Some estimates indicate that this system could be operational in 2-5 years. US Assistant Secretary for Near East Affairs testified on July 28, 1998, that the US estimated that the system still needed added foreign assistance to improve its motors and guidance system.
 - Some reports indicate that the Shahab 4 is based on the Soviet SS-4 missile. Others that there is a longer range Shahab 5, based on the SS-4 or Tapeo Dong missile. Reports saying the Shahab is based on the SS-4 say it has a range of up to 4,000 kilometers and a payload in excess of one ton.)
 - Iran may have two other missile programs include longer-range systems, variously reported as having maximum ranges of 3,650, 4,500-5,000, 6,250, or 10,000 kilometers.
 - It seems clear that Iran has obtained some of the technology and design details of the Russian SS-4. The SS-4 (also known as the R-12 or “Sandal”) is an aging Russian liquid fuel designed that first went into service in 1959, and which was supposedly destroyed as part of the IRBM Treaty. It is a very large missile, with technology dating back to the early 1950s, although it was evidently updated at least twice during the period between 1959 and 1980. It has a CEP of 2-4 kilometers and a maximum range 2,000 kilometers, which means it can only be lethal with a nuclear warhead or a biological weapon with near-nuclear lethality.
 - At the same time, the SS-4’s overall technology is relatively simple and it has a throwweight of nearly 1,400 kilograms (3,000 pounds). It is one of the few missile designs that a nation with a limited technology base could hope to manufacture or adapt, and its throwweight and range would allow Iran to use a relatively unsophisticated nuclear device or biological warhead. As a result, an updated version of the SS-4 might be a suitable design for a developing country.
- Iran is reported to have carried out the test of a sea-launched ballistic missile in 1998.
- Russia has been a key supplier of missile technology.
 - Some sources have indicated that Russian military industries have signed contracts with Iran to help produce liquid fueled missiles and provide specialized wind tunnels, manufacture model missiles, and develop specialized computer software. For example, these reports indicate that the Russian Central Aerohydrodynamic Institute is cooperating with Iran’s Defense Industries Organization (DIO) and the DIO’s Shahid Hemmat Industrial Group (SHIG). The Russian State Corporation for Export and Import of Armament and Military Equipment (Rosvoorouzhnie) and Infor are also reported to be involved in deals with the SHIG. These deals are also said to include

specialized laser equipment, mirrors, tungsten-coast graphite material, and maraging steel for missile development and production. They could play a major role in help Iran develop long range versions of the Scud B and C, and more accurate variations of a missile similar to the No Dong.

- The Israeli press reported in August, 1997 that Israeli had evidence that Iran was receiving Russian support. In September, 1997, Israel urged the US to step up its pressure on Iran, and leaked reported indicating that private and state-owned Russian firms had provided gyroscopes, electronic components, wind tunnels, guidance and propulsion systems, and the components needed to build such systems to Iran.
- President Yeltsin and the Russian Foreign Ministry initially categorically denied that such charges were true. Following a meeting with Vice President Gore, President Yeltsin stated on September 26, 1997 that, "We are being accused of supplying Iran with nuclear or ballistic missile technologies. There is nothing further from the truth. I again and again categorically deny such rumors."
- Russia agreed, however, that Ambassador Wisner and Yuri Koptev, the head of the Russian space program, should jointly examine the US intelligence and draft a report on Russian transfers to Iran. This report reached a very different conclusion from President Yeltsin and concluded that Russia had provided such aid to Iran. Further, on October 1, 1997 -- roughly a week after Yeltsin issued his denial -- the Russian security service issued a statement that it had "thwarted" an Iranian attempt to have parts for liquid fuel rocket motors manufactured in Russia, disguised as gas compressors and pumps.
- Russian firms said to be helping Iran included the Russian Central Aerohydrodynamic Institute which developed a special wind tunnel; Rosvoorouzhenie, a major Russian arms-export agency; Kutznetzov (formerly NPO Trud) a rocket motor manufacturer in Samara; a leading research center called the Bauman National Technical University in Moscow, involved in developing rocket propulsion systems; the Tsagi Research Institute for rocket propulsion development; and the Polyus (Northstar) Research Institute in Moscow, a major laser test and manufacturing equipment firm. Iranians were also found to be studying rocket engineering at the Baltic State University in St. Petersburg and the Bauman State University.
- Russia was also found to have sold Iran high strength steel and special foil for its long-range missile program. The Russian Scientific and Production Center Inor concluded an agreement as late as September, 1997 to sell Iran a factory to produce four special metal alloys used in long-range missiles. Inor's director, L. P Chromova worked out a deal with A. Asgharzadeh, the director of an Iranian factory, to sell 620 kilograms of special alloy called 21HKMT, and provide Iran with the capability to thermally treat the alloy for missile bodies. Iran had previously bought 240 kilograms of the alloy. Inor was also selling alloy foils called 49K2F, CUBE2, and 50N in sheets 0.2-0.4 millimeters thick for the outer body of missiles. The alloy 21HKMT was particularly interesting because North Korea also uses it in missile designs. Inor had previously brokered deals with the Shahid Hemat Industrial Group in Iran to supply maraging steel for missile cases, composite graphite-tungsten material, laser equipment, and special mirrors used in missile tests.
- The result was a new and often tense set of conversations between the US and Russia in January, 1998. The US again sent Ambassador Frank Wisner to Moscow, Vice President Gore called Prime Minister Viktor Chernomyrdin, and Secretary of State Madeline Albright made an indirect threat that the Congress might apply sanctions. Sergi Yastrzhembsky, a Kremlin spokesman, initially responded by denying that any transfer of technology had taken place.
- This Russian denial was too categorical to have much credibility. Russia had previously announced the arrest of an Iranian diplomat on November 14, 1997, that it caught attempting to buy missile technology. The Iranian was seeking to buy blueprints and recruit Russian scientists to go to Iran. Yuri Koptev, the head of the Russian Space Agency, explained this, however, by stating that that, "There have been several cases where some Russian organizations, desperately struggling to make ends meet and lacking responsibility, have embarked on some ambiguous projects...they were stopped long before they got to the point where any technology got out."

- The end result of these talks was an agreement by Gore and Chernomyrdin to strengthen controls over transfer technology, but it was scarcely clear that it put an end to the problem. As Koptev has said, "There have been several cases where some Russian organizations, desperately struggling to make ends meet and lacking responsibility, have embarked on some ambiguous projects." Conditions in Russia are getting worse, not better, and the desperation that drives sales has scarcely diminished.
- Prime Minister Chernomyrdin again promised to strengthen his efforts to restrict technology transfer to Iran in a meeting with Gore on March 12, 1998. The US informed Russia of 13 cases of possible Russian aid to Iran at the meeting and offered to increase the number of Russian commercial satellite launches it would license for US firms as an incentive.
- New arrests of smugglers took place on April 9, 1998. The smugglers had attempted to ship 22 tons of specialized steel to Iran via Azerbaijan, using several Russia shell corporations as a cover.
- On April 16, 1998, the State Department declared 20 Russian agencies and research facilities were ineligible to receive US aid because of their role in transferring missile technology to Iran.
- A US examination of Iran's dispersal, sheltering, and hardening programs for its anti-ship missiles and other missile systems indicate that Iran has developed effective programs to ensure that they would survive a limited number of air strikes and that Iran had reason to believe that the limited number of preemptive strikes Israel could conduct against targets in the lower Gulf could not be effective in denying Iran the capability to deploy its missiles.
- Iran has shorter missile range systems:
 - In 1990, Iran bought CSS-8 surface-to-surface missiles (converted SA-2s) from China with ranges of 130-150 kilometers.
 - Has Chinese sea and land-based anti-ship cruise missiles. Iran fired 10 such missiles at Kuwait during Iran-Iraq War, hitting one US-flagged tanker.
- Iran has acquired much of the technology necessary build long-range cruise missile systems from China:
 - Such missiles would cost only 10% to 25% as much as ballistic missiles of similar range, and both the HY-2 Seersucker and CS-802 could be modified relatively quickly for land attacks against area targets.
 - Iran reported in December, 1995 that it had already fired a domestically built anti-ship missile called the Saeqe-4 (Thunderbolt) during exercises in the Strait of Hormuz and Gulf of Oman. Other reports indicate that China is helping Iran build copies of the Chinese CS-801/CS-802 and the Chinese FL-2 or F-7 anti-ship cruise missiles. These missiles have relatively limited range. The range of the CS-801 is 8-40 kilometers, the range of the CS-802 is 15-120 kilometers, the maximum range of the F-7 is 30 kilometers, and the maximum range of the FL-10 is 50 kilometers. Even a range of 120 kilometers would barely cover targets in the Southern Gulf from launch points on Iran's Gulf coast. These missiles also have relatively small high explosive warheads. As a result, Iran may well be seeking anti-ship capabilities, rather than platforms for delivering weapons of mass destruction.
 - A platform like the CS-802 might, however, provide enough design data to develop a scaled-up, longer-range cruise missile for other purposes, and the Gulf is a relatively small area where most urban areas and critical facilities are near the coast. Aircraft or ships could launch cruise missiles with chemical or biological warheads from outside the normal defense perimeter of the Southern Gulf states, and it is at least possible that Iran might modify anti-ship missiles with chemical weapons to attack tankers -- ships which are too large for most regular anti-ship missiles to be highly lethal.
 - Building an entire cruise missile would be more difficult. The technology for fusing CBW and cluster warheads would be within Iran's grasp. Navigation systems and jet engines, however, would still be a major potential problem. Current inertial navigation systems (INS) would introduce errors of at least several kilometers at ranges of 1,000 kilometers and would carry a severe risk of total guidance failure -- probably exceeding two-thirds of the missiles fired. A differential global positioning system (GPS) integrated with the inertial navigation system (INS) and a radar altimeter, however, might produce an accuracy of 15 meters. Some existing remotely piloted vehicles (RPVs), such as the South African

- Skua claim such performance. Commercial technology is becoming available for differential global positioning system (GPS) guidance with accuracies of 2 to 5 meters.
- There are commercially available reciprocating and gas turbine engines that Iran could adapt for use in a cruise missile, although finding a reliable and efficient turbofan engine for a specific design application might be difficult. An extremely efficient engine would have to be matched to a specific airframe. It is doubtful that Iran could design and build such an engine, but there are over 20 other countries with the necessary design and manufacturing skills.
 - While airframe-engine-warhead integration and testing would present a challenge and might be beyond Iran's manufacturing skills, it is inherently easier to integrate and test a cruise missile than a long-range ballistic missile. Further, such developments would be far less detectable than developing a ballistic system if the program used coded or low altitude directional telemetry.
 - Iran could bypass much of the problems inherent in developing its own cruise missile by modifying the HY-2 Seersucker for use as a land attack weapon and extending its range beyond 80 kilometers, or by modifying and improving the CS-801 (Ying Jai-1) anti-ship missile. There are reports that the Revolutionary Guards are working on such developments at a facility near Bandar Abbas.
 - Su-24 long-range strike fighters with range-payloads roughly equivalent to US F-111 and superior to older Soviet medium bombers.
 - F-4D/E fighter bombers with capability to carry extensive payloads to ranges of 450 miles.
 - Can modify HY-2 Silkworm missiles and SA-2 surface-to-air missiles to deliver weapons of mass destruction.
 - Iran has made several indigenous-long range rockets.
 - The Iran-130, or Nazeat, since the end of the Iran-Iraq War. The full details of this system remain unclear, but it seems to use commercially available components, a solid fuel rocket, and a simple inertial guidance system to reach ranges of about 90-120 kilometers. It is 355 mm in diameter, 5.9 meters long, weighs 950 kilograms, and has a 150 kilogram warhead. It seems to have poor reliability and accuracy, and its payload only seems to be several hundred kilograms.
 - The Shahin 2. It too has a 355 mm diameter, but is only 3.87 meters long, and weighs only 580 kilograms. It evidently can be equipped with three types of warheads: A 180 kilogram high explosive warhead, another warhead using high explosive submunitions, and a warhead that uses chemical weapons.
 - Iranian Oghab (Eagle) rocket with 40+ kilometers range.
 - New SSM with 125 mile range may be in production, but could be modified FROG.
 - Large numbers of multiple rocket launchers and tube artillery for short range delivery of chemical weapons.
 - The CIA reported in January 1999 that entities in Russia and China continue to supply missile-related goods and technology to Iran. Tehran is using these goods and technologies to achieve its goal of becoming self-sufficient in the production of MRBMs. The July flight test of the Shahab-3 MRBM demonstrates the success Iran has achieved in realizing that goal. Iran already is producing Scud SRBMs with North Korean help and has begun production of the Shahab-3. In addition, Iran's Defense Minister has publicly acknowledged the development of the Shahab-4 ballistic missile, with a "longer range and heavier payload than the 1,300-km Shahab-3."
 - Iran's earlier success in gaining technology and materials from Russian companies accelerated Iranian development of the Shahab-3 MRBM, which was first flight tested in July 1998.
 - The CIA report on missile proliferation in September 1999 estimated that Iran is the next hostile country most capable of testing an ICBM capable of delivering a weapon to the United States during the next 15 years.

- Iran *could test* an ICBM that could deliver a several-hundred kilogram payload to many parts of the United States in the latter half of the next decade, using Russian technology and assistance.
- Iran *could pursue* a Taepo Dong-type ICBM. Most analysts believe it could test a three-stage ICBM patterned after the Taepo Dong-1 SLV or a three-stage Taepo Dong-2-type ICBM, possibly with North Korean assistance, in the next few years.
- Iran is *likely to test* an SLV by 2010 that—once developed—could be converted into an ICBM capable of delivering a several-hundred kilogram payload to the United States.
- Analysts differ on the likely timing of Iran's first flight test of an ICBM that could threaten the United States. Assessments include:
 - *likely* before 2010 and *very likely* before 2015 (noting that an SLV with ICBM capabilities will *probably be tested within the next few years*);
 - no more than an *even chance* by 2010 and a *better than even chance* by 2015;
 - and less than an even chance by 2015.

Chemical Weapons

- Iran purchased large amounts of chemical defense gear from the mid-1980s onwards. Iran also obtained stocks of non-lethal CS gas, although it quickly found such agents had very limited military impact since they could only be used effectively in closed areas or very small open areas.
- Acquiring poisonous chemical agents was more difficult. Iran did not have any internal capacity to manufacture poisonous chemical agents when Iraq first launched its attacks with such weapons. While Iran seems to have made limited use of chemical mortar and artillery rounds as early as 1985 -- and possibly as early as 1984 -- these rounds were almost certainly captured from Iraq.
- Iran had to covertly import the necessary equipment and supplies, and it took several years to get substantial amounts of production equipment, and the necessary feedstocks. Iran sought aid from European firms like Lurgi to produce large "pesticide" plants, and began to try to obtain the needed feedstock from a wide range of sources, relying heavily on its Embassy in Bonn to manage the necessary deals. While Lurgi did not provide the pesticide plant Iran sought, Iran did obtain substantial support from other European firms and feedstocks from many other Western sources.
- By 1986-1987, Iran developed the capability to produce enough lethal agents to load its own weapons. The Director of the CIA, and informed observers in the Gulf, made it clear that Iran could produce blood agents like hydrogen cyanide, phosgene gas, and/or chlorine gas. Iran was also able to weaponize limited quantities of blister (sulfur mustard) and blood (cyanide) agents beginning in 1987, and had some capability to weaponize phosgene gas, and/or chlorine gas. These chemical agents were produced in small batches, and evidently under laboratory scale conditions, which enabled Iran to load small numbers of weapons before any of its new major production plants went into full operation.
- These gas agents were loaded into bombs and artillery shells, and were used sporadically against Iraq in 1987 and 1988.
- Reports regarding Iran's production and research facilities are highly uncertain:
 - Iran seems to have completed completion of a major poison gas plant at Qazvin, about 150 kilometers west of Tehran. This plant is reported to have been completed between November, 1987 and January, 1988. While supposedly a pesticide plant, the facility's true purpose seems to have been poison gas production using organophosphorous compounds.
 - It is impossible to trace all the sources of the major components and technology Iran used in its chemical weapons program during this period. Mujahideen sources claim Iran also set up a chemical bomb and warhead plant operated by the Zakaria Al-Razi chemical company near Mahshar in southern Iran, but it is unclear whether these reports are true.

- Reports that Iran had chemical weapons plants at Damghan and Parchin that began operation as early as March, 1988, and may have begun to test fire Scuds with chemical warheads as early as 1988-1989, are equally uncertain.
- Iran established at least one large research and development center under the control of the Engineering Research Centre of the Construction Crusade (Jahad e-Sazandegi), had established a significant chemical weapons production capability by mid-1989,
- Debates took place in the Iranian parliament or Majlis in late 1988 over the safety of Pasdaran gas plants located near Iranian towns, and that Rafsanjani described chemical weapons as follows: "Chemical and biological weapons are poor man's atomic bombs and can easily be produced. We should at least consider them for our defense. Although the use of such weapons is inhuman, the war taught us that international laws are only scraps of paper."
- Post Iran-Iraq War estimates of Iran chemical weapons production are extremely uncertain:
 - US experts believe Iran was beginning to produce significant mustard gas and nerve gas by the time of the August, 1988 cease-fire in the Iran-Iraq War, although its use of chemical weapons remained limited and had little impact on the fighting
 - Iran's efforts to equip plants to produce V-agent nerve gases seem to have been delayed by US, British, and German efforts to limit technology transfers to Iran, but Iran may have acquired the capability to produce persistent nerve gas during the mid 1990s.
 - Production of nerve gas weapons started no later than 1994.
 - Began to stockpile of cyanide (cyanogen chloride), phosgene, and mustard gas weapons after 1985. Recent CIA testimony indicates that production capacity may approach 1,000 tons annually.
- Weapons include bombs and artillery. Shells include 155 mm artillery and mortar rounds. Iran also has chemical bombs and mines. It may have developmental chemical warheads for its Scuds, and may have a chemical package for its 22006 RPV (doubtful).
- There are reports that Iran has deployed chemical weapons on some of its ships.
- Iran has increased chemical defensive and offensive warfare training since 1993.
- Iran is seeking to buy more advanced chemical defense equipment, and has sought to buy specialized equipment on world market to develop indigenous capability to produce advanced feedstocks for nerve weapons.
 - CIA sources indicated in late 1996, that China might have supplied Iran with up to 400 tons of chemicals for the production of nerve gas.
 - One report indicated in 1996, that Iran obtained 400 metric tons of chemical for use in nerve gas weapons from China -- including carbon sulfide.
 - Another report indicated that China supplied Iran with roughly two tons of calcium-hypochlorate in 1996, and loaded another 40,000 barrels in January or February of 1997. Calcium-hypochlorate is used for decontamination in chemical warfare.
 - Iran placed several significant orders from China that were not delivered. Razak Industries in Tehran, and Chemical and Pharmaceutical Industries in Tabriz ordered 49 metric tons of alkyl dimethylamine, a chemical used in making detergents, and 17 tons of sodium sulfide, a chemical used in making mustard gas. The orders were never delivered, but they were brokered by Iran's International Movalled Industries Corporation (Imaco) and China's North Chemical Industries Co. (Nocinco). Both brokers have been linked to other transactions affecting Iran's chemical weapons program since early 1995, and Nocinco has supplied Iran with several hundred tons of carbon disulfide, a chemical uses in nerve gas.
 - Another Chinese firm, only publicly identified as Q. Chen, seems to have supplied glass vessels for chemical weapons.

- The US imposed sanctions on seven Chinese firms in May, 1997, for selling precursors for nerve gas and equipment for making nerve gas -- although the US made it clear that it had, "no evidence that the Chinese government was involved." The Chinese firms were the Nanjing Chemical Industries Group and Jiangsu Yongli Chemical Engineering and Import/Export Corporation. Cheong Yee Ltd., a Hong Kong firm, was also involved. The precursors included tonyl chloride, dimethylamine, and ethylene chlorohydril. The equipment included special glass lined vessels, and Nanjing Chemical and Industrial Group completed construction of a production plant to manufacture such vessels in Iran in June, 1997.
- Iran sought to obtain impregnated Alumina, which is used to make phosphorous-oxychloride -- a major component of VX and GB -- from the US.
- It has obtained some equipment from Israelis. Nahum Manbar, an Israeli national living in France, was convicted in an Israeli court in May 1997 for providing Iran with \$16 million worth of production equipment for mustard and nerve gas during the period from 1990 to 1995.
- CIA reported in June 1997 that Iran had obtained new chemical weapons equipment technology from China and India in 1996.
- India is assisting in the construction of a major new plant at Qazvim, near Tehran, to manufacture phosphorous pentasulfide, a major precursor for nerve gas. The plant is fronted by Meli Agrochemicals, and the program was negotiated by Dr. Mejid Tehrani Abbaspour, a chief security advisor to Rafsanjani.
- A recent report by German intelligence indicates that Iran has made major efforts to acquire the equipment necessary to produce Sarin and Tabun, using the same cover of purchasing equipment for pesticide plants that Iraq used for its Sa'ad 16 plant in the 1980s. German sources note that three Indian companies -- Tata Consulting Engineering, Transpek, and Rallis India -- have approached German pharmaceutical and engineering concerns for such equipment and technology under conditions where German intelligence was able to trace the end user to Iran
- Iran ratified the Chemical Weapons Convention in June 1997.
 - It submitted a statement in Farsi to the CWC secretariat in 1998, but this consisted only of questions in Farsi as to the nature of the required compliance.
 - It has not provided the CWC with any data on its chemical weapons program.
- The CIA estimated in January 1999 that Iran obtained material related to chemical warfare (CW) from various sources during the first half of 1998. It already has manufactured and stockpiled chemical weapons, including blister, blood, and choking agents and the bombs and artillery shells for delivering them. However, Tehran is seeking foreign equipment and expertise to create a more advanced and self-sufficient CW infrastructure.
 - The CIA stated that Chinese entities sought to supply Iran with CW-related chemicals during 1997-1998 period. The US sanctions imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's CW program remain in effect.

Biological Weapons

- Extensive laboratory and research capability.
- Weapons effort documented as early as 1982. Reports surfaced that Iran had imported suitable type cultures from Europe and was working on the production of Mycotoxins -- a relatively simple family of biological agents that require only limited laboratory facilities for small scale production.
- US intelligence sources reported in August, 1989, that Iran was trying to buy two new strains of fungus from Canada and the Netherlands that can be used to produce Mycotoxins. German sources indicated that Iran had successfully purchased such cultures several years earlier.
- The Imam Reza Medical Center at Mashhad Medical Sciences University and the Iranian Research Organization for Science and Technology were identified as the end users for this purchasing effort, but it is likely that the true end user was an Iranian government agency specializing in biological warfare.

- Many experts believe that the Iranian biological weapons effort was placed under the control of the Islamic Revolutionary Guards Corps, which is known to have tried to purchase suitable production equipment for such weapons.
- Since the Iran-Iraq War, Iran has conducted research on more lethal active agents like Anthrax, hoof and mouth disease, and biotoxins. In addition, Iranian groups have repeatedly approached various European firms for the equipment and technology necessary to work with these diseases and toxins.
 - Unclassified sources of uncertain reliability have identified a facility at Damghan as working on both biological and chemical weapons research and production, and believe that Iran may be producing biological weapons at a pesticide facility near Tehran.
 - Some universities and research centers may be linked to biological weapons program.
 - Reports surfaced in the spring of 1993 that Iran had succeeded in obtaining advanced biological weapons technology in Switzerland and containment equipment and technology from Germany. According to these reports, this led to serious damage to computer facilities in a Swiss biological research facility by unidentified agents. Similar reports indicated that agents had destroyed German bio-containment equipment destined for Iran.
 - More credible reports by US experts indicate that Iran has begun to stockpile anthrax and Botulinum in a facility near Tabriz, can now mass manufacture such agents, and has them in an aerosol form. None of these reports, however, can be verified.
 - The CIA has reported that Iran has, “sought dual-use biotech equipment from Europe and Asia, ostensibly for civilian use.” It also reported in 1996 that Iran might be ready to deploy biological weapons. Beyond this point, little unclassified information exists regarding the details of Iran's effort to “weaponize” and produce biological weapons.
- Iran may have the production technology to make dry storable and aerosol weapons. This would allow it to develop suitable missile warheads and bombs and covert devices.
- Iran may have begun active weapons production in 1996, but probably only at limited scale suitable for advanced testing and development.
- CIA testimony indicates that Iran is believed to have weaponized both live agents and toxins for artillery and bombs and may be pursuing biological warheads for its missiles. The CIA reported in 1996 that, “We believe that Iran holds some stocks of biological agents and weapons. Tehran probably has investigated both toxins and live organisms as biological warfare agents. Iran has the technical infrastructure to support a significant biological weapons program with little foreign assistance.
- CIA reported in June 1997 that Iran had obtained new dual use technology from China and India during 1996.
- Iran announced in June 1997 that it would not produce or employ chemical weapons including toxins.
- The CIA estimated in January 1999 that Iran continued to pursue purchasing dual-use biotechnical equipment from Russia and other countries, ostensibly for civilian uses. Its biological warfare (BW) program began during the Iran-Iraq war, and Iran may have some limited capability for BW deployment. Outside assistance is both important and difficult to prevent, given the dual-use nature of the materials and equipment being sought and the many legitimate end uses for these items.
 - Russia remains a key source of biotechnology for Iran. Russia's world-leading expertise in biological weapons makes it an attractive target for Iranians seeking technical information and training on BW agent production processes.

Nuclear Weapons

- The Shah established the Atomic Energy Organization of Iran in 1974, and rapidly began to negotiate for nuclear power plants.

- He concluded an extendible ten year nuclear fuel contract with the US in 1974, with Germany in 1976, and France in 1977.
- In 1975, he purchased a 10% share in a Eurodif uranium enrichment plant being built at Tricastin in France that was part of a French, Belgian, Spanish, and Italian consortium. Under the agreement the Shah signed, Iran was to have full access to the enrichment technology Eurodif developed, and agreed to buy a quota of enriched uranium from the new plant.
- He created an ambitious plan calling for a network of 23 power reactors throughout Iran that was to be operating by the mid-1990s, and sought to buy nuclear power plants from Germany and France.
- By the time the Shah fell in January, 1979, he had six reactors under contract, and was attempting to purchase a total of 12 nuclear power plants from Germany, France, and the US. Two 1,300 megawatt German nuclear power plants at Bushehr were already 60% and 75% completed, and site preparation work had begun on the first of two 935 megawatt French plants at Darkhouin that were to be supplied by Framatome.
- The Shah also started a nuclear weapons program in the early to mid-1970s, building upon his major reactor projects, investment in URENCO, and smuggling of nuclear enrichment and weapons related technology from US and Europe.
 - 5 megawatt light-water research reactor operating in Tehran.
 - 27 kilowatt neutron-source reactor operating in Isfahan.
 - Started two massive 1300 megawatt reactor complexes.
 - The Shah attempted to covertly import controlled technology from the US/.
- US experts believe that Shah began a low-level nuclear weapons research program, centered at the Amirabad Nuclear Research Center. This research effort included studies of weapons designs and plutonium recovery from spent reactor fuel.
 - It also involved a laser enrichment program which began in 1975, and led to a complex and highly illegal effort to obtain laser separation technology from the US. This latter effort, which does not seem to have had any success, continued from 1976 until the Shah's fall, and four lasers operating in the critical 16 micron band were shipped to Iran in October, 1978.
 - At the same time, Iran worked on other ways to obtain plutonium, created a secret reprocessing research effort to use enriched uranium, and set up a small nuclear weapons design team.
 - In 1976, Iran signed a secret contract to buy \$700 million worth of yellow cake from South Africa, and appears to have reached an agreement to buy up to 1,000 metric tons a year. It is unclear how much of this ore South Africa shipped before it agreed to adopt IAEA export restrictions in 1984, and whether South Africa really honored such export restrictions. Some sources indicate that South Africa still made major deliveries as late as 1988-1989.
 - Iran also tried to purchase 26.2 kilograms of highly enriched uranium; the application to the US for this purchase was pending when the Shah fell
 - The Shah did eventually accept full IAEA safeguards but there value is uncertain .
- In 1984, Khomeini revived nuclear weapons program begun under Shah.
 - Received significant West German and Argentine corporate support in some aspects of nuclear technology during the Iran-Iraq War.
 - Limited transfers of centrifuge and other weapons related technology from PRC, possibly Pakistan.
 - It has a Chinese-supplied heavy-water, zero-power research reactor at Isfahan Nuclear Research Center, and two-Chinese supplied sub-critical assemblies -- a light water and graphite design.
 - It has stockpiles of uranium and mines in Yazd area. It may have had a uranium-ore concentration facility at University of Tehran, but status unclear.
 - Some experts feel that the IRGC moved experts and equipment from the Amirabad Nuclear Research Center to a new nuclear weapons research facility near Isfahan in the mid-1980s, and formed a new

nuclear research center at the University of Isfahan in 1984 -- with French assistance. Unlike many Iranian facilities, the center at Isfahan was not declared to the IAEA until February 1992, when the IAEA was allowed to make a cursory inspection of six sites that various reports had claimed were the location of Iran's nuclear weapons efforts.

- (Bushehr I & II), on the Gulf Coast just southwest of Isfahan, were partially completed at the time of the Shah's fall. Iran attempted to revive the program and sought German and Argentine support, but the reactors were damaged by Iraqi air strikes in 1987 and 1988.
- Iran may also have opened a new uranium ore processing plant close to its Shagand uranium mine in March, 1990, and it seems to have extended its search for uranium ore into three additional areas. Iran may have also begun to exploit stocks of yellow cake that the Shah had obtained from South Africa in the late 1970s while obtaining uranium dioxide from Argentina by purchasing it through Algeria.
- Iran began to show a renewed interest in laser isotope separation (LIS) in the mid-1980s, and held a conference on LIS in September, 1987.
- Iran opened a new nuclear research center in Isfahan in 1984, located about four kilometers outside the city and between the villages of Shahrida and Fulashans. This facility was built at a scale far beyond the needs of peaceful research, and Iran sought French and Pakistani help for a new research reactor for this center.
- The Khomeini government may also have obtained several thousand pounds of uranium dioxide from Argentina by purchasing it through Algeria. Uranium dioxide is considerably more refined than yellow cake, and is easier to use in irradiating material in a reactor to produce plutonium.
- The status of Iran's nuclear program since the Iran-Iraq War is highly controversial, and Iran has denied the existence of such a program.
 - On February 7, 1990, the speaker of the Majlis publicly toured the Atomic Energy Organization of Iran and opened the new Jabir Ibn al Hayyan laboratory to train Iranian nuclear technicians. Reports then surfaced that Iran had at least 200 scientists and a work force of about 2,000 devoted to nuclear research
 - Iran's Deputy President Ayatollah Mohajerani stated in October, 1991, that Iran should work with other Islamic states to create an "Islamic bomb."
 - The Iranian government has repeatedly made proposals to create a nuclear-free zone in the Middle East. For example, President Rafsanjani was asked if Iran had a nuclear weapons program in an interview in the CBS program *60 Minutes* in February 1997. He replied, "Definitely not. I hate this weapon."
 - Other senior Iranian leaders, including President Khatami have made similar categorical denials. Iran's new Foreign Minister, Kamal Kharrazi, stated on October 5, 1997, that, "We are certainly not developing an atomic bomb, because we do not believe in nuclear weapons... We believe in and promote the idea of the Middle East as a region free of nuclear weapons and other weapons of mass destruction. But why are we interested to develop nuclear technology? We need to diversify our energy sources. In a matter of a few decades, our oil and gas reserves would be finished and therefore, we need access to other sources of energy...Furthermore, nuclear technology has many other utilities in medicine and agriculture. The case of the United States in terms of oil reserve is not different from Iran's The United States also has large oil resources, but at the same time they have nuclear power plants. So there is nothing wrong with having access to nuclear technology if it is for peaceful purposes..."
- The IAEA reports that Iran has fully complied with its present requirements, and that it has found no indications of nuclear weapons effort, but IAEA only inspects Iran's small research reactors.
 - The IAEA visits to other Iranian sites are not inspections, and do not use instruments, cameras, seals, etc. They are informal walk-throughs.
 - The IAEA visited five suspect Iranian facilities in 1992 and 1993 in this manner, but did not conduct full inspections.

- Iran has not had any 93+2 inspections and its position on improved inspections is that it will not be either the first or the last to have them.
- Iranian officials have repeatedly complained that the West tolerated Iraqi use of chemical weapons and its nuclear and biological build-up during the Iran-Iraq War, and has a dual standard where it does not demand inspections of Israel or that Israel sign the NPT.
- These are reasons to assume that Iran still has a nuclear program:
 - Iran attempted to buy highly enriched fissile material from Khazakstan. The US paid between \$20 million and \$30 million to buy 1,300 pounds of highly enriched uranium from the Ust-Kamenogorsk facility in Khazakstan that Iran may have sought to acquire in 1992. A total of 120 pounds of the material -- enough for two bombs -- cannot be fully accounted for.
 - Iran has imported maraging steel, sometimes used for centrifuges, by smuggling it in through dummy fronts. Britain intercepted 110 pound (50 kilo) shipment in August, 1996. Seems to have centrifuge research program at Sharif University of Technology in Tehran. IAEA "visit" did not confirm.
 - Those aspects of Iran's program that are visible indicate that Iran has had only uncertain success. Argentina agreed to train Iranian technicians at its Jose Balaseiro Nuclear Institute, and sold Iran \$5.5 million worth of uranium for its small Amirabad Nuclear Research Center reactor in May 1987. A CENA team visited Iran in late 1987 and early 1988, and seems to have discussed selling sell Iran the technology necessary to operate its reactor with 20% enriched uranium as a substitute for the highly enriched core provided by the US, and possibly uranium enrichment and plutonium reprocessing technology as well. Changes in Argentina's government, however, made it much less willing to support proliferation. The Argentine government announced in February, 1992, that it was canceling an \$18 million nuclear technology sale to Iran because it had not signed a nuclear safeguards arrangement. Argentine press sources suggested, however, that Argentina was reacting to US pressure.
 - In February, 1990 a Spanish paper reported that Associated Enterprises of Spain was negotiating the completion of the two nuclear power plants at Bushehr. Another Spanish firm called ENUSA (National Uranium Enterprises) was to provide the fuel, and Kraftwerke Union (KWU) would be involved. Later reports indicated that a 10 man delegation from Iran's Ministry of Industry was in Madrid negotiating with the Director of Associated Enterprises, Adolfo Garcia Rodriguez.
 - Iran negotiated with Kraftwerke Union and CENA of Germany in the late 1980s and early 1990s. Iran attempted to import reactor parts from Siemens in Germany and Skoda in Czechoslovakia. None of these efforts solved Iran's problems in rebuilding its reactor program, but all demonstrate the depth of its interest.
 - Iran took other measures to strengthen its nuclear program during the early 1990s. It installed a cyclotron from Ion Beam Applications in Belgium at a facility in Karzaj in 1991.
 - Iran conducted experiments in uranium enrichment and centrifuge technology at its Sharif University of Technology in Tehran. Sharif University was also linked to efforts to import cylinders of fluorine suitable for processing enriched material, and attempts to import specialized magnets that can be used for centrifuges, from Thyssen in Germany in 1991.
 - In 1992, Iran attempted to buy beryllium from a storage site in Kazakhstan that also was storing 600 kilograms of highly enriched uranium. These contacts then seem to have expanded to an attempt to try the material. In 1994, they helped lead the US to buy the enriched material and fly it out of the country.
 - It is clear from Iran's imports that it has sought centrifuge technology ever since. Although many of Iran's efforts have never been made public, British customs officials seized 110 pounds of maraging steel being shipped to Iran in July 1996.
 - Iran seems to have conducted research into plutonium separation and Iranians published research on uses of tritium that had applications to nuclear weapons boosting. Iran also obtained a wide range of US and other nuclear literature with applications for weapons designs. Italian inspectors seized eight steam condensers bound for Iran that could be used in a covert reactor program in 1993, and high technology ultrasound equipment suitable for reactor testing at the port of Bari in January, 1994.
 - Other aspects of Iran's nuclear research effort had potential weapons applications. Iran continued to operate an Argentine-fueled five megawatt light water highly enriched uranium reactor at the

University of Tehran. It is operated by a Chinese-supplied neutron source research reactor, and subcritical assemblies with 900 grams of highly enriched uranium, at its Isfahan Nuclear Research Center. This Center has experimented with a heavy water zero-power reactor, a light water sub-critical reactor, and a graphite sub-critical reactor. In addition, it may have experimented with some aspects of nuclear weapons design.

- The German Ministry of Economics has circulated a wide list of such Iranian fronts which are known to have imported or attempted to import controlled items. These fronts include the:
 - Bonyad e-Mostazafan;
 - Defense Industries Organization (Sazemane Sanaye Defa);
 - Pars Garma Company, the Sadadja Industrial Group (Sadadja Sanaye Daryae);
 - Iran Telecommunications Industry (Sanaye Mokhaberet Iran);
 - Shahid Hemat Industrial Group, the State Purchasing Organization, Education Research Institute (ERI);
 - Iran Aircraft Manufacturing Industries (IAI);
 - Iran Fair Deal Company, Iran Group of Surveyors;
 - Iran Helicopter Support and Renewal Industries (IHI);
 - Iran Navy Technical Supply Center;
 - Iran Tehran Kohakd Daftar Nezarat, Industrial Development Group;
 - Ministry of Defense (Vezerate Defa).
- Iran claims it eventually needs to build enough nuclear reactors to provide 20% of its electric power. This Iranian nuclear power program presents serious problems in terms of proliferation. Although the reactors are scarcely ideal for irradiating material to produce Plutonium or cannibalizing the core, they do provide Iran with the technology base to make its own reactors, have involved other technology transfer helpful to Iran in proliferating and can be used to produce weapons if Iran rejects IAEA safeguards.
- Russian has agreed to build up to four reactors, beginning with a complex at Bushehr -- with two 1,000-1,200 megawatt reactors and two 465 megawatt reactors, and provide significant nuclear technology.
 - Russia has consistently claimed the light water reactor designs for Bushehr cannot be used to produce weapons grade Plutonium and are similar to the reactors the US is providing to North Korea.
 - The US has claimed, however, that Victor Mikhaliiov, the head of Russia's Atomic Energy Ministry, proposed the sale of a centrifuge plant in April, 1995. The US also indicated that it had persuaded Russia not to sell Iran centrifuge technology as part of the reactor deal during the summit meeting between President's Clinton and Yeltsin in May, 1995.
 - It was only after US pressure that Russia publicly stated that it never planned to sell centrifuge and advanced enrichment technology to Iran, and Iran denied that it had ever been interested in such technology. For example, the statement of Mohammed Sadegh Ayatollahi, Iran's representative to the IAEA, stated that, "We've had contracts before for the Bushehr plant in which we agreed that the spent fuel would go back to the supplier. For our contract with the Russians and Chinese, it is the same." According to some reports, Russia was to reprocess the fuel at its Mayak plant near Chelyabinsk in the Urals, and could store it at an existing facility, at Krasnoyarsk-26 in southern Siberia.
 - The CIA reported in June 1997 that Iran had obtained new nuclear technology from Russia during 1996.
 - A nuclear accident at plant at Rasht, six miles north of Gilan, exposed about 50 people to radiation in July, 1996.
 - Russian Nuclear Energy Minister Yevgeny Adamov and Russian Deputy Prime Minister Vladimir Bulgak visited in March, 1998. and Iran dismissed US complaints about the risk the reactors would be used to proliferate.

- Russia indicated that it would go ahead with selling two more reactors for construction at Bushehr within the next five years.
- The first 1,000 megawatt reactor at Bushehr has experienced serious construction delays. In March, 1998, Russia and Iran agreed to turn the construction project into a turn key plant because the Iranian firms working on infrastructure had fallen well behind schedule. In February, Iran had agreed to fund improved safety systems. The reactor is reported to be on a 30- month completion cycle.
- The US persuaded the Ukraine not to sell Iran \$45 million worth of turbines for its nuclear plant in early March, 1998, and to strengthen its controls on Ukrainian missile technology under the MTCR.
- The CIA reported in January 1999 that Russia remained a key supplier for civilian nuclear programs in Iran and, to a lesser extent, India. With respect to Iran's nuclear infrastructure, Russian assistance would enhance Iran's ability to support a nuclear weapons development effort. Such assistance is less likely to significantly advance India's effort, given that India's nuclear weapons program is more mature. By its very nature, even the transfer of civilian technology may be of use in the nuclear weapons programs of these countries.
 - Following intense and continuing engagement with the United States, Russian officials have taken some positive steps. Russia has committed to observe certain limits on its nuclear cooperation with Iran, such as not providing militarily useful nuclear technology.
 - In January 1998, the Russian Government issued a broad decree prohibiting Russian companies from exporting items known or believed to be used for developing WMD or related delivery systems, whether or not these items are on Russia's export control list. In May 1998, Russia announced a decree intended to strengthen compliance of Russian businesses with existing export controls on proliferation-related items. These actions, if enforced, could help to counter the proliferation of WMD and their delivery systems.
 - However, there are signs that Russian entities have continued to engage in behavior inconsistent with these steps. Monitoring Russian proliferation behavior, therefore, will have to remain a very high priority for some time to come.
 - On January 14, 2000, Russia's Minister of Defense Igor Ivanavov met with Hassan Rowhani, the secretary of Iran's Supreme National Security Council, and promised that Russia would maintain defense cooperation, and that Russia, "intends to fulfill its obligations under the agreements made in 1989-1990."
 - The same day, Vice Minister Ilya Klebanov met with Hassan Rowhani, and announced that Iran might order three additional Russian reactors.
 - The CIA warned in January 2000 that Russia might have sold Iran heavy water and graphite technology.
- China is reported to have agreed to provide significant nuclear technology transfer and possible sale of two 300 megawatt pressurized water reactors in the early 1990s, but then to have agreed to halt nuclear assistance to Iran after pressure from the US.
 - Iran signed an agreement with China's Commission on Science, Technology, and Industry for National Defense on January 21, 1991, to build a small 27-kilowatt research reactor at Iran's nuclear weapons research facility at Isfahan. On November 4, 1991, China stated that it had signed commercial cooperation agreements with Iran in 1989 and 1991, and that it would transfer an electromagnetic isotope separator (Calutron) and a smaller nuclear reactor, for "peaceful and commercial" purposes.
 - The Chinese reactor and Calutron were small research-scale systems and had no direct value in producing fissile material. They did, however, give Iran more knowledge of reactor and enrichment technology, and US experts believe that China provided Iran with additional data on chemical separation, other enrichment technology, the design for facilities to convert uranium to uranium hexafluoride to make reactor fuel, and help in processing yellowcake.
 - The US put intense pressure on China to halt such transfers. President Clinton and Chinese President Jiang Zemin reached an agreement at an October, 1997 summit. China strengthened this pledge in negotiations with the US in February, 1998.

- In March, 1998, the US found that the China Nuclear Energy Corporation was negotiating to sell Iran several hundred tons of anhydrous hydrogen fluoride (AHF) to Isfahan Nuclear Research Corporation in central Iran, a site where some experts believe Iran is working on the development of nuclear weapons. AHF can be used to separate plutonium, help refine yellow cake into uranium hexafluoride to produce U-235, and as a feedstock for Sarin. It is on two nuclear control lists. China agreed to halt the sale.
- Iran denied that China had halted nuclear cooperation on March 15, 1998.
- Even so, the US acting Under Secretary of State for Arms Control and International Security Affairs stated that China was keeping its pledge not to aid Iran on March 26, 1998.
- The CIA reported in January 1999 that During the first half of 1998, China continued to take steps to strengthen its control over nuclear exports. China promulgated new export control regulations in June 1998 that cover the sale of dual-use nuclear equipment. This follows on the heels of the September 1997 promulgation of controls covering the export of equipment and materials associated exclusively with nuclear applications. These export controls should give the Chinese Government greater accounting and control of the transfer of equipment, materials, and technology to nuclear programs in countries of concern.
 - China pledged in late 1997 not to engage in any new nuclear cooperation with Iran and to complete work on two remaining nuclear projects—a small research reactor and a zirconium production facility—in a relatively short period of time. During the first half of 1998, Beijing appears to have implemented this pledge. The Intelligence Community will continue to monitor carefully Chinese nuclear cooperation with Iran.
 - During the reporting period, Chinese entities provided a variety of missile-related items and assistance to several countries of proliferation concern. China also was an important supplier of ACW to Iran through the first half of 1998.
- The control of fissile material in the FSU remains a major problem:
 - US estimates indicate the FSU left a legacy of some 1,485 tons of nuclear material. This include 770 tons in some 27,000 weapons, including 816 strategic bombs, 5,434 missile warheads, and about 20,000 theater and tactical weapons. In addition, there were 715 tons of fissile or near-fissile material in eight countries of the FSU in over 50 sites: enough to make 35,000-40,000 bombs.
 - There are large numbers of experienced FSU technicians, including those at the Russian weapons design center at Arzamas, and at nuclear production complexes at Chelyabinsk, Krasnoyarsk, and Tomsk.
 - These factors led the US to conduct Operation Sapphire in 1994, where the US removed 600 kilograms of highly enriched uranium from the Ulba Metallurgy Plant in Kazakhstan at a time Iran was negotiating for the material.
 - They also led to Britain and the US cooperating in Auburn Endeavor, and airlifting fissile material out of a nuclear research facility in Tbilisi, Georgia. There were 10 pounds of material at the institute, and 8.8 pounds were HEU. (It takes about 35 pounds to make a bomb.) This operation was reported in the New York Times on April 21, 1998. The British government confirmed it took place, but would not give the date.
- The Jerusalem Post reported on April 9, 1998 that Iran had purchased four tactical nuclear weapons from Russian smugglers for \$25 million in the early 1990s, that the weapons had been obtained from Kazakhstan in 1991, and that Argentine technicians were helping to activate the weapon.
 - It quoted what it claimed was an Iranian report, dated December 26, 1991, of a meeting between Brigadier General Rahim Safavi, the Deputy Commander of the Revolutionary Guards and Reza Amrohalli, then head of the Iranian atomic energy organization.
 - It also quoted a second document -- dated January 2, 1992 --- saying the Iranians were awaiting the arrival of Russian technicians to show them how to disarm the protection systems that would otherwise inactivate the weapons if anyone attempted to use them.
 - The documents implied the weapons were flawed by did not indicate whether Iran had succeeded in activating them.

- The US intelligence community denied any evidence that such a transfer had taken place.
- The most detailed reports of Iran's nuclear weapons program are the least reliable, and come from the People's Mujahideen, a violent, anti-regime, terrorist group. Such claims are very doubtful, but the People's Mujahideen has reported that:
 - Iran's facilities include a weapons site called Ma'allem Kelayah, near Qazvin on the Caspian. This is said to be an IRGC-run facility established in 1987, which has involved an Iranian investment of \$300 million. Supposedly, the site was to house the 10 megawatt reactor Iran tried to buy from India.
 - Two Soviet reactors were to be installed at a large site at Gorgan on the Caspian, under the direction of Russian physicists.
 - The People's Republic of China provided uranium enrichment equipment and technicians for the site at Darkhouin, where Iran once planned to build a French reactor.
 - A nuclear reactor was being constructed at Karaj; and that another nuclear weapons facility exists in the south central part of Iran, near the Iraqi border.
 - The ammonia and urea plant that the British firm M. W. Kellogg was building at Borujerd in Khorassan province, near the border with Turkestan, might be adapted to produce heavy water.
 - The Amir Kabir Technical University, the Atomic Energy Organization of Iran (AEOI) (also known as the Organization for Atomic Energy of Iran or AEOI), Dor Argham Ltd., the Education and Research Institute, GAM Iranian Communications, Ghoods Research Center, Iran Argham Co., Iran Electronic Industries, Iranian Research Organization, Ministry of Sepah, Research and Development Group, Sezemane Sanaye Defa, the Sharif University of Technology, Taradis Iran Computer Company, and Zakaria Al-Razi Chemical Company are all participants in the Iranian nuclear weapons effort.
 - Other sources based on opposition data have listed the Atomic Energy Organization of Iran, the Laser Research Center and Ibn-e Heysam Research and Laboratory Complex, the Bonab Atomic Energy Research Center (East Azerbaijan), the Imam Hussein University of the Revolutionary Guards, the Jabit bin al-Hayyan Laboratory, the Khoshomi uranium mine (Yazd), a possible site at Moallem Kalayeh, the Nuclear Research Center at Tehran University, the Nuclear Research Center for Agriculture and Medicine (Karaj), the Nuclear Research Center of Technology (Isfahan), the Saghand Uranium mine (Yazd), the Sharif University (Tehran) and its Physics Research Center.
 - The CIA estimated in January 1999 that, Iran remains one of the most active countries seeking to acquire WMD technology and ACW. During the reporting period, Iran focused its efforts to acquire WMD-related equipment, materials, and technology primarily on two countries: Russia and China. Iran is seeking to develop an indigenous capability to produce various types of nuclear, chemical, and biological weapons and their delivery systems.
- Iran actively sought relevant production technology to lessen its dependence on foreign sources.
 - Russian entities continued to market and support a variety of nuclear-related projects in Iran during the first half of 1998, ranging from the sale of laboratory equipment for nuclear research institutes to the construction of a 1,000-megawatt nuclear power reactor in Bushehr, Iran, that will be subject to International Atomic Energy Agency (IAEA) safeguards. These projects, along with other nuclear-related purchases, will help Iran augment its nuclear technology infrastructure, which in turn would be useful in supporting nuclear weapons research and development.
 - Russia has committed to observe certain limits on its nuclear cooperation with Iran. For example, President Yel'tsin has stated publicly that Russia will not provide militarily useful nuclear technology to Iran. Beginning in January this year, the Russian Government has taken a number of steps. For example, in May 1998, Russia announced a decree intended to strengthen compliance of Russian businesses with existing export controls on proliferation-related items.
 - China continued to work on one of its two remaining projects—to supply Iran's civil nuclear program with a zirconium production facility. This facility will be used by Iran to produce cladding for reactor fuel. As a party to the Nuclear Nonproliferation Treaty, Iran is required to apply IAEA safeguards to nuclear fuel, but safeguards are not required for the zirconium plant or its products. During the US-China October 1997 Summit, China pledged not to engage in any new nuclear cooperation with Iran

and to complete cooperation on two ongoing nuclear projects in a relatively short time. This pledge appears to be holding. In addition, China promulgated new export regulations in June 1998 that cover the sale of dual-use nuclear equipment. The regulations took effect immediately and were intended to strengthen control over equipment and material that would contribute to proliferation. Promulgation of these regulations fulfills Jiang Zemin's commitment to the United States last fall to implement such controls by the middle of 1998.

- Iran claims to desire the establishment of a complete nuclear fuel cycle for its civilian energy program. In that guise, it seeks to obtain whole facilities, such as a uranium conversion facility, that, in fact, could be used in any number of ways in support of efforts to produce fissile material needed for a nuclear weapon. Despite outside efforts to curtail the flow of critical technologies and equipment, Tehran continues to seek fissile material and technology for weapons development and has set up an elaborate system of military and civilian organizations to support its effort.
- US estimates of Iran's progress in acquiring nuclear weapons have changed over time.
 - In 1992, the CIA estimated that Iran would have the bomb by the year 2000. In 1995, John Holum testified that Iran could have the bomb by 2003.
 - In 1997, after two years in which Iran might have made progress, he testified that Iran could have the bomb by 2005-2007.
 - In 1999, the NIE on proliferation estimated that Iran could test a missile that could reach the US by 2010, but did not change the 1997 estimate or when Iran might acquire a bomb.
 - In early 2000, the New York Time reported that the CIA had warned that Iran might now be able to make a nuclear weapon. The assessment stated that the CIA could not monitor Iran closely enough to be certain whether Iran had acquired fissile material from an outside source.
 - US experts increasingly refer to Iran's efforts as "creeping proliferation" and there is no way to tell when or if Iranian current efforts will produce a weapon, and unclassified lists of potential facilities have little credibility..
 - Timing of weapons acquisition depends heavily on whether Iran can buy fissile material -- if so it has the design capability and can produce weapons in 1-2 years -- or must develop the capability to process Plutonium or enrich Uranium -- in which case, it is likely to be 5-10 years.

Missile Defenses

- Seeking Russian S-300 or S-400 surface-to-air missile system with limited anti tactical ballistic missile capability.

¹ Washington Post, April 17, 1995, p. A-12; New York Times, May 2, 1995, p. A-6.

² Rodney W. Jones and Mark G. McDonough with Toby Dalton and Gregory Koblenz Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998, Carnegie Endowment for International Peace, 1999, "Iran".

³ Washington Post, April 17, 1995, p. A-12; New York Times, May 2, 1995, p. A-6.

⁴ Washington Times, February 24, 1997, p. A-1; Sunday Telegraph, February 23, 1997, p. 1.

⁵ Associated Press, May 5, 1997, 01:26.

⁶ Reuters, January 16, 1998, 0551.

⁷ Reuters, January 16, 1998, 0551.

⁸ Reuters, January 16, 1998, 0551.

⁹ Congressional Research Service, Issue Briefs 92076, 92056, and 93033; Washington Times, December 19, 1994, p. A-18.

¹⁰ Associated Press, May 5, 1997, 01:26.

¹¹ United Press, August 14, 1996, 1041. These statements are typical of the comments of Iranian officials and media found in a review of the FBIS-NES during 1995-1997. For example, see FBIS-NES-97-233, August 21, 1997, and Tehran Jomhuri-ye Eslmai, August 21, 1997.

¹² IRNA, August 17, 1997, 2041; BBC Summary of World Broadcasts, August 19, 1997.

¹³ IRNA, August 17, 1997, 2041; BBC Summary of World Broadcasts, August 19, 1997, August 28, 1997, September 12, 1997; Agence France Presse, August 16, 1997, 15:22; London Times, August 16, 1997; SAPA, September 11, 1997, 0946; Xinhua, September 11, 1997, 0911305.

¹⁴ David Kyd, a spokesman of the IAEA, stated on August 19, 1997 that the IAEA had no evidence that Iran was trying to obtain nuclear weapons components from South Africa. See IRNA, August 17, 1997 (FBIS-TAC-97-229, August 17, 1997), 2041; BBC Summary of World Broadcasts, August 19, 1997, August 28, 1997, September 12, 1997; Agence France Presse, August 16, 1997, 15:22; London Times, August 16, 1997; SAPA, September 11, 1997, 0946; Xinhua, September 11, 1997, 0911305; ,

¹⁵ Washington Post, October 5, 1997, p. C-4.

¹⁶ See Eric Arnett, "Iran, threat perception and military confidence-building measures, www.sipri.se/projects/technology/Iran-CBM.html, accessed April 17, 1997; the introduction and Chapters 10-13 of Eric Arnett, Editor, Military Capacity and the Risk of War: China, India, Pakistan, and India, Stockholm, Stockholm Institute of Peace Research Institute, March, 1997; Jane's Defense Weekly, April 16, 1997, p. 16.

¹⁷ According to one report by Zalmay Khalizad in Survival, Pakistan was deeply involved in this \$10 billion effort, as was China. US experts do not confirm these reports. Washington Post, May 17, 1995, p. A-23.

¹⁸ Associated Press, May 5, 1997, 01:26.

¹⁹ For a detailed history and list of suppliers see the author's Weapons of Mass Destruction in the Middle East, London, Brassey's, 1991, and After the Storm: The Changing Military Balance in the Middle East, Boulder, Westview, 1993.

²⁰ Working papers by Leonard Spector, Daniel Poneman, Nuclear Power in the Developing World, London, Allen and Unwin, 1982, Chapter 5; "Iran's Nuclear Weapons Program," Mednews, Vol. 5,17/18, June 8, 1992, pp. 1-7.

²¹ Some reports indicate that one reactor at Bushehr was 80% complete.

²² Much of this analysis is based on research by Leonard Spector of the Carnegie Endowment.

²³ The lasers were exported by a firm headed by Dr. Jeffrey Earkens, who had worked on classified laser enrichment technology. They seem to have been exported filled with gases that did not produce the optimal wave length for nuclear enrichment, but could be refilled with the gases necessary to produce the required wave length.

²⁴ Los Angeles Times, August 22, 1979; Leonard Spector, Going Nuclear, Cambridge, Ballinger, 1987, pp. 47-53' Shyam Bhatia, Nuclear Rivals in the Middle East, London, Routledge, 1988, p. 85; JPRS-NTD, December 23, 1989.

²⁵ Observer, May 17, 1987.

²⁶ Yellow cake is not subject to IAEA inspection. Kenneth R. Timmerman, Weapons of Mass Destruction: The Cases of Iran, Syria, and Libya, Simon Wiesenthal Center, Los Angeles, August, 1992, pp. 28-45.

²⁷ See Atomic Energy Organization of Iran, The Performance of the Atomic Energy Organization of Iran, Tehran, AEOI, August 1997; Tehran Salam, August 21, 1997, and August 27, 1997; FBIS/NES, September 5, 1997, 09031007000318; September 8, 1997, NC0809092597

²⁸ Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

²⁹ Working papers by Leonard Spector and Washington Post, April 12, 1987.

³⁰ The agreement made under the Shah was have given Iran about 250-300 metric tons of Uranium enriched to 3%. During 1980-1990, Iran refused to accept the material or pay for it. When Iran did ask for the material in 1991, France used the fact that Iran's option to obtain enriched material for its investment had expired to deny Iran shipment of the material guaranteed under the original terms of the Iranian investment. Washington Times, November 15, 1991, p. F-4; David Albright and Mark Hibbs, "Spotlight Shifts to Iran," Bulletin of the Atomic Scientists, March, 1992, pp. 9-12.

³¹ Washington Post, April 12, 1987, p. D-1; James Bruce, "Iraq and Iran: Running the Nuclear Technology Race," Jane's Defense Weekly, December 5, 1988, p. 1307; working papers by Leonard Spector; JPRS-TND, October 6, 1989, p. 19.

³² El Independent, Madrid, February 5 and 6, 1990; FBIS-Middle East, December 1, 1988; Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

³³ Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

³⁴ El Independent, Madrid, February 5 and 6, 1990; FBIS-Middle East, December 1, 1988.

³⁵ El Independent, Madrid, February 5 and 6, 1990; FBIS-Middle East, December 1, 1988.

³⁶ Uranium dioxide is normally subject to IAEA safeguards and inspection, but Argentine compliance is uncertain. Argentina sold at least three metric tons to Algeria in January, 1986. Nucleonics Week, May 7, 1987, p. 6

³⁷ Working papers by Leonard Spector; Observer, June 12, 1988; Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; US News and World Report, February 12, 1990; FBIS-NES, March 23, 1990, p. 57; FBIS-EAS, December 9, 1989, December 11, 1989; Defense and Foreign Affairs, November 20, 1989, p. 2; New York Times, May 8, 1989, June 27, 1989.

³⁸ Nucleonics Week, May 2, 1991; Robert Shuey and Shirley A Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

³⁹ Washington Times, April 22, 1987, page 6; Economist, "Foreign Report", April 2, 1987, p. 7; "Iran's Nuclear Weapons Program," Mednews, Vol. 5,17/18, June 8, 1992, pp. 1-7.

⁴⁰ Many of the details on these aspects of the Iranian effort are drawn from working papers provided by Leonard Spector of the Carnegie Endowment, and Warren Donnelly of the Congressional Research Service. Also see Nucleonics Week, November 19, 1987, p. 1; November 26, 1987, p. 5; March 3, 1988, p. 7; July 28, 1988, p. 15

⁴¹ For further background on recent developments, see Director of Central Intelligence, "The Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions," Washington, CIA, June, 1997; Leonard Spector, Mark G. McDonough and Evan Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995; Treaty on the Non-Proliferation of Nuclear Weapons: Problems for its Prolongation, Moscow, Russian Foreign Intelligence Service, 1995; Greg Gerardi and Maryam Ahrinijad, "An Assessment of Iran's Nuclear Facilities," Nonproliferation Review, Spring-Summer, 1995, pp. 209-215; David A. Schwarzbach, "Iran's Nuclear Puzzle," Scientific American, June 1997, pp. 62-65; David A. Schwarzbach, Iran's Nuclear Program: Energy or Weapons, Natural Resources Defense Council, Nuclear Weapons data book series, 1995; Shahram Chubin, "Does Iran Want Nuclear Weapons?," Survival, Vol. 37, No. 1, Spring 1995, pp. 86-104.

⁴² There is a broad consensus among Western intelligence experts and governments that quiet discussions with potential supplier nations and corporations, and criminal prosecution of violators in the West, works better than open efforts to embarrass given suppliers. Suppliers are more cooperative and have less fear of media attacks that have often been launched against companies who have not actually made the reported transfers. More important, it is possible to keep the nature of such tracking efforts secret, and avoid providing a model of what to buy to other proliferators. As a result, most Iranian purchasing efforts do not become public. Western governments and intelligence organizations do occasionally deliberately embarrass uncooperative governments and companies with "leaks," but these are usually deliberately vague enough to preserve security. Similarly, briefings to outside governments and experts are usually very carefully limited. Intelligence experts have found that even classified briefings to friendly governments almost inevitably leak in detail to the media or hostile sources.

⁴³ The US had supplied 11 pounds of 93% enriched uranium in the mid-1970s, but this was largely depleted and could not keep the reactor running continuously. Base upon work by Leonard Spector; Nucleonics Week, May 14, 1989, p. 2; Observer, March 6, 1988.

⁴⁴ Reuters, February 7, 1992, AM Cycle, and Rio Negro, February 7, 1992; Washington Post, November 17, 1992, pp. A-1 to A-30.

⁴⁵ Nuclear Engineering International, March, 1990, p. 3.

⁴⁶ Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

⁴⁷ Robert Shuey and Shirley A. Kan, Chinese Nuclear and Missile Proliferation, Congressional Research Service, IB92056, October 4, 1994; Washington Times, October 16, 1991, November 6, 1991, p. F-4, November 1, 1991, p. 7; Los Angeles Times, October 31, 1991, p. B-4, March 17, 1992, p. 1; David Albright and Mark Hibbs, "Spotlight Shifts to Iran," Bulletin of the Atomic Scientists, March, 1992, pp. 9-12; Washington Post, October 31, 1991, p. 1, January 12, 1992, p. C-7, February 2, 1992, p. A-1, September 12, 1992, p. A-13, June 26, 1991, October 30, 1991; "Iran's Nuclear Weapons Program," Mednews, Vol. 5,17/18, June 8, 1992, pp. 1-7; New York Times, September 11, 1992, p. A-6, May 27, 1993; Nucleonics Week, May 2, 1991, September 24, 1992, October 1, 1992; Los Angeles Times, January 18, 1993, p. A-1, March 17, 1992, p. A-1; Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

⁴⁸ Robert Shuey and Shirley A. Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Washington Post, April 17, 1995, p. A-1, April 18, 1995, p. A-13.

⁴⁹ New York Times, May 16, 1995, p. A-1; United Press August 14, 1996, 1041; Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Washington Times, May 17, 1995, p. A-15.

⁵⁰ Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Washington Times, May 17, 1995, p. A-15.

⁵¹ See Atomic Energy Organization of Iran, The Performance of the Atomic Energy Organization of Iran, Tehran, AEOI, August 1997; Tehran Salam, August 21, 1997, and August 27, 1997; FBIS/NES, September 5, 1997, 09031007000318; September 8, 1997, NC0809092597; Kenneth Katzman, "Iran: Arms and Technology Acquisitions," Library of Congress, CRS-97-474F, October 1, 1997; Kenneth Katzman, "Iran: Military Relations With China," Library of Congress, CRS-967-572F, June 26, 1996; Shirley A. Kan, "Chinese Proliferation of Weapons of Mass Destruction, Background and Analysis," Library of Congress, CRS-96-767F, September 13, 1996.

⁵² Washington Post, November 17, 1992, p. A-1, April 18, 1995, p. A-13; Wall Street Journal, May 11, 1993, p. 14; Robert Shuey and Shirley A. Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Nucleonics Week, September 24, 1992, October 1, 1992; New York Times, May 27, 1993; The Middle East, July/August, 1994, pp. 9-10.

⁵³ Washington Post, November 17, 1992, p. A-1, April 18, 1995, p. A-13; Wall Street Journal, May 11, 1993, p. 14; Robert Shuey and Shirley A. Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Nucleonics Week, September 24, 1992, October 1, 1992; New York Times, May 27, 1993; The Middle East, July/August, 1994, pp. 9-10.

⁵⁴ New York Times, February 23, 1995, May 16, 1995, p. A-1, May 18, 1995, p. A-11; Washington Post, April 18, 1995, p. A-13, May 8, 1995, p. A-22, May 18, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March 28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United Press, November 21, 1994, Reuters, November 20, 1994.

⁵⁵ Washington Times, April 18, 1996, p. A-7.

⁵⁶ Washington Times, October 14, 1997, p. A-1; October 15, 1997, p. A-3; Washington Post, October 25, 1997, p. A-1; October 30, 1997, p. A-15; New York Times, on-line news service, October 31, 1997.

⁵⁷ Christian Science Monitor, December 19, 1996, p. 1; Associated Press, May 5, 1997, 01:26; Director of Central Intelligence, "The Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions," Washington, CIA, June, 1997; Leonard Spector, Mark G. McDonough and Evan Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, p. 123; Treaty on the Non-Proliferation of Nuclear Weapons: Problems for its Prolongation, Moscow, Russian Foreign Intelligence Service, 1995, pp. 56-59; Greg Gerardi and Maryam Ahrinijad, "An Assessment of Iran's Nuclear Facilities," Nonproliferation Review, Spring-Summer, 1995, pp. 209-215.

⁵⁸ Associated Press, August 24, 1997, 2216.

⁵⁹ Washington Times, October 22, 1997, p. A-12.

⁶⁰ Washington Times, October 14, 1997, p. A-1; October 15, 1997, p. A-3; Washington Post, October 30, 1997, p. A-15; New York Times, on-line news service, October 31, 1997; Reuters, March 15, 1998, 1312, March 26, 1998, 0743; Washington Post, March 13, 1998, p. A-1.

⁶¹ Washington Post, March 13, 1998, p. A-1

⁶² New York Times, February 23, 1995, May 18, 1995, p. A-11; Washington Post, April 18, 1995, p. A-13, May 8, 1995, p. A-22, May 18, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12,

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⁶³ Executive News Service, September 23, 1993, 1730, September 28, 1995, 1647; Washington Times, September 25, 1995, p. A-1; Washington Post, September 28, 1995, p. A-22; New York Times, September 30, 1995, p. A-4.

⁶⁴ Reuters, March 15, 1998, 1312.

⁶⁵ For a comprehensive summary of Russian nuclear exports to Iran, see Fred Wehling, "Russian Nuclear and Missile Exports to Iran," The Nonproliferation Review/Winter 1999. The report is accessible through the web page of the Monterey Institute at Monterey Institute, www.cns.miis.edu.

⁶⁶ See Atomic Energy Organization of Iran, The Performance of the Atomic Energy Organization of Iran, Tehran, AEOI, August 1997; Tehran Salam, August 21, 1997, and August 27, 1997; FBIS/NES, September 5, 1997, 09031007000318; September 8, 1997, NC0809092597

⁶⁷ Chalk Times, January 11, 1995, p. 1; New York Times, January 5, 1995, p. A-10.

⁶⁸ New York Times, January 8, 1995, p. A-8, February 23, 1995, p. A-8; Washington Post, January 7, 1995, p. A-17, February 11, 1995, p. A-11, March 3, 1995, p. A-32, April 17, 1995, p. A-13; Washington Times, February 21, 1995, p. A-13; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

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⁷⁰ New York Times, February 23, 1995, May 18, 1995, p. A-11; Washington Post, May 8, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March 28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United Press, November 21, 1994, Reuters, November 20, 1994; Los Angeles Times, March 10, 1995, p. A-3 Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

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⁷³ FBIS-SOV, July 21, 1995, p. 1.

⁷⁴ FBIS-SOV, June 29, 1995, pp. 5-7; Washington Times, May 5, 1997, p. A-13..

⁷⁵ Reuters, July 3, 1997, 0640.

⁷⁶ Based on reporting in a working paper by the Monterey Institute. See ITAR-TASS world service broadcast, 18

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⁷⁷ Washington Post, April 17, 1995, p. A-12, May 17, 1995, p. A-23; New York Times, May 19, 1995, p. A-1, May 22, 1995, p. A-1; Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123.

⁷⁸ Reuters, March 6, 1998, 1452 and March 11, 1998, 0947; Washington Post, March 7, 1998, p. A-15

⁷⁹ Based on reporting in a working paper by the Monterey Institute. See Sergey Alekhin, "Izhorskiye Zavody: We Shall Build Reactor for Iran," *Rossiyskaya gazeta*, 13 February 1999, p.3; in "Petersburg Plant To Supply Equipment for Bushehr," FBIS Document FTS19990215000317.]{Entered 3/11/99 CF

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¹⁰¹ For typical press reporting on such issues, see International Defense Review, 2/1997, pp. 21-23, and Washington Times, September 23, 1997, p. A-13; Extensive separate analysis has been done by the CSIS.

¹⁰² Washington Post, July 3, 1997, p. A-7; Director of Central Intelligence, "The Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions," Washington, CIA, June, 1997; Reuters, July 3, 1997, 0640.

¹⁰³ Jane's Defense Weekly, March 19, 1997, p. 3.

¹⁰⁴ Washington Post, November 17, 1992, p. A-30. Wall Street Journal, May 11, 1993, p. A-14; Christian Science Monitor, February 18, 1993, p. 7.

¹⁰⁵ Chalk Times, January 9, 1995, p. 6; New York Times, January 5, 1995, p. A-10, January 8, 1995, p. A-8, January 10, 1995, p. A-3; Washington Times, December 19, 1994, p. A-18, January 6, 1995, p. A-15; Washington Post, January 7, 1995, p. A-17, .

¹⁰⁶ Washington Times, May 5, 1997, p. A-13.

¹⁰⁷ For a detailed unclassified summary of the Iranian nuclear program, see Andrew Koch and Jeanette Wolf, "Iran's Nuclear Facilities, a Profile, available at the web page of the Monterey Institute, www.cns.miis.edu.

¹⁰⁸ Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; New York Times, April 3, 1995, p. A-1.

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¹¹⁰ Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; Washington Post, March 24, 1995, p. A-28, April 29, 1995, p. A-8, May 5, 1995, p. A-29; New York Times, April 3, 1995, p. A-1, April 29, 1995, p. A-6; Philadelphia Inquirer, May 3, 1995, p. A-3; Washington Post, February 27, 1995, p. 27; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

¹¹¹ Associated Press, December 24, 1997, 1305.

¹¹² Washington Times, November 15, 1991, p. F-4; Washington Post, February 7, 1992, p. A-18, February 15, 1992, p. A-29; Associated Press PM Cycle, February 6, 1992; "Iran's Nuclear Weapons Program," Mednews, Vol. 5, 17/18, June 8, 1992, pp. 1-7.

¹¹³ Gerald White, The Risk Report, Volume 1, Number 7, September, 1995.

¹¹⁴ Gerald White, The Risk Report, Volume 1, Number 7, September, 1995.

¹¹⁵ It may also be possible to cheat an IAEA inspection. At least one effort was detected in Iraq to create reactor design which concealed an irradiation chamber in the reactor for producing plutonium. Israel permitted US inspection of its facilities in Dimona in one point in its nuclear weapons program where it provided a false control panel and records simulating a different operational cycle, and smaller reactor capacity, than was actually the case. The technology now available to the IAEA makes it unlikely that such efforts could succeed, but such success is at least possible.

¹¹⁶ Robert Shuey and Shirley A Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

¹¹⁷ Patrick Clawson, Iran's Challenge to the West, How, When, and Why, Washington, The Washington Institute Policy Papers, Number Thirty Three, 1993, pp. 60-61; Financial Times, February 6, 1992; Washington Post, February 15, 1992, pp. A-29-A-30, November 17, 1992, p. A-30; Los Angeles Times, March 17, 1992, p. 1; Associated Press, AM Cycle, February 12, 1992; Agence France Presse, February 12, 1992. Christian Science Monitor, February 18, 1993, p. 7; Wall Street Journal, May 11, 1993, p. A-14; Middle East Economic Digest, March 17, 1995, p. 7.

¹¹⁸ The major uncertainty in such matters is whether Iran not has a significant centrifuge effort in a secret or underground locations. A few experts feel there is some risk that Iran might also have a secret reactor to produce Plutonium, but this seems unlikely. Washington Post, November 20, 1993, p. A-13.

¹¹⁹ The major uncertainty in such matters is whether Iran not has a significant centrifuge effort in a secret or underground locations. A few experts feel there is some risk that Iran might also have a secret reactor to produce Plutonium, but this seems unlikely. Washington Post, November 20, 1993, p. A-13.

¹²⁰ Sunday Telegraph, February 24, 1997, p. 1; Washington Times, February 24, 1997, p. A-1.

¹²¹ United Press, August 14, 1996, 1041; Sunday Telegraph, August 12, 1996.

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¹²³ David A. Schwarzbach, "Iran's Nuclear Puzzle," Scientific American, June, 1997, p. 62.

¹²⁴ White House "Fact Sheet," May 14, 1997; Washington Post, May 15, 1997, p. A-24. Also see the discussion of monitoring and country activity in Director of Central Intelligence, "The Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, July-December, 1996," Washington, CIA, June 1997, and Shai Feldman, Nuclear Weapons and Arms Control in the Middle East, Cambridge, MIT Press, 1997.

¹²⁵ Reuters, September 3, 1997, 0150.

¹²⁶ Speech at the annual USCENTCOM conference, June 26, 1997.

¹²⁷ Los Angeles Times, March 17, 1992, p. 1.

¹²⁸ New York Times, November 30, 1992, pp. A-1 and A-6, January 5, 1995, p. A-10; Washington Times, January 6, 1995, p. A-15.

¹²⁹ New York Times, January 10, 1995, p. A-3; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

¹³⁰ Associated Press, May 5, 1997, 01:26.

¹³¹ Chalk Times, January 10, 1995, p. 31; Washington Times, January 19, 1995, p. A-18.

¹³² Although the possibility is a real one. Financial Times, January 30, 1992, p. 4; Agence France Presse, January 26, 1992; Sunday Times, January 26, 1992; Der Spiegel, July 20, 1992, p. 117; Patrick Clawson, Iran's Challenge to the West, How, When, and Why, Washington, The Washington Institute Policy Papers, Number Thirty Three, 1993, pp. 63-65; United States News and World Report, November 14, 1994, p. 88; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

¹³³ New York Times, January 17, 2000, p. A-8.

¹³⁴ Rodney W. Jones and Mark G. McDonough with Toby Dalton and Gregory Koblentz Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998, Carnegie Endowment for International Peace, 1999.

¹³⁵ <http://www.defenselink.mil/pubs/prolif97/graphics.html>

¹³⁶ Washington Times, July 29, 1998, p. A-12.

¹³⁷ Non-Proliferation Center, Director of Central Intelligence, Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and

Advanced Conventional Munitions 1 January Through 30 June 1999. This report is issued in response to a Congressionally directed action in Section 721 of the FY 97 Intelligence Authorization Act, which requires: "(a) Not later than 6 months after the date of the enactment of this Act, and every 6 months thereafter, the Director of Central Intelligence shall submit to Congress a report on

(1) the acquisition by foreign countries during the preceding 6 months of dual-use and other technology useful for the development or production of weapons of mass destruction (including nuclear weapons, chemical weapons, and biological weapons) and advanced conventional munitions; and (2) trends in the acquisition of such technology by such countries." At the DCI's request, the DCI Nonproliferation Center (NPC) drafts this report and coordinates it throughout the Intelligence Community. As directed by Section 721, subsection (b) of the Act, it is unclassified. As such, the report does not present the details of the Intelligence Community's assessments of weapons of mass destruction and advanced conventional munitions programs that are available in other classified reports and briefings for the Congress.

¹³⁸ New York Times, January 17, 2000, p. A-1 and A-8; Bloomberg New, January 17, 2000, 08:28; Reuters, January 17, 2000, 13:53; Associated Press, January 18, 2000, 0211.

¹³⁹ Reuters, January 24, 2000, 18:55; January 26, 2000, 11:21.

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¹⁴² New York Times, May 14, 1995; Washington Post, November 5, 1997, p. A-1..

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