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IRANIAN WEAPONS OF MASS DESTRUCTION

IRAN'S NUCLEAR WEAPONS PROGRAMS: WORK IN PROGRESS?

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V. Possible Nuclear Weapons Programs

There is more information available on Iran's nuclear programs than on its chemical and biological programs, but this scarcely eliminates major areas of uncertainty. The flood of information regarding Iran's nuclear programs includes many gaps and conflicting reports and assessments, as major problems in assessing the credibility of information which often has to be collected from questionable sources.

Estimating Iranian nuclear capabilities is further complicated by three key factors:

- First, the United States, the European Union, and the United Nations all agree that Iran has the right to acquire a full nuclear fuel cycle for peaceful purposes under the Nuclear Non-Proliferation Treaty (NPT), but there is no clear way to distinguish many of the efforts needed to acquire a nuclear weapon from such "legitimate" activities or pure research.
- Second, Iran has never denied that it carries out a very diverse range of nuclear research efforts. In fact, it has openly claimed that it is pursuing nuclear technology and has a "national" right to get access to nuclear energy. This has given it a rationale for rejecting Russia's offer to provide Iran nuclear fuel without giving Tehran the technology and the expertise needed to use it for weaponization purposes, and the United States agrees with this position, and,
- Third, it has never been clear whether Iran does have a "military" nuclear program that is separate from its "civilian" nuclear research. American and French officials have argued that they believe that Iran's nuclear program would make sense only if it had military purposes. Both governments have yet to provide evidence to prove these claims.

If Iran is actively developing nuclear weapons, as seems steadily more likely, it has shown that it can conduct a skilled program capable of hiding many aspects of its activities, that it can mask its activities by sending confusing and contradictory signals, and that it can simultaneously exploit both deception and the international inspection process. It has also shown that it can rapidly change the character of given facilities, and pausing and retreating when this is expedient.

A Case Study in Deception, Obfuscation, and Misdirection?

Iran learned from the US invasion of Iraq in 2003 and used these lessons to its advantage. The 2003 invasion of Iraq took place under the pretense of finding and destroying Iraq's WMD programs, which turned out to be greatly exaggerated, and possibly nonexistent; which in turn showed the shortcomings of the intelligence community and created credibility issues for future operations, especially in regards to the Middle East and WMD programs.

Iran is taking full advantage of this situation with by developing a strategy which focuses on creating just enough uncertainty in the international community that any use of force could very well be taken as further signs of US imperialism. Tehran's posture would seem to indicate that it is betting on a strategy that by maintaining a high level of ambiguity while showing some level of compliance; it can create enough uncertainty to avoid a unilateral preventive strike by the US or Israel.

Tehran has shown how well it can use the media, public speaking engagements, international forums and contradicting official's statements as an invaluable weapon in its continuing war of deception. Misdirection has become a cornerstone of Iran's strategy in

concealing its true intentions and capabilities in its WMD programs, missile programs, asymmetric forces, and use of proxies and non-state actors.

As Figure 5.1 indicates, Iran repeatedly demonstrated in recent years that denial can be a weapon; by consistently finding an alternative explanation for all its actions, including concealment and actions that are limited violations of the NPT, it can maintain some degree of "plausible deniability" for a long chain of ambiguous actions and events.

Figure 5.1: Major Developments in Iran's Nuclear Program 2006-2008[1]

- **Early January 2006:** Iran removed 52 International Atomic Energy Agency (IAEA) seals on Natanz, Pars Trash, and Farayand centrifuge projects.
- **February 4, 2006:** The IAEA Board of Governors voted to refer Iran to the United Nations Security Council (UNSC).
- **February 27, 2006:** IAEA Director General Mohamed El Baradei reported that the IAEA was still tracking enriched uranium activity, the status of P-1 centrifuge program was still uncertain, P-2 centrifuge acquisition remained uncertain, there were still uranium tetrafluoride (UF4) to uranium metal conversion issues, and the status of plutonium experiments; level of Pu-239 versus Pu-240, still assessing mining, polonium, beryllium, site inspection "transparency" issues (e.g., Lavisan-Shian) dating back to 2004.
- **Early March 2006:** Twenty cascade machines were reported running at Natanz and Farayand.
- **April 2006:** The Iranian parliament passed a resolution for Iran to withdraw from the NPT.
- **April 28, 2006:** IAEA Director General Mohamed El Baradei reported that there was no clarification on enrichment, highly enriched uranium (HEU) contamination issues remained, P-1 and P-2 centrifuge issues were not addressed; new issues over P-2 designs, new issues over uranium hexafluoride (UF6) to metal and casting of uranium hemispheres (Iran refused to hand over a 15-page document about the casting of enriched and depleted uranium metal into hemispheres), still no clarification on plutonium experiments, the heavy-water reactor at Arak was still under construction, new transparency issues, Iran was building a second and third cascade at the Pilot Fuel Enrichment Plant.
- **May 30, 2006:** IAEA Director General Mohamed El Baradei stated that Iran's nuclear activity "does not present an immediate threat."
- **May 31, 2006:** Secretary of State Condoleezza Rice acknowledged Iran's right to civil nuclear energy, support for the EU-3 (British, French, German) offer to Iran, offered "new and positive relationship…looks forward to a new relationship," "as soon as Iran fully and verifiably suspends its enrichment and reprocessing activities, the U.S. would come to the table with our EU-3 colleagues and meet with Iran's representatives"; Rice repeated willingness to hold talks on August 29.
- **June 8, 2006:** Director General Mohamed El Baradei reported that there was no further resolution on contamination, P-1, P-2, or uranium metal and casting, warned that Iran had started centrifuge cascade activity for 164-machine cascade and started work on second 164-machine unit (second cascade launched on October 23, 2006, but without UF6 insertion), no improvement in transparency, especially plutonium and heavy-water reactor, new UF6 conversion campaign had begun in the Isfahan Uranium Conversion Facility (UCF) on June 6, 2006, following up on "Green Salt" project, investigating high explosives testing and design of missile reentry vehicle.
- **July 31, 2006:** United Nations Security Council Resolution (UNSCR) 1696 (July 31, 2006) found that there was "Serious concern" over IAEA DG reports of February 27, April 28, June 8,

[1] Figure 5.1 was adapted from multiple sources including, but not limited to; NTI, GlobalSecurity.org, IAEA reporting, UNSC reporting, ISIS, various intelligence agencies, and various news sources.

"Demands…that Iran shall suspend all enrichment-related and reprocessing activities, including research and development…", Expressed intention (if Iran did not comply by August 31) to adopt appropriate measures under Article 41 of Chapter VII of Charter of UN to "persuade Iran to comply…and underlines that further decisions will be required should such additional measures prove necessary."

- **August 20, 2006:** Ayatollah Ali Khamenei said in a speech that, "The Islamic Republic of Iran has made up its mind based on the experience of the past 27 years to forcefully pursue its nuclear program and other issues it is faced with".[2]
- **August 26, 2006:** Mahmoud Ahmadinejad inaugurated the Arak heavy-water production plant.
- **August 27, 2006:** Chief nuclear negotiator Larijani rejected the UN deadline. Ahmadinejad says Iran will never abandon purely peaceful program. Repeats rejection of deadline on August 29. Verbally attacks Britain and the United States.
- **August 31, 2006:** IAEA Director General Mohamed El Baradei reported that Iran tested 164-machine cascade to 5-percent enrichment, second 164 centrifuge cascade to start in September (reportedly did start on October 23), limiting access to Natanz, possibly in the future to Arak and Isfahan, no indications of ongoing reprocessing, no resolution of HEU contamination (partly still unaccounted for), P-1, and P-2 issues, machining of uranium remains unresolved, uranium conversion stepping up but is inspected, transparency issues on environmental sampling and missile reentry vehicles (Green Salt) unresolved.
- **September 11, 2006:** Secretary of State Condoleezza Rice said that a temporary suspension of the uranium enrichment program might be sufficient for holding direct negotiations with Iran.[3]
- **October 1, 2006:** Ahmadinejad announced that Iran was planning to construct 100,000 centrifuges.
- **November 14, 2006:** The IAEA Board of Governors Reported the testing of the second 164-machine cascade with UF6 was begun; as of November 7, Iran had produced 55 tons of uranium (in the form of UF6) out of the 160 tons of uranium ore it started processing at its Isfahan UCF in June 2006.
- **August 13 to November 2, 2006:** According to the IAEA, during this time period Iran reported that approximately 34 kilograms of UF6 was fed into the centrifuges and enriched to levels below 5 percent U-235. Iran had reported by August 31 that a total of 6 kilograms of UF6 was fed into the then-single cascade between June 23 and July 8. This would represent an almost 500-percent increase in the inserted quantity of UF6, which in return may be an indication of additional and/or more efficient cascades.
- **December 23, 2006:** The UNSC passed resolution 1737, which calls on Iran to stop all uranium enrichment activities and heavy-water experiments within 60 days, allow monitoring and verification of its enrichment activities, and imposes sanctions on several Iranian persons and organizations that are believed to be linked to the nuclear program.
- **January 2007:** Iran blocked the entry to 38 IAEA inspectors in retaliation for sanctions.[4] Islamic Republic News Agency (IRNA) reported that inspectors from countries which voted in favor of U.N. Security Council resolution placing sanction on Iran would be banned. ISNA did not name the diplomat, saying he spoke on condition of anonymity.[5]

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[2] Michael Slackman, "Iran Defiant on nuclear program as deadline approaches", *New York Times*, August 22, 2006.
[3] Glenn Kessler and Dafna Linzer, Brief Nuclear Halt may lead to talks with Iran, *Washington Post*, September 12, 2006.
[4] "Timeline of Iran nuclear stand-off." *Agence France Presse*, June 23, 2008. http://w3.nexis.com/new/auth/checkbrowser.do?t=1214323132418&bhcp=1
[5] "ElBaradei Calls for Timeout on Iran Nuclear Program." CNN Interview with Mohamed ElBaradei. 27 January, 2007. http://www.iaea.org/NewsCenter/Transcripts/2007/cnn270107.html

- **February 19, 2007:** Mohamed El Baradei said that Iran may be six months away from enriching uranium on an industrial scale. He added that according to U.S. and British intelligence, Iran was five to ten years away from developing a nuclear bomb.[6]
- **February 22, 2007:** The IAEA Board of Governors issued a report (Gov/2007/8) that addressed Iran's compliance with the provisions set forth in UNSCR 1737. The February 22 report concluded that not only had Iran not complied with any of the calls set forth in UNSCR 1737, but it had informed the IAEA that it was installing two additional 164-machine cascades for uranium enrichment. Further, Iran informed the IAEA that it was planning to build a module of 18 164-machine cascades underground by mid-2007. However, by the time IAEA report Gov/2007/8 was issued, apparently no UF6 had been fed into the centrifuges.
- **March 15, 2007:** The five permanent members of the UN Security Council plus Germany agreed on a draft resolution on further sanctions on Iran. Apparently, the draft contained an arms embargo and broader economic sanctions such as a halt on international loans and freezing assets on individuals connected to the nuclear as well as the ballistic missile development programs. However, by the end of March 2007, the UNSC had not taken up a vote on the matter of further UN sanctions, and it was not clear what the smallest common political denominator at the UNSC would be on the matter.
- **April 5, 2007:** Iran's head of its Atomic Energy Agency, Ali Larijani, tells a European Union group that, "The Islamic Republic of Iran is ready to negotiate only on non-diversion of its nuclear program for military purposes, and not on its nuclear rights….Iran will not accept any preconditions or suspension for a time. Nor can suspending enrichment be a precondition or the result of negotiations (with the Permanent Members of the U.N. Security Council)…"[7]
- **April 9, 2007:** Iranian President Ahmadinejad announces that Iran is now capable of nuclear fuel production on an "industrial scale."[8]
- **May 14, 2007:** Inspectors for the IAEA concluded that Iran had solved most of its technical problems in enriching uranium and is doing so on a much larger scale than before. A short-notice inspection of Natanz found up to 1,300 active centrifuges, with 300 more being tested and another 300 under construction. Iran seems to be capable of installing up to 3,000 centrifuges as early as June 2007 in "cascades" of 164 centrifuges each. Some diplomats speculate that Iran could have as many as 5,000 centrifuges installed by the end of the year, and some estimates go as high as 8,000. There is, however, no data on the efficiency of this effort or its real-world capability to produce given amounts of weapons-grade uranium.[9]
- **October 20, 2007:** Ali Larijani, the top Iranian negotiatior over nuclear program issue, resigns from his post because of differences with President Ahmadinejad. He is replaced by the deputy foreign minister Saeed Jalili.[10]
- **November 22, 2007:** The head of the IAEA, Mohamed ElBaredei, tells the Board that although Iran has been positively cooperating about many important aspects of its nuclear activities it needs to be more forthcoming on the remaining outstanding issues.[11]
- **December 3, 2007:** Declassified U.S. National Intelligence Estimate on Iran stated that work on a nuclear weapons program was abandoned in 2003 and that the halt lasted at least several years.[12]

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[6] Daniel Dombey, „FT-Interview: Mohamed El-Baradei", *Financial Times*, 19 February, 2007.
[7] Agence France Press, Tehran, April 5, 2007.
[8] "Iran Says It Can Enrich Uranium on a Large Scale," *New York Times*, April 10, 2007, http://www.nytimes.com/2007/04/10/world/middleeast/10iran.html.
[9] David E., Sanger, "Atomic Agency Concludes Iran is Stepping Up Nuclear Work," *New York Times*, May 14, 2007; [9] David E., Sanger, "Inspectors Cite Big Gain by Iran on Nuclear Fuel," *New York Times*, May 14, 2007
[10] "Iran's nuclear negotiator resigns." *BBC News*, October 20, 2007. http://news.bbc.co.uk/2/hi/middle_east/7053963.stm.
[11] "Statements of the Director General." IAEA News Centre, 22 November 2007. http://www.iaea.org/NewsCenter/Statements/2007/ebsp2007n019.html.

- **January 22, 2008:** The permanent U.N. Security Council members plus Germany (P5+1) reach agreement on new sanctions resolution targeting Iran's nuclear program. The IAEA and Iran agree to a four week deadline for Iran to clear up the remaining outstanding questions on its nuclear activities.[13]

- **February 22, 2008:** Director General El Baradei presents the latest nuclear safeguards report to the IAEA Board. The report states that good progress has been made but that a final verdict cannot be offered.[14]

- **March 3, 2008:** The U.N. Security Council authorizes Resolution 1803. This is the third round of sanctions targeting Iran over its nuclear activities. The resolution also demands the Director General of the IAEA to report within 90 days on whether Iran has ceased its uranium enrichment process, as previously demanded by the Security Council.[15]

- **April 11, 2008:** The Islamic Republic News Agency (IRNA) reports that three sets of 164-machine cascades from a second series of 3,000 are in motion at Natanz. Previous reports stated that 18 sets of 164-machine cascades were already active in uranium enrichment. During the National Nuclear Technology Festival President Ahmadinejad declared that activities have started for the installment of 6,000 P1 centrifuges.[16]

- **May 27, 2008:** IAEA report on Implementation of the NPT Safeguards Agreement stated that the alleged studies in the development of nuclear weapons remain "a matter of serious concern" and that Iran still owes "substantial explanations" on its nuclear activities. Using unprecedented blunt language the report accuses Iran of "willful lack of cooperation."[17]

- **June 7, 2008:** A senior member of the Israeli cabinet, Shaul Mofaz, said that an attack on Iran would be "inevitable" if Iran is to be stopped from developing nuclear weapons.[18] The comments by the Israeli minister were credited for a record one-day jump in oil prices by $11, setting the all-time price record of $139/barrel.[19]

- **June 14, 2008:** The EU foreign affairs representative Javier Solana delivered the "carrots and stick" package to Tehran.[20] The package was meant as an incentive to the halt of uranium enrichment and the beginning of negotiations to resolve the nuclear crisis. In case of rejection, sanctions could be in place within a month.[21]

- **June 16, 2008:** Ongoing investigations revealed that the Tinners, a Swiss family with a middle-man role in the A.Q. Khan network, were in possession of electronic blueprints for a sophisticated and compact nuclear weapon. The new weapon design was reported to be more sophisticated than the old designs that emerged in 2003 when Libya gave up its nuclear weapons program. Prior evidence indicated that the network led by the Pakistani scientist had sold uranium enrichment technology to Libya, Iran, and North Korea.[22] According to David Albright of the Institute for

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[12] "Timeline of Iran nuclear stand-off," *Agence France Presse*, June 23, 2008. http://w3.nexis.com/new/auth/checkbrowser.do?t=1214323132418&bhcp=1.

[13] David Gollust, "Major Powers Agree on Contents of New Iran UN Resolution." Voice of America, January 22, 2008. http://www.voanews.com/english/archive/2008-01/2008-01-22-voa72.cfm.

[14] "Latest Iran Safeguards Report Circulated to IAEA Board." IAEA News Centre, February 22, 2008. http://www.iaea.org/NewsCenter/News/2008/iranreport0208.html.

[15] "Security Council authorizes more sanctions against Iran over nuclear issue." UN News Centre, March 3, 2008. http://www.un.org/apps/news/story.asp?NewsID=25835&Cr=iran&Cr1.

[16] "3 164-machine sets from 2nd series of 3,000 centrifuges in motion – source." IRNA. April 11, 2008. http://www2.irna.ir/en/news/view/line-17/0804112108181137.htm.

[17] Elaine Sciolino, "Nuclear Agency Accuses Iran Of Willful Lack Of Cooperation." New York Times. May 27, 2008.

[18] Tobias Buck and Daniel Dombey, "Israel May Strike Iran, Deputy PM Says." Financial Times. June 7, 2008.

[19] "Mofaz criticised over Iran threat." BBC News. June 8, 2008. http://news.bbc.co.uk/2/hi/middle_east/7442471.stm.

[20] IAEA Information Circular (INFCIRC/730). IAEA News Centre. July 1, 2008. http://www.iaea.org/Publications/Documents/Infcircs/2008/infcirc730.pdf.

[21] "Tehran Gets Last Chance Of Deal On Nuclear Power." *London Times*. June 14, 2008.

[22] David E. Sanger and William J. Broad, "Officials Fear Bomb Design Went To Others." New York Times. June 16, 2008.

Science and International Security (ISIS) the design in Switzerland "would have been ideal for two of Khan's other major customers, Iran and North Korea. They both faced struggles in building a nuclear warhead small enough to fit atop of their ballistic missiles, and these designs were for a warhead that would fit."[23]

- **June 18, 2008:** Iran responded to the Solana package with a counter offer of comprehensive negotiation, of which the nuclear issue is only one part.[24]. The IAEA circulated a communication from Iran (issued as INFCIRC/729) that forwarded the text of the "Islamic Republic of Iran´s proposed package for constructive negotiation"

- **June 20, 2008:** IAEA Director General Muhammad El Baradei said in an interview that if Iran wanted a nuclear weapon it would have to leave the NPT, expel IAEA inspectors, and then it "would need at least six months to one year" to produce a nuclear weapon. El Baredei added that at the moment there is no justification for a strike on Iran because this is not a scenario "where we would wake up one morning to an Iran with a nuclear weapon."[25]

- **June 20, 2008:** Reports emerged in the media that the Israeli Air Force conducted a major military exercise earlier in the month of June. The exercise involved more than 100 Israeli F-15 and F-16 fighters alongside rescue helicopters and refueling tankers. The maneuvers took place across 900 miles over the eastern Mediterranean and Greece, and were largely seen as rehearsal for an eventual attack on Iranian nuclear facilities.[26]

- **June 23, 2008:** The EU agreed on new sanctions aimed at companies and individuals seen as linked to the Iranian ballistic missile and nuclear programs. The punitive measures included the freeze of Bank Melli assets and a ban on select Iranian officials. Iran condemned the measures by calling them illegal and damaging to the diplomatic process.[27]

- **June 25, 2008:** Media reported alleged claims by an adviser to the Israeli National Security Council that Syria planned to supply Iran with spent nuclear fuel for reprocessing into weapons-grade plutonium. If confirmed, these reports would indicate greater nuclear cooperation between Syria and Iran than previously known.[28]

- **June 28, 2008**: Iran was reported as having repositioned its Shahab 3B missiles targeting Israeli sites, including Dimona nuclear plant. The move was perceived as a deterrence response against possible Israeli air strikes, given the "dress rehearsal" Israeli Air Force (IAF) long-range exercises earlier in June.[29]

- **June 29, 2008:** Saber-rattling between Israel and Iran. Former head of the Mossad and current adviser to the Israeli parliament's foreign and defense committees, Shabtai Shavit, said that Israel "should do whatever necessary" to prevent Iran from obtaining nuclear weapons. His assessment was that Israel has a 12-month window of opportunity to destroy Iran's nuclear program. The worst case scenario analysis is that Iran will use nuclear weapons against Israel once it has the capability, and that in case sanctions fail the military action is the only option.[30] Major General. Mohammad Ali Jafari of the Revolutionary Guard declared to Iranian media that "Iran will

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[23] David Albright, "Swiss Smugglers Had Advanced Nuclear Weapons Designs." ISIS. June 16, 2008. http://www.isis-online.org/publications/expcontrol/Advanced_Bomb_16June2008.pdf.

[24] IAEA Information Circular (INFCIRC/729). IAEA News Centre. June 12, 2008. http://www.iaea.org/Publications/Documents/Infcircs/2008/infcirc729.pdf.

[25] "IAEA Director-General Dr. Muhammad ElBaradei: Iran Can Produce Enough Enriched Uranium for a Nuclear Bomb in Six Months to a Year." The Middle East Media Research Institute, Clip No. 1797. June 20, 2008.http://www.memritv.org/clip_transcript/en/1797.htm.

[26] Michael R. Gordon and Eric Schmitt, "U.S. Says Exercise By Israel Seemed Directed At Iran." *New York Times*. June 20, 2008.

[27] "Iran: European Sanctions Condemned." *New York Times*. June 25, 2008.

[28] Ian Black, "Syria planned to supply Iran with nuclear fuel, Israel says." *Guardian*. June 25, 2008. http://www.guardian.co.uk/world/2008/jun/25/syria.iran.

[29] Herb Keinon, "Times: Iran targeting Dimona reactor." *Jerusalem Post*. June 28, 2008.

[30] Carolynne Wheeler and Tim Shipman, "Israel Has A Year To Stop Iran Bomb, Warns Ex-Spy." *London Sunday Telegraph*. June 29, 2008.

definitely act to impose control on the Persian Gulf and Strait of Hormuz" stemming the flow of oil and putting pressure on Western economies. Additionally, Jafari noted that Israel is well within reach of Iranian missiles, and that Iran would retaliate against regional countries that partake in attacks on Iran.[31]

- **June 30, 2008:** Anonymous U.S. Defense officials reported to ABC News that Israel is likely to strike Iran by the year's end. The Israeli decision is contingent upon two "red-lines." a) whether Iran produces enough enriched uranium at Natanz to make a nuclear weapon; b) deployment of SA-20 air defense system Iran is reportedly purchasing from Russia. Israeli government declined to comment on the allegations, but former head of the Mossad, Ephraim HaLevy, said that a potential Israeli strike has been "in the air" for a long time. However, for Hirsch Goodman of the Jafee Center for Strategic Studies in Tel Aviv, these comments are the "the latest in the hype." According to Goodman "It's all total rubbish by anonymous officials who want to create an atmosphere of pressure on those who need to make decisions and implement sanctions." Goodman does not believe these attacks to be militarily and politically feasible.[32] Furthermore, according to a recent report by *Jane's* the Russian-Iranian deal over the SA-20 (S-300) air defense system "has since been shelved because of disagreements over the price."[33] Defense Secretary Gates later said that it was "unlikely that those air-defense missiles would be in Iranian hands any time soon."[34]

- **July 2, 2008:** Admiral Mike Mullen, the Chairman of the Joint Chiefs of Staff, expressed his concern about a conflict with Iran upon his return from Israel, where he consulted with Israeli defense minister and the chief of defense staff. Mullen said that "[o]pening up a third front right now would be extremely stressful on us" and that "[t]his is a very unstable part of the world, and I don't need it to be more unstable."[35] Manouchehr Mottaki, the Iranian foreign minister, dismissed the possibility of an attack upon Iran as psychological warfare, adding that Iran did not believe that the U.S. was in a position to wage another war. Nevertheless, Iranian officials appeared to be giving greater consideration to the package of political and economic incentives offered by Western diplomats. There were also talks of a "freeze-for-freeze" deal, where Iran would stop adding new uranium-enrichment capabilities and the West would stop pushing for sanctions, resulting in a period of preliminary talks. [36]

- **July 4, 2008:** Iran responded to the P5+1 package of incentives saying that it was willing to begin comprehensive negotiations with EU foreign policy representative Javier Solana. The letter from Iran's foreign minister Manouchehr Mottaki did not address the issue of stopping uranium-enrichment activities,[37] The following day a spokesperson for the Iranian government commented that Iran's nuclear policy had not changed and that Iran would not comply with any UN Security Council resolution requiring a halt of uranium-enrichment.[38]

- **July 7, 2008:** The *London Daily Telegraph* reported that according to the latest intelligence circulated among Western diplomats, Iran's Revolutionary Guard had set up a network of civilian companies to manufacture components for the advanced P2 centrifuges. The operation is allegedly based on the 2004 plot involving Kalaye Electric Company and exposed by UN nuclear inspectors.[39]

- **July 9, 2008:** The U.S. Navy's Fifth Fleet and allied navies conducted "Exercise Stake Net", a five-day drill in the Persian Gulf aimed at protecting the oil-rich region. The drill was seen as a

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[31] "Iran Threatens To Shut Down Persian Gulf Oil Lanes If Attacked," Los Angeles Times. June 29, 2008.
[32] Sara Sorcher, "Will Israel Attack Iran? Israeli Analysts Reflect on U.S. Reports of a Possible Israeli Attack on Iran." NBC News. July 1, 2008. http://abcnews.go.com/International/Story?id=5284361&page=1.
[33] "Russia and Iran's Marriage of Convenience." Jane's Foreign Report. July 3, 2008.
[34] Anthony Capaccio, "Iran May Get First Russian Missiles in December, Pentagon Says." Bloomberg. July 9, 2008. http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aQFCIm6IdP0c
[35] "Broadcast News Coverage of Admiral Mullen Briefing." CNN The Situation Room. July 2, 2008.
[36] Robin Wright, "Iran Appears To Warm To Diplomacy." Washington Post. July 2, 2008.
[37] Elaine Sciolino, "Iran Responds Obliquely to Nuclear Plan." New York Times. July 5, 2008.
[38] Elaine Sciolino, "Iran Says Its Nuclear Policy Has Not Changed." New York Times. July 6, 2008.
[39] Con Coughlin, "Iran Has Resumed A-Bomb Project, Says West." London Daily Telegraph. July 7, 2008.

response to Iranian threats against regional U.S. interests and oil flows through the Strait of Hormuz.[40] At the same time the State and Treasury departments proceeded to place greater financial sanctions on key Iranian public and private officials, as well as companies, accused of being involved in the alleged nuclear weapons program.[41]

- **July 9, 2008:** The Iranian media broadcasted the IRGC test-firing nine missiles 100 miles south of Tehran; all the while Iran was also conducting "The Great Prophet III" naval games at the mouth of the Strait of Hormuz.[42] One of the fired missiles was presumed to be a Shahab-3 with a one-ton warhead and a range of 1,200 miles, capable of reaching Israel and U.S. targets within the region.[43] According to Charles Vick of GlobalSecurity.org the launched Shahab-3s appeared to have a conic warhead indicating that they may have been older models with a 900-mile range. Vick suggested that these may have been the Shahab-3A, rather than the more advanced triconic nosecone Shahab-3B, which is suspected to be Iran's delivery system for a potential nuclear weapon. The other missiles were identified as Zelzal and Fateh.[44] Thomas Fingar, head of the National Intelligence Council, described Iran as pursuing a "hedgehog strategy," coupling bellicose rhetoric and display of military capabilities with offers of comprehensive negotiations.[45] The test firing did not seem to show any new capabilities, mostly involving middle-range to close-range battlefield rockets.[46]

- **July 19, 2008:** The P5+1 group held a meeting with Iran in Geneva, Switzerland to hear the Iranian response to its diplomatic offer. The Under Secretary for Political Affairs of the U.S. State Department, Ambassador William Burns, was present as an observer in what was considered to be the highest level contact between the U.S. and Iran since the 1979 revolution.[47] While Iranian foreign minister Saeed Jalili described the talks as "constructive and progressing" the European officials expressed disappointment in the Iranian response.[48] The two-page document that Iran circulated at the meeting did not substantially address the major demands, and ignored the "freeze-for-freeze" offer. The paper called for three more meetings with Javier Solana and gave the impression that Iran intended to prolong the talks. U.S. Secretary of State Rice said that Iran could not continue to stall the process and warned of more sanctions in case Iran failed to respond positively within a two week period.[49]

- **July 21, 2008:** British Prime Minister Gordon Brown told the Knesset, the Israeli parliament in Jerusalem, that he was ready to back another round of sanctions if Iran didn't take concrete steps to meeting Security Council demands.[50]

- **July 23, 2008:** Iranian President Mahmoud Ahmadinejad said the Persian Gulf nation would resist pressure from world powers to halt its nuclear program, following the 19 July Geneva talks that failed to produce a breakthrough in the dispute over the project.[51]

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[40] "U.S., Allies Hold Gulf Exercises." Washington Times. 9 July, 2008.
[41] "U.S. Seeks Sanctions For Nuclear Work." Washington Post. July 9, 2008.
[42] Lauren Gelfand, "Iran bolsters retaliation warning with missile tests." Jane's Defence Weekly. July 9, 2008. http://www8.janes.com/Search/documentView.do?docId=/content1/janesdata/mags/jdw/history/jdw2008/jdw37161.htm@current&pageSelected=allJanes&keyword=&Prod_Name=JDW&backPath=http://search.janes.com/Search.
[43] Glenn Kessler, "Iran Launches Nine Test Missles, Says More Are Ready." Washington Post. July 10, 2008.
[44] Alex Watanka, "Iran launches dual-purpose missiles." Jane's Intelligence Review. July 18, 2008. http://www4.janes.com/subscribe/jir/doc_view.jsp?K2DocKey=/content1/janesdata/mags/jir/history/jir2008/jir10447.htm@current&Prod_Name=JIR&QueryText=.
[45] Alan Cowell and William J. Broad, "Iran Reports Missile Test, Drawing Rebuke." New York Times. July 10, 2008.
[46] Pamela Hess, "Test Exhibits No-Long Range Rocket." Washington Times. July 12, 2008.
[47] Elaine Sciolino, "U.S. Is Present, But Iran Nuclear Talks End In Stalemate." International Herald Tribune. July 20, 2008. http://www.iht.com/articles/2008/07/20/africa/20nuke.php.
[48] Dan Eggen, "U.S. Talks With Iran Exemplify Bush's New Approaches." Washington Post. July 20, 2008. http://www.washingtonpost.com/wp-dyn/content/article/2008/07/19/AR2008071901597.html.
[49] Elaine Sciolino, "Iran Offers 2 Pages and No Ground in Nuclear Talks." New York Times. July 22, 2008. http://www.nytimes.com/2008/07/22/world/22iran.html?_r=1&oref=slogin.
[50] Robin Millard, "British PM warns Iran in landmark Israel speech," France 24, July 21, 2008, available at http://www.france24.com/en/20080721-british-pm-warns-iran-landmark-israel-speech.

- **July 24, 2008:** Just five days after Tehran stonewalled demands from the P5+1 that it halt activities capable of producing the fissile core of warheads, Iranian Vice President Gholam Reza Aghazadeh signaled that Iran would no longer cooperate with U.N. experts probing for signs of clandestine nuclear weapons work, confirming the investigation was at a dead end a year after it began. [52]

- **July 26, 2008:** Iran's President Mahmoud Ahmadinejad claimed that Iran now possessed 6,000 centrifuges which is double the 3,000 uranium-enriching machines Iran had previously said it was operating. Iran says it plans to move toward large-scale uranium enrichment that will ultimately involve 54,000 centrifuges. President Ahmadinejad also called the U.S. participation in the latest round of nuclear talks "a victory for Iran." In the past, the U.S. said it would join talks only if Iran suspended uranium enrichment first. Ahmadinejad was quoted as saying that "[t]he presence of a U.S. representative ... was a victory for Iran, irrespective of the outcome. ... The U.S. condition was for Iran to suspend enrichment but they attended (the talks) without such a condition being met,"[53]

- **July 28, 2008:** "Today, we see new behavior shown by the United States and the officials of the United States. My question is, is such behavior rooted in a new approach?" the president told NBC in a rare interview with a US broadcaster. "In other words, mutual respect, cooperation and justice? Or is this approach a continuation in the confrontation with the Iranian people, but in a new guise?" he said from Tehran, speaking through an interpreter. If US behavior represented a genuine change, "we will be facing a new situation and the response by the Iranian people will be a positive one,"[54] …Although Iran's tone has softened, ``they haven't agreed to a slowdown in progress, not withstanding all the hints they would be doing so," Mark Fitzpatrick, a senior fellow for non- proliferation at the London-based International Institute for Strategic Studies policy group, said in a telephone interview. ``Of course he says they aren't producing a bomb, but they are producing the wherewithal to make a bomb once they have the enrichment capability." [55]

- **August 1, 2008:** Iran failed to win support from the non-aligned nations to remove UN Security Council sanctions. A U.S. official said that the conference was deadlocked on portions of the draft statement presented by Iran, which demands the removal of sanctions, dismissed UN authority, and affirmed Iran's right to possess the entire nuclear fuel cycle. Iran did receive broad endorsement to pursue a peaceful nuclear program.[56]

- **August 4, 2008:** The P5+1 nations agreed to seek new sanctions against Iran after the country failed to respond to an incentives package aiming to resolve the nuclear dispute. "We are disappointed that we have not yet received a response from Iran," State Department spokesman Gonzalo Gallegos tells reporters. "We agreed in the absence of a clear, positive response from Iran [that] we have no choice but to pursue further measures against Iran."[57]

- **August 16, 2008:** Iran test-fired a new rocket, named Safir-e Omid, capable of carrying a satellite into orbit. The White House said Iran's rocket announcement was "troubling," calling it part of a pattern of Iranian activity to build a nuclear program and the means to potentially launch a weapon. "The Iranian development and testing of rockets is troubling and raises further questions

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[51] "Iran vows no nuclear concessions," BBC News, July 23, 2008, available at http://news.bbc.co.uk/2/hi/middle_east/7520854.stm.

52 George Jahn, "Iran ends cooperation with UN nuclear arms probe," USA Today, July 23, 2008 available at http://www.usatoday.com/news/topstories/2008-07-24-483908543_x.htm.

53 "Report: Iran now possesses 6,000 centrifuges," USA Today from the Associated Press, July 26,, 2008 available at http://www.usatoday.com/news/world/2008-07-26-iran-nuclear_N.htm.

54 "If US has new approach, Iran will respond: Ahmadinejad." Agence France Presse, July 28, 2008. http://afp.google.com/article/ALeqM5hGxbTykDNZA2f4Bsa7wRqvqBbtpA

55 Robin Stringer, "Iran Not Building Nuclear Bomb, Ahmadinejad Tells NBC (Update2)." Bloomberg.com. July 28, 2008. http://www.bloomberg.com/apps/news?pid=20601087&sid=agN336SOksKw&refer=home.

[56] U.S. Officials: Iran Rebuffed on Nuclear Support," The Associated Press, 2 August 2008.

[57] "New sanctions sought for Iran on nuke works," *Newsday,* 4 August 2008, "Iran Issues new Warning after Defying Deadline," *The New York Times,* 5 August 2008.

about their intentions," said White House spokesman, Gordon D. Johndroe. Rocket scientists agree that the same technology that puts satellites into orbit can deliver warheads.[58]

- **August 28, 2008:** In the wake of the Russian invasion of Georgia, the Russian ambassador to Iran, Alexander Sadovnikov, told the official IRNA news agency that Moscow won't support a new round of U.N. Security Council sanctions against Iran. "The Russian move into Georgia has begun a tectonic shift in the (Mideast) region," said Joshua Landis, a Syria expert in the United States. "It has emboldened Syria, Hezbollah and Iran to push harder against Israel and the U.S."[59] Also on this date it was reported that Iran offered to share its nuclear technology with Nigeria to boost electricity production. The deal was signed at the end of three days of talks between the oil producing nations. Both countries stress that the nuclear program is for peaceful purposes only.[60]

- **August 29, 2008:** Iranian Deputy Foreign Minister Ali Reza Sheikh announced that Iran has increased the number of centrifuges at its uranium enrichment plant to 4,000 and is preparing to install 3,000 more in the Natanz plan. By reaching 4,000 centrifuges, the program is moving into an industrial-scale program that could churn out enough enriched material for dozens of nuclear weapons..[61]

- **September 5, 2008:** According to Iranian President Mahmoud Ahmadinejad, Iran was considering imposing unilateral sanctions against Western powers in response to measures to punish Tehran over its nuclear program,.[62]

- **September 6, 2008:** President Hu Jintao of China urged other nations to negotiate a resolution to Iran's nuclear issue during a meeting with Iranian President, Mahmoud Ahmadinejad, making clear again that China disapproved of any move by Western countries to attack Iran with military force.[63]

- **September 7, 2008:** The Kremlin was reported as discussing sending teams of Russian nuclear experts to Tehran and inviting Iranian nuclear scientists to Moscow for training, according to sources close to the Russian military.[64]

- **September 8, 2008:** A senior Russian nuclear official was quoted by ITAR-TASS news agency as saying that the start-up of the first reactor at Iran's Bushehr nuclear plant will be "irreversible" by February next year. "Between December 2008 and February 2009 various technical measures will be carried out... that will make the physical start-up process of the first Bushehr reactor irreversible," the report quoted the head of the Russian company working on the facility, Atomstroiexport, as saying. He said further high-level meetings between Russian and Iranian officials would be held September 29. Russia, using Bushehr as a lever in relations with Tehran, has repeatedly put back the start-up date. Moscow had said it expected the plant to be started up some time this year. [65]

- **September 10, 2008:** The US imposed sanctions on The Islamic Republic of Iran Shipping Lines (IRISL) and 18 of its affiliates over its alleged support for Tehran's nuclear programme. The US treasury said that The IRISL's US-based assets would be frozen and its transactions banned. "Not only does IRISL facilitate the transport of cargo for UN-designated proliferators, it also falsifies

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[58] William J. Broad, "Iran Reports Test of Craft Able to Carry a Satellite," The New York Times, August 17, 2008, http://www.nytimes.com/2008/08/18/world/middleeast/18iran.html.

[59] "Syria and Iran warm to Russia as U.S. tensions grow." International Herald Tribune from The Associated Press, , August 27, 2008, http://www.iht.com/articles/ap/2008/08/27/africa/ME-Mideast-Russia-Fallout.php.

[60] "Iran Offers Nuclear Technology to Nigeria," *Voice of America News,* 29 August 2008; "Iran, Nigeria Announce Peaceful Nuclear Deal," *Mobile Register,* 29 August 2008.

[61] "Iran Reports 4,000 Centrifuges in Nuclear Program," The New York Times from The Associated Press,, http://www.nytimes.com/aponline/world/AP-Iran-Nuclear.html?partner=rssnyt&emc=rss.

[62] "Ahmadinejad threatens West with sanctions," GlobalSecurity.org, September 5, 2008, http://www.globalsecurity.org/wmd/library/news/iran/2008/iran-080829-irna01.htm.

[63] Edward Wong, "China Calls For Peaceful Resolution Of Nuclear Standoff," New York Times, September 6, 2008.

[64] Mark Franchetti, "Vladimir Putin set to bait US with nuclear aid for Tehran," The Sunday Times, September 7, 200, http://www.iranfocus.com/en/nuclear/vladimir-putin-set-to-bait-us-with-nuclear-aid-for-tehran.html.

[65] "Iran nuclear reactor launch 'irreversible' by February: report," Agence France Presse, September 8, 2008.

documents and uses deceptive schemes to shroud its involvement in illicit commerce," Stuart Levey, Under Secretary for Terrorism and Financial Intelligence, said in a statement, and added that, "IRISL's actions are part of a broader pattern of deception and fabrication that Iran uses to advance its nuclear and missile programs,"[66]

- **September 12, 2008:** IAEA Nuclear experts said they believed Iran had renewed work on developing nuclear weapons. "The inspectors only have limited access at Isfahan and it looks as though Iranian officials have removed significant quantities ... at a stage in the process that is not being monitored," an IAEA nuclear official told the Daily Telegraph. "If Iran's nuclear intentions are peaceful, then why are they doing this?" Nuclear experts responsible for monitoring Iran's program said they'd discovered that enough uranium, which if enriched could make up to six bombs, was no longer at the Isfahan nuclear production facility, and that spy satellites identified suspicious sites that Iran hasn't declared to nuclear inspectors.[67]

- **September 15, 2008:** In its latest report on the Iranian nuclear program the IAEA, said it had failed to make meaningful progress in assessing Iran's past nuclear activities. In its report, the IAEA said that Iran was failing to co-operate with its investigators. In May, the UN watchdog said Tehran was withholding information about projects to develop a nuclear warhead, convert uranium and test high explosives. It called for access to key sites, documents and officials so that investigators could assess Iran's position that its nuclear work was for peaceful purposes. But, said the IAEA, no such access had been granted. "Regrettably the agency has not been able to make any substantial progress on the alleged studies and other associated key remaining issues which remain of serious concern," and that without greater transparency from Iran, the IAEA would "not be able to provide credible assurances about the absence of undeclared nuclear material and activities in Iran". The IAEA also said that Iran was continuing to install new cascades of centrifuges to enrich uranium in defiance of a UN Security Council order. Around 3,800 centrifuges were now in operation at Iran's enrichment plant in Natanz, an increase of 300 since May, the report said. Responding to the report, the US said Iran could face more punitive measures.[68]

- **September 15, 2008:** The ISIS wrote that the IAEA reported that it has recently obtained information about the possibility of Iran drawing on "foreign expertise" in conducting experiments connected with the symmetrical initiation of a hemispherical high explosive charge suitable for an implosion-type nuclear weapon. The official noted that the IAEA had not linked this expertise to the A.Q. Khan Proliferation network.[69]

- **September 16, 2008:** The IAEA showed the UN documents and photographs suggesting Iran secretly tried to modify a missile cone to fit a nuclear bomb. Tehran said the alleged weapon-related studies were based on fabricated documents or pertained only to conventional arms, and it provided the IAEA a 117-page response in May addressing some of the agency's questions. This evidence heightened Western concerns that Iran may have had "foreign expertise" helping in experiments on a detonator applicable to an implosion-type nuclear blast occurring at high altitude.[70]

- **September 17, 2008:** "We are against offering the [IAEA] an open door once more and that they expect Iran to respond to any claim," said Alaeddin Borujerdi, the head of parliament's national security and foreign affairs commission, adding that, "We do not think there should be an open forum so America can bring up a new claim every day and pass it on to the [IAEA], expecting Iran

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[66] "US sanctions target Iran carrier," BBC News, September 10, 2008, available at http://news.bbc.co.uk/2/hi/middle_east/7609150.stm.

[67] "Experts say Iran resumed nuke weapons plan," UPI.com, September 12 2008, available at http://www.upi.com/Top_News/2008/09/12/Experts_say_Iran_resumed_nuke_weapons_plan/UPI-12581221221568/

[68] "UN nuclear agency criticises Iran," BBC News, September 15, 2008, available at http://news.bbc.co.uk/2/hi/middle_east/7616744.stm.

[69] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

[70] Mark Heinrich, "IAEA shows photos alleging Iran nuclear missile work," Reuters, September 17, 2008, available at http://www.iranfocus.com/en/nuclear/iaea-shows-photos-alleging-iran-nuclear-missile-work.html.

to address any claim," and, "We continue cooperating with the IAEA but they should not expect us to apply the additional protocol," Iran stopped applying the additional protocol, which gives inspectors broader access to its nuclear sites, after the nuclear case was referred to the UN Security Council in 2006.[71]

- **September 20, 2008:** The Russian Foreign Minister stated that Russia's position in regards to the Iran situation is that Russia is against the United Nations taking any extra measures on Iran over its nuclear program for now, and thinks efforts towards dialogue should continue. The comments came after talks between majors powers over a fourth round of U.N. sanctions against Iran ended with no firm commitment on September 19th. The United States, Britain, France and Germany are pushing for harsher measures over Tehran's defiance of U.N. demands for full disclosure and a halt to uranium enrichment, which can have both civilian and military purposes. Moves which Russia and China have resisted. [72]

- **September 23, 2008:** Iranian President Mahmoud Ahmadinejad addressed the United Nations General Assembly 63rd Session in New York. The following are remarks made by the President Ahmadinejad regarding Iran's nuclear program and Iranian perception of the international system:[73]

    - *"Iraq was attacked under the false pretext of uncovering weapons of mass destruction and overthrowing a dictator. The dictator is toppled and WMDs are not uncovered A democratic government is established by the votes of the people but, after six years, the occupiers are still there. They insist on imposing colonial agreements on the people of Iraq by keeping them under Chapter 7 of the UN Charter. The occupiers, without sense of shame, are still seeking to solidify their position in the political geography of the region and to dominate oil resources.*

    - *The UN is not capable enough to solve the problems and to remove aggression, occupation and imposition.*

    - *The Security Council cannot do anything and sometimes, under pressure from a few bullying powers, even paves the way for supporting these Zionist murderers. It is natural that some UN resolutions that have addressed the plight of the Palestinian people have been relegated to the archives unnoticed.*

    - *The people of Afghanistan are the victims of the willingness of NATO member states to dominate the regions surrounding India, China, and South Asia The Security Council cannot do anything about it because some of these NATO members also happen to be the major decision makers in the Security Council.*

    - *The never-ending arms race and the proliferation stockpile of nuclear and other weapons of mass destruction and the threats to use them, and the establishment of missile defense systems, have made the system unstable.*

    - *With regards to Iran's peaceful nuclear program, despite the inalienable right of all nations including the Iranian nation, in producing nuclear fuel for peaceful purposes, and despite such facts as the transparency of all Iranian activities and our country's full cooperation with the inspectors of the IAEA and the Agency's repeated confirmation of the fact that Iran's activities are peaceful, a few bullying powers have sought to put hurdles in the way of the peaceful nuclear activities of the Iranian nation by exerting political and economic pressures against Iran, and also through threatening and pressuring the IAEA. These are the same powers that produce new generations of lethal nuclear arms and possess stockpiles of nuclear weapons that no international*

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[71] "Iran against broader cooperation with IAEA" AFP, September 17, 2008, available at http://afp.google.com/article/ALeqM5iDAY5VRkOxsYMAUUTSVPPXLUD93g.

[72] "Russia against new U.N. measures on Iran," Reuters, September 20, 2008, available at http://www.reuters.com/article/worldNews/idUSLK12187420080920.

[73] Iranian President Mahmoud Ahmadinejad addresses the United Nations General Assembly 63rd Session in New York September 23, 2008. Statement available at http://www.un.org/ga/63/generaldebate/iran.shtml.

organization is monitoring; and, the tragedies of Hiroshima and Nagasaki were perpetuated by one of them.

- *Indeed, they are not against weapons, but they oppose other nations' progress, and tend to monopolize technologies and to use those monopolies in order to impose their will on other nations. But it is very natural that the great Iranian people, with their trust in God, and with determination and steadfastness and will continue to defend its rights. The Iranian nation is for dialogue. But it has not accepted and will not accept illegal demands. The time has come for the IAEA to present a clear report to the international community on its monitoring of the disarmament of these nuclear powers and their nuclear activities, and for a disarmament committee to be established by independent states to monitor the disarmament of these nuclear powers.*
- *The theories of development that are in line with the hegemonic system and not in accordance with the true needs of humankind and human societies.*
- *A universal resistance against the acquisitiveness, aggression and selfishness of the bullying powers is being formed. Today, the bullying powers' thoughts, practices and strategies are rejected by nations and governments, and all are seeking to establish new human relations based on justice with a view to attain prosperity, perfection, security, and sustainable welfare.*
- *Today, the Zionist regime is on a definite slope to collapse, and there is no way for it to get out of the cesspool created by itself and its supporters.*
- *The American empire in the world is reaching the end of its road, and its rulers must limit their interference to their own borders."*

- **September 23, 2008:** The Russian Foreign Ministry reported that it would not participate in a meeting with the United States to discuss Iran's nuclear program, the most significant indication yet of how Russia's war with Georgia has spoiled relations regarding other security issues. Russia and the United States, with China, Britain, France and Germany, had been scheduled to meet Thursday in New York to discuss additional punitive actions against Iran in the wake of a report by the International Atomic Energy Agency criticizing Iran's failure to fully answer questions about its nuclear activities. But Russia's refusal to attend meetings and support further sanctions has lead to a cancellation of the UN Security Council meeting regarding Iran's nuclear program.[74]
- **September 25, 2008:** The Guardian reported that on 14 May 2008, then Israeli Prime Minister Ehud Olmert raised the issue of a military strike on Iranian nuclear sites, but was told by President George W Bush that he would not support it and did not expect to revise that view for the rest of his presidency, says senior European diplomatic sources. The decision to refuse to offer any support for a strike on Iran appeared to be based on two factors, the sources said. One was US concern over Iran's likely retaliation, which would probably include a wave of attacks on US military and other personnel in Iraq and Afghanistan, as well as on shipping in the Persian Gulf. The other was US anxiety that Israel would not succeed in disabling Iran's nuclear facilities in a single assault even with the use of dozens of aircraft. It could not mount a series of attacks over several days without risking full-scale war. So the benefits would not outweigh the costs. If Israel were to launch an attack on Iran without US approval its planes could not reach their targets without the US becoming aware of their flight path and having time to ask them to abandon their mission. In this context Iran would be bound to assume Bush had approved it, even if the White House denied fore-knowledge, raising the prospect of an attack against the US.[75]
- **September 26, 2008:** The UN Security Council reaffirmed three earlier rounds of sanctions against Iran. No new sanctions were imposed, but the resolution declared that, "our determination to ensure that the international rules are upheld in this very important area," U.K. Foreign

[74] Steven Lee Myers, "Russia won't meet with U.S. on Iranian nuclear program," The New York Times, September 23, 2008.

[75] Jonathan Steele, "Israel asked US for green light to bomb nuclear sites in Iran," guardian.co.uk, September 25, 2008, available at http://www.guardian.co.uk/world/2008/sep/25/iran.israelandthepalestinians.

Secretary David Miliband said. Russia's UN ambassador Vitaly Churkin stated that "there were some concerns" that the P5+1 were not working together. In order to dispel those concerns "the ministers have decided to introduce this very brief draft resolution which would reaffirm the previous decisions of the Security Council."[76]

- **October 5, 2008:** Iranian Foreign Minister Manouchehr Mottaki stated that, "Iran's uranium enrichment policy remains unchanged. Enrichment will continue until Iran becomes self-sufficient in fuel production for nuclear plants." Mottaki indicated that Iran is willing to supply other countries with nuclear fuel after it is self-sufficient.[77]

- **October 9, 2008:** The IAEA reported that it is investigating whether a Russian scientist helped Iran conduct nuclear weapons related experiments. The agency obtained a five-page document written in Farsi from undisclosed sources, detailing precision detonator experiments allegedly conducted by Iran with the Russian scientist's help. The Russian scientist appears to have been working for Iran without the sanction of the Russian government. Iranian officials are calling the charges "groundless" and claiming that the experiments were for conventional arms. In response, IAEA Chief Weapons Inspector Olli Heinonen asserts the experiments were "not consistent with any application other than the development of a nuclear weapon."[78]

- **October 11, 2008:** The United States and a number of Western allies began discussions regarding imposing new financial sanctions on Iran outside of the UN Security Council. The sanctions would target oil refining products and refined petroleum. According to one Western diplomat, "The idea would be to get together a coalition of the willing ... given the difficulties we would have getting this past Russia and China."[79]

- **October 14, 2008:** Approximately 700 Iranian nuclear engineers who received their training in Russia were reported to be ready to begin work on the Bushehr reactor**.** Iranian nuclear official Ahmad Fayyazbakhsh reported that Bushehr will become operational in March 2009.[80]

- **October 17, 2008:** Russia will reportedly ship nearly 1,000 tons of equipment to Iran for construction of the nuclear power plant at Bushehr. Iranian officials expect Bushehr to be commissioned early next year.[81]

- **October 19, 2008:** According to Mohammad Qods, managing director of Iran's Power Plant Construction Company, some Western countries are interested in cooperating with Iran on the Darkhovin reactor's design and construction. Qods indicated that the design of the 360MW light water reactor would be completed in six years and construction would begin in 2013.[82]

- **October 20, 2008:** Mohamed El Baradei assessed that Iran still lacked the key components to produce nuclear weapons. According to El Baradei, "They do not have even the nuclear material, the raw un-enriched uranium to develop one nuclear weapon if they decide to do so. Even if you decide to walk out tomorrow from the NPT (Nuclear Nonproliferation Treaty) and you go into a lot of scenarios, we're still not going to see Iran tomorrow having nuclear weapons."[83]

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[76] "U.S., Russia Reach Deal on New UN Iran Resolution," The Associated Press, 26 September 2008; "UN set to Reaffirm Iran Sanctions," *BBC News,* 26 September 2008.

[77] "Iran: We Won't Halt Enrichment even if Nuclear Fuel Supply Guaranteed," The Associated Press, 5 October 2008; "Iran Refuses to Halt Enrichment for Fuel Guarantees," Global Security Newswire, 6 October 2008.

[78] Elaine Sciolino, "Nuclear Aid by Russian to Iranians Suspected," *The New York Times,* 9 October 2008; "Russian Aided Iranian Nuke Research, IAEA Suspects," Global Security Newswire, 10 October 2008.

[79] Daniel Bombay and James Blitz, "Go-it-Alone Plan on Iran Sanctions," *The Financial Times,* 12 October 2008; "Western Nations Consider Independent Iran Sanctions," Global Security Newswire, 14 October 2008.

[80] "Iranian Engineers Ready to Work on Nuclear Plant," The Associated Press, 14 October 2008; "Western Nations Consider Independent Iran Sanctions," Global Security Newswire, 14 October 2008.

[81] "Iran: Russia to Ship Nuke Plant Supplies," United Press International, 17 October 2008; "Russia Plans Major Supply Shipment to Iran," Global Security Newswire, 20 October 2008.

[82] "Foreign Firms Interested to Build Darkhovin Nuclear Plant: Official," *Tehran Times,* 20 October 2008.

[83] "IAEA Chief: Iran not Close to Developing Nuclear Weapons," *Haaretz,* 21 October 2008; "Iran Far From Nuke Capability, IAEA Chief Says," Global Security Newswire, 21 October 2008.

As is the case in assessing everyday aspect of Iran's missile programs and efforts to acquire nuclear weapons, the devil really does lie in the details. Figure 5.1 shows that Tehran has learned from the failures of other nation's nuclear programs in terms of denial and deception. Iran learned from the overly covert nuclear program of Saddam Husain, that the perception of compliance, limited transparency, and plausible deniability is more effective than constant denial and the concealment strategy that was the cornerstone to the Iraqi nuclear program. Iran also learned that too much transparency and overtly threatening actions and strategy, such as in the case of North Korea, can be counterproductive and lead to greater isolation coupled with the constant fear of preventive or preemptive action against the regime.

Jose Goldemberg, Brazil's former secretary of state for science and technology, made this point in commenting on the denuclearization of Brazil and Argentina. He observed that a country developing the capability to produce nuclear fuel "does not have to make an explicit early [political] decision to acquire nuclear weapons. In some countries, such a path is supported equally by those who genuinely want to explore an energy alternative and by government officials who either want nuclear weapons or just want to keep the option open."[84] This statement seems to sum up the dangers of allowing Iran to further its nuclear programs.

Problems in Analyzing Iran's Weapons of Mass Destruction (WMD) Program: Nuclear Weapons as a Case Study

Given this background, it is scarcely surprising that Iran's nuclear programs present major problems in intelligence collection and analysis. The details of U.S., British, and other intelligence efforts to cover Iran remain classified. At the same time, studies of U.S. and British intelligence failures in covering Iraq have provided considerable insights into the difficulties in covering a nation like Iran, and background discussions with intelligence analysts and users reveal the following general problems in analyzing the WMD threat:

- The uncertainties surrounding collection on virtually all proliferation and weapons of mass destruction programs are so great that it is impossible to produce meaningful point estimates. As the Central Intelligence Agency (CIA) has shown in some of its past public estimates of missile proliferation, the intelligence community must first develop a matrix of what is and is not known about a given aspect of proliferation in a given country, with careful footnoting or qualification of the problems in each key source. It must then deal with uncertainty by creating estimates that show a range of possible current and projected capabilities--carefully qualifying each case. In general, at least three scenarios or cases need to be analyzed for each major aspect of proliferation in each country--something approaching a "best," "most likely," and "worst case."[85]

- Even under these conditions, the resulting analytic effort faces serious problems. Security compartmentation within each major aspect of collection and analysis severely limits the flow of data to working analysts. The expansion of analytic staffs has sharply increased the barriers to the flow of data and has brought a large number of junior analysts into the process that can do little

[84] Jose Goldemberg, "Looking Back: Lessons From the Denuclearization of Brazil and Argentina," *Arms Control Today*, April 2006, available at: http://www.armscontrol.org/act/2006_04/LookingBack.

[85] Earlier unclassified CIA reports on problems like the ballistic missile threat often projected alternative levels of current and future capability. The qualifications and possible futures are far less well defined in more recent reports. For example, see CIA, Unclassified Summary of a National Intelligence Estimate, Foreign Missile Developments and the Ballistic Missile Threat Through 2015," National Intelligence Council, December 2001, http://www.cia.gov/nic/pubs/other_products/Unclassifiedballisticmissilefinal.htm.

more than update past analyses and judgments. Far too little analysis is subjected to technical review by those who have actually worked on weapons development, and the analysis of delivery programs, warheads and weapons, and chemical, biological, and nuclear proliferation tends to be compartmented. Instead of the free flow of data and exchange of analytic conclusions, or "fusion" of intelligence, analysis is "stovepiped" into separate areas of activity. Moreover, the larger staffs get, the more stovepiping tends to occur.

- Analysis tends to focus on technical capability and not on the problems in management and systems integration that often are the real-world limiting factors in proliferation. This tends to push analysis toward exaggerating the probable level of proliferation, particularly because technical capability is often assumed if collection cannot provide all the necessary information.

- Where data are available on past holdings of weapons and the capability to produce such weapons--such as data on chemical weapons feedstock's and biological growth material--the intelligence effort tends to produce estimates of the maximum size of the possible current holding of weapons and WMD materials. While ranges are often shown, and estimates are usually qualified with uncertainty, this tends to focus users on the worst case in terms of actual current capability. In the case of Iraq, this was compounded by some 12 years of constant lies and a disbelief that a dictatorship obsessed with record keeping could not have records if it had destroyed weapons and materials. The end result, however, was to assume that little or no destruction had occurred whenever the United Nations Special Commission, the United Nations Monitoring, Verification and Inspection Commission, and the IAEA reported that major issues still affected Iraqi claims.

- Intelligence analysis has long been oriented more toward arms control and counterproliferation rather than warfighting, although the Defense Intelligence Agency and the military services have attempted to shift the focus of analysis. Dealing with broad national trends and assuming capability is not generally a major problem in seeking to push nations toward obeying arms control agreements or in pressuring possible suppliers. It also is not a major problem in analyzing broad military counterproliferation risks and programs. The situation is very different in dealing with warfighting choices, particularly issues like preemption and targeting. Assumptions of capability can lead to preemption that is not necessary, overtargeting, inability to prioritize, and a failure to create the detailed collection and analysis necessary to support warfighters down to the battalion level. This, in turn, often forces field commanders to rely on field teams with limited capability and expertise and to overreact to any potential threat or warning indicator.

- The intelligence community does bring outside experts into the process, but often simply to provide advice in general terms rather than a cleared review of the intelligence product. The result is often less than helpful. The use of other cleared personnel in U.S. laboratories and other areas of expertise are inadequate and often present major problems because those consulted are not brought fully into the intelligence analysis process and given all of the necessary data.

- The intelligence community does tend to try to avoid explicit statements of the shortcomings in collection and methods in much of its analysis and to repeat past agreed judgments on a lowest common denominator level--particularly in the form of the intelligence products that get broad circulation to consumers. Attempts at independent outside analysis or "B-Teams," however, are not subject to the review and controls enforced on intelligence analysis the teams, collection data, and methods used are generally selected to prove given points rather than to provide an objective counterpoint to finished analysis.[86]

[86] There is no way to determine just how much the Special Plans Office team set up within the office of the Secretary of Defense to analyze the threat in Iraq was designed to produce a given conclusion or politicized intelligence. The Department has denied this, and stated that the team created within its policy office was not working Iraqi per se, but on global terrorist interconnections. It also stated that the Special Plans Office was never tied to the Intelligence Collection Program—a program to debrief Iraqi defectors—and relied on CIA inputs for its analysis. It states that simply conducted a review, presented its findings in August 2002, and its members returned to other duties. See Jim Garamone, "Policy Chief Seeks to Clear Intelligence Record," American Forces Information Service, June 3, 2003; and Briefing on policy and intelligence matters, Douglas J. Feith, under secretary of defense for policy, and William J. Luti,

- There often is no reliable methodology for estimating capability at the technical level. Models for estimating missile range-payload, accuracy, and reliability are extremely uncertain unless based on observation of actual missile testing and access to classified national data or telemetry. There is no way to reliably estimate the amount of weapons-grade material a given country needs for a functioning warhead or bomb, or its level of progress in design for fission, boosted, and fusion weapons. Estimates of reactor and centrifuge production of weapons-grade material are extremely uncertain, and estimates of the timelines to use such devices to produce given numbers of nuclear weapons are often worst-case speculations. On the other hand, many analyses of such capabilities can be over conservative because they assume an unrealistic emphasis on reliability or conventional production techniques and/or that a nation cannot "leapfrog" into weapons designs using minimal amounts of weapons-grade material.

Few of these problems have been explicitly addressed in open-source reporting on Iran, and it is uncertain from the reporting on past intelligence failures in the intelligence analysis of Iraq before the 2003 invasion that the intelligence community has covered them at the classified level.

Part of the problem lies with the user. Policy-level and other senior users of intelligence tend to be intolerant of analysis that consists of a wide range of qualifications and uncertainties even at the best of times and the best of times do not exist when urgent policy and warfighting decisions need to be made. Users inevitably either force the intelligence process to reach something approaching a definitive set of conclusions or else they make such estimates themselves.

Intelligence analysts and managers are all too aware of this fact. Experience has taught them that complex intelligence analysis--filled with alternative cases, probability estimates, and qualifications about uncertainty--generally go unused or make policy makers and commanders impatient with the entire intelligence process. In the real world, hard choices have to be made to provide an estimate that can actually be used and acted upon, and these choices must be made either by the intelligence community or by the user.[87]

These problems are compounded by the fact that so many sources report on parts of the picture – some conflicting and some almost endlessly repeating information and speculation

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deputy under secretary of defense for special plans and Near East and South Asian affairs, June 4, 2003, http://www.defenselink.mil/transcripts/2003/tr20030604-0248.html.

Some intelligence experts dispute this view, however, and claim the team's effort was used to put press on the intelligence community. Such "B-teams" also have a mixed history. They did help identify an intelligence community tendency to underestimate Soviet strategic nuclear efforts during the Cold War. The threat analysis of missile threats posed to the United States by the "Rumsfeld Commission," however, was a heavily one-sided assessment designed to justify national missile defense. Also see Greg Miller, "Pentagon Defends Role of Intelligence Unit on Iraq," The Los Angeles Times, June 5, 2003; and David S. Cloud, "The Case for War Relied on Selective Intelligence," The Wall Street Journal, June 5, 2003.

[87] Some press sources cite what they claim is a deliberate effort to ignore a September 2002 DIA report on Iraqi chemical weapons capabilities called "Iraq-Key WMD Facilities-An Operational Support Study." See James Risen, "Word that n be a weapon; by consistently finding an alternative explanation for all its actions, including concealment and actions that are limited violations of heres. (15 page document dn fact, the unclassified excerpts from the DIA report, show that DIA was not stating that Iraqi did not have chemical weapons, but rather that it had, No reliable information on whether Iraq is producing and stockpiling chemical weapons, or where Iraq has—or will—establish its chemical weapons facilities." The report went on to say that "although we lack any direct information, Iraq probably possess CW agent in chemical munitions, possibly include artillery rockets, artillery shells, aerial bombs, and ballistic missile warheads. Baghdad also probably possesses bulk chemical stockpiles, primarily containing precursors, but that also could consist of some mustard agent of stabilized VX."

If anything, the report is a classic example of what happens when intelligence reports do state uncertainty and of how the user misreads or misuses the result.

provided in previous reports. These sources also have very different motives. First, one key source has been opposition groups, largely associated with the Mujahadeen-e-Khalq (MEK). Their information has proven to be useful at times, yet some of the data they provided have been "too good to be true." Revelations by the National Council of Resistance of Iran (NCRI) about Iran's secret nuclear program did prove to be the trigger point in inviting the IAEA into Tehran for inspections, but their claims about "5,000 centrifuges" were premature and came to be seen by many as an exaggeration or at least an unconfirmed allegation.[88]

Later IAEA inspections have shown these numbers to be greatly exaggerated, although the inspectors have been denied access to a number of suspected sites, and Iran may have numerous undisclosed facilities, some of which may be concealed in underground facilities.

The source of such claims must be taken into account. Mr. Alireza Jafarzadeh is the former President of NCRI, which is associated with Mujahadeen-e-Khalq (MEK) – an organization that is considered by the U.S. Department of State as a terrorist organization, and until recently was on the EU list of terrorist groups. Its motives are well known, and its information must be considered with a certain level of skepticism. As a former CIA counterintelligence official said, "I would take anything from them with a grain of salt."[89]

The NCRI claimed that it relied on human sources, including scientists and civilians working in the facilities or locals who live near the sites. In addition, the NCRI claimed at times that their sources are inside the Iranian regime and added, "Our sources were 100 percent sure about their intelligence."[90] The NCRI did not provide any confirmation about their sources, and their information is considered by some in the U.S. and European governments as less than credible. Another example was the NCRI's claim in September 2004 that Tehran allocated $16 billion to build a nuclear bomb by mid-2005. This again was proven inaccurate.[91]

Even though these allegations should be taken with viewed with some skepticism, some of the NCRI's reporting has turned out to be accurate to a certain degree, and should not be ignored or discarded when assessing Iran's nuclear program; but should not be regarded as actionable intelligence on its own. It should be noted that it was information provided by the MEK that led to IAEA investigations of into Iran's nuclear program.

Second, U.S. officials have cited "walk-in" sources to prove the existence of an Iranian nuclear program. It is unclear who those sources are, but the United States insisted that they were not associated with the MEK or NCRI. In November 2004, for example, U.S. officials claimed that a source provided U.S. intelligence with more than 1,000 pages worth of technical documents on Iranian "nuclear warhead design" and missile modifications to deliver an atomic warhead. In addition, it was reported that the

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[88] Alireza Jafarzadeh, "Iranian Regime's Plan and Attempts to Start Uranium Enrichment at Natanz Site," Statement at the National Press Club, Washington DC, January 10, 2006.
[89] "Iran Says it Will Resume Uranium Conversion Today," *Global Security Newswire*, August 11, 2005, available at: http://www.nti.org/d_newswire/issues/2005/8/1/6860ebe5-d0a1-428e-829d-6005c7b26698.html.
[90] Dafna Linzer, "Powell Says Iran Is Pursuing Bomb," *The Washington Post,* November 18, 2004, p. A01.
[91] "UN Atomic Agency Seeks To Visit Key Iranian Defense Site: Diplomats," *Agence France Presse,* September 10, 2004.

documents also included "specific" warhead design based on implosion and adjustments, which was thought to be an attempt at fitting a warhead to Iranian ballistic missiles.[92]

According to the *Washington Post*, the walk-in source that provided the documents was not previously known to U.S. intelligence. In addition, it was not clear if this source was connected to an exile group. The same source was, apparently, the basis for the comments by then Secretary of State Colin Powell on November 17, 2004, when he said, "I have seen some information that would suggest that they have been actively working on delivery systems… You don't have a weapon until you put it in something that can deliver a weapon... I'm not talking about uranium or fissile material or the warhead; I'm talking about what one does with a warhead."[93]

Press reports indicate that walk-in documents came from one source and were without independent verification. The uncertainty about this source, reportedly, stopped many in the U.S. government from using the information, and some expressed their surprise when Secretary Powell expressed confidence in the information provided. Some saw it as a reminder of the problems in his presentation to the UN regarding Iraqi WMD and hoped that he had not made those remarks before they were confirmed. Some U.S. officials even went as far as saying that Powell "misspoke" when he was talking about the information.[94]

Other U.S. officials described the intelligence as "weak."[95] Other press reports claimed that the source, who was "solicited with German help," provided valuable intelligence that referred to a "black box," which U.S. officials claim was a metaphor to refer to nuclear warhead design. One U.S. official was quoted by the *Wall Street Journal* as saying the documents represented "nearly a smoking gun," yet the same official claimed that this was not definitive proof.[96]

Third, there are sources within Iran that have cooperated with the IAEA. According to IAEA reports, Iranian nuclear scientists were interviewed on specific questions. For example, in November 2003, the Agency requested clarification on the bismuth irradiation. The IAEA reported that in January 2004, it "was able to interview two Iranian scientists involved in the bismuth irradiation. According to the scientists, two bismuth targets had been irradiated, and an attempt had been made, unsuccessfully, to extract polonium from one of them."[97]

The credibility of these scientists depends on how much freedom they have to talk about specific issues, their level of involvement, and the nature of the questions posed to them. The nature of access and the type of information provided to the IAEA by Iranian scientists remain uncertain.

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[92] Dafna Linzer, "Nuclear Disclosure on Iran Unverified," *The Washington Post,* November 19, 2004, p. A01.
[93] Dafna Linzer, "Powell Says Iran Is Pursuing Bomb," *The Washington Post*, November 18, 2004, p. A01.
[94] Dafna Linzer, "Nuclear Disclosure on Iran Unverified," *The Washington Post*, November 19, 2004, p. A01.
[95] Sonni Efron, Tyler Marshall, and Bob Drogin, "Powell's Talk of Arms Has Fallout," *The Lost Angeles Times*, November 19, 2004.
[96] Carla Anne Robbins, "As Evidence Grows Of Iran's Program, U.S. Hits Quandary," *The Wall Street Journal*, March 18, 2005, p. 1.
[97] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, November 15, 2004, p. 18, available at: http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83_derestrict.pdf

Fourth, the IAEA and UN have been a major source of data, much of it is verified by one the scene visits or more detailed inspections. IAEA reports have often provided the most concrete data on what Iran is, and is not, known to be doing; as well as on the major uncertainties affecting Iran's actions and possible nuclear programs. The IAEA, however, is limited in what it can say by the fact it is an international organization focused on one aspect of arms control – nuclear proliferation. It also often has to be moderate or tactful in its summary reporting even if the detailed portions of its reports raise more serious questions and challenges.

Finally, there are sources like background briefings based on intelligence gathered by the United States, the European Union, and regional powers. These are based on sources like satellite images, electronic intercepts, human intelligence, and various forms of information gathering and intelligence analysis. The IAEA and the UN do not have their own intelligence and have to rely on member states to provide them with the necessary information. The history of the U.S. and the U.K. intelligence provided to UN inspectors in Iraq, however, has shown the limits to the ability of intelligence agencies to get a full picture of a country's nuclear, biological, chemical, and missile programs.

Iran's Nuclear Programs: Key Milestones

It is clear that Iran has sought to acquire nuclear reactors and technology since the 1960s, and that the Shah imported suspect technology that could be used to produce fissile material long before the 1979 Revolution. It is also clear from IAEA discoveries that Iran has pursued two key tracks towards acquiring nuclear fuel or fissile material since the revolution: uranium enrichment and production of plutonium.[98] Both of these tracks can produce the materials that can be used for nuclear reactors and for nuclear weapons.

While some of the details of Iran's history of nuclear activities are controversial, work by the IAEA, Nuclear Threat Initiative, and other sources provides the following chronology of the key milestones in Iran's nuclear programs from 1959-2008:[99]

- **1959:** The Shah ordered the establishment of a nuclear research centre at Tehran University.
- **1960:** Iran arranged to establish a 5MW research centre at Tehran University. The United States was supplying a research reactor; it also sold Iran many hot cells.
- **1964:** During his visit to the United States the Shah decided to start an ambitious plan for nuclear power.
- **1967:** Start-up of the U.S.-supplied 5-megawatt research reactor at Tehran University.
- **1 July 1968:** Iran signed the Nuclear Non-Proliferation Treaty (NPT) on the day it was opened for signature.
- **2 February 1970:** Iran ratified NPT.
- **1974:** The AEOI was established. The Shah announced that Iran intended to generate 23,000MWe at nuclear power plants "as soon as possible." US State Department said that the United States

[98] John R. Bolton, "Preventing Iran from Acquiring Nuclear Weapons," Remarks to the Hudson Institute, Washington DC, August 17, 2004.

[99] Information for chronology of key milestones in Iran's nuclear programs drawn from numerous open sources including: multiple media outlets, www.nti.org, http://www.globalsecuritynewswire.org/gsn/, www.globalsecurity.org, http://www.oxfordresearchgroup.org.uk/work/middle_east/iranchronology.php, www.iranwatch.org, IAEA reporting, http://www.wisconsinproject.org/countries/iran/nuke-miles.htm, http://www.isis-online.org/, etc.

considered co-operation with Iran in the field of nuclear energy as an alternative means for energy production to be a suitable area for joint collaboration and co-operation. The majority of reactors were to be built by the United States. The Shah stated that Iran would have nuclear weapons, "without a doubt and sooner than one would think." ("The Shah Meets the Press," Kayhan International) France and Iran ratified a preliminary agreement for France to supply five 1,000MWe reactors, uranium, and a nuclear research centre to Iran. The United States and Iran reached a provisional agreement for the United States to supply two nuclear power reactors and enriched uranium fuel. A State Department document says the United States and Iran were preparing to negotiate an agreement that would permit the sale of nuclear reactors as well as enriched fuel "at levels desired by the Shah." The United States also notified the Shah of their support for Iran's proposal to buy up to 25% interest in a commercial uranium enrichment plant. Iran signed agreements to purchase two 1200MWe pressurized water reactors (PWRs) from the German firm Kraftwerk Union (KWU) to be installed at Bushehr and two 900 MWe reactors from Framatome of France to be installed at Bandar Abbas. Under the contracts, France and Germany would provide enriched uranium for the initial loading and ten years' worth of reloads. The French reactors were to be built under license from Westinghouse of the United States.

- **1975:** US Secretary of State Henry Kissinger and Iranian Finance Minster Hushang Ansari signed a broad trade agreement that called for the purchase of eight reactors valued at $6.4 billion. The US Atomic Energy Commission agreed to supply Iran with fuel for two 1,200MWe light water reactors and signed a provisional agreement to supply fuel for as many as six additional reactors with a total power capacity of 8,000MWe.
- **1979:** German construction at the Bushehr reactors was suspended because of the Islamic Revolution in Iran; which in turn put an end to Iran’s nuclear program.
- **1980:** Iraq invaded Iran and triggered a war that lasted eight years.
- **1987-1988:** Bushehr reactors were heavily damaged by Iraqi bombing raids.
- **1990:** Iran signed a ten-year nuclear cooperation agreement with China.
- **July 1989:** Iranian President Akbar Hashemi-Rafsanjani signed the 10-point Iran-Russia co-operation pact on peaceful utilization of "nuclear materials and related equipment."
- **1992:** After a week-long inspection in Iran, an IAEA team found no evidence that Iran had a nuclear weapon program.
- **1993:** The Iranian Majlis [Parliament] ratified bills on co-operation pacts with Russia and China. China provided Iran with an HT-6B Tokamak fusion reactor that was installed at the Plasma Physics Research Centre of Azad University. Iran asked Russia for heavy water reactors. President Clinton convinced Russian President Boris Yeltsin to kill negotiations with Iran on the sale of a natural-uranium-burning [heavy water] reactor. Germany refused to resume construction of the 80-percent-complete Siemens-built nuclear power plant at Bushehr. Russian Ambassador to Iran Sergei Tretyakov confirmed that Russia would help Iran to complete nuclear reactor in Bushehr, indicating that a preliminary agreement had been reached but that financing was still being negotiated. The Central Intelligence Agency (CIA) assessed Iran is 8-10 years away from acquiring nuclear weapons and asserted that foreign assistance would be critical to the effort.
- **1994:** Russian experts started work on the first unit of Iran's 1000MW plant, according to a source at the plant. The Bushehr nuclear power plant was scheduled to be finished in four years. Iran signed a contract with China's National Nuclear Corporation for the supply of two 300-megawatt power reactors and continued to shop for a heavy water research reactor.
- **1995:** Iran signed a contract with Russia to complete one of the Bushehr reactors and tried to buy a uranium enrichment plant.
- **1997:** China canceled plans to build a nuclear power plant in Iran.

- **1998:** American pressure forced Turboatom, a Ukrainian manufacturer of steam turbines, to abandon its $45 million deal to supply turbines to Bushehr. Russia proposed to build a research reactor in Iran using 20% enriched uranium.
- **1999:** Iran threatened to withhold further nuclear contracts from Russia for failing to complete the Bushehr plant in time.
- **2000:** The CIA speculated that Iran might be able to make a nuclear weapon. The finding apparently wasn't based on reliable evidence, but on the fact that it was unable to track Iran's covert efforts to acquire nuclear materials and technology on the international black market. The U.S. Senate approved legislation that would impose sanctions on entities assisting Iran's chemical, biological and nuclear weapons programs. Iran announced that it was no longer working with China on nuclear projects. Russia's Ministry of Atomic Energy acknowledged that the Bushehr project was running 18 months behind schedule. The Czech government, under pressure from the United States, banned companies from supplying parts to Bushehr. The ZVVZ Milevsko Company had planned to provide Bushehr with air conditioning equipment. Russia's deputy minister for atomic energy said the Bushehr plant would be completed in 2002. In its report on worldwide proliferation, the CIA stated that Iran sought nuclear-related equipment, material, and technical expertise from a variety of sources, especially in Russia, during the second half of 1999, and that Russian entities continued to interact with Iranian research centers on various activities.
- **2002:** Exiled opposition group, National Council of Resistance of Iran, reported the existence of a uranium enrichment facility at Natanz and a heavy water plant at Arak. Russian technicians restarted work on the abandoned Bushehr reactor despite strong US objection. The United States accused Iran of "across-the-board pursuit of weapons of mass destruction".
- **2003:** The International Atomic Energy Agency (IAEA) report, after February inspections of Natanz and Arak, stated that Iran had failed to comply with the nuclear Non-Proliferation Treaty. Iran told France, Britain and Germany -- the "EU3" negotiating for the European Union – that it would suspend all enrichment-related activities. Iran signed protocol allowing snap inspections of nuclear facilities.
- **2004:** The IAEA board complained of inadequate co-operation from Iran. In retaliation, Iran said it would resume production and testing of centrifuges. Iran agreed to suspend voluntarily all of its uranium enrichment activity as part of a deal with EU3 (Paris Agreement). Iranian Scientists broke seals on centrifuges that can be used to create weapons grade material. Iran claimed that they had started to prepare 37 tonnes of raw uranium for processing in centrifuges.
- **2005:** President Mohammad Khatami asserted that no Iranian government would give up nuclear technology programs. The Iranian Parliament voted to continue the enrichment program. Iran said it had resumed uranium conversion at its Esfahan plant. A report by IAEA chief Mohamed ElBaradei confirmed Iran had resumed uranium conversion at Isfahan. New Iranian President Mahmoud Ahmadinejad stated that Iran was ready to transfer nuclear know-how to other Muslim nations.
- **2006:** The IAEA Board of Governors voted to refer Iran to the United Nations Security Council (UNSC). Iran stated that it had developed machinery to separate uranium from its ore. Iranian President Mahmoud Ahmadinejad said that Iran will have "completed its fuel cycle" by February-March of 2007, and bragged about bringing thousands of centrifuges online. Twenty cascade machines were reported running at Natanz and Farayand. Mahmoud Ahmadinejad inaugurated the Arak heavy-water production plant. IAEA Director General Mohamed El Baradei reported that Iran tested 164-machine cascade to 5-percent enrichment, and second 164 centrifuge cascade started October 23. The IAEA Board of Governors Reported the testing of the second 164-machine cascade with UF6 was begun; as of November 7, Iran had produced 55 tons of uranium (in the form of UF6) out of the 160 tons of uranium ore it started processing at its Isfahan UCF in June 2006. Iran reported that approximately 34 kilograms of UF6 was fed into the centrifuges and enriched to levels below 5 percent U-235. Iran had reported by August 31 that a total of 6 kilograms of UF6 was fed into the then-single cascade between June 23 and July 8. This would

represent an almost 500-percent increase in the inserted quantity of UF6, which in return may be an indication of additional and/or more efficient cascades.

- **2007:** Mohamed El Baradei said that Iran may be six months away from enriching uranium on an industrial scale. He added that according to U.S. and British intelligence, Iran was five to ten years away from developing a nuclear bomb.[100]The IAEA reported that the Iranian Centrifuge Facility at Natanz had completed the 164 unit cascade, adding to the 10 and 24 unit cascades in the Pilot Fuel Enrichment Plant that already existed. The 164 unit cascade is at the production EFP and in which the first 18 will be tested shortly. The current enrichment quality is at 4.2% U-235 proving the design efficiency of the facility. Iran continues to deny remote monitoring of the 3000 machine hall but pledges to allow frequent inspector visits. Iran also stated that once the hall reaches 500 machines, all monitoring will cease. The IAEA reports that Iran's publicly visible (as inspected by the IAEA) uranium enrichment capacity has doubled since their last look in March, now operating some 164 separation centrifuges in the gallery they hope to have 3000 such devices in operation. Iranian President Ahmadinejad announces that Iran is now capable of nuclear fuel production on an "industrial scale."[101] Inspectors for the IAEA concluded that Iran had solved most of its technical problems in enriching uranium and is doing so on a much larger scale than before. A short-notice inspection of Natanz found up to 1,300 active centrifuges, with 300 more being tested and another 300 under construction. Iran seems to be capable of installing up to 3,000 centrifuges as early as June 2007 in "cascades" of 164 centrifuges each. Some diplomats speculate that Iran could have as many as 5,000 centrifuges installed by the end of the year, and some estimates go as high as 8,000. There is, however, no data on the efficiency of this effort or its real-world capability to produce given amounts of weapons-grade uranium.[102]

- **2008:** Iranian officials confirmed they had begun installing IR-2 centrifuges that churn out enriched material at a rate more than double that of Iran's earlier centrifuges. The Islamic Republic News Agency (IRNA) reports that three sets of 164-machine cascades from a second series of 3,000 are in motion at Natanz. Previous reports stated that 18 sets of 164-machine cascades were already active in uranium enrichment. During the National Nuclear Technology Festival President Ahmadinejad declared that activities have started for the installment of 6,000 P1 centrifuges.[103] Iran has stated their intent to move to full rate production using some 54,000 centrifuges. A Washington Post article cites a report which indicates that Pakistani nuclear proliferator A.Q. Kahn may have sold Iran the design for a so called "compact" nuclear weapon -- a higher technology nuke that weighs less and is smaller -- ideal for mounting in a ballistic missile nosecone. The information comes from drawings discovered in the investigation in 2006 of Swiss businessmen Maroc, Urs, and Friedrich Tinner who identified by the U.S., U.K and IAEA investigators as black market smugglers of nuclear secrets. The London Daily Telegraph reported that according to latest intelligence circulated among Western diplomats, Iran's Revolutionary Guard had set up a network of civilian companies to manufacture components for the advanced P2 centrifuges. The operation was allegedly based on the 2004 plot involving Kalaye Electric Company and exposed by UN nuclear inspectors.[104]

- **September 2008:** In its latest report on the Iranian nuclear program, the UN nuclear watchdog, the IAEA, said it had failed to make meaningful progress in assessing Iran's past nuclear activities. The IAEA also said that Iran was continuing to install new cascades of centrifuges to enrich uranium in defiance of a UN Security Council order. Around 3,800 centrifuges were now in operation at Iran's enrichment plant in Natanz, an increase of 300 since May, the report said. Iran had 3,800 centrifuges operating, with increasing stability, at Natanz. Under optimal – if unlikely – conditions, a fully functional capacity of 3,000 P-1 class centrifuges could give Iran enough

[100] Daniel Dombey, „FT-Interview: Mohamed El-Baradei", *Financial Times*, 19 February, 2007.
[101] "Iran Says It Can Enrich Uranium on a Large Scale." New York Times, April 10, 2007, http://www.nytimes.com/2007/04/10/world/middleeast/10iran.html
[102] David E., Sanger, "Atomic Agency Concludes Iran is Stepping Up Nuclear Work," *New York Times*, May 14, 2007;
[102] David E., Sanger, "Inspectors Cite Big Gain by Iran on Nuclear Fuel," *New York Times*, May 14, 2007
[103] "3 164-machine sets from 2nd series of 3,000 centrifuges in motion – source." IRNA. April 11, 2008. http://www2.irna.ir/en/news/view/line-17/0804112108181137.htm
[104] Con Coughlin, "Iran Has Resumed A-Bomb Project, Says West." London Daily Telegraph. July 7, 2008.

material for one fission device in 18-27 months, and some private experts by the worst case figure in as at little as 12 months – some point to 2008. [105] According to estimates made by the ISIS and based on data obtained in IAEA inspections, Iran had fed 7,600 kg of UF6 into its centrifuges as of August 30, 2008, and had produced approximately 480 kg of LEU.[106] The ISIS writes that the IAEA reported that it has recently obtained information about the possibility of Iran drawing on "foreign expertise" in conducting experiments connected with the symmetrical initiation of a hemispherical high explosive charge suitable for an implosion-type nuclear weapon. The official noted that the IAEA has not linked this expertise to the A.Q. Khan Proliferation network.[107] The IAEA showed the UN documents and photographs suggesting Iran secretly tried to modify a missile cone to fit a nuclear bomb.[108]

- **October 2008:** Approximately 700 Iranian nuclear engineers who received their training in Russia were reported to be ready to begin work on the Bushehr reactor**.** Iranian nuclear official Ahmad Fayyazbakhsh reported that Bushehr will become operational in March 2009.[109] Russia will reportedly ship nearly 1,000 tons of equipment to Iran for construction of the nuclear power plant at Bushehr. Iranian officials expect Bushehr to be commissioned early next year.[110] According to Mohammad Qods, managing director of Iran's Power Plant Construction Company, some Western countries are interested in cooperating with Iran on the Darkhovin reactor's design and construction. Qods indicated that the design of the 360MW light water reactor would be completed in six years and construction would begin in 2013.[111]

Iran's Key Nuclear Facilities

Iran has numerous facilities associated with its various nuclear programs and activities. Some of these sites are still suspected sites, and the details of the true activities taking place at these sites are still speculative and cannot be confirmed due to Iran's lack of transparency and full cooperation with IAEA inspectors. Based on numerous open sources -- including (but not limited to) reporting by the IAEA, FAS, GlobalSecurity.org, NTI, the University of Wisconsin's Iran Watch program, and multiple media outlets -- it is possible to put together the following list of declared and suspected key nuclear facilities in Iran, with a brief explanation of their contribution, or possible contribution, to Iran's nuclear program has been compiled:[112]

- **Jabr Ibn Hayan Multipurpose Laboratory (JHL):**
    - Radioisotope R&D and Uranium Conversion. At least a laboratory-scale capability to convert uranium. In a letter to the IAEA, the Iranian authorities confirmed that in 1991,

[105] "UN nuclear agency criticises Iran," BBC News, September 15, 2008, available at http://news.bbc.co.uk/2/hi/middle_east/7616744.stm

[106] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

[107] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

[108] Mark Heinrich, "IAEA shows photos alleging Iran nuclear missile work," Reuters, September 17, 2008, available at http://www.iranfocus.com/en/nuclear/iaea-shows-photos-alleging-iran-nuclear-missile-work.html

[109] "Iranian Engineers Ready to Work on Nuclear Plant," The Associated Press, 14 October 2008; "Western Nations Consider Independent Iran Sanctions," Global Security Newswire, 14 October 2008.

[110] "Iran: Russia to Ship Nuke Plant Supplies," United Press International, 17 October 2008; "Russia Plans Major Supply Shipment to Iran," Global Security Newswire, 20 October 2008.

[111] "Foreign Firms Interested to Build Darkhovin Nuclear Plant: Official," *Tehran Times,* 20 October 2008.

[112] Information for Iran's key nuclear facilities drawn from numerous open sources including: multiple media outlets, www.fas.org, www.nti.org, http://www.globalsecuritynewswire.org/gsn/, www.globalsecurity.org, www.iranwatch.org, IAEA reporting, http://www.wisconsinproject.org/countries/iran/nuke-miles.htm, http://www.isis-online.org/, etc.

the facility had received natural uranium that was not previously reported. Iran stated that in 1991, they received 1000kg of UF6, 400kg of UF4, and 400kg of UO2. This material was being held, and likely remains, at the JHL. Iran further stated that some of the imported UO2 was used to test uranium purification and conversion processes. In 2000, Iran converted almost all of the UF4 that it had obtained in 1991 to uranium metal. Subsequently, Iran stored the conversion equipment at that facility and began refurbishing it to create a dedicated metal reprocessing laboratory. JHL is a primary training facility for nuclear science and technology. It was established in 1990. The staff at JHL is involved in all aspects of Iran's research and development program. It comprises a nuclear spectrometry laboratory, nuclear production fuel facility, conversion laboratory, an instrumental analysis laboratory, and a health physics section.

- **Suspected Rudan Conversion Facility at Fasa:**
  - This facility is thought to be the site of a uranium hexafluoride gas conversion plant, or some other form of nuclear research center. Indications of the existence of this facility (wherever it might be located) included Russian press reports of a shipment of uranium hexafluoride gas from China to Iran in late 1994, as well as purchases of hydrogen fluoride from Germany and attempts to buy fluorification equipment from Britain. U.S. officials asserted that in the mid-1990s, China built a uranium hexafluoride conversion plant in Rudan as part of a secret nuclear cooperation agreement signed in 1991. The agreement came as the result of a two-day Chinese visit of Iran's nuclear facilities in July 1991. According to media reports, in late 1994, China delivered equipment for the plant to Iran. The last list of delcared Iranian nuclear facilities, published in 2004, did not include any additional uranium conversion facilities. IAEA reports as of July 2008 had not mentioned a facility near Fasa or referred to as Rudan.
  - In mid-2001 Israel's Eros A1 imaging spacecraft photographed what its operators believed to be the construction site for a facility that could be used to store large missiles. Fasa had not previously been associated with missile-related activities. The image taken by the spacecraft showed excavation works for large underground bunkers. The roads on the site formed two hexagons and below these the start of what might have been intended as an octagon. Between the hexagons and the main road were around 20 buildings, some of which were contained in a small pentagonal-shaped area.

- **[Esfahan] Isfahan Nuclear Technology Center (INTC); Isfahan Uranium Conversion Facility (UCF); Isfahan Fuel Manufacturing Plant (FMP); Isfahan Fuel Element Cladding Plant; Isfahan Nuclear Fuel Research and Production Center (NFRPC); Isfahan Nuclear Waste Storage Facility:**
  - Large scale multipurpose facility: R&D, Uranium Conversion, Nuclear Waste Storage, etc. Some sources assess Isfahan to be the primary location of the Iranian nuclear weapons program.
  - The NFRPC was founded in 1974 for scientific and technical support of country's comprehensive nuclear power plant program. It is involved in various aspects of fuel analysis and research. The Metallurgical Engineering and Fuel Department at the center operates the Fuel Fabrication Laboratory (FFL) and is involved in "experimental production of fuel for WWER reactors." NFRPC may be the future location of the fuel manufacturing plant (FMP). Construction at the site of INTC may have included a hexafluoride plant that was built with Chinese assistance, as part of nuclear cooperation deal, which was later cancelled under US pressure.
  - Located at the University of Isfahan, The Isfahan INTC is one of Iran's largest nuclear research complexes. In 1975, France signed an agreement to build the facility and train personnel to operate the Bushehr reactor. Isfahan is a multi-purpose research center. It operates two research reactors, a critical assembly and a sub-critical assembly. It also operates a hexafluride conversion facility, fuel production plant, a zirconium cladding

plant, and other facilities and laboratories. The INTC may also operate a laboratory scale heavy water production facility on its premises. In a letter to the IAEA dated 19 August 2003, the AEOI reported that the decision to conduct research in heavy research production was taken in the early 1980s. By the mid-1980s, laboratory scale experiments were undertaken at the INTC. The results of those experiments prompted subsequent decisions in the mid-1990s to construct a heavy water reactor.

- The Isfahan UFC was constructed to facilitate the conversion of yellowcake into uranium oxide, uranium hexafluoride, and uranium metal at the INTC. In July 2003, Iran revealed to the IAEA that it had obtained the designs for the UCF from abroad, and that this information was sufficient to complete a more detailed design of the facility and manufacture conversion equipment indigenously. The facility was planned with the intention of supplying UO2 as fuel to the 40MW Heavy Water Reactor under construction at Arak and to meet the needs of UF6 for the Natanz enrichment facility. IAEA chief Mohamed ElBaradei confirmed Iranian statements that it had resumed uranium conversion at Isfahan in 2005. In 2006, IAEA Director General Mohamed El Baradei reported that Iran tested 164-machine cascade to 5-percent enrichment, and second 164 centrifuge cascade started October 23. The IAEA Board of Governors Reported the testing of the second 164-machine cascade with UF6 was begun; as of November 7, Iran had produced 55 tons of uranium (in the form of UF6) out of the 160 tons of uranium ore it started processing at its Isfahan UCF in June 2006. Iran reported that approximately 34 kilograms of UF6 was fed into the centrifuges and enriched to levels below 5 percent U-235. Iran had reported by August 31 that a total of 6 kilograms of UF6 was fed into the then-single cascade between June 23 and July 8. This would represent an almost 500-percent increase in the inserted quantity of UF6, which in return may be an indication of additional and/or more efficient cascades.
- Waste from the "testing of processes envisioned for UCF, isotope production experiments at TRR, and the use of pellets for testing chemical processes for the MIX facility" is said to have been transferred to storage facilities at Isfahan.

- **Natanz Enrichment Facility (FEP & PFEP):**
  - The Natanz facility is believed to be the third stage in the three stages of Iran's centrifuge enrichment program. The program is believed to have begun in 1985 on the AEOI's premises in Tehran, before moving to the second stage at the Kalaye Electric Company, also in Tehran, in 1997. In 2002, assembly activities were moved to Natanz.
  - The Natanz Enrichment Plant comprises at least three main areas: an above-ground area, three large underground structures, and one large building standing alone. The above-ground area consists of six large buildings. Two of these are twin 2,500 meter halls. The function of the above-ground buildings is to assemble gas centrifuges. The underground structures are primarily centrifuge halls. The first two buildings each measure 190 meters by 170 meters, with a surface area of approximately 32,000 square meters. The third structure is smaller, with a gross ground area of approximately 7,700 square meters. It is intended to provide support and administrative services to the two larger structures.
  - The Natanz Enrichment Plant is a large facility holding a Pilot Fuel Enrichment Plant (PFEP) and commercial Fuel Enrichment Plant (FEP). The PFEP is a test facility located at Natanz before industrial scale enrichment takes place at the FEP, Iran's main uranium enrichment facility. The PFEP, when completed, will hold 1,000 centrifuges. The Director General of the IAEA visited the facility in February 2003 and observed over 100 (as many as 160) centrifuges already installed. The PFEP was originally scheduled to be completed and begin operation in June 2003. On 25 June 2003, Iran introduced UF6 into a centrifuge for single machine testing and subsequently on 19 August 2003, began testing a small ten-machine cascade with UF6. At the time, both tests were conducted with safeguards measures in place. Questions remain as to how the Iranians tested their centrifuges.

- Since the removal of the seals at the Natanz facility, Iran has conducted substantial renovation of the gas handling system at the PFEP. Following the release of an updated design information for the PFEP to the IAEA on 8 February 2006, on 11 February 2006, Iran started enrichment tests by feeding a single P-1 centrifuge machine with UF6 gas. Subsequently, by 15 February and 22 February, the feeding of a 10-machine cascade and 20-machine cascade were carried out at the PFEP respectively. In 2007 the IAEA reported that the Iranian Centrifuge Facility at Natanz has completed the 164 unit cascade, adding to the 10 and 24 unit cascades in the Pilot Fuel Enrichment Plant that already existed. .
- In April 2006, Iran successfully completed a UF6 feeding campaign using a 164-machine cascade at the PFEP. The level of the enriched product from the aforementioned process was estimated to be between 3.5 percent to 4.8 percent uranium-235. In May 2006, the IAEA took samples to confirm the enrichment levels of the product. Since the April campaign, Iran has fed UF6 into a single machine, and one machine of the 10-machine cascade. Beginning June 6, Iran has started feeding UF6 into the 164-machine cascade and is working on the installation of another 164-machine cascade at the PFEP. While the enrichment process and products at the PFEP, including the feed and withdrawal station are under IAEA containment and surveillance measures, Iran has thus far declined to discuss implementation of remote monitoring for verification of its enrichment facilities.
- During his February 2003 visit, the International Atomic Energy Agency's Director General learned that the Fuel Enrichment Plant (FEP) at Natanz, when completed would house 50,000 centrifuges at full operational capacity. The IAEA received updated design information from Iran for the FEP on 8 February 2006. Also, as per IAEA reports, equipment such as process tanks and an autoclave are being moved into the FEP. At the present time the number of complete centrifuges in Iran's possession is yet uncertain. It is estimated that once completed, the FEP operating at full capacity of 50,000 centrifuges will have the potential to produce at a minimum, 500kg of weapons-grade uranium per year. Twenty cascade machines were reported running at Natanz in 2005. A short-notice IAEA inspection of Natanz in 2007 found up to 1,300 active centrifuges, with 300 more being tested and another 300 under construction. In its September 2008 report the IAEA stated that Iran was continuing to install new cascades of centrifuges to enrich uranium in defiance of a UN Security Council order. Around 3,800 centrifuges were now in operation at Iran's enrichment plant in Natanz, an increase of 300 since May, the report said. Iran had 3,800 centrifuges operating, with increasing stability, at Natanz.

- **Suspected Additional Enrichment Sites at Lashkar-Abad and Ramandeh:**
  - On 27 May 2003, the People's Mojedin Organization (MKO) revealed that two additional secret uranium enrichment facilities were being constructed by the Iranian government. The first is at Lashkar-Abad, which is close to Hashtgerd, and the second is at Ramandeh. The MKO asserted that construction at both facilities is complete and there may already be "a number" of centrifuges installed there. The MKO also stated that the additional facilities are "complimentary" to the larger Natanz site, and may support the larger facility or even take over for Natanz if it were destroyed. The MKO claims that these additional sites may be under the management of the front company, "Noor-Afza-Gostar." In July 2003, the IAEA sought permission to take environmental samples at these two sites, but the Iranian authorities refused their access.
  - IAEA inspectors were permitted visits to these locations on 13 August 2003. During that visit, they determined that the Lashkar-Abad facility was operating a laser laboratory. Iranian officials claim that the facility was originally devoted to laser fusion research and laser spectroscopy, but that its focus has since changed. The IAEA inspectors noted that the facility was engaging in the production of copper vapor lasers of up to 100 watts, but that no experiments involving laser spectroscopy or enrichment appeared to be underway. The officials claimed that in the past, the laser division of the AEOI had cooperated with a university student to write a thesis in laser spectroscopy of SF6. The IAEA noted in its

August 2003 to its board of governors, that, "While the study could be seen as relevant to laser enrichment, the underlying experiments appear not to have involved nuclear material." IAEA inspectors were not able to take environmental samples at Lashkar-Abad.

- **Khondab Water Production Plant**; **Arak Heavy Water Reactor** (**IR-40):**
  - The heavy water production plant is under construction in Khondab, near Arak. According to the May 2003 NSG Plenary notes, the production capacity for this plant is approximately 100 tons per year.
  - On 14 August 2002, members of an Iranian resistance group, the National Council of Resistance of Iran, alleged that the Iranian government was involved in the construction of "at least two secret sites that support its nuclear weapons program." One of these was a heavy water production plant in Arak. These allegations prompted the IAEA to question the Iranian authorities about the existence of a heavy water program. On 5 May 2003, the Iranian authorities informed the IAEA of their intention to construct a heavy water research reactor at Arak. However, the decision to supplement Iran's nuclear program with a heavy water reactor was made in the mid-1990s. Construction of the Arak reactor, a 40MW thermal heavy water reactor began in 2004. The Arak reactor will use natural UO2 fuel and heavy water as both cooler and moderator. At present, construction continues at the reactor site and is scheduled for completion in 2009. It is believed that the IR-40 will be used for research and development activities, radioisotope production, and training. To meet the isotope production requirements, Iranian officials believe that the reactor must have a neutron flux of 1013 to 1014 n/cm2/s. This would require a reactor capable of producing 30-40MW thermal when using UO2 as fuel. Once fully operational, it is believed that the Arak reactor will be able to produce about nine kilograms of weapons grade plutonium each year, or enough for about two nuclear weapons each year. IAEA inspectors confirmed that a heavy water production plant was under construction in Arak. In 2006 Iranian President Mahmoud Ahmadinejad inaugurated the Arak heavy-water production plant.
  - The Iranian state-owned heavy manufacturing firm Machine Sazi Arak bought eight vertical turning and boring machines (three Model SKJ-12A, three Model SKJ-20A, and two SKD-32A), and the Czech firm TST Kovosvit Semimovo Usti provided Machine Sazi Arak with at least five CNC drilling machines. These machines are used in the construction of uranium centrifuges.
- **Bushehr Nuclear Power Generators:**
  - Bushehr is nearing completion and expected to come online sometime in early 2009. It is similar to the technical configuration of Unit Four at Russia's Balakovskaya plant in Balakovo.
  - The Bushehr project began in 1975, before the 1979 revolution. The West German company Kraftwerke Union (KWU) started building what would have been a pair of 1,300MWe pressurized water reactors at that time. Bushehr-1 was 90 percent built and Bushehr-2 partly built when a series of problems began to plague the project. The first came in 1979 after the new government under the Ayatollah Khomeini decided to freeze construction of the reactors. The project was restarted shortly after the new government came to power. However, from 1980-1988, Iraqi warplanes conducted a series of bombing raids on the reactors and damaged them severely. Subsequently, the government requested assistance from foreign commercial contractors to rebuild and complete the power plants. Iran contacted various countries including Argentina, China, Russia, and West Germany. Finally, in 1995, Tehran and Moscow signed an $800 million agreement for the completion of Bushehr-1. Minatom assumed overall management of the work, utilizing organizations such as Zarubezhatomenergostroy (Nuclear Energy Construction Abroad) and Novosibirsk Chemical Concentrate Plant, which is contributing nuclear fuel. In addition, Russia has been training at least 10-20 graduate students and PhD students

annually in Russian facilities such as the Kurchatov Institute. Other Iranian technicians have been trained in Russia at various reactors and institutes over the years. The experience that these students and technicians gain may be used to operate Bushehr, but may also be used to develop new indigenous reactors, or other more discreet military applications.

- With Bushehr nearing completion and scheduled to come online in early 2009, as per a deal signed between Iran and Russia in February 2005, fuel for the reactor will be supplied by Russia. Under the terms of the deal Iran is also required to return spent fuel rods from the Bushehr reactor to Russia.
- Approximately 700 Iranian nuclear engineers who received their training in Russia were reported to be ready to begin work on the Bushehr reactor in October 2008**.** Iranian nuclear official Ahmad Fayyazbakhsh reported that Bushehr will become operational in March 2009.[113] Russia will reportedly ship nearly 1,000 tons of equipment to Iran for construction of the nuclear power plant at Bushehr. Iranian officials expect Bushehr to be commissioned early next year.[114]
- On 14 August 2003, Iran's First Vice President Mohamad Reza Aref authorized the AEOI to sign contracts for the construction of a second reactor at the Bushehr nuclear power plant, with a capacity of 1,000MW.

- **Tehran Nuclear Research Center (TNRC); Tehran Research Reactor (TRR) (IR-0001); Laboratory Scale Milling Facility; Kalaye Electric, Sharif University of Technology (SUT); Atomic Energy of Iran; Molybdenum, Iodine, and Xenon Radioisotope Production Facility (MIX Facility):**
  - The Tehran Nuclear Research Center (TNRC) is located at the University of Tehran. The center was constructed in the early 1960s and became operational in 1965. The University of Tehran originally oversaw the center, but in 1974 it was transferred to its present management, the AEOI. The TNRC is composed of the following: Reactor Research and Operation Department; Radioisotopes Research and Production Department; Nuclear Physics Department; Theoretical Physics and Mathematics Departments; Analytical Chemistry Department; Engineering Department; Solid State Physics Section; Health Physics Department; Electronics Department; and the Chemistry & Physics Department. Iran may have separated gram quantities of plutonium from spent fuel at a laboratory at the TNRC. In 1988, an Iranian nuclear engineer stated that he took part in experiments at the TNRC in which he and his colleagues cold-tested a plutonium extraction laboratory, but did not reprocess any plutonium. Akbar Etemad, former head of the AEOI, also confirmed that experiments were performed on a laboratory scale related to the reprocessing of spent fuel. The TNRC operates several hot cells that were supplied by the United States in 1967. These provide a basic capability for separating plutonium from spent fuel, but do not constitute a dedicated program by themselves. However, there are other facilities at the TNRC such as a radiation measurements laboratory, chemistry laboratory and radioisotope production unit that may contribute to a reprocessing capability. In the 1990s, the TNRC radiochemistry section conducted some "laboratory scale experiments," presumably at this laboratory, to produce UF4 from depleted UO2 that was imported by Iran in 1997.
  - The TNRC is also on the site of the Tehran Research Reactor (TRR). In 1967, this US-made 5MWt pool-type light water research reactor went critical. Intelligence analysts believe that the TNRC is the location of Iran's secret nuclear program, including plutonium reprocessing, laser enrichment, and weapons design efforts. It is capable of producing up to 600 grams of plutonium annually. In 1987, the AEOI paid Argentina's

[113] "Iranian Engineers Ready to Work on Nuclear Plant," The Associated Press, 14 October 2008; "Western Nations Consider Independent Iran Sanctions," Global Security Newswire, 14 October 2008.
[114] "Iran: Russia to Ship Nuke Plant Supplies," United Press International, 17 October 2008; "Russia Plans Major Supply Shipment to Iran," Global Security Newswire, 20 October 2008.

Applied Research Institute (INVAP) $5.5 million to convert the reactor's fuel from 93 percent enriched uranium to 20 percent enriched uranium. The Argentine Nuclear Energy Commission (CNEA) has subsequently supplied the reactor with 115.8kg of safeguarded 20 percent enriched uranium fuel. In the 1990s, TRR was used to irradiate UO2 targets for subsequent separation of I-131 at the MIX facility. The facility remains in operation.

- The Kalaye Electronic Company comprises several facilities, one of which is a workshop where open sources have reported on the possible conduct of enrichment activities. When questioned about the reports, the Iranian authorities acknowledged that the workshop was used for the production of centrifuge components, but stated that no nuclear material had been used in the operation of this workshop or the assembly of centrifuges, either at the Kalaye Electric Company or at any other location in Iran. During later visits, IAEA officials noted that much construction had taken place since the previous visit in March 2003.
- In its February 2005 declaration to the IAEA, Iran informed the Agency that it had prepared a small amount of UO2 for use in pellets to test the chemical processes of the MIX facility. The material was used to fabricate targets, irradiate it at the Tehran Research Reactor (TRR), and separate it in a lead-shielded cell at a laboratory in the MIX facility to obtain the resulting I-131 isotope. Analysts are concerned that other activities may have occurred during these experiments. According to David Albright and Corey Hinderstein, "The question is whether plutonium was also separated from these targets, or whether other undeclared targets were produced, irradiated, and processed to obtain separated plutonium."
- SUT is one of the largest engineering schools in Iran. There are approximately 8,000 students supported by 300 full-time faculty and 430 adjunct staff. SUT was established in 1966 under the name of Aryarmehr University of Technology. Western intelligence once believed that Sharif University was at the center of research in uranium enrichment and spent fuel reprocessing. To prove this, some analysts cite a 1991 attempt by SUT staff to purchase ring magnets from the German firm Thyssen. This attempt ultimately failed. The Iranian government may have supported SUT's efforts by clandestinely procuring nuclear-related and dual-use technologies, and buying small companies, particularly in Germany, to serve as export fronts for sensitive equipment. The status of these activities is unknown.

- **Gorgan al-Kabir Center:**
  - Possible nuclear weapon production: In the early 1990s, the media reported that there was a secret nuclear research facility at Gorgan. According to one report, scientists from Iran, Ukraine, Russia, and Kazakstan were working at the Gorgan al-Kabir Center to develop nuclear weapons. These reports have never been substantiated.
- **Weapons development facility at Chalus:**
  - Chalus had been reported as the location of an underground nuclear weapons development facility located inside a mountain south of this coastal town. The facility had been variously reported as being staffed by experts from Russia, China and North Korea. The reports came in 1995 from Iranian exiles living in Europe. In March 2002 the claims resurfaced in a report by the *Middle East Intelligence Bulletin*. It was described as an alleged underground nuclear weapons development facility built in the Alborz Mountains. Iranian authorities reportedly told their citizens that the facility was an electricity generation plant operated by Canadians.
- **Moallem Kaleyah:**
  - The Iranian Revolutionary Guard Corps (IRGC) reportedly operates a gas centrifuge uranium enrichment plant and suspected nuclear weaponization research site. In 1987, Iran acquired equipment from French, German, and Italian companies to construct and outfit the facility. Some sources report that the facility was for weaponization. Other

sources state that Moallem Kaleyah may be used for laser enrichment. In 1992, IAEA inspectors visited the site and found only a small training center under construction. Some believe that the inspectors were taken to the wrong location, away from the real site.

- **Saghand Uranium Mine:**
  - The Saghand uranium mine is divided into two distinct deposits, Saghand 1 which is approximately 16m below the surface and encompasses an area 200 by 300 meters, and Saghand 2 which is approximately 70m below the surface. Identified reserves for Saghand 1 are estimated at 1,927 tonnes of Uranium and for Saghand 2 at 1,367 tonnes of Uranium. Undiscovered reserves for the Saghand mine are estimated at 7,500 tonnes of uranium.
  - Iran has received assistance in exploiting its uranium deposits at various times and from various countries. Specialists have come from Argentina, Germany, Czechoslovakia, Hungary, and Russia. Most notably, the Chinese have provided the greatest assistance. In the early 1990s, over 600 Chinese and Iranian specialists formed a working group to investigate the deposits. Experts from the Beijing Research Institute of Uranium Geology have assisted Iran in prospecting for uranium in the past. Additionally, the National Council of Resistance in Iran (NCRI) has previously alleged the presence of approximately 50 Chinese experts at Saghand, and is reportedly host to approximately 230 workers comprising of Iranian specialists and engineers.
- **Talmesi and Meskani Uranium Mines:**
  - These mines contain approximately 200 tons of EAR-II uranium. They are among the oldest known ore deposits in Iran. However, they have only been systematically exploited since 1935. The mines have experienced intermittent operations since then and were closed in 1968 after copper mining operations were shut down. Upon discovering uranium at the sites in the 1990s, the AEOI began operating the mines to exploit the deposits.
- **Bonab Atomic Research Center:**
  - In 1989, Iran began the first phase of Bonab's development, but it did not become operational until 1995. The center conducts research on nuclear technology for agricultural applications. In July 1997, IAEA Director General Hans Blix visited Bonab and found that all was in order. However, there have been allegations that not all activities at Bonab that has been declared to the IAEA.
- **Ardakan Pilot Yellow Cake Production Facility and Uranium Ore Processing Plant:**
  - This large-scale facility will be able to process between 100 to 200 tons of ore annually. Iran may have received assistance in developing the plant from various countries. In 1989, Argentina signed an agreement to build a series of structures, but that deal fell through due to US input. In the mid-1990s, Russia drew designs for the plant. Later, Chinese specialists helped Iran begin constructing the plant.
- **Yazd Radiation Processing Center (YRPC); Benefication and Hydrometallurgical Center (BHRC):**
  - The YRPC is one of the newest industrial complexes of Iran. It is engaged in geophysical research to analyze the mineral deposits surrounding the city. The AEOI expects this center to play an important role in supporting the medical and polymer industries. The YRPC is equipped with a Rhodotron TT200 accelerator, made by IBA, Belgium, with outputs of 5 and 10MeV beam lines and a maximum power of 100KW. The YRPC was organized to apply radiation research in the field of applied radiation chemistry. The facility provides buildings for accelerator equipment, administration offices, and laboratory equipment. Professor M. Haji Saeid, Director of YRPC, leads the group to

engage technology implementation, and collaboration with the Agriculture and Medical Center in Karaj and other scientific institutions in Iran.

  - AEOI personnel working at the BHRC examine the mineralogy, mineral processing, beneficiation, preparation and leaching of uranium ores to determine the best method for mining and recovery of uranium in Yazd. The BHRC operates research labs and engineering facilities that undertake: Sampling, crushing, grinding, preparation, and mineral processing of uranium, thorium, and phosphates; Research to determine the process-flow for the hydrometallurgy of resources in the bench-scale and pilot-plant; Studies to compare lab and pilot-plant conditions; Expansion of heap-leaching methods, in-place, in-situ, and bacteria leaching; Preparation of technical-specifications and the layout of pilot plant for production of yellow cake; and All areas of purification and milling operation at a laboratory scale.

- **Karaj Agricultural and Medical Research Center (30MeV Cyclotron) (1 Millamp Calutron):**
  - On 11 May 1991, the AEOI began operating this research center. It comprises the Departments of Nuclear Agriculture, Ion Beam Applications, Materials Engineering, Nuclear Electronics, Nuclear Medicine, and Health Physics. It also operates a 30MeV cyclotron accelerator, a one milliamp calutron, and secondary standard dosimetry laboratory. The C30 is a fixed-field, fixed-frequency, variable-energy dual-proton beam cyclotron. In 1991, Belgium's Ion Beam Applications supplied C30 to Iran. C30 produces "Single Photon-Emission Tomography (SPECT)" and "Positron Emission Tomography (PET)" isotopes. The cyclotron has ten ports that are capable of holding a wide range of target and chemistry systems to produce a variety of isotopes. This calutron was provided by the Chinese. The existence of these devices has led to allegations that China was installing a uranium enrichment facility using calutrons at Karaj. A large hydroelectric dam located nearby could provide the facility with the great amounts of electricity it would require. However, the Chinese-supplied calutron is housed in a gymnasium-sized building that uses an unprotected ventilation system that would normally exclude it from working with radioactive substances.

- **Azad University Plasma Physics Research Center at Damarand:**
  - The research center conducts research to examine plasma activities. It houses a HT-6B Tokamak nuclear fusion research reactor. In 1993, China's Institute of Plasma Physics agreed to transfer the Tokamak to Azad University. Under the agreement two teams of Chinese scientists and engineers assisted Iran to install the reactor.

- **Engineering Research Center for the Constructions Crusade (Jihad-e Sazandegi) at Tabriz:**
  - Engineering defense research, possible CBRN weaponization research facility.

Iran's Current Nuclear Developments

No consensus exists regarding the degree to which Iran's current nuclear activities are or are not designed to help give it nuclear weapons, and especially over the critical question of how close Iran is to having a nuclear device. Few now believe that Iran has nuclear weapons, or is so close to acquiring them that it presents a time-urgent threat. Many believe, however, that Iran is no more than several years away from having a viable nuclear weapons program and that it is a matter of when – rather than if – Tehran acquires nuclear weapons. That is, once Iran gets the capability to produce the materials necessary to closing the nuclear cycle, Iran would acquire the capabilities to produce nuclear weapons.

As of summer 2006, U.S. intelligence estimates still projected that Iran was five to eight years away from a bomb.[115] Some Israeli estimates in early 2007, however, indicated that Iran might acquire a nuclear device as early as 2009. This Israeli timeline gathered more credibility in the spring of 2007, when Iran claimed that it had succeeded in deploying some 1,312 centrifuges and would have 3,000 by the summer of 2007.

The US National Intelligence Estimate (NIE) released 3 December 2007 judged that late 2009 is the earliest Iran would be technically capable of producing enough HEU for a weapon, but that this is very unlikely and that the more likely timeframe remains 2010-15 or later.

The IAEA does not believe that Iran is yet capable of making fissile material, or that it can do so in the near future, but its assessments have also reacted to Iran's progress. In 2006, Mohamed El Baradei, the Director General of the IAEA, stated that, "To develop a nuclear weapon, you need a significant quantity of highly enriched uranium or plutonium, and no one has seen that in Iran."[116] The IAEA has not changed that position since, but the IAEA has made it clear that Iran is coming steadily closer to the point where it could produce fissile material, and has identified Iranian activities and possible attempts at acquiring a wide range of technology and manufacturing capabilities necessary to produce a bomb.

In April of 2007, Mohamed El Baradi, the Director of the IAEA, discounted such Iranian claims, however, and felt Iran had far less than 3,000 centrifuges, and other experts put the maximum number of functional units at around 650 actually operating in series. They felt many of these were still running empty, although IAEA experts felt some were now running UF6 at low pressure.[117] It should also be noted that some experts speculate Iran may face a special problem because its uranium ore is contaminated with heavy metals like molybdenum and that this would limit enrichment to 20 percent without outside technical aid from an advanced power like Russia.[118]

The IAEA issued a report on September 15, 2008 that assessed that Iran had 3,800 centrifuges operating, with increasing stability, at Natanz. Under optimal – if unlikely – conditions, a fully functional capacity of 3,000 P-1 class centrifuges could give Iran enough material for one fission device in 18-27 months, and some private experts by the worst case figure in as at little as 12 months – some point to 2008.

The key variable in gauging the timeline is how soon Iran could get the cascades functioning smoothly to produce enriched uranium around-the-clock. In the most plausible break-out scenario, Iran would produce a stockpile of low enriched uranium under IAEA verification, and only when it had a sufficient quantity, in one or two years, expel the inspectors and enrich this stockpile to weapons grade in five to eight weeks. According to the ISIS analysis of the 15 September 2008 IAEA findings, Iran has largely overcome previous centrifuge problems, which is reflected in the increased feed rates and

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[115] Rowan Scarborough, "U.S. military sees Iran's nuke bomb 5 years away", *Washington Post*, 31 August 2006.
[116] Dafna Linzer, "Strong Leads And Dead Ends In Nuclear Case Against Iran," *Washington Post*, February 8, 2006, p.A01.
[117] Dnna Abu Nasr, "UN Nuke Chief: Iran's Program Limited," *Washington Post*, April 12, 2007; Dafna Linzer, "Boost In Iran's Capacity to Enrich Uranium Noted," *Washington Post*, April 19, 2007, p. 23; ISIS, "IAEA letter to Iran's Representative," April 18, 2007, 5:38:23, isis@isis-online.org.
[118] Frank Barnaby, "World Air Strikes Work?, " Oxford Research Group, March 2007, p. 7.

LEU production. One official close to the IAEA stated that Iran may have reached a point where its cascades are operating in a stable manner, noting that fewer centrifuges are breaking.[119]

No one knows the actual current or final design output of Iran's P-1 centrifuges or the efficiency of its cascades and overall production systems. Some speculate, however, that the annual output of each P-1 could be 2.5 seperative work units (SWU) or some 0.013 kilograms of HEU a year (European P-2 centrifuges are about twice as efficient and produce 5 SWU a year). Under some conditions, a total system of 3,000 Iranian P-1s could produce as much as 7,500 SWU per year or enough to provide 40 kilograms of HEU per year. This would be enough for one weapon a year and possibly two. [120]

On October 20, 2008, Mohamed El Baradei assessed that Iran still lacked the key components to produce nuclear weapons. According to El Baradei, "They do not have even the nuclear material, the raw un-enriched uranium to develop one nuclear weapon if they decide to do so. Even if you decide to walk out tomorrow from the NPT (Nuclear Nonproliferation Treaty) and you go into a lot of scenarios, we're still not going to see Iran tomorrow having nuclear weapons."[121]

But on 27 October 2008, El Baradei also reiterated that Iran is continuing to block the IAEA inspectors from verifying whether the nation has any ambitions for nuclear weaponry. "I regret that we are still not in a position to achieve full clarity regarding the absence of undeclared nuclear material and activities in Iran," El Baradei asserted. He urged Tehran to do more to ensure "transparency," but emphasized that the Vienna-based IAEA "does not in any way seek to pry into Iran's conventional or missile-related military activities;"[122] which Iran has continued to assert that the IAEA, under the corrupt thumb of the west, is trying to do.

Fissile Material and Weapons Production

Many experts believe that the key factor limiting Iran is obtaining fissile material. Here it should be noted that there is also a major debate over how much fissile material Iran would need and much depends on the sophistication of its weapons design efforts. Figure V.2 shows the range of material required for older weapons designs. Advanced weapons designs only require a fraction of this material, but Iran is unlikely to have access to such designs. As a result, it seems doubtful than Iran could make nuclear weapons using less than 50-70% of the fissile material shown in Figure 5.2 during the next decade.

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[119] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

[120] [120] David E., Sanger, "Atomic Agency Concludes Iran is Stepping Up Nuclear Work," *New York Times*, May 14, 2007; [120] David E., Sanger, "Inspectors Cite Big Gain by Iran on Nuclear Fuel," *New York Times*, May 14, 2007/

[121] "IAEA Chief: Iran not Close to Developing Nuclear Weapons," *Haaretz,* 21 October 2008; "Iran Far From Nuke Capability, IAEA Chief Says," Global Security Newswire, 21 October 2008.

[122] John Heilprin, "UN nuclear chief says Iran blocking progress," The Associated Press, October 28, 2008, available at: http://www.iranfocus.com/en/nuclear/un-nuclear-chief-says-iran-blocking-progress-16575.html.

Figure 5.2: Amount of Fissile Material Need to Build a Basic Fission (Non-Boosted) Weapon

Highly Enriched Uranium HEU (90% U-235)	**Simple gun-type weapon**	**90-110 lbs/40-50 kg**
	Simple implosion weapon	**33lbs/15 kg.**
	Sophisticated implosion weapon	**20-26lbs/9-12kg**
Weapons Grade Plutonium	**Simple implosion weapon**	**14lbs/6 kg**
	Sophisticated implosion weapon	**4.5-9lbs/2-4 kg**

Extract from the unclassified estimates in Union of Concerned Scientists, "Preventing Nuclear Terrorism Fact Sheet," April 2004, and work by Abdullah Toucan

The US NIE on Iran's nuclear programs issued in November 2007 made the importance of fissile material clear:[123]

> "We continue to assess with low confidence that Iran probably has imported at least some weapons-usable fissile material, but still judge with moderate-to-high confidence it has not obtained enough for a nuclear weapon. We cannot rule out that Iran has acquired from abroad—or will acquire in the future—a nuclear weapon or enough fissile material for a weapon. Barring such acquisitions, if Iran wants to have nuclear weapons it would need to produce sufficient amounts of fissile material indigenously—which we judge with high confidence it has not yet done."
>
> "We assess centrifuge enrichment is how Iran probably could first produce enough fissile material for a weapon, if it decides to do so. Iran resumed its declared centrifuge enrichment activities in January 2006, despite the continued halt in the nuclear weapons program. Iran made significant progress in 2007 installing centrifuges at Natanz, but we judge with moderate confidence it still faces significant technical problems operating them."
>
> "Iranian entities are continuing to develop a range of technical capabilities that could be applied to producing nuclear weapons, if a decision is made to do so. For example, Iran's civilian uranium enrichment program is continuing. We also assess with high confidence that since fall 2003, Iran has been conducting research and development projects with commercial and conventional military applications—some of which would also be of limited use for nuclear weapons."

Plutonium Production

Plutonium is one of the two key sources of fissile material, and Iran has followed a number of different paths it could use to develop the capacity to produce plutonium:

First, Iran is building heavy-water production plants, which U.S. officials claim that their only purpose is to supply heavy water that is optimal for producing weapons-grade plutonium. The Iranian government, on the other hand, has claimed that their purpose is for isotope production for its civilian nuclear energy program.[124]

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[123] Assessments from NIE report, "Iran: Nuclear Intentions and Capabilities," November 2007.

[124] John R. Bolton, "Preventing Iran from Acquiring Nuclear Weapons," Remarks to the Hudson Institute, Washington DC, August 17, 2004.

Second, Iran is building light-water power reactors. The main reactor is at Bushehr, which is designed to produce civilian nuclear technology. Bushehr is also the reactor that Russia agreed to supply its fuel and recover the spent fuel from the reactor. According to an agreement between Russia and Iran dating from September 2006, Russia agreed to provide low-enriched uranium for the reactor by March 2007, regardless of UN sanctions.[125] The US under Secretary for Arms Control and International Security, John R. Bolton, claimed that Bushehr would produce enough plutonium per year to manufacture nearly 30 nuclear weapons.[126]

Third, Iran is developing new heavy water reactors. Iran is seeking to replace or supplant its small, 35-year old, research reactor in Tehran, with a more modern, 40-megawatt, thermal-cooled, heavy-water reactor, at Arak. Some outside experts feel that Iran's IR-40 heavy reactor could be operational by 2011 and allow Iran to begin producing significant amounts of weapons-grade material by 2014.

Such a reactor could be used to produce up to 8 kilograms of weapons grade plutonium a year – enough for one to two weapons a year. Iran might also need far less weapons-grade plutonium per weapons than uranium. One outside expert quotes a figure of 5 kilograms for plutonium versus 25 kilograms of uranium--although such calculations are based on nominal figures used for arms control purposes that have little relevance to actual weapons designs employed since the 1960s.[127]

Fourth, Iran has experimented extensively with plutonium separation, which extracts plutonium that can be used for weapons from irradiated nuclear reactor fuels such as those used in Iran's new nuclear power reactor at Bushehr. The following chronology shows the history of Iran's plutonium separation experiments reported in IAEA documents:[128]

- **1987–1988:** The separation process was simulated using imported unirradiated uranium dioxide (UO2); dissolution and purification took place in the Shariaty Building at TNRC [Tehran Nuclear Research Center]; pressed and sintered pellets were manufactured using imported UO2 (DU) at Fuel Fabrication Laboratory (FFL); the UO2 pellets were further manipulated into aluminum and stainless steel capsules at FFL.

- **1988–1993:** The capsules (containing a total of 7 kilograms of UO2 in the form of powder, pressed pellets, and sintered pellets) were irradiated in Tehran Research Reactor (TRR).

- **1991–1993:** Plutonium was separated from some of the irradiated UO2 targets in the capsules (about 3 kilograms of the 7 kilograms of UO2) and plutonium solutions produced; these activities were carried out at the Shariaty Building and, after the activities were transferred in October/November 1992, at the Chamaran Building at TNRC; the research and development related irradiation and separation of plutonium were terminated in 1993.

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[125] Paul Kerr, "Russia, Iran sign deal to fuel Bushehr reactor", Arms Control Today, November 2006, available at http://www.armscontrol.org/act/2006_11/RussiaIran.asp

[126] John R. Bolton, "Preventing Iran from Acquiring Nuclear Weapons," Remarks to the Hudson Institute, Washington DC, August 17, 2004.

[127] Frank Barnaby, "World Air Strikes Work?, " Oxford Research Group, March 2007, p. 7.

[128] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, Annex 1, p. 14, available at: http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf

- **1993–1994:** The unprocessed irradiated UO2 was initially stored in capsules in the spent fuel pond of TRR and later transferred into four containers and buried behind the Chamaran Building.
- **1995:** In July, purification of the plutonium solution from the 1988–1993 period was carried out in the Chamaran Building; a planchet (disk) was prepared from the solution for analysis.
- **1998:** In August, additional purification of plutonium from the 1988–1993 period was carried out in the Chamaran Building; another planchet (disk) was prepared from the solution for analysis.
- **2000:** The glove boxes from the Chamaran Building were dismantled and sent to ENTC [Esfahan Nuclear Technology Center] for storage; one glove box was moved to the Molybdenum Iodine Xenon Facility.
- **2003:** Due to construction work being carried out behind the Chamaran Building, two containers holding the unprocessed irradiated UO2 were dug up, moved, and reburied.
- **2003:** Iran in February confirmed that it was building a heavy-water production plant at Arak.
- **2003:** The IAEA DG report of November 10 (GOV/2003/71) asserts that "between 1992 and 1998 it [Iran] had irradiated 7 kg of UO2 targets and extracted small quantities of plutonium."
- **2003:** John Bolton, U.S. Under Secretary of State for Arms Control and International Security, stated at a conference on December 2: **"**In what can only be an attempt to build a capacity to develop nuclear materials for nuclear weapons, Iran has enriched uranium with both centrifuges and lasers, and produced and reprocessed plutonium […] Iran is trying to legitimize as "peaceful and transparent" its pursuit of nuclear fuel cycle capabilities that would give it the ability to produce fissile material for nuclear weapons. This includes uranium mining and extraction, uranium conversion and enrichment, reactor fuel fabrication, heavy water production, a heavy water reactor well-suited for plutonium production, and the "management" of spent fuel--a euphemism for reprocessing spent fuel to recover plutonium."
- **2004:** The IAEA in its March 17 Board of Governors Resolution (GOV/2004/21) stated that the nature and the scope of Iranian research into laser isotopic enrichment and the question of experiments in the production of polonium-210 remained not satisfactory disclosed.
- **2004:** IAEA DG report (GOV/2004/82) from November 15: **"**Between 1988 and 1993, Iran carried out plutonium separation experiments at TNRC. The shielded glove boxes in which these experiments were carried out were dismantled in 1993, relocated to JHL and used for other purposes […] In its letter of 21 October 2003, Iran acknowledged the irradiation of depleted UO_2 targets at TRR and subsequent plutonium separation experiments in shielded glove boxes in the Nuclear Safety Building of TNRC. Neither the activities nor the separated plutonium had been reported previously to the Agency […] Iran stated that the Am-241 had been imported from abroad prior to the Iranian revolution in 1979, and explained that, in 1990, the glove box that had been used in connection with the Am-241 had been transferred to the building where the plutonium separation took place, but that it had been used for training purposes and not for plutonium experiments […] In addition, while Iran has provided preliminary design information on the IR-40 heavy water research reactor, the construction of which should commence in 2004, the Agency has raised some questions regarding Iran's attempts to acquire manipulators and lead glass windows for the hot cells. With respect to the latter issue, in October and November 2004, Iran provided some clarifications, which are now being assessed."
- **2005:** In June, Iran admitted that it conducted small-scale experiments to produce plutonium. Iran had declared to the IAEA that it ended certain plutonium experiments in 1993, but disclosed to the IAEA that those experiments were still being undertaken in 1998.
- **2008:** In June, media reports alleged claims by an adviser to the Israeli National Security Council that Syria was planning to supply Iran with spent nuclear fuel for reprocessing into weapons-grade

> plutonium. If confirmed, these reports would indicate greater nuclear cooperation between Syria and Iran than previously known.[129]

The IAEA reported in September 2005, "A final assessment of Iran's plutonium research activities must await the results of the destructive analysis of the disks and targets."[130] The IAEA analysis of Iran's plutonium separation experiments concluded, however, that the solutions that were tested were 12–16 years old, which seemed to corroborate Iran's claims. In addition, the IAEA carried out verification tests for unprocessed irradiated UO2 targets stored in four containers. These results also supported Iranian claims, although the IAEA argued that the number of targets provided by Iran was much lower than the actual ones it has.

Uranium Enrichment

Many weapons experts believe that the Iranian uranium enrichment program is more advanced than its plutonium programs and does not rely on Iran's nuclear reactors. The former Chief UN weapons inspector in Iraq, Hans Blix, has said that Tehran's plans to build a 1,000-megawatt power reactor at Bushehr, which is considered Iran's main plutonium production facility, should not be the main concern. He argued that the light-water reactor used only low-enrichment (3.5 percent) uranium and is scarcely ideal for plutonium production.

He added, "What is uncomfortable and dangerous is that they have acquired the capacity to enrich uranium of their own uranium that they dig out of the ground…If you can enrich to five percent you can enrich it to 85 percent."[131] Others note, however, that the reactor will use some 103 tons of uranium contained in 193 fuel assemblies and still generate some 250 kilograms of plutonium a year. They speculate that there would be enough plutonium in every four irradiated fuel assemblies to produce a single nuclear weapon, and if Iran broke its fuel agreement with Russia and dedicated the reactor to weapons production, it could provide enough plutonium for 40-50 weapons a year. Given Iran's stated plans to acquire a total of six 1,000-megawatt reactors, it is hard to dismiss these concerns.[132]

Iran has a long history of research into uranium enrichment. According to one report, Iran had made earlier attempts just after the oil crisis of 1974.[133] It is likely that work on uranium enrichment was conducted between 1974 and 2003; however, it is not known to what extent.

In October 2003, during negotiations with the EU-3, Iran agreed to suspend its uranium enrichment program, most likely because it feared an escalation of the issue with interference by the UN Security Council. Two months later, Iran also signed the IAEA

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[129] Ian Black, "Syria planned to supply Iran with nuclear fuel, Israel says." Guardian. June 25, 2008. http://www.guardian.co.uk/world/2008/jun/25/syria.iran

[130] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, p. 7, available at: http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf

[131] "Iran Far From Nuclear Bomb-Making Capacity: Ex-UN Weapons Chief Blix," Agence France Presse, June 23, 2005.

[132] Frank Barnaby, "World Air Strikes Work?, " Oxford Research Group, March 2007, p. 8.

[133] Revati Prasad and Jill Marie Parillo, "Iran's programs to produce plutonium and enrichment uranium", *Carnegie Fact Sheet*, February 2006.

Model Additional Protocol. Reportedly, Iran resumed enrichment activities in 2004, but then agreed to suspension again in 2005, after facing referral to the United Nations Security Council again. In August 2005, the EU-3 proposal failed and Iran began enrichment activities anew.

Iran showed it was determined to continue the enrichment program even though it faced IAEA referral to the UN Security Council – a referral that eventually took place in February 2006. Mohammad Saeedi, Iran's Deputy Nuclear Chief, reiterated that Iran aimed to expand uranium enrichment to industrial scale at Natanz. In addition to installing 3,000 centrifuges at Natanz by 2006, Saeedi claimed that Iran aims at expanding the total number of centrifuges to 54,000, which would be used to fuel a 1,000-megawat nuclear power plant.[134] Iran's Deputy Foreign Minister Mohammad Reza Bagheri pointed out Iran's stance on the uranium enrichment program: "It is our red line. We will never do it."[135]

While some believe that these Iranian claims were credible, others speculated that Iran made the announcement to send a message that military strikes or sanctions would not deter Iran from achieving a full nuclear cycle. Much depends on what the announcement really meant. Iran had previously obtained at least 2-percent enrichment from the experimental use of centrifuges and possibly significantly higher levels. The IAEA had previously made it clear that it lacked the data to determine how far Iran had actually progressed. Iran also had reached enrichment levels as high as 8 percent making experimental use of laser isotope separation, although it seemed far from being able to scale such efforts up beyond laboratory tests.

Mahmoud Ahmadinejad announced on April 11, 2006, that Iran was successful at enriching uranium. "At this historic moment, with the blessings of God almighty and the efforts made by our scientists, I declare here that the laboratory-scale nuclear fuel cycle has been completed and young scientists produced enriched uranium needed to the degree for nuclear power plants [on April 9]." The head of the Atomic Energy Agency of Iran (AEOI) and Iran's Vice President, Gholamreza Aghazadeh, and Iranian nuclear scientists stated Iran's accomplishments and/or goals as follows:[136]

- Started enriching uranium to a level—3.5 percent—needed for fuel on a research scale using 164 centrifuges, but not enriched enough to build a nuclear bomb;
- Produced 110 tons of uranium hexafluoride (UF6)—this amount is nearly double the amount that Iran claimed to have enriched in 2005;
- Aim[s] to produce a gas high with an increased percentage of U-235, the isotope needed for nuclear fission, which is much rarer than the more prevalent isotope U-238; and
- Plan[s] to expand its enrichment program to be able to use 3,000 centrifuges at the nuclear center at Natanz by the end of 2006.

[134] Ali Akbar Dareini, "Iran To Move to Large Scale Enrichment," *Associated Press,* April 12, 2006.
[135] "Iran says to go ahead with fuel work", Reuters, August 27, 2006.
[136] Ali Akbar, "Iran Hits Milestone in Nuclear Technology," *Associated Press,* April 11, 2006.

According to estimates made by the ISIS and based on data obtained in IAEA inspections, Iran had fed 7,600 kg of UF6 into its centrifuges as of August 30, 2008, and had produced approximately 480 kg of LEU.[137]

The Centrifuge Challenge

Iran has experimented with two different methods of uranium enrichment ever since the time of the Shah. First, Iran has manufacturing and testing centrifuges. Second, Iran also pursued enriching uranium through laser enrichment. According to Mohamed El Baradei, the Director General of the IAEA, Iran was able to enrich uranium up to 1.2 percent using centrifuges and up to a peak enrichment grade of 13 percent using lasers.[138]

The Origin's of Iran's Centrifuge Program

Many of Iran's experiments took place between 1981 and 1993 at the TNRC and at the ENTC. One source reports that uranium enrichment in centrifuges began in 1985.[139] In this case, however, it is clear that some of these activities continued throughout 2002. According to the IAEA, Iran's uranium enrichment activities also received some foreign help in 1991. The IAEA outlined its findings regarding Tehran's uranium enrichment as follows:

> In 1991, Iran entered into discussions with a foreign supplier for the construction at Esfahan of an industrial scale conversion facility. Construction on the facility, UCF, was begun in the late 1990s. UCF consists of several conversion lines, principal among which is the line for the conversion of UOC to UF6 with an annual design production capacity of 200 t uranium as UF6. The UF6 is to be sent to the uranium enrichment facilities at Natanz, where it will be enriched up to 5% U-235 and the product and tails returned to UCF for conversion into low enriched UO2 and depleted uranium metal. The design information for UCF provided by Iran indicates that conversion lines are also foreseen for the production of natural and enriched (19.7%) uranium metal, and natural UO2. The natural and enriched (5% U-235) UO2 are to be sent to the Fuel Manufacturing Plant (FMP) at Esfahan, where Iran has said it will be processed into fuel for a research reactor and power reactors. […]
>
> In March 2004, Iran began testing the process lines involving the conversion of UOC into UO2 and UF4, and UF4 into UF6. As of June 2004, 40 to 45 kg of UF6 had been produced. A larger test, involving the conversion of 37 t of yellowcake into UF4, was initiated in August 2004. According to Iran's declaration of 14 October 2004, 22.5 t of the 37 t of yellowcake had been fed into the process and that approximately 2 t of UF4, and 17.5 t of uranium as intermediate products and waste, had been produced. There was no indication as of that date of UF6 having been produced during this later campaign.[140]

IAEA inspections found traces of contamination from advanced enrichment effects at Natanz. Iran claimed that these contaminations were from equipment it purchased in the 1980s from abroad (presumably from Pakistan). Reports by the IAEA, however, showed

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[137] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

[138] John R. Bolton, "Preventing Iran from Acquiring Nuclear Weapons," Remarks to the Hudson Institute, Washington DC, August 17, 2004.

[139] Revati Prasad and Jill Marie Parillo, "Iran's Programs to produce plutonium and enriched uranium", *Carnegie Fact Sheet*, February 2006.

[140] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, November 15, 2004, available at: http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83_derestrict.pdf

that Iran may well have started its enrichment program in the 1970s and that the Iranians were already partially successful at uranium conversion.

Some of Iran's gas centrifuge program initially depended on help it got from Pakistan. Although reports by the Director General of the IAEA do not mention Pakistan by name, Iran's gas centrifuges could be traced back to the mid-1990s when A. Q. Khan approached an Iranian company and offered it P-1 documentation and components for 500 centrifuges. Iran claimed that it received only the P-1 and not the P-2 design (the P-1 and the P-2 refer to two designs for centrifuges by Pakistan). Both Iran and Pakistan would later admit to this transaction and provide the documents to support these allegations.[141]

According to the IAEA, Tehran received P-1 components and documentation in January 1994. Tehran, however, claimed that it did not receive the first of these components until October 1994. Regardless of the month of delivery, there is one more important element that remains unresolved. The IAEA refers to this as the "1987 offer," which reportedly provided Iran with a sample machine, drawings, descriptions, and specifications for production and material for 2,000 centrifuge machines.[142]

In addition, Iran received the P-2 design in 1994/1995 from Pakistan, but all of its components were designed and manufactured in Iran. According to Iran's official statements, the AEOI awarded a contract to a company in Tehran to build P-2 centrifuges.[143] Furthermore, Iran claimed that it did not pursue any work on the P-2 design between 1995 and 2002 due to shortages in staff and resources at the AEOI and that Tehran focused on resolving outstanding issues regarding the P-1 design. The IAEA, however, was not convinced that Iran did not pursue further development of the P-2 design and called on Iran in September 2005 to provide more information on the history of its P-2 development.[144]

Iran No Longer is Dependent on Imports

The IAEA's discoveries have made it clear that Iran no longer needs imports of technology and equipment to move forward. It has functioning centrifuge design and manufacturing capability. Revati Prasad and Jill Marie Parillo state that the AEOI purchased designs and components for the P-1 centrifuges through the A.Q. Khan network in 1987.[145] It also seemed highly likely that it had acquired P2 centrifuge designs and the same basic Chinese design data for a fissile weapon suitable for mounting on a ballistic missile that North Korea had sold to Libya.

Iran also has reactor development capability, and plutonium separation capability. As has been touched upon earlier, it has experimented with polonium in ways that show it can

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[141] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, available at: http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf

[142] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, available at: http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf

[143] Revati Prasad and Jill Marie Parillo, "Iran's programs to produce plutonium and enrichment uranium", *Carnegie Fact Sheet*, February 2006.

[144] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 2, 2005, available at: http://www.iaea.org/Publications/Documents/Board/2005/gov2005-67.pdf

[145] Revati Prasad and Jill Marie Parillo, "Iran's programs to produce plutonium and enrichment uranium", *Carnegie Fact Sheet*, February 2006.

make a neutron initiator, it has the technology to produce high-explosive lenses and beryllium reflectors, it can machine fissile material, and it has long had a technology base capable of designing nuclear weapons and performing non-fissile simulation tests of its weapons designs of the kind used by Pakistan in its nuclear weapons-design efforts.

As a result, both the claims Mahmoud Ahmadinejad made on April 11, 2006 that Iran had made a major breakthrough by successfully enriching uranium, and President George W. Bush's response that Iran would not be allowed to acquire the technology to build a nuclear weapon were little more than vacuous political posturing. Ahmadinejad's statement seems to have been an effort to show the UN that it could not take meaningful action and exploit Iranian nationalism.

The Bush statement seems to have been the result of a combination of basic technical ignorance on the part of his speechwriters, and of an effort to push the UN toward action and to convince Iran that it could face the threat of both serious sanctions and military action if diplomacy and sanctions failed. It effectively ignored the fact that Iran not only already had the technology, but could disperse it to the point where it was extremely unlikely that any UN inspection effort could find it, even if Iran allowed this, or any military option could seriously affect Iran's technology base--as distinguished from its ability to create survivable large-scale production facilities and openly deploy nuclear-armed delivery systems.

In reality, Iran's progress in developing its centrifuge program has been steady, dependent on past imports of technology, and evolutionary. In fact, diplomats and officials from the IAEA were quick to point out that the announcement by Iran should not be a sign of concern and that Iran may face many technical hurdles before it can enrich enough quantities of uranium at high levels to produce a nuclear weapon.

The Uncertain Status of Iran's Current Centrifuge Programs

One European official said that while the 164-machine centrifuges were more industrial, "…it's not like they haven't come close to achieving this in the past." This assessment has been reflected in reports by the IAEA, which argues that Iran has used centrifuges and laser to enrich uranium throughout the 1990s and even before.[146]

This helps explain why experts have argued that Iran's goal of producing 50,000 centrifuges in Natanz should be considered a sign of serious concern for the international community. As far as the future developments of Natanz is concerned, Iran established its additional cascades underground, and the IAEA GOV/2007/8 confirms that Iran moved about ten tons of unenriched uranium into the cavernous halls in Natanz.

David Albright and Corey Hinderstein of the Institute for Science and International Security (ISIS) have argued that Iran planned in January 2006 to install centrifuges in modules of 3,000 machines that were designed to produce low enriched uranium for civilian power reactors. If half of these machines were to be used to create HEU instead, they could produce enough HEU for one nuclear weapon a year. Furthermore, if the Iranians do achieve their ultimate goal of 50,000 centrifuges, Albright and Hinderstein

[146] Nazila Fathi and Christine Hauser, "Iran Marks Step in Nuclear Development," *New York Times,* April 11, 2006.

argue, "At 15–20 kilograms per weapon that would be enough for 25–30 nuclear weapons per year."[147]

Key Centrifuge Facilities

Natanz is the primary uranium enrichment site in Iran. It contains installations both above and below ground and covers an area of about 100,000 square meters.[148] The commercial enrichment plant reportedly is buried underground and is located in three structures that are to be capable of housing 50,000 cascades.

Until early 2007, Iran was believed to have two 164-cascade machines running in its Natanz facility. In February 2007, however, the IAEA reported that Iran installed four additional cascades underground, which would equal a total of 1,018 centrifuges in Natanz, most of them underground. IAEA report GOV/2007/8 described the situation as follows:

> During the design information verification (DIV) carried out at FEP on 17 February 2007, Agency inspectors were informed that two 164-machine cascades had been installed and were operating under vacuum and that another two 164-machine cascades were in the final stages of installation. In light of this, in a letter dated 19 February 2007, the Agency requested that arrangements be made for the relocation of cameras into the cascade hall during the Agency's next visit to FEP, which is scheduled to take place between 3 and 5 March 2007. The issue of remote monitoring remains to be resolved.[149]

This meant that in addition to the two cascade machines with 164 centrifuges each that were confirmed to be running in the Natanz pilot plant, Iran had installed another two machines with 164 cascades each. As of the time of the report, 656 cascades were reported by the IAEA to be running, half of them under vacuum. It also meant that if Iran installed yet another two "chains," "cascades," or "links" of 164 centrifuges, the total number of running cascades would amount to 984.

The IAEA gave no indication in this report when any additional chains of centrifuges would be operational. A report by David Albright and Jacqueline Shire from November 14, 2006, had expressed doubt about how quickly this could happen.[150] It then became clear, however, that Iran fed an unexpectedly large amount of UF6 into its cascades in late 2006 and 2007. An ISIS report by Jacqueline Shire and David Albright dated March 15, 2007, concluded that Iran fed about 100 kilograms of UF6 into its cascades at the Natanz plant between mid-August 2006 and mid-February of 2007. It should be noted that by March 2007, Iran had reached its highest rate of UF6 insertions, a trend that had continually grown since Iran agreed to resume uranium enrichment in early 2006.

The authors of the ISIS report also computed that at that rate of enrichment activity, Iran could feed about 613 kilograms of UF6 into its existing centrifuges. The uranium, according to Iranian estimates, was enriched to a 5-percent enrichment level. Shire and

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[147] David Albright and Corey Hinderstein, "Iran's Next Steps: Final Tests and the Construction of a Uranium Enrichment Plant," Institute for Science and International Security, Issue Brief, January 12, 2006, available at: http://www.isis-online.org/publications/iran/irancascade.pdf

[148] Revati Prasad and Jill Marie Parillo, "Iran's programs to produce plutonium and enrichment uranium", *Carnegie Fact Sheet*, February 2006.

[149] IAEA, *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolution 1737 (2006) in the Islamic, Republic of Iran*, Report by the Director General (Gov/2007/8), February 22, 2007.

[150] David Albright and Jacqueline Shire, *Latest IAEA Report on Iran: Continued Progress on Cascade Operations, No New Cooperation with IAEA*, Institute for Science and International Security, November 14, 2006.

Albright conclude that Iran operated its centrifuges for an average of about five hours a day.

Problems in Estimating the Efficiency of Iran's Centrifuge Programs

David Albright noted Iran's potential difficulties in mastering, i.e., linking, all its centrifuge cascades. According to Albright, there are four likely reasons Iran has problems:

- The centrifuges have experienced an unknown technical problem that prevents continuous operation;
- Iran is slowing its program down so as not to alarm the international community;
- Iran is already competent in operating cascades to enrich uranium, but that competency is being hidden. For example, Iran may have received undeclared assistance from the Khan network in this area; or
- Iran is simply implementing its own plan for cascade installation that includes its own method to become proficient, according to its own timetable, and has chosen not to share it with the IAEA or the outside world.[151]

Shire and Albright acknowledged in March 2007, however, that Iran's centrifuges were running better than commonly expected by most observers.[152] Moreover, in April 2007, Iran claimed that it had succeeded in deploying some 1,312 centrifuges and would have 3,000 by the summer of 2007. As has been noted earlier, a fully functional capacity of 3,000 P-1 class centrifuges could give Iran enough material for one fission device in 18-27 months under optimal--if unlikely--conditions.

The problem in making such estimates is there are no data on the operational status and efficiency of Iran's units. Mohamed ElBaradi, the Director of the IAEA, discounted Iranian claims in April 2007, for example, and felt Iran had far less than 3,000 centrifuges, and other experts put the maximum number of functional units at around 650 actually operating in series. They felt many of these were still running empty, although IAEA experts felt some were now running UF6 at low pressure.[153]

At the same time, a smaller facility might be adequate. A study by Frank Barnaby for the Oxford Research Group estimates Iran's current centrifuges could produce about 2.5 SWUs a year, with a range of 1.9–2.7 SWUs. If Iran had the P-2, each centrifuge would produce roughly 5 SWUs a year. A fully operational 3,000-centrifuge facility could then produce some 7,500 SWUs or about 40 kg of HEU a year, and it would probably take a total capacity of 5,000 machines to keep 3,000 online at all times.[154] As is discussed later, the 1,500-centrifuge pilot facility that Iran is now seeking to operate could conceivably produce a single weapon in two to three years.

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[151] David Albright, Iran's Nuclear Program: Status and Uncertainties, Prepared testimony by David Albright, President, Institute for Science and International Security (ISIS), Before the House Committee on Foreign Affairs, Subcommittee on Terrorism, Nonproliferation, and Trade, Subcommittee on the Middle East and Asia, March 15, 2007, p.4.

[152] Jacqueline Shire and David Albright, *Iran's centrifuges: How well are they working*, Institute for Science and International Security, March 15, 2007.

[153] Barbara Slavin, "Iran Claims Nuclear Advance," USA Today, April 10, 2007, p. 1; Donna Abu Nasr, "UN Nuke Chief: Iran's Program Limited," Washington Post, April 12, 2007; Dafna Linzer, "Boost In Iran's Capacity to Enrich Uranium Noted," Washington Post, April 19, 2007, p. 23; ISIS, "IAEA letter to Iran's Representative," April 18, 2007, 5:38:23, isis@isis-online.org; IAEA, "Communication dated 18 April 2007 from the Secretariat to the Resident Representative of the Islamic Republic of Iran," IAEA GOV/Inf/2007/10, April 18, 2007.

[154] Dr. Frank Barnaby, "Iran's Nuclear Activities," Oxford Research Group, February 2006.

Continuing Iranian Efforts

The IAEA reported on 15 September 2008 that Iran is continuing to install new cascades of centrifuges to enrich uranium in defiance of a UN Security Council order. Around 3,800 centrifuges were now in operation at Iran's enrichment plant in Natanz, an increase of 300 since May.[155]

The IAEA reported that on August 30, 2008 five 164-machine cascades were being fed with UF6, another cascade was in a vacuum without UF6, and installation continued on the remaining 12 cascades at the unit. Approximately 7,600 kg of UF6 has been fed into the cascades Natanz, and based on Iran's daily operating records, as of August 30 2008 Iran had produced approximately 480 kg of LEU. This indicates that Iran's centrifuges are running at approximately 85 percent of their stated previous target capacity, which is a significant increase over previous rates.[156]

This latest report, according to ISIS analysis of the IAEA findings, shows that Iran has largely overcome previous centrifuge problems, which is reflected in the increased feed rates and LEU production. One official close to the IAEA stated that Iran may have reached a point where its cascades are operating in a stable manner, noting that fewer centrifuges are breaking.[157]

Based on data from the September 15, 2008 IAEA report, the ISIS estimates that under optimal conditions, Iran could use between 700 and 800 kilograms of LEU to produce in its P1 centrifuges 20-25 kilograms of weapon-grade uranium, enough for a crude fission weapon. Other estimates are more pessimistic about Iran's ability to enrich the LEU up to weapon-grade, estimating that 1,000-1,700 kilograms of LEU would be necessary to produce 25-30 kilograms of weapon-grade uranium, generally considered more than enough for one nuclear weapon. Whatever the actual amount of LEU, Iran is progressing toward this capability and can be expected to reach it in six months to two years.[158]

Figure 5.3 gives estimates of Iran's centrifuge and LEU status from the University of Wisconsin's Iran Watch webpage, and estimates of Iran's progress in moving from weapons reactor-grade to weapon's grade uranium. Figure 5.4 gives the estimated number of centrifuges deployed over time according to IAEA inventories. These estimates are based on open source information collected and analyzed by the University of Wisconsin's Iran Watch program; which was primarily initially attained via IAEA reporting.

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[155] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 15, 2008.

[156] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008. Based on Iran's stated feed rates of 70 grams per hour per cascade, one would expect that a single cascade would consume 50 kg per month, with 18 cascades consuming 900 kg. Between May 7 2008 and August 30, 2008 we calculate that 21 cascades were operating on average, with a potential maximum feed of 4200 kg. Iran introduced 3630 kg during this period, indicating that the cascades were operating at approximately 85 percent capacity. This is a significant increase over the 50 percent capacity indicated by the last IAEA report.

[157] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

[158] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

Figure 5.3: Iran's Centrifuge and LEU Status September 2008 and Estimates in Moving toward Weapons Grade Uranium[159]

As Iran increases the number of centrifuge machines it is operating, and increases its stockpile of low-enriched uranium, it will consolidate its status in the future as a "virtual" nuclear weapon state. The following estimates are based on information in quarterly reports by the International Atomic Energy Agency (IAEA), which is responsible for nuclear inspections in Iran:

Iran's progress towards this status by the end of September 2008 is *estimated* below:

- Amount of U-235 contained in Iran's stockpile of low-enriched uranium: 13.6 kg
    - Iran is estimated to have produced 528 kg of low-enriched UF6 (480 kg on August 30 plus one month's production at 48 kg per month (see note l)), 357 kg of which is uranium; 357 kg of uranium enriched to 3.8% contain 13.6 kg of U-235.
- Amount of this U-235 produced each month: 1.2 kg
    - Iran is estimated to produce about 48 kg of low-enriched UF6 each month, 32.5 kg of which is uranium; enriched to 3.8%, this 32.5 kg contains 1.2 kg of U-235.
- Amount of this U-235 required to fuel a first-generation implosion bomb: 17.6 kg
    - Sixteen kilograms are assumed to be sufficient for an implosion bomb. This was the amount called for in the implosion device Saddam Hussein was trying to perfect in the 1980's, and the design for such a device has circulated on the nuclear black market, to which Iran has had access. The critical mass of a sphere of U-235 metal is only 15 kg with a Beryllium reflector. See Gunter Hildenbrand, Nuclear energy, nuclear exports and the proliferation of nuclear weapons, AIF Conference on International Commerce and Safeguards for Civil Nuclear Power, March 1977.[160] Because of losses during the enrichment process, Iran would need 684 kg of UF6 enriched to 3.8% U-235, of which 462 kg would be uranium, in order to achieve 16 kg of weapon-grade uranium. 462 kg of uranium enriched to 3.8% U-235 contain 17.6 kg of U-235.[161]
- Date by which Iran is likely to have stockpiled the above: mid-January 2009
    - Assuming 13.6 kg of U-235 on hand at the end of September 2008, a requirement of 17.6 kg for a first bomb, and a production rate of 1.2 kg of U-235 each month, Iran would need 3.3 months (mid-January 2009).
- Number of additional months needed to convert this low-enriched uranium to weapon-grade: 2-3
    - Once enriched to weapon-grade, this material would still need to be converted from gas to metal and then machined into a form suitable for a bomb. The IAEA estimates the conversion time for low-enriched uranium to weapon-grade uranium metal to be approximately 3-12 months. However, if it would take approximately 822 SWUs to produce 16 kg of weapon-grade uranium from a stockpile of 3.8% enriched uranium (see note o), and if Iran is producing at least 6,000 SWUs per year (see note q), then a conversion time at the lower end of this range is probable. Therefore, Iran could have weapon-grade UF6 within 2-3 months, even assuming a delay in processing.
- Date by which Iran may have enough U-235 to fuel a second bomb: October 2009

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[159] Figure 5.3 is adapted from the "Iran Nuclear Timetable," IranWatch.org, University of Wisconsin Project on Nuclear Arms Control, October 15, 2008, available at: http://www.iranwatch.org/ourpubs/articles/iranucleartimetable.html.

[160] For a schematic diagram of an implosion bomb, see: www.wisconsinproject.org/bomb-facts/images/nw-1.jpg.

[161] See the SWU calculator published by URENCO, a European uranium enrichment consortium: web.archive.org/web/20021226100607/www.urenco.de/trennarbeit/swucal_e.html.

- If Iran were to add at least half of the centrifuges it is currently installing to those operating with UF6, a total of 4,920 machines, and the average monthly production rate of low-enriched UF6 would be approximately 80 kg and Iran could accumulate the requisite 684 kg by October 2009.

- Date by which Iran may have enough U-235 to fuel a third bomb: March 2010
  - If Iran operates all 5,904 centrifuges that are currently either in use or being installed, and if the feed rate for these machines improves modestly, the average monthly production rate of low-enriched UF6 would be approximately 100 kg and Iran could accumulate the requisite 684 kg by as early as March 2010.

Additional estimates: *Moving from reactor-grade to weapon-grade uranium*

- Amount of uranium hexafluoride (UF6) enriched to 3.8 percent U-235 now on hand: 528 kg
  - The IAEA estimates an inventory of about 480 kg of low-enriched UF6 based on production from the beginning of operations in February 2007 through the end of August 2008); at an average production rate of 48 kg of UF6 each month (see note l), by the end of September 2008 Iran would have stockpiled about 528 kg of low-enriched UF6.

- Average monthly production rate of this low-enriched UF6: 48 kg
  - According to the IAEA, Iran produced about 75 kg of low-enriched UF6 from February through mid-December 2007, and a total of 480 kg of low-enriched UF6 from February 2007 through August 2008; thus, Iran produced 405 kg of low-enriched UF6 between mid-December 2007 and August 2008, or approximately 48 kg/month.

- Amount of this LEU needed to produce a bomb's worth of weapon-grade UF6: 684 kg
  - This is assuming natural uranium tails and that 16 kg of U-235 are needed for a bomb.[162]

- Number of separative work units (SWUs)[163]needed to accomplish the above: 822[164]

- Number of first generation IR-1 centrifuges operating in Iran on a production basis: At least 3,000
  - According to the IAEA, Iran has "continued to operate" an 18 cascade unit (A24) of 2,952 machines at the Natanz Fuel Enrichment Plant; it is not clear whether the 820 centrifuges operating in the unit being installed (A26) are contributing to the production of low-enriched UF6.

- Number of SWUs these 3,000 centrifuges are assumed to produce per year: 6,000
  - Iran's IR-1 centrifuge is widely estimated to have an annual enrichment output of about 2 SWUs.

- Number of months needed for 3,000 centrifuges so operating to produce 822 SWUs: 1.6
  - If 822 SWUs are needed to bring a bomb's worth of Iran's stockpiled low-enriched UF6 to weapon-grade, and if Iran's centrifuges produce 6,000 SWUs per year, it would take about 1.6 months.

Additional estimates: *Low-enriched uranium production*

- Average monthly feed rate of UF6: 698 kg

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[162] See the SWU calculator published by URENCO, a European uranium enrichment consortium: web.archive.org/web/20021226100607/www.urenco.de/trennarbeit/swucal_e.html.

[163] The Separative Work Unit is the standard measure of the effort required to increase the concentration of the fissionable U-235 isotope.
See www.urenco.com/Content/89/Glossary.aspx.

[164] See the SWU calculator published by URENCO, a European uranium enrichment consortium: web.archive.org/web/20021226100607/www.urenco.de/trennarbeit/swucal_e.html.

  - According to the IAEA, Iran fed centrifuge cascades at the Natanz Fuel Enrichment Plant with 5,930 kg of UF6 from mid-December 2007 through August 2008.

- Number of IR-1 centrifuges being fed as of August 30 with UF6 at the Natanz Fuel Enrichment Plant: 3,772
  - According to the IAEA, Iran was operating an 18 cascade unit (A24) of 2,952 machines at the Natanz Fuel Enrichment Plant as of August 30, 2008, and was feeding UF6 into an additional 820 machines, totaling 3,772 machines.
- Average monthly percentage of natural uranium feed converted to low-enriched UF6 product from February 2007 to December 12, 2007: 0.43
  - According to the IAEA, during this 10.5 month period, Iran fed 1,670 kg of UF6 into operating cascades at the Natanz Fuel Enrichment Plant, yielding 75 kg of low-enriched UF6.
- Average monthly percentage of natural uranium feed converted to low-enriched UF6 product from December 12, 2007 to August 30, 2008: 0.80
  - According to the IAEA, during this 8.5 month period, Iran fed 5,930 kg of UF6 into operating cascades at the Natanz Fuel Enrichment Plant, yielding 405 kg of low-enriched UF6.
- Percentage increase in productivity from the first period to the second: 86%

Figure 5.4: Number of centrifuges deployed over time[165]

Date of IAEA inventory	Centrifuges being fed with UF6	Centrifuges being tested without UF6	Centrifuges being installed
2/17/2007	0	328	328
5/13/2007	1312	328	492
8/19/2007	1968	328	328
11/3/2007	2952	0	0
12/12/2007	2952	0	?
5/7/2008	3280	164	2460
8/30/2008	3772	164	1968

165 Figure 5.3 is adapted from the "Iran Nuclear Timetable," IranWatch.org, University of Wisconsin Project on Nuclear Arms Control, October 15, 2008, available at: http://www.iranwatch.org/ourpubs/articles/iranucleartimetable.html.

Laser Isotope Separation

As for Iran's other route to uranium enrichment, Iran has acknowledged it had started a laser enrichment program in the 1970s. Iran has claimed that it used two different tracks in using laser enrichment: (1) atomic vapor laser isotope separation (AVLIS) and (2) molecular isotope separation (MLIS). Iran, however, depended on key contracts with four (unnamed) different countries to build its laser enrichment program. The following chronology was presented by the IAEA:[166]

- **1975:** Iran contracted for the establishment of a laboratory to study the spectroscopic behavior of uranium metal; this project was abandoned in the 1980s as the laboratory did not function properly.
- **Late 1970s:** Iran contracted with a second supplier to study MLIS, under which four carbon monoxide lasers and vacuum chambers were delivered, but the project was ultimately terminated due to the political situation before major development work was begun.
- **1991:** Iran contracted with a third supplier for the establishment of a "Laser Spectroscopy Laboratory" (LSL) and a "Comprehensive Separation Laboratory" (CSL), where uranium enrichment would be carried out on a milligram scale based on the AVLIS process. The contract also provided for the supply of 50 kilograms natural uranium metal.
- **1998:** Iran contracted with a fourth supplier to obtain information related to laser enrichment and the supply of relevant equipment. However, due to the inability of the supplier to secure export licenses, only some of the equipment was delivered (to Lashkar Ab'ad).

The IAEA seems to be more confident about its findings regarding Iran's laser enrichment developments than gas centrifuges. This is largely due to Iranian cooperation, but it also stems from the fact that Iran had nothing to hide since its foreign contractors failed to deliver on the four contracts Tehran signed between the 1970s and the 1990s.

According to the IAEA, Iran claimed that the laser spectroscopy laboratory and the MLIS laboratory (the first two contracts) were never fully operational.

As for the third contract, the IAEA estimated the contract was finished in 1994, but that CSL and LSL had technical problems and were unsuccessful between 1994 and 2000. Iran responded by claiming that the two labs were dismantled in 2000. In addition, the IAEA concluded, "As confirmed in an analysis, provided to the Agency, that had been carried out by the foreign laboratory involved in the project, the highest average enrichment achieved was 8%, but with a peak enrichment of 13%."

Finally, the fourth contract was signed in 1998, but failed due to the supplier's inability to obtain export licenses. Tehran claimed that it attempted to procure these equipment and parts, but it was unsuccessful.[167]

These failures almost certainly did strain Tehran's ability to effectively use the laser enrichment track to advance its uranium enrichment activities. This may explain why Iran did less to try to conceal its laser enrichment program than conceal the details of its centrifuge program. According to the IAEA, Tehran's declarations largely tracked with the IAEA inspectors' findings. For example, Iran claimed that its enrichment level was

[166] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 1, 2004, Annex, p. 7, http://www.iaea.org/Publications/Documents/Board/2004/gov2004-60.pdf.
[167] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 1, 2004, Annex, p. 7, http://www.iaea.org/Publications/Documents/Board/2004/gov2004-60.pdf

0.8 percent U235, and the IAEA concluded that Iran reached an enrichment level of 0.99 percent ± 0.24 percent U235.[168]

The IAEA findings regarding this aspect of Tehran's enrichment program are summarized in the following two paragraphs:[169]

> The Agency has completed its review of Iran's atomic vapor laser isotope separation (AVLIS) program and has concluded that Iran's descriptions of the levels of enrichment achieved using AVLIS at the Comprehensive Separation Laboratory (CSL) and Lashkar Ab'ad and the amounts of material used in its past activities are consistent with information available to the Agency to date. Iran has presented all known key equipment, which has been verified by the Agency. For the reasons described in the Annex to this report, however, detailed nuclear material accountancy is not possible.
>
> It is the view of the Agency's AVLIS experts that, while the contract for the AVLIS facility at Lashkar Ab'ad was specifically written for the delivery of a system that could achieve 5 kg of product within the first year with enrichment levels of 3.5% to 7%, the facility as designed and reflected in the contract would, given some specific features of the equipment, have been capable of limited HEU production had the entire package of equipment been delivered. The Iranian AVLIS experts have stated that they were not aware of the significance of these features when they negotiated and contracted for the supply and delivery of the Lashkar Ab'ad AVLIS facility. They have also provided information demonstrating the very limited capabilities of the equipment delivered to Iran under this contract to produce HEU (i.e. only in gram quantities).

The accuracy of such findings is critical because isotope separation is far more efficient than centrifuge separation, much less costly once mature, uses far less power, and is much harder to detect.[170]

Other Aspects of Iranian Activity

Other aspects of Iranian activity have been less than reassuring. Following Iran's announcement that it converted 37 tons of yellowcake into UF4 in May 2005, experts believed that this amount of uranium could "theoretically" produce more than 200 pounds of weapons-grade uranium, which would be enough to produce five to six crude nuclear weapons. The head of Iran's Supreme National Security Council, Hasan Rowhani, was quoted in 1995 saying, "Last year, we could not produce UF_4 and UF_6. We didn't have materials to inject into centrifuges to carry out enrichment, meaning we didn't have UF_6 […] But within the past year, we completed the Isfahan facility and reached UF_4 and UF_6 stage. So we made great progress."[171]

In February 2006, ahead of the IAEA board meeting, it was reported in the press that a report was circulated to IAEA member states regarding what press reports called "the Green Salt Project." The report largely used information provided by U.S. intelligence. The project name was derived from "green salt," or uranium tetrafluoride. The materials

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[168] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 1, 2004, Annex, p. 7, http://www.iaea.org/Publications/Documents/Board/2004/gov2004-60.pdf
[169] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, September 1, 2004, p. 7, http://www.iaea.org/Publications/Documents/Board/2004/gov2004-60.pdf
[170] Dr. Frank Barnaby, "Iran's Nuclear Activities," Oxford Research Group, February, 2006.
[171] Ali Akbar, "Iran Confirms Uranium-To-Gas Conversion," Associated Press, May 9, 2005.

are considered intermediate materials in uranium conversion ore into uranium hexafluoride, UF4, which is central to producing nuclear fuel.[172]

This project was reportedly started in spring of 2001 by an Iranian firm, Kimeya Madon, under the auspices of the IRGC. U.S. officials believe that Kimyea Madon completed drawings and technical specifications for a small uranium conversion facility (UCF), and they argue that the drawings provide "pretty compelling evidence" for Iran's clandestine uranium conversion program. In addition, there was evidence that the Iranians envisioned a second UCF. It remains uncertain why the operation of Kimeya Mado stopped in 2003. Some speculated that this was a plan to replace Isfahan in case of a military strike against it. Another view is that Iran scratched the plan after it was revealed that the new UCF was not "as good as what they had" at Isfahan.[173]

Another important development was the IAEA's discovery of "a document related to the procedural requirements for the reduction of UF6 to metal in small quantities, and on the casting and machining of enriched, natural and depleted uranium metal into hemispherical forms," as the IAEA February 4, 2006, resolution emphasized.[174]

The description of this document first appeared in an IAEA report on November 15, 2005. This "one-page document" apparently was related to the Pakistani offer in 1987, and the IAEA made the following assessment:[175]

> As previously reported to the Board, in January 2005 Iran showed to the Agency a copy of a hand-written one-page document reflecting an offer said to have been made to Iran in 1987 by a foreign intermediary for certain components and equipment. Iran stated that only some components of one or two disassembled centrifuges, and supporting drawings and specifications were delivered by the procurement network, and that a number of other items of equipment referred to in the document were purchased directly from other suppliers. Most of these components and items were included in the October 2003 declaration by Iran to the Agency.
>
> The documents recently made available to the Agency related mainly to the 1987 offer; many of them dated from the late 1970s and early to mid-1980s. The documents included: detailed drawings of the P-1 centrifuge components and assemblies; technical specifications supporting component manufacture and centrifuge assembly; and technical documents relating to centrifuge operational performance. In addition, they included cascade schematic drawings for various sizes of research and development (R&D) cascades, together with the equipment needed for cascade operation (e.g. cooling water circuit needs and special valve consoles). The documents also included a drawing showing a cascade layout for 6 cascades of 168 machines each and a small plant of 2000 centrifuges arranged in the same hall. Also among the documents was one related to the procedural requirements for the reduction of UF6 to metal in small quantities, and on the casting and machining of enriched, natural and depleted uranium metal into hemispherical forms, with respect to which Iran stated that it had been provided on the initiative of the procurement network, and not at the request of the Atomic Energy Organization of Iran (AEOI).

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[172] Elaine Sciolino and William J. Broad, "Atomic Agency Sees Possible Link Of Military to Iran Nuclear Work," The New York Times, February 1, 2006, p. 1.

[173] Dafna Linzer, "Strong Leads And Dead Ends In Nuclear Case Against Iran," The Washington Post, February 8, 2006, p. A01.

[174] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Resolution adopted on 4 February 2006, February 4, 2006, available at: http://www.iaea.org/Publications/Documents/Board/2006/gov2006-14.pdf

[175] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General, November 18, 2005, p. 11, available at: http://www.iaea.org/Publications/Documents/Board/2005/gov2005-87.pdf

As noted earlier, the foreign intermediary is believed to have been A. Q. Khan, the Pakistani nuclear scientist. The United Kingdom argued that the document, on casting uranium into hemispheric form, had no other application other than nuclear weapons. Experts agreed with this assessment.[176] IAEA officials, however, were more cautious. One senior IAEA official was quoted as saying that the document "is damaging," but he argued that the handwritten document was not a blueprint for making nuclear weapons because it dealt with only one aspect of the process.[177]

Many experts believe that in order to understand Iran's nuclear program, one must understand its gas centrifuge program--particularly whether Tehran's ability to establish a test run of 1,500 centrifuges at Natanz would give Iran enough capacity to produce HEU. David Albright and Corey Hinderstein of the ISIS argued that Iran may well be on its way to achieving this capacity:

> Each P1 centrifuge has an output of about 3 separative work units (swu) per year according to senior IAEA officials. From the A. Q. Khan network, Iran acquired drawings of a modified variant of an early-generation Urenco centrifuge. Experts who saw these drawings assessed that, based on the design's materials, dimensions, and tolerances; the P1 in Iran is based on an early version of the Dutch 4M centrifuge that was subsequently modified by Pakistan. The 4M was developed in the Netherlands in the mid-1970s and was more advanced than the earlier Dutch SNOR/CNOR machines. Its rotor assembly has four aluminum rotor tubes connected by three maraging steel bellows.
>
> With 1,500 centrifuges and a capacity of 4,500 swu per year, this facility could produce as much as 28 kilograms of weapon-grade uranium per year, assuming a tails assay of 0.5 percent, where tails assay is the fraction of uranium 235 in the waste stream. This is a relatively high tails assay, but such a tails assay is common in initial nuclear weapons programs. As a program matures and grows, it typically reduces the tails assay to about 0.4 percent and perhaps later to 0.3 percent to conserve uranium supplies.
>
> By spring 2004, Iran had already put together about 1,140 centrifuge rotor assemblies, a reasonable indicator of the number of complete centrifuges. However, only about 500 of these rotors were good enough to operate in cascades, according to knowledgeable senior IAEA officials. The November 2004 IAEA report stated that from the spring to October 10, 2004, Iran had assembled an additional 135 rotors, bringing the total number of rotors assembled to 1,275. As mentioned above, a large number of these rotors are not usable in an operating cascade.
>
> Iran is believed to have assembled more centrifuges prior to the suspension being re-imposed on November 22, 2004. Without more specific information, it is assumed that Iran continued to assemble centrifuges at a constant rate, adding another 70 centrifuges, for a total of 1,345 centrifuges. However, the total number of good centrifuges is estimated at about 700.[178]

These developments led some observers to question whether Iran received more help from Pakistan than it admitted. Some experts argued that the A. Q. Khan network tended to hand over the "whole package" as was the case with Libya, and they question whether Iran received only the few pages that it shared with the IAEA.[179] These revelations point out how little is known about how advanced Iran's uranium enrichment program is.

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[176] Ian Traynor, "Papers Found in Iran are Evidence of Plans for Nuclear Weapon Manufacture, Says UK," The Guardian, November 25, 2005, available at: http://www.guardian.co.uk/iran/story/0,,1650423,00.html

[177] "Iran Hands Over Suspected Atom Bomb Blueprint: IAEA," Agence France Presse, November 18, 2005.

[178] David Albright and Corey Hinderstein, "The Clock is Ticking, But How Fast?," Institute for Science and International Security, Issue Brief, March 27, 2006, available at: http://www.isis-online.org/publications/iran/clockticking.pdf

[179] "Iran Hands Over Suspected Atom Bomb Blueprint: IAEA," Agence France Presse, November 18, 2005.

Most experts, however, believe that Iran's uranium enrichment program is far more dangerous and far more advanced than its plutonium production activities. They argue that the danger of the enrichment program is that regardless of how high Iran's enrichment level of uranium is, if Iran were able to enrich it at a low level, Iran will have the know-how to enrich it at higher levels and produce the weapons-grade uranium to produce nuclear weapons.[180]

In addition, experts are concerned that Iran may acquire uranium from other nations. For example, during a visit by Iranian Parliament Speaker Gholam Ali Haddad-Adel in early 2006, Iran and Venezuela signed a deal that allowed Iran to explore Venezuela's strategic minerals. Venezuelan opposition figures to President Hugo Chávez claimed that the deal could involve the production and transfer of uranium from Venezuela to Iran. The United States, however, downplayed such reports. A Department of States official was quoted as saying, "We are aware of reports of possible Iranian exploitation of Venezuelan uranium, but we see no commercial activities in Venezuela."[181]

Does Iran Have a Nuclear Weapons Program? The NIE on Iran's Nuclear Forces

The most authoritative document the US intelligence community has ever released on how these developments can be linked to Iran's military programs is the unclassified summary of a US National Intelligence Estimate (NIE) on Iranian nuclear weapons, "Iran: Nuclear Intentions and Capabilities," which was issued in November 2007. This unclassified summary is a striking document in many ways:

- On the one hand, it indicates that Iran suspended a nuclear weapons effort in 2003, and is susceptible to international pressure and negotiation. The US intelligence community analysis indicates that it is highly probable that the US and the international community have some 4-7 years to negotiate before Iran could become a nuclear power. It provides a major argument against any early military action against Iran, and it refutes much of the hard-line rhetoric emerging from various neoconservatives. In broad terms, it reinforced the moderate, pro-negotiation positions of key officials and officers like Secretary Rice, Secretary Gates, Admiral Mullen, and Admiral Fallon.

- On the other hand, it provides the first solid indication that the US intelligence community had the equivalent of a "smoking gun" to confirm that Iran had an active nuclear weapons program. It shows far less confidence that this program has continued to be halted than that it was halted for a time in 2003. It states Iran's enrichment programs allow it to move forward towards a nuclear weapons effort in spite of any continuing suspension of a formal nuclear weapons program, and it raises serious doubts as to whether Iran's longer term efforts to acquire nuclear weapons are negotiable. It does not in any way indicate that the UN effort to prevent further Iranian weapons development is unnecessary or that further sanctions are not needed to limit or halt Iran's efforts.

- The document is the summary of a 150-page NIE that the *Washington Post* reports was based on some 1,500 intelligence indicators, including intercepts of communications from Iranian military officers. It is not an intelligence report. It does not portray the range of opinion or most dissenting views. It does not describe the nature of the indicators and analytic methods used. This is a critical point because past outside commentary on NIEs, and attempts to parse out the words in summary

[180] "Iran Far From Nuclear Bomb-Making Capacity: Ex-UN Weapons Chief Blix," Agence France Presse, June 23, 2005.

[181] Kelly Hearn, "Iranian Pact With Venezuela Stokes Fears of Uranium Sales," *The Washington Times,* March 13, 2006, P. 1.

judgments, have provide to be highly unreliable. Moreover, a "war of leaks" almost inevitably follows where advocates of one policy position or another.

- The summary does not address what the US intelligence community does and does not know about Iran's efforts in each of the five areas the NIE addressed;

  • What are Iran's intentions toward developing nuclear weapons?

  • What domestic factors affect Iran's decision-making on whether to develop nuclear weapons?

  • What external factors affect Iran's decision-making on whether to develop nuclear weapons?

  • What is the range of potential Iranian actions concerning the development of nuclear weapons, and the decisive factors that would lead Iran to choose one course of action over another?

  • What is Iran's current and projected capability to develop nuclear weapons? What are our key assumptions, and Iran's key chokepoints/vulnerabilities?

- The NIE only indirectly addresses the limits in US ability to detect and track Iranian covert efforts. It does not address related military developments like Iran's missile programs, many of which only seem to make sense if armed with a nuclear warhead.

- No mention is made of the progress Iran has made in nuclear weapons design before 2003 or to date. It does not address any of key issues indicating that Iran was developing nuclear missile warheads. It does not address the transfer of nuclear weapons designs from North Korea and the AQ Khan network, the "Green Salt" and "Laptop" issues being addressed by the IAEA, or what kind of nuclear weapons Iran was found to be working on in 2003. No hint is made of Iranian progress in completing fission, boosted or thermonuclear weapons designs.

The Need to For Careful Review

It is very important for anyone using or making judgments about the document to actually read the full text of the judgments the NIE makes about Iran's nuclear program. Press summaries and outside commentary are not a substitute for responsible literacy and attentions to details. [183]

This level of careful attention is particularly important because the first few pages carefully define the meaning of the words used in assessing Iran's efforts. The definition of levels of confidence is particularly important in understanding what the document actually says:

- *High confidence* generally indicates that our judgments are based on high-quality information, and/or that the nature of the issue makes it possible to render a solid judgment. A "high confidence" judgment is not a fact, nor is it a certainty, however, and such judgments still carry a risk of being wrong.

- *Moderate confidence* generally means that the information is credibly sourced and plausible but not of sufficient quality or corroborated sufficiently to warrant a higher level of confidence.

- *Low confidence* generally means that the information's credibility and/or plausibility is questionable, or that the information is too fragmented or poorly corroborated to make solid analytic inferences, or that we have significant concerns or problems with the sources.

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[183] The document is available at (http://www.dni.gov/press_releases/20071203_release.pdf).

It is also important to point out that the US intelligence community has made major changes and improvements in its intelligence methods in recent years. Accordingly, while the document does provide the summary comparison of the judgments in the new document with past judgments made in a May 2005 NIE shown at the end of this report, it should be noted that the intelligence collection and analytic efforts that created the two documents are not directly comparable and that outside attempts to make word for word comparisons, and judge credibility can be highly misleading.

Examining the NIE's Key Judgments

A careful reading shows that the US intelligence community made careful caveats about its knowledge of whether Iran has continued to halt its program and the level of confidence the intelligence community has regarding Iran's actions.

The full texts of the key portions of the NIE's judgments are shown below, and key points are outlined in red:

> We judge with high confidence that in fall 2003, Tehran halted its nuclear weapons Program (For the purposes of this Estimate, by "nuclear weapons program" we mean Iran's nuclear weapon design and weaponization work and covert uranium conversion-related and uranium enrichment-related work; we do not mean Iran's declared civil work related to uranium conversion and enrichment.);
>
> …we also assess with moderate-to-high confidence that Tehran at a minimum is keeping open the option to develop nuclear weapons.
>
> We judge with high confidence that the halt, and Tehran's announcement of its decision to suspend its declared uranium enrichment program and sign an Additional Protocol to its Nuclear Non-Proliferation Treaty Safeguards Agreement, was directed primarily in response to increasing international scrutiny and pressure resulting from exposure of Iran's previously undeclared nuclear work.
>
> • We assess with high confidence that until fall 2003, Iranian military entities were working under government direction to develop nuclear weapons.
>
> • We judge with high confidence that the halt lasted at least several years. (Because of intelligence gaps discussed elsewhere in this Estimate, however, DOE and the NIC assess with only moderate confidence that the halt to those activities represents a halt to Iran's entire nuclear weapons program.)
>
> • We assess with moderate confidence Tehran had not restarted its nuclear weapons program as of mid-2007, but we do not know whether it currently intends to develop nuclear weapons.
>
> • We continue to assess with moderate-to-high confidence that Iran does not currently have a nuclear weapon.
>
> • Tehran's decision to halt its nuclear weapons program suggests it is less determined to develop nuclear weapons than we have been judging since 2005. Our assessment that the program probably was halted primarily in response to international pressure suggests Iran may be more vulnerable to influence on the issue than we judged previously.
>
> B. We continue to assess with low confidence that Iran probably has imported at least some weapons-usable fissile material, but still judge with moderate-to-high confidence it has not obtained enough for a nuclear weapon. We cannot rule out that Iran has acquired from abroad—or will acquire in the future—a nuclear weapon or enough fissile material for a weapon. Barring such acquisitions, if Iran wants to have nuclear weapons it would need to produce sufficient amounts of fissile material indigenously—which we judge with high confidence it has not yet done.

C. We assess centrifuge enrichment is how Iran probably could first produce enough fissile material for a weapon, if it decides to do so. Iran resumed its declared centrifuge enrichment activities in January 2006, despite the continued halt in the nuclear weapons program. Iran made significant progress in 2007 installing centrifuges at Natanz, but we judge with moderate confidence it still faces significant technical problems operating them.

• We judge with moderate confidence that the earliest possible date Iran would be technically capable of producing enough HEU for a weapon is late 2009, but that this is very unlikely.

• We judge with moderate confidence Iran probably would be technically capable of producing enough HEU for a weapon sometime during the 2010-2015 time frame. (INR judges Iran is unlikely to achieve this capability before 2013 because of foreseeable technical and programmatic problems.) All agencies recognize the possibility that this capability may not be attained until after 2015.

D. Iranian entities are continuing to develop a range of technical capabilities that could be applied to producing nuclear weapons, if a decision is made to do so. For example, Iran's civilian uranium enrichment program is continuing. We also assess with high confidence that since fall 2003, Iran has been conducting research and development projects with commercial and conventional military applications—some of which would also be of limited use for nuclear weapons.

E. We do not have sufficient intelligence to judge confidently whether Tehran is willing to maintain the halt of its nuclear weapons program indefinitely while it weighs its options on whether it will or already has set specific deadlines or criteria that will prompt it to restart the program.

• Our assessment that Iran halted the program in 2003 primarily in response to international pressure indicates Tehran's decisions are guided by a cost-benefit approach rather than a rush to a weapon irrespective of the political, economic, and military costs. This, in turn, suggests that some combination of threats of intensified international scrutiny and pressures, along with opportunities for Iran to achieve its security, prestige, and goals for regional influence in other ways, might—if perceived by Iran's leaders as credible—prompt Tehran to extend the current halt to its nuclear weapons program. It is difficult to specify what such a combination might be.

• We assess with moderate confidence that convincing the Iranian leadership to forgo the eventual development of nuclear weapons will be difficult given the linkage many within the leadership probably see between nuclear weapons development and Iran's key national security and foreign policy objectives, and given Iran's considerable effort from at least the late 1980s to 2003 to develop such weapons. In our judgment, only an Iranian political decision to abandon a nuclear weapons objective would plausibly keep Iran from eventually producing nuclear weapons—and such a decision is inherently reversible.

F. We assess with moderate confidence that Iran probably would use covert facilities— rather than its declared nuclear sites—for the production of highly enriched uranium for a weapon. A growing amount of intelligence indicates Iran was engaged in covert uranium conversion and uranium enrichment activity, but we judge that these efforts probably were halted in response to the fall 2003 halt, and that these efforts probably had not been restarted through at least mid-2007.

G. We judge with high confidence that Iran will not be technically capable of producing and reprocessing enough plutonium for a weapon before about 2015.

H. We assess with high confidence that Iran has the scientific, technical and industrial capacity eventually to produce nuclear weapons if it decides to do so.

The Key Issues that Were Not Addressed

It is important to note several things about these judgments:

- No mention is made of exactly what nuclear weapons efforts Iran halted and whether this included all covert and dual-use programs.

- The NIE unambiguously says that US intelligence did have high confidence Iran was actively working on nuclear weapons until 2003, and the intelligence community expresses important levels of uncertainty over whether Iran has resumed its nuclear weapons effort.
- Iran's current enrichment efforts have and will continue to move it closer to being able to deploy nuclear weapons even if key elements of its weapons design and production activity have been halted or suspended.
- The NIE does not address any of the major issues and uncertainties still being examined by the IAEA. The omission of any discussion of the Green Salt, Lap Top, and warhead issues is particularly important.
- The commentary on the uncertainty relating to research and dual-use activity is particularly important. Iran is known to have work on technology that could be used produce the high explosive lens, uranium machining, neutron initiator, neutron reflector and other components needed for a fission weapon. Ongoing covert research in each area would be very easy to disperse and conceal. Passive and conventional high explosive testing of actual warhead and weapons designs using non-fissile material would not provide any indicators other than – at most – those associated with conventional high explosives. Missile testing using warheads with such assemblies and similar bomb testing would probably only be detectable through a major leak of human intelligence.
- Moreover, no mention is made of Iran's long-range missile programs, but Iran is clearly continuing to improve its ability to develop advanced nuclear delivery systems and has announced two new missile programs within the last month.

In short, the NIE is good news in that it indicates that past efforts to pressure Iran have had some impact, and there is time for negotiation and to find alternatives to attacking Iran – such as the containment approach suggested by General Abizaid. It does not, however, make any promises for the future, or resolve the major credibility problems the US incurred in providing incorrect intelligence on Iraq.

The bad news is that many will focus only on taking the more positive news out of context, and judge credibility of the basis of comparisons between the 2005 and 2007 estimates while ignoring the full text of the key judgments and the many areas where the unclassified summary leaves more questions than answers.

Figure 5.5: Key Differences Between the Key Judgments of This Estimate on Iran's Nuclear Program in the May 2005 Intelligence Community Assessment Estimate and the 2007 National Intelligence Estimate

2005 IC Estimate	2007 NIE
Assess with high confidence that Iran currently is determined to develop nuclear weapons despite its international obligations and international pressure, but we do not assess that Iran is immovable. We have moderate confidence in projecting when Iran is likely to make a nuclear weapon; we assess that it is unlikely before early-to-mid next decade. Iran could produce enough fissile material for a weapon by the end of this decade if it were to make more rapid and successful progress than we have seen to date.	Judge with high confidence that in fall 2003, Tehran halted its nuclear weapons program. Judge with high confidence that the halt lasted at least several years. (DOE and the NIC have moderate confidence that the halt to those activities represents a halt to Iran's entire nuclear weapons program.) Assess with moderate confidence Tehran had not restarted its nuclear weapons program as of mid-2007, but we do not know whether it currently intends to develop nuclear weapons. Judge with high confidence that the halt was directed primarily in response to increasing international scrutiny and pressure resulting from exposure of Iran's previously undeclared nuclear work. Assess with moderate-to-high confidence that Tehran at a minimum is keeping open the option to develop nuclear weapons. We judge with moderate confidence that the earliest possible date Iran would be technically capable of producing enough highly enriched uranium (HEU) for a weapon is late 2009, but that this is very unlikely. We judge with moderate confidence that the earliest possible date Iran would be technically capable of producing enough highly enriched uranium (HEU) for a weapon is late 2009, but that this is very unlikely. We judge with moderate confidence Iran probably would be technically capable of producing enough HEU for a weapon sometime during the 2010-2015 time frame. (INR judges that Iran is unlikely to achieve this capability before 2013 because of foreseeable technical and programmatic problems.)

The DNI's Follow Up to the NIE

It is also important to note that the NIE is scarcely the last word of the US intelligence community. The Director of national Intelligence stated on February 27, 2008 that,[184]

> Over the past year we have gained important new insights into Tehran's activities related to nuclear weapons and the Community recently published a National Intelligence Estimate on Iranian intent and

[184] Extract from J. Michael McConnell, Director of National Intelligence, "Annual Threat Assessment of the Intelligence Community for the Senate Armed Services Committee," 27 February 2008

capabilities in this area. I want to be very clear in addressing the Iranian nuclear capability. First, there are three parts to an effective nuclear weapons capability:

1. Production of fissile material
2. Effective means for weapons delivery
3. Design and weaponization of the warhead itself

We assess in our recent NIE on this subject that warhead design and weaponization were halted, along with covert military uranium conversion- and enrichment-related activities. Declared uranium enrichment efforts, which will enable the production of fissile material, continue. This is the most difficult challenge in nuclear production. Iran's efforts to perfect ballistic missiles that can reach North Africa and Europe also continue.

We remain concerned about Iran's intentions and assess with moderate-to-high confidence that Tehran at a minimum is keeping open the option to develop nuclear weapons. We have high confidence that Iranian military entities were working under government direction to develop nuclear weapons until fall 2003. Also, Iranian entities are continuing to develop a range of technical capabilities that could be applied to producing nuclear weapons. Iran continues its efforts to develop uranium enrichment technology, which can be used both for power reactor fuel and to produce nuclear weapons. And, as noted, Iran continues to deploy ballistic missiles inherently capable of delivering nuclear weapons, and to develop longer-range missiles. We also assess with high confidence that even after fall 2003 Iran has conducted research and development projects with commercial and conventional military applications—some of which would also be of limited use for nuclear weapons.

We judge with high confidence that in fall 2003, Tehran halted its nuclear weapons design and weaponization activities, as well as its covert military uranium conversion and enrichment-related activities, for at least several years. Because of intelligence gaps, DOE and the NIC assess with only moderate confidence that all such activities were halted. We assess with moderate confidence that Tehran had not restarted these activities as of mid-2007, but since they comprised an unannounced secret effort that Iran attempted to hide, we do not know if these activities have been restarted.

We judge with high confidence that the halt was directed primarily in response to increasing international scrutiny and pressure resulting from exposure of Iran's previously undeclared nuclear work. This indicates that Iran may be more susceptible to influence on the issue than we judged previously.

We do not have sufficient intelligence information to judge confidently whether Tehran is willing to maintain the halt of its nuclear weapons design and weaponization activities indefinitely while it weighs its options, or whether it will or already has set specific deadlines or criteria that will prompt it to restart those activities. We assess with high confidence that Iran has the scientific, technical and industrial capacity eventually to produce nuclear weapons. In our judgment, only an Iranian political decision to abandon a nuclear weapons objective would plausibly keep Iran from eventually producing nuclear weapons—and such a decision is inherently reversible. I note again that two activities relevant to a nuclear weapons capability continue: uranium enrichment that will enable the production of fissile material and development of long-range ballistic missile systems.

We assess with moderate confidence that convincing the Iranian leadership to forgo the eventual development of nuclear weapons will be difficult given the linkage many within the leadership see between nuclear weapons development and Iran's key national security and foreign policy objectives, and given Iran's considerable effort from at least the late 1980s to 2003 to develop such weapons.

We continue to assess with moderate-to-high confidence that Iran does not currently have a nuclear weapon. We continue to assess with low confidence that Iran probably has imported at least some weapons-usable fissile material, but still judge with moderate-to-high confidence it has not obtained enough for a nuclear weapon. We cannot rule out that Iran has acquired from abroad—or will acquire in the future—a nuclear weapon or enough fissile material for a weapon. Barring such acquisitions, if

Iran wants to have nuclear weapons it would need to produce sufficient amounts of fissile material indigenously—which we judge with high confidence it has not yet done.

Iran resumed its declared centrifuge enrichment activities in January 2006, despite the 2003 halt in its nuclear weapons design and weaponization activities. Iran made significant progress in 2007 installing centrifuges at Natanz, but we judge with moderate confidence it still faces significant technical problems operating them.

We judge with moderate confidence that the earliest possible date Iran would be technically capable of producing enough highly enriched uranium (HEU) for a weapon is late 2009, but that is very unlikely.

We judge with moderate confidence Iran probably would be technically capable of producing enough HEU for a weapon sometime during the 2010-2015 time frame. INR judges Iran is unlikely to achieve this capability before 2013 because of foreseeable technical and programmatic problems. All agencies recognize the possibility that this capability may not be attained until *after* 2015.

We know that Tehran had a chemical warfare program prior to 1997, when it declared elements of its program. We assess that Tehran maintains dual-use facilities intended to produce CW agent in times of need and conducts research that may have offensive applications. We assess Iran maintains a capability to weaponize CW agents in a variety of delivery systems.

We assess that Iran has previously conducted offensive BW agent research and development. Iran continues to seek dual- use technologies that could be used for biological warfare.

The Iranian Commitment to Nuclear Programs

It is not clear how future Iranian leaders will treat either Iran's nuclear weapons programs or the issue of nuclear power. Iran did, however, express an interest in acquiring two more nuclear power reactors in April 2007, and its statements in reaction to both the new Security Council sanctions passed in early 2007 and the announcement in April 2007 that it was scaling up its centrifuge program provide at least some indication of how deep Iran's commitment may be.

The following quotes all come from Iranian statements made on Iran's "Nuclear Day" on April 10, 2007, and show little sign of giving way to international pressure:[185]

- **President Mahmoud Ahmadinejad, speaking on Iran's Nuclear Day, April 10, 2007**: "I declare today, in all pride, that from this day, Iran is among the countries producing nuclear fuel on an [industrial] scale…Today, Iran's enemies are embarrassed by Iran's progress in various areas…According to a pre-set program, the Iranian government is determined to produce at least 20,000 megawatts of nuclear electricity according to a specific timetable…We warmly shake the hands of all governments interested in holding talks with us and in cooperating with us in this area.

  "I [address] the governments that have so far refused to come to terms with today's reality and with the Iranian people's right [to develop nuclear technology], and demand that they stop acting aggressively, illogically, hostilely, and in violation [of the law] towards Iran. [They had better know] that every member of the Iranian people stands fast behind its leaders, out of knowledge, faith, and absolute unity, and [that the Iranian people] will defend its right to the end…The [Western countries] should know that the path of the progress of the Iranian people is irreversible…They must pay attention, and do nothing to cause this brave and brave people to reconsider the way it deals with them. [Western countries] have tried this [hostile] approach

[185] Drawn from quotes assembled by Y Mansharof of MEMRI, Inquiry and Analysis-Iran, No. 342, www.themeriblog.org.

several times, and have seen that the [Iranian] people are capable of [reconsidering its approach towards them]…"[186]

- **Ali Larijani, Iran's chief Nuclear Negotiator, April 10, 2007**: "[The Western countries] must in any event accept a nuclear Iran…We are moving vigorously along the path of obtaining…54,000 centrifuges…The sanctions against us [UN Resolution 1747] have had no effect, and will have no effect, on our government towards this goal [in the future][187]…The number of centrifuges doesn't matter. But we have a work output of 3,000 centrifuges. This level and above is considered industrial…"

- **Gholam Reza Aghazadeh, Vice President for Atomic Energy of the Islamic Republic of Iran and President of the Atomic Energy Organization of Iran, April 10, 2007:** "Iran's program is not to install and operate only 3,000 centrifuges at the Natanz uranium enrichment facilities, but 50,000…We planned and invested for [the installation of] 50,000 centrifuges. The infrastructure that has been established--including equipment for air filtering, electricity, a new air supply, and everything required for this industry--was for 50,000 centrifuges…I intentionally did not indicate any number [in my speech at the Natanz celebrations]…because I wanted no misunderstandings in the foreign media, [and I did not want] them to think that Iran's [nuclear program] included [only] 3,000 centrifuges.

  "[The situation is] quite the opposite. As we enter the industrial stage, the installation of the centrifuges will be carried out on an ongoing basis, until all 50,000 [centrifuges] are installed…Our declaration that we have entered the stage [of producing nuclear fuel] on an industrial [scale means] that there is no turning back."[188]

  At the Natanz celebrations, Aghazadeh stressed that "despite the commitments we have received from [various] countries, no expert of [external] company has stood by us…but despite these challenges, obstacles, and problems, Iran was determined to realize, by means of its creative young people, its nuclear program--which includes peaceful purposes, with the first priority being to produce a nuclear fuel cycle as supreme science in nuclear technology…and in the past year, our young scientists have managed to produce 270 tons of UF6."

  "Not long ago, [producing] this important substance was far from the imagination of our country's nuclear researchers and scientists. But finally, we managed to attain [enrichment of] uranium, at [a level of] 3.5% to 5%...Now, as we enter mass production of centrifuges and begin to produce [nuclear fuel] on an industrial [scale], we are taking one more step towards the flowering of Iran…"

  "Now that Iran has entered into production of nuclear fuel on an industrial [scale], there will be no limit on the production of nuclear fuel in Iran…This is the accomplishment of some 3,000 expert scientists and the best of the forces that worked in the best year night and day at the Natanz facility."

- **Keyhan editorial, "The West Must Expect a Shock from Iran at Any Moment, April 10, 2007**: "Under the current threatening and unjust conditions, Iran has decided to employ a strategy of ambiguity. Since Iran's nuclear dossier was illegally returned to the UN Security Council, the eyes of the IAEA--the intelligence agency of the West--are finding it more difficult every day [to monitor Iran's activities]. When [the IAEA] reported on [Iran's nuclear dossier] to the Security Council last winter, Iran announced that it would no longer be implementing the Additional Protocol. A few months later, when sanctions resolution 1737 was issued, Iran began to install 3,000 centrifuges in Natanz…When sanctions resolution 1747 was passed, Iran further reduced IAEA access [to its nuclear facilities] by stopping the implementation of the agreements connected to the 'Safeguards Agreement.'"

- **Keyhan editorial, "Duel with an Unloaded Gun," April 11, 2007:** "Now America has expended all the bullets in its clip. Now, it is Iran that will decide, in the face of the shocked world, on the

[186] IRNA, Keyan, April 10, 2007.
[187] IRNA, (Iran) April 10, 2007.
[188] IRNA (Iran) and Keyhan, April 10, 2007

> 'news' and the 'event' with which it will strike the superpowers at their weak points and their Achilles heel. Iran still has great wisdom in its clip--each bullet of wisdom prepares the ground for new opportunities, and makes Iran's hands more skilled…America is now dealing with the deadly hail of Iran's wisdom…"

Since these statements were made, Iranian officials have continued to assert that Tehran will not be deterred from its current policy regarding its "civilian" nuclear program. On 5 October 2008 Iranian Foreign Minister Manouchehr Mottaki stated that, "Iran's uranium enrichment policy remains unchanged. Enrichment will continue until Iran becomes self-sufficient in fuel production for nuclear plants." Mottaki indicates that Iran is willing to supply other countries with nuclear fuel after it is self-sufficient. [189]

Recent reports, statements, and activities reaffirm Tehran's commitment to its nuclear program. The latest reports out of Iran and Russia assess that Iran's Bushehr reactor be operational in March of 2009, with the assistance of Russian engineers and equipment in the final stages of its completion.[190]

A Continuing Process of Discovery

It is clear that there is still much more to learn, and equally clear that Iran may well have a program that is opportunistic, which constantly evolves, and where it is impossible to predict the rate of Iranian progress or the end result. As noted earlier, in early 2006, the *New York Times* reported on new U.S. intelligence estimates that suggested Iran's "peaceful" program included a "military-nuclear dimension." This assessment was reportedly based on information provided by the United States to the IAEA and referred to a secret program called the Green Salt Project. This project was started to work on uranium enrichment, high explosives, and on adapting nuclear warheads to Iranian missiles. The report suggested that there was evidence of "administrative interconnections" between weaponization and nuclear experts in Iran's nuclear program. Tehran argued that these claims were "baseless" and promised to provide further clarifications on the matter.[191]

The IAEA report on Iran's nuclear activities in August 2006 made it clear, however, that Iran was not clarifying any major issues that have arisen relating to its nuclear activities, and this raised new questions about Iran's activities in highly enriching uranium that could not be linked to any contamination of centrifuges imported from Pakistan.

Claims that there was a link between Iran's civilian and military nuclear tracks seem to support the comments made by then Secretary of State Colin Powell in November 2004, yet it remains uncertain if the sources of intelligence were the same. Mr. Powell argued that the U.S. intelligence had information that showed Iranian efforts to adapt their nuclear research to fit their Shahab-3 missile. He argued that it made no sense that Iran would work on advancing its delivery systems unless it were also working on the

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[189] "Iran: We Won't Halt Enrichment even if Nuclear Fuel Supply Guaranteed," The Associated Press, 5 October 2008; "Iran Refuses to Halt Enrichment for Fuel Guarantees," Global Security Newswire, 6 October 2008.

[190] "Iranian Engineers Ready to Work on Nuclear Plant," The Associated Press, 14 October 2008; "Western Nations Consider Independent Iran Sanctions," Global Security Newswire, 14 October 2008; "Iran: Russia to Ship Nuke Plant Supplies," United Press International, 17 October 2008; "Russia Plans Major Supply Shipment to Iran," Global Security Newswire, 20 October 2008.

[191] Elaine Sciolino and William J. Broad, "Atomic Agency Sees Possible Link Of Military to Iran Nuclear Work," The New York Times, February 1, 2006, p. 1.

warheads. Other U.S. officials, however, argued that the information Colin Powell used came from unconfirmed sources with uncertain information and should not be seen as a definitive proof.[192]

The source for this information seems to be a stolen laptop computer, which contained designs of a small-scale uranium gas production facility by Kimeya Madon, an Iranian company. In addition, the documents contained modification to the Shahab-3 missile in a way, U.S. officials believe, to fit a nuclear warhead. U.S. intelligence experts, reportedly, believe that the files on the computer were authentic, but they argue that there was no way to prove it. They argue that while there was the possibility that the document was forged by Iranian opposition groups or fabricated by a third country like Israel, it was unlikely. In addition, the authenticity of the document also seemed to have been confirmed by British intelligence.[193]

What concerns U.S. officials is that while there was no mention of the word "nuclear" on the laptop, the documents mentioned the names of military officers that were linked to Mohsen Fakhrizadeh, who is believed to direct "Project 111." U.S. intelligence believes that this project has been responsible for weaponizing Iran's nuclear research efforts and missile developments. In addition, the United States believes that this project is the successor to Project 110, which used to be the military arm of Iran's nuclear research program. These revelations, however, are "cloaked" with uncertainty, and the United States believes that the only way to know is if Fakrizadeh cooperates with IAEA inspectors.[194]

These concerns about Iranian weaponization efforts were exacerbated by the IAEA's discovery of a document relating to the requirement of reducing UF6 to small quantities of metal as well as casting enriched and natural depleted uranium into hemispherical forms.[195] This is believed to be the first link the IAEA has shown between Iran's military and civilian nuclear program. Many argue that this discovery was the turning point in the IAEA negotiation efforts with Tehran and that the failure to disclose this document early in the inspections was a cause for concern for the Agency.

Press reports have also claimed that there was further evidence of Iran's effort to weaponize its nuclear research. A U.S. intelligence assessment was leaked to the *Washington Post*. According to U.S. officials, Iran's nuclear researchers have completed the drawing of "a deep subterranean shaft." The drawings outlined the plans for a 400-meter underground tunnel with remote-controlled sensors to measure pressures and temperatures. U.S. experts believed that the tunnel was being prepared for an underground nuclear test. One U.S. official was quoted saying, "The diagram is consistent with a nuclear test-site schematic." This assessment was based on the fact that the drawings envisioned a test control team to be so far away—ten kilometers--from the test site, but the United States believes that the tunnel was still in the drawing stage and

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[192] Dafna Linzer, "Powell Says Iran Is Pursuing Bomb," The Washington Post, November 18, 2004, p. A01.
[193] Dafna Linzer, "Strong Leads And Dead Ends In Nuclear Case Against Iran," The Washington Post, February 8, 2006, p. A01.
[194] Dafna Linzer, "Strong Leads And Dead Ends In Nuclear Case Against Iran," The Washington Post, February 8, 2006, p. A01.
[195] IAEA, Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Resolution adopted on 4 February 2006, February 4, 2006, available at: http://www.iaea.org/Publications/Documents/Board/2006/gov2006-14.pdf

no developments have taken place. The evidence for this tunnel and Iranian weaponization efforts were the closest thing to a smoking gun in proving Iranian nuclear weapons program.[196]

This illustrates the point that Iran can gain as much from concealing and obfuscating its weaponization activities as from hiding or obfuscating the nature of its nuclear program. As long as Iran does not actually test a full nuclear explosion, it can develop and test potential weapons and warhead designs in a wide range of ways. It can also prepare for underground testing and test simulated weapons underground to validate many aspects of the test system--including venting--without exploding a bomb until it is ready for the international community to know it has actually tested a weapon.

Iran can develop and deploy its missile program with conventional warheads and create considerable confusion over the nature of its warhead and bomb tests, concealing whether it has carried out extensive research on CBRN weaponization as part of what it claims is the testing of conventional weapons. Telemetry can be encrypted, avoided, and made deliberately misleading. The same is true of static explosive testing or the use of air-delivered warheads and bombs. So far, for example, the international community and outside experts have generally failed to explore the rationale for Iran's missile efforts and other weaponization activities. The IAEA and the Chemical Weapons Convention (CWC) lack any clear mandate for inspection and analysis of such activities, and the Biological Weapons Convention (BWC) does not address the issue.

Following the 15 September 2008 report by the IAEA, the ISIS wrote that the IAEA reported that it had recently obtained information about the possibility of Iran drawing on "foreign expertise" in conducting experiments connected with the symmetrical initiation of a hemispherical high explosive charge suitable for an implosion-type nuclear weapon. The official noted that the IAEA has not linked this expertise to the A.Q. Khan Proliferation network.[197]

In addition to the report by the ISIS, IAEA Director General Dr. Mohamed El Baradei showed the UN documents and photographs suggesting Iran secretly tried to modify a missile cone to fit a nuclear bomb. Tehran said the alleged weapon-related studies were based on fabricated documents or pertained only to conventional arms, and it provided the IAEA a 117-page response in May addressing some of the agency's questions. This evidence heightened Western concerns that Iran may have had "foreign expertise" helping in experiments on a detonator applicable to an implosion-type nuclear blast occurring at high altitude.[198]

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[196] Dafna Linzer, "Strong Leads And Dead Ends In Nuclear Case Against Iran," *The Washington Post,* February 8, 2006, p. A01.

[197] David Albright, Jacqueline Shire, and Paul Brannan, "IAEA Report on Iran: Centrifuge Operation Significantly Improving; Gridlock on Alleged Weaponization Issues," ISIS Report, September 15, 2008.

[198] Mark Heinrich, "IAEA shows photos alleging Iran nuclear missile work," Reuters, September 17, 2008, available at http://www.iranfocus.com/en/nuclear/iaea-shows-photos-alleging-iran-nuclear-missile-work.html

While addressing the UN General Assembly on 28 October 2008, IAEA Director General Dr. Mohamed El Baradei made the following statements regarding Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran:[199]

> Six years have elapsed since the Agency began working to clarify Iran´s nuclear programme. Substantial progress has been made under a work plan agreed with Iran to clarify outstanding issues, including the nature of Iran´s enrichment activities. The Agency has been able to continue to verify the non-diversion of *declared* nuclear material in Iran.
>
> However, I regret that we are still not in a position to achieve full clarity regarding the absence of *undeclared* nuclear material and activities in Iran. This is because the Agency has not been able to make substantive progress on the so-called alleged studies and associated questions relevant to possible military dimensions to Iran´s nuclear programme.
>
> I reiterate that the Agency does not in any way seek to "pry" into Iran´s conventional or missile-related military activities. Our focus is clearly on nuclear material and activities. I am confident that arrangements can be developed which enable the Agency to clarify the remaining issues while ensuring that Iran´s legitimate right to protect the confidentiality of sensitive information and activities is respected. I therefore urge Iran to implement all the transparency measures required to build confidence in the exclusively peaceful nature of its nuclear programme at an early date. This will be good for Iran, good for the Middle East region and good for the world.

New information is constantly being uncovered regarding Iran's controversial nuclear program; but due to the factors discussed previously, uncertainty remains, and without greater transparency the truth will remain elusive. The IAEA and the UNSC P5+1 continue to stress that their patience is running thin with Iran, but have not take a united, decisive stance against Iran's noncompliant actions.

The IAEA continues to press Iran for greater cooperation and transparency, but to no avail. The IAEA does not have the teeth to implement the provisions set forth in the NPT, which Iran is a party to, in order to get Tehran to comply to requests for transparency. Without greater international cooperation on the nuclear issue, threats become "paper tigers" and Iran gets closer to its goal. Whether that goal is creating a civilian nuclear reactor or a nuclear weapons arsenal, the international community cannot stand by and let Iran continue along its current path unchecked.

It is important to note that much of what Iran has done or is suspected of doing, in regards to its nuclear program, has been covert. Many of Iran's nuclear related sites and activities have been discovered not by Iranian declaration, but through collection of intelligence. Given past Iranian behavior, it is entirely possible that Iran will continue working on, or restart a covert nuclear weapons program.

If Iran Becomes a Serious Nuclear Weapons Power

The situation will change strikingly if Iran does go from developing nuclear weapons and long-range missiles to deploying an effective nuclear strike capability. At this point in time, there is no way to be certain what such a force would look like or how capable it would be. There is no way to know the yield, reliability, or any other aspect of Iran's first nuclear devices or weapons, or how soon it could more on to boosted or thermonuclear weapons.

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[199] IAEA Director General Dr. Mohamed ElBaradei, Statement to the Sixty-Third Regular Session of the United Nations General Assembly, UN General Assembly New York, October 28, 2008, available at: http://www.iaea.org/NewsCenter/Statements/2008/ebsp2008n010.html.

One thing, however, is clear. Even the political-psychological impact of a limited fissile surface or underground test would be enormous, and the strategic debate would immediately shift from trying to deny Iran nuclear capability to preemption, containment, defense and nuclear or conventional deterrence. Even the prospect of an Iranian weapon has created a de facto nuclear arms race with Israel, which is quietly improving its own capabilities and is making Arab states reconsider acquiring such weapons and delivery systems.

There are many different ways in which Iran can proliferate, deploy nuclear-armed or other chemical, biological, radiological, and nuclear (CBRN) weapons, and use them to deter, intimidate, and strike against other nations. All have only one thing in common: they are all provocative and dangerous to any nation Iran may choose to try to intimidate and target, *and* they are all provocative and dangerous to Iran.

Even Iranian ambiguity will probably lead Israel and the United States – and possibly India, Pakistan, and Russia—to develop nuclear options to deter or retaliate against Iran. Israeli and/or U.S. restraint in striking Iran does not have to stop at the first convincing Iranian threat to use nuclear or highly lethal biological weapons, but it could do so.

As of regional options, Iranian nuclear ambiguity might be enough to trigger Saudi, Egyptian, and Turkish efforts to become nuclear powers and some form of Israeli sea basing to enhance the survivability of its nuclear forces while increasing range and/or yield to strike Iran. Saudi Arabia has already said that it has examined nuclear options and rejected them, but this is no certainty and inevitably depends on Iranian action. The successful deployment of a highly capable Iranian force, and Israel's existential vulnerability, would almost certainly lead Israel to develop a retaliatory capability to destroy Iran's cities and kill most of its population.

Regional powers might show restraint if the United States could provide convincing ballistic and cruise missile defenses and the same form of extended deterrence it once provided to Germany during the Cold War. But these options are speculative and do not yet exist. Successfully deploying a nuclear warhead is one achievement; second-strike capability is another that must be considered by Iranian decision makers. It borders certainty that Iran's reaching a second-strike nuclear capability will take at least a decade if it will ever be achieved.

Any form of major nuclear confrontation could be a nightmare for all concerned. Iran's effort to limit or control the game will probably end at the first ground zero. Any actual Iranian use of such weapons is likely to provoke a nuclear response and may well provoke one targeted on Iranian cities and its population. Moreover, while Israel may technically be a more vulnerable "one bomb" country, it is highly questionable whether any form of Persian state could emerge from nuclear strikes on Iran's five to ten largest cities.

The end result is the prospect of a far more threatening mix of CBRN capabilities in the Gulf region and the area that most models project as the main source of continued world oil and gas exports beyond 2015. It is also the near certainty of an Israeli-Iranian nuclear arms race that means crossing Arab territory, U.S. nuclear targeting of Iran in some form of extended deterrence, the threat of more polarization between Sunni and Shi'ites, and

broader regional tensions and actions that spill over out of the confrontation over Iran's nuclear activities. None of these prospects are pleasant.

The greater implications of a nuclear Iran will be discussed in further detail in later chapters, but most of the implications of a nuclear Iran are very speculative and create even greater uncertainty than the programs that Iran is pursuing. The more actors that are threatened by Iran's nuclear and regional ambitions, the more complex and dangerous the big picture becomes. No matter how speculative the possible scenarios are, none of them result in any kind of peace or stability for a region that is already plagued by insecurity, instability and conflict.

Appendix A: Key Acronyms

AEOI - Atomic Energy Organization of Iran
AVLIS - Atomic Vapor Laser Isotope Separation
BHRC - Benefication and Hydrometallurgical Center
BNPP - Bushehr Nuclear Power Plant
BW - Biological Weapons/Warfare
CAIC - Chengdu Aircraft Industrial Corporation
CBRN - Chemical, Biological, Radiological, and Nuclear warheads
CBW - Chemical and Biological Weapons
CEP - Circular Error Probable
CIA - U.S. Central Intelligence Agency
CSL - Comprehensive Separation Laboratory
CSP - Conference of States Parties
CW - Chemical Weapons/Warfare
CWC - Chemical Weapons Convention
CWD - Chemical Demilitarization Conference
DG - Director General
DHS - U.S. Department of Homeland Security
DIA - U.S. Defense Intelligence Agency
DIV - Design Information Verification
EBW - Exploding Bridgewire
EIA - U.S. Energy Information Agency
EMP - Electromagnetic Pulse
ERI - Education Research Institute
FEP - Fuel Enrichment Plant
FMP - Fuel Manufacturing Plant
FSU - Former Soviet Union
GA - Tabun (Chemical nerve agent)
GB - Sarin (Chemical nerve agent)
GLONAS - Global Navigation Satellite System
GPS - Global Positioning System
IAEA - International Atomic Energy Agency
IAF - Iranian Air Force
IAIO - Iranian Aerospace Industries Organization
IAP - Institute of Applied Physics
IISS - International Institute for Strategic Studies
IOC - Initial Operating Capability
IR-40 - Iran Nuclear Research
IRBM - Intermediate Range Ballistic Missile
IRGC - Islamic Revolutionary Guards Corps
IRGCAF - Iranian Revolution Guards Corps Air Force
IS&R - Intelligence, surveillance, and reconnaissance
*I*sp - Specific Impulse
JHL - Jabr Ibn Hayan Multipurpose Laboratory
Kgf - Kilogram-force
KM - Kimia Maadan Company

LOW - Launch-on-warning
LRICBM - Limited Range Intercontinental Ballistic Missile
LSL - Laser Spectroscopy Laboratory
LUA - Launch-under attack
MEK - Mujahedeen-e-Khalq
MIX - Molybdenum, Iodine, Xenon Radioisotope Production Facility Reactor
MLIS - Molecular Isotope Separation
MRBM - Medium Range Ballistic Missile
MTRC - Missile Technology Control Regime
NATO - North Atlantic Treaty Organization
NBC - Nuclear Biological Chemical
NCRI - National Council of Resistance of Iran
NGO - Nongovernmental organization
NIOC - National Iranian Oil Company
NPT - Non Proliferation Treaty
NTI - Nuclear Threat Initiative
ODNI - U.S. Office of the Director of National Intelligence
OPCW - Organization for the Prohibition of Chemical Weapons
PFEP - Pilot Fuel Enrichment Plant
PHRC - Physics Research Center
PIT - Physical Inventory Taking
PLC - Programmable Logic Control
PPE - Personal Protective Equipment
PRC - Peoples Republic of China
R&D - Research and Development
SHIG - Shahid Hemat Industrial Group
SLBM - Submarine Launched Ballistic Missile
SRBM - Short Range Ballistic Missile
SUT - Sharif University of Technology
SWU - Separative Work Units
TEL - Transporter-Erector-Launcher
TERCOM - Terrain Contour Matching
TNRC - Tehran Nuclear Research Center
TRR - Tehran Research Reactor
UAV - Unmanned Aerial Vehicles
UCAV - Unmanned Combat Aerial Vehicles
UCF - Uranium Conversion Facility
UO2 - Uranium Dioxide
UF4 - Uranium Tetrafluoride
UF6 - Uranium Hexafluoride
WHO - World Health Organization
WME - Weapons of Mass Expenditure
WMM - Weapons of Mass Media
WMP - Weapons of Mass Panic
YRPC - Yazd Radiation Processing Center
ZKA - German Customs Office of Criminal Investigations