Iran's Developing Nuclear and Missile Programs

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Iran's Nuclear Program:

U.S. Strategic Options

World of Bad Choices

- No consensus for decisive allied or UN action regardless of Iranian actions.
- Iranian strategy of "diplomatic" attrition has limited risk to them, allows for political gains over time, and improves their bargaining position if they succeed
- Strikes on their facilities cannot be surgical; will not remove technology base. The resulting delay, however, may be significant.
- Technology in delivery systems, all areas of CBRN weapons advancing and becoming easier to conceal.
- But, open, successful deployment changes map of risk and military balance in the Gulf

US Strategic Options

- Play out negotiating options without accepting proliferation:
  - "Good cop, bad cop" and "arm wavers" help.
- Seek to lead allies to firmer action if Iran does not cave.
  - Overcome the legacy of Iraq
  - Prepare for bringing issue to the UN.
  - Consider backup-plan if UN action/sanctions do not work
- Improve intelligence, seek hard facts and "smoking guns."
  - Same data needed for negotiating, arms control and targeting.
  - Look at missiles, chemical and biological weapons, not just nuclear.
- Restrict overt and covert acquisitions of Iranian weapons?.
- Preserve and improve military options.
- Develop missile defenses – extended deterrence.
- Support regime change/Iranian factions who are against a nuclear program
- Act through proxies

Iran's Nuclear Program:

Key Issues, Violations, and Uncertainties

Aside from the first slide in this section, the analysis of violations and uncertainties is taken from Jacqueline Shire and David Albright, "Iran's NPT Violations – Numerous and Possibly On-Going?", The Institute for Science and International Security (ISIS), September 29, 2006

Weapons Related Research

- Beryllium (neutron reflector)
- Polonium (neutron initiator)
- Plutonium separation
- High Uranium enrichment
- Machining of Uranium
- Re-entry vehicle design?
- Acquisition of North Korean (Chinese) weapons design?
- High explosive lenses?

Major Violations - Part I

- **Uranium Imports**: Iran failed to report that it had purchased natural uranium (1,000 kg of UF6, 400 kg of UF4, and 400 kg of UO2) from China in 1991, and its subsequent transfer for further processing. Iran acknowledged the imports in February 2003.

- **Uranium conversion**: Iran did not inform the IAEA of its use of the imported uranium in tests of its uranium conversion processes, including "uranium dissolution, purification using pulse columns, and the production of uranium metal, and the associated production and loss of nuclear material." Iran acknowledged this failure in February 2003.

Major Violations - Part II

- **Uranium enrichment**: Iran failed to report that it had used 1.9 kg of the imported UF6 to test P-1 centrifuges at the Kalaye Electric Company centrifuge workshop in 1999 and 2002. In its October 2003 declaration to the IAEA, Iran first admitted to introducing UF6 into a centrifuge in 1999, and into as many as 19 centrifuges in 2002. Iran also failed to declare the associated production of enriched and depleted uranium.

- **Hidden Sites**: Iran did not declare to the IAEA the existence of a pilot enrichment facility at the Kalaye Electric Company Workshop, and laser enrichment plants at the Tehran Nuclear Research center and at Lashkar Ab'ad. Because experiments at these sites involved the use of nuclear material in equipment, Iran was obligated to report them to the IAEA.

Major Violations - Part III

- **Laser Isotope Enrichment Experiments**: Iran failed to report that in 1993 it imported 50 kg of natural uranium metal, and that it used 8 kg of this for atomic vapor laser isotope separation (AVLIS) experiments at Tehran Nuclear Research Center between 1999 to 2000, and 22 kg of the metal for AVLIS experiments at Lashkar Ab'ad between 2002 to 2003. These activities were ultimately acknowledged in an October 2003 declaration.

- **Plutonium Experiments**: Iran did not report to the IAEA that it had produced uranium dioxide (UO2) targets, irradiated them in the Tehran Research Reactor, and then separated the plutonium from the irradiated targets. Iran also failed to report the production and transfer of waste associated with these activities and that it had stored unprocessed irradiated targets at the Tehran Nuclear Research Center. In later meetings with the IAEA, Iran said that it conducted the plutonium separation experiments between 1988 and 1993 using shielded glove boxes at the Tehran Nuclear Research Center.

This analysis of violations is taken from Jacqueline Shire and David Albright, "Iran's NPT Violations – Numerous and Possibly On-Going?", The Institute for Science and International Security (ISIS), September 29, 2006. It is also based on the IAEA report for 2004, http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83.pdf, and International Atomic Energy Agency, "Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran," GOV/2003/75, 10 November 2003, Annex 1, p. 2.

Unresolved Issues - I

- **P-1 Centrifuges and the Khan Network**: Iran showed the IAEA a copy of a hand-written one page document dating from contacts with the Khan network in 1987, discussing the supply of 2000 centrifuges, drawings and specifications for a "complete plant" including a workshop for the manufacture of supporting equipment. Iran claims that it had no contact with the Khan network again until 1993 and that this single document is all that remains of the 1987 offer. Iran has refused to provide the IAEA with a copy of the document and insists that no additional documentation exists regarding those earlier exchanges. IAEA officials have interviewed members of the Khan network and reported that "statements made by Iran and key members of the network…. are still at variance with one another." The acquisition of about 500 sets of P-1 parts in the mid-1990s remains unaccounted for.

- **P-2 Centrifuges**: Iran told the IAEA that it received drawings for P-2 components via the Khan network in 1995 but claims that it conducted no work on the machines until 2002, when it contracted for the local manufacture of at least seven P-2 rotors. In a discussion with IAEA inspectors, the Iranian engineer responsible for the rotors said that because the P-2 design required maraging steel cylinders with bellows, which Iran could not manufacture indigenously, he modified the design for carbon composite rotors. Other officials explain the seven year gap in conducting R&D by pointing to staffing shortages and a decision to pursue the P-1 program. The IAEA is struck, however, by the short time it took for engineers to make design modifications to the P-2 rotors after reportedly seeing the drawings for the first time, stating that Iran's reasons for the delay "do not give sufficient assurance that there were no related activities carried out during that period…."(2) Iran has informed the IAEA that work on P-2 centrifuges amounts to "an ongoing and progressing R&D activity without using nuclear materials."

Unresolved Issues II

- **Documents about Work with Uranium Metal**: The IAEA first reported the existence of this document in November 2005, describing it as containing "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…."(3) Iran claims that it received this document, which concerns the process necessary to machine uranium metal into a form suitable for use in a nuclear weapon, unsolicited from the Khan network, and that it has not performed any such research. Though the document has been placed under IAEA seal, Iran has denied IAEA requests for a copy. Most recently IAEA inspectors were told they could not take notes from the document, and that some notes already taken must be destroyed. (4)

- **HEU and LEU Contamination**: IAEA sampling in 2003 has turned up evidence of LEU and HEU particles (36% U-235 to 70% U-235 enrichment levels) at several nuclear facilities, in particular the Natanz plant and the Kalaye Electric Company. The IAEA calls this a "long outstanding issue" and notes that Iran's decision to stop adhering to the Additional Protocol (which allows IAEA inspectors access to Iran's centrifuge manufacturing and storage facilities) makes it impossible to rule out Iran as the source for some of the particles found. Iran maintains that any HEU particles found are the result of cross contamination from its suppliers. Sample analysis by the IAEA "tends, on balance, to support Iran's statement about the foreign origin of most of the HEU contamination…."(5)

Unresolved Issues - III

- **Lavisan-Shian**: One outstanding issue of contamination involves the Physics Research Center at Lavisan-Shian. Environmental samples taken in January 2006 revealed a "small number of particles of natural and high enriched uranium."(6) Iran has "not yet responded" to IAEA requests for further sampling or for an interview with one of the former directors of the center. Also in January, Iran was asked to explain documentation it provided the IAEA regarding procurement of specialized equipment related to uranium enrichment, (7) The IAEA continues to await further information about this and related procurement.

- **Experiments with Plutonium**: Like the matter of HEU and LEU contamination, this is a long outstanding issue with the IAEA, involving multiple iterations of IAEA requests for information, Iranian explanations and subsequent IAEA requests for clarification. The IAEA's conclusion, expressed in its report of April 28, 2006, is that "the Agency cannot exclude the possibility— notwithstanding the explanations provided by Iran—that plutonium analysed by the Agency was derived from source(s) other than the ones declared by Iran."(8) Simply stated, this could mean that Iran either acquired undeclared plutonium from foreign sources, or separated indigenously more than it has declared to the IAEA.

Unresolved Issues - IV

- **Laptop Documents**: The existence of a laptop computer, reportedly containing extensive documentary evidence indicating Iranian work on a re-entry vehicle with a "black box" consistent with many of the technical parameters for a nuclear warhead, was first disclosed by the *Washington Post* and *Wall Street Journal*. Also found on the computer were drawings for a part of a uranium conversion facility involved in producing uranium tetrafluoride, or "green salt," documents about high explosive work, and what appears to be a test shaft, possibly for a nuclear device. According to media reports, the laptop was acquired through an intelligence operation and its contents forensically analyzed by experts at the U.S. Department of Energy, who have deemed them credible. The IAEA has sought to question Iranian officials about the programs, entities and individuals mentioned in the documents. Iran denies outright the existence of any such programs, claims the documents are forgeries, and refuses to discuss the matter further with IAEA inspectors. (Carla Anne Robbins, "Atomic Test: As Evidence Grows Of Iran's Program, U.S. Hits Quandary," *Wall Street Journal,* March 18, 2005, A1; Dafna Linzer, "Nuclear Disclosures on Iran Unverified," *Washington Post*, November 19, 2004, A1.)

This analysis of violations was taken from Jacqueline Shire and David Albright, "Iran's NPT Violations – Numerous and Possibly On-Going?", The Institute for Science and International Security (ISIS), September 29, 2006.

(1). IAEA Report, GOV/2006/15, February 27, 2006, para 15; (2) IAEA Report, GOV/2004/83, November 15, 2004, para 48. (3).IAEA Report, GOV/2005/87, November 18, 2005, para 6. (4) IAEA Report, GOV/2006/53, August 31, 2006, para 14. (5) IAEA Report, GOV/2006/15, February 27, 2006, para 9. (6) IAEA Report, GOV/2006/53, August 31, 2006, para 24.(7) IAEA Report, GOV/2006/15, February 27, 2006, para 34.(8) IAEA Report, GOV/2006/27, April 28, 2006, para 17.

Iran's Nuclear Program:

Recent Developments

Referral to the UNSC

- February 4, 2006: IAEA board voted to refer Iran to the UNSC
- IAEA expressed "serious concern" about Iran's possession of a document on the production of uranium metal hemispheres.
- Iran "suspend all voluntary measure and extra cooperation with the Agency."
- Left the door open to further cooperation with some countries.
- On December 23, 2006, the UNSC in Resolution 1737 decided that Iran suspend immediately "all enrichment-related and reprocessing activities including research and development" as well as suspend "work on all heavy water-related projects"; further, the UNSC decided that all nations halt transfer goods and services that may aid Iran in its enrichment and heavy water development. However, the political disagreements among the UNSC members on how to deal with these sanctions continue to be unresolved.

The Iranian Winter & Spring 2006

- Early January: Iran removes 52 IAEA seals on Natanz, Pars Trash, and Farayand centrifuge projects.
- Renovates PFEP plant and centrifuge cascades at Nantanz (installed up to 200 secretly, designed to hold six 164-machine cascades.
- Early March: 20 machine runs at Natanz and Farayand.
- Uranium Hexaflouride plant operating at Isfahan.
- April 2006: The Iranian parliament passed a resolution calling for Iran to withdraw from the NPT.

New Nuclear-Military Dimensions? - I

- US intelligence estimates reveal a new “military-nuclear dimension.”
- Assessment was reportedly based on information provided by the US to the IAEA, and it referred to a secret program called “the Green Salt Project” to produce UF4, which, according to the IAEA Deputy Director General for Safeguards “could have a nuclear military dimension”.
- This project worked on uranium enrichment, high explosives, and on adapting nuclear warheads to Iranians missiles.
- The report suggested that there were evidence of “administrative interconnections” between weaponization and nuclear experts in Iran’s nuclear program.
- Tehran argued that these claims were “baseless.”

New Nuclear-Military Dimensions? - II

- US officials claimed that these estimates tracked with the comments made by then Secretary of State Collin Powell in November 2004 about Iran's delivery system to carry nukes.
- The uranium mine in Gchine is believed to be under IRGC control.
- There is a high degree of organizational and personnel overlap between state-owned defense industries, the military and even more so the IRGC.
- The Annex to UNSCR 1737 identifies a number of companies and individuals involved in the ballistic missile and nuclear programs that are mainly the Atomic Energy Organization of Iran (AEOI) and Defense Industries Organization (DIO).

IAEA DG Report of February 27, 2006

- Still tracking enriched Uranium activity.
- Status of P-1 centrifuge program uncertain.
- P-2 centrifuge acquisition uncertain.
- UF4 to Uranium metal conversion issues.
- 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.

IAEA DG Report of April 28, 2006

- No clarification on enrichment.
- HEU contamination issues remain.
- P-1 and P-2 centrifuge issues not addressed; new issues over P-2 designs.
- New issues over UF6 to metal and casting of Uranium hemispheres. (15 page document discovered.)
- Not clarify Plutonium experiments.
- Heavy water reactor at Arak still under construction.
- New transparency issues.
- Iran is building second and third cascades at the PFEP.

US (Secretary Rice) Statement of May 31, 2006

- Acknowledges right to Iranian civil nuclear energy.
- Supports European (British, French, German) offer to Iran.
- Offers "new and positive relationship…looks forward to a new relationship."
- "…as soon as Iran fully and verifiably suspends its enrichment and reprocessing activities, the US will come to the table with our EU-3 colleagues and meet with Iran's representatives."
- Rice repeats willingness to talk on August 29th.
- El-Baradei stated on May 30 that Iran "does not present an immediate threat"

Getting Ready for a Test?

- The Washington Post reported on February 8, 2006 that Tehran completed sophisticated drawings of *a deep subterranean shaft* with:
  - remote-controlled sensors to measure pressure and heat,
  - plans for the 400-meter tunnel appear designed for an underground atomic test).
  - a test control team parked a safe 10 kilometers from the shaft
  - US official was quoted as saying "The diagram is consistent with a nuclear test-site schematic."
- According to US officials, the source was a set of documents received from a laptop obtained by US intelligence in 2004
  - US believes this is "nearest" to a "smoking gun."
  - British believe information authentic
  - German & French believe the information are "troubling"
  - Russians believe information inconclusive

New Delivery Systems?

- Shahab-4:
  - Shahab-4 with a range of about 2,200 km (with 1,000 kg warhead) and could carry 3 atomic warheads?
  - Reportedly based on Soviet SS-4.
  - Perhaps successfully tested on January 28, 2006. Intelligence reports that examined the flight trajectory states that the missile may fly as far as 4,000km. Some sources claim there was a test on January 17th.
  - Announced on Iranian TV by a commander of the IRGC?

- Shahab-5:
  - Revealed at the Munich conference
  - Intelligence services consider it possible that as early as *next year* Iran will test a Shahab-5.
  - Shahab-5 may have a range of from 3,000 to 5,000 km.
  - Believed to draw on Taep'o Dong -2 technology, but it remains unclear to what extent.

- Shahab-6:
  - 2/3-stage solid fuel missile with up to 6,000km range. Reportedly, this missile is virtually an improved Shahab-5.

Currently, there is no evidence or definition of a missile "above" the Shahab-3. The addition of numbers may be little more than backing up political rhetoric.

IAEA DG Report of June 8, 2006

- No further resolution on contamination, P-1, P-2, or Uranium metal and casting.
- Warning Iran has 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 conversion campaign began in Isfahan UCF on June 6, 2006.
- Following up on “Green Salt” Project.
- Investigating high explosives testing and design of missile re-entry vehicle.

UNSCR 1696 (July 31, 2006)

- "Serious concern" over IAEA DG reports of 27 February, April 28, June 8
- "Demands…that Iran shall suspend all enrichment-related and reprocessing activities, including research and development…"
- Acting under Article 40 of the UN Charter, expresses intention (if Iran does not comply by August 31) to adopt appropriate measures under Article 41 of Chapter VII of Charter of UN (allows for economic sanctions) to "persuade Iran to comply…and underlines that further decisions will be required should such additional measures prove necessary."

Key Points in Resolution 1696

- Called upon Iran without further delay to take the steps required by the Board of Governors in its resolution GOV/2006/14, which are essential to build confidence in the exclusively peaceful purpose of its nuclear programme and to resolve outstanding questions;
- Demanded, in this context, that Iran shall suspend all enrichment-related and reprocessing activities, including research and development, to be verified by the Agency;
- Underlined the necessity of the Agency continuing its work to clarify all outstanding issues relating to Iran's nuclear programme;
- Called upon Iran to act in accordance with the provisions of the Additional Protocol and to implement without delay all transparency measures as the Agency may request in support of its ongoing investigations; and
- Requested by 31 August a report from the Director General primarily on whether Iran has established full and sustained suspension of all activities mentioned in this resolution, as well as on the process of Iranian compliance with all the steps required by the Board and with the above provisions of this resolution, to the Board of Governors and in parallel to the Security Council for its consideration.

Arak Heavy Water Production Plant Announcement

- Ahmadinejad inaugurates on August 26.
- Heavy water production plant with reactor to be completed in 2009.
- Reactor can use natural uranium mined by Iran without outside enrichment.
- Spent fuel can be reprocessed to extract Plutonium for bomb.
- Claim to diagnose and treat AIDS and cancer, medical and agricultural research.
- Iran admitted to procurement of hot cells for Arak, which would be suitable for the production of plutonium.

Iranian August 31 Deadline Statements

- Call UNSCR deadline “illegal.”
- Khameni says Iran “will continue its path” on August 20.
- Foreign Ministry spokesman Asefi claims “ we are not going to suspend enrichment” on August 22.
- Chief nuclear negotiator Larijani rejects UN deadline on August 27.
- Ahmadinejad says Iran will never abandon purely peaceful program. Repeats rejection of deadline on August 29. Attacks Britain and US.
- Iranian diplomats then say Iran’s position “flexible.”

IAEA DG Report of August 31, 2006

- Tested 164-machine cascade to 5% enrichment.
- Second 164 centrifuge cascade to start in September (did start on October 23)
- Limiting access to Natanz, possibly in future to Arak and Isfahan.
- No indications of ongoing reprocessing.
- No resolution of contamination, 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 re-entry vehicles (Green Salt) unresolved.

IAEA Board of Governors Report November 14, 2006

- Testing of the second 164-machine cascade with UF6 had 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.

UNSCR 1737 (December 23, 2006)

- Orders Iran to suspend work on uranium conversion and enrichment, work on heavy water reactors, and nuclear weapon delivery systems.
- Leaves Iran 60 days to prove compliance or face further sanctions.

IAEA Board of Governors Report on the Cooperation between Iran and the IAEA, February 9, 2007

- Following the passing of UNSCR 1737, the IAEA evaluated all existing cooperation programs with Iran. On February 9, 2007, the Director General issued a report that evaluated each existing program in the light of the requirements of UNSCR 1737
- Recommended the continuation or termination of all cooperation programs between the IAEA and Iran.

Other assessments by the IAEA

- According to the IAEA, between August 13 and November 2, 2006, Iran reported that approximately 34 kg of UF6 was fed into the centrifuges and enriched to levels below 5 % U-235.
- Iran had reported by August 31 that a total of 6 kg of UF6 was fed into the then-single cascade between June 23 and July 8. à almost 500% increase in the inserted quantity of UF6 à additional and/or more efficient cascades

Iran's Nuclear Program:

Current Assessments

Motives for the Nukes

- National pride
- Strategic posture in the region
- The legacy of Iraq
- Instability in the Gulf and the region
- Deterrence to the US and US discussion of military action and regime change
- Deterrence to Israel, strategic parity with Israel
- Nuclear sandwich
- Lessons from recent conflicts
- The threat of Sunni Islamic extremism
- The cause of Shiite Islamic extremism

Official US Policy Towards Iran

- "It's vital that the Iranians hear the world speak with one voice that they shouldn't have a nuclear weapon. You know, yesterday I was asked about the U.S. position, and I said all options are on the table. That's part of our position. But I also reminded people that diplomacy is just beginning."
  - President George W. Bush on February 3, 2005.

  - "We have seen in Iraq that once war is unleashed it becomes unpredictable; the consequences of a military conflict with Iran could be quite dramatic. Therefore, I would counsel against military action except as a last resort and if we felt our vital interests were threatened"
    - Secretary of Defense-nominee Robert Gates on December 4, 2006, Senate confirmation hearing

Official US Policy Towards Negotiating with Iran

- The US policy since March 11, 2005, has been to actively support the diplomatic efforts of Britain, France and Germany (the EU-3).
- The US was prepared to drop its objection to Iran's application to the World Trade Organization.
- The US was also prepared to lift objections to the licensing of spare parts for Iranian commercial aircraft.
- While no options are off the table, Sec. Rice publicly stated that an attack on Iran was "not on the agenda" as of February 4, 2005.
- US agreed to join with EU-3 in negotiating with Iran, Russian fuel and enrichment offer in March 2006.
- US is calling for a UNSCR that combines political and economic sanctions against Iran.

US Assessments of Iran's Nuclear Capabilities

- The US believes Iran is developing a nuclear weapons program under the guise of a civilian nuclear energy program.
- Iran is potentially using two routes: uranium enrichment and plutonium separation.
- The CIA's unclassified report to Congress stated that the "United States remains convinced that Tehran has been pursuing a clandestine nuclear weapons program…"
- The US Undersecretary of State, Robert G. Joseph, said "…we don't have perfect information or perfect understanding. But the Iranian Record, plus what the Iranians leaders have said … lead us to conclude that we heave to be highly skeptical

DNI "Annual National Threat Assessment" 2006

Director of National Intelligence, John Negroponte:

"We judge that Tehran probably does not yet have a nuclear weapon and probably has not yet produced or acquired the necessary fissile material. Nevertheless, the danger that it will acquire a nuclear weapon and the ability to integrate it with the ballistic missiles Iran already possesses is a reason for immediate concern. Iran already has the largest inventory of ballistic missiles in the Middle East, and Tehran views its ballistic missiles as an integral part of its strategy to deter—and if necessary retaliate against—forces in the region, including US forces."

US Estimates

- **NIC:** "Iran has very active missile and WMD development programs, and is seeking foreign missile, nuclear, chemical, and biological technologies."

- **DIA (2005):** "Iran is likely continuing nuclear weapon-related endeavors in an effort to become the dominant regional power and deter what it perceives as the potential for US or Israeli attacks. We judge Iran is devoting significant resources to its weapons of mass destruction and ballistic missile programs. Unless constrained by a nuclear non-proliferation agreement, Tehran probably will have the ability to produce nuclear weapons early in the next decade."

- **NIE (2005):** revised the timeline to reflect possible technical obstacles in Iran's nuclear program. If such complexities were taken into account, Iran would be "unlikely to produce a sufficient quantity of highly enriched uranium, the key ingredient for an atomic weapon, before 'early to mid-next decade.'"

- **CIA (2006):** According to news reports in November 2006, the CIA presented a classified draft report on Iranian that did not find conclusive evidence on an Iranian nuclear weapons program.

- **DNI (2007):** We assess that Tehran is determined to develop nuclear weapons, despite its international obligations and international pressure.

Israeli Estimates

- **IDF official (2005):** "We no longer think that a secret military track runs independent of the civilian one…If it were then they could acquire weapons in 2007… We have changed our estimation. Now we think the military track is dependent on the civilian one. However, from a certain point it will be able to run independently. But not early than 2008."

- **Meir Dagan (2005):** Iran is almost "at the point of no return." He added that if Iran enriches uranium in 2005, it will take Tehran two to three more years to acquire nuclear weapons. "The moment you have the technology for enrichment, you are home free," Dagan said.

  (2006): If Iran operates 3,000 centrifuges at Natanz by 2007, it could produce 25 kg of fissile material by 2008, enough for one nuclear weapon. By 2009, Iran could have a warhead ready necessary for delivery. This timeline represents a worst-case scenario.

- **General Aharon Zeevi Farkash, the head of AMAN (2005):** "Barring an unexpected delay, Iran is going to become nuclear capable in 2008 and not in 10 years as was recently reported in the American press."
  - He also said in 2004 "once they have the ability to produce enough enriched Uranium, we estimate that the first bomb will be constructed within two years--i.e. the end of 2006 or the beginning of 2007."

Independent Estimates

- **Mohammad El-Baradei said (2005):** "It depends on whether they have been doing weaponization. We haven't seen signs of that. But they have the know-how. If they resume the fuel cycle, they should be able to get the fissile material within a year or two. If they have that, they are a year away from a weapon. It's a matter of time, because they have the know-how and the industrial infrastructure."

- **Hans Blix said (2005):** "They have many years to go before they will be able to produce highly enriched uranium for a bomb and I believe there is plenty of room for negotiations.," Blix was quoted as saying. He argued that Iran's plans to build 40-megawatt heavy-water reactor in Bushehr "are very much in their infancy and the West is not particularly worried and may be (can) count on being able to talk the Iranians out of it."

- **Gary Samore of the IISS (2005):** "They're trying to avoid international reaction and I think it's perhaps more likely that they try to develop their nuclear capabilities over a much longer period of time, a decade or 15 years,"

Iran's Nuclear Program:

Iranian Nuclear Facilities

Nuclear Weapons Production Capacity

- Estimates of Iranian Nuclear Capacity differ:
  - The IAEA warned that Iran intended to "turn 37 tons of nearly raw uranium called yellowcake, into uranium hexafluoride." Experts contend that this could be enough to create 5-6 atomic weapons.
  - Many assessments cite 25 kilograms of weapon-grade uranium (HEU containing more than 90 percent uranium 235) as the minimum amount necessary for a crude, implosion-type fission weapon of the type Iran is expected to build.
  - From August-September 2005, Iran produced approximately 7 tons of the gas used in uranium enrichment, which might be enough to produce 1 nuclear bomb.
- No consensus on capabilities of centrifuge "chains" or "cascades"
- Weapons design factors critical to such estimates
- As of May 2006, Iran was believed to have enough components for up to 5,000 centrifuges.


300 miles
500 km
TURKEY
CASPIAN SEA
TURKMENISTAN
Lashkar A'bad
Tehran
Sites circled in red
unknown pre-mid 2002
IRAQ
Arak
Natanz
Isfahan
IRAN
Saghand
Ardekan
AFGHANISTAN
PAKISTAN
KUWAIT
Bushehr
1000 MW
The Gulf
Gachin
BAHRAIN
SAUDI ARABIA
QATAR
Gulf of Oman
MIDDLE EAST
MW Megawatts
Uranium processing facility
Uranium mines
Heavy-water facility
Research reactors / research facilities
Uranium enrichment facility
Light-water reactor (under construction)
Source: IISSmaps
IISSmaps

Location	As of November 2004	Status
Tehran Nuclear Research Center (TNRC)	Tehran Research Reactor (TRR)	Operating
	Molybdenum, Iodine and Xenon Radioisotope Production Facility (MIX Facility)	Constructed, but not operating
	*Jabr Ibn Hayan Multipurpose Laboratories (JHL)	Operating
	*Waste Handling Facility (WHF)	Operating
Esfahan Nuclear Technology Center	Miniaturized Neutron Source Reactor (MNSR)	Operating
	Light Water Sub-Critical Reactor (LWSCR)	Operating
	Heavy Water Zero Power Reactor (HWZPR)	Operating
	FFL	Operating
	UCL	Closed down
	UCF	Hot testing/commissioning stage
	GSCR	Decommissioned
	*Fuel Manufacturing Plant (FMP)	In detailed design stage, construction to begin in 2004
	*Zirconium Production Plant (ZPP)	Under construction

Location	As of November 2004	Status
Natanz	***Pilot Fuel Enrichment Plant (PFEP)	Operational; currently suspended
	***Fuel Enrichment Plant (FEP)	Under construction; currently suspended
Karaj	*Radioactive Waste Storage	Partially operating
Lashkar Ab'ad	*Pilot Uranium Laser Enrichment Plant	Dismantled
Arak	***Iran Nuclear Research Reactor (IR-40)	In detailed design phase
	*Hot cell facility for production of radioisotopes	Declared as no longer being under consideration
	*Heavy Water Production Plant (HWPP)	Under construction
Anarak	*Waste storage site	Waste to be transferred to JHL
Tehran	***Kalaye Electric Company	Dismantled pilot enrichment facility; being converted to centrifuge enrichment R&D
Bushehr	Bushehr Nuclear Power Plant (BNPP)	Under construction, believed to be operational in early 2007

Key Nuclear Sites

- 18 known sites
- Two sites of particular concern: **Arak** and **Natanz**, that could be used to produce materials for nuclear weapons: Iran claims it needs a test facility of 3,000 centrifuges at Natanz; UF6 activity claimed to be permitted.
- The US is also concerned about the **Bushehr** reactor, which could provide Iran with enough plutonium each year for 30 weapons.
- **Isfahan** is where it is believed that Iran was successful in converting 37 tons (85 tons?) of uranium (yellowcake UF4) into gas in May 2005. It is believed that much yellowcake is enough to produce 5-6 atomic weapons.
- In September 2005, Iran solicitated two tenders for new nuclear facilities.

Isfahan Conversion Facility

- Can convert Uranium yellowcake into Uranium Hexaflouride (UF6), Uranium Dioxide (UO2), and Uranium metal. Operational in February 2006.
- Has converted Uranium Tetraflouride (UF4) into metal.
- Conducted P-2 centrifuge research and had advanced drawings. Found rotor cylinders. Supposed to transfer to Pars Trash Company in Tehran.

Arak Heavy-Water Reactor in Development in 2005

A Pictorial Illustration

(Note: Some estimates put capacity as designed to support production of 2-3 Pu-239)

Arak Heavy Water Facility

- Initially said producing for export and medical applications.
- Announced 40 MW thermal heavy water reactor construction in 2004; to be completed in 2009.
- Deny has hot cells for Plutonium production. Found to have tested in Tehran.
- Could produce 8-10 kilograms of Pu-239 a year; enough for 1-2 weapons.
- IAEA in 2006 decided to exclude this program from potential recipients of technical aid.

Arak 40 MWth Heavy Water Reactor

DigitalGlobe Quickbird commercial satellite image

14 FEB 05

Arak 40 MWth Heavy Water Reactor

DigitalGlobe Quickbird commercial satellite image

22 MAR 05

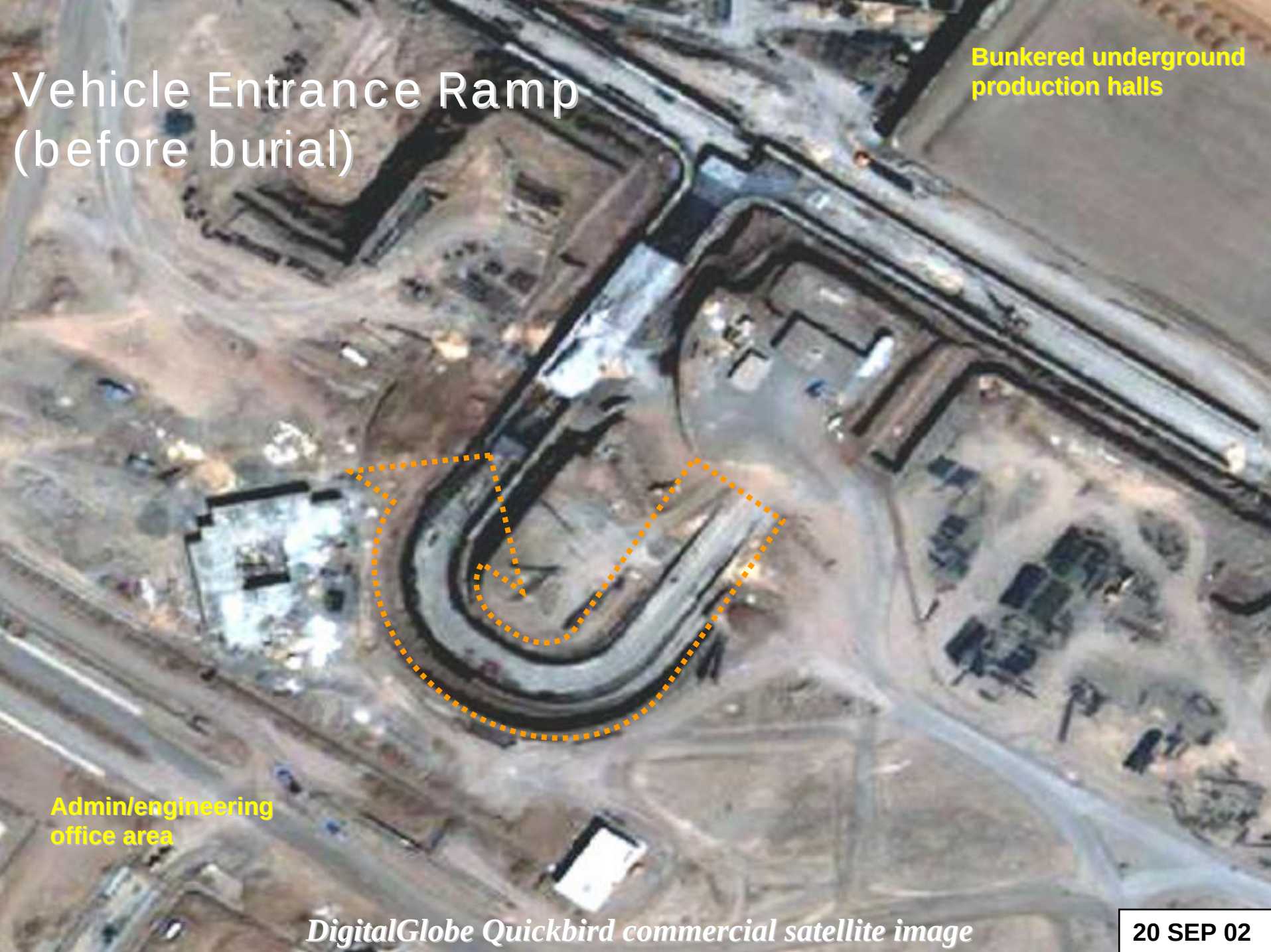
Natanz Gas Centrifuge in 2002 and 2004:

A Pictorial Illustration

(Note: Some estimates put capacity of full plant at one or more U-235 weapons per year)

Natanz Centrifuge Plant

- Pilot plant with six 164-centrifuge cascade lines and expansion to 1,000. 164-328 in operation or being placed.
- Commercial plant with three underground structures. Can house up to 50,000 P-1 centrifuges, enough for 380-520 kilograms of U-235 a year - 10-25 weapons. Iran reportedly plans to install 54,000 centrifuges in Natanz.
- Module of 3,000 in construction underground. Earliest date is 2009. Could produce 1-3 weapons worth of HEU a year.
- P-2 centrifuge technology would give 5-7 times more output than P-1. State of the art is far higher than P-2.
- Iran told the IAEA that it intends to start the installation of the first 3,000 P1 centrifuges (first module) in the underground cascade halls at the PFEP in the fourth quarter of 2006.


Vehicle Entrance Ramp
(before burial)
Bunkered underground
production halls
Admin/engineering
office area
DigitalGlobe Quickbird commercial satellite image
20 SEP 02


Vehicle Entrance Ramp
(after burial)
Bunkered underground
Centrifuge cascade halls
Helicopter
pads
New security
wall
Dummy building
concealing tunnel
entrance ramp
Admin/engineering
office area
DigitalGlobe Quickbird commercial satellite image
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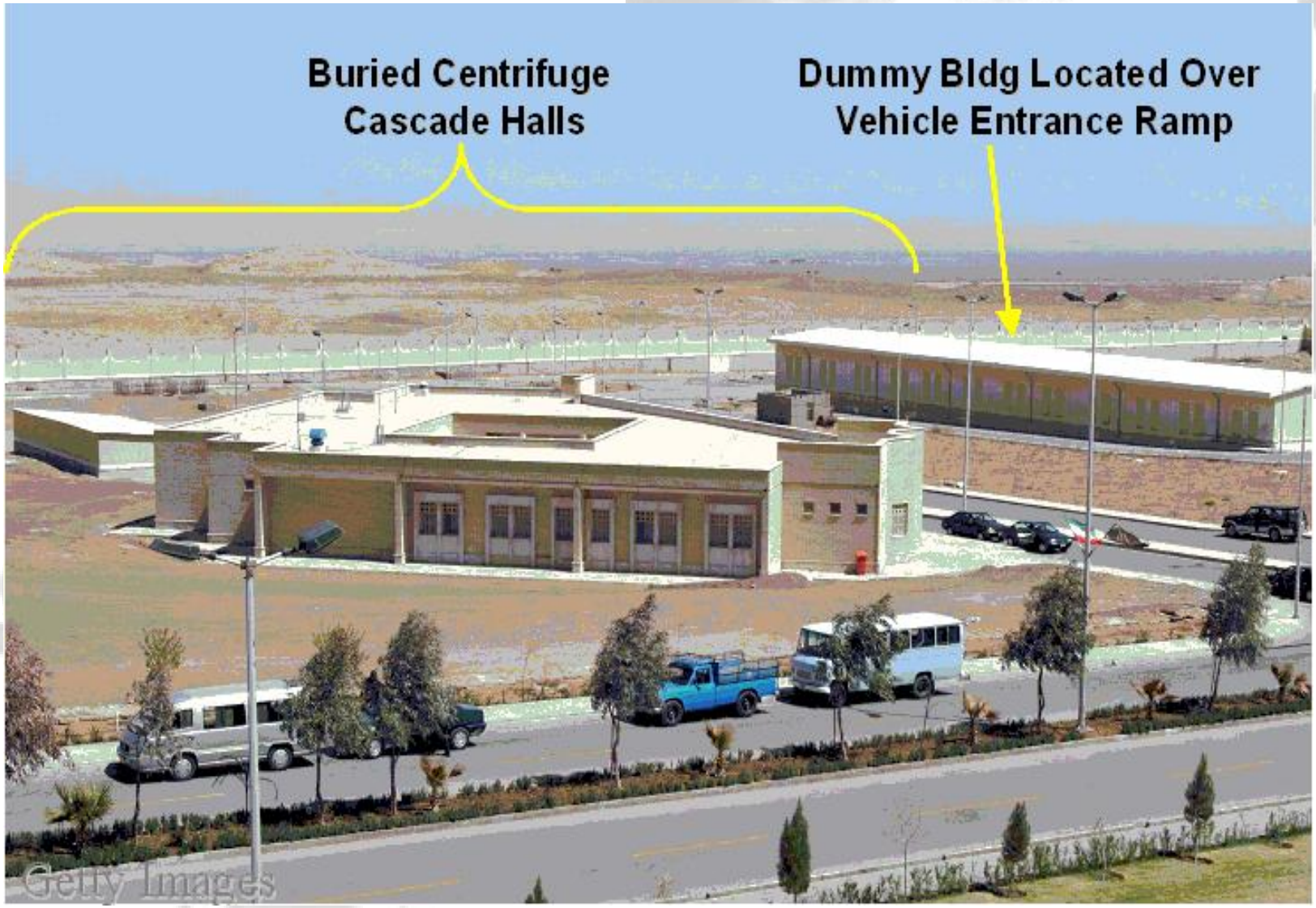
Effective Concealment



Iran's Nuclear Program:

Iranian Delivery Options

"No Rules" Delivery Options

- Missiles
- Air
- Covert
- Proxy
- Remote

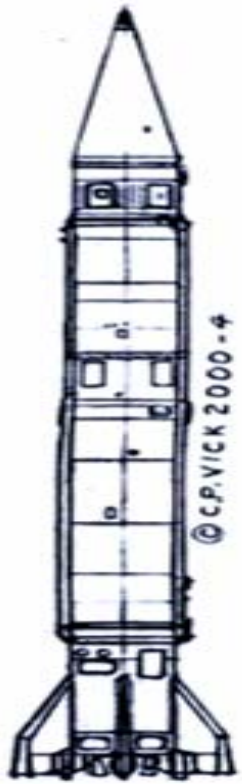
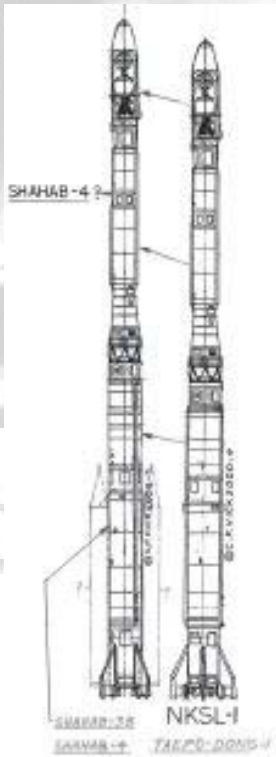
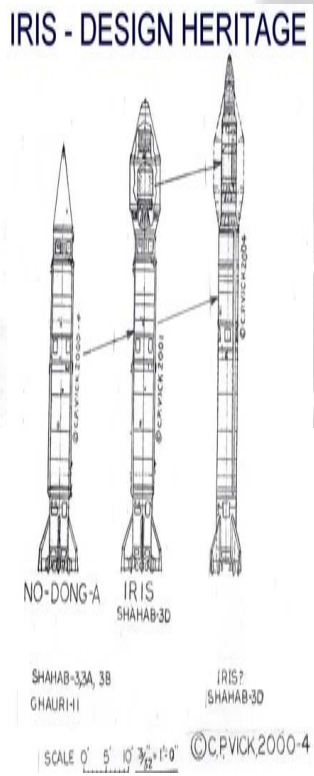
Chemical, Biological, Radiological.

Not just Nuclear

Iran's Current Delivery Assets

- **Scud B/C:** up to 18+ launchers, 300 missiles (IISS); 200 Scud B and 150 Scud C (CNS); distributed among three to four battalions, which form one Shahab brigade.
- **Shaheen-1/Shaheen-2:** (operational status unclear)
- **Su-24 MK:** 30 export versions in inventory
- **MiG-29 A/UB:** 25 export versions in inventory (for training)
- **F-4D:** 65 Phantoms in inventory
- **F-14**: 25 in inventory
- **R-27/SS-N-6:** A German intelligence report stated that Iran obtained BM-25 missiles from North Korea with an operational range of over 2,500 km. Given that BM-25 is the name for the Soviet Katyusha, an MRLS system, it has been assumed that the report referred to the SS-N-6 (Sawfly) missile.
- **Jury Rigged ASM or cruise**
  - Alleged procurement of AS-15 Kent with 3,000 km range and 410 kg payload

Iranian Missile Program

Shahab-3	No Dong	Shahab-4	Variant	IRIS
				
Range 1,300	1,300	2,000	2,000	3,000
Payload ~1,000	700-1000	?	700	~1,000
IOC 2002	?	?	?	2005

Stages of Development of Iran's Missiles

Designation	Stages	Progenitor Missiles	Propellant	Range (Km)	Payload (Kg)	IOC (Year)	Inventory
Mushak-120	1	CSS-8, SA-2	Solid	130	500	2001	?
Mushak-160	1	CSS-8, SA-2	Liquid	160	500	2002	?
Mushak-200	1	SA-2	Liquid	200	500	NA	0
Shahab-1	1	Soviet SSN-4, N Korean SCUD B	Liquid	300	987-1,000	1995	250-300
Shahab-2	1	Soviet SSN-4, N Korean SCUD C	Liquid	500	750-989	?	200-450
Shahab-3	1	N Korea Nodong-1	Liquid/pos. solid	1,300	760-1,158	2002	25-100
Shahab-4	2	N Korea Taep'o-dong-1	Liquid	3,000	1,040-1,500	NA	0
Ghadr 101	multi	Pakistan Shaheen-1	Solid	2,500	NA	NA	0
Ghadr 110	multi	Pakistan Shaheen-2	Solid	3,000	NA	NA	0
IRIS	1	China M-18	Solid	3,000	760-1,158	2005	NA
Kh-55	1	Soviet AS-15 Kent, Ukraine	jet engine	2,900-3,000	200kgt nuclear	2001	12
Shahab-5	3	N Korea Taep'o-dong-2	Liquid	5,500	390-1,000	NA	0
Shahab-6	3	N Korea Taep'o-dong-2	Liquid	10,000	270-1,220	NA	0

Source: Adapted from Iran Special Weapons Guide, GlobalSecurity.org, available at: http://www.globalsecurity.org/wmd/world/iran/missile.htm

Shahab-3 MRBM: Chronology I

- **October 1997:** Russia began training Iranian engineers on missile production for the Shahab-3.
- **1998:** Iran began testing its own Shahab-3s. Problems with finding or making an advanced guidance system hindered many of their tests, however. Meanwhile, Iran begins experimenting with the Shahab-4.
- **July 23, 1998:** Iran launched its first test flight of the Shahab-3. The missile flew for approximately 100 seconds, after which time it was detonated. It is not known if it malfunctioned, or because the Iranians did not want to risk discovery.
- **July 15, 2000:** Iran had its first successful test of a Shahab-3.
- **Summer, 2001:** Iran began production of the Shahab-3.
- **July 7, 2003:** Iran completes final test of Shahab-3. The missile is seen in Iranian military parades and displayed openly.
- **October, 2003:** Iran claimed it was abandoning it was Shahab-4 program, citing that the expected increase in range (2,200 to 3,000km) would cause too much global tension.
- **Late 2003:** Some sources indicated that Iran had begun only limited production of the Shahab-3.
- **August 11, 2004:** Iran decreases the size of the Shahab-3 warhead, making a move towards the fete of being able to mount a nuclear warhead to a Shahab-3. At this point, the modified Shahab-3 is often referred to as the Shahab-3M.
- **October 2004:** Iran announced that it extended the range of the Shahab-3 to 1,200 miles. A version of this extended-range missile has been referred to as Shahab-4.
- **May 31, 2005:** Iran claimed that Iran successful tested a new missile motor using solid-fuel technology with a range of 2000 km.

Shahab-3 MRBM: Chronology II

- **September 2005:** Two Shahab-3 missiles with triconcic warheads were displayed at a parade. These missiles were believed to be new variants of the Shahab-3.
- **February 16, 2006:** Iran is believed to have successfully completed four successful missile test launches this year, including one of a Shahab-3 and a Shahab-4 missile with ranges of 1,300 kilometers and 2,200 kilometers respectively.
- **April 7, 2006:** The *London Telegraph* reports that Iran has succeeded in adapting the nosecone of the Shahab-3 missile to deliver a nuclear weapon. Allegedly, a modified Shahab-3 could carry the Pakistani version of a nuclear warhead and it is rumored that Iran possesses this design.
- **November 23, 2006:** It was reported that Iran for the first time fired Shahab-3 missiles in an exercise in early November. Allegedly, a Shahab-3 version with a range of **1,900 km** (with cluster bombs) was fired, and a senior IRGC commander stated that the missile had a CEP of a few meters.

Shahab-3 Profile

- Shahab-3:
  - approximate range: 1,300-2,000km.
  - It carries a 750-989-1,158kg warhead.
  - It has a height of 16m,
  - a stage mass of 15,092,
  - a dry mass of 1,780-2,180,
  - a propellant mass of 12,912.
- Shahab-3's accuracy and reliability are uncertain:
  - If the system used older guidance technology and warhead separation methods, its CEP could be anywhere from 1,000 to 4,000 meters.
  - If it uses newer technology, such as some of the most advanced Chinese technology, it could have a CEP as low as 190-800 meters.

Shahab-3 Key Developments I

- The **Shahab-3** requires numerous launching support vehicles for propellant transport and loading and power besides its Transport Erector Launcher (TEL)
- **Shahab-3** is also slow in setting up, taking several hours to prepare for launch. Allegedly, the missile requires a one hour-long exposure for refueling before launch.
- US claimed that Iran attempting to modify the **Shahab-3** missile to deliver a "black box," i.e. nuclear warhead?
- **Shahab-3** is in mass production, but:
  - The new "bottle neck" warhead made the **Shahab-3M** more accurate and capable of air-burst detonations. The smaller warhead also increased the range.
  - The Shahab-3 with the solid fuel source created yet another variant of the Shahab-3 series, the **Shahab-3D**, or **IRIS** missile.

Shahab-3 Key Developments II

- Reportedly, Chinese technical assistance is required to advance Iran's solid-fueled missile production capabilities.
- New Shahab-3 with triconcic warheads will likely be the future means of delivery of choice.
- Allegedly, Iran has begun a program to fit a nuclear warhead on a Shahab-3 (project 111).
- Iran is believed to have developed a new TEL that can erect a fueled missile, thereby reducing the exposure time of the missile (see above).

Other Missile Developments

- Some sources claim that Iran has begun a new missile development project (project *Koussar/Kowsar*) to develop an IRBM
- Teheran is suspected to have acquired a North Korean SLBM, which in return was reverse-engineered from a Russian SS-N-6.
- Iran is believed to have transformed this missile into a land-based IRBM. According to unconfirmed reports, Iran tested this missile in January 2006.

Assessment of Iran's Delivery Systems

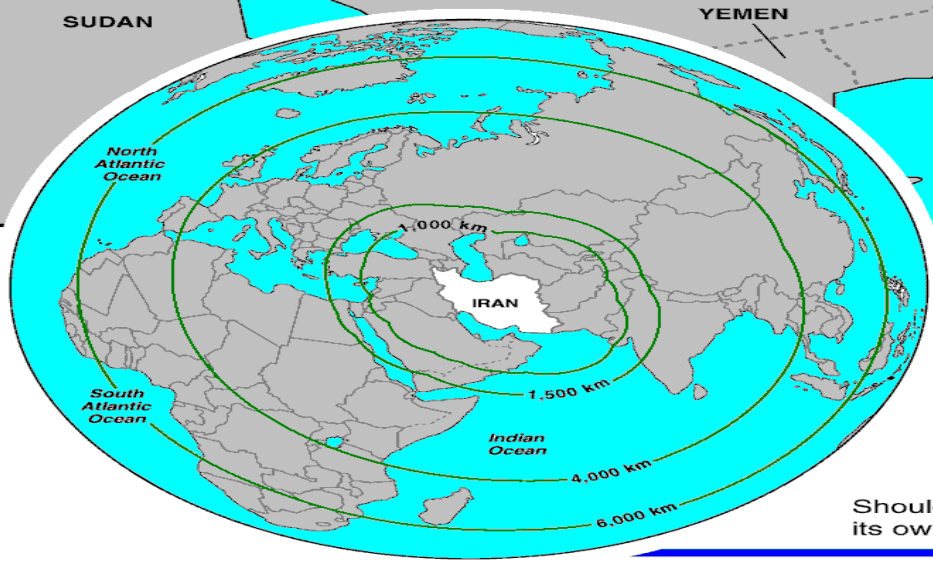
- **Iran missiles are:**
  - Missile Technology more advanced than its nuclear capabilities,
  - Too inaccurate to be used for conventional attacks,
  - Cruise missiles, solid fuel, accuracy, reliability, warhead design key uncertainties,
  - But, technology is getting more advanced by the day.
- The former Director of the Nonproliferation Center at Central Intelligence Agency (CIA), Gordon Oehler, said "If someone has a good idea for a missile program, and he has really good connections, he'll get the program through….But that doesn't mean there is a master plan for nuclear weapon."

US Estimates of Iran's Missile Program

- **DIA (2005):** "We judge Iran will have the technical capability to develop an ICBM by 2015. It is not clear whether Iran has decided to field such a missile. Iran continues to field 1300-km range Shahab III MRBMs capable of reaching Tel Aviv. Iranian officials have publicly claimed they are developing a new 2000-km-range variant of the Shahab III. Iranian engineers are also likely working to improve the accuracy of the country's SRBMs."

- **CIA (2004):** "Iran's ballistic missile inventory is among the largest in the Middle East and includes some 1,300-km-range Shahab-3 medium-range ballistic missiles (MRBMs) and a few hundred short-range ballistic missiles (SRBMs)-including the Shahab-1 (Scud-B), Shahab-2 (Scud C), and Tondar-69 (CSS-8) - as well as a variety of large unguided rockets. Already producing Scud SRBMs, Iran announced that it had begun production of the Shahab-3 MRBM and a new solid-propellant SRBM, the Fateh-110. In addition, Iran publicly acknowledged the development of follow-on versions of the Shahab-3. It originally said that another version, the Shahab-4, was a more capable ballistic missile than its predecessor but later characterized it as solely a space launch vehicle with no military applications. Iran is also pursuing longer-range ballistic missiles."

Estimated Ranges of Current and Potential Iranian Ballistic Missiles



IRAN

Current Missile Delivery System	Range (km)	Source
CSS-8	150	China
SCUD B	300	Libya; North Korea
SCUD C	500	North Korea

Potential Missile Delivery System	Range (km)	Potential Source
No Dong	1,000	North Korea
Taepo Dong 1	More than 1,500	North Korea
Taepo Dong 2	4,000–6,000	North Korea

Should Iran receive long range missiles from North Korea, or develop its own, it could threaten a much wider area.

Iran's Nuclear Program:

Iranian Force Structure and Employment Options

Iran's Evolving Force Posture

- "Bomb in basement:" Threatened or real
- Conceal weapons: air, missile, or covert delivery armed only when necessary
- Test or testing, proven and evolving capability
- Deployed, armed missile and air capability
- Launched or working, launched under attack quick reaction alert, ride out.
- Countervalue (cities), counterforce (military), or both
- Proxy or cover delivery

The "Intangibles" of Iranian Force Development

- Weapon of deterrence and intimidation, how far can you go?
- Testing safety, reliability, size, height, fissile materials, type, yield
- Bomb and warhead capability
- Targeting doctrine, escalation: counter force, counter value, existential
- Accuracy and reliability vs. yield and target choice
- Effect prompt vs. delayed height of burst, thermal vs. blast vs. radiation
- Survivability
- C4I/BM: Plans vs. reality, damage assessment, situational awareness, perception of enemy

Iran's Nuclear Program:

US Military Options

Limited US Attacks

- 16-20 Cruise missiles and sorties
- 2-3 major facilities damaged or destroyed—but limited value assets
- Technology base survives; much of equipment
- Drive deep underground, better disperse, conceal, and compartment
- Deter and delay vs. mobilize and provoke
- International reaction

Major US Attacks

- 200-400 cruise missiles and sorties
- Hit all suspect facilities for nuclear, missile, BW, and C4I/BM
- Knock out SAMS, sensors, C4I/BM for future freedom of action
- Technology base survives; some equipment
- Drive Deep underground, disperse and conceal
- May drive to biological weapons covert delivery
- Deter and delay vs. mobilize and provoke
- International reaction

Delay and Then Strike

- More chance of "smoking gun" and international consensus
- Iran must commit major resources, create high value targets
- More flexibility to broadening to hit hostage? targets: power, refineries, military industries, etc.
- Risk of unanticipated Iranian break out
- Dispersal and sheltering may be much better
- Allied and regional reactions?

Ride Out Iranian Proliferation

- Missile defenses
- US guarantees of extended deterrence
- Preemptive open at constant combat readiness
- Allied/Regional proliferation
- Israel declared options
- Offer security guarantees
- Rely on multilateral non-proliferation regime

Iran's Nuclear Program:

Asymmetric Counterthreats

Possible Iranian Reaction?

- Retaliate against US forces in Iraq and Afghanistan covertly and/or overtly (Worst case: Shahab-3 missiles armed with CBR warheads)
- Use asymmetric capabilities to attacks US interests and forces in the region
- Attack US naval forces stationed in the Gulf with anti-ship missiles
- Attack Israel with missile attacks possibly with CBR warheads
- Escalate attacks by Hezbollah or Hamas against Israel
- Retaliate against energy targets in the Gulf and attack the flow of oil through Gulf and out of Strait of Hormuz
- Cut off Iranian oil to hurt the global and US economy
- Covert attacks against US or Israeli interests by its intelligence, Qods, and IRGC assets.

Iranian Asymmetric Capabilites

- **IRGC:**
  - 125,000 strong (100,000 ground,20,000 naval, 5,000 marines)
  - Large intelligence and unconventional war capabilities
  - 5000 men are assigned to unconventional warfare
  - One Special Forces division
  - Controls Iran's strategic missile force
- **Qods Forces:**
  - Directly controlled by Khameni
  - Assigned to deal with foreign proxies.
  - Has directorates for Iraq; Lebanon, Palestine, and Jordan; Afghanistan, Pakistan, and India; Turkey, the Arabian Peninsula; the Asiatic republics of the FSU, Western Nations and North Africa
  - "sections" in many Iranian embassies

The Iranian Counterthreat

- Hardened extremist nationalism
- Support of terrorists, use as proxies
- Destabilization of Iraq, Arab-Israeli Conflict, and Afghanistan
- Shift to biological, high risk concealed nuclear
  - LOW, LOA, proxy, false flag.
  - Concealed P-2 centrifuge and UF6 development, exploitation of Chinese Weapons Designs
- Threaten Gulf oil traffic with mines, subs, SSNs, IRGC Naval Branch.
- Conventional Resistance: 540,000 in forces, 1,600 tanks, 1,400 OAFUs, 3,000 arty, 3 subs, 59 surface ships, 311 combat aircraft, 245 major SAMs.
- Possible impact on global oil markets
- Promise to fight “never-ending” guerilla war if attacked

Iran's Nuclear Program:

Conclusions

Conclusion: What We Don't Know

- There is no simple or reliable way to characterize Iran's ability to acquire nuclear weapons and the means to deliver them.
- El Baradei said: "We at the IAEA lack conclusive evidence. We have yet to see a *smoking gun* that would convict Tehran. I can make assumptions about intentions, but I cannot verify intentions, just facts,"
- It is hard to discuss the case against Iran without raising questions about the mistakes the US and UK made in characterizing Iraq's efforts to acquire weapons of mass destruction. The US in particular, has problems in convincing the international community that Iran is a grave threat to global security.

Conclusion: What We Know

- There are strong indications of an active Iranian interest in acquiring nuclear weapons since the time of the Shah, and that Khomeini revived such efforts after Iraq invaded Iran and began to use chemical weapons.
- The EU-3 and the US claim that Iran is actively pursuing nuclear weapons
- Iran's missile development problems only make sense if they are equipped with CBRN warheads.
- Analyses and estimates are cloaked with uncertainty
- There are no risk-free options: military, sanctions, do nothing