

Iran's Progress to the Bomb: Changes since the Interim Deal

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How close is Iran to the bomb and what has changed since the interim deal (formally: the Joint Plan of Action – JPA) was signed? The answers to both questions are seemingly simple: according to reliable sources in Israel, Iran is a decision away, plus three to six months for achieving the capability to detonate a nuclear device.¹ Changes to the technical assessment since the interim deal was concluded are minor. Nonetheless, one may assume that since the interim deal was signed in November 2013, Iran has moved farther away from making such a decision, at least as long as no extraordinary events occur that would accelerate such a decision.

Although Iran has a civilian nuclear program for energy production and industrial and medical uses, there is no doubt that it is developing a parallel program designed to attain military nuclear capabilities to be realized if and when the leadership decides to produce nuclear weapons. This essay surveys Iran's potential in the military nuclear realm, the possible motives for deciding to produce a nuclear device, and the effect of the interim deal on both Iran's technical potential and its drive to produce a nuclear weapon.

Iran's Technical Potential

Fissile Material

In its first phase, Iran's military nuclear program is based on the use of uranium isotope 235, found in nature at a concentration of 0.7 percent and enriched to a military grade of 90 percent, at which point it can serve as the fissile material, i.e., the nuclear material in the core of the nuclear explosive

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device. At a later stage, and after completing the construction of a heavy water and natural uranium reactor in Arak, the Iranian program will also include the use of plutonium as fissile material. Since this second track is farther from completion, the essay surveys the uranium track more extensively.

As much as is known, Iran has three uranium enrichment facilities: a large installation in Natanz, a smaller installation in Fordow, and an experimental installation (also in Natanz).² At present, the enrichment process is executed by means of gas centrifuges based on an early Pakistani model. Some 9,000 centrifuges of this design are installed in various facilities and are spinning to enrich uranium. As of February 2014, Iran had enriched a significant amount of uranium to a 3.5 percent level, sufficient, if enriched to weapons grade, for making six to eight nuclear bombs, as well an additional amount enriched to a 20 percent level sufficient for one nuclear bomb, if enriched to weapons grade.³

The Explosive Device

There are hints and bits of evidence, including in reports issued by the International Atomic Energy Agency, of Iran working on the development of the explosive mechanism, without which no nuclear explosion is possible. Iran continues to refuse to answer the full range of questions in this regard, instead accusing the world of deception and forgery of the documents discovered. As in the case of Libya, Iran presumably acquired the design of the explosive mechanism from Pakistan, fundamentally a Chinese design tested successfully several times. The work with uranium allows Iran to test the operation of the explosive mechanism using natural uranium, a perfect simulator for the final mechanism, unlike plutonium, which represents a thornier problem for developers. Even if Iran did not obtain the design from Pakistan, there is clear evidence that it worked on the development of the mechanism over a decade ago. Considering Iran's technical capabilities, one cannot assume that Iran does not have a proven design (without fissile material) for a nuclear explosive mechanism. Such a mechanism is sufficient for carrying out a nuclear test or a delivery at any target using primitive means ("a bomb in a container"), not as part of a military arsenal of nuclear weapons for which more development is needed.

The Breakout Methodology

The Mission

Iran's primary task on the road to the construction of a nuclear explosive device is enriching enough uranium to a 90 percent level. Iran will likely only build a bomb if the leadership makes an explicit decision to do so while strictly adhering to the following: secrecy, to the extent possible; maximal speed of execution; acquisition of the other parts of the nuclear program, like the explosive mechanism; a ready means of delivery (should this be the goal of the breakout); and/or preparation of the nuclear test site. Unless these components are in place, it is hard to assume Iran will break out only for the sake of stockpiling fissile material and run the risk of seriously jeopardizing its nuclear ambitions.

Given that Iran has a significant amount of uranium already enriched to 3.5 percent, which constitutes most of the work required for enrichment to 90 percent, further enrichment to this level will not be necessary at the time of breakout. Thus, all enrichment resources can be freed for enrichment to higher levels. Iran has also enriched a certain amount of uranium to 20 percent; this can, without much work, be turned into material enriched to 90 percent. The same centrifuges are used to enrich uranium to weapons grade, though certain changes in the cascading structure (the connections between the centrifuges allowing efficient enrichment) must be made; this is discussed below.

Because Iran's enrichment facilities have many centrifuges – more than those enriching uranium at the beginning of 2014, and include centrifuges of an advanced design that have not yet been used for uranium enrichment – one may assume that the Iranians will use all the potential at their disposal for breakout and rapid uranium enrichment to military grade.

Breakout Time

After the upper echelons in Iran have issued the orders for breakout, the stages are as follows: enriching uranium to weapons grade; turning the enriched gas into metal; casting the metal; machining the metal into the shape of the final core; and integrating the core with the explosive mechanism. The main factor that will determine the time it will take to complete the breakout is the concentration of initial uranium 235. If Iran starts from natural concentration, the enrichment process will require much more time

than if it starts enrichment from even 3.5 percent. There are different time estimates in the literature for a breakout, varying from a few weeks to one year.⁴ If the breakout starts from existing 3.5 percent enriched stockpiles and uses the entire enrichment system known to exist in Iranian facilities, this process would take two to three months. The other stages – making the core and integrating it with the explosive mechanism – would take one to three months, dependent on Iranian readiness. Thus, from the moment the decision is made, breakout time can be grossly estimated at three to six months.

The Effect of the Agreements on Iran's Technical Timetable

The agreements that may affect Iran's potential to break out and make an explosive nuclear device and the particular timetable for that operation, from the start of breakout activity to the completion of the first nuclear device, are the Joint Plan of Action concluded on November 24, 2013 (which went into effect on January 20, 2014) and the document called the Summary, which interprets the JPA.⁵ There are three types of agreements relevant to the matter at hand: agreements that may affect the rate of breakout in the immediate future; agreements that may affect timetables in the long run; and agreements that have no concrete effect on Iran's nuclear plans. This latter category includes the gamut of agreements and understandings between Iran and the IAEA, because the IAEA has very limited powers of supervision. As long as the supervision terms are not significantly expanded, there is no meaningful way to follow up on the Iranian nuclear program, as much of it can be done clandestinely. For the first two categories, paragraphs of the Summary are studied against the real effect on the nuclear program in Iran; for the third category, only general features are noted.⁶

Category A: Direct Impact on Breakout Speed

The only paragraphs with direct impact on the speed of breakout are those discussing uranium enrichment up to 20 percent. Iran has some 400 kg of 20 percent enriched uranium (in the form of uranium hexafluoride, a gas compound). Should it be enriched to weapons grade, this is enough material for at least one explosive core. Iran has moved about half of this quantity to a facility manufacturing nuclear fuel, because this level of enrichment is suitable for use in the Tehran Research Reactor, and converted some of the quantity into uranium oxide. Although the original agreement said

something slightly different, the Summary document states the following about the uranium enriched to 20 percent: uranium enrichment to 20 percent will cease; half of this amount of uranium, in the form of the gas compound, will be diluted to a level of 3.5 percent or less; the process of turning the rest of the material into uranium oxide will continue, as, according to the document, it is unusable for further enrichment. In addition, the centrifuge facilities that served the 20 percent enrichment process will be dismantled.⁷

The only significant part of these decisions is the dilution of about one-quarter of the amount enriched to 20 percent and its restoration to a lower enrichment level. In other words, Iran is left with a hefty amount of uranium enriched to 20 percent, even if it is in the form of uranium oxide.⁸ At the same time, the statement on the latter material's lack of usability is incorrect and misleading.⁹ True, turning it back into a gas needed for enrichment requires certain chemical processes, but these are definitely possible and are known to the Iranians. The effort, especially if all the preparations have been made, is not all that difficult.

Therefore, as long as Iran has a significant amount of uranium gas enriched to 20 percent, it can, almost immediately, start enriching to 90 percent, after the appropriate adjustments are made to the existing cascades. If this happens, the delay to the nuclear program as a whole will be negligible, because Iran will enrich to 20 percent at the same time that it enriches the existing stockpile to military grade. The dismantling of the special facilities mentioned for enriching to 20 percent is not very important, because these served only to increase the rate of enrichment somewhat. Iran will still be able to use existing facilities to that end.

In other words, if at the outset Iran does not have a usable amount of gas enriched to 20 percent, the Iranian breakout will be postponed by about one month.

Category B: Impact on the Longer Term of the Nuclear Program

The details of the agreement include: prohibition on expanding enrichment capabilities to the 3.5 percent level; determination at a later date of the amount of uranium enriched to this level to be left in Iran at the end of the agreement period; restrictions on enrichment R&D; restrictions on continuing construction of the Arak reactor; and the prohibition on establishment of a reprocessing facility for spent fuel in Arak.

Keeping enrichment capabilities to their current limit entails several secondary restrictions: not operating centrifuges that have not yet been in operation, including not operating advanced models of centrifuges; not constructing new enrichment facilities; restrictions on R&D of centrifuges not yet launched; and the production of centrifuges only if needed as replacement for broken centrifuges. Thus, Iran can continue to produce uranium enriched to 3.5 percent at the current pace. The JPA mentioned turning this material into an (allegedly unusable) oxide form, but as far as is known, this has yet to be implemented.

Category C: Agreements with No Direct Bearing on Iran's Breakout Capabilities

In general terms, this category includes IAEA supervision and international inspection of the agreement's execution designed to provide timely warnings if and when Iran decides not to uphold some or all of the agreements. But there are two important aspects of supervision that the agreements fail to touch upon: supervision of the military parts of Iran's nuclear program and the search for facilities, materials, and activities Iran has failed to disclose. Should this lapse not be addressed in the final agreement, the Iranians will, if they choose, be able to undertake concurrent nuclear activities liable to provide them with military nuclear capabilities without a reasonable early warning system.¹⁰

Iran's Political Decisions

Negotiations over the final agreement among the partners to the interim deal – Iran and the P5+1 – began in early 2014. The negotiating period was set to last six months, with an option for extension. The key question is: can the participants drag the talks out indefinitely, and if they can't, what will cause the change and where will change lead? The state of equilibrium will be disrupted in one of the following general scenarios: from Iran's perspective, if the Iranian economy disintegrates, in which case the domestic reality in the country will require a change in the status quo, or if there is a real military and/or political threat against it; from the other parties' perspective, if Iran violates the interim deal, undeclared nuclear facilities are discovered, and/or the military pieces of Iran's military nuclear program are exposed.

On the eve of July 20, 2014, and as the parties agreed to extend the negotiations, the objectives of the sides remained what they had been at the

outset: from the perspective of the major powers, the purpose of the final agreement is to remove the possibility of a quick Iranian nuclear breakout; for its part, Iran is still intent on preserving all of its current capabilities and developing them further. Is there a meeting point among these respective independent goals? From Iran's perspective, a gradual lifting of sanctions to a bearable level would maintain an equilibrium – perhaps not entirely stable, but one that isn't limited by a clear deadline. Iran is also interested in buying time, because the window of opportunity for breaking out – making an explosive nuclear device – narrows with each passing day.¹¹ For their part, the world powers are also not interested in exacerbating the situation, because although they have not drawn any red lines, the situation could deteriorate to the point where they would have to respond with greater severity to the possibility that Iran is arming itself with a nuclear bomb. Should the Iranians feel threatened, they are liable to make the decision to break out and carry out a nuclear test at the earliest possible opportunity. Based on the precedents of India, Pakistan, and North Korea, this could lead to a situation that would be the most stable for Iran. There is hardly any doubt that if Iran is militarily attacked or if it suffers significant damage because of some hostile action, it will try to break out and prove its nuclear capabilities.

All of the above is based on the assumption that the stated policy of not permitting Iran to produce nuclear weapons (proclaimed notably by the United States) is in fact implemented, thereby rendering the question of containing Iran redundant. However, the United States never really declared that containing *the capability* to manufacture nuclear weapons is out of the question, because it is already in existence.¹² Such a situation, should it be agreed upon with Iran, will create stability, but will also be a source for increasing anxiety on the part of the region's countries, especially the Gulf states and Israel.

The Limitations of the Agreements

The agreements refer to acknowledged facilities, their capabilities, and the stocks of known nuclear materials. However, what if Iran has undeclared facilities, activities and materials about which we know nothing? If that is the case, all timetable assessments are incomplete, because despite boasts by US intelligence services that they can discover any fallacy, the possibility of failure is not negligible.¹³ History shows that the past is full of intelligence failures, even in the United States, and that one cannot place absolute trust

in the timely warning abilities of any intelligence system. All of the above also assumes that Iran will not make the decision to break out and prove its capabilities for the sake of prestige or to attain regional hegemony, but those options cannot be ruled out either. The decision making processes in Iran may be technically known, but the rationale behind them is not always crystal clear, and motivations for decisions may not be understandable to the Western mind examining them.

One must not assume that the Iranians, if they make the breakout decision and use the declared materials and facilities, will succeed in hiding the breakout activities and producing the first nuclear bomb for any length of time. But based on past experience it is reasonable to assume that the world's response will be so slow and ineffectual as to be virtually useless, especially when one looks at the North Korean case study and earlier incidents concerning India and Pakistan. It would be very different were Iran to use hidden facilities to make nuclear weapons. In such a case, the world could wake up one morning to discover that Iran has already carried out a successful underground nuclear test.

In conclusion, Iran can take the breakout decision anytime now, and three to six months are needed for producing a nuclear explosive device; the interim deals have, in the best case scenario, delayed the breakout time, for technical reasons, by one month at the most, and further postponed a final reckoning as long as the final agreement negotiations meander along to the satisfaction of all parties involved.

Notes

- 1 Based on a speech made by Defense Minister Yaalon at the INSS annual conference "Security Challenges of the 21st Century," January 29, 2014.
- 2 Given that the entire history of the Iranian nuclear project is replete with instances of subterfuge and concealment, it is impossible to rule out the existence of facilities about which we know nothing. See report by the IAEA from February 20, 2014, <http://isis-online.org/uploads/isis-reports/documents/iaea-iranreport-02202014.pdf>.
- 3 See the analysis by ISIS of the IAEA report in David Albright, Christina Walrond, and Andrea Stricker, "ISIS Analysis of IAEA Iran Safeguards Report," February 20, 2014; http://www.isisnucleariran.org/assets/pdf/ISIS_Analysis_IAEA_Safeguards_Report_20February2014-Final.pdf.
- 4 Patrick Migliorini, David Albright, Houston Wood, and Christina Walrond, "Iranian Breakout Estimates, Updated September 2013," ISIS Report, October 24, 2013, http://isis-online.org/uploads/isis-reports/documents/Breakout_Study_24October2013.pdf.

- 5 “Joint Plan of Action,” Geneva, November 24, 2013. See also “Summary of Technical Understandings Related to the Implementation of the Joint Plan of Action on the Islamic Republic of Iran’s Nuclear Program,” The White House, Office of the Press Secretary, January 16, 2014, <http://www.whitehouse.gov/the-press-office/2014/01/16/summary-technical-understandings-related-implementation-joint-plan-action>.<http://www.theguardian.com/world/interactive/2013/nov/24/iran-nuclear-deal-joint-plan-action>.
- 6 The Summary does not include all the paragraphs of the agreement. Some remain classified for unclear – and worrisome – reasons.
- 7 Although there is no difference between centrifuges that enrich to a low level and those that enrich to a high level, the structure of the cascades – the number of centrifuges in each cascade and the pipes connecting one centrifuge to another – may differ for different levels of enrichment; these pipes must be rearranged.
- 8 The statement that many accept and cite – that Iran does not have a significant amount of uranium enriched to 20 percent – is both wrong and misleading. See Paragraph 4 in the main findings of the report, David Albright, Paulina Izewicz, Andrea Stricker, and Serena Kelleher-Vergantini, “ISIS Analysis of IAEA Iran Safeguards Report,” May 23, 2014, http://www.isisnucleariran.org/assets/pdf/ISIS_Analysis_IAEA_Safeguards_Report_23May2014-finaldoc.pdf.
- 9 “Conversion and Deconversion,” World Nuclear Association, September 2013, <http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Conversion-Enrichment-and-Fabrication/Conversion-and-Deconversion/>.
- 10 Emily B. Landau, Ephraim Asculai, and Shimon Stein, “Atomic Amnesia: The Forgotten Military Aspects of Iran’s Nuclear Program,” *National Interest*, June 3, 2014, <http://nationalinterest.org/feature/atomic-amnesia-the-forgotten-military-aspects-iran%E2%80%99s-nuclear-10585>.
- 11 William C. Witt, Christina Walrond, David Albright, and Houston Wood, “Iran’s Evolving Breakout Potential,” ISIS Report, October 8, 2012; http://isis-online.org/uploads/isis-reports/documents/Irans_Evolving_Breakout_Potential.pdf.
- 12 Nick Simeone, “DoD Official: U.S. Will Not Allow Iran to Acquire Nuclear Weapon,” American Forces Press Service, February 11, 2014, <http://www.defense.gov/news/newsarticle.aspx?id=121643>.
- 13 Senate Statement by James R. Clapper, Director of National Intelligence, January 29, 2014. <http://www.intelligence.senate.gov/140129/clapper.pdf>.