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PREVENTING A NUCLEAR-ARMED IRAN: Requirements for a Comprehensive Nuclear Agreement

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INTRODUCTION AND SUMMARY

A fter a dozen-year standoff between Iran and the international community over the Iranian nuclear program, negotiations are underway between representatives of Iran, on the one hand, and the P5+1 countries (the United States, the United Kingdom, France, Germany, Russia, and China) and European Union, on the other, on a comprehensive agreement aimed at ensuring that an Iranian nuclear program declared to be devoted to peaceful purposes will not be turned into a program for producing nuclear weapons.

An Iranian nuclear crisis has been building for a long time. Since the early 2000s, we have witnessed failed negotiations between Iran and the EU3 (U.K., France, Germany); the exposure of several covert Iranian nuclear facilities; the discovery by the International Atomic Energy Agency (IAEA) of numerous Iranian safeguards violations; a formal finding of Iranian non-compliance by the IAEA's Board; the U.N. Security Council's adoption of sanctions and the demand that Iran suspend uranium enrichment; Iran's defiance of the Council and failure to address IAEA concerns about past nuclear weapons-related activities; years of unproductive talks between Iran and the EU/P5+1; and the imposition by the United States and a broad international coalition of crippling sanctions against Iran. All the while, Iran steadily ramped up its nuclear program-to the point where it now has the enrichment capacity, should it decide to build nuclear weapons, to produce enough weapons-grade uranium for a first nuclear bomb in about two months.

In June 2013, two key factors created conditions more favorable for resolving the Iranian nuclear crisis—the devastating impact on Iran's economy of international sanctions, especially oil and banking sanctions, and the election as president of pragmatic regime insider Hassan Rouhani, who views an agreement on the nuclear issue as a crucial means of ending the sanctions, rebuilding Iran's economy, and overcoming its international isolation.

P5+1/EU negotiations with Rouhani's new team supplemented and accelerated by secret U.S.-Iranian engagement—led to agreement in November 2013 on a Joint Plan of Action (JPA), a six-month interim agreement designed to provide the time and space needed to work out a final, comprehensive solution. The JPA halts further progress in all significant aspects of Iran's nuclear program, reverses progress in a few areas, and provides Iran modest relief from certain sanctions. It took effect on January 20, 2014, and has so far operated smoothly.

Intensive negotiations are now proceeding on the comprehensive agreement, with all parties seemingly committed to trying to reach agreement by the time the JPA expires on July 20. But key differences exist on the requirements of an acceptable deal, not just among negotiators at the table but also among key players outside the negotiations. Israeli officials and a number of members of Congress are demanding the elimination of key elements of Iran's nuclear program, and the Obama Administration and its supporters counter that several of those demands are neither achievable nor necessary for a sound agreement.

This paper recommends key requirements for an acceptable agreement—requirements designed to

prevent Iran from having a rapid breakout capability and to deter a future Iranian decision to build nuclear weapons. A crucial issue in the negotiations, especially for the Iranians, is how the lifting of nuclear-related sanctions, as agreed in the JPA, will be phased. However, this paper focuses on the negotiating requirements of the P5+1, primarily the United States, and does not address the sanctions-lifting side of the negotiating equation.

IRAN'S INTENTIONS TOWARD NUCLEAR WEAPONS

While the evidence is strong that, at least until 2003, Iran actively worked to develop the capability to produce nuclear weapons, its intentions for the future are far less clear. The U.S. Intelligence Community (IC) believes that in 2003 Iran-concerned about international reactions to discovery of Iranian secret facilities and fearful of a U.S. military attack after the U.S. invasion of Iraq-disbanded its organized program of nuclear weapons-related research and suspended a key part of its weapons program, the part aimed at developing a nuclear explosive device. (It continued its fissile material production and missile delivery system efforts.) Since then, the IC assesses that Iran has kept open the option to acquire nuclear weapons but has not decided to restart its organized weapons program. The IC repeatedly states that it does not know whether Iran will eventually decide to build nuclear weapons.

Within Iran's strategic elite, despite sharp ideological differences on such issues as engagement with the United States, there appears to be a consensus in favor of continuing the current nuclear program, keeping a future nuclear weapons option open, and deferring any decision on crossing the nuclear threshold and acquiring nuclear weapons.

If these assessments are correct, Iran's ultimate intentions toward nuclear weapons are not yet fixed. Future decision-making on nuclear weapons is likely to depend on a wide range of domestic and international factors, including the risks Iran would take and the price it would pay if it actively pursued nuclear weapons. By constraining the technical pathways toward nuclear weapons and making any pathways as transparent and time-consuming as possible, a nuclear agreement could increase the perceived risks to Iran of opting to build nuclear weapons.

DETERRING A DECISION TO BUILD NUCLEAR WEAPONS

Ideally, an agreement would completely eliminate Iran's capability ever to produce nuclear weapons. But given its current technical know-how, its handson experience, and its material and financial resources, it already has that capability. Even if it could somehow be persuaded to dismantle its enrichment facilities and export all its stocks of enriched uranium, it would be capable of reconstituting its nuclear program. It would just be a matter of time and political will.

However, preventing the Iranians from acquiring nuclear weapons does not depend on eliminating their capability ever to produce them or on dismantling their enrichment facilities. The goal of preventing a nuclear-armed Iran can be achieved by deterring an Iranian political decision to build nuclear weapons—by making it clear that any such decision would be extremely costly. An agreement that could realize that goal—and serve the security interests of the United States and its friends in the Middle East —would meet the following requirements:

- It would provide confidence that any steps to abandon constraints and move toward nuclear weapons, whether at covert or declared facilities, are detected at the earliest possible stage.
- It would ensure that the period of time between the detection of such breakout steps and the production of sufficient weapons-grade fissile material to fabricate a nuclear weapon is long enough to enable the international community, especially the United States, to take decisive action to prevent the acquisition of sufficient nuclear material.

• Primarily as a result of actions taken and policies adopted outside the scope of the agreement, it would convey clearly and credibly to Iran's leadership that any effort to abandon constraints and pursue nuclear weapons would be met with a firm international response that would be highly costly to Iranian interests.

EARLY DETECTION OF BREAKOUT

If the international community is to act quickly enough to stop any breakout attempt, it must detect breakout activities, whether conducted covertly or at declared facilities, at the earliest possible stage. Given Iran's track record of non-compliance with its safeguards obligations and inadequate cooperation with the IAEA, this would require a robust and specially devised monitoring system:

- The IAEA will require monitoring authorities and procedures not necessarily found in any existing safeguards agreements. The IAEA Board of Governors and, if necessary, the U.N. Security Council can provide any needed authorization.
- In particular, monitoring arrangements will need to go well beyond those contained in the Additional Protocol (AP), at least for an agreed period of time. To deter and detect covert activities, monitoring measures more rigorous that those in the AP will be needed for centrifuge production and storage, uranium mining and milling, nuclear-related imports, and other areas.
- Measures already authorized under the existing IAEA-Iran safeguards agreement should be more fully utilized, including depending on the risks posed by different kinds of facilities—more frequent and wider access by IAEA personnel, more extensive installation of surveillance and containment equipment, and greater use of remote, real-time monitoring.

- Unique inspection procedures should be devised that balance legitimate Iranian interests (e.g., shrouding sensitive equipment unrelated to the agreement) with the need for effective verification, including unannounced inspections and access to military installations.
- Procedures should be developed to ensure that compliance uncertainties or anomalies are investigated and resolved expeditiously and that any difficulties in promptly resolving questions of compliance will be rapidly escalated, including to the IAEA Board and the Joint Commission involving Iran, the EU, and the P5+1.
- Resolving IAEA concerns about the "possible military dimensions" (PMD) of Iran's nuclear program is essential to any solution to the Iran nuclear issue. Iran's full and detailed admission of all past nuclear weapons-related activities is neither achievable (given its religion-based claims of never having pursued nuclear weapons) nor necessary. The IAEA should prioritize its investigation to focus most heavily on issues that are most relevant to a possible covert program and that could best contribute to a nuclear explosive capability, with a view to providing confidence that weapons-related activities will not continue in the future. If Iran has not adequately resolved the IAEA's PMD concerns by the time the comprehensive agreement is reached, the agreement's phased lifting of sanctions could be designed to maintain significant sanctions until the PMD issues are resolved to the IAEA's satisfaction.

LENGTHENING THE BREAKOUT TIMELINE

A second requirement for deterring an Iranian decision to build nuclear weapons is to lengthen the breakout timeline. Iranians must know not only that breakout activities will be discovered at an early stage but also that the time they would need to produce enough fissile material for a bomb will be long enough to enable the international community to intervene to stop them.

How long should the breakout timeline be? In the event breakout activities are detected, the international community would probably turn initially to diplomatic and other non-military approaches in an effort to get Iran to reverse course. If military means eventually had to be used, their legitimacy would depend heavily on whether such approaches had first been exhausted. Non-military steps—including efforts in the IAEA Board and U.N. Security Council, and the adoption of new sanctions—could take many months, and a case can be made that the comprehensive agreement should ensure that the breakout timeline is long enough to accommodate such steps.

The key goal, however, is to deter Iran—to ensure that it believes it would not have enough time to produce the fissile material for a nuclear weapon before others could intervene to stop it. It may factor into its calculations the time non-military steps might take. But it could never be sure how long it would have for its race to the bomb, including whether military force would be used soon after detection.

There is no definite answer to the question of how long the breakout timeline should be. Deterrence will depend on a combination of factors. Breakout time is important because the longer the time it takes to produce enough material, the greater the prospect of detection and the greater the opportunity for decisive intervention. But if Iran believes that its breakout activities are very likely to be detected at an early stage and that it will pay a very high price as a result, then the time it would need to produce the required material may be a less important factor.

Clearly, the longer the breakout timeline, the better —and speculation in non-governmental circles has focused on the period of six to twelve months. But the adequacy of a particular timeline will depend on other key aspects of an agreement. If effective monitoring measures increase the likelihood of early detection and credible signals about strong responses to detection increase the perceived costs of breakout, then an acceptable timeline can be shorter, and vice versa. In the end, it will come down to a political judgment about what combination of factors will serve as an effective deterrent to an Iranian breakout decision.

Enrichment breakout. In the centrifuge enrichment area, the breakout timeline depends on the numbers and types of centrifuges used as well as on the amounts and enrichment levels of enriched uranium stocks fed into those centrifuges. In general, the fewer the centrifuges, the less advanced the type of centrifuge, and the smaller the amount of enriched uranium stocks, the longer the breakout timeline.

A timeline of between six and twelve months could be achieved by limiting centrifuges to between 2000 and 6000 first-generation IR-1 Iranian centrifuges (or significantly lower numbers if more advanced IR-2m centrifuges are included) and reducing enriched uranium stocks, especially at the near-20 percent level. Any given timeline can be achieved using many different combinations of centrifuges and enriched uranium stocks; so there are trade-offs between constraints on centrifuges and constraints on stocks that will enable negotiators to consider a range of possible solutions. But whatever numbers and combinations are chosen, lengthening the breakout timeline to between six and twelve months would require substantial reductions in current Iranian centrifuge and stockpile levels.

Ensuring a relatively long breakout timeline would also require constraints on centrifuge research and development. If produced covertly, high performance centrifuges would provide the ability to construct relatively small and concealable covert enrichment facilities and to produce weapons-grade uranium much faster than less advanced types. Limits should therefore be placed on the performance levels of centrifuges permitted in Iran's R&D program, although those limits might be raised over time.

To address concerns about breakout at the Fordow enrichment plant, the facility should be converted into an R&D facility for testing more advanced centrifuges and conducting other types of nuclear research. Although small centrifuge cascades would be permitted for R&D purposes, currently installed centrifuges would be removed to monitored storage.

Plutonium breakout. Concerns regarding the plutonium path focus on the Arak IR-40 reactor, which the Iranians claim is intended to produce medical isotopes but which is optimized for the production of plutonium, especially because it is fueled with natural uranium and is designed to operate at an unnecessarily high power level (40 MW). Although the IR-40 is not yet completed and therefore poses a less immediate breakout threat than the enrichment route, it could eventually produce enough plutonium for one nuclear weapon each year.

The solutions probably preferred by Iran—banning a facility capable of separating plutonium from spent fuel and shipping spent fuel out of Iran after its radioactivity has sufficiently dropped—are necessary but not sufficient to deal with breakout. In addition, changes should be made in the reactor's design to greatly reduce its production of plutonium, especially to fuel it with enriched uranium and reduce its power level. The best solution would be to convert it to a light water-moderated research reactor, but other options requiring less extensive modification of the reactor are being explored. Fueling the reactor with enriched uranium would make it more capable of producing medical isotopes than the original IR-40.

Focusing on practical needs. Divergent U.S. and Iranian positions on the size and composition of Iran's nuclear program—with the United States calling for large reductions and Iran seeking to maintain and even expand existing capabilities—create the impression that there is a fundamental incompatibility between the requirement to lengthen breakout time and the requirements of Iran's civil nuclear energy program. But if one looks closely at the realistic needs of Iran's civil program, those two sets of requirements do not seem so at odds.

Indeed, Iran's actual need to produce enriched uranium for fueling reactors is quite limited, at least in the near and middle terms. It has already produced enough near-20 percent enriched uranium for the Tehran Research Reactor. Russia is providing enriched fuel for the Bushehr power reactor it sold Iran and is willing to supply fuel for any future power reactors it sells Iran. Moreover, any power reactor that Iran may wish to construct and fuel indigenously is at least 15 to 20 years away—and even then, it would be cheaper to do what many countries with advanced nuclear programs do: rely on the international market to acquire enriched uranium.

Iran would need enrichment capability if it agreed to convert the Arak IR-40 reactor to be fueled with enriched, rather than natural, uranium. Several years down the road, it would also need enriched uranium to fuel the 10 MW light water research reactors it has notified the IAEA it intends to build. However, the enriched uranium needs of these research reactors are low, much lower than the needs of power reactors, and can be met with the limited enrichment capacity required to satisfy P5+1 concerns about breakout.

In any discussion with the Iranians about the practical needs of their program, they are likely to start off by greatly inflating their needs as a way to justify retaining and even expanding their nuclear infrastructure. If they are determined to ensure short breakout times, the discussions will not get very far. But if the Iranians are serious about having just a civil nuclear program, they may come to realize that their actual needs are compatible with the limits that the P5+1 require to ensure against a rapid breakout capability.

Bringing them to that conclusion could be facilitated if the P5+1 offered to cooperate with Iran in the civil nuclear area. They could assist Iran to design, construct, and fabricate the fuel for the modern light water research reactors it plans to build. Russia could offer to train Iranians in fabricating fuel for Bushehr, eventually enabling them to produce the fuel themselves in Iran. P5+1 countries might also offer to help design an indigenous power reactor, provided that Iran could agree that such a reactor would use enriched uranium acquired on the world market or from a multinational enrichment facility outside Iran in which Iranians participated.

SIGNALING A STRONG INTERNATIONAL RESPONSE TO BREAKOUT

To deter a future Iranian breakout decision, it is not enough to detect breakout at an early stage and lengthen the breakout timeline. A third requirement is to convey clearly to Iran's leaders that any attempt to abandon constraints and pursue nuclear weapons would be met with a firm international response that would be highly damaging to Iran's interests. Among the actions needed to convey that message—most of which would be taken outside the negotiations soon after an agreement had been reached—are the following:

- The U.N. Security Council should adopt a resolution stating that, in the event of violations of the comprehensive agreement that threaten international peace and security (e.g., breakout activities), the Council would meet urgently to adopt measures necessary to head off the threat—or similar formulations that would convey the intention of the Council to act promptly to take whatever measures are necessary to prevent a successful breakout.
- The Congress, in adopting any legislation needed to meet the requirement of the comprehensive agreement to lift nuclear-related sanctions, could provide that, in the event of an Iranian attempt to break out and acquire nuclear weapons, the president would be required to notify the Congress immediately, at which point the Congress would act promptly to enact new legislation that would restore the old sanctions and put in place additional ones.
- The Congress should take legislative action to give the president prior authorization to use military force in the event of clear evidence that Iran has taken steps to abandon the agreement and move toward producing nuclear weapons. The president would be required to report immediately to the Congress on the reasons for using military force,

including evidence that Iran had violated the agreement and was moving toward the production of nuclear weapons.

The U.S. administration should indicate publicly that, in the event of a future breakout, it would work actively not only to put additional U.S. sanctions in place but also to persuade others in the international community to join in restoring old sanctions and putting in place additional ones. While making clear that the United States would do everything possible to try to reverse a breakout attempt through peaceful means, the president should state publicly that, in the event of clear evidence of an Iranian effort to break out and if other efforts prove unsuccessful, he would be prepared to use force to stop Iran from building a nuclear weapon.

OTHERS ELEMENTS OF A COMPREHENSIVE AGREEMENT

Duration of the agreement. The issue of duration is especially important because, after the comprehensive agreement expires, Iran will be treated the same way as any non-nuclear weapon state party to the Non-Proliferation Treaty (NPT). With the U.S. wanting a long duration (about 20 years) and Iran wanting a short one (less than five), agreement on a single duration will be difficult. The parties might therefore agree to adopt different durations for different provisions. Some could be permanent (e.g., reprocessing ban); others could have a limited duration (e.g., detailed reporting of imports); and still others could be subject to review and adjustment (e.g., centrifuge R&D limits).

Ballistic missiles. With Security Council resolution 1929's mandate that Iran "not undertake any activity related to ballistic missiles capable of delivering nuclear weapons," negotiators will have to address the missile issue. But rather than deal with it in the agreement, which Iran adamantly opposes, the parties might address it as a confidence-building measure, with Iran stating that, for a specific period, it

would not flight test rocket systems with greater capability than it has previously tested.

THE AGREEMENT-AND ITS ALTERNATIVES

Achieving an agreement that meets the requirements outlined here will not be easy. It will require continued unity among the P5+1 and a firm resolve among members of the broad sanctions coalitions to keep in place the measures needed to give Tehran the incentive to reach an acceptable deal.

Any agreement that emerges from the negotiations will face criticism from America's friends in the Middle East as well as from critics at home. It will be important for Washington to demonstrate to its regional partners, including the Gulf Arab states, that the deal does not signal U.S. disengagement from the region and that the United States remains committed to protecting their interests and countering Iranian troublemaking in their neighborhood. Above all, the agreement will have to be viewed, both abroad and at home, as an effective deterrent to a future decision by Iran's leaders to pursue nuclear weapons-by making the path to nuclear weapons appear, in the minds of those leaders, too detectable, too lengthy, and too risky for them ever to want to take that path.

No agreement that is reached will be perfect. But the test is not how it compares with an ideal but unattainable agreement; it is how it measures up against alternative ways of dealing with the Iran nuclear issue. One alternative for the United States attempting to increase sanctions dramatically in the hope of forcing major concessions—would run up against strong resistance by Iran's leaders to accepting a deal that would be portrayed by their domestic critics as a capitulation to U.S. pressure and a surrender of Iran's rights. And by creating the impression that the United States is making excessive demands, it could lead to the erosion of international support for sanctions.

The other main alternative—the use of military force—would only set back Iran's nuclear program temporarily, could result in a region-wide conflict of unpredictable dimensions, and could well trigger an Iranian decision to evict inspectors, withdraw from the NPT, and go for nuclear weapons as soon as possible.

If Iran is determined to maintain and even shorten its nuclear breakout capability and is unwilling to accept significant limits on its nuclear capacities and rigorous monitoring measures, the United States will have little choice but to turn to these alternatives. But before it does, it should make every effort to negotiate an agreement that can influence future Iranian nuclear decision-making and significantly reduce the likelihood that Iran will opt to build nuclear weapons.

Iran's Compliance Track Record

Any evaluation of the requirements for an agreement should begin with an understanding of Iran's past behavior on the nuclear issue. The more skeptical we are about that behavior, the more rigorous we will need to be in constraining and monitoring Iran's nuclear activities.

SAFEGUARDS VIOLATIONS AND LACK OF COOPERATION

Iran's track record provides plenty of grounds for skepticism. Since the mid-1980s, Iran has engaged in numerous undeclared nuclear activities, including the construction of major, dual-use "fuel cycle" facilities. In August 2002, an Iranian dissident group, the National Council of Resistance of Iran, disclosed that Iran was building a uranium enrichment facility at Natanz as well as a heavy water plant at Arak to support a nuclear reactor of a type and size used by several nuclear-armed states to produce plutonium for nuclear weapons. In September 2009, the United States, the United Kingdom, and France revealed that Iran was secretly constructing an enrichment facility near Qom. That facility, which Iran called the Fordow Fuel Enrichment Plant, was especially suspicious because it was buried deep underground, located at a site that has been used by the military, and built with a capacity too small to contribute meaningfully to a civil nuclear energy program but suitable as a covert facility for enriching uranium to weapons-grade.

In violation of its safeguards agreement with the International Atomic Energy Agency (IAEA), Iran failed to report a wide range of experiments and other activities involving nuclear materials, including importing various uranium compounds, testing centrifuges at an undisclosed centrifuge production workshop, separating plutonium from irradiated nuclear material, and converting uranium compounds to uranium metal, which is an important technique for fabricating highly enriched uranium cores for nuclear weapons. In its resolution in September 2005, with the support of all P5+1 governments, the IAEA Board decided that "Iran's many failures and breaches of its obligations to comply with its NPT Safeguards Agreement . . . constitute non-compliance in the context of . . . the Agency's Statute."1 In February 2006, after Iran resumed fuel cycle activities that had been suspended during two years of negotiations with the Europeans, the IAEA Board voted to refer the Iranian nuclear issue to the United Nations Security Council.²

In response to numerous IAEA requests for clarification of suspicious activities, Iran cooperated grudgingly, belatedly, or not at all. Any cooperation was usually piecemeal, calculated to deflate international pressure and chosen to avoid giving the IAEA access to suspicious information. For example, to thwart IAEA efforts to investigate suspect facilities, Iran went to great lengths to sanitize sites at Lavizan-Shian and Parchin, razing buildings, removing topsoil, and otherwise seeking to hide incriminating evidence. It initially accepted-but later stopped implementing-a provision of its safeguards agreement (i.e., modified code 3.1) requiring notification of new nuclear facilities as soon as a decision is made to begin construction, becoming the only state with significant nuclear facilities not to fulfill that requirement.

On several occasions, the IAEA Board of Governors formally appealed to Iran to give IAEA inspectors the necessary access to sites, facilities, records, and individuals. But when those appeals went largely or wholly unheeded, the Board several times deplored Iran's failure to provide "full, timely, or proactive" cooperation. Former IAEA Director General Mohamed ElBaradei said that Iran's uncooperative behavior had created a "confidence deficit."

Possible Military Dimensions of Iran's Nuclear Program

An especially worrisome aspect of Iran's track record is a persuasive body of information indicating that Tehran pursued an organized program to develop a nuclear weapons capability and carried out a significant number of weapons-related procurement and research activities associated with that program. In November 2011, IAEA Director General Amano issued a comprehensive report to the Agency's Board of Governors outlining widespread evidence of what was called the "possible military dimensions" (PMD) of Iran's nuclear program. On the basis of what it regarded as "credible" information from a "wide variety of independent sources" and the IAEA's own investigations, the report concluded that "Iran has carried out activities relevant to the development of a nuclear explosive device."3

Among the detailed activities cited in the Director General's report and its annex were efforts to procure nuclear-related and dual-use equipment by military-related entities; efforts to develop undeclared pathways for the production of nuclear materials; acquisition of nuclear weapons development information and documentation from a clandestine nuclear supply network; and work related to a design of a nuclear weapon, including the testing of components. The report noted that, while some of the activities had civilian as well as military applications, "others are specific to nuclear weapons."⁴

According to the IAEA report, the nuclear weapons-related activities were consolidated by the early 2000s under a "structured programme" called the AMAD Plan. The report further noted that the IAEA had received information that, due to growing concerns about the security situation in Iraq, the AMAD Plan was stopped abruptly in late 2003 by senior Iranian officials. Still, the Director General stated that there were indications that some activities relevant to the development of a nuclear explosive device continued after 2003, and might still be ongoing.⁵

The Director General's report was consistent with the findings of a National Intelligence Estimate (NIE) released by the U.S. intelligence community in November 2007. The unclassified version of the 2007 NIE stated that "we assess with high confidence that until fall 2003, Iranian military entities were working under government direction to develop nuclear weapons." Also consistent with the IAEA report, the NIE maintained "with high confidence that in fall 2003, Tehran halted its nuclear weapons program." Subsequently, U.S. officials clarified that the NIE only meant to indicate that Iran had suspended the part of its weapons program aimed at developing a nuclear explosive device ("nuclear weapon design and weaponization work") and not its efforts to acquire nuclear material or missile delivery systems, which are also critical elements of a nuclear weapons program. Indeed, the NIE assessed "with moderate-to-high confidence that Tehran at a minimum is keeping open the option to develop nuclear weapons."6

For two years after the release of the Director General's 2011 report, the IAEA, at the direction of its Board, met frequently with Iranian officials in an effort to resolve the Agency's outstanding concerns about compliance, especially with respect to PMD. But these talks —aimed only at agreeing on the modalities for tackling the outstanding compliance issues, and not actually at resolving the issues themselves—made little progress, primarily due to Iranian stonewalling and obfuscation.

In November 2013, with a new Iranian negotiating team in place following the election of President Hassan Rouhani, Iran and the IAEA agreed on a "framework for cooperation" involving "six initial practical steps" to resolve all present and past issues. The practical steps were worthwhile in addressing some outstanding problems; for example, Iran agreed to provide access to the Gchine mine and the Heavy Water Production Plant. But they did not deal with the Agency's concerns about PMD.⁷

In February 2014, Iran and the IAEA continued their dialogue on outstanding compliance issues and agreed to seven additional "practical measures," including access to the Saghand mine and the Ardakan concentration plant and submission of design information for the Arak reactor. Notably, the February agreement also required Iran to provide "information and explanations for the Agency to assess Iran's stated need or application for the development of Explosive Bridge Wire detonators," one of the outstanding PMD issues, but not considered one of the more sensitive ones.⁸

In evaluating Iran's track record on the nuclear issue and considering what constraints and monitoring measures are needed to provide confidence in the peaceful nature of Iran's nuclear program, it is important to bear in mind the summary assessment provided by Director General Amano in his report to the IAEA Board in February 2014, which is essentially the same assessment contained in a long succession of previous quarterly reports to the Board: "The Agency is not in a position to provide credible assurance about the absence of undeclared nuclear material and activities in Iran, and therefore to conclude that all nuclear material in Iran is in peaceful activities."⁹

IRAN'S REBUTTAL ON COMPLIANCE ISSUES

Iran has taken strong exception to charges that it has not complied with its safeguards obligations, that it has not cooperated with the IAEA, and especially that it has pursued a nuclear weapons development program. Regarding the undeclared fuel cycle facilities, it argued that it was not obliged to notify the IAEA of those facilities until a later stage of construction, and that secrecy was needed to avoid unwarranted pressure to cease construction and to guard against military attack. Iran justified the Natanz plant as necessary to provide enriched uranium fuel for an ambitious nuclear power program, arguing that an independent enrichment capability was needed because foreign governments opposed any Iranian civil nuclear program and could not be trusted as reliable sources of enriched uranium. It contended that the Arak heavy water reactor was needed to eventually replace the aging Tehran Research Reactor for the production of medical isotopes. And it maintained that the deeply buried Fordow enrichment plant was required as a back-up facility due to military threats that had been made to the more vulnerable Natanz facility.

Regarding PMD, Iran has claimed that the IAEA's evidence was based on forged documents and fabricated data provided by Western intelligence agencies for political purposes. Citing large numbers of inspection visits to Iran, various clarifications and admissions it provided to the IAEA, and steps it took to implement a 2007 IAEA-Iran work plan on outstanding issues, Iran has argued that it has cooperated fully with the IAEA but that the Agency, which it claims is unduly influenced by the United States and other Western governments, has been unwilling to close the books on issues that have already been satisfactorily resolved. Moreover, Iranian officials have often cited the repeated IAEA finding that it continues to verify Iran's non-diversion of declared nuclear materials from nuclear facilities declared by Tehran—ignoring the much more damning finding that the Agency cannot verify the absence of undeclared nuclear material or activities in Iran.

IRAN'S BURDEN OF PROOF

Notwithstanding Iran's protestations about the peaceful nature of its nuclear program—including assertions by President Rouhani that Iran "never" sought nuclear weapons¹⁰—the evidence available to the IAEA and several Western intelligence agencies is persuasive that, at least until 2003, Iran made a determined, regime-sanctioned effort to develop the capability to produce nuclear weapons. The timing of Tehran's early nuclear activities tends to support this conclusion. The IAEA traces the beginning of Iran's secret enrichment program to the period of the Iraq-Iran war in the 1980s, when Saddam's Iraq was

using chemical weapons against Iran and was widely suspected of pursuing nuclear weapons. It would hardly be surprising if, under those circumstances, Iran's secret efforts to enrich uranium were directed not at fueling an ambitious civil nuclear power program—of which no mention was made by Iran at the time—but at developing a nuclear deterrent to counter Iraq and other perceived threats.

It is also not surprising that today, when it wants an agreement with the P5+1 that would remove sanctions and end its isolation, Iran would try to get the international community to shift its attention from Iran's highly incriminating past record to the task of monitoring Iran's nuclear program going forward -and to persuade the international community to treat that task as essentially the same as would be required to monitor the program of any non-nuclear weapon state party to the NPT. Moreover, portraying themselves as victims of a U.S.-led conspiracy to deprive them of their rights, keep them isolated internationally, and undermine their regime, Iranians often say that it is the responsibility of the United States and its Western partners to take steps to earn Iran's trust.

But Iran is not like any non-nuclear weapon state party to the NPT. It has committed numerous violations of its safeguards obligations; it has been formally found in non-compliance by the IAEA's governing body; it has been sanctioned in several legally binding U.N. Security Council resolutions (all of which it defied and called illegal); and it has not cooperated in addressing credible concerns about past nuclear weapons-related activities. Its longstanding cat-and-mouse game with the international community has produced deep and widespread suspicions. The burden must be on Iran to earn the international community's trust, not the other way around.

Tehran's current leaders seem to recognize that Iran has a special responsibility to demonstrate convincingly that its nuclear program is exclusively peaceful. Foreign Minister Javad Zarif stated in September 2013 that the nuclear negotiations should be based on "two principles:" respect for Iran's rights in the area of nuclear technology, especially enrichment, and the need to allay international concerns about Iran's nuclear program. Zarif continued that "allaying international concerns is in our interest because atomic weapons do not form part of the Islamic Republic's policies. Consequently, our interest is to remove any ambiguity regarding our country's nuclear program."¹¹

If it truly wishes to remove any ambiguity, overcome its confidence deficit, and convince the world that, regardless of its past behavior, its nuclear program going forward will be genuinely peaceful, Iran will have to accept constraints and monitoring measures that go well beyond what is required of non-nuclear parties to the NPT in good standing—at least for a substantial period of time.

IRAN'S CURRENT NUCLEAR INTENTIONS

The requirements for a comprehensive agreement should be influenced not only by Iran's past record but also by an assessment of its current intentions with respect to nuclear weapons. While the evidence is strong that, in the past, Iran actively worked to develop the capability to produce nuclear weapons—whether or not a formal decision was ever made to build them —its intentions for the future are far less clear.

It appears that in 2003-concerned about the prospect of strong international pressures over the Natanz and Arak facilities and fearful that the U.S. invasion of Iraq could be a prelude to military action against it-Iran decided to suspend both its structured program to develop a nuclear weapons capability as well as a key dimension of that program: the "weaponization" effort. Iranian leaders may have calculated at the time that, even with weaponization work suspended (or perhaps pursued through low-level research activities only partially related to weapons applications), they could continue to advance toward the nuclear weapons threshold by openly pursuing activities that could be portrayed as having non-weapons (e.g., enrichment) or non-nuclear (e.g., ballistic missiles) justifications. They could therefore avoid the risks of being detected engaging in the most incriminating, weapons-specific activities while still moving forward with the time-consuming and less risky activities considered to be the "long poles in the tent" of a nuclear weapons program: production of sufficient enriched uranium and development of effective delivery systems.

Such a strategy would be consistent with what the U.S. Intelligence Community has been assessing in

recent years: that Iran is keeping open the option to acquire nuclear weapons by pursuing various nuclear capabilities—including a uranium enrichment capability—that would give it the ability to produce nuclear weapons if it chose to do so.¹² Director of National Intelligence James R. Clapper has stated on a number of occasions that the Intelligence Community does not believe Iran has yet made a decision to restart the dedicated program to develop nuclear weapons that, according to the 2007 NIE, was halted in 2003.¹³ He has also testified that any decision to produce nuclear weapons would be made by the Supreme Leader and that "at this point, we don't know if he'll eventually decide to build nuclear weapons."¹⁴

DIFFERENCES AMONG IRAN'S STRATEGIC ELITE

Any future decision by the Supreme Leader on the nuclear weapons issue would be heavily influenced by what might be called the Iranian strategic elite, which includes high-level members of the military, Iranian Revolutionary Guard Corps (IRGC), Basij, intelligence and security communities, top officials of the three branches of government, and the Leader's key advisers. They will be influenced, in turn, by a somewhat wider circle of Iranians in the Majlis, the business and clerical communities, the military, the executive agencies, and the media.

From what we can tell from the increasingly explicit public debate in Iran, there appear to be important differences within the Iranian strategic elite, especially on the issue of engagement with the United States and the West in general. A more hard-line,

ideological group seems to see Iran in a zero-sum confrontation with a United States committed to regime change and using the nuclear issue as a tool in a much broader struggle. Its mistrust of the West, wariness toward engagement, and conviction that the Islamic Republic is on its own are driven by its reading of history, including the West's perceived indifference to Iraq's use of chemical weapons against Iran in the 1980s. Apparently believing that U.S. global and regional influence is on the wane, this group judges that time is on Iran's side and that Tehran does not need a nuclear deal. Among the more outspoken members of this group-which includes some of Khamenei's main sources of support-are senior IRGC leaders, the Majlis' Paydari faction, IRGC-affiliated media such as Kayhan and Javan Online, and hard-line clerics such as Ayatollah Mesbah-Yazdi.

A more moderate, pragmatic group in Iran's strategic elite also sees Iran in a competitive relationship with the United States and its allies and is wary of their intentions. But this group appears to believe Iranian interests are better served by engagement and active diplomacy-including on the nuclear issue-which can remove sanctions, strengthen the economy, end isolation, and enhance Iran's regional and international influence. It is more skeptical of the narrative that the United States is in decline and that Iran can therefore afford to bide its time and do without a nuclear deal. It is less convinced than the hard-line camp of the inevitable, long-term hostility of the United States and West and assesses that there are areas where the interests of the United States and the Islamic Republic overlap and mutually beneficial cooperation is possible. Members of this group include President Rouhani and key officials in his administration, Foreign Minister Zarif and the Foreign Ministry's professional diplomats, former President Rafsanjani and Rafsanjani-affiliated technocrats, and Iran's reformist camp.

AREAS OF DOMESTIC IRANIAN CONSENSUS

Despite the often sharp differences between these two camps, there seems to be agreement on some key objectives, primarily preserving the regime, getting the economy moving (including by lifting international sanctions), and ensuring Iran's rightful international position as a leading if not dominant player in the region. There also appears to be a consensus within the strategic elite, at least for the time being, on preserving the accomplishments of the nuclear program and keeping future options open with respect to nuclear weapons.

There seems to be virtually no domestic support at present for what would be seen as gutting the nuclear program or for giving up a future nuclear weapons option. The program is a source of national pride and prestige. To many Iranians, it shows the world at large that their leaders have the willpower to stand up to the United States and much of the international community in order to safeguard Iran's rights and sovereignty. By mastering enrichment, the program demonstrates that Iran deserves to be regarded as one of the world's advanced technological powers. And not least important, it provides a future option to acquire nuclear weapons.

An influential segment of the elite may well regard the possession of nuclear weapons as indispensable to deterring military threats and other pressures, safeguarding Iran's independence, expanding its influence in the region and beyond, and achieving the recognition it deserves as a world player. To get to where Iran's nuclear program stands today, Iran has made great sacrifices, both in terms of the direct costs of the program and the enormous price it has paid as a result of the sanctions. It will not want those sacrifices to be in vain.

While there is little or no domestic support for rolling back the nuclear program, there also seems to be little interest at the present time in pressing ahead to build nuclear weapons. Iranians probably recognize they would pay a very high price if they openly pursued weapons or were caught conducting a covert weapons program. When Iran began its nuclear weapons-related activities well over a decade ago, its leaders probably did not fully appreciate the price they would pay. Now, having borne the brunt of severe economic sanctions and international isolation and having experienced the exposure of several secret facilities, they are more aware that resuming dedicated weaponization efforts could again place Iran's hopes for the future in jeopardy. Moreover, Iranian security officials may calculate that it makes little strategic sense to break out in the near term, when they only have the wherewithal in terms of enrichment capacity and enriched uranium stocks to build a handful of nuclear weapons.

So for now, there appears to be an Iranian consensus in favor of maintaining the current nuclear program, keeping a future weapons option open, and deferring any decision on crossing the threshold and building nuclear weapons. We can speculate that there are those who would like to press forward to build nuclear weapons now rather than wait as well as those who believe it would be in Iran's interest to forgo the nuclear weapons option altogether. But if these views exist, we see little public indication of them and, in any event, they seem outside the current elite consensus. The Supreme Leader appears to be in no rush to take a decision on nuclear weapons.

THE ROLE OF THE FATWA

Any decision on nuclear weapons is likely to be influenced only marginally by the official Iranian position that the acquisition of nuclear weapons is strictly forbidden by religious edict, or fatwa. Supreme Leader Ayatollah Khamenei's 2005 fatwa against possession of nuclear weapons is constantly cited by Iranian officials as proof of the veracity of their claim that the Islamic Republic has never pursued and will never pursue such weapons. Maintaining that the United States and its allies do not understand the significance of the fatwa, the Iranian Foreign Ministry spokesman asserted that "when the highest jurist and authority in the country's leadership issues a fatwa, this will be binding for all of us to follow" and should be definitive in dispelling suspicions about Iran's intentions toward nuclear weapons.¹⁵

No doubt there are many Iranians who sincerely regard the *fatwa* as a reliable indicator of Iran's intentions. But they should understand that Americans and many others have a much more skeptical view and will never place much weight on the *fatwa*, especially when the security stakes are so high. Reinforcing this skepticism is a recognition that *fatwas* are not immutable and can be altered if circumstances change. As one scholar put it, "should the needs of the Islamic Republic or the Muslim *umma* change, requiring the use of nuclear weapons, the Supreme Leader could just as well alter his position in response."¹⁶ If the Supreme Leader believes that the possession of nuclear weapons is important for regime survival, the *fatwa* will not stand in the way.

Although the *fatwa* is not seen by Americans as a guarantee against Iran's pursuit of nuclear weapons, it may still serve some useful purposes. By invoking high religious authority, it can be a valuable political tool for the Supreme Leader if he wishes to continue refusing to give a green light to Iranian proponents of early weaponization. And if the Iranian leadership ever decides to rule out the acquisition of nuclear weapons altogether, it can provide a rationale that is difficult to challenge, at least publicly.

INFLUENCING IRAN'S FUTURE DECISION-MAKING ON NUCLEAR WEAPONS

If the preceding analysis is correct, Iran's ultimate intentions toward nuclear weapons are not yet fixed. Future decision-making on nuclear weapons is likely to depend on a wide range of factors that are currently unknowable, especially outside Iran including Tehran's perceptions of its changing security environment; its evolving relationships with its neighbors, the wider world, and especially the United States; its ability to strengthen its economy and international standing without nuclear weapons; and not least the evolution of the domestic political situation within Iran, especially the balance of power and influence between pragmatic "moderates" and more ideological "hardliners."

In addition to these factors, a critical consideration in Iran's decision-making will be an assessment of the risks it would face and the price it would pay if it actively pursued nuclear weapons. In that respect, a comprehensive agreement with the P5+1 countries could play a significant role. By constraining the technical pathways toward nuclear weapons and making any pathways as transparent and time-consuming as possible, an agreement can increase the perceived risks to Iran of opting to build nuclear weapons. Those risks would be weighed against other factors, such as those mentioned above, that may push for or against the acquisition of nuclear weapons. But depending on how effective the agreement is at elevating the risk factor, it could have an important impact on Iran's future decision-making.

The Joint Plan of Action

The Joint Plan of Action (JPA)—concluded by L the P5+1 countries, the European Union, and Iran in November 2013-was a good start towards a comprehensive agreement.¹⁷ Intended as an interim step toward a final deal, the six-month JPA took effect on January 20, 2014, and will expire on July 20, 2014. It can be extended (and presumably modified, if desired) by mutual consent. Given the complexity of a final agreement and the sizable differences that currently exist on its key provisions, there is a wide expectation that an extension beyond six months will be required. The JPA states the aim of concluding and commencing implementation of the final deal within one year of November 2014, a timeframe reinforced by pressures in both the United States and Iran not to allow the interim arrangements to drag on too long.

HALTING ADVANCES IN IRAN'S PROGRAM

A key objective of the United States and its partners in pursuing an interim deal was to halt further progress in Iran's nuclear program while negotiations on a final agreement are underway. They achieved that objective more effectively than most experts expected. During the six-month period, Iran will be barred from producing near-20 percent enriched uranium, increasing its stocks of gaseous enriched uranium below 5 percent, installing additional first-generation or more advanced centrifuges, operating the large number of installed centrifuges now idle, testing or producing fuel or installing additional components for the Arak reactor, or producing additional centrifuges except to replace broken ones. In a few cases, the JPA took steps not just to halt but to reverse Iran's progress toward a nuclear breakout capability, in particular by requiring that all existing near-20 percent uranium hexafluoride be diluted to below 5 percent or converted to an oxide, a chemical form less readily usable for the production of weapons-level uranium. These JPA provisions will result in lengthening Iran's breakout timeline—the time it would take, using available centrifuges and uranium stocks, to produce enough weapons-grade uranium for a single bomb—by roughly a few months.¹⁸

ENHANCED MONITORING

The JPA will also permit additional and more frequent access by the IAEA to Iranian nuclear facilities and other locations. IAEA inspectors will have daily access to surveillance records at the Natanz and Fordow enrichment facilities and "managed access" to centrifuge assembly workshops, centrifuge rotor production workshops and storage facilities, and uranium mines and mills. In addition, Iran will be required to provide extensive information to the IAEA on its nuclear facilities and activities. The JPA also established a Joint Commission of the P5+1, the EU, and Iran to monitor implementation of the interim agreement and work with the IAEA to facilitate resolution of past and present compliance issues.

SANCTIONS EASING MEASURES

In exchange for these constraints and monitoring provisions, Iran will receive a variety of sanctions easing measures, including the suspension of U.S. sanctions on petrochemicals, the auto industry, and gold; a pause in the U.S. requirement that purchasers of Iranian crude oil continue to make further reductions; the release of \$4.2 billion of Iranian oil revenues from restricted overseas accounts; the creation of an approved financial channel for transactions in humanitarian goods; and a U.S. pledge not to impose new sanctions during the interim deal.

INTERIM DEAL IS NOT ENOUGH FOR EITHER SIDE

Both the Obama and Rouhani administrations have strongly defended the JPA against its critics, domestic and, in the U.S. case, foreign. At the same time, both have made clear that the interim deal is not acceptable for the long term. For Iran, the sanctions relief provided in the JPA is far short of what it needs to get its economy on track. The essential goal of Iran's leaders is to get the sanctions lifted altogether, and they know that will require a comprehensive agreement.

For the United States, the halt of further progress in Iran's nuclear program achieved by the JPA is not nearly enough. The JPA lengthens the current breakout timeline somewhat, especially compared to the significantly shorter timeline that would exist in the absence of the interim agreement. But even at existing, currently frozen levels of centrifuges and enriched uranium stocks, Iran has the wherewithal to break out and produce a number of nuclear weapons. So while the freeze and neutralization of the near-20 percent stocks improve the breakout situation and prevent it from deteriorating in the short run, the JPA still allows Iran to retain a breakout timeline (roughly two-three months) that is much shorter than would be tolerable in the long run. In addition, the reversible character of most JPA constraints would enable Iran to ramp up its capabilities quickly if it decided to leave the JPA or allow it to lapse. Another reason the United States would not be satisfied with the JPA over the long term is that its monitoring measures-while a significant improvement from prior practice and sufficient for the needs of a temporary deal-are inadequate for the more demanding verification tasks required in the long term.

Key Elements of Final Deal Left Unresolved

Both sides have strong incentives to reach a final deal. But the outlines of a final deal are still very uncertain. During negotiations on the JPA, the parties sought agreement on some of the key parameters of a comprehensive, final deal. As recorded in the last section of the JPA, they were able to reach agreement on some of those parameters:

- United Nations Security Council, multilateral, and national nuclear-related sanctions would be comprehensively lifted.
- There would be no reprocessing or construction of a facility capable of reprocessing.
- Iran would ratify and implement the IAEA Additional Protocol.

However, they were not able to agree on several other issues, and the general language adopted in the JPA made clear that some key parameters remained unresolved:

- Unable to agree on a specific duration for the comprehensive agreement, they recorded that the agreement would be of "longterm duration." The issue of duration is especially important because of agreement in the JPA that, after expiration of the comprehensive agreement, Iran's nuclear program "will be treated in the same manner as that of any non-nuclear weapon state party to the NPT."
- Unable to come to terms on the final disposition of the Arak heavy-water reactor, the parties agreed only to "fully resolve concerns related to the reactor at Arak."
- The complicated and controversial issue of the conditions under which a domestic enrichment program would be permitted in Iran was left to future negotiations. The JPA states that a comprehensive agreement would "involve a mutually defined enrichment

programme with mutually agreed parameters consistent with practical needs, with agreed limits on scope and level of enrichment activities, capacity, where it is carried out, and stocks of enriched uranium."

 Finally, to make clear that even tentative areas of agreement were conditioned on agreement on an overall package, the JPA concludes with "the standard principle" that "nothing is agreed until everything is agreed."

IMPLEMENTING THE JPA

The JPA contained the key elements of the interim agreement, but left important implementation issues to be worked out. In the course of intensive negotiations that concluded on January 12, 2014, experts from Iran, the EU, and the P5+1 finalized these implementation details. Although the full text of their "technical understanding" was not made public, the White House released a summary.¹⁹ The agreed technical understandings outlined the role of the IAEA in monitoring the interim agreement, addressed the role of the Joint Commission, elaborated on the agreed monitoring and transparency measures, provided details of certain sanctions relief measures, and specified the sequence in which initial actions would be carried out.

The JPA formally took effect on January 20, 2014, and as of late March, implementation has gone smoothly. In his report to the IAEA Board on February 20, 2014, Director General Yukiya Amano stated that Agency inspectors were able to confirm that Iran was fulfilling its JPA obligations, including ceasing production of near-20 percent enriched uranium and making progress in neutralizing its stock of near-20 percent uranium hexafluoride by diluting it or converting it to oxide. Concurrently, the EU and P5+1 have been meeting their JPA commitments, including by suspending certain EU and U.S. sanctions and by arranging the release of several tranches of previously frozen oil revenues.

Toward a Comprehensive Agreement

An initial round of negotiations on a comprehensive agreement took place in Vienna the week of February 17, and a second round was held, also in Vienna, the week of March 17. By all accounts, all parties were serious about trying to reach agreement by the time the interim deal expires on July 20, if at all possible.

A formidable challenge is that key players—not just those at the negotiating table but interested parties outside the negotiations—have very different notions of what would constitute an acceptable deal.

Israel. The Israeli government has taken the most demanding approach. At a conference in Tel Aviv in late January 2014, Prime Minister Benjamin Netanyahu said: "We will only support an arrangement that ensures the complete dismantling of Iran's infrastructure and capabilities to build nuclear weapons."20 He previously stated that this would require, at a minimum, the dismantlement of the Natanz and Fordow enrichment facilities and the Arak heavy-water reactor as well as the elimination of all enriched uranium stocks on the territory of Iran. He and other Israelis have justified these demands by stressing the importance of not only preventing Iran from producing nuclear weapons but also eliminating Iran's "capability" to produce nuclear weapons. In a meeting with German Chancellor Angela Merkel in February, Netanyahu succinctly reiterated his position: "Zero enrichment, zero centrifuges, zero plutonium."21

U.S. Congress. Members of Congress in significant numbers as well as a portion of the American

non-governmental national security community support the Israeli position, including the demand for "zero enrichment." Fifty-nine senators have co-sponsored an Iran sanctions bill that would impose harsh new sanctions at the end of the sixmonth negotiating period and only allow the president to suspend the imposition of sanctions at that time if he could certify that an agreement had been achieved, or was close to being achieved, that essentially met Israel's far-reaching dismantlement requirements. The Obama administration succeeded in persuading some key Senate Democrats that adoption of the bill would seriously undermine negotiations, and as a result the bill was not brought to a vote. Subsequently, 83 senators signed a letter to President Obama stating that any agreement "must dismantle Iran's nuclear weapons program and prevent it from ever having a uranium or plutonium path to a bomb." The letter also expressed the belief that "Iran has no reason to have an enrichment facility like Fordow" and "the regime must give up its heavy water reactor at Arak."22 These formulations left ambiguous whether the senators were insisting on zero enrichment and no reactor of any type at Arak, which is probably why the letter was able to receive so many supporters.

Obama Administration. The President and his advisers agree that eliminating Iran's sensitive nuclear facilities and completely banning enrichment would be the best outcome. But administration officials —and practically all experts who closely follow the Iranian scene—believe that such an agreement cannot be reached. The Iranian regime, in its persistent and skillful public framing of the nuclear issue as a

matter of legal rights and national dignity, has built overwhelming support across the political spectrum in Iran for enrichment and the nuclear fuel cycle. No agreement prohibiting these activities would be supported domestically in Iran.

President Rouhani and his key advisers recognize the importance to Iran's economy of getting an agreement that would lift the sanctions. But rather than accept a deal that would be strongly condemned within Iran as a humiliating capitulation to U.S. pressure, they would almost surely be prepared to walk away from the table, do their best to boost the economy by correcting the mismanagement of the Ahmadinejad years, and work aggressively to try to erode the international sanctions in the absence of agreement.

Obama officials also believe that pressing in the negotiations for such a demanding outcome would be not only futile but counterproductive. Key U.S. partners in the international sanctions coalition against Iran would conclude that the United States, and not Iran, had become the main impediment to agreement, and their support for implementing sanctions would consequently weaken and the sanctions regime would eventually unravel.

Most importantly, the administration has concluded that a sound agreement does not require banning enrichment. It believes that an effective agreement —one that prevents Iran from having a rapid nuclear breakout capability—can be achieved by reducing significantly Iran's current enrichment capacity, neutralizing the plutonium production threat at the Arak reactor, and incorporating far-reaching monitoring arrangements. Some prominent and knowledgeable Israeli experts share this view,²³ as do all the governments of America's P5+1 partners.

Iran. The Iranians have indicated that they can accept limitations on their enrichment program, special provisions related to their Arak reactor, and enhanced transparency measures. But comments by senior Iranians suggest that the restrictions they have in mind and those the United States has in mind are very different.

In an interview at the Davos World Economic Forum, President Rouhani stated that "in the context of nuclear technology, particularly of research and development and peaceful nuclear technology, we will not accept any limitations."²⁴ Rouhani and several other senior Iranians have publicly opposed dismantling centrifuges, shutting down nuclear facilities, or exporting stocks of enriched uranium. They assert that any agreement will leave their nuclear program intact. Together with statements to the effect that Iran will not accept discriminatory treatment in terms of IAEA access and monitoring arrangements, it is clear that the positions of the two main protagonists at the negotiating table—Iran and the United States—are far apart.

THE GOAL OF A COMPREHENSIVE AGREEMENT

With such widely divergent perspectives on what would constitute an acceptable outcome, it is useful to step back and consider what should be the fundamental goal of the Iran nuclear negotiations from a U.S. perspective.

Ideally, an agreement would completely eliminate Iran's capability in the future to produce nuclear weapons. But that goal is not achievable, at least no longer. Iran already has the technical know-how, the nuclear and non-nuclear materials, the equipment, and the financial resources required to build nuclear weapons.

Even if Iran were to accept far-reaching demands to renounce enrichment and dismantle all sensitive nuclear facilities, it would retain the capability to re-constitute a nuclear weapons program. More extensive rollback could increase the time it would take Iran to re-constitute the program—to refurbish or rebuild equipment and facilities and resume operations—but it could not deny Iran the capability eventually to acquire nuclear weapons.

This has essentially been the judgment of the U.S. Intelligence Community since the 2007 NIE. As Director of National Intelligence Clapper testified in April 2013, "Tehran has the scientific, technical, and industrial capacity to produce [nuclear weapons]. So the central issue is its political will to do so."²⁵

Rather than seeking in a comprehensive agreement to eliminate Iran's capability to produce nuclear weapons once and for all, a more realistic and achievable goal is to deter—effectively and indefinitely —an Iranian political decision to acquire them. As discussed earlier, Iran's ultimate intentions toward nuclear weapons are not yet fixed and will depend on a range of international and domestic factors. The overall U.S. goal for an agreement should be to have a major impact on the Iranian leadership's future deliberations on the costs and benefits of acquiring nuclear weapons, in particular by tipping the balance decisively in favor of not opting to pursue them.

Eliminating Iran's current nuclear capability or banning its enrichment program is neither achievable nor necessary to achieve a sound agreement that serves the security interests of the United States and its friends in the Middle East.

We can expect that, in a comprehensive agreement, the Iranians will insist on retaining sufficient nuclear capability to give them an option to acquire nuclear weapons at some future time. Justifying their position in terms of the requirements of their civil nuclear energy plans, they will press for an outcome that shortens as much as possible the time it would take to cross the nuclear weapons threshold, should they ever decide to do so.

The challenge for the United States and its partners is to construct an agreement that makes clear to the Iranians that any effort to break out of the agreement and acquire nuclear weapons would be a detectable, lengthy, and risky process that would not only fail but would inevitably result in Iran paying a very high price in terms of its national interests. It would deter any Iranian decision to pursue nuclear weapons for the foreseeable future and bring Iran's leaders eventually to the conclusion that they should abandon any nuclear weapons ambitions altogether.

An agreement that could serve as an effective deterrent to any future Iranian decision to pursue nuclear weapons would meet the following requirements:

- It would provide confidence that any steps to abandon constraints and move toward nuclear weapons, whether at covert or declared facilities, are detected at the earliest possible stage.
- It would ensure that the period of time between the detection of such breakout steps and the production of sufficient weapons-grade fissile material to fabricate a nuclear weapon is long enough to enable the international community, especially the United States, to take decisive action to prevent the acquisition of sufficient nuclear material.
- Primarily as a result of actions taken and policies adopted outside the scope of the agreement, it would convey clearly and credibly to Iran's leadership that any effort to abandon constraints and pursue nuclear weapons would be met with a firm international response—from diplomatic pressures to harsh sanctions to the use of military force—that would be highly costly to Iranian interests.

The following sections will discuss each of these requirements in detail.

EARLY DETECTION OF BREAKOUT

If the international community is to be able to act quickly enough to stop any breakout attempt, it must detect breakout activities as early as possible. Some potential breakout activities would be fairly clear indicators of the intention to move quickly to produce fissile materials for nuclear weapons—for example, evicting or blocking inspectors at enrichment facilities, restoring connections between centrifuge cascades to enable higher enrichment levels, and reconverting near-20 percent enriched uranium oxide to uranium hexafluoride gas.

However, *any* violation of the comprehensive agreement—including those apparently not directed at rapid production of fissile material—would be worrisome, perhaps indicating only a desire to achieve marginal advantage under the agreement but perhaps indicating early preparations to break out at a future date. Activities in this category might include prohibited production or installation of addition centrifuges, R&D activities exceeding agreed limits, construction of equipment or a facility capable of separating plutonium from spent fuel, and failure to provide notification of certain imported materials or equipment.

So, while the monitoring system for a comprehensive agreement should place high priority on detecting almost immediately the most alarming activities, it should be capable of detecting all significant violations, including those less time-sensitive or more ambiguous in their intent. This will require the IAEA to achieve the same basic monitoring mission it pursues in other countries—namely, to detect any violations involving declared facilities or activities as well as to ensure the absence of any undeclared (i.e., covert) facilities or activities. But in Iran, given its track record and the huge stakes, that mission will be more challenging and critical.

BREAKOUT AT DECLARED OR COVERT FACILITIES?

Experts have debated which route Iran would choose to break out of an agreement-using declared, safeguarded facilities and materials or, alternatively, using undeclared facilities and materials hidden from the IAEA safeguards system. It has been assumed by many that Iran would prefer the covert route, both because breakout from safeguarded facilities would almost surely be discovered sooner or later and because some key elements in a covert program (e.g., a small underground centrifuge enrichment plant) may be relatively easy to hide from the IAEA and intelligence services. The 2007 NIE assessed "with moderate confidence that Iran probably would use covert facilities-rather than declared nuclear sites -for the production of highly enriched uranium for a weapon."26

However, there are several reasons why the covert route might not be preferable for Iran. Although a single covert facility might be successfully hidden, a covert program to produce weapons-grade uranium, for example, could require a network of undeclared facilities, activities, and materials—including unmonitored sources of uranium ore or yellowcake, a conversion facility, a centrifuge production workshop, an enrichment facility, undeclared movements of materials among these facilities, and—if a combination of undeclared and declared facilities is used—natural or enriched uranium hexafluoride diverted from safeguarded facilities. A successful covert program would require each element of such a network to evade detection.

Moreover, unlike a breakout scenario at declared facilities, which can exist legally even as preparations are being made for breakout at those facilities, the mere existence and detection of any undeclared elements of a covert network would constitute a clearcut violation. Also, a covert network is vulnerable to detection during the entire period it takes to construct and operate it, potentially a lengthy period of time, whereas in a breakout scenario at declared facilities, the main risks of detection only begin when breakout steps actually get underway. Another factor that could weigh against the covert route in the minds of Iranian leaders is the notable lack of success Iran has had keeping the facilities at Natanz, Arak, and Fordow secret.

Looking at these factors, it is not obvious what choice Iran would make. A covert breakout scenario has the advantage, if successful, of getting all the way to the production of fissile material without detection. But it has the downside of a lengthy period in which any one of its elements may be detected.

A breakout scenario at declared facilities has the advantage of avoiding the lengthy and potentially detectable construction and operation of an illicit breakout infrastructure. But it has the downside of almost surely being detected, probably soon after breakout begins, and then having to race to produce fissile material before the international community reacts.

Given our uncertainty about how Iranian leaders might view this choice, an agreement's verification system must seek to deter both scenarios.

A NEED FOR UNIQUE ARRANGEMENTS

Much of what will be required to deter those scenarios is already being done routinely and effectively by the IAEA in implementing its current safeguards agreement with Iran. Tasks such as counting centrifuges, measuring enrichment levels and quantities of enriched uranium, and monitoring non-diversion of stored materials are standard elements of the Agency's tool kit and are currently playing a significant role in monitoring the provisions of the JPA.

Most if not all of the measures the IAEA uses to monitor the JPA should be carried over into a comprehensive agreement. However, given the much broader scope of the comprehensive deal and the need for greater assurance in a much longer-term agreement, a number of the measures used to monitor the JPA would have to be strengthened and additional measures would have to be agreed.

The parties negotiating the monitoring arrangements —and they must include the IAEA, whose expertise is essential—should approach the task with the perspective that the Iran nuclear issue poses unique challenges and requires unique solutions. They should draw heavily on the authorities, techniques, and procedures embodied in current IAEA safeguards arrangements. But to build the necessary confidence where little now exists and to address fears about breakout, the negotiators should not be limited by those current arrangements. If Iran and the P5+1 countries can agree on measures not contained in existing safeguards agreements, the IAEA Board of Governors—and if needed the U.N. Security Council—can provide the necessary authorization.

Iran can be expected to resist far-reaching monitoring arrangements, especially those going beyond what most other IAEA members have accepted. But if the Iranians truly wish to alleviate international concerns about the nature of their nuclear program and be treated like a law-abiding member of the international community, they must be willing—at least for an agreed period of time—to agree to a rigorous and unique set of measures. By agreeing in the JPA that Iran will be treated in the same manner as that of any non-nuclear weapon state party to the NPT *after* the comprehensive agreement reaches its expiration date, Iran implicitly recognizes that, *during* the comprehensive agreement, it will be subject to special arrangements.

SUPPLEMENTING THE ADDITIONAL PROTOCOL

As part of the JPA, Iran accepted that, under a comprehensive agreement, it would ratify and implement the IAEA Additional Protocol (AP), which over 100 IAEA member states have already accepted and which will provide the Agency more extensive access and information than it is entitled to receive under the existing Iran-IAEA safeguards agreement. However, while the AP provides a more solid foundation for a verification system in Iran than exists at present, it will have to be supplemented in a number of critical areas.

Accounting for centrifuges. Getting an accurate understanding of centrifuge production, centrifuge production capabilities, and centrifuge inventories will be essential to gain confidence in the absence of a covert enrichment program. The AP gives the IAEA periodic access to certain centrifuge production facilities, but does not provide for accountancy measures. The JPA calls for "managed access" to declared centrifuge assembly workshops as well as to centrifuge rotor production workshops and storage facilities. These are steps in the right direction, but a comprehensive agreement must be more rigorous. It should enable the IAEA to maintain an accurate count of the numbers and types of centrifuges and key centrifuge components that are produced and stored in Iran, to know the locations of all centrifuge-related facilities, and to be informed of the amounts and locations in Iran of key raw materials for manufacturing centrifuges, such as maraging steel and carbon fiber.

Uranium ore and yellowcake. Also important to reducing concerns about a possible covert enrichment program is gaining a better handle on Iranian mining of uranium ore and production of yellowcake —and ensuring that those materials are not diverted to unsafeguarded channels. While strict accountancy of uranium ores and processed uranium is not as necessary as in the case of centrifuges, a comprehensive agreement should help the IAEA get a more accurate picture of the scale of production and destinations of those materials than is possible under the AP's periodic visits and the JPA's managed access. Nuclear-related imports. Greater transparency will also be required regarding Iranian importation of nuclear-related equipment and materials. Currently, U.N. Security Council restrictions prevent Iran from importing a wide range of items with nuclear applications, including uranium ores. Under a comprehensive agreement, those restrictions would presumably be relaxed, perhaps on a phased basis. The AP would call on Iran to supply information on imports that it is not now required to supply under its current safeguards agreement. But here too, the comprehensive agreement should require Iran to do more, including, for example, to notify the IAEA of the importation, end use, and destination of all nuclear-specialized and dual-use items on the Nuclear Supplier Group's lists as well as of any other equipment and materials that the IAEA deems necessary.

Stepping up currently authorized measures. Monitoring measures for which the IAEA already has authority under its current safeguards agreement with Iran should be stepped up in a variety of ways. Depending on the risks presented by different types of facilities, the frequency of inspector visits and their access within facilities could be enhanced, the installation of containment and surveillance equipment could be strengthened, and the use of remote, real-time monitoring could increasingly be introduced. Such stepped up measures could be helpful, for example, in detecting modifications of centrifuge cascades or diversions of safeguarded nuclear materials from storage, both indications of possible breakout intent.

Permanent safeguards. The IAEA could also conclude what are called INFCIRC 66 safeguards agreements with Iran that would apply to Iranian enrichment facilities and reactors. Unlike "comprehensive safeguards agreements" (INFCIRC 153), which apply to an NPT non-nuclear weapon state's entire nuclear program but which expire if a state exercises its right to withdraw from the NPT, INFCIRC 66 agreements apply to specific facilities or materials and are of unlimited duration. Thus, if Iran gave the required 90-day notice and withdrew from the NPT, it would not be able legally to use facilities under INFCIRC 66 agreements to produce fissile material for

nuclear weapons. Such a measure would only have value as a deterrent against Iran's legal withdrawal from the NPT, because such withdrawal would not enable Iran legally to use its still-safeguarded facilities in a nuclear weapons program. Of course, if the Iranians are prepared to take the brazen route of simply violating the NPT and the comprehensive agreement and moving quickly to produce nuclear weapons—the scenario addressed here—then having permanent safeguards agreements in place would hardly stop them.²⁷

STRENGTHENING INSPECTION RIGHTS

IAEA inspection rights under a comprehensive agreement would be critical. The AP enables the Agency to inspect not only declared facilities but also undeclared sites. However, the AP stops well short of authorizing "anywhere, anytime" access which—however desirable—is exceedingly unlikely to be accepted by a sovereign country not defeated in battle (as was the case in Iraq in 1991). The IAEA, Iran, and the P5+1 countries will need to work out a unique inspection arrangement, one not necessarily based strictly on existing models such as the AP or the "special inspections" provision of NPT-required comprehensive safeguards agreements.

Such an arrangement would have to contain appropriate protections for Iran. It could not allow "fishing expeditions" or unduly frequent or disruptive visits and would require inspectors to have reasonable grounds for seeking access to particular sites. Through managed access or shrouding procedures, it would enable Iran to conceal limited and especially sensitive portions of facilities or pieces of equipment that are unrelated to its obligations under the nuclear agreement.

But no types of facilities or locations, including military installations, would be "out of bounds." Suspected weaponization activities, including those not involving nuclear materials, could be investigated through inspection visits. Unannounced inspections would be permitted, although perhaps limited in frequency. Access would be provided not just to locations, but also to records for close examination and to individuals for interviews. Special procedures would be needed to ensure that any disputes arising between Iran and the IAEA over inspector access and responsibilities would be quickly resolved, perhaps through immediate referral to a Joint Commission of the EU/P5+1 and Iran (as was established by the JPA) or prompt escalation, if necessary, to an emergency session of the IAEA Board.

EXPEDITING AND ESCALATING THE RESOLUTION OF COMPLIANCE ISSUES

Such special procedures should be developed not just for disputes over inspector access but for any difficulties that arise in monitoring the comprehensive agreement. We can anticipate that information received about Iranian compliance, whether from the agreement's monitoring arrangements or intelligence sources, will often be ambiguous or incomplete and will require further investigation and clarification. This would be especially concerning if the inconclusive information seemed to point to potential breakout activities because, in the actual event of breakout, we would expect Iran to seek to stymie efforts by the IAEA to discover its true intent as long as possible—through delay, obfuscation, and other uncooperative tactics.

For the international community to be in a position to respond quickly and effectively to any Iranian breakout attempt, the IAEA, supported by the P5+1, must therefore be able to clarify expeditiously any uncertainties that arise in monitoring the agreement, whether those uncertainties turn out to have benign explanations or not. Procedures should be developed that obligate Iran to provide its full and timely cooperation in resolving issues of compliance and that, in the absence of such cooperation, would escalate the issues promptly to a Joint Commission involving the EU/P5+1, to the IAEA Board, and—if warranted—to the U.N. Security Council.

In developing all of these procedures and monitoring arrangements for the comprehensive agreement, it is essential that the IAEA Secretariat play an integral role. It has the experience and expertise to know what will work. And it has demonstrated in the past that it has the flexibility to depart from traditional roles and practices to implement what its Board of Governors and the international community call on it to do.

Possible Military Dimensions of Iran's Nuclear Program

The IAEA's role will be crucial in resolving PMD issues. For close to two years after the Director General's November 2011 report, the Iranians essentially stonewalled Agency efforts to follow up on information the IAEA deemed credible that, prior to 2003 and possibly since then, Iran engaged in various research and procurement activities related to the development of nuclear weapons (e.g., implosion testing, detonator development, adaptation of a missile re-entry vehicle for nuclear weapons delivery, procurement by military-related entities). U.N. Security Council and IAEA Board resolutions, as well as repeated statements by the United States and its P5+1 partners, indicate that a satisfactory resolution of the PMD issues is a necessary requirement for resolving the Iran nuclear issue.

There is understandable support for the view that only by owning up to its past nuclear weapons-related activities and fully disclosing the details of those activities can Iran build sufficient confidence about its peaceful intentions for the future. According to David Albright: "If Iran is unwilling to detail its past efforts to build nuclear weapons, or at the very least acknowledge the existence of a program, it will undermine the credibility of statements about its present day nuclear intentions. . . Significant questions about its motives, such as a desire to maintain a latent breakout capability, will likely remain."²⁸

While full and honest Iranian disclosure of past activities is undoubtedly the best result, such an outcome faces formidable obstacles: in particular, the adamant insistence by Iranian leaders that Iran "never" pursued nuclear weapons and especially the Supreme Leader's *fatwa* that nuclear weapons are prohibited by Islam. It is hard to imagine, particularly in today's political climate in Tehran, an Iranian admission of past behavior inconsistent with these formal and religiously-based expressions of Iran's policy.

PRIORITIZING PMD CONCERNS

Getting to the bottom of the PMD issues through Iran's full disclosure and admission of all past nuclear weapons-directed activities is almost surely unachievable. But such an admission is not necessary in order to develop a sufficient degree of confidence that those activities are not continuing, at least not on a meaningful scale or in a manner that would trigger concerns about the resumption of the structured program that existed prior to 2003. To develop such confidence, it will be important for the IAEA to prioritize its PMD concerns-to focus most heavily on those aspects that have the most serious implications for a possible future covert weapons program and are most relevant to the successful design of a nuclear explosive device. It should avoid a box-checking exercise in which the Agency spends too much of its time and political capital seeking greater clarification of politically sensitive but secondary issues for the sake of completeness.

This is not to say the IAEA should be undemanding of Iran. Indeed, Iran's unwillingness to admit its interest in weapons-related research or to provide full details of past weapons-related activities places a heavier burden on Tehran to provide the transparency necessary to convince the international community about the absence of those activities going forward. It means that the IAEA should frame its PMD inquiries in such a way as to make it easier for the Iranians to provide information valuable to assessing ongoing behavior, without requiring them to make confessions about the past that they are not prepared to make. One expert has suggested that the IAEA direct its inquiries to understanding what was done and not seek to draw any conclusions about why it was done.29

Iran would still need to provide substantial information about its past activities. For example, it will be important for Tehran to fully disclose its past illicit procurement of nuclear-related equipment and materials and the current whereabouts and quantities of those items. Information about the present inventory of such items is necessary to reduce the likelihood of their use in a covert program.

For past activities that the Iranians claim had benign purposes, Iran should provide more information on the progress made in such research and on where those activities stand today. How Iran deals with its work on explosive bridge wire detonators—which the IAEA and Iran agreed in February to address and which Iran claims has a non-nuclear explanation may provide clues as to how forthcoming Tehran will be on the PMD issues.

In the cases of nuclear-related research and procurement activities carried out by military-affiliated institutions and companies, Iran should be transparent about the roles those entities and any successor organizations are playing today. Especially important will be allowing the IAEA to interview and maintain continuing contact with personnel in those entities as well as other individuals believed to have participated in PMD activities. The IAEA has tried for years to get access to key individuals believed to have been involved in Iran's "structured" weapons program. Tehran's willingness to make such individuals available will be an important test of its readiness to resolve PMD issues. The JPA states that the Joint Commission consisting of Iran and the EU/P5+1 "will work with the IAEA to facilitate resolution of past and present issues of concern." So presumably, the United States and its P5+1 partners will consult with the Agency on PMD questions in the period ahead. However, the P5+1 countries know that, to be credible, any resolution of the PMD issues will have to be worked out mainly by Iran and the IAEA and will have to be regarded by the Agency and its Director General as satisfactory.

Until the IAEA and its Board reach the conclusion that they no longer have concerns about Iran's past activities, the Iran nuclear issue will remain unresolved and the Security Council's requirements for terminating sanctions will not be met. It is possible that the comprehensive agreement between Iran and the EU/P5+1 will be concluded before the PMD issues are resolved. In that event, the provisions of the agreement regarding the phasing out of sanctions can be designed in such a way as to make the removal of certain sanctions conditional upon a finding by the IAEA Board that the PMD issues have been satisfactorily addressed.

Lengthening the Breakout Timeline

I n addition to detecting breakout steps at an early stage, a second requirement for deterring any future Iranian decision to build nuclear weapons is to lengthen as much as possible Iran's breakout timeline—the period between initial breakout steps and the accumulation of enough weapons-grade nuclear material to fabricate a nuclear weapon. Iranian leaders must have a clear appreciation not only that their early breakout activities will be discovered but that the gauntlet they will have to run before possessing their first nuclear weapon will be a lengthy one one that gives the international community ample opportunity to intervene decisively to stop them.

How Long Should the Breakout Timeline Be?

If Iranian breakout activities were detected, the United States and others in the international community probably would turn initially to diplomatic and other non-military means of pressuring Iran to desist. Various steps might be taken. If evidence of possible breakout activities acquired by the IAEA or intelligence agencies were ambiguous, efforts would need to be made by the IAEA and others to clarify the situation. Private diplomatic efforts through various channels would probably be pursued to press Iran to forgo and reverse breakout. At some point, the IAEA Board could be convened to assess the situation and perhaps refer the issue to the U.N. Security Council. The Council could then deliberate on what steps to authorize or even mandate, including further sanctions or possibly the use of force. In parallel, key countries-particularly the United States-could be expected to adopt and implement harsh new sanctions on a national basis.

If military means eventually had to be used, their perceived legitimacy—and prospects for maintaining broad international support for preventing a nuclear-armed Iran—would depend significantly on whether such non-military approaches had first been exhausted. Non-military steps to stop a breakout in progress could take many months, and a case can be made that the comprehensive agreement should ensure that the breakout timeline would have to be long enough to accommodate such steps.

The key goal, however, is to deter Iran—to ensure that it believes it would not have enough time to produce the fissile material for a nuclear weapon before others could intervene to stop it. It might factor into its calculations the time non-military steps might take. But it could never be sure how long it would have for its race to the bomb, including whether military force would be used soon after detection.

There is no definite answer to the question of how long the breakout timeline should be. Deterrence will depend on a combination of factors. Breakout time is important because the longer the time it takes to produce enough material, the greater the prospect of detection and the greater the opportunity for decisive intervention. But if Iran believes that its breakout activities are very likely to be detected at an early stage and that it will pay a very high price as a result, then the time it takes to produce the needed material may be a less important factor.

Clearly, the longer the breakout timeline, the better —and speculation in non-governmental circles has focused on the period of six to twelve months. But the adequacy of a particular timeline will depend on other key aspects of an agreement. If effective monitoring measures increase the likelihood of early detection and credible signals about strong responses to detection increase the perceived costs of breakout, then an acceptable timeline can be shorter, and vice versa. In the end, it will come down to a political judgment about what combination of factors will serve as an effective deterrent to an Iranian breakout decision.

Still, a key negotiating objective for the comprehensive agreement between the P5+1 and Iran should be to achieve as long a breakout timeline as possible, whether using uranium enrichment to produce weapons-grade uranium or reprocessing to produce separated plutonium.

In Iran, the more immediate breakout threat comes from enrichment rather than the separation of plutonium. With its current centrifuges and enriched uranium stocks, Iran could produce enough weapons-grade uranium for a nuclear weapon in a matter of months. With its Arak heavy-water reactor not yet completed and with no known reprocessing capability, Iran is still years away from breakout using the plutonium route.

BREAKING OUT USING ENRICHMENT

In the case of enrichment, the length of the breakout timeline is a function of enrichment capacity, which in turn depends on several factors, primarily the number of centrifuges, the efficiency of the types of centrifuges used, and the amount of enriched uranium—at various enrichment levels and in various chemical forms—available for use as feedstock. The lower the enrichment capacity, the longer the breakout timeline.

Working with centrifuge experts at the University of Virginia, the Institute for Science and International Security (ISIS) has made estimates of the Iranian enrichment capacities that would translate into various breakout timelines:³⁰

- Iran would take about six months to produce enough weapons-grade uranium for a single nuclear weapon using 4000 first-generation IR-1 centrifuges, about 100 kilograms of near-20 percent enriched uranium hexafluoride, and about 1000 kilograms of 3.5 percent uranium hexafluoride.
- It would also take Iran about six months using 6000 IR-1s if no near-20 percent enriched uranium is available and it uses roughly about 1500 kilograms of 3.5 percent uranium hexafluoride.
- It would take 12-14 months using 2000 IR-1s and roughly 1500 kilograms of 3.5 percent uranium hexafluoride, with no near-20 percent enriched uranium used as feedstock.
- It would take 12 months using 6000 IR-1s and feeding roughly 500 kilograms of 3.5 percent uranium hexafluoride and the remainder in natural uranium hexafluoride.

Many combinations are possible for any given breakout timeline. In general, the lower the number of centrifuges and the smaller the stocks of enriched uranium, the longer the timeline. Reducing to very low levels or ideally eliminating all stocks of near-20 percent enriched uranium, whether in gaseous or oxide form, is especially important to lengthening the timeline.

Stocks of 3.5 percent enriched uranium also make an essential contribution to breakout capability. But because a minimum of about 1000-1200 kilograms of 3.5 percent hexafluoride is enough material to produce a single nuclear weapon, capping Iranian stocks of 3.5 percent at levels *above* about 1200 kilograms would have little if any effect on the time it would take in a breakout scenario to produce the first weapon (although limiting Iran's stock of available 3.5 percent enriched uranium above that level could reduce the time it would take to produce additional weapons). Capping 3.5 percent stocks at levels well *below* 1000 kilograms—and therefore requiring the use of natural uranium as feedstock—would, however, have a significant effect on the breakout timeline.

Efficiency of centrifuges. Breakout times are critically affected by the efficiency of the centrifuges used. Iran's IR-2m centrifuge-of which about 1000 have been installed but are prohibited from operating under the interim agreement—is estimated to be roughly four times more efficient than the first-generation IR-1. Any agreed cap on the number of centrifuges that permitted both IR-1s and IR-2ms and allowed Iran to choose its preferred mix of the two would have to assign different weights to each type. Under a limit expressed as the number of centrifuges, IR-2ms could be counted as equivalent to about four IR-1s. Alternatively, the limit could be expressed in separative work units (SWUs) per year-a measure of centrifuge output-with each centrifuge type assigned a different SWU value. So if IR-1s were assigned a value of 0.9 SWU/year and IR-2ms a value of 4 SWUs/year, an agreed cap of 3600 SWUs/year would permit a maximum of 4000 IR-1s, or a maximum of 900 IR-2ms, or many combinations of the two.³¹

In theory, centrifuge types much more efficient that the IR-2m could be accommodated under such a limit, whether expressed in numbers of centrifuges or SWUs. They would be assigned higher values and replace greater numbers of less efficient types under the ceiling. But advanced centrifuges could pose a covert breakout threat. Given their efficiency, a covert facility housing them would require fewer machines and could therefore be relatively small and concealable. And more efficient centrifuges could significantly shorten the breakout timeline compared to the less efficient centrifuge types operating overtly.

Limiting centrifuge R&D. This concern about advanced centrifuges arises in connection with a future agreement's treatment of centrifuge research and development. If Iran is allowed to carry out R&D with advanced centrifuges and gain experience in their operation, concern about their potential use in a covert breakout scenario could increase. Effective monitoring arrangements—including monitoring capable of providing confidence that no production or covert storage of advanced centrifuges is taking place could substantially lower the risks of advanced centrifuge R&D. However, to further minimize those risks, it would be useful to limit the efficiency levels of centrifuges undergoing R&D, perhaps to a level somewhat greater than the IR-2m. The agreement could provide that, as the demonstrated need for enriched uranium in Iran's civil nuclear program increases, the parties could agree to raise the limit.

Significant reductions in Iran's current capacity.

At the end of the JPA's six-month duration, Iran will possess about 19,000 installed centrifuges, over 9000 operating centrifuges, about 235 kilograms of near-20 percent uranium oxide, about 7600 kilograms of uranium hexafluoride below 5 percent, and over 1500 kilograms of uranium oxide below 5 percent. Its breakout time will be roughly two months.

According to the ISIS analysis cited earlier, to produce breakout timelines between six and twelve months, the number of centrifuges would range between 2000 and 6000 IR-1s (or their equivalent in SWUs), the amount of near-20 percent uranium hexafluoride between zero and 100 kilograms, and the amount of 3.5 percent uranium hexafluoride between 500 and 1500 kilograms. Any given timeframe-six or twelve months or a period in between-can be achieved using different combinations of centrifuges and enriched uranium stocks; the trade-offs between constraints on centrifuges and constraints on stocks would enable negotiators to consider a range of possible solutions. But whatever combination is chosen, it is clear that lengthening the breakout timeline to between six and twelve months would require substantial reductions in current Iranian centrifuge and stockpile levels.

BREAKING OUT USING PLUTONIUM

International concern regarding the potential plutonium path to an Iranian nuclear weapon focuses on the Arak reactor, designated the IR-40—a 40 megawatt (MW), heavy water-moderated, natural uraniumfueled reactor the Iranians say will be used to produce medical isotopes and test reactor fuels and materials. Its natural uranium fueling makes it optimal for the production of plutonium and ill-suited for its declared purpose of isotope production and research, and its unnecessarily high power level only increases widespread suspicion about its intended use.

Iran has dismissed concerns about the IR-40 on the grounds that the comprehensive agreement will prohibit reprocessing or the construction of a facility capable of reprocessing, and so questions about separating plutonium from the reactor's spent fuel should not arise. Moreover, the Iranians may well be willing to ship Arak's spent fuel out of the country after its radioactivity has been sufficiently reduced, as they have agreed to do in the case of the Bushehr power reactor's spent fuel. But neither of these measures addresses concerns about a potential breakout scenario, in which it is assumed that spent fuel would suddenly be sent to a previously built covert reprocessing facility rather than shipped out of Iran.

Arak is a much less immediate breakout concern than Iran's enrichment program. Iran's existing enrichment capacity gives Iran the ability to produce enough weapons-grade uranium for a nuclear weapon in a couple of months. There is an urgent challenge in the enrichment area to lengthen that breakout timeline.

In contrast, the Arak reactor is not yet fully built. Under the Joint Plan of Action, Iran will not install remaining components, test additional fuel assemblies, or produce more fuel for the reactor. If these activities resumed, construction would have to be completed, fuel assemblies would have to be successfully tested and loaded into the reactor, the fuel would have to be irradiated for more than a half year, irradiated fuel would have to be discharged from the reactor and placed in a cooling pool for at least several more months, and the spent fuel would have to be taken to an illicit reprocessing facility, where sufficient plutonium would have to be separated for a nuclear weapon. From today, these steps could take two to three years.

So plutonium breakout is not a near-term threat. The risk of breakout becomes more serious once the reactor has been operating for quite some time and significant quantities of spent fuel have been sitting long enough in the cooling pool to be handled safely. At that point, breakout could occur. Iran could violate the agreement by suddenly removing the less radioactive spent fuel from the cooling pool to a covert reprocessing facility and unloading the reactor core to begin cooling additional irradiated fuel. These actions would be readily detected by the IAEA. The time from breakout to the separation of plutonium from the available spent fuel could be well less than a year.

So a critical factor would be the amount of plutonium present in the spent fuel. The natural uranium-fueled IR-40 can produce almost eight kilograms of plutonium each year in its spent fuel, enough for a single first-generation nuclear weapon. That is the main reason why the United States strongly opposes the Arak reactor as currently configured.

From numerous statements by senior Iranian officials, it seems highly unlikely that Tehran would abandon its plans to build a reactor at Arak. The only practical solution may therefore be to reconfigure the reactor in such a way as to reduce its plutonium-production capability.

The best solution would be to convert the reactor to a light water-moderated, enriched uranium-fueled research reactor. Almost all the isotope production reactors built in the last 30 years are of this type, with power levels from 10 to 30 MW. A light-water research reactor (LWRR) fueled with 19.75 percent enriched uranium, which is typical, produces much less plutonium than natural uranium-fueled reactors. For example, such a 20 MW LWRR operated for 300 days a year would produce only 0.7 kilograms of plutonium per year-less than a tenth of the IR-40's plutonium production rate and much less than the amount needed for a nuclear weapon if its spent fuel were reprocessed in a breakout scenario. And importantly, it would be a far better producer of isotopes than the Arak reactor.

Providing fuel for an LWRR fueled with 19.75 percent enriched uranium could be somewhat complicated. Iran has stopped producing near-20 percent enriched uranium under the JPA and the P5+1 countries will want a comprehensive agreement to continue limiting Iran's enrichment to no greater than 5 percent. If Iran agreed to convert Arak to such a reactor, it could purchase 19.75 percent enriched uranium from abroad, perhaps swapping its indigenously produced enriched uranium below 5 percent for an equivalent quantity of 19.75 percent material. Or conceivably it could be permitted to produce a very limited working stock of 19.75 percent material sufficient to fabricate fuel for the LWRR on a "just in time" basis.

The practicalities of converting the IR-40 to an LWRR—the engineering challenges, time, and expense—are not yet clear. It is uncertain, for example, how difficult it would be to convert the IR-40 to operate like Australia's 20 MW Opal LWRR. Technical discussions between Iranian and Western LWRR experts would be required to find out.

The Iranians have so far resisted conversion to an LWRR. Ali Akbar Salehi, head of the Atomic Energy Organization of Iran, told Iranian Press TV that "we see no point stopping the work on this reactor." But he also said "we can . . . make some change in the design in order to produce less plutonium in this reactor and in this way allay the worries and mitigate the concerns."³²

It is not clear how far Salehi is prepared to go in terms of a design change. Experts at Princeton University have suggested design changes less extensive than conversion to an LWRR that they believe would address key concerns about the IR-40.³³ While keeping Arak as a heavy water-moderated reactor, they would fuel the reactor with 5 percent enriched uranium rather than natural uranium and reduce the power level to 10 or 20 MW. These modifications would greatly reduce the production of plutonium in the spent fuel—to about half the amount produced by a 20 MW LWRR fueled with 19.75 enriched uranium if power is reduced to 10 MW and roughly the same amount as produced by the LWRR if the power is only reduced to 20 MW.

Like an LWRR, therefore, an enriched uranium-fueled Arak reactor would produce much less plutonium annually in its spent fuel than would be necessary to make breakout feasible. Moreover, also like the LWRR, it would be much more effective than the original IR-40 design for isotope production and research. The safety implications of modifying the IR-40 in this way would have to be examined further.

An advantage of the approach over the LWRR option is that the reactor would run on 5 percent rather than 19.75 percent enriched fuel, thus avoiding the complication of either requiring the Iranians to acquire 19.75 percent enriched uranium from abroad or allowing them to produce a limited working stock of 19.75 percent enriched uranium themselves.

A likely disadvantage compared to the LWRR option is that this design change could be readily reversed, unlike the more fundamental conversion to a light water-moderated reactor. In a breakout scenario involving the modified Arak design, Iran could relatively quickly replace the 5 percent enriched fuel with natural uranium fuel and boost the power level to 40 MW. However, it would take up to a year for the reactor operating in this mode to produce enough plutonium for a single nuclear weapon and up to another year to allow the spent fuel to cool and to be reprocessed at a reprocessing facility (which could be built while the illegally loaded natural uranium fuel was being irradiated). Moreover, it would require Iran to successfully conceal the production of the necessary 150 natural uranium fuel assemblies before the replacement of enriched fuel with those assembliesthe readily detectable start of breakout —begins.³⁴

Iran would also have breakout options under the LWRR approach—for example, irradiating natural uranium targets in available irradiation channels in and around the reactor core, but LWRR breakout would be expected to produce less plutonium than suddenly reverting to the original IR-40 design.

These various approaches to limiting plutonium breakout need to be explored further. In any event, banning the construction of a reprocessing facility and requiring that Arak's spent fuel be shipped out of Iran as soon as it cools, while both necessary, will not be sufficient to alleviate concerns about breakout. Some significant changes in the IR-40's original design will be required—at a minimum, using enriched uranium fuel and reducing its power level, but preferably also converting it to a light water-moderated research reactor.

Focusing on the Practical Needs of Iran's Civil Nuclear Program

The measures needed in a comprehensive agreement to lengthen the enrichment breakout timeline and constrain plutonium breakout options have often been at variance with positions articulated publicly by senior Iranian officials. They have asserted that Iran's civil nuclear program will remain intact, that no centrifuges will be dismantled, that plans for the Arak reactor and Fordow enrichment facility will proceed, and that research and development on powerful new centrifuges will continue.

The often sharp differences between P5+1 (primarily U.S.) and Iranian stated positions have suggested a fundamental incompatibility between the requirements of preventing a rapid breakout capability and the declared goals and needs of Iran's civil nuclear program. But if one takes a careful look at the realistic needs of Iran's civil program, the two do not appear so at odds.

Focusing on the practical needs of Iran's civil nuclear program is an approach anticipated in the Joint Plan of Action's treatment of the enrichment issue. The JPA states that a comprehensive solution would involve "a mutually defined enrichment programme with mutually agreed parameters consistent with practical needs."

What are Iran's practical needs? An immediate practical need is to have enough uranium fuel enriched to near-20 percent to run the aging Tehran Research Reactor, a small, U.S.-supplied and Argentine-renovated light water research reactor. But Iran has already produced enough near-20 enriched uranium to fuel the TRR for around a decade, which is one reason why Tehran was willing to suspend the production of enriched uranium above 5 percent for the six-month interim agreement.

Iran also has a practical need to fuel its 1000 MW power reactor at Bushehr, which was supplied by Russia. But the Russia-Iran contract for Bushehr

provides that Russia will supply the enriched fuel for the reactor for at least 10 years, and Russia would be willing to continue supplying fuel for the life of the reactor. On March 11, 2014, it was announced that Russia and Iran had reached a preliminary agreement on the constructions of at least two more nuclear power reactors, to be sited near the first Bushehr plant.³⁵ The details are still to be worked out, but the Russians presumably would be prepared to supply fuel for the life of those reactors as well.

If agreement is reached to modify the Arak IR-40 reactor—either to convert it to a light water research reactor or to keep it as a heavy water reactor but run it with enriched uranium fuel—Iran would have a practical need for enriched uranium. A rough estimate is that it would take about 700 IR-1 centrifuges to fuel a 20 MW LWRR annually using available 3.5 percent enriched uranium and about 3400-3500 IR-1s to fuel such a reactor if natural uranium is instead used as feedstock.³⁶

Using natural uranium as feedstock, it would take about 650 IR-1s annually to fuel an IR-40 modified to operate with 5 percent enriched uranium at 10 MW, and about 1300 IR-1s annually to fuel the IR-40 if modified to operate with 5 percent fuel at 20 MW.³⁷

Another, longer-term practical need would be to provide enriched fuel for the small, light-water research reactors that Iranian officials say they want to design and build. Iranian officials have talked about building four such reactors. In February 2014, Iran wrote the IAEA that a "10 MW light water pool-type reactor with 20 percent enriched uranium oxide fuel is planned to be constructed to order to fulfill the national demand on educational nuclear research, material testing, medical radio isotopes production and other beam line application" and that "the site selection process is still in its preliminary stages."³⁸ Thus, the construction and operation of the first of these LWRRs is still years away.

Moreover, even if Iran eventually fulfills its plan to build four LWRRs—which hardly seems necessary to meet its isotope and research requirements, especially if the Arak reactor goes forward in some configuration—the amount of enriched uranium needed to fuel such reactors is relatively small. David Albright of ISIS indicates that one 10-MW LWRR using 20 percent enriched uranium would require about 350 IR-1 centrifuges using 3.5 percent enriched uranium to produce the necessary fuel.³⁹

Iran can be expected to argue that its enrichment program should also have the capacity to provide fuel for any power reactors that it designs and constructs indigenously. In August 2008, Iran stated that its plans to build a 360 MW light water power reactor at Darkhovin had entered the design stage, that the reactor would be based on expertise gained in constructing the Arak IR-40 reactor, and that Iran would produce the required fuel domestically.⁴⁰ But fueling light water power reactors requires much more enriched uranium than LWRRs. Even a relatively small power reactor like Darkhovin (about one-third the size of Bushehr) would need about 35,000 IR-1 centrifuges for its annual fuel supply -which would give Iran a much greater breakout capability than the United States would be willing to accept in a comprehensive agreement.

Iran, however, has no practical need to provide fuel for an indigenous power reactor for many years. Despite occasional Iranian references to plans for a Darkhovin reactor, there are no concrete indications that Iran's intention to design and build power reactors has made it past the drawing board. As of early 2013, despite repeated requests by the IAEA, Iran had not provided design information for the proposed Darkhovin plant.⁴¹ Most experts believe that operation of any such indigenously constructed power reactor is 15 to 20 years away.

Fueling research reactors. So looking realistically at the actual practical needs of Iran's civil nuclear program, it seems that the requirements for indigenously produced enriched uranium are rather small, especially in the near term. Essentially, they are to provide enriched fuel for a modified Arak reactor and, after several more years, to provide fuel for the first 10-MW LWRR and perhaps eventually additional ones. Based on the estimated fuel requirements of those reactors as noted above, those needs can be met under a comprehensive agreement that

also meets the P5+1 need to prevent a rapid nuclear breakout capability.

For example, to ensure a breakout timeline of at least six months, ISIS suggests a ceiling on centrifuges of 3600 SWUs (or 4000 IR-1s), a limit of about 65 kilograms on near-20 percent enriched uranium (uranium mass) in the form of oxide, a limit of 1500 kilograms on enriched uranium hexafluoride below 5 percent, and a ceiling of 20,000 kilograms on total stocks below 5 percent, with all but 1500 kilograms in the form of oxide.⁴² With the stocks Iran could keep under these constraints, as well as the 1100 kilograms of 3.5 percent enriched uranium hexafluoride it could produce each year with the 4000 IR-1s, Tehran would have more than enough enrichment capacity for many years to meet the fuel requirements of Iran's planned research reactors.

Relying on the market to fuel power reactors. Of course, these constraints would not permit Iran to fuel power reactors, given their much greater fuel requirements. But unless Iran can compete with the world's most efficient centrifuge operations, which countries as technologically advanced as Japan have been unable to do, it will make sense for Iran to do what many countries with significant power programs have done—rely on foreign suppliers for enriched fuel for power reactors.

Iranians have sometimes made the argument that they need to produce enriched uranium indigenously for power reactors because foreign suppliers could cut off supplies for political or other reasons. They have even suggested that they could not depend on Russia to be a reliable supplier of enriched fuel. This ignores the fact that Russia defied the international community by building Bushehr and insisting on a carve-out from Security Council restrictions to complete and fuel it. But it also ignores a variety of means to guarantee a timely and reliable supply of fuel, such as back-up fuel supply arrangements with international fuel banks and stockpiling several reloads of fabricated fuel on Iranian territory.

Relying on the international market for enriched uranium especially makes sense for power reactors acquired from foreign suppliers, such as the Bushehr reactor and any additional power reactors purchased from Russia. Foreign suppliers are in the best position to provide enriched uranium that meets the precise specifications of the reactors they design and build.

Acquiring enriched uranium from abroad also makes economic sense for indigenously designed and constructed power reactors. In any event, given the long time it is likely to take Iran to design and build its own power reactor, the issue is unlikely to arise any time soon, probably not during the duration of the comprehensive agreement. Iran can afford to forgo in the near- and mid-term the capacity to fuel indigenous power reactors while it continues to work on the design of such a reactor.

Centrifuge R&D at Fordow. It can also continue developmental work on more advanced centrifuges. As noted earlier, to address breakout concerns, centrifuge research and development could initially be limited to designs somewhat more efficient than the IR-2m, but such a limit could be raised over time if the need arises. Centrifuge R&D could be carried out at the Fordow facility, which would be converted into a facility for nuclear R&D activities by removing existing centrifuge cascades and putting them in monitored storage.

Dealing with stocks. There is little practical need for Iran to retain large stocks of enriched uranium on its territory. To fabricate fuel for its research reactors, Iran will need sufficient working stocks of uranium enriched to up to 5 percent as well as to near-20 percent, which should be stored in oxide form. Stocks in excess of those working levels could be sent abroad—for further processing (e.g., to near-20 percent LWRR fuel), for use in overseas fuel fabrication, or simply for storage. Stocks held overseas could be returned to Iran, sometimes in processed form, on a "just in time" basis to meet Iran's fuel fabrication needs.

Reviewing and revising limits. Given the limited practical needs of Iran's nuclear program in the near term and the P5+1 need to constrain breakout capability, the initial limits on Iran's nuclear program will

be quite strict, requiring significant reductions in key Iranian capacities, such as numbers of centrifuges. At the same time, the agreement could provide for the possibility of reviewing and revising certain restrictions to accommodate the evolving practical needs of Iran's civil nuclear program.

It might describe conditions under which such revisions could be made. For example, if Iran were to build another LWRR, the parties could, if necessary, review the SWU limit or restrictions on amounts and forms of enriched uranium stocks. Or if Iran reached certain milestones in the construction of an indigenous nuclear power reactor, the parties might agree that Iran, in addition to its then-existing enrichment capability, could participate in a multinational enrichment facility outside Iran.

Offering nuclear cooperation. To increase the likelihood of agreement, the P5+1 and the wider international community could offer Iran various forms of cooperation in the civil nuclear field.

- As part of a package deal that would include conversion of the Arak reactor, the P5+1 and other states with relevant experience could cooperate with Iran to design, construct, and fabricate the fuel for the LWRRs that Iran plans to build.
- Moscow could agree to train Iranians in Russia in the fabrication of Bushehr fuel, enabling Iranians eventually to make fuel for Bushehr in Iran, which would be a major benefit to Iran's civil program and reduce any concern about reliability of fuel supply.
- P5+1 countries might also assist Iran in the process of designing and building indigenous power reactors—provided Iran would agree that enriched uranium to fuel such reactors would be acquired on the world market or would be produced in a multinational facility outside Iran.

Discussions with Iranians on the practical needs of their civil nuclear program will not be easy. They can be expected to start off with inflated notions of their needs as a justification for retaining and expanding their nuclear infrastructure, especially their enrichment capacity. And if they are determined to ensure a short breakout timeline, the discussions will not get very far. But if the Iranians are serious about pursuing a civil nuclear energy program, they may come to realize that they can meet their civil nuclear goals—even advance those goals by collaborating with the P5+1 and other countries in the design, construction, and fueling of modern research and power reactors—while at the same time satisfying the international community that it is not insisting on a rapid breakout capability.

OTHER TIMELINE ISSUES

Ballistic missiles. The ballistic missile issue affects the timeline for Iran having a nuclear weapon deliverable to the United States, not the shorter timeline of breakout to producing enough fissile material for a nuclear weapon, which has been the focus of the discussion here. The missile issue is addressed in U.N. Security Council Resolution 1929 (operative paragraph 9), which mandated that "Iran shall not undertake any activity related to ballistic missiles capable of delivering nuclear weapons, including launches using ballistic missile technology, and that states shall take all necessary measures to prevent the transfer of technology or technical assistance to Iran related to such activities." ⁴³

There is considerable logic to addressing ballistic missiles in the context of addressing the nuclear weapons threat. Long-range missiles, in particular, exacerbate concerns about nuclear weapons intentions because, given the inaccuracy of early-generation, long-range ballistic missiles, such missiles only have military utility if they carry munitions with a very wide radius of destruction, mainly nuclear weapons. Moreover, even if a comprehensive nuclear deal were to greatly reduce concerns about a future Iranian nuclear breakout, there would remain a residual uncertainty. Restrictions on missile delivery could serve as a collateral constraint, providing additional reassurance against a future nuclear threat. The nuclear and missile issues are also linked in the Iran case by evidence cited by the IAEA Director General in his November 2011 PMD report that Iran had carried out engineering studies on how to integrate what the Agency suspected was a nuclear weapon into the payload chamber of the Shahab-3 missile's re-entry vehicle.⁴⁴

The United States believes a comprehensive deal should include constraints on ballistic missiles capable of delivering nuclear weapons. Iran has taken an adamant position that missile issues have no place in the nuclear negotiations. But if the negotiations succeed, ballistic missiles would have to be addressed at some point—if only because the Security Council would have to decide what to do with the many restrictions contained in its Iran resolutions, including those on ballistic missiles.

A way out of this potential impasse may be to exclude missile issues from the comprehensive agreement itself but work out a separate understanding on ballistic missiles. As a confidence-building measure, Iran might indicate that it will refrain from certain missile-related activities for a certain period of time (e.g., five to ten years). For example, it might say that it will not flight test long-range rocket systems (either ballistic missiles or space-launch vehicles) with greater capability, in terms of range and payload (or physical size as a surrogate), than they have demonstrated in previous flight testing. This confidence-building measure, which could be monitored without inspections, would limit Iran to rocket systems of the capability/size of the extended-range Shahab-3, or Ghadr, and the Ashura, or Sejil-2, ballistic missiles as well as the Safir-2 space launch vehicle, which launched a small satellite into orbit.45 In addition, Iran might say that it will not flight test any rocket system previously declared to be a space launch vehicle in a ballistic missile trajectory. By demonstrating that Iran was not flight testing an ICBM-class rocket system, which makes little sense without a nuclear warhead, Iran could further enhance confidence that it was not pursuing a nuclear weapon.

Duration of the agreement. The issue of duration is especially important because of the agreement in the JPA that, after the comprehensive agreement expires, Iran will be treated the same as any non-nuclear weapon state party to the NPT. Presumably this means that, after expiration, Iran will not be obliged to continue implementing special restrictions and monitoring measures not practiced by other NPT non-nuclear states. Iran, naturally wanting any Iran-specific measures to be in effect as briefly as possible, favors a relatively short duration for the comprehensive agreement (e.g., five years or shorter). The United States, believing that building confidence that Iran's program is genuinely peaceful will take a long time, supports a duration of about 20 years.

Mistrust of Iran's nuclear intentions runs deep, not just in the United States but in many other countries. Iranian proclamations of peaceful intent, the *fatwa*, and even Iran's scrupulous implementation of the JPA will not allay concerns that Iran is only biding its time – that it may be prepared to accept nearterm constraints on its nuclear capacities in the expectation that it will be unencumbered before long and can resume its quest for nuclear weapons when the time looks propitious and the sanctions have been removed and become harder to re-impose. If Iran is truly interested in dispelling these concerns, it should accept a long-term duration, even if for that period it will be abiding by measures that few, if any, other states currently accept.

In that connection, a positive outcome of Iran accepting more rigorous measures might be a demonstration of their effectiveness and their adoption by a growing number of states. If some or many of the Iran-specific measures became, in effect, the "new normal" for NPT non-nuclear weapon states, not only might Iran be more comfortable continuing such measures without feeling "singularized," but the NPT regime as a whole could be strengthened.

So it would be desirable for the comprehensive agreement to have a duration in the neighborhood of 20 years. Iranian officials have claimed all along that they have nothing to hide and are open to greater transparency. Experience in many states has demonstrated that enhanced monitoring can be carried out in a way that is not a burden to a state's civil nuclear program. And by continuing to build confidence in the international community about Iran's intentions, it would ensure readiness on the part of the P5+1 side to continue to remove sanctions and fulfill the remainder of its commitments.

Moreover, it is likely that the provisions of the comprehensive agreement regarding Iran's enrichment capacity and the Arak reactor-assuming they are along the lines suggested earlier-will not be an impediment to the advancement of Iran's civil nuclear program over the next twenty years. As long as the key Iranian requirement for enrichment is to fuel planned research reactors and Iran is willing to acquire enriched uranium on the world market for power reactors (and in any event recognizes that indigenous power reactors are still many years away), then a realistic Iranian civil nuclear program can grow significantly and modernize, including through cooperation with advanced nuclear energy countries, with a comprehensive agreement of 20year duration.

But if a single 20-year duration for the agreement is regarded as too constraining in a number of ways, it would be possible for Iran and the P5+1 to adopt a variety of different durations for different elements of the agreement. Some elements could be of relatively short duration, others could be significantly longer, and still others could be of indefinite duration. For example, some transparency measures (e.g., enhanced monitoring at enrichment plants) and some constraints (e.g., no reprocessing, no enrichment above a certain level) could be permanent. Some measures (e.g., detailed reporting of imports) could have limited duration. Others (e.g., limits on centrifuge R&D, limits on numbers of centrifuges/ SWUs) could be subject to agreed procedures for reviewing and adjusting limits.

While agreement on the duration of each of the elements will not be easy, it should be a lot easier than reaching agreement on a single duration for the overall agreement.

Signaling a Strong International Response to Breakout

To deter a future Iranian decision to break out of the agreement and build nuclear weapons, it is not enough to detect breakout activities at the earliest possible stage and lengthen the time period between such breakout activities and the accumulation of enough fissile material for a nuclear weapon. It is also essential to convey clearly to Iran's leaders that any attempt to abandon constraints and pursue nuclear weapons would be met with a firm international response that would be very costly to Iranian interests.

EXPEDITIOUS HANDLING OF COMPLIANCE ISSUES

One element of convincing Iran that the international community will be able to respond quickly and decisively is having agreed procedures-such as those discussed in an earlier section-that would prevent Iran from thwarting or delaying the IAEA's investigation of ambiguous or anomalous activities that strongly suggest an effort to break out of the agreement. In the face of Iranian stonewalling or delaying tactics, the IAEA must be able to escalate compliance issues expeditiously-to the IAEA Board of Governors and the Joint Commission, which was established by the JPA to monitor implementation of the interim agreement but should be retained in a comprehensive agreement. Iran must understand that failure to cooperate with the IAEA on such critical compliance issues will be perceived as highly incriminating and inconsistent with the comprehensive agreement-and that the international community will have little choice but to act on that perception.

Procedures to ensure expeditious handling of compliance concerns should be included in a comprehensive agreement. But most steps to put Iran on notice that it would face a firm response to any breakout decision would be pursued outside the agreement, since such steps could not be expected to gain Iranian support.

ROLE OF THE SECURITY COUNCIL

The U.N. Security Council would play an important role in deterring any future Iranian breakout decision. The Council can be expected to adopt a number of resolutions in connection with any comprehensive agreement. Once Iran demonstrates that it is in compliance with its obligations, including by resolving the IAEA's concerns about its past activities, the Council would suspend and eventually terminate nuclear-related U.N. sanctions. The Council can also be expected to adopt a resolution endorsing any agreement reached by the P5+1 and Iran, giving it the force of international law. In such a resolution or in a subsequent one, it would be especially valuable to state that, in the event of violations of the agreement that threaten international peace and security (i.e., breakout activities), the Security Council would meet urgently to review the situation and adopt measures necessary to head off the threat-or similar formulations that would convey the intention of the Council to act promptly to take whatever measures are necessary to prevent a successful breakout.

Obviously, the language regarding how the Council would respond to clear indications of an Iranian nuclear breakout would require difficult negotiations, especially with the Russians and Chinese, both of whom could be expected to resist formulations that could be seen as authorizing the use of military force. The United States and its European partners would need to persuade them that the effectiveness and durability of the nuclear deal depend on signaling clearly that any effort to break out of the agreement and build nuclear weapons would be met with a very firm international response—and that such a signal, in advance, could help ensure that no decision to break out would ever be made.

ROLE OF THE CONGRESS

The Congress would also play a critical role. The JPA calls for the lifting of all nuclear-related sanctions against Iran as part of a comprehensive solution. While the president has considerable authorityusing executive orders and the waiver provisions of U.S. sanctions laws-to refrain from imposing sanctions, it is likely that new legislation will eventually be required to meet the U.S. commitment in a final agreement to lift sanctions. Any new legislation repealing nuclear-related sanctions could also provide that, in the event of an Iranian attempt to break out of the agreement and pursue nuclear weapons, the president would be required to notify the Congress immediately, at which point the Congress would promptly enact new legislation that would restore the old sanctions and put in place additional ones.

Prior authorization to use military force. Congress could take an additional step to deter an Iranian breakout decision. After a comprehensive agreement is reached and enters into force, the Congress could take legislative action to give the president prior authorization to use military force in the event of clear evidence that Iran has taken steps to abandon the agreement and move toward producing nuclear weapons. The president would be required to report immediately to the Congress, on a classified or unclassified basis, on the reasons for using military force, including evidence that Iran had violated the agreement and was moving toward the production of nuclear weapons. But no further action by the Congress would be required. At present, there is significant concern among U.S. security partners in the Middle East and among some observers in Washington that the credibility of U.S. willingness to use force against Iran was undermined by the administration's failure to gain Congressional support for using military force in response to Syria's use of chemical weapons. They are concerned that Iran's leaders may draw the conclusion from that episode that the U.S. executive and legislative branches do not have the political will to use force against Iran and may therefore believe they would be able to violate a nuclear agreement with impunity.

It is not at all clear that Iran has drawn that conclusion. The Syrian and Iranian cases are very different, and Iran presumably recognizes that. A military attack against Syria would have been an after-thefact penalty to discourage Syria from using chemical weapons again. Congress balked not just because members feared it could be a prelude to more direct U.S. involvement in the Syrian civil war, but also because they did not believe the very small military strike that was advertised by the administration would have much impact, either on the outcome of the civil war or on Syria's inclination to use chemical weapons.

In the case of Iran, the reason for using force would be much more compelling—to head off the imminent acquisition of nuclear weapons, an objective strongly supported in the Congress. The circumstances would be very different from what we have today, when negotiations are proceeding, there is no evidence that Iran is on the verge of building nuclear weapons, and consequently there is little support in the United States for using force against Iran. But in a situation where Iran was violating the agreement and clearly heading toward nuclear weapons, things would be very different. The inhibitions against the use of force would be much weaker.

Still, even if the Syria case is very different and does not presage a reluctance to use force against Iran, it would be desirable to counter any perception, however erroneous, that it does. Congressional action to give the president prior authorization could be a useful way of enhancing the credibility of the U.S. determination—by any means necessary—to prevent Iran from acquiring nuclear weapons. It would send a powerful message of U.S. national unity and resolve, and Iran would know that it could not count on a president getting bogged down in time-consuming and contentious discussions with the Congress over the use of force.

It is hard to predict whether the Congress would provide prior authorization. On the one hand, the Congress is wary about getting involved in new military conflicts and, given the experience with Iraqi WMD, may be reluctant to give the president a blank check without being able to evaluate the information the executive branch would cite to justify the use of force. On the other, Congress genuinely wants to prevent Iran from getting nuclear weapons, and members may find it easier to vote for prior authorization as a deterrence measure-before a contingency in which force might be used has arisen-than to vote for authorizing a specific attack. Before seeking prior authorization, the administration would need to consult the Congress quietly to assess the prospects for approval. The worst outcome in terms of deterring an Iranian breakout decision would be to make a major public effort to gain such authorization and then not get it.

ROLE OF THE U.S. ADMINISTRATION

In addition to declaring its intention to restore strong U.S. sanctions in the event of breakout, the administration should consult with key members of the international sanctions coalition, especially the European Union and its members, to encourage them to lift sanctions in such a way as to make it possible to restore them promptly in the event of an Iranian breakout—and to make public their readiness to do so.

While working with Security Council members, sanctions coalition partners, and the Congress to make clear to Iran the high price it would pay if it abandoned constraints and pursued nuclear weapons, the administration would also need to put down some markers unilaterally. The administration, and first and foremost the president, would have to state publicly what the United States would be prepared to do if clear indications appeared of an Iranian breakout.

Readiness, if necessary, to use military force. In the wake of concluding a comprehensive agreement, the administration should indicate that, in the event of an Iranian breakout attempt, it would seek to mobilize the international community, including the Security Council, to impose strong pressures and sanctions on Iran to persuade it to reverse course. It should make clear that it would do everything possible to try to resolve the issue through peaceful means. But to maximize the deterrent against an Iranian breakout decision-and to reassure U.S. security partners in the region-the president should state publicly that, in the event of clear evidence of an Iranian effort to break out and if efforts in the Security Council and elsewhere prove unsuccessful, he would be prepared to use force to stop Iran from building a nuclear weapon.

Signaling our partners, not just Iran. Such a declaratory policy would be important, but just as important would be maintaining the U.S. military capability in the region to reinforce the credibility of such a policy. U.S. partners in the Middle East will want to be reassured that the nuclear deal does not signal a reduced U.S. commitment to the region or an American belief that the agreement itself will ensure their security. Sustaining America's military presence would convey the message not only that the U.S. is not withdrawing from the region but also that it is determined that the nuclear deal be effectively enforced.

Iran's reaction. To say the least, the Iranians will not welcome expressions of intent to restore harsh sanctions or use military force. They will charge the United States with resorting to pressure tactics, demonstrating continued hostility to the Islamic Republic, and acting contrary to the spirit of the agreement just concluded. But Iran should neither be surprised nor alarmed by the U.S. intention to react strongly to any Iranian attempt to break out of the agreement. The United States has been saying all along, and at the highest levels, that it is committed to preventing Iran from acquiring a nuclear weapon and that it is prepared to use all elements of its power, including military force, to do so.⁴⁶

Moreover, in the context of the comprehensive agreement, Iranians would have less reason to regard these policies and statements about possible responses to breakout as a threat. In advance of an agreement, they have protested what they claimed to see as pressures and threats against a legitimate civil nuclear program. With a comprehensive agreement in place, the United States would essentially be saying that strong response options, including the military option, would only be "on the table" if Iran violated an agreement it freely entered into and pursued weapons it has repeatedly said are not in its interest or permitted by its religion.

Not Ideal, But Better than the Alternatives

As negotiations intensify between Iran and the EU/P5+1 group on a comprehensive agreement to succeed the interim deal that was reached last November, there remain sharply differing views among publics and interested governments about what would constitute an acceptable solution.

From the standpoint of stability in the Middle East and nonproliferation, it would have been ideal if Iran had never received centrifuge enrichment technology from Pakistani scientist A.Q. Khan's black market network, uranium conversion technology and uranium compounds from China, or heavy water reactor technology from Russian entities. Without these and other developments, there might not be a crisis today over Iran's nuclear program, although sooner or later Iran may well have acquired nuclear capabilities on its own. In any event, these past developments are water under the bridge.

Even now, it would be desirable for Iran to decide to terminate its fuel cycle programs and pursue a civil nuclear research and power program without an enrichment capability to produce its own fuel. This is what countries with some of the world's most advanced nuclear energy capabilities have done, and a strong case can be made that—if Tehran were truly interested in only having a modern civil nuclear energy program this is the course it would follow.⁴⁷ But Iran is not only interested in a civil nuclear program. It also wants to retain at least an option to pursue nuclear weapons at some future time. And it has convinced its public that resisting pressures to forgo enrichment is essential to national sovereignty and dignity. So in current circumstances, "zero enrichment" is not achievable. A false debate has been taking place between preventing Iran from acquiring a nuclear weapon and preventing Iran from acquiring a nuclear weapons *capability*. With its current technical know-how, its hands-on experience, and its material and financial resources, Iran *already* has the capability to acquire nuclear weapons. Even if somehow it could be persuaded to dismantle its enrichment facilities and export all its stocks of enriched uranium, it would be capable of reconstituting its nuclear program in the future.

Preventing the Iranians from acquiring nuclear weapons does not depend on preventing them from having a nuclear weapons capability or compelling them to forgo enrichment. Even though they already have that capability, the goal of prevention can be achieved by deterring the decision to exercise their capability—by making it clear to them that any future decision to acquire nuclear weapons would be extremely costly, and the costs would outweigh any benefits they hoped to achieve.

It will not be easy to achieve a comprehensive agreement. The positions of the parties—especially the United States and Iran—are still far apart. Persuading Iran to accept a deal along the lines suggested here will require unity among the P5+1 partners and a continuing resolve among members of the broad international sanctions coalition to keep in place the sanctions measures necessary to give Tehran the incentive to come to terms on an deal acceptable to the United States and its partners.

Selling an Agreement in Iran

It will also require devising an agreement that Iran's leaders can sell at home. The Supreme Leader is the ultimate decision-maker on the nuclear issue and so far has backed his negotiators. But in addition to his own ideological predisposition to resist accommodation with the United States, he must answer to constituencies that are the pillars of the regime and of his own support, and many of them are strongly opposed to an agreement. It will be important for him and Rouhani to have a deal they can portray as protecting Iran's rights and meeting its goals in the civil nuclear energy area.

That is why it would be useful to approach the issue of constraints on Iran's nuclear capabilities from the standpoint of the practical needs of Iran's civil nuclear energy program, which are quite limited, especially in the near term. Focusing on actual needs—not inflated, hypothetical ones—could encourage the Iranians to take a hard look at their current facilities and activities and, if they are genuinely interested in pursuing nuclear energy for peaceful purposes, to consider what would best serve the interests of a future civil program.

It might bring them to recognize that holding onto an unnecessarily large number of obsolete centrifuges hardly makes sense. Nor does continuing to build a reactor not configured properly for its intended purpose of producing medical isotopes, or planning to produce enriched uranium for nuclear power reactors when foreign enrichment operations can provide the fuel more cheaply and efficiently and without sacrificing reliability of supply. It might also encourage Iran to consider how collaboration with the P5+1 and other interested countries—in such areas as the design, construction, and fueling of modern research reactors and fuel fabrication for power reactors – could provide long-term benefits for its civil nuclear program.

In general, focusing on practical needs might demonstrate that what the United States and its P5+1 partners consider necessary to prevent a rapid nuclear breakout capability is not inconsistent with the requirements of a sound Iranian civil nuclear energy program.⁴⁸

ANTICIPATING CRITICISM

Any agreement that does emerge from the negotiating process will face widespread criticism from many directions. If domestic Iranian reactions to the interim deal are a preview of what is to come, President Rouhani and his negotiators will be strongly attacked on the grounds that the comprehensive agreement gives up too much of Iran's nuclear capabilities.

The Obama administration will also face strong criticism, some of it directed not at the agreement itself but at Iran's regional activities, including its role in Syria and its support for groups like Hezbollah and Hamas, and its human rights record at home. The United States will need to demonstrate through its continuing military and diplomatic presence that the agreement does not in any way signal its disengagement from the region. It will also need to make clear that it remains committed to effectively countering Tehran's regional troublemaking, protecting the interests of its Middle East friends, and focusing on Iran's human rights abuses-while, at the same time, explaining that, unless the nuclear issue is given priority and resolved, Iran's behavior will only pose much greater threats.

In addition to raising questions about Iran's regional behavior, critics will of course focus on the elements of the agreement itself, particularly on whether Iran's nuclear infrastructure has been sufficiently scaled back and whether monitoring arrangements are adequate. In evaluating a final agreement, it will be important to look at the overall package and how the various components interact.

For example, if there is strong public support, both internationally and in the United States, for responding firmly and promptly to any Iranian breakout attempt, then the breakout timeline may not have to be quite as long. If Iran is prepared to accept low limits on enriched uranium stocks, centrifuge numbers can be higher, and vice versa. Or if agreed monitoring arrangements can provide strong confidence in compliance going forward, including in the absence of a covert program, then the requirement for detailed information about all past activities need not be quite so demanding.

The key question on which the agreement should be judged is whether, taken as a whole, the deal will provide an effective deterrent to a possible future decision by Iran's leaders to pursue nuclear weapons —whether it will make the path to nuclear weapons appear, in the minds of those leaders, so detectable, so lengthy, and so risky that they will never decide to take that path.

Comparing a Deal with the Alternatives

Any such assessment will also require comparing the inevitably imperfect agreement that emerges from negotiations with its alternatives—not with an ideal but unattainable agreement, but with the realistic alternatives for dealing with the Iran nuclear issue.

One alternative is to try to ratchet up sanctions dramatically in the hope of pressuring the Iranians to make far-reaching concessions they have been unwilling to make. But the same factors that have led the Iranians to reject what they considered to be excessive demands—including a readiness to muddle through economically without an agreement rather than be seen as capitulating to U.S. pressure and sacrificing Iran's rights—would continue to make it difficult to compel them to give in. Moreover, if Washington took a much more demanding position in the negotiations, the United States might then be seen by some members of the P5+1 and the international sanctions coalition as the more intransigent party, and support for sanctions could unravel.

The other main alternative to agreement is the use of military force. But military strikes would only set back Iran's nuclear program temporarily—not end it—and could result in Iranian or Iranian-inspired retaliation in the region and beyond of unpredictable dimensions. And the military option could trigger and provide strong justification for the Iranian decision the United States had hoped to deter—the decision to kick out inspectors, withdraw from the NPT, and move as quickly as possible to produce nuclear weapons.

If Iran is determined to maintain and even shorten its nuclear breakout capability and is unwilling to accept significant limits on its nuclear capacities and rigorous monitoring measures, the United States will have little choice but to turn to these alternatives. But before it does, it should make every effort to negotiate an agreement that can influence future Iranian nuclear decision-making and significantly reduce the likelihood that Iran will opt to build nuclear weapons. While not the ideal outcome, it would be far more in the U.S. interest than the alternatives.

Annex I

JOINT PLAN OF ACTION

Preamble

The goal for these negotiations is to reach a mutually-agreed long-term comprehensive solution that would ensure Iran's nuclear program will be exclusively peaceful. Iran reaffirms that under no circumstances will Iran ever seek or develop any nuclear weapons. This comprehensive solution would build on these initial measures and result in a final step for a period to be agreed upon and the resolution of concerns. This comprehensive solution would enable Iran to fully enjoy its right to nuclear energy for peaceful purposes under the relevant articles of the NPT in conformity with its obligations therein. This comprehensive solution would involve a mutually defined enrichment program with practical limits and transparency measures to ensure the peaceful nature of the program. This comprehensive solution would constitute an integrated whole where nothing is agreed until everything is agreed. This comprehensive solution would involve a reciprocal, step-by step process, and would produce the comprehensive lifting of all UN Security Council sanctions, as well as multilateral and national sanctions related to Iran's nuclear program.

There would be additional steps in between the initial measures and the final step, including, among other things, addressing the UN Security Council resolutions, with a view toward bringing to a satisfactory conclusion the UN Security Council's consideration of this matter. The E3+3 and Iran will be responsible for conclusion and implementation of mutual near-term measures and the comprehensive solution in good faith. A Joint Commission of E3/ EU+3 and Iran will be established to monitor the implementation of the near-term measures and address issues that may arise, with the IAEA responsible for verification of nuclear-related measures. The Joint Commission will work with the IAEA to facilitate resolution of past and present issues of concern.

Elements of a first step

The first step would be time-bound, with a duration of 6 months, and renewable by mutual consent, during which all parties will work to maintain a constructive atmosphere for negotiations in good faith.

Iran would undertake the following voluntary measures:

- From the existing uranium enriched to 20%, retain half as working stock of 20% oxide for fabrication of fuel for the TRR. Dilute the remaining 20% UF6 to no more than 5%. No reconversion line.
- Iran announces that it will not enrich uranium over 5% for the duration of the 6 months.
- Iran announces that it will not make any further advances of its activities at the Natanz Fuel Enrichment Plant (1), Fordow (2), or the Arak reactor (3), designated by the IAEA as IR-40.
- Beginning when the line for conversion of UF6 enriched up to 5% to UO2 is ready, Iran has decided to convert to oxide UF6 newly enriched up to 5% during the 6 month period, as provided in the operational schedule of the conversion plant declared to the IAEA.
- No new locations for the enrichment.
- Iran will continue its safeguarded R&D practices, including its current enrichment R&D practices, which are not designed for accumulation of the enriched uranium.
- No reprocessing or construction of a facility capable of reprocessing.

- Enhanced monitoring:
 - Provision of specified information to the IAEA, including information on Iran's plans for nuclear facilities, a description of each building on each nuclear site, a description of the scale of operations for each location engaged in specified nuclear activities, information on uranium mines and mills, and information on source material. This information would be provided within three months of the adoption of these measures.
 - Submission of an updated DIQ for the reactor at Arak, designated by the IAEA as the IR-40, to the IAEA.
 - Steps to agree with the IAEA on conclusion of the Safeguards Approach for the reactor at Arak, designated by the IAEA as the IR-40.
 - Daily IAEA inspector access when inspectors are not present for the purpose of Design Information Verification, Interim Inventory Verification, Physical Inventory Verification, and unannounced inspections, for the purpose of access to offline surveillance records, at Fordow and Natanz.
 - IAEA inspector managed access to:
 - centrifuge assembly workshops4;
 - centrifuge rotor production workshops and storage facilities; and,
 - uranium mines and mills.

In return, the E3/EU+3 would undertake the following voluntary measures:

• Pause efforts to further reduce Iran's crude oil sales, enabling Iran's current customers to purchase their current average amounts of crude oil. Enable the repatriation of an agreed amount of revenue held abroad. For such oil sales, suspend the EU and U.S. sanctions on associated insurance and transportation services.

- Suspend U.S. and EU sanctions on:
 - Iran's petrochemical exports, as well as sanctions on associated services. (5)
 - Gold and precious metals, as well as sanctions on associated services.
- Suspend U.S. sanctions on Iran's auto industry, as well as sanctions on associated services.
- License the supply and installation in Iran of spare parts for safety of flight for Iranian civil aviation and associated services. License safety related inspections and repairs in Iran as well as associated services. (6)
- No new nuclear-related UN Security Council sanctions.
- No new EU nuclear-related sanctions.
- The U.S. Administration, acting consistent with the respective roles of the President and the Congress, will refrain from imposing new nuclear-related sanctions.
- Establish a financial channel to facilitate humanitarian trade for Iran's domestic needs using Iranian oil revenues held abroad. Humanitarian trade would be defined as transactions involving food and agricultural products, medicine, medical devices, and medical expenses incurred abroad. This channel would involve specified foreign banks and non-designated Iranian banks to be defined when establishing the channel.
 - This channel could also enable:
 - transactions required to pay Iran's UN obligations; and,
 - direct tuition payments to universities and colleges for Iranian students studying abroad, up to an agreed amount for the six month period.

• Increase the EU authorisation thresholds for transactions for non-sanctioned trade to an agreed amount.

Elements of the final step of a comprehensive solution*

The final step of a comprehensive solution, which the parties aim to conclude negotiating and commence implementing no more than one year after the adoption of this document, would:

- Have a specified long-term duration to be agreed upon.
- Reflect the rights and obligations of parties to the NPT and IAEA Safeguards Agreements.
- Comprehensively lift UN Security Council, multilateral and national nuclear-related sanctions, including steps on access in areas of trade, technology, finance, and energy, on a schedule to be agreed upon.
- Involve a mutually defined enrichment program with mutually agreed parameters consistent with practical needs, with agreed limits on scope and level of enrichment activities, capacity, where it is carried out, and stocks of enriched uranium, for a period to be agreed upon.
- Fully resolve concerns related to the reactor at Arak, designated by the IAEA as the IR-40. No reprocessing or construction of a facility capable of reprocessing.
- Fully implement the agreed transparency measures and enhanced monitoring. Ratify and implement the Additional Protocol, consistent with the respective roles of the President and the Majlis (Iranian parliament).
- Include international civil nuclear cooperation, including among others, on acquiring modern light water power and research reactors and associated equipment, and the

supply of modern nuclear fuel as well as agreed R&D practices.

Following successful implementation of the final step of the comprehensive solution for its full duration, the Iranian nuclear program will be treated in the same manner as that of any non-nuclear weapon state party to the NPT.

FOOTNOTES

- (1) Namely, during the 6 months, Iran will not feed UF6 into the centrifuges installed but not enriching uranium. Not install additional centrifuges. Iran announces that during the first 6 months, it will replace existing centrifuges with centrifuges of the same type.
- (2) At Fordow, no further enrichment over 5% at 4 cascades now enriching uranium, and not increase enrichment capacity. Not feed UF6 into the other 12 cascades, which would remain in a non-operative state. No interconnections between cascades. Iran announces that during the first 6 months, it will replace existing centrifuges with centrifuges of the same type.
- (3) Iran announces on concerns related to the construction of the reactor at Arak that for 6 months it will not commission the reactor or transfer fuel or heavy water to the reactor site and will not test additional fuel or produce more fuel for the reactor or install remaining components.
- (4) Consistent with its plans, Iran's centrifuge production during the 6 months will be dedicated to replace damaged machines.
- (5) 'Sanctions on associated services' means any service, such as insurance, transportation, or financial, subject to the underlying U.S. or EU sanctions applicable, insofar as each service is related to the underlying sanction and required to facilitate the desired transactions. These services could involve any non-designated Iranian entities.
- (6) Sanctions relief could involve any non-designated Iranian airlines as well as Iran Air.

* With respect to the final step and any steps in between, the standard principle that 'nothing is agreed until everything is agreed' applies.

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#1 Resetting U.S.-Russian Leadership on Nuclear Arms Reductions and Non-Proliferation, by Steven Pifer, Joseph Cirincione and Clifford Gaddy, January 2010

#2 Salvaging the Conventional Armed Forces in Europe Treaty Regime: Options for Washington, by Anne Witkowsky, Sherman Garnett and Jeff Mc-Causland, March 2010

#3 U.S. Nuclear and Extended Deterrence: Considerations and Challenges, by Steven Pifer, Richard C. Bush, Vanda Felbab-Brown, Martin S. Indyk, Michael O'Hanlon and Kenneth M. Pollack, May 2010

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#7 NATO, Nuclear Weapons and Arms Control, by Steven Pifer, July 2011 #8 Missile Defense in Europe: Cooperation or Contention?, by Steven Pifer, May 2012

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