An Arms Control Association
Briefing Book

Solving the Iranian Nuclear Puzzle

Updated September 2013

ACA Research Staff

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Acknowledgements

The Arms Control Association is grateful for the generous support of our members and donors, without which this report would not have been possible. In particular, we wish to thank the Carnegie Corporation of New York, the William and Flora Hewlett Foundation, the John D. and Catherine T. MacArthur Foundation, the Ploughshares Fund, and the Prospect Hill Foundation, which provide support for ACA research and public education programs on nuclear nonproliferation issues. We also thank Victor Silva for research assistance, Brian Allen for copy editing and Jackie Barrientes for the design and production of the report. Responsibility for the report's contents rests exclusively with the authors and our recommendations do not necessarily represent those of the Board of Directors and members of the Arms Control Association.

Cover Photo

In an August 6 news conference, Iran's President Hassan Rouhani said that Tehran is ready to for serious negotiations on its nuclear program. Rouhani was inaugurated on August 3. Credit: Atta Kenare/AFP/Getty Images

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Introduction

For decades, U.S. and international leaders have worked to eliminate the enormous dangers posed by the spread of nuclear weapons. The 1968 nuclear Non-Proliferation Treaty (NPT) and its inspections and safeguards were major steps toward containing proliferation. Along with global limits on nuclear weapons testing and innovative counter-proliferation programs, these measures have helped keep the number of nuclear-armed states to a minimum.

But the dangers posed by nuclear weapons and the proliferation of the technologies necessary to make them remain high. Today, Iran's leaders are pursuing an array of sensitive nuclear fuel-cycle projects that provide them with the ability to amass the nuclear material necessary for an arsenal if they were to choose to do so.

Ten years have elapsed since the International Atomic Energy Agency (IAEA) first confirmed that Iran, a signatory to the NPT, had secretly built a uranium-enrichment facility at Natanz in violation of its commitments under the treaty to comply with safeguards designed to detect diversion of nuclear materials for military purposes.

After the disclosure led to talks between the so-called EU-3 group (U.K., France, and Germany) and Iran, Tehran agreed to halt its program from 2003-2005 and allow for more extensive IAEA inspections, opening the way for a long-term resolution.

But the talks stalled and Iran resumed and expanded its enrichment activities and continued other nuclear fuel cycle projects. In 2006, Iran's nuclear file moved from the IAEA's Board of Governors to the United Nations Security Council, which has approved six sets of resolutions that demand Iran curb its nuclear work, address the outstanding questions regarding its nuclear activities, and mandate increasingly stringent sanctions designed to curb Iran's nuclear and missile related activities.

Since then, IAEA inspectors have documented the steady but slow progress of Iran's uranium enrichment program and other sensitive nuclear fuel cycle activities. In 2009, a second uranium enrichment facility, Fordow, was revealed. In November 2011, the IAEA catalogued information that strongly suggests Iran engaged in activities with "potential military dimensions" before 2004. The Agency continues to seek further cooperation with Iran's leaders to verify that such activities have been halted.

Iran apparently has still not made a strategic decision to build nuclear weapons and does not yet have the necessary ingredients for an effective nuclear arsenal, but its capabilities are improving. The latest IAEA report finds that Iran could soon have enough stockpiled 20 percent enriched uranium for one nuclear bomb if it is further enriched to weapons grade; Iran is deploying more sophisticated types of uranium centrifuges that could significantly increase its capacity to produce enriched uranium; and Iran may soon complete work on a heavy water reactor near Arak that could be used to produce plutonium for weapons at some point in the future.

Since 2006, Iran and the P5+1—China, France, Germany, Russia, the United Kingdom, and the United States—have fumbled fleeting opportunities to reach a deal that could reduce the risk of a nuclear-armed Iran in exchange for a rollback of proliferation-related sanctions.

There is still time for diplomacy, but both sides need to move with greater urgency toward a lasting solution. The inauguration of Hassan Rouhani as president of Iran on August 3 provides an important opportunity

to reinvigorate negotiations between Iran and the P5+1 group that President Barack Obama and other key leaders must seize.

A Net Assessment

This second edition of *Solving the Iranian Nuclear Puzzle* is designed to provide a clear understanding of Iran's nuclear history and the regional security context, the technical realities of Iran's nuclear program, as well as the risks, benefits, and limitations of the policy options.

It remains our conclusion that a deal that sets reasonable limits on Iran's enrichment activities, its nuclear materials stockpiles, and other sensitive nuclear fuel-cycle activities, combined with more extensive IAEA safeguards, could sufficiently guard against a nuclear-armed Iran. Pursuing such a course is difficult, but it is clearly the best option on the table.

Tighter international sanctions can help slow the advance of Iran's nuclear and missile programs and increase pressure on Tehran to negotiate seriously. Yet, sanctions alone will not halt Iran's nuclear pursuits. The adoption of further sanctions by the U.S. Congress ahead of the next round of negotiations risks fracturing international support for the current sanctions regime and could undermine the prospects for a successful diplomatic outcome.

The so-called military option would be counterproductive and costly for all sides. Potential Israeli or U.S. air strikes could set back Iran's program for no more than a few years and could lead Tehran to withdraw from the NPT and openly pursue nuclear weapons. Further cyber attacks on Iran's nuclear installations may buy time, but also deepen mistrust and increase the determination of Iran's leaders to expand their nuclear program.

The five rounds of nuclear talks in 2012 and 2013 have revealed the substantial differences between the two sides, but a meaningful deal that guards against a nuclear-armed Iran still appears to be within reach if both sides provide greater flexibility and creativity.

On August 4, the White House issued a statement saying: "The inauguration of President Rouhani presents an opportunity for Iran to act quickly to resolve the international community's deep concerns over Iran's nuclear program. Should this new government choose to engage substantively and seriously to meet its international obligations and find a peaceful solution to this issue, it will find a willing partner in the United States."

President Rouhani told reporters on August 6 that "Iran has a serious political will to solve the nuclear problem while protecting the rights of the Iranian people at the same time as it seeks to remove concerns of the other party." He also said a "win-win" outcome is possible. In an August 19 interview, Iran's new Foreign Minister, Mohammad Javad Zarif said that "according to the fatwa issued by the Supreme Leader and based on the strategic needs of Iran, nuclear weapons have no place in our national security doctrine and are even detrimental to our national security."

The task now is to translate words into action. That requires renewing talks soon, tabling realistic new proposals, and adjusting positions to achieve a win-win deal.

Given Iran's growing nuclear weapons potential, the P5+1 group's top priority must be reaching a deal that halts Iran's accumulation of 20 percent-enriched uranium, which is above the level used in civilian power reactors and significantly closer to weapons grade, in exchange for fuel assemblies for Iran's Tehran Research Reactor and/or medical isotopes. This could serve as a basis for a broader deal to limit the size and scope of Iran's enrichment program and would be consistent with the principle that Iran can enrich uranium but only in full compliance with safeguards and only for legitimate civilian purposes. Iran must also be willing to consider halting work on its Arak heavy water reactor in exchange for other forms of civil nuclear cooperation or energy assistance that do not represent such a high proliferation risk.

To get to "yes," the P5+1 should also be prepared to forego additional sanctions and phase out certain existing ones if Iran follows through on its commitments. If Iran does not follow through with tangible steps, sanctions could be reinstated and expanded.

For its part, Iran could make a deal and sanctions relief more likely if it would immediately cooperate with the IAEA on inspections of key sites, including Parchin, and to ensure that past weapons-related experiments have been discontinued. In addition, Iran must clarify when it will allow IAEA inspections under the terms of an additional protocol to its safeguards agreement.

Some critics of the diplomatic option wrongly suggest that further negotiations with Iran would only allow it to "buy time" for nefarious nuclear pursuits. The reality is that international and national sanctions will remain in place until Iran takes the steps necessary to provide confidence that it is not pursuing nuclear weapons. There is time for a diplomatic solution to the Iranian nuclear puzzle, but that time should not be squandered nor should it be undermined.

Daryl G. Kimball,
Executive Director,
September 1, 2013

SECTION 1

The Status of Iran's Nuclear Program

Iran has been engaged in efforts to acquire the capability to build nuclear weapons for more than two decades. Although it remains uncertain whether Tehran will make the final decision to build nuclear weapons, it has developed a range of technologies, including uranium enrichment, warhead design, and delivery systems, that would give it this option in a relatively short time frame. Such an effort is not the same as a crash program designed to acquire a nuclear weapon as soon as possible, in which case Iran would eject inspectors and produce weapons-grade material at its existing facilities. Tehran appears to be taking a more deliberate approach, building up as much of its technological base as possible under the guise of a peaceful program, while putting off the need to make a political decision to build and deploy nuclear weapons.

One of the most challenging aspects of addressing Iran's nuclear program is accurately measuring the extent to which Iran has proceeded along this course and, more importantly, determining the path that it would likely pursue in order to obtain nuclear weapons given a decision to do so.

Iran's Nuclear Motivations

Iran's interest in developing a nuclear weapons capability is directly aligned with the central priority of its leadership: the survivability of its regime. The Islamic Republic's revolutionary government has seen itself as under threat since it came into power in 1979, both because of Tehran's adversarial relationship with the United States and from its bitter eight-year war with Iraq. Although its former primary adversary in Baghdad has been replaced by a friendlier government, the presence of U.S. forces in Afghanistan and Iraq has likely heightened its concerns about the external threat from the United States. Tehran's national security aims are grounded in deterring threats to the regime, and according to a 2010 Pentagon report on Iran's military power, "Iran's nuclear program and its willingness to keep open the possibility of developing nuclear weapons is a central part of its deterrent strategy."[1]

Iran's nuclear ambitions also are rooted in the country's aspiration to politically dominate its geographic neighborhood. Tehran's military power is not proportionate to its economic power, and its conventional military capabilities are limited by lack of training and modern weaponry. Iranian military modernization also has been constrained since the Iran-Iraq war because of limited access to foreign weapons. Consequently, although Iran has been active in building a domestic arms industry, it still retains U.S.-built weapons from the time of the shah and lower-quality Russian- or Chinese-built systems acquired later. Iran sees ballistic missiles with nuclear weapons potential as a means of making its military capabilities commensurate with its own view of its political importance for the region.

At the same time, a decision to pursue nuclear weapons would need to overcome political as well as technical hurdles. Iran has long said that its intent is a peaceful nuclear program. Supreme Leader Ayatollah Ali Khamenei has called nuclear weapons a "grave sin," claiming that Iran "has never pursued and will never pursue" them.[2] Iran's apparent nuclear warhead work, at

least prior to 2004, undermines Khamenei's assurances; Iran would need to find some way to reconcile such protestations by its leader if it sought to become nuclear armed. Moreover, major countries and rising powers such as China, Russia, India, and Brazil have been reluctant to place heavier pressure on Iran so long as it is not obviously pursuing weapons. Yet, they would not be able to maintain close relations with Tehran in the event of an open decision to build nuclear weapons. Iran is likely wary of the political and economic consequences of such a decision, which would bring even greater isolation.

Background to Iran's Nuclear Ambitions

Iran's interest in pursuing an ambitious nuclear power program preceded the 1979 revolution. The United States provided a kick-start to Iran's nuclear program by signing a nuclear cooperation agreement under President Dwight Eisenhower's Atoms for Peace Program in 1957 and subsequently provided the five-megawatt Tehran Research Reactor (TRR). The shah's government later announced plans for building more than 20 nuclear power reactors for generating electricity.[3]

From the first serious discussions with Tehran in the 1970s about helping to construct nuclear power reactors, the U.S. government sought to impose safeguards beyond those required by the nuclear Nonproliferation Treaty (NPT). For his part, the shah pushed hard for domestic development of the full nuclear fuel cycle, in particular the ability to reprocess spent fuel.[4] Although Iran claims today that Washington accepted a robust nuclear power program in Iran under the shah, the United States insisted at the time that Iran not possess a reprocessing capability due to fears it would be used to produce plutonium for nuclear weapons.

After a brief interregnum following the 1979 revolution, the Iranian government resumed its pursuit of the previous regime's nuclear aspirations, albeit slowly, as Ayatollah Ruhollah Khomeini initially opposed nuclear development for theological reasons. Following his death in 1989, the new Supreme Leader, Ayatollah Ali Khamenei, expanded Iran's undeclared nuclear activities.[5] The nuclear capabilities that Iran has been pursuing can be used both for a peaceful nuclear energy program and nuclear weapons, although some of the capabilities on which Iran has focused strongly suggest an intention to build weapons.

Today, the most relevant aspects of Iran's nuclear program for a nuclear weapons option are its uranium-enrichment-related facilities, its heavy-water reactor activities, and the work it has carried out on warhead development. These activities must be addressed in some way to prevent Iran from acquiring either a virtual or an actual nuclear arsenal.

Uranium Enrichment

Iran's uranium-enrichment program lies at the center of concern about Iran's nuclear aspirations because it provides Iran with the ability to produce one form of fissile material for nuclear weapons: weapons-grade highly enriched uranium (HEU). This is the most likely path Iran would use to produce nuclear weapons. Iran enriches uranium using a machine called the gas centrifuge, which spins at high speeds to increase the concentration, or percentage, of the fissionable isotope uranium-235. The centrifuges are organized in groups called cascades, which generally contain either 164 or 174 machines. Beginning in the mid-1980s, Iran acquired gas centrifuge technology through the nuclear smuggling network led by former Pakistani nuclear official Abdul Qadeer Khan, who provided similar assistance to Libya and North Korea. The centrifuge model that Iran is currently using to enrich uranium, called the IR-1, is based on a Pakistani design, called the P-1, acquired from the Khan network, which Khan originally smuggled from the European enrichment consortium URENCO in the 1970s.

Iran's centrifuge capacity is gradually increasing, as it continues to install more machines and develop advanced models. By mid-2013, Iran had over 15,000 first generation centrifuges (IR-1) installed in its underground industrial-sized enrichment facility at a site called Natanz.[6] The Natanz plant is intended to eventually house about 50,000 centrifuges, although it is unclear if Iran has sufficient material to construct that many machines. However, it is unlikely that Iran is able to produce all of the materials, such as high-quality carbon fiber and maraging steel indigenously. Tehran continues to rely on illicit networks to bypass international sanctions prohibiting the purchase of these materials.

These IR-1 machines are currently running to enrich uranium to 3.5 percent low-enriched uranium (LEU), the level generally used in nuclear power reactors. By August 2013, Iran had produced a total of over 9,704 kilograms of LEU, an amount sufficient for several nuclear weapons if enriched further to weapons grade and then fabricated into the weapons' metallic cores. As of the August report of the International Atomic Energy Agency (IAEA), 6,774 kilograms remain in the stockpile, while the remainder has been fed into additional machines to produce uranium enriched to nearly 20 percent.

The Natanz site also houses the above-ground Pilot

Steps to Building Nuclear Weapons

The most recent U.S. Intelligence Community assessment of Iran's nuclear weapons potential, as expressed by Director of National Intelligence James Clapper in testimony before Congress in January 2012, is that "… Iran is keeping open the option to develop nuclear weapons in part by developing various nuclear capabilities that better position it to produce such weapons, should it choose to do so. We do not know, however, if Iran will eventually decide to build nuclear weapons. Iran has the scientific, technical, and industrial capacity to eventually produce nuclear weapons… if it so chooses."

There are two routes for Iran (or any state) to obtain sufficient fissile material to make nuclear weapons—using highly enriched uranium or plutonium. The following major scientific, technical, and industrial steps are required to build a uranium or plutonium weapon.

Mining or Importation of Uranium Ore
Iran is believed to have large reserves of uranium and two working mines.

Milling of Uranium
Concentrating uranium from ore, i.e., increasing uranium oxide content to 65-85 percent to produce "yellow cake."

Processing (Conversion)
Converting yellow cake, a solid, into uranium hexafluoride, a gas.

URANIUM ENRICHMENT ROUTE
Increasing the relative abundance of the uranium-235 isotope in the uranium hexafluoride

- to light-water power-reactor grade (3.5 percent)
- to research-reactor grade (20 percent)
- to weapons grade (90+ percent)

The IAEA estimates that 25 kg of weapons grade uranium is sufficient to produce one nuclear device.

PLUTONIUM PRODUCTION ROUTE
A nuclear "heavy water" reactor fueled by natural uranium will produce plutonium as a byproduct of reactor operatons. The plutonium must be separated from the spent fuel and the highly radioactive fission product contained in the fuel.

Spent Fuel Reprocessing
A separate reprocessing facility is needed to separate out the plutonium before it can be used in nuclear weapons.

The IAEA estiamtes that 8 kg of weapons-grade plutonium is sufficient to produce one nuclear device.

Fabrication
Converting weapons-grade uranium hexafluoride to uranium dioxide powder and into metallic forms for use in the fissile core of a nuclear device, or fabricating plutonium weapons components from reprocessed fuel.

Weapons Design and Assembly
Designing and assembling the other non-nuclear components in and around the fissile material core to make a device capable of forming the "physics package" of a warhead, suitable for use as part of a combat-ready weapons system.

Nuclear Explosive Testing
Detonating the nuclear device as proof of concept. Typically, multiple nuclear test explosions are necessary to perfect warhead designs, particularly smaller, lighter, more efficient designs.

Weapons Integration With a Delivery System
Adapting the warhead for placement into a bomb or the nose cone of a delivery vehicle.

Missile Testing With Inert Warhead
Performing flight tests with an inert warhead to confirm the performance of the non-nuclear functions of the warhead, such as safing, arming, and fusing, which are necessary in order to achieve higher levels of confidence and reliability.

Fuel Enrichment Plant, where Iran tests its advanced centrifuges and, since February 2010, has been enriching uranium to about 20 percent U-235 using IR-1 centrifuges. As of August 2013, Iran has produced about 178 kilograms of 20 percent-enriched material at the Natanz site.

In January 2012, Iran also began enriching uranium to 20 percent at its Fordow enrichment plant, where Tehran says it aims to move all of its 20 percent enrichment work. The Fordow facility is located inside a mountain bunker and had been built in secrecy until September 2009, when its existence was publicly revealed by France, the United Kingdom, and the United States. Iran is believed to have informed the IAEA about the plant's existence only after discovering that Western intelligence agencies had learned of it. As of August 2013 Iran was operating about 700 centrifuges to enrich uranium to 20 percent at Fordow and had produced about 186 kilograms of 20 percent-enriched uranium at that facility. An additional 11 cascades containing approximately 1,900 centrifuges, are completely installed there but not yet operating. Only one of the 16 cascades remains incomplete. The facility now contains nearly its full design capacity of approximately 2,800 machines.

Combined with the 20 percent-enriched uranium produced at Natanz, Iran's total production was 372 kilograms as of August 2013. However, Iran withdrew approximately 185 kilograms of the 20 percent-enriched uranium hexafluoride gas for conversion into uranium oxide, a solid, at the Esfahan Fuel Plate Fabrication Plant. The uranium oxide is 20 percent-enriched material in the form of a powder used to produce fuel plates for the TRR. This leaves the stockpile available for a breakout to nuclear weapons at about 185 kilograms,[7] which is not enough for a single weapon if further enriched to weapons grade.[8] Iran would need a stockpile of between 240-250 kilograms of 20 percent-enriched material to produce the quantity of weapons-grade uranium required for a single nuclear weapon. Iran could reconvert the uranium oxide back to uranium hexafluoride, but this process would take several weeks. It is unlikely that Tehran could avoid the IAEA inspectors noticing the reconversion. Material would also be lost in the conversion process.

Iran is enriching uranium to 20 percent allegedly to provide fuel for the TRR, which produces medical isotopes, and for similar research reactors Iran claims it will build in the future.[9] Although enriching uranium to 20 percent is not necessarily indicative of an intention to make a nuclear weapon, stockpiling uranium at this level is worrisome because if Iran attempted to produce weapons-grade uranium, it could do so much faster using 20 percent-enriched uranium than by starting with 3.5 percent-enriched material. Enriching uranium to 20 percent constitutes about 90 percent of the work needed to enrich to weapons-grade levels.

Ending Iran's uranium enrichment to 20 percent is therefore the most urgent proliferation risk to address.

Moreover, the rationale behind Iran's production of 20 percent-enriched uranium is dubious, particularly as experts assess that current stockpiles "exceed any realistic assessment of [Iran's] need."[10] Tehran does not likely have the technical capacity to build additional research reactors that would use 20 percent-enriched uranium fuel, and it has not shared with the IAEA any plans to do so, despite the agency's multiple requests. The most plausible reason it is amassing this material is to be able to produce weapons-grade uranium as quickly as possible if such a decision were to be made. Ending Iran's uranium enrichment to 20 percent is therefore the most urgent proliferation risk to address.

Although Iran received design information and components for the more efficient P-2 centrifuge model from the Khan network during the 1990s, its development of newer designs derived from the P-2 has been slow.[11] Iran has been working on more-advanced designs to replace the IR-1 design, which is known to be crash prone and inefficient. Two alternative successor models, called the IR-2M and the IR-4, have been under development for years. In January 2013, Iran informed the IAEA that it planned to install IR-2M machines in production-scale cascades at the Natanz facility Fuel Enrichment Plant.

As of August 2013, Iran had installed the casings for 1,008 IR-2M centrifuges in the Fuel Enrichment Plant at Natanz. While these centrifuges were not yet operational, experts assess that the centrifuges will be three to four times more efficient than the IR-1s. Based on the design information provided to the IAEA, Iran is

Getty Images

Technicians work inside of a uranium conversion facility at Esfahan in March 2005. The facility produces uranium hexaflouride gas to feed into centrifuges for enrichment.

likely to install approximately 3,000 IR-2M centrifuges in this area of the facility. According to the Atomic Energy Organization of Iran, these centrifuges will produce uranium enriched to 3.5 percent.

The August 2013 report also noted that Iran has begun testing of three other advanced centrifuge models at the Natanz Pilot Fuel Enrichment Plant. According to the May report the IR-5 had been installed in the research and development area for the first time. The IR-6 and the IR-6S were present in the area as of the previous report in February 2013, and were now being fed with natural uranium. Iranian officials told the IAEA they intend to begin testing the new designs in small numbers.[12] It is unclear, however, how Iran might decide which among these models it will deploy, when it would be capable of doing so in large numbers, and their efficiency relative to the IR-1.

The type of centrifuge Iran would use to produce weapons-grade uranium is a key factor in determining the time it would take for Iran to produce enough weapons-grade material for a nuclear weapon, should it decide to do so. Estimates for the time it would take Iran to bolster the enrichment level of its LEU stockpile from 3.5 percent to weapons-grade range from four to 12 months using the commercial-scale Natanz enrichment plant. The longer time frame, believed to be the assessment of the U.S. government, assumes that Iran would need to reconfigure its centrifuges at Natanz in order to carry out the additional enrichment while some experts suggest that Iran could close off valves as a shortcut to reconfiguring the plant, leading to a much shorter time frame.[13]

Given the unreliability of the IR-1 machine, some U.S. officials and experts have questioned whether Iran would decide to rely on it to enrich uranium to weapons-grade levels. Department of State Special Advisor for Nonproliferation and Arms Control Robert Einhorn told an Arms Control Association audience in March 2011 that "it would make no sense" for Iran to leave the NPT and produce material for nuclear weapons "with a machine that produces material so inefficiently," referring to the IR-1.

When the IR-2M centrifuges are operational, the timeframe could be reduced even further. Additionally, if Iran uses its stockpile of 20 percent enriched uranium, once it accumulates enough for one bomb's worth, approximately 250 kilograms, it could reduce its breakout time to a matter of weeks. However, it remains unlikely that Iran could do this without alerting the IAEA inspectors.

Heavy-Water Reactor Project

Another potential path to the construction of nuclear weapons that Iran could pursue is to produce plutonium using a heavy-water reactor it has been constructing at Arak. This reactor, which Iran claims is intended to produce medical isotopes, is poorly suited for that function but well suited for production of

weapons-grade plutonium. When operational, the Arak reactor could potentially produce enough plutonium for one or two weapons each year.[14] In order to use the plutonium produced in the reactor for weapons, Iran would also need a reprocessing facility to separate the plutonium from the reactor's spent fuel. In 2004, Iran revised its declaration to the IAEA regarding Arak. The revision eliminated plans for a reprocessing facility at the site, and Iran currently is not known to be working on such a capability.

Ensuring that Iran abandons the Arak reactor or converts the facility to a light-water reactor (LWR), which is less useful as a source of plutonium and easier to detect in terms of misuse, will be important in preventing Iran from producing material for nuclear weapons.

Iran made noticeable progress on the reactor in 2013, including installing the upper containment vessel and testing prototype uranium fuel assemblies for the reactor in the TRR. Iran claimed that the reactor will be completed in early 2014, but revised that timeline in August 2013, citing construction delays. Arak has been delayed multiple times in the past, in part because sanctions prevented the importation of materials necessary for finishing construction. In addition, Iran has not provided the IAEA with updated design information for the reactor, so an exact assessment of progress is difficult to determine.

Warhead Development Program

Although much of Iran's nuclear program consists of dual-use technology that can be dedicated to civil nuclear energy and nuclear weapons, Tehran is widely believed to have been engaged in a series of activities that point to a program to develop a nuclear warhead. U.S. intelligence estimates have long referred to these activities as Iran's nuclear weapons program.

In November 2011, the IAEA released information in its quarterly report that detailed Iran's suspected warhead work based on intelligence it received from the United States and several other countries, as well as its own investigation.[15] According to the report, Iran was engaged in an effort prior to the end of 2003 that spanned the full range of nuclear weapons

Iran's Key Nuclear Facilities

FACILITY NAME	STATUS	FUNCTION
Fuel Enrichment Plant, Natanz	OPERATING, INCOMPLETE	Produces 3.5 percent-enriched uranium
Pilot Fuel Enrichment Plant, Natanz	OPERATING	Research, development, test, and evaluation on advanced centrifuges; produces 20 percent-enriched uranium
Fordow Fuel Enrichment Plant	OPERATING, INCOMPLETE	Produces 20 percent-enriched uranium
Tehran Research Reactor	OPERATING	Produces medical isotopes
Heavy-Water Reactor (IR-40), Arak	UNDER CONSTRUCTION	Produces medical isotopes; better suited to producing plutonium
Uranium Conversion Facility, Esfahan	SUSPENDED	Produces uranium hexafluoride, the feedstock for uranium enrichment
Fuel Manufacturing Plant, Esfahan	PARTIAL OPERATION	Produces fuel assemblies for reactors; can possibly fashion uranium metal cores for nuclear weapons
Bushehr Nuclear Power Plant, Bushehr	OPERATING	Produces electricity; has limited proliferation risk
Ardakan Yellowcake Production Plant, Ardakan	OPERATING	Processes mined uranium

development, from acquiring the raw nuclear material to working on a weapon that could eventually be delivered via a missile. This judgment is consistent with the 2007 U.S. National intelligence Estimate (NIE), which said that Iran's nuclear weapons program was halted in the fall of 2003. According to the November 2011 IAEA report, some of Iran's weapons-related activities are believed to have resumed since 2004. Subsequent IAEA reports in 2012 indicate that the agency received further information substantiating this assessment.

The series of projects that made up Iran's nuclear program, which the IAEA referred to in their November 2011 report as "the AMAD Plan," appears to have been overseen by senior Iranian figures who were engaged in working-level correspondence consistent with a coordinated program.[16] Among the key components of this program:

- **FISSILE MATERIAL PRODUCTION.** As documented in previous IAEA reports, Iran ran an undeclared effort to produce uranium tetrafluoride, also known as Green Salt and a precursor for the uranium used in the enrichment process. The affiliation between this project and other projects directly related to warhead development suggests that Iran's nuclear weapons program included fissile material production and warhead development. Although the report does not detail a uranium-enrichment effort as part of the AMAD Plan, the secret nature of the Natanz enrichment plant prior to 2002 suggests that it was originally intended to produce HEU for weapons.

- **HIGH-EXPLOSIVES TESTING**. Iran's experiments involving exploding bridgewire detonators and the simultaneous firing of explosives around a hemispherical shape point to work on nuclear warhead design. The agency says that the type of high-explosives testing matches an existing nuclear weapons design based on information provided by nuclear weapons states. Iran admits to carrying out such work, but claims it was for conventional military purposes and disputes some of the technical details.

- **WARHEAD DESIGN VERIFICATION.** Iran carried out experiments using high explosives to test the validity of its warhead design and engaged in preparatory work to carry out a full-scale underground nuclear test explosion.

- **SHAHAB-3 RE-ENTRY VEHICLE.** Documentation reviewed by the IAEA has suggested that, as late as 2003, Iran sought to develop a nuclear warhead small enough to fit on a Shahab-3 missile. Confronted with some of the studies, Iran admitted to the IAEA that such work would constitute nuclear weapons development, but Tehran denies carrying out the research.

Iran has denied pursuing a warhead-development program and claims that the information on which the IAEA assessment is based is a fabrication. Yet, Tehran has not cooperated with the agency's efforts over the past several years to verify Iran's claims, adding to suspicions about the role of Iran's nuclear activities. Any resolution to the Iran nuclear issue will need to include an accounting of Iran's past activities and assurances that any warhead-related activities that occurred or are still occurring have been halted.

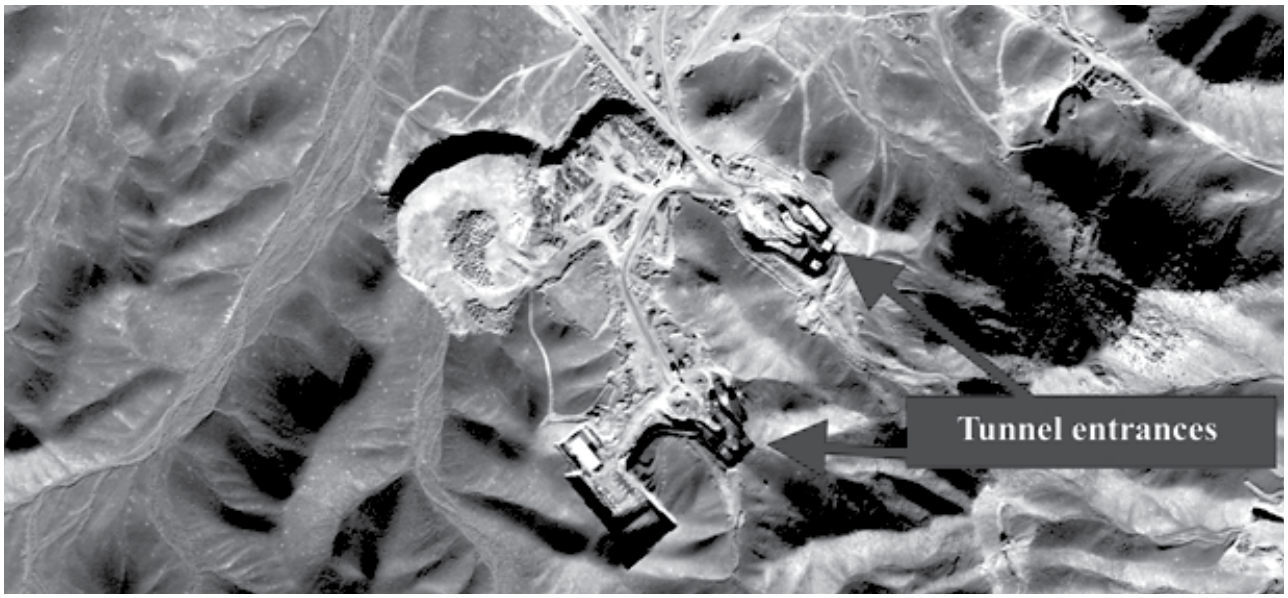
In February 2012, Iran and the IAEA began negotiating a framework agreement to resolve the agency's outstanding concerns about Iran's possible weapons-related activities. Iranian and IAEA officials met ten times between February 2012 and June 2013. At the June meeting of the IAEA Board of Governors, Director-General Yukiya Amano said that the talks were "going around in circles" and no progress has been made on negotiating the structured approach. This could result in the Board of Governors requesting that the UN Security Council take further action against Iran. The IAEA and Iran will begin talks again in September 2013.

IAEA Safeguards

For nearly 20 years, Iran pursued much of its sensitive nuclear work in secret without informing the IAEA of its activities. It was not until Iran's facilities at Natanz and Arak were publicly revealed in the fall of 2002 that the agency was able to begin carrying out a thorough accounting of work Iran performed on uranium enrichment and other programs with possible weapons purposes.

Since 2003, many key Iranian facilities have been under IAEA safeguards, with unannounced inspections being carried out weekly or every few weeks. Most importantly, Iran's Natanz and Fordow enrichment sites and the conversion plant at Isfahan, which provides the feed material for enrichment, are currently being monitored. Tehran would not be able to move its enriched uranium or uranium hexafluoride feedstock or enrich either material to weapons grade without being discovered.

Yet, Iran is currently keeping many activities out of the inspections process. For example, Iran's centrifuge manufacturing and development work is no longer being safeguarded after Iran in 2006 stopped applying the additional protocol to its IAEA safeguards



ISIS

A satellite image from January 2009 shows the tunnel entrances into the underground uranium enrichment plant at Fordow.

agreement. In 2007, Iran also stopped sharing early access and design information of its nuclear facilities with the IAEA as it is obligated to do under the so-called modified Code 3.1 of its safeguards agreement. Although Iran announced it would revert to the original arrangement, the agency said the modified arrangement to which Iran agreed cannot be unilaterally altered.[17] As a result, the agency does not have regular access to the heavy-water reactor under construction at Arak, and Iran has refused to share plans regarding the construction of any additional nuclear facilities. Tehran has also refused IAEA requests to install real-time camera monitoring at its enrichment facilities, a measure that would provide the earliest indication of any Iranian move to begin producing weapons-grade material.

The Iranian government claims that the IAEA and the UN Security Council are trying to deprive Iran of the inherent rights to which all NPT members are entitled. In fact, Iran is reneging on the terms of the safeguards agreement it concluded with the IAEA, one of its core NPT responsibilities on which its rights to nuclear technology is conditioned. The agency is fulfilling its responsibility by exercising due diligence in monitoring Iran's program so that it can determine whether the program encompasses weapons-related activities.

Iran's Nuclear Weapons Options

If Iran decided to try to build nuclear weapons, it could choose among three basic paths:

- Enriching safeguarded LEU to weapons grade uranium at existing facilities (shortest time frame);
- Using a parallel, clandestine nuclear program with a full series of nuclear facilities built in secret (longest time frame);
- Diverting safeguarded material to a secret facility and enriching to weapons grade (moderate time frame).

Most estimates of when Iran could produce a nuclear weapon are based on the use of the Natanz enrichment plant to produce HEU. Assessments of the time it would take Tehran to enrich enough uranium from 3.5 percent to weapons grade at its Natanz plant range from about four months to one year using IR-1 centrifuges. This discrepancy is based on a number of factors, including whether Iran would need to reconfigure the facility for higher-level enrichment and the efficiency of its centrifuges.

Such an approach would carry serious risks for Tehran because its facilities and nuclear material are under IAEA safeguards and any move in the near future to begin enriching to weapons grade would be discovered before the process was completed. Iran may even face the destruction of Natanz in the course of carrying out this further enrichment. It is highly unlikely that Iran would decide to take such a step until it can significantly reduce the time frame to produce weapons-grade uranium to avoid detection. Efforts to reduce that time frame include operating thousands of advanced centrifuges and stockpiling a sufficient amount of 20 percent-enriched uranium needed to produce fissile material for several weapons.

The Fordow enrichment facility also could be used to carry out enrichment to weapons grade. Because

Iran's Major Nuclear Facilities

Fordow only has a capacity of about 2,800 centrifuges, however, Iran's options for a rapid breakout at Fordow are limited. Iran would need either to install advanced centrifuges to enrich to weapons grade or to use a stockpile of 20 percent-enriched uranium feedstock. As with the Natanz plant, if the time frame to enrich to weapons grade were too long, Iran would risk the facility being destroyed or at least rendered inoperable before it could complete the process.

Because of these vulnerabilities, Iran might prefer not to use its declared enrichment plants to enrich to weapons grade even if it were able to significantly reduce the time required to produce HEU for a weapon, relying instead on covert facilities in some form. The 2007 NIE assessed with moderate confidence that "Iran would probably use covert facilities—rather than its declared nuclear sites—for the production" of HEU for a weapon.

A clandestine, parallel nuclear program would require that Iran construct a series of additional nuclear facilities along the uranium-enrichment path that mirrors its existing facilities. Because Iran's declared nuclear material is monitored under IAEA safeguards, Iran would need an entirely separate stream of material beginning with uranium ore, all the way to weaponizing the enriched uranium. Iran's uranium-mining and -milling operations to produce yellowcake do not fall under safeguards, although such activities could be detected through intelligence means. Iran would also need to construct another conversion plant to produce uranium hexafluoride, an enrichment plant to produce weapons-grade uranium, and a fabrication plant to manufacture the material into metal cores. Producing weapons-grade uranium using such a covert series of facilities appears to have been Iran's original intent prior to the exposure of its nuclear facilities in 2002.

Using such a path, Iran could potentially develop nuclear weapons without the international community knowing about it, so long as all of the duplicate facilities and nuclear material remained hidden. In the past, Iran's two major enrichment facilities have been detected by foreign intelligence well before they became operational. This would require a much longer time frame for Iran to accomplish, as well as far more resources to invest in duplicate facilities. Iran is already believed to be resource strained by sanctions, and an extended period of time would increase the risk that clandestine facilities would be uncovered. It is unlikely that Iran would decide to pursue this path.

Iran's most likely path to a nuclear weapon, if it were to make such a decision, would be through diversion to covert sites, which is an amalgam of the first two. This approach might entail the construction of a secret uranium-enrichment plant where Iran would further enrich its stockpile of 3.5 percent-enriched and 20 percent-enriched uranium to HEU. Tehran would likely need to construct another facility where that HEU would be fashioned into metallic cores for use in weapons to avoid using its declared fuel manufacturing plant at Esfahan. Such an approach would avoid the need to completely duplicate many aspects of Iran's nuclear program while carrying out the final stages of weapons development in locations Tehran believed to be safe from pre-emptive attack.

Iran's attempt to build the Fordow enrichment plant in secret suggests that it was already considering pursuing such a path. Once that facility became public and subject to IAEA monitoring in 2009, Iranian work on the facility slowed considerably, suggesting that Tehran needed to repurpose the facility from a covert role to a declared one.

Iran announced in 2009 that it planned to build 10 additional uranium-enrichment plants, a goal likely

beyond Iran's resources, but a decision to build any additional plants without revealing their location suggested that Iran wanted to maintain locations where it could enrich in secret. In 2011, Iranian officials said that plans to construct any additional plants would be postponed for a couple of years. Tehran has never provided any clarification to the IAEA about its intentions regarding the possible construction of additional uranium-enrichment facilities. U.S. officials have reportedly expressed confidence that there is no secret uranium-enrichment site at present and attempts to build further covert facilities would likely be detected.[18]

Iran's Nuclear Delivery Path

Iran has a determined ballistic missile development program and would likely make such missiles its delivery vehicle of choice if it decided to build nuclear weapons. Indeed, Iran is suspected to have carried out research and development on how to mount a nuclear warhead on a missile and detonate it at an appropriate height.[19] Ballistic missiles offer a delivery path preferable to Iran's aging air force, which remains predominately based on 1970s-era U.S.-supplied aircraft.

Although Iran is believed to have the largest and most diverse missile arsenal in the region, official U.S. assessments say that Iran's ballistic missile program has been focused on increasing the sophistication of its medium-range ballistic missiles.[20] With a range of 1,000 to 3,000 kilometers, missiles in this category are capable of striking targets in Israel, Turkey, and the Persian Gulf. Iran's currently operational medium-range ballistic missile systems are derived from 1950s-era Soviet Scud short-range ballistic missile technology, which Iran received from North Korea. Iran's premier medium-range ballistic missile, the liquid-fueled Shahab-3, is essentially identical to the North Korean Nodong missile. The most capable ballistic missile in Iran's operational inventory is the Ghadr-1, which is an enhanced version of the Shahab-3 and is able to carry a 750-kilogram warhead at least 1,600 kilometers and possibly up to 2,000 kilometers.

A key aspect of Iran's efforts to increase the sophistication of its missile program is the development of solid-fuel missile technology. Solid-fuel missiles hold some advantages over Tehran's predominately liquid-fuel missile arsenal, including shorter launch times, greater mobility, and easier handling and storage.

Drawing from its extensive experience with short-range solid-fuel rockets, Iran is in the advanced stages of developing its two-stage Sejjil-2 medium-range ballistic missile, capable of a range of about 2,400 kilometers. If Iran were to develop a nuclear warhead for threatening Israel, this missile would be the most likely platform. Its range would permit it to be fired at Israel from any part of Iran. The Sejjil-2 was first successfully tested in May 2009, and although Iranian officials claimed at that time that mass production of the system would begin, further development and testing is likely required before the system is deployed.

Ballistic Missle Range Categories

Short-range ballistic missile	<1,000 km
Medium-range ballistic missile	1,000-3,000 km
Intermediate-range ballistic missile	3,000-5,500 km
Intercontinental-range ballistic missile	>5,500 km

However, no known tests of the Sejjil-2 have occurred since February 2011, and according to a UN panel of experts tasked with assessing Security Council sanctions on Iran, the missile had not been seen over the twelve months covered by the most recent report of June 2013. Experts assess that the hiatus is likely due to the impact of sanctions, which prevent Iran from obtaining the necessary materials to continue indigenous production and development of solid-propellant rocket motors.[21]

In addition to enhancing its medium-range ballistic missile capabilities, Iran has been improving its technical capacity to develop and produce longer-range ballistic missiles. Iran's satellite launch program and its successful use of space-launch vehicles is central to this emerging capacity. The ability to put a satellite in space does not guarantee an ability to accurately target and deliver a warhead at long ranges, but there is sufficient overlap in propulsion, staging, and other important component technologies used by space-launch vehicles to make them a useful test bed for developing long-range missile systems. Nonetheless, Iran appears to have a genuine interest in developing space-launch capabilities beyond their military applications.

Iran placed a satellite in orbit on several occasions, in February 2009, June 2010, June 2011, and February 2012. All four launches used a two-stage Safir space-launch vehicle, and in the February 2012 launch, a modified Shahab-3 ballistic missile was identified by experts as the first stage. The Safir itself is not suitable as a military system because of its limited carrying capacity, and Iran is unlikely to convert it into a military missile. Iran showed a mockup of a larger space-launch vehicle called the Simorgh in 2010, but it has yet to launch this new system. Because Iran has not flight-tested either a long-range military system or a space-launch vehicle capable of being converted to such a system, an intercontinental ballistic missile capable of targeting the United States is unlikely to be available before 2020.

SECTION 2

The Impact and Role of Sanctions

"We believe Iran has had difficulties in acquiring some key technologies, and we judge this has had an effect of slowing down some of its programs."

— Robert Einhorn, Special Advisor for Nonproliferation and Arms Control, Department of State, March 11, 2011

Iran has been subjected to fairly comprehensive U.S. sanctions since the early 1980s for a variety of reasons, including the regime's support for terrorism, human rights violations, and proliferation concerns.

Additionally, since the UN Security Council took up the Iran nuclear file in 2006, Iran has been subjected to increasingly rigorous multilateral sanctions aimed at encouraging compliance with its nuclear nonproliferation obligations and addressing international concerns about the nature of its nuclear program. These sanctions focus on preventing Iran from acquiring the technologies and materials needed for its nuclear and missile programs by requiring all countries to restrict sensitive exports to Iran. The sanctions geared toward slowing Iran's nuclear and missile programs appear to be increasingly effective as additional countries strengthen controls over exporting sensitive goods to Iran. But they have not prevented Iran from improving its domestic capabilities nor led Iran's leadership to abandon the pursuit of a nuclear weapons capability.

U.S.-led sanctions have increasingly targeted the Iranian energy sector, the most critical part of its economy, to impose economic pressure on Iran in the hopes of influencing the decision-making of Iran's leadership. More recently, the Iranian banking sector has been targeted by sanctions designed to isolate it from the global financial system.

Sanctions should remain an important component of efforts to demonstrate to Iran that it has nothing to gain and much to lose from its current nuclear ambitions, but sanctions will not be enough to end any nuclear aspirations. Tehran appears to have judged that the security and political gains it expects to receive from a nuclear weapons capability are worth the cost of increasing economic isolation from the West and the significant resources invested in its strategic programs. In order to have a more effective impact on Iran's cost-benefit calculations, Tehran will need to be shown the benefits of curbing its nuclear pursuits.

UN Sanctions

The UN Security Council first resorted to employing sanctions in 2006 when Iran refused to comply with a binding resolution that required, among other measures, that Iran suspend all uranium-enrichment and heavy-water-related activity. Three other resolutions tightening sanctions followed, with a June 2010 resolution introducing some of the most sweeping measures against Iran to date. Taken together, sanctions introduced under these resolutions prohibit Iran's access to proliferation-sensitive items, technical assistance, and technology. The resolutions also target designated Iranian entities and persons involved in the nuclear and ballistic missile activities that are barred by the resolutions.

As a result of the sanctions, Iranian entities, front companies, and persons affiliated with or facilitating Iran's proscribed activities are subject to asset freezes and travel bans and are barred from accessing any financial services located in UN member states. To further prevent Iran's access to sensitive know-how and materials, Iran is banned from gaining any shares in proliferation-related commercial activities such as those involving uranium mining and the use of

nuclear materials in other countries. Member states also are urged to inspect vessels believed to carry prohibited items bound for Iran.

Most importantly, the June 2010 Security Council resolution included nonbinding provisions that open the way for states to significantly expand the type of restrictions to which Iran is subject. For example, provisions in the resolution recognize the link between Iranian energy revenues and funding for Iran's proliferation-sensitive nuclear and missile activities. Recognition of this link provides a basis for the introduction of additional unilateral measures by individual UN member states that target Iran's ability to sustain and expand these programs. States are given broad latitude to prohibit Iran from opening bank offices or accessing financial services under their jurisdiction on the grounds that they could contribute to Iran's proliferation activities.

Given the failure of the talks between the IAEA and Iran on resolving outstanding concerns related to the possible military dimensions of Iran's past nuclear activities, the United States is considering working through the IAEA Board of Governors to request the that the Security Council take further action, likely in the form of sanctions, against Iran. This could take place as early as the September or November 2013 meetings of the board.

Unilateral Sanctions

The United States has in place some of the most sweeping and longest-standing sanctions against Iran. Dating back to the takeover of the U.S. embassy by Iranian students in 1979, under a web of congressional acts, executive orders, and subsequent regulations by the departments of the Treasury and State Departments, Iran is subject to far-reaching measures that largely prohibit economic exchanges between the United States and Iran. This includes a full ban on trade and investment with Iran that, except for items permitted under humanitarian grounds, largely prohibits any commercial activity between the United States and Iran.

Since 2008, all financial institutions under U.S. jurisdiction also are prohibited from carrying out so called "U-turn" transactions. This prohibition prevents U.S. banks from completing transactions with foreign banks acting on behalf of an Iranian entity. This Treasury Department regulation effectively cuts Iran off from the U.S. financial system and further isolates it by denying Iran the ability to conduct transactions in U.S. dollars, the currency of oil markets.

Most significantly, since 1996 when Congress approved the Iran and Libya Sanctions Act, the United States has had in place legislation that is intended to deter foreign entities from carrying out any significant investment in Iran's oil and gas industries. Legislation passed by Congress in July 2010 expanded the application of the bill to deter foreign companies from selling refined oil products such as gasoline to Iran as well as equipment or services that could contribute to Iran's ability to produce refined petroleum domestically. Foreign entities that are found

Atta Kenare/AFP/Getty Images

An Iranian man counts banknotes after exchanging a gold coin for cash in Tehran on January 23, 2012. Sanctions against Iran have caused the value of the country's currency, the rial, to drop dramatically.

in violation of these provisions could become subject to U.S. sanctions that limit their access to the U.S. market or services. Such measures include cutting off foreign companies from U.S. government contracts, loan assistance for exports, and trading any U.S.-based properties.

Measures with an extraterritorial application also extend to the financial industry. Non-U.S. banks may be cut off from the U.S. financial system if they are found to have facilitated any transaction involving persons that are subject to UN-mandated sanctions or who have provided services to the Iranian Revolutionary Guard Corps or other designated Iranian entities. In December 2011, further financial restrictions were imposed on foreign banks that conduct transactions with the Central Bank of Iran. Foreign central banks that continue to process oil transactions without an exemption granted by the administration risk losing access to existing accounts in the United States and could be barred from opening new accounts. These sanctions have further isolated Iran's central bank and forced the state to conclude alternative arrangements to sell oil, including barter arrangements and sales in local currencies. Reputational fears as well as concerns of being cut off from the U.S. financial market have driven a number of major international financial companies to sever business ties with Iranian entities.

Extraterritorial provisions in the December 2011 legislation also require countries continuing to purchase oil from Iran to receive a waiver from the United States or risk being cut off from the U.S. financial system. Waivers may be granted to countries that can demonstrate a significant reduction in the total amount of oil purchased every six months. As of June 2013, six countries are receiving waivers to continue importing oil. New provisions also went into effect in February 2013 that prevents Iran from repatriating any earnings from oil sales. Foreign banks facilitating oil transactions must ensure that funds from the sales are used only for trade between that country and Iran or face loosing access to the U.S. banks.

Additional legislation passed by the House of Representatives in July 2013, could result in a total embargo of Iranian oil within a year if the measure becomes law. This legislation requires the countries importing oil from Iran to reduce their combined total imports by one million barrels per day. Iran's current production is approximately that amount. However, these measures risk fracturing the international consensus for implementation of sanctions against Iran. Wendy Sherman, undersecretary of state for political affairs and head of the U.S. delegation for the P5+1, testified to Congress at a Senate Foreign Relations Committee hearing on May 15, 2013, that if the United States wants to require further reductions in the oil imports, it has to "work very carefully" with the six importing countries. Both China and Russia already have voiced displeasure at further U.S. unilateral sanctions measures.

Sanctions alone will not be enough to induce a change in Iran's pursuit of a nuclear weapons capability.

H.R. 850 also expands current sanctions to the mining and automotive industries, and requires the administration to determine whether the Revolutionary Guard should be classified as a Foreign Terrorist Organization.

Given the long-standing, nearly comprehensive U.S. sanctions against Iran, there are increasingly limited options for additional punitive measures directly aimed at Iran. Washington has therefore increasingly relied on extraterritorial sanctions aimed at getting other countries to curtail their own business with Iran or face U.S. penalties. Such efforts have been met with some success, but not without risk. In 1998 the European Union threatened to take U.S. extraterritorial sanctions against Iran's energy sector to the World Trade Organization. Moreover, although many U.S. partners will be strongly influenced by extraterritorial U.S. sanctions, other major countries such as China and Russia have firms that do little to no business with the United States, allowing them not only to continue investing in Iran, but also to replace any business halted by U.S. partners.

This picture has changed to some extent in recent years, with U.S. partners such as Canada, the EU, and Japan demonstrating greater willingness to curtail business in Iran. This is due to increasing concerns over Iran's nuclear ambitions and a more

internationalized approach by the United States, in which economic penalties against Iran's are directly authorized or in some way legitimized in UN Security Council resolutions.

For example, following in the footsteps of UN Security Council Resolution 1929, in July 2010 and January 2012 the European Council introduced additional measures that went beyond those required by the resolution, directly targeting Iran's energy, transport, and financial sectors. Under EU-wide provisions from the 2010 council decision, entities subject to EU member states' jurisdiction are now prohibited from undertaking any new investments in Iran's gas and oil industries or providing any key items or technology that contribute to extraction and refining of Iranian oil or liquefaction of natural gas. The council decision prohibits member states from providing Iran with any financial grants or concessionary loans, purchasing Iranian bonds, and opening any new branches of Iranian banks in a member's territory. In addition, these measures ban the provision of any insurance or reinsurance service to Iranian entities as well as any bunkering services for Iranian vessels. Tight measures have also been introduced to monitor financial transactions to and from Iran. A number of other countries, including Australia, Japan, Norway, and South Korea, have introduced equal or less-sweeping provisions that follow closely those introduced by the EU.

The January 2012 European Council decision went further, instituting an EU-wide embargo on oil imports from Iran as of July 1. In addition, the decision prevented companies in the eurozone from providing the necessary protection and indemnity insurance guarantees on tankers transporting Iranian oil. Without these insurance measures in place, countries continuing to import oil from Iran, such as China, India, Japan, and South Korea, must arrange the insurance domestically or look to Tehran to provide the guarantees.

In October of the same year, the European Council revised its sanctions on Iran to further restrict the flow of foreign currency in and out of the country. Under these rules large monetary transfers between Iranian entities require prior authorization from EU Member State authorities. This round of sanctions also imposed an embargo on Iranian natural gas, and strengthened the restrictions on the commercialization of resources and technologies related to the energy and naval industries.

Constraining Iran's Access to Key Items and Technology

Although the output of Iran's nuclear and missile programs has continued at a steady pace, Iran remains dependent on key items and technology to sustain and further develop these programs. A recent UN report assessing the impact of sanctions on Iran, identified at least 10 "choke point items" that Tehran needs to maintain and advance its gas centrifuge program

Atta Kenare/AFP/Getty Images

An oil tanker is seen off the port of Bandar Abbas, southern Iran, on July 2, 2012. Sanctions imposed by the United States and the European Union make it increasingly difficult for Iran to export oil.

but finds difficult "to produce indigenously." The report also provided a list of missile-related items and technology that Iran has been seeking to procure. This assessment has been shared by U.S. officials and independent experts.[22]

Iran's efforts to secure sensitive items and technology appear to be hampered by sanctions on the financial institutions and shipping lines that facilitate these transactions. Iran has taken measures to try to circumvent the application of sanctions by renaming and reflagging vessels and switching transactions to other financial institutions. At times, such actions have compounded the impact of restrictive measures as countries have moved to sanction new entities previously unrelated with the banned programs. For example, in May 2011 the EU designated up to 100 new Iranian entities and persons involved in efforts to procure items and materials for Iran's nuclear and missile programs. To avoid detection and ensure continued operation, one of Iran's shipping lines, IRISL, which also is designated by the United States and the EU, had largely disappeared from the market by 2010. A UN sanctions report indicated that it accomplished this by concealing most of its vessels under new entities.

In order to restrict Iranian banks access to international markets the European-based Society for Worldwide Interbank Financial Telecommunications (Swift) announced that it would exclude fourteen of Iran's largest financial institutions from its messaging network in March 2012. The move came after the United States accused Swift of facilitating the flow of foreign capital into Iran, and threatened to freeze the company's assets. Swift provides a secure avenue of communication for most of the world's banks and corporations, without access to this network Iranian institutions are unable to efficiently and safely transfer money from one bank to another.

The Comprehensive Iran Sanctions, Accountability, and Divestment Act, adopted by the U.S. Congress in June 2010, includes an important provision aimed at bolstering international controls over the spread of sensitive technology to Iran. The law requires the administration to determine countries in which such technologies were exported, re-exported, or transshipped to Iran in order to highlight such proliferation pathways. The law then opens the door for U.S. cooperation to strengthen the relevant export controls of those countries to close such pathways or for U.S. penalties if the state was unwilling to cooperate. Such an approach is not only helpful for specifically addressing proliferation to Iran, but also general proliferation concerns.

By curtailing Iran's access to key items and technology, sanctions are clearly increasing the cost Iran faces to maintain its nuclear and missile program and constraining Iran's ability to develop these capabilities further. These costs are expected to increase as sanctions continue to take their toll and UN member states improve their export control mechanisms and adjust to Iran's circumvention attempts. Despite the obstacles put in place by the international community, there is little to suggest that the restrictive measures have affected Iran's intention to pursue these programs.

Economic Impact

One of the key goals of the sanctions regime is to "drive up the cost of [Iranian] intransigence," according U.S. State Department advisor Robert Einhorn.[23] The United States and its allies credit the economic pressure created by the multilateral sanctions effort as a primary motivator for inducing Iran to return to diplomatic negotiations. In February 2013, talks between Tehran and the so-called P5+1 (China, France, Russia, the United Kingdom, the United States, and Germany) resumed after an eight month lull, but after two rounds, the talks were put on hold again. This was due in part to Iran's presidential election in June 2013. Negotiations are likely to resume this fall, following the August 3 inauguration of Hassan Rouhani as Iran's new president.

The impact of sanctions has been seen most visibly in the Iranian energy sector, which remains dependent on foreign investment and technology for maintaining the current rate of production as well as developing new capacities. U.S. legislation has long penalized foreign companies for any investment in the Iranian energy sector that exceeded $20 million per year, but pressure on companies has been ratcheted up especially since last year when the EU approved measures that to a large degree harmonized U.S. and EU sanctions on the energy sector.

Iran is the fourth-largest oil producer in the world, holding up to 10 percent of the world's known oil reserves, but Iranian oil production has steadily been declining. For example, by 2010, oil production had fallen slightly to about four million barrels per day, resulting in an assessed annual decline rate of about 8 percent from the 1970s peak. In 2012, as a result of EU and U.S. measures, Iranian oil sales were reduced by over 50 percent, costing Iran up to $5 billion in lost revenue every month, according to Treasury Department Undersecretary for Terrorism and Financial Intelligence David Cohen.[24]

Iran possesses the second-largest gas reserves in

Summary of Major U.S. Sanctions on Iran

FINANCIAL AND TRADE RESTRICTIONS	
Banking	On Nov. 6, 2008, the Department of the Treasury banned U.S. banks from handling indirect transactions with Iranian banks.
	The Comprehensive Iran Sanctions, Accountability, and Divestment Act (CISADA) of 2010 excludes foreign banks from the U.S. financial system if they conduct transactions with the Islamic Revolutionary Guard Corps or entities sanctioned by executive orders or the United Nations.
	On Nov. 21, 2011, Secretary of the Treasury Timothy Geithner used Section 311 of the USA PATRIOT Act to identify Iran as a "jurisdiction of primary money laundering concern."
	The National Defense Authorization Act of 2012 restricts foreign banks that do business with Iran's central bank from accessing the U.S. financial system.
Assets Freeze	*Executive Order 13224 (2001)* authorizes the president to freeze assets of entities supporting international terrorism and bar U.S. transactions with these entities.
	Executive Order 13382 (2005) grants the President the authority to block the assets of WMD proliferators.
Trade and Investment	*Executive Order 12959 (1995)* bans U.S. firms from trading with or investing in Iran, with exemptions for food and medical products.
OIL AND GAS SECTOR RESTRICTIONS	
Crude Oil Purchases	*Executive Order 12613 (1987)* bans U.S. companies from importing Iranian oil.
Refined Petroleum	The CISADA amended the Iran Sanctions Act (ISA) of 1996 by sanctioning the sale of gasoline and the sale of equipment related to Iranian energy imports and production to Iran.
Trade and Investment	The ISA sanctions foreign entities that invest in Iran's energy sector.
	Executive Order 13590 (2011) modifies the ISA to include the sanctioning of sales to Iran of oil and gas exploration and extraction equipment.
STRATEGIC TRADE CONTROLS	
Nuclear and Missile Technology	*The Iran-Iraq Arms Nonproliferation Act of 1992* imposes sanctions on foreign entities that supply Iran with WMD technology or "destabilizing" conventional arms.
	The Iran-North Korea-Syria Nonproliferation Act of 2000 authorizes sanctions on individuals or corporations that are assisting Iran's WMD programs.
Conventional Arms	*The Arms Export Control Act of 1976* bans U.S. arms sales to Iran, given its status as a state sponsor of terrorism.
	The International Emergency Economic Powers Act of 1977, implemented by executive orders, allows for restrictions on the sale of dual-use items to Iran.
Shipping	*Executive Order 13382 (2005)* freezes the U.S.-based property of Islamic Republic of Iran Shipping Lanes and other related entities.
Travel	The CISADA imposes travel bans on Iranians determined to be involved in human rights abuses since Iran's June 12, 2009, presidential elections.

the world, but remains a net importer of natural gas. Senior Iranian oil officials have reportedly said that, to maintain production and tap into the gas reserves, the Iran oil and gas sector needs up to $25 billion in investments every year.

U.S. and EU sanctions present a significant challenge for Iran as it finds that much of the technology required for tapping into the gas reserves and sustaining production in its maturing oil fields is owned by Western companies. Deprived of access to such technologies, Iran is reportedly looking for alternative sources of investment and resorting to using less-advanced technologies. Senior U.S. administration officials have said that other countries, including China, have been hesitant to fill the space left by European companies.

"There is substantial evidence that Beijing has taken a cautious, go-slow approach toward its energy cooperation with Iran," Einhorn said at a March 2011 forum. Speaking during the same event, Kenneth Katzman of the Congressional Research Service, added, "Very little new investment in Iran [oil and gas sector] is evident."

Iran is finding it increasingly difficult to gain access to gasoline and other refined oil products that it needs to import. Despite Iran's large oil reserves, Iran possesses limited refining capacities and imports up to 30 percent of its gasoline to meet domestic needs. Even prior to the adoption of the latest congressional sanctions strengthening penalties against companies that do business in Iran's oil sector, several major firms began pulling out of Iran's energy sector. These included major traders such as Lukoil, Reliance, Vitol, Glencore, IPG, Tüpra and Trafigura, which halted refined petroleum sales to Iran.

Another sector where sanctions are particularly affecting the Iranian economy is the financial industry. Under the cumulative effect of EU, UN, and especially U.S. sanctions, Iran is finding it increasingly difficult to financially service the significant international energy transactions that sustain the government's budget. For example, the U.S. Treasury Department decision in 2008 to rescind the right of international banks to facilitate dollar-denominated transactions on behalf of Iranian companies has largely prevented Iran from conducting any banking transaction in U.S. dollars.

As a result, Iran has found it far more difficult to collect payments for the sale of its oil. For example, in December 2010 the Indian central bank stopped Indian financial institutions from conducting payments for Iranian crude oil through the Asian Clearing Union, a financial body set up by the United Nations to facilitate trade in the region, which allowed Iran to evade the reach of U.S. financial sanctions. This presents a particular challenge for Iran when it comes to settling payment with countries that run a positive trade balance for Iran and where it cannot revert to what are in effect bartering practices to settle payments.

U.S. Treasury levies measures against financial institutions for having violated U.S. legislation if they facilitate payments for sanctioned Iranian entities. For example, in June 2012, ING Bank agreed to pay a $619 million settlement for violating U.S. sanctions between the 1990s and 2007. The bank was accused of facilitating illegal transactions through the U.S. banking system for sanctioned countries, including Iran. In 2009 the Swiss-based Credit Suisse agreed to pay a fine of $536 million for processing similar transactions through U.S. banks, and in the same year, Lloyds TSB paid $350 million to settle charges that it altered records for clients, including Iran, that allowed them to access the U.S. banking system.

As economic interactions with Western countries have decreased, Iran has been seeking other economic partners in Asia and Latin America and courting countries in the region. China, for example, replaced the EU as Iran's largest trading partner in 2009, and Turkey has reported a 10-fold increase in trade with Iran since 2000. In 2012, Iran concluded a preferential trade agreement with India.

Looking Ahead

Despite the mounting costs of the sanctions imposed on Iran, they have not led to any discernible shift in Iran's behavior, although it could be argued that they indirectly affected Iran's June 2013 presidential election results. Sanctions alone will not be enough to induce a change in Iran's pursuit of a nuclear weapons capability. Kimberly Elliott, a senior fellow at the Center for Global Development, speaking at the ACA Iran sanctions event in March 2011, acknowledged that a preponderant focus only on the cost that sanctions incur detracts from a successful sanctions strategy. "[D]on't focus only on the cost side," Elliot said.

U.S. intelligence officials have continued to assess that Iran's decision-making is guided by a cost-benefit analysis. The costs are becoming even more acute, but the benefits of a shift in policy need to be made clearer through negotiations.

A strong multilateral coalition and time are two key ingredients for ensuring the full impact of the sanctions regime, as is creatively devising a package of arrangements that Iran would be able to accept without losing face.

SECTION 3

Examining the Military Option

"When we talked about this in the government, the consensus was that [attacking Iran] would guarantee that which we are trying to prevent—an Iran that will spare nothing to build a nuclear weapon and that would build it in secret."

—Michael Hayden, former Director of the Central Intelligence Agency, January 19, 2012 [25]

The longer that the Iranian government persists in its defiance of UN Security Council resolutions and the closer it gets to a nuclear weapons breakout capability, the higher the political pressure will rise for considering the "military option." This expression is generally used as shorthand for a preventive military strike against Iran's nuclear facilities, presumably without international authorization or broad support and absent any imminent military threat from Iran.

The objective of such an attack would be to seriously damage Iran's nuclear weapons potential, but military and intelligence experts widely agree that such a strike would not prevent Iran from developing nuclear weapons. Rather, it would only postpone Iran's ability to achieve that objective while increasing the likelihood that Iran would pursue the bomb with greater determination.

In this context, it is instructive to look back at the conventional wisdom about Israel's 1981 raid on Iraq's Osirak reactor. Generally regarded at the time as a spectacular success, the attack did indeed delay Saddam Hussein's nuclear weapons program. Yet, Iraq's determination to succeed was strengthened, its commitment of personnel and resources skyrocketed,[26] and its success at hiding its activities from the IAEA and Western intelligence collectors increased.

Moreover, Iran today is less vulnerable to such an attack than Iraq was in 1981. Iran is further along in mastering the nuclear fuel cycle and has a more widely dispersed nuclear infrastructure than did Iraq then. Thus, the delay could be less, and the psychological impact would be similarly counterproductive. In September 2012, over thirty former high-ranking U.S. officials and military officers endorsed a report concluding that a sustained military strike by the United States would only set Iran's nuclear program back up to four years and subsequently increase Iran's motivation to build nuclear weapons to inhibit any future attack.[27]

A military attack against Iran's nuclear facilities would likely prompt Iran to leave the IAEA, probably accompanied by an Iranian revocation of its safeguards agreement and withdrawal from the NPT. This would close off the most important source of information available to the international community on the status of Iran's nuclear program. It would also increase uncertainty over time about the extent of Iran's nuclear activities, leading to a situation similar to that of Iraq between the Operation Desert Fox air strikes in December 1998 and the return of inspectors in November 2002.

A military operation targeting Iran's nuclear capability would require a major sustained air campaign. The target list would likely extend far beyond Iran's 25 declared nuclear facilities and related sites to include Iran's air defenses, its command and control nodes, and its means of retaliation, such as its ballistic and cruise missile forces and the naval vessels used to lay anti-ship mines. Such a military campaign would probably last weeks.

Beyond the strike assets, additional resources would be required for personnel recovery and post-strike battle damage assessments. A campaign of this

magnitude would necessarily involve phases, allowing some Iranian assets not initially hit to be removed and hidden before being struck. Afterward, the United States would soon confront difficult decisions concerning the need to go back and attack surviving facilities again or to disrupt the reconstruction of those that had been destroyed.

A military attack against Iran's nuclear facilities would likely prompt Iran to leave the IAEA, probably accompanied by an Iranian revocation of its safeguards agreement and withdrawal from the NPT.

The Iranian government's natural inclination to retaliate in response to an attack would be reinforced by popular sentiment. Iran's nationalistic population is overwhelmingly supportive of the country's nuclear program and sensitive about perceived threats to national sovereignty.

Such retaliation could take a number of forms, from ballistic missile attacks against U.S. military bases in the region and the cities, ports, and oil terminals of U.S. allies in the Persian Gulf to missile and rocket attacks against Israel. One of the most vulnerable retaliatory targets would be the oil tanker traffic flowing through the Strait of Hormuz. Ninety percent of the oil produced by Persian Gulf states passes through the strait, as does almost 35 percent of all seaborne-traded oil and almost 20 percent of all oil traded worldwide.[28]

In 2006, Supreme Leader Khamenei warned that if the United States punished or attacked Iran, then "definitely the shipment of energy from this region will be seriously jeopardized."[29] The most effective way to drive up oil costs would be to block the strait, halting or at least reducing the passage of shipping by laying several hundred mines in the water. Iran has a variety of platforms it could use for this task. From the first evidence that mines had been laid, maritime insurance rates and the price of oil would skyrocket, compelling the United States to undertake a mine-clearing campaign.

Atta Kenare/AFP/Getty Images

Iranian F-14 fighter jets fly during the annual Army Day military parade in Tehran on April 17, 2012.

Given the limited number of mine countermeasure assets available and their vulnerability to Iranian attack, clearing even a relatively safe channel for passage would take several days; clearing the entire strait could take a month. During a Jan. 31, 2012, Senate Intelligence Committee hearing, Defense Intelligence Agency Director Lt. Gen. Ronald Burgess said the Iranians "have the capability, we assess, to temporarily close" the strait.[30] Other experts stated that efforts to reopen the vital waterway, in the event of an Iranian closure, could only be accomplished as part of a major military operation, which "could quickly become a war to clear the Iranian harbors and coast of most remnants of the country's military."[31]

Another vector of Iranian retaliation might be to sponsor Hezbollah and Hamas attacks against Israel. Thousands of short-range rockets of varying degrees of sophistication are available in Gaza and southern Lebanon for such action.

Iran could use surrogates to launch attacks on U.S. military forces deployed in the region, which has already happened sporadically and in varying degrees. In the wake of an unprovoked U.S. attack on Iran, the governments in Kabul, Baghdad, Islamabad, and elsewhere would be much less inclined to help provide protection to U.S. forces and more inclined to make deals with the militant opposition in Iran.

The hostile political reaction likely to be unleashed in the region by a U.S. attack would have ominous implications for prosecution of the ongoing war being fought in Iran's neighbors to the east. Pakistan and Russia are vital links in the long logistics chain to U.S. military forces in the field. Given heightened

Ebrahim Noroozi/AFP/Getty Images

The Iranian navy conducts naval wargames in the Strait of Hormuz in southern Iran on January 1, 2012.

tensions between Islamabad and Washington in the wake of the operation against Osama bin Laden and continuing U.S. drone strikes inside Pakistan, the bilateral relationship is at a particularly delicate juncture, with little safety margin for absorbing additional shocks.

The southern logistical route through Pakistan has already been subject to attrition from attacks, cost inflation from security requirements, and lengthy politically directed blockages, but it could get much worse if Islamabad felt a need to express opposition to U.S. military intervention in Iran. Severing critical components of the troops' lifeline and easing pressure on the Pakistani Taliban would not only raise the cost of the deployments, but it could also force a precipitous U.S. retreat from these theaters of operation.

Engagement with Iranian ground forces, either in connection with securing the north coast of the Persian Gulf to ensure safe passage of tanker traffic or clashes along Iran's borders, could result in fighting which would be difficult to halt or limit. Because U.S. ground forces are already heavily committed worldwide, further sustained demand for additional manpower would put additional strain on the National Guard and the Reserves.

A close look at the military option reveals that it would fail at permanently halting Iran's nuclear weapons pursuits and present grievous new challenges for U.S. foreign, domestic, and security policies, adding incalculable costs to the nation in blood and treasure.

SECTION 4

The Necessity of a Diplomatic Solution

"[T]he only way to truly solve this problem is for the Iranian government to make a decision to forsake nuclear weapons."

—President Barack Obama, March 4, 2012[32]

To prevent an Iranian nuclear weapon and find a permanent resolution to the Iran nuclear challenge, a negotiated resolution must be reached. Arriving at such a diplomatic settlement will not be easy, and it will be dependent as much on the political will in Tehran, Washington, and other major capitals as on the substantive issues on the table. Most importantly, it will require that Iran make a decision to back away from its current pursuit of a nuclear weapons capability, including giving up some of the capabilities that it has already established and agreeing to a more robust international monitoring and inspection systems.

The United States and its diplomatic partners need to realize that getting Iran to indefinitely forgo all uranium enrichment activity is neither feasible nor necessary to prevent Tehran from developing nuclear weapons. The most urgent goal for the international community is to secure a halt to Iran's enrichment of uranium to 20 percent U-235 and establish a more robust verification regime that adequately detects and deters any Iranian violation. If Tehran can agree to such measures, the West should be prepared to roll-back some of the nonproliferation-specific sanctions that have been levied on Tehran for its noncompliance to date.

Past Negotiations

All of the key parties involved in the confrontation over Iran's nuclear program, including the United States, the EU, Israel, and Iran itself, have said that they wish to resolve the issue diplomatically, although none of them have been able to agree on the terms of such a settlement. The current negotiations framework involves Iran and the P5+1. These six powers have met intermittently with Iran since 2006.[33] The most recent meetings occurred in February and April 2013 in Almaty, Kazakhstan.

The starting point for a comprehensive agreement is already in place with the incentives package the P5+1 proposed to Iran in 2006. Although this proposal has not had success in enticing Iran to fruitful negotiations, it has the support of the six countries and already contains many essential elements of any eventual negotiated agreement. That proposal called for Iran to suspend enrichment-related activities for a period of time subject to review and also to apply the additional protocol to its safeguards agreement. In return, Tehran would be eligible to acquire light-water reactors (LWR) and technical and economic cooperation and achieve the lifting of UN sanctions. In 2008 the P5+1 revised this package to include additional elements such as security assurances, cooperation on Afghanistan, and steps toward normalizing relations.

Recent Negotiating Proposals And Future Options

Since President Barack Obama took office four years ago, diplomats from the P5+1 group of states (China, France, Russia, the United Kingdom, the United States and Germany) and Iran have engaged in renewed but intermittent discussions aimed at resolving concerns about Iran's nuclear program. So far, however, the two sides have been unable to reach an agreement that would bridge the differences between the proposals that have been exchanged during the talks.[35]

The inauguration of President Hassan Rouhani

The Zero-Enrichment Approach: Unrealistic and Unnecessary

Some policymakers and analysts argue that any negotiated settlement with Tehran must require Iran to give up enrichment. There are numerous credible justifications for this demand. Most important of all is that Iran has pursued its enrichment capability in secret for 18 years and did so as part of an apparent nuclear weapons program. Tehran only declared its enrichment-related facilities after those facilities were publicly revealed or otherwise discovered. The materials and technology for this work were primarily acquired illicitly, both through the Khan network and by violating national export controls in other countries. In essence, Iran's enrichment program was entirely illegal from the start.

There is also Iran's questionable rationale for its enrichment program. Tehran claims that it wants to enrich uranium to manufacture fuel for an ambitious nuclear energy plan, ultimately producing a total of about 20,000 megawatts of electricity in about 20 nuclear reactors. Yet, Iran's sole nuclear power reactor at Bushehr began operations only last year, and Russia has agreed to provide fuel for that plant for at least the next 10 years. Iran has not yet provided design information for a second nuclear power plant it intends to build at Darkhovin. As a result, Iran does not appear to have any need for LEU for at least the next decade. The fact that Iran decided in 2010 to begin enriching uranium to 20 percent, well above the 3.5 percent used in power reactors, only further raises concerns about Tehran's motives.

Finally, in the context of efforts to prevent sensitive fuel-cycle technologies from spreading, including through the adoption of more-stringent guidelines for enrichment and reprocessing transfers by the Nuclear Suppliers Group, a continued Iranian enrichment capability may undermine global efforts to discourage their development. If Iran were allowed to maintain such a capacity, it would be difficult to convince other countries that have been in compliance with their nonproliferation obligations that such capabilities should be eschewed.

Although the arguments against Iran maintaining an enrichment capability are valid, the prospect of achieving such an outcome through negotiations or any other means is not realistic at this point. Iran is not likely to give up such a capacity willingly, and there are no credible options to forcibly eliminate such a capacity from Iran altogether.

Iran's nuclear program has received a significant degree of public support in Iran across the political spectrum and has assumed a high degree of political significance. Moreover, such public support does not distinguish between a nuclear program with or without enrichment. Although public opinion polling in Iran, even by outside independent organizations, is notably unreliable, such polls do offer a general sense of public attitudes on the nuclear issue. Any Iranian political leadership likely will seek to maintain and pursue a robust nuclear program as a matter of national pride and recognition. Such an approach did not originate with the Islamic Republic of Iran, but was first adopted by the shah, who sought fuel cycle capabilities consummate with his view of Iran as a regional superpower. Iran is legally required to suspend all activities related to enrichment on the basis of its continued violations of its IAEA safeguards agreement and its apparent nuclear weapons research in contravention of its NPT Article II obligations. Yet, there is no legal basis to make such a suspension requirement permanent if Iran verifiably came into compliance with those commitments.

In the absence of a clear economic rationale for uranium enrichment, if Iran agreed to an arrangement that would make it difficult to misuse such a capability for nuclear weapons or determined that a weapons capability was not in its interests, Tehran would be confronted with the prospect of proceeding with a wasteful enrichment program. Although enrichment has become a matter of national pride for the Iranian leadership and much of the public, a cost-benefit analysis of such a program in the aftermath of an

agreed settlement might conclude that the long-term maintenance of such a capability, especially on a large scale, was no longer feasible.

The zero-enrichment stance also does not appear to have the support of much of the international community. Developing countries, including key U.S. partners such as India, have frequently issued statements backing Iran's rights to a peaceful nuclear program. A Brazilian-Turkish diplomatic effort with Iran concluded in a May 2010 statement that Iran has the right under the NPT "to develop research, production and use of nuclear energy (as well as nuclear fuel cycle including enrichment activities) for peaceful purposes without discrimination." Perhaps most importantly, although China and Russia supported the UN Security Council's demand for enrichment suspension, they do not appear to require that Iran permanently forgo enrichment. If these key countries are unwilling to enforce a zero-enrichment demand on Iran, efforts to apply political and economic pressure on that basis will not be successful.

Lastly, if the West's position on enrichment is the only issue preventing agreement on a long-term settlement, it is not worth giving up such an opportunity to maintain the zero-enrichment principle, particularly as it is not inconsistent with stated U.S. policy. In testimony before the House Foreign Affairs Committee on March 1, 2011, Secretary of State Hillary Rodham Clinton said that "under very strict conditions Iran would, sometime in the future, having responded to the international community's concerns and irreversibly shut down its nuclear weapons program, have such a right [to enrich uranium] under IAEA inspections." [34]

Although allowing Iran to maintain an enrichment capability would make it more difficult to convince other countries to forgo sensitive fuel-cycle technologies, the damage to the nonproliferation regime would be far greater if a potential opportunity to resolve the issue diplomatically were passed up and Iran proceeded down a nuclear weapons' path in the context of a divided international community. National enrichment capabilities for the vast majority of countries are economically unviable, likely to be a weightier consideration than whether Iran has its own enrichment facility.

in August 2013 represents an important new opportunity to engage in serious negotiations that the international community must exploit.

If they are to achieve progress, negotiators from both sides will need to consider new variations on their earlier diplomatic proposals if they are to resolve the concerns about Iran's growing nuclear capabilities and resulting nuclear weapons potential.

There is still time for diplomacy, but both sides need to move with greater urgency toward a lasting solution. Iran apparently has not made a strategic decision to pursue nuclear weapons and does not yet have the necessary ingredients for an effective nuclear bomb. However, as the latest International Atomic Energy Agency (IAEA) quarterly report makes clear, its uranium enrichment capabilities are improving and it stockpile of enriched uranium is growing.[36] Negotiators cannot afford to rely only on proposals that failed to gain traction during previous rounds of talks.

Current Positions and Proposals

During the first round of the high-level political negotiations in April 2012 in Istanbul, the two sides agreed to pursue negotiations based on a step-by-step approach with reciprocal actions. Further high-level meetings were held in Baghdad in May and in Moscow in June. In June, EU High Representative Catherine Ashton said that "significant gaps" remained between the two sides, but she also said that the talks addressed "substance" and "critical issues."

Talks were suspended until 2013, when negotiations resumed in Almaty, Kazakstan. The P5+1 and Iran met there twice in February and April, with a technical level meeting held in March in Istanbul. After the April talks, the parties agreed that that significant differences remained and no further talks were scheduled.

Both Iran and the P5+1 presented proposals in the 2013 talks that were based on negotations from the previous year and highlighted key concerns of each side. Iran's proposals highlighted its principle concerns, namely recognitition of the right to enrich uranium and sanctions relief, where the P5+1 has prioritized suspending enrichment activities to 20 percent and reducing the stockpile of that material.

While there are a number of common elements in the respective proposals, there are significant differences regarding the sequence of actions, the scope of issues to be addressed, and the timing of sanctions relief.

Nevertheless, if each side provides slightly more flexibility and creativity, it may be possible to bridge the gaps and reach a resolution that addresses the most urgent proliferation risks posed by Iran's nuclear program, as well as Iran's desire to continue some nuclear activities and begin to remove elements of the severe sanctions regime that has been put in place.

In the coming months, both sides must consider alternative proposals that can break the current impasse and build momentum toward a mutually acceptable and sustainable resolution to the crisis.

There are a number of options for both short-term confidence building measures and the long-term actions that can lead to a mutually acceptable "endgame" for all sides. Drawn from a variety of experts, the following options take into account key elements of the proposals put forward by Iran and the P5+1 last year, as well as the statements of senior government officials.

The options listed here are by no means exhaustive, but are intended to illustrate how negotiators might achieve progress toward a meaningful diplomatic solution in the coming year.

Confidence-Building Measures

One strategy for making progress in the talks is to implement confidence-building steps that would prevent the situation from worsening in the short term, while a more comprehensive proposal for the "end-game" can be negotiated. Given the current trust deficit and the fractured Iranian political leadership, as well as the differences between the proposals offered by Tehran and the P5+1, this approach may be the most feasible method of making progress toward an ultimate solution.

For these short-term measures to be meaningful, however, they still must address the core concerns of both sides and build trust between the parties. In the near-term, the P5+1 have made it clear they want to halt the continued growth of Iran's stockpile of uranium enriched to 20 percent and otherwise ensure that an Iranian "breakout" is not imminent. Iran appears to be interested in confidence building measures that include acknowledgement of its right to enrich under certain conditions, guarantees that further sanctions would not be imposed, and assurances that Iran will not be subjected to a military attack.

Suspension for Recognition

In an October 8, 2012 interview with Der Spiegel, Iranian Foreign Minister Ali Akbar Salehi said that Iran is prepared to "offer an exchange" in which Tehran would voluntarily limit "the extent of our enrichment program" in return for a guaranteed supply of fuel rods and a recognition that Iran has the right to enrich.[37]

One of the attractions of this proposal is that it gives Iran a view of the "end-game." Recognition of the right to enrich ensures Tehran that a negotiated settlement will respect future enrichment under certain guidelines. Moreover, it is not inconsistent with the current position of the P5+1.

The United States, for instance, already has recognized Iran's right to enrich uranium if it is in compliance with its safeguards obligations. Secretary Clinton's aforementioned testimony made it clear that the United States would support Iran enriching uranium in the future under strict IAEA supervision once the concerns of the international community were resolved. Clinton also said in the March 1, 2011 testimony that she thought that this was the position of the international community.

Atta Kenare/AFP/Getty Images

Iranian President Mahmoud Ahmadinejad (center) at the opening ceremony for the heavy water production plant in Arak in August 2006.

Over the course of the past year, the United States' negotiating partners in the P5+1 have made similar statements. This offer also addresses the principal immediate concern of the international community, namely preventing any further increase in Iran's stockpile of 20 percent enriched uranium.

Suspension for Suspension

Another possible interim measure is pursing a "suspension for suspension" agreement, whereby Iran agrees to suspend enrichment to 20 percent and the P5+1 agrees to suspend the imposition of any future sanctions. A number of experts, including former U.S. Special Envoy to Afghanistan James Dobbins,[38] have argued that this option would be in line with the agreement in April 2012 to pursue a step-by-step process with reciprocal actions.

A suspension-for-suspension agreement would be a win-win on both sides because Iran would be spared the suffering resulting from the imposition of more draconian sanctions, while the P5+1 would be given the assurance that Iran's enrichment to the 20 percent level would stop short of the amount needed to rapidly enrich to one bomb's worth of fissile material. It would also build trust, reduce growing tensions, and widen the window of opportunity for negotiating a long-term settlement.

Conversion of the 20% Stockpile Of Enriched Uranium

Another possible option, outlined by former Iranian nuclear negotiator Hussein Mousavian, is conversion of Iran's 20 percent stockpile of enriched uranium hexafluoride gas to the solid form of uranium oxide, which is used in the manufacturing of fuel plates for the Tehran Research Reactor (TRR).[39] Uranium oxide poses less of a threat for a rapid nuclear breakout, since it would have to first be converted back to a gaseous form before enrichment to weapons-grade and any conversion efforts would likely be detected by the IAEA.

If this "zero 20 percent uranium hexafluoride stockpile" option were pursued, it would address the most acute P5+1 concerns and demonstrate Iran's commitment to its claim that it is not producing uranium at this enrichment level for weapons purposes.

Israeli Defense Minister Ehud Barak recently indicated that the conversion mitigates some concern over Iran's possible movement toward a breakout capability.[40]

In the long-term, however, continued conversion of uranium hexafluoride to uranium oxide is not a viable solution for two reasons. First, such conversion does not remove the enriched uranium from potential weapons uses because the solid form can be converted back to hexafluoride gas. Doing so would, however, add another step to the breakout process and any reversal would be quickly noticed by the IAEA.

Second, Iran's continued stockpiling of uranium oxide well in excess of its needs for the TRR[41] will perpetuate suspicions that Iran is producing 20 percent enriched uranium for possible military purposes.

There is still time for diplomacy, but both sides need to move with greater urgency toward a lasting solution.

Mutual Recognitions

Another confidence building measure Mousavian suggested is that a new round of high-level political talks begin with an exchange of recognitions that address critical concerns raised by each side. He recommends the following:[42]

- Iran recognizes that the international community's concerns over the development of its nuclear program are legitimate and do need to be addressed by Tehran; and

- the P5+1 recognize that Iran has a right to pursue uranium enrichment to a limited level for peaceful purposes.

These "mutual recognitions" could then provide a basis for further confidence-building measures by the parties acknowledging that each side has legitimate concerns and that negotiations must occur within a framework palatable to both sides. It also gives a view of the essential characteristics of a negotiated settlement: the P5+1 concerns will be addressed and Iran's right to enrich uranium for peaceful purposes

The Importance of Effective Monitoring and Verification

To ensure that any ongoing Iranian nuclear activities are not diverted for weapons purposes, the United States and other parties not only need to secure an agreement that Iran will discontinue to enrichment beyond normal power reactor fuel-grade, but they will need to secure additional international monitoring and transparency measures to guard against rapid breakout and a potential secret program.

The starting point for such a verification regime is the additional protocol to Iran's safeguards agreement with the IAEA. The protocol provides access to undeclared sites and aspects of Iran's nuclear program that are crucial to its fuel cycle facilities. The IAEA has stated repeatedly in its reports that unless Iran implements its additional protocol, "the agency will not be in a position to provide credible assurance about the absence of undeclared nuclear material and activities in Iran."

Iran has signed an additional protocol and, between 2003 and 2006, implemented it on a provisional basis. Tehran now maintains that it will not ratify the provision until its case is moved from the UN Security Council and back to the IAEA. Former Iranian deputy nuclear negotiator Seyyed Hossein Mousavian and senior Iranian government officials have said, however, that Iran could likely agree to the protocol as part of a package agreement.

Yet, the additional protocol will not be enough to provide sufficient assurance against proliferation if Iran continues to maintain an enrichment program. In addition to the protocol, Iran would need to be subject to additional formal verification requirements and may need to submit to additional confidence-building measures. Such steps would need to cover all of Iran's nuclear activities, including its uranium mines, and would need to ensure that Iran would not be left with an LEU stockpile it could quickly convert to weapons grade.

One of the key objectives for any enhanced safeguards regime in Iran would be instituting measures that would provide an accurate and thorough accounting of nuclear material being used at Iran's enrichment-related facilities. Any nuclear facilities Iran maintains would continue to pose a risk that nuclear material might be diverted. Therefore, more-stringent material accountancy in key nuclear facilities would provide greater assurance that no material has been diverted and impose a stronger deterrent against such action. Such stronger measures could include measuring the mass balance of uranium going into and coming out of Iran's uranium-conversion plant and using the destructive analysis technique at Iran's enrichment plant to reduce errors in measuring the amount of nuclear material present. Under these procedures, Iran would find it more difficult to siphon off some of its nuclear material for any parallel program.

An intensified safeguards regime would need to provide the earliest-possible indication of any diversion or any other attempted misuse of nuclear material and facilities. The expedited inspections regime under the additional protocol would need to be supplemented by real-time monitoring of key facilities, in particular Iran's enrichment and conversion plants. If Iran decided to move either its stores of uranium hexafluoride or LEU from those facilities to enrich to weapons-grade levels, a real-time monitoring arrangement would provide the earliest-possible indication of such an action, allowing the international community to respond before Iran could manufacture nuclear devices.

Finally, Iran could institute confidence-building measures regarding the nuclear material it produces, such as exporting the LEU it produces for fuel fabrication, thereby preventing it from holding in its territory a stockpile of LEU that could be further enriched to produce nuclear weapons. Such a measure would not likely be agreed on a long-term basis, but could be instituted following a suspension period to provide additional confidence and until Iran develops a domestic need for such LEU.

preserved.

These recognitions would also allow each side to claim an initial victory, sustaining domestic support for the difficult negotiations that would follow.

Realigning the Existing Proposals

While there are substantial differences between the formal proposals advanced by Iran and the P5+1, there is considerable common ground between the two proposals discussed in 2013 at Almaty. With adjustments, a compromise package could be forged that would address the key concerns of both side and allow each to claim "victory."

For example, the P5+1 proposal could be enhanced by more clearly recognizing that at a future date Iran will be allowed to enrich under certain circumstances, such as fully meeting its IAEA safeguards obligations.

Suspending some types of international sanctions, and/or guaranteeing that no further sanctions will be imposed, would also help balance the demands made by the P5+1.

Similarly, the Iranian proposal could be improved with a pledge to provide immediate and full cooperation with the IAEA's ongoing investigation of Iran's program, and a prompt halt in the accumulation of 20% enriched uranium material. Iran could also improve its proposal by recognizing that cooperation with the IAEA's investigations does not warrant full sanctions relief from unilateral or multilateral sanctions. Accepting IAEA monitoring of enrichment and assistance from the P5+1 on fuel fabrication for the TRR is also not sufficient to terminate UN Security Council sanctions and remove Iran from that body's agenda. Suspending specific measures or halting the imposition of new sanctions is a more feasible, balanced approach for what Iran is offering.

Medium-for-Medium

Some experts, however, caution that pursuing confidence-building measures, particularly those centered around the issue of 20 percent enriched uranium, is insufficient and that a more ambitious "medium-for-medium" deal should be pursued. MIT senior fellow James Walsh says that by focusing on short-term confidence-building steps, the negotiators would only "push the can down the road."

Additionally, Walsh says it shrinks the negotiation space to the point where, if there are disagreements, it is difficult to reach an agreement because there are no

Ali Al-Saadi/AFP/GettyImages

Iran's chief nuclear negotiator Saeed Jalili meets with Catherine Ashton, lead negotiator for the P5+1, in Baghdad on May 23, 2012 to continue talks on Iran's controversial nuclear program.

other issues to trade against.[43]

Others argue that, because Iran has already rejected the most recent P5+1 proposal to halt 20 percent uranium enrichment operation (arguing that the P5+1 did not offer sanctions relief during the 2012 talks), a more ambitious "medium-for-medium" proposal might be more suitable for both sides. While these proposals would not necessarily resolve the "end-game," they would at least address the most urgent issues of both parties and would prevent the situation from worsening.

Former administration officials have suggested that a medium-for-medium deal should require more of Iran for limited sanctions relief than is called for in the existing P5+1 proposal, but offers less relief than Iran has requested in its own proposal. Such an approach might involve the following steps:

IRAN:

- stop 20 percent enrichment;
- move all 20 percent enriched material out of the country;
- shut Fordow or temporarily suspend work at Fordow;
- oxidize or remove a substantial portion of the 3.5 percent enriched uranium stockpile; and
- implement the Additional Protocol.

P5+1:

- suspend implementation of certain sanctions for a renewable period;
- freeze new sanctions initiatives; and
- provide Iran with fuel rods for the TRR.

The suspension of existing sanctions could be automatically revoked if Iran violated its commitments under such an agreement.

The former Head of the UN Special Commission on Iraq, Ambassador Rolf Ekeus, also has spoken in favor of limited and gradual sanctions relief in return for a more "intrusive, permanent monitoring system, including an early warning system."[44]

A Revised Fuel Swap

Another variation on the medium-for-medium approach could be based on the October 2009 fuel swap proposal and a revised version that was outlined in the May 2010 Tehran Declaration, which was brokered by Brazil and Turkey and agreed to by Iran.

At an October 2009 meeting with the United States, France, Russia, and the IAEA, Iran agreed in principle to export 1,200 kilograms of its 1,600 kilogram stockpile of uranium enriched to 3.5 percent to Russia for further enrichment to 20 percent (Iran was not yet enriching uranium to 20 percent at the time). France would then fabricate the 20 percent enriched uranium into fuel rods for the TRR. Additionally, the United States would work with the IAEA to improve safety at the TRR.

However, Iran never officially accepted the proposal. Prominent Iranian political figures voiced their opposition to the terms of the agreement, and suggested alternatives that undermined the proposed deal. The domestic opposition was likely motivated in part by opponents' dislike of President Mahmoud Ahmadinejad, who supported the fuel swap.

During the spring of 2010, Brazil and Turkey attempted to revive the fuel swap deal. Under the terms of the revised fuel swap deal, Iran would transfer 1,200 kilograms of uranium enriched to 3.5 percent out of the country and receive in return fuel plates for the TRR.

Iran began enriching to 20 percent in February 2010, for the ostensible purpose of fabricating its own fuel plates, but this was not addressed in the document. The declaration also recognized Iran's right to develop and use nuclear energy, including enrichment, for peaceful purposes.

The United States, France, and Russia rejected this deal, citing concerns that it did not address Iran's ability to produce uranium enriched to 20 percent or to accumulate excessive amounts of 3.5 percent enriched uranium. In addition, the Tehran Declaration did not take into account the growth of the stockpile since the Oct. 2009 fuel swap was negotiated. It only required Iran to ship 1,200 kilograms. Iran's ongoing technical difficulties with fuel fabrication for the TRR suggest that its leaders may still have an interest in such an arrangement.

A revised TRR fuel swap package could include the following actions:

IRAN:

- accepts limits to is stockpile of 3.5 percent enriched uranium;
- ships out its stockpile of 20 percent enriched uranium; and
- agrees to forgo enrichment beyond 3.5 percent.

P5+1:

- agree to provide fuel plates for the TRR and for any future medical isotope production;
- suspend the imposition of further sanctions during the interval of the swap and begin to dismantle sanctions after Iranian enrichment to 20 percent is verifiably suspended and the

stockpile shipped out of the country; and
- provide technical cooperation for Iran's development of a light water research reactor.

"Big-for-Big" Approach

Another potential option is a "big-for-big" approach that definitively would resolve the Iranian nuclear question and take steps to improve the broader relationship between Iran and the P5+1.

Under this approach, other areas of contention between the parties would be addressed and measures implemented to strengthen the economic and civil society ties. A key part of such an approach would be the resolution of the IAEA's outstanding concerns regarding the possible military dimensions of Iran's nuclear program, which the Agency is currently negotiating with Iran on a separate track, and more intrusive IAEA inspections under the terms of the code 3.1 version of comprehensive safeguards and the IAEA Additional Protocol.

A number of experts, including former National Security Council Advisor Stephen Hadley, have argued for a more comprehensive approach.[45] According to Hadley and others such an approach would require that Iran:

- agree not to enrich uranium above 3.5 percent;
- accept a stockpile limit of 3.5 percent enriched uranium based on calculations of what is needed for civilian power production;
- agree not to pursue or attempt to purchase a nuclear weapon (operationalize the fatwa against nuclear weapons);
- forego any intention of nuclear reprocessing or plutonium production;
- shut down and dismantle Fordow;
- accept and implement the IAEA Additional Protocol;
- address IAEA concerns about past weapons activities; and
- agree to end support for terrorist activities and non-state actors, such as Hezbollah.

Hadley and others suggest that the P5+1 could then agree to:

- provide support for Iran's civilian nuclear power program;
- phase out sanctions;
- revive Iran's economy, including investment in oil and gas and technology transfers;
- encourage organizations, businesses, and foundations to establish training centers in Iran;
- establish exchange programs for students, business and civil society leaders;
- reestablish diplomatic relations;
- establish a regional international nuclear reprocessing and enrichment center with Iran as a partner, but not possessor of critical technology;
- accept enrichment to 3.5 percent at Natanz;
- limit Iran's total stockpile of uranium enriched to 3.5 percent to 800 kilograms (not including fuel rods); and
- clearly renounce any acts of sabotage or acts of violence against Iranian citizens and facilities.

These provisions could be implemented on a one-for-one reciprocal basis over a timeframe agreed to by the parties and laid out in the proposal.

Advocates of this approach suggest that there should be a mechanism that automatically reestablishes sanctions and/or authorizes military force in the event of a violation of the agreement by Iran. Such an agreement could be further strengthened through an endorsement in a UN Security Council Resolution that also lays out what constitutes a violation and the reciprocal consequences.

The Iran-IAEA Talks On Safeguards and "PMD"

In addition to the P5+1 talks with Iran, Iran and the IAEA are engaged in talks that began in early 2012 to address Iranian activities with "potential military dimensions" (PMD), which are detailed in the Agency's November 2011 report to the Board of Governors and include the following concerns:

- high explosives experiments with nuclear weapons implications;
- neutron initiation and detonator development;
- work to fit a nuclear warhead on a missile, along with arming, firing and fusing mechanisms; and
- Iranian procurement activities related to its alleged warhead work.

The IAEA presented an initial proposal to Iran in February 2012 for a structured approach to resolve these issues and provide the agency with the information necessary to confirm there is no ongoing warhead development work.[46]

Despite multiple consultations over the past year, the parties have yet to agree on the "structured approach." In response to the impasse, the IAEA Board of Governors approved a resolution on September 13, 2012 faulting Iran for failing to

address UN Security Council demands that it suspend uranium enrichment activities and cooperate with the agency's investigations.

Iran and the IAEA met a total of ten times between February 2012 and June 2013 to continue negotiating a framework for moving forward but no further progress was achieved. Talks will resume on September 27, 2013.

To move its investigation forward, the IAEA should clarify that the goal of the investigation is to ensure that no weapons related activities are currently underway.

For its part, Iran must also drop demands that delay the agency's investigations or compromise its ability to follow-through on its investigation. In its initial response to the IAEA's February 2012 work plan, Iran rejected the possibility of parallel investigations on suspected activities, which would speed up the agency's work.

Iran also proposed striking language that would allow for follow-up investigations if further issues arise for Tehran to clarify during the process. These limitations could prevent the IAEA from adequately following up on information that could be uncovered during its investigation.

Iran's leaders must also recognize that concrete progress toward concluding the IAEA's investigation would bolster its assertion that its program is only for peaceful purposes and would accelerate progress in the high-level political talks between Tehran and the P5+1 group.

As Secretary of State John F. Kerry said in his January 24 confirmation hearing:

> "[T]he president has made it clear that he is prepared to engage …. I think everybody's very hopeful that we can make some progress on the diplomatic front now. I'd say this to the Iranians, I hope they listen. They have continually professed the peacefulness of their program. It is not hard to prove a peaceful program. Other nations have done that and do it every day. And it takes intrusive inspections. It takes living up to publicly arrived at standards. Everybody understands what they are."

Conclusions

International sanctions have slowed Iran's nuclear program and increased pressure on Tehran to respond more favorably to P5+1 overtures. Yet these sanctions, even if tightened further, cannot stop Iran's nuclear pursuits.

The use of military force against Iran's extensive and highly dispersed nuclear infrastructure, short of a complete military occupation of the country, can only temporarily set back Iran's program and would likely prompt Iran to eject the IAEA inspectors and actively pursue nuclear weapons.

Consequently, the military option would be counterproductive and costly, and would foreclose diplomatic options, erode international support for sanctions, lessen Iran's isolation, and possibly trigger a regional war leading to enormous civilian casualties and human suffering.

President Obama and other leaders must redouble efforts to engage Iran in serious, sustained negotiations on arrangements that guard against a nuclear-armed Iran. Iran's leaders must, of course, also be willing to engage in good faith in these efforts.

To do so, it is essential that Iran agree to halt its accumulation of 20 percent enriched uranium and restrict its enrichment operations and stockpiles to normal power reactor-grade levels and other civilian, peaceful needs. To verify and monitor Iran's commitments, the IAEA must be allowed to conduct more intrusive monitoring and it must be able to ascertain that any past weapons-related work by Iran has been discontinued. In exchange, there should be an appropriate and proportional paring back of international sanctions on Iran and P5+1 recognition that Iran has a legitimate claim to pursue the peaceful uses of nuclear energy.

A diplomacy-centered approach is the only option that can prevent an Iranian nuclear weapon. Pursuing such a course is difficult, but it is the best option on the table.

APPENDIX A

Timeline of Nuclear Diplomacy with Iran

NOVEMBER 1967: Iran's first nuclear reactor, the U.S.-supplied five-megawatt Tehran Research Reactor (TRR), goes critical. It operates on uranium enriched to about 93 percent (it is converted to run on 20 percent in 1993), which the United States also supplies.

FEBRUARY 1970: The Iranian parliament ratifies the nuclear Nonproliferation Treaty (NPT).

1974: Shah Reza Pahlavi establishes the Atomic Energy Organization of Iran (AEOI) and announces plans to generate about 23,000 megawatts of energy over 20 years, including the construction of 23 nuclear power plants and the development of a full nuclear fuel cycle. Initiating this plan, Iran reaches an agreement with Germany to build two nuclear power reactors at Bushehr. A U.S. National Intelligence Estimate (NIE) expresses concerns that the shah's regional and nuclear ambitions may lead Iran to develop nuclear weapons.

1979: The Iranian Revolution and the seizure of the U.S. embassy in Tehran result in a severing of U.S.-Iranian ties and damages Iran's relationship with the West. Iranian nuclear projects are halted. Germany halts construction of the Bushehr power plants.

JANUARY 19, 1984: The U.S. Department of State adds Iran to its list of state sponsors of terrorism, effectively imposing sweeping sanctions on Tehran.

1987: Iran acquires technical schematics for building a P-1 centrifuge from the Abdul Qadeer Khan network.

1992: Congress passes the Iran-Iraq Arms Nonproliferation Act of 1992, which prohibits the transfer of controlled goods or technology that might contribute "knowingly and materially" to Iran's proliferation of advanced conventional weapons.

1993: Conversion of the TRR is completed by Argentina's Applied Research Institute. It now runs on fuel enriched to just under 20 percent, 115 kilograms of which is provided by Argentina. The contract for the conversion was signed in 1987.

JANUARY 1995: Iran signs a contract with Russia to finish constructing one of the Bushehr nuclear power plants.

AUGUST 5, 1996: Congress passes the Iran-Libya Sanctions Act, also known as the Iran Sanctions Act, that penalizes foreign and U.S. investment exceeding $20 million in Iran's energy sector in one year.

MAY 18, 1998: Following an EU threat to bring U.S. sanctions against companies investing in Iran's energy sector before the World Trade Organization, the United States waives sanctions against a French firm and its partners in return for EU cooperation on counterproliferation and counterterrorism issues.

AUGUST 2002: The National Council of Resistance on Iran, the political wing of the terrorist organization Mujahideen-e Khalq (MeK), holds a press conference where the organization declares Iran has built nuclear facilities near Natanz and Arak. The United States is believed to have already known about the existence of the facilities.

MAY 4, 2003: Swiss Ambassador to Iran Tim Guldimann faxes an Iranian proposal to the U.S. State Department outlining a "road map" for a comprehensive agreement on the nuclear issue. The proposal suggests an Iranian willingness to cooperate on the nuclear issue, terrorism, Iraq, and the

Middle East peace process in return for a lifting of sanctions, access to technology, and cooperation against the MeK. U.S. officials later express mixed views about the seriousness and provenance of the proposal.

SEPTEMBER 12, 2003: The International Atomic Energy Agency (IAEA) Board of Governors adopts a resolution calling for Iran to suspend all enrichment- and reprocessing-related activities. The resolution requires Iran to declare all material relevant to its uranium-enrichment program and allow IAEA inspectors to conduct environmental sampling at any location. Finally, the resolution urges Iran to implement an additional protocol to its safeguards agreement. The IAEA set a deadline of Oct. 31 for Iran to meet these conditions.

OCTOBER 21, 2003: Iran agrees to meet IAEA demands by the Oct. 31 deadline. In a deal struck between Iran and European foreign ministers, Iran agrees to suspend its uranium-enrichment activities and ratify an additional protocol to its safeguard agreement.

DECEMBER 18, 2003: Iran signs an additional protocol to its IAEA safeguards agreement.

JUNE 18, 2004: The IAEA rebukes Iran for failing to cooperate with IAEA inspectors. Iran responds by refusing to suspend enrichment-related activities as it had previously pledged.

NOVEMBER 14, 2004: Iran notifies the IAEA that it will suspend enrichment-related activities following talks with France, Germany, and the United Kingdom. According to the so-called Paris Agreement, Iran would maintain the suspension for the duration of talks among the four countries. As a result, the IAEA Board of Governors decides not to refer Tehran to the UN Security Council.

FEBRUARY 27, 2005: Russia and Iran conclude a nuclear fuel supply agreement in which Russia would provide fuel for the Bushehr reactor it is constructing and Iran would return the spent nuclear fuel to Russia. The arrangement is aimed at preventing Iran from extracting plutonium for nuclear weapons from the spent nuclear fuel.

AUGUST 8, 2005: Iran begins producing uranium hexafluoride at its Isfahan facility. As a result, France, Germany, and the United Kingdom halt negotiations with Tehran.

SEPTEMBER 24, 2005: The IAEA adopts a resolution finding Iran in noncompliance with its safeguards agreement by a vote of 22-1 with 12 members abstaining. The resolution says that the nature of Iran's nuclear activities and the lack of assurance in their peaceful nature fall under the purview of the UN Security Council, paving the way for a future referral.

FEBRUARY 4, 2006: A special meeting of the IAEA Board of Governors refers Iran to the UN Security Council in a 27-3 vote, with five abstentions. The resolution "deems it necessary for Iran to" suspend its enrichment-related activities, reconsider the construction of the Arak heavy-water reactor, ratify the additional protocol to its safeguards agreement, and fully cooperate with the agency's investigation.

FEBRUARY 6, 2006: Iran tells the IAEA that it will stop voluntarily implementing the additional protocol and other non-legally binding inspection procedures.

APRIL 11, 2006: Iran announces that it has enriched uranium for the first time. The uranium enriched to about 3.5 percent was produced at the Natanz pilot enrichment plant.

JUNE 6, 2006: China, France, Germany, Russia, the United Kingdom, and the United States (the so-called P5+1, referring to the five permanent members of the UN Security Council and Germany) propose a framework agreement to Iran offering incentives for Iran halt its enrichment program for an indefinite period of time. The proposal requires Iran to do three things before negotiations begin: cooperate fully with the IAEA investigation, resume implementing its additional protocol, and suspend all enrichment-related activities.

JULY 31, 2006: The UN Security Council adopts Resolution 1696, making the IAEA's calls for Iran to suspend enrichment-related and reprocessing activities legally binding for the first time. The resolution is approved by 14 members of the council, with Qatar voting against. The resolution also endorses the P5+1 proposal for a "comprehensive arrangement" on the Iran nuclear issue.

AUGUST 22, 2006: Iran delivers a response to the

P5+1 proposal, rejecting the requirement to suspend enrichment but declaring that the package contained "elements which may be useful for a constructive approach."

DECEMBER 23, 2006: The UN Security Council unanimously adopts Resolution 1737, imposing sanctions on Iran for its failure to suspend its enrichment-related activities. The sanctions prohibit countries from transferring sensitive nuclear- and missile-related technology to Iran and require that all countries to freeze the assets of 10 Iranian organizations and 12 individuals for their involvement in Iran's nuclear and missile programs.

MARCH 24, 2007: The UN Security Council unanimously adopts Resolution 1747 in response to Iran's continued failure to comply with the council's demand to suspend uranium enrichment. The resolution expands sanctions against Iran, prohibiting it from exporting any arms, and targets an additional 15 individuals and 13 entities for financial sanctions, including Bank Sepah, one of Iran's largest banks.

AUGUST 21, 2007: Following three rounds of talks in July and August, the IAEA and Iran agree on a "work plan" for Iran to answer long-standing questions about its nuclear activities, including work suspected of being related to nuclear weapons development. The United States and European governments said that the work plan does not constitute compliance with UN demands and that they would continue to seek additional sanctions against Iran.

DECEMBER 3, 2007: The United States publicly releases an unclassified summary of a new National Intelligence Estimate (NIE) on Iran's nuclear program. The NIE says that the intelligence community judged "with high confidence" that Iran halted its nuclear weapons program in the fall of 2003 and assessed with moderate confidence that the program had not resumed as of mid-2007. The report defines Iran's nuclear weapons program as "design and weaponization work" as well as clandestine uranium conversion and enrichment. The NIE also said that Iran was believed to be technically capable of producing enough highly enriched uranium for a nuclear weapon between 2010 and 2015.

MARCH 3, 2008: The UN Security Council passes Resolution 1803, further broadening sanctions on Iran. The resolution was adopted in a 14-0 vote with Indonesia abstaining. It requires increased efforts on the part of member states to prevent Iran from acquiring sensitive nuclear or missile technology and adds 13 persons and seven entities to the UN blacklist. The resolution calls on states to inspect the cargoes of transports suspected of violating the sanctions.

MAY 13, 2008: Iran offers a negotiating proposal to the P5+1, highlighting a number of areas for cooperation, but does not mention any Iranian action related to its nuclear program.

JUNE 14, 2008: The P5+1 present a new comprehensive proposal to Iran updating its 2006 incentives package. The new proposal maintained the same basic framework as the one in 2006, but highlighted an initial "freeze-for-freeze" process wherein Iran would halt any expansion of its enrichment activities while the UN Security Council agreed not to impose additional sanctions. Officials from P5+1 countries said that a key aim of the new initiative was demonstrating clearly to the Iranian people the benefits of cooperation.

FEBRUARY 3, 2009: Iran announces that it successfully carried out its first satellite launch, raising international concerns that Iran's ballistic missile potential was growing.

APRIL 8, 2009: Following an Iran policy review by the new Obama administration, the United States announces that it would participate fully in the P5+1 talks with Iran, a departure from the previous administration's policy requiring Iran to meet UN demands first.

JUNE 12, 2009: Iran holds presidential elections. Incumbent Mahmoud Ahmadinejad is declared the winner amid many indications that the election was rigged. This sparks weeks of protests within Iran and delays diplomatic efforts to address Iran's nuclear program.

SEPTEMBER 25, 2009: President Barack Obama, British Prime Minister Gordon Brown, and French President Nicolas Sarkozy announced that Iran has been constructing a secret, second uranium-enrichment facility in the mountains near the holy city of Qom. IAEA spokesman Marc Vidricaire said that Iran informed the agency Sept. 21 about the existence of the facility, but U.S. intelligence

officials said Iran offered the confirmation only after learning that it had been discovered by the United States.

OCTOBER 1, 2009: The P5+1 and Iran agree "in principle" to a U.S.-initiated, IAEA-backed proposal to fuel the TRR. The proposal entails Iran exporting the majority of its 3.5 percent-enriched uranium in return for 20 percent-enriched uranium fuel for the TRR, which has exhausted much of its supply. This agreement was later met with domestic political opposition in Iran, resulting in attempts by Tehran to change the terms of the "fuel swap."

FEBRUARY 9, 2010: Iran begins the process of producing 20 percent-enriched uranium, ostensibly for the TRR.

MAY 17, 2010: Brazil, Iran, and Turkey issue a joint declaration attempting to resuscitate the TRR fuel-swap proposal. In the declaration, Iran agrees to ship 1,200 kilograms of 3.5 percent-enriched uranium to Turkey in return for TRR fuel from France and Russia. France, Russia, and the United States reject the arrangement, citing Iran's larger stockpile of 3.5 percent-enriched uranium and the failure of the declaration to address Iran's enrichment to 20 percent.

JUNE 9, 2010: The UN Security Council adopts Resolution 1929, significantly expanding sanctions against Iran. In addition to tightening proliferation-related sanctions and banning Iran from carrying out nuclear-capable ballistic missile tests, the resolution imposes an arms embargo on the transfer of major weapons systems to Iran. It highlights the connection between the revenues from Iran's energy sector and its nuclear and missile programs, providing some basis for the European Union to adopt restriction on Iran's oil and gas

IIPA via Getty Images

In August 2010 the first fuel is loaded into Iran's sole nuclear power plant, Bushehr, which is operated by the Russians. Russia also supplies the enriched uranium to fuel the plant.

sector. The resolution received 12 votes in favor, with Brazil and Turkey voting no and Lebanon abstaining.

JUNE 24, 2010: Congress adopts the Comprehensive Iran Sanctions, Accountability, and Divestment Act, tightening U.S. sanctions against firms investing in Iran's energy sector, extending those sanctions until 2016, and imposing new sanctions on companies that sell refined petroleum to Iran. The law seeks to identify countries at risk of serving as a conduit for sensitive technologies to Iran to bolster their export controls to prevent sales of these technologies to Iranian entities. Obama signs the legislation into law July 1.

JULY 26, 2010: The EU agrees to further sanctions against Iran. A statement issued by EU member state foreign ministers refers to the new sanctions as "a comprehensive and robust package of measures in the areas of trade, financial services, energy, [and] transport, as well as additional designations for [a] visa ban and asset freeze."

SEPTEMBER 16, 2010: The Stuxnet computer virus is first identified by a security expert as a directed attack against an Iranian nuclear-related facility, likely to be the Natanz enrichment plant.

JANUARY 21-22, 2011: Following a December meeting in Geneva, the P5+1 meets with Iran in Istanbul, but the two sides do not arrive at any substantive agreement. Iran's two preconditions for further discussions on a fuel-swap plan and transparency measures, recognition of a right to enrichment and the lifting of sanctions, were rejected by the P5+1.

FEBRUARY 16, 2011: U.S. intelligence officials tell a Senate committee that Iran has not yet decided whether it wants to develop nuclear weapons but is keeping that option open through development of its material capabilities.

MAY 8, 2011: Iran's Bushehr nuclear power plant begins operations and successfully achieves a sustained chain reaction two days later, according to Atomstroyexport, the Russian state-owned company constructing and operating the plant.

JUNE 8, 2011: Iran announces that it intends to triple the rate of 20 percent-enriched uranium production using more-advanced centrifuge designs. It also says it will move production to the Fordow enrichment plant near Qom, which is still under construction.

JULY 12, 2011: Russian Foreign Minister Sergey Lavrov unveils a proposal wherein Iran would take steps to increase cooperation with the IAEA and carry out confidence-building measures in return for a gradual easing of sanctions.

OCTOBER 21, 2011: EU foreign policy chief, Catherine Ashton, sends a letter to Iranian nuclear negotiator Saeed Jalili calling for "meaningful discussions on concrete confidence-building steps" to address international concerns about Iran's nuclear ambitions.

NOVEMBER 8, 2011: The IAEA releases a report detailing a range of activities related to nuclear weapons development in which Iran is suspected to have engaged as part of a structured program prior to 2004. The report raises concerns that some weapons-related activities occurred after 2003. The information in the report is based primarily on information received from other countries, but also includes information from the agency's own investigation. The findings appear consistent with the U.S. 2007 NIE on Iran.

DECEMBER 31, 2011: As part of the fiscal year 2012 National Defense Authorization Act, Congress passes legislation that will allow the United States to sanction foreign banks if they continue to process transactions with the Central Bank of Iran.

JANUARY 2012: The EU passes a decision that will ban all member countries from importing Iranian oil beginning July 1, 2012. Other provisions of the decision will prevent member countries from providing the necessary protection and indemnity insurance for tankers carrying Iranian oil.

FEBRUARY 15, 2012: Jalili responds to Ashton's Oct. 21 letter, while Iran simultaneously announces a number of nuclear advances, including the production of a fuel plate for the TRR.

APRIL 14, 2012: Iran meets with the P5+1 in Istanbul for talks both sides call "positive." They agree on a framework of continuing negotiations with a step-by-step process and reciprocal actions.

MAY 23-24, 2012: Iran and the P5+1 meet in Baghdad for a second set of talks.

JUNE 18-19, 2012: Talks between Iran and the P5+1 continue in Moscow. Representatives discuss the substance of a P5+1 proposal and an Iranian proposal. Lead negotiators decide to hold a technical-level meeting July 3 in Istanbul, followed by a meeting between the deputy negotiators Helga Schmid and Ali Bagheri. After the experts meet, Ashton and Jalili will determine if political-level talks will continue.

JULY 3, 2012: Experts representing the six parties meet in Istanbul to discuss the technical aspects of the P5+1 proposal and the Iranian proposal.

AUGUST 10, 2012: The United States passes further sanctions legislation that prevents foreign banks from repatriating funds paid to Iran for oil purchases. The legislation also further targets individuals or entities that provide services to Iran's energy sector, help Iran evade sanctions, or transport Iranian oil.

OCTOBER 15, 2012: The EU approves further sanctions on limiting natural gas imports and on financial transactions between EU countries and Iranian banks.

NOVEMBER 16, 2012: The IAEA reports that Iran completes the installation of centrifuges at Fordow, although the number of centrifuges enriching uranium remains unchanged.

JANUARY 2, 2013: The United States adopts new sanctions targeting international companies that do business with Iran's shipping sector and imposes sanctions on the sale of certain commodities.

FEBRUARY 25, 2013: Negotiations between Iran and the P5+1 resume in Almaty, Kazakhstan. The P5+1 proposal is based on the 2012 negotiations.

MARCH 14, 2013: Representatives from Iran and the P5+1 hold technical level talks in Istanbul.

APRIL 5-6, 2013: Iran and the P5+1 meet again in Almaty, Kazakhstan to resume talks. Both sides bring proposals to talks, but agree that the sides are too far apart to continue negotiating.

JUNE 3, 2013: IAEA Director General Yukiya Amano tells the agency Board of Governors that talks between Iran and the IAEA are not have not made any progress.

JUNE13, 2013: Hassan Rouhani, a former nuclear negotiator for Iran from 2003-2005, is elected the new president of Iran. Rouhani promises greater transparency in Iran's nuclear program in a speech following his election.

JULY 1, 2013: Further sanctions against Iran go into effect, including a ban on the sale of all precious metals to any Iranian entity or individuals.

AUGUST 3, 2013: Hassan Rouhani is inaugurated as the president of Iran.

APPENDIX B

History of Official Proposals on the Iranian Nuclear Issue

Diplomatic initiatives to resolve the Iranian nuclear issue have produced several proposals for a negotiated settlement. Thus far, none of those proposals have gained acceptance from all of the involved parties, and efforts to address Iran's nuclear program continue.

SPRING 2003 PROPOSAL

MAY 2003: Iran's proposal to address a number of outstanding contentious issues with the United States, including

- relief of all U.S. sanctions on Iran;
- cooperation to stabilize Iraq;
- full transparency over Iran's nuclear program, including implementation of the additional protocol to its safeguards agreement;
- cooperation against terrorist organizations, particularly the Mujahedin-e Khalq and al Qaeda;
- Iran's acceptance of the Arab League's 2002 "land for peace" declaration on Israel and Palestine; and
- Iran's full access to peaceful nuclear technology, as well as chemical and biotechnology.

PROPOSALS DURING THE 2005 EU-3 (FRANCE, GERMANY, UNITED KINGDOM)-IRAN NEGOTIATIONS

JANUARY 17, 2005: Iranian proposal to the EU-3/Iran Political and Security Working Group outlining general possible commitments, including

- an Iranian commitment not to pursue weapons of mass destruction (WMD);
- a rejection of any attacks, threats of attack, or sabotage of Iran's nuclear facilities;
- cooperation on combating terrorism, including intensifying the exchange of information and the denial of safe havens;
- regional security cooperation, including on Afghanistan and Iraq; and
- cooperation on strategic trade controls and the EU removal of restrictions on transfers of conventional arms and dual-use goods to Iran.

MARCH 23, 2005: Iranian proposals to the EU-3/Iran steering committee detailing proposed "objective guarantees" regarding its nuclear program, such as

- Iran's adoption of an additional protocol to its safeguards agreement and continuous on-site inspections at key facilities;
- limiting the expansion of Iran's enrichment program and a policy declaration of no reprocessing;
- immediately converting all enriched uranium to fuel rods;
- an EU declaration recognizing Iran as a major source of energy for Europe;
- Iran's guaranteed access to advanced nuclear technology along with contracts for the construction of nuclear plants in Iran by the European Union; and
- normalizing Iran's status under Group of Eight export controls.

APRIL 29, 2005: Iran's outline for a phased approach, building off the March proposal and including new provisions, such as

- Iran's adoption of an additional protocol to its safeguards agreement;
- a policy declaration of no reprocessing by Iran;
- continued enrichment suspension for six months;
- establishment of joint task forces on counterterrorism and export control; and
- an EU declaration recognizing Iran as a major source of energy for Europe.

JULY 18, 2005: Iranian message from Hassan Rowhani, then-secretary of Iran's Supreme National Security Council, to the EU-3, proposing

- an agreement on initial limitations on uranium enrichment at Natanz;
- negotiations for the full-scale operation of Natanz;
- arrangements to import material for uranium conversion and the export of uranium hexafluoride; and
- negotiation of an "optimized" International Atomic Energy Agency (IAEA) monitoring mechanism for Natanz.

AUGUST 5, 2005: EU-3 package framework for a long-term agreement, which entailed

- arrangements for the assured supply of low-enriched uranium (LEU) for any light-water reactors (LWRs) constructed in Iran;
- establishing a buffer store of nuclear fuel located in a third country;
- a commitment by Iran not to pursue fuel cycle technologies, reviewable after 10 years;
- a legally binding commitment by Iran not to withdraw from the nuclear Nonproliferation Treaty (NPT) and Iran's adoption of an additional protocol to its safeguards agreement;
- arrangements for Iran to return spent nuclear fuel to supplier countries;
- EU recognition of Iran as a long-term source of fossil fuel energy; and
- EU-Iran cooperation in a variety of political-security areas, including Afghanistan and Iraq, terrorism, and drug trafficking.

PROPOSALS BETWEEN THE P5+1 AND IRAN

JUNE 6, 2006: China, Russia, and the United States join the EU-3 to offer another proposal for comprehensive negotiations with Iran, involving

- Iran's suspension of enrichment-related and reprocessing activities;
- the establishment of a mechanism to review this moratorium;
- Iran's resumption of implementation of an additional protocol to its safeguards agreement;
- the provision of state-of-the-art LWRs to Iran through joint projects, along with nuclear fuel guarantees and a five-year buffer stock of fuel;
- suspension of the discussion of Iran's nuclear program in the UN Security Council; and
- cooperation on civil aviation, telecommunications, high technology, agriculture, and other areas between the United States and the EU and Iran.

MAY 13, 2008: Iranian package to the P5+1, proposing

- "[e]stablishing enrichment and nuclear fuel production consortiums in different parts of the world-including Iran";
- improved IAEA supervision "in different states";
- cooperation on nuclear safety and physical protection;
- cooperation on export controls; and
- cooperation on regional security and global economic issues.

JUNE 12, 2008: The revised P5+1 package includes the 2006 proposal plus the following updates

- treatment of Iran's nuclear program as with any other NPT non-nuclear-weapon state once confidence is restored;
- technological and financial assistance for Iran's nuclear energy program;
- reaffirmation of the UN Charter obligation to refrain from the use and threat of use of force;
- cooperation on Afghanistan, including drug trafficking, refugee return, reconstruction, and border controls;
- steps toward normalizing economic and trade relations, including support for Iran's membership in the World Trade Organization; and
- prospective cooperation on agriculture, the environment and infrastructure, civil aviation, and social development and humanitarian issues.

SEPTEMBER 9, 2009: Iranian proposal for cooperation on political-security, international, and economic issues (there was no section on nuclear issues), such as

- cooperation to address terrorism, drug trafficking, organized crime, and piracy;
- UN and Security Council reform;
- the codification of rights for the use of space;
- promoting a "rule-based" and "equitable" IAEA oversight function; and
- promoting NPT universality and WMD nonproliferation.

TEHRAN RESEARCH REACTOR (TRR) PROPOSAL

OCTOBER 1, 2009: Iran agreed "in principle" to a fuel swap with the IAEA, France, Russia, and the United States, exporting most of its LEU in exchange for fuel for the Tehran Research Reactor (TRR).

- Iran exports 1,200 kilograms of LEU before the end of the 2009.

- Russia further enriches Iran's LEU to about 20 percent, a process producing about 120 kilograms of 20 percent-enriched uranium for the TRR fuel rods.
- France manufactures the TRR fuel rods for delivery about one year after the conclusion of the agreement, prior to the depletion of the current TRR fuel supply.
- The United States works with the IAEA to improve safety and control implementation at the TRR.
- The six countries make a statement of political statement for the deal to guarantee that the TRR fuel would be delivered to Iran.
- Financing is provided for the movement of LEU and fuel.
- The IAEA has the option to hold Iran's LEU in escrow in a third country until the TRR fuel is delivered.

MAY 17, 2010: Brazil and Turkey carried out a diplomatic initiative in the spring of 2010 to broker the 2009 TRR fuel swap with Iran.

- The three countries "recall the right of all State Parties, including the Islamic Republic of Iran, to develop research, production and use of nuclear energy (as well as nuclear fuel cycle including enrichment activities)."
- Iran transfers 1,200 kilograms of LEU to be held in escrow in Turkey within one month.
- Pending their approval of the Tehran Declaration, the IAEA, France, Russia, and the United States (the Vienna Group) would agree to provide 120 kilograms of 20 percent-enriched uranium fuel to Iran within one year.
- If the terms were not filled by the Vienna Group, Turkey would transfer the LEU back to Iran, which maintains legal possession of the material.

RUSSIAN "STEP-BY-STEP" PROPOSAL

JULY 12, 2011: Russian Foreign Minister Sergey Lavrov first publicly proposed a "road map" to implement the P5+1's proposed incentives package.

Step 1
- Iran limits enrichment to Natanz, does not install any additional centrifuges, and halts the production of advanced centrifuges.
- The P5+1 suspends some UN sanctions, including financial sanctions and ship inspections.

Step 2
- Iran agrees to provide early design information to the IAEA under Code 3.1 of its safeguards agreement, caps its enrichment level at 5 percent, and allows greater IAEA monitoring over its centrifuges.
- The P5+1 suspends most UN sanctions and gradually lifts unilateral sanctions.

Step 3
- Iran implements the additional protocol to its safeguards agreement.
- The P5+1 suspends all UN sanctions in a phased manner.

Step 4
- Iran suspends all enrichment-related activities for three months.
- The P5+1 lifts all sanctions and begins to implement the group's proposed incentives.

2012 PROPOSALS

MAY 18, 2012: Iran and the P5+1 held a second high-level political meeting in Baghdad after agreeing the previous month to pursue negotiations based on a step-by-step approach with reciprocal actions. Each side laid out a proposal for discussion.

2012 IRANIAN FIVE-STEP PROPOSAL

Step 1 - Guidelines
- Iran emphasizes commitments under the NPT and its opposition to nuclear weapons based on the supreme leader's fatwa.
- The P5+1 recognizes and openly announces Iran's nuclear rights, particularly its enrichment activities, based on Article 4 of the NPT.

Step 2 - Transparency measures
- Iran continues broad cooperation with the IAEA and will transparently cooperate with the IAEA on "possible military dimensions."
- The P5+1 will end unilateral and multilateral sanctions against Iran outside of UN Security Council resolutions.

Step 3 - Confidence-building steps
- Beyond continuous IAEA monitoring of enrichment activities for TRR fuel, Iran will cooperate with the P5+1 to provide enriched fuel needed for the TRR.

- The P5+1 will terminate the UN sanctions and remove Iran's nuclear file from the UN Security Council agenda.

Step 4 - Strengthening cooperation on mutual interests

- Parties will start and boost cooperation on designing and building nuclear power plants and research reactors (Iran's priorities) and light-water research reactors, nuclear safety and security, and nuclear fusion (the P5+1's priorities).

Step 5 - Strengthening joint cooperation

- Parties will start cooperating on regional issues, especially Syria and Bahrain (Iran's priorities), and combating piracy and countering narcotics activities (the P5+1's priorities).

2012 P5+1 PROPOSAL

Iranian actions:

- Iran halts all 20 percent-enrichment activities.
- Iran transfers all 20 percent-enriched uranium to a third country under IAEA custody.
- Iran shuts down the Fordow facility.

P5+1 actions:

- The P5+1 will provide fuel assemblies for the TRR.
- The P5+1 will support IAEA technical cooperation to modernize and maintain the safety of the TRR.
- The P5+1 could review the IAEA technical cooperation projects and recommend to the IAEA Board of Governors restarting some of them.
- The P5+1 will provide medical isotopes for cancer patients in Iran.
- The United States is prepared to permit safety-related inspection and repair in Iran for Iranian commercial aircraft and provide spare parts.
- The P5+1 will cooperate in acquiring a light-water research reactor to produce medical isotopes.

2013 P5+1 PROPOSAL

APRIL 5-6, 2013: Iran and the P5+1 hold talks in Almaty, Kazakhstan. The two sides had resumed negotiations in Almaty in February 2013 after a nine-month interval. Each side brought a proposal to the April talks, but failed to reach consensus on a way forward. The P5+1 proposal was based on the proposal from the 2012 negotiations.

Iranian Actions:

- Iran stops production of 20 percent enriched uranium for six months.
- Iran suspends operations at Fordow.
- Iran ships part of its stockpile of 20 percent enriched uranium out of the country.
- Iran provides the IAEA with information to address the outstanding allegations of possible military activities, commits to the additional protocol and the modified version of the subsidiary arrangement to Iran's safeguards agreement, known as Code 3.1

P5+1 actions:

- The P5+1 will provide fuel assemblies for the TRR.
- The P5+1 will support IAEA technical cooperation to modernize and maintain the safety of the TRR.
- The P5+1 could review the IAEA technical cooperation projects and recommend to the IAEA Board of Governors restarting some of them.
- The P5+1 will provide medical isotopes for cancer patients in Iran.
- The United States is prepared to permit safety-related inspection and repair in Iran for Iranian commercial aircraft and provide spare parts.
- The P5+1 will cooperate in acquiring a light-water research reactor to produce medical isotopes. The P5+1 will provide sanctions relief on sales of precious metals and petrochemicals.

IRAN'S PROPOSAL

Iran's proposal on day 1 of the April Alamty talks was similar to the five-step proposal Tehran brought to the negotiations in 2012. However, after the P5+1 expressed dissatisfaction with this proposal, which it viewed as a step backward, Iran revised its proposal for the second day of talks to include the following:

Iran's Actions:

- Iran freezes centrifuge installation at Fordow.
- Iran continues talks with the IAEA.
- Iran continues converting 20 percent enriched uranium hexafluoride to uranium oxide.
- Iran suspends enrichment of uranium to 20 percent.

P5+1 Actions:

- The P5+1 lifts all sanctions against Iran.
- The P5+1 recognizes Iran's nuclear rights.

NOTES

1. U.S. Department of Defense, "Unclassified Report on Military Power of Iran," April 2010.

2. "Iran Will Never Seek Nuclear Weapons: Leader," Press TV, February 22, 2012. www.presstv.ir/detail/228014.html

3. Mark Fitzpatrick, ed., "Iran's Nuclear, Chemical and Biological Capabilities: A Net Assessment," International Institute for Strategic Studies, February 2011.

4. Abbas Milani, "The Shah's Atomic Dreams," *Foreign Policy*, December 29, 2010.

5. Mark Fitzpatrick, ed., "Iran's Nuclear, Chemical and Biological Capabilities: A Net Assessment," International Institute for Strategic Studies, February 2011.

6. International Atomic Energy Agency (IAEA) Board of Governors, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran: Report by the Director General," GOV/2013/40, August 28 , 2013.

7. Ibid.

8. If Iran continues production of 20 percent-enriched uranium at its current rates, it will have enough material for a weapon by May 2013 if enriched to weapons grade. If Iran continues to divert material 20 percent-enriched material for conversion to uranium oxide, this timeline would be extended. If Iran expands its capacity, as Tehran claims it will, it could accumulate enough 20 percent-enriched uranium by the end of 2012. David Albright and Christina Walrond, "Iranian Production of 19.75 Percent Enriched Uranium: Beyond Its Realistic Needs," *ISIS Report*, June 15, 2012, www.isis-online.org/uploads/isis-reports/documents/Twenty_percent_production_15June2012.pdf

9. The United States originally supplied Iran with the Tehran Research Reactor (TRR) in 1967. At that time, it ran on highly enriched uranium fuel enriched to more than 90 percent U-235. In 1993, conversion of the TRR to run on fuel targets enriched to just under 20 percent was completed. Argentina facilitated the conversion and provided 115 kilograms of 20 percent-enriched uranium for the reactor. Fitzpatrick, "Iran's Nuclear, Chemical and Biological Capabilities."

10. William C. Witt, Christina Walrond, David Albright, and Houston Wood, "Iran's Evolving Breakout Potential," *ISIS Report*, October 8, 2012, http://isis-online.org/uploads/isis-reports/documents/Irans_Evolving_Breakout_Potential.pdf

11. Olli Heinonen, "Nuclear Program of Iran: Current Status" (ACA briefing, Carnegie Endowment for International Peace, November 22, 2010).

12. David Albright, Paul Brannan, and Christina Walrond, "ISIS Analysis of IAEA Iran Safeguards Report," *ISIS Report*, February 24, 2012, http://isis-online.org/uploads/isis-reports/documents/ISIS_Analysis_IAEA_Rerport_24Feb2012.pdf.

13. David Albright, Paul Brannan, and Christina Walrond, "Critique of a Recent Breakout Estimate at the Natanz Fuel Enrichment Plant (FEP)," *ISIS Report*, September 20, 2011, http://isis-online.org/uploads/isis-reports/documents/Critique_of_Greg_Joness_analysis_20Sept2011.pdf

14. Robert J. Einhorn, "Iran's Heavy-Water Reactor: A Plutonium Bomb Factory," Arms Control Association, November 9, 2006.

15. IAEA Board of Governors, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," GOV/2011/65, November 8, 2011 (hereinafter IAEA 2011 Iran report).

16. Ibid.

17. Ibid.

18. Tabassum Zakaria and Mark Hosenball, "Special Report: Intel Shows Iran Nuclear Threat Not Imminent," Reuters, March 23, 2012, www.reuters.com/article/2012/03/23/us-iran-usa-nuclear-idUSBRE82M0G020120323

19. IAEA 2011 Iran report.

20. Office of the Director of National Intelligence, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 January to 31 December 2011."

21. "Iran sanctions halt long-range ballistic-missile development," *Strategic Comments*, International Institute for Strategic Studies, July 2012, http://www.iiss.org/publications/strategic-comments/past-issues/volume-18-2012/july/iran-sanctions-halt-long-range-ballistic-missile-development/

22. Peter Crail, "Sanctions Seen Slowing Iran Nuclear Work," *Arms Control Today*, Vol. 41: 5, July 2011.

23. Robert J. Einhorn, "Solving the Iranian Nuclear Puzzle," (ACA briefing, Carnegie Endowment for International Peace, March 9, 2011.)

24. David Cohen, "The Law and Policy on Iran Sanctions," (New York University School of Law, September 9, 2012.)

25. Ken Dilanian, "U.S. Intelligence Chief Sees Limited Benefit in an Attack on Iran," *Los Angeles Times*, February 16, 2012.

26. See, for example: Bennett Ramberg, "Preemption Paradox," *Bulletin of the Atomic Scientists*, July/August 2006, p. 51.

27. "Weighing Benefits and Costs of Military Action Against Iran," The Iran Project, July 2012, http://www.wilsoncenter.org/sites/default/files/IranReport_091112_FINAL.pdf

28. U.S. Energy Information Administration, "Country Analysis Briefs: World Oil Transit Chokepoints," December 30, 2011, www.eia.gov/EMEU/cabs/World_Oil_Transit_Chokepoints/pdf

29. "Khamenei Threatens Energy Disruption," *The Jerusalem Post*, June 4, 2006.

30. U.S. Defense Intelligence Agency, "Senate Select Intelligence Committee Holds Hearing on Worldwide Threats," January 31, 2012.

31. Caitlin Talmadge, "Closing Time: Assessing the Iranian Threat to the Strait of Hormuz," *International Security*, Vol. 33, No. 1 (Summer 2008): 117.

32. Barack Obama, "Speech to the American Israeli Political Action Committee," Washington, DC, (March, 2012).

33. The United States did not send a representative to the P5+1 talks with Iran until June 2008.

34. Hillary Rodham Clinton, testimony before the House Foreign Affairs Committee, March 1, 2011.

35. "History of Official Proposals on the Iranian Nuclear Issue," Arms Control Association Fact Sheet, updated January 2013, http://www.armscontrol.org/factsheets/Iran_Nuclear_Proposals

36. Kelsey Davenport, Daryl G. Kimball, and Greg Thielmann, "The November 2012 IAEA Report on Iran and its Implications," Arms Control Association *Iran Nuclear Brief*, Nov. 16, 2012, http://www.armscontrol.org/Iran-Nuclear-Brief/The-November-2012-IAEAReport- on-Iran-and-Its-Implications

37. Interview with Ali Akbar Salehi, *Der Speigel*, October 8, 2012.

38. Email correspondence with author. Oct. 18, 2012.

39. Amb. Hossein Mousavian, Panel on Preventing a Nuclear-Armed Iran, Arm Control Association Annual Meeting, June 4, 2012, http://www.armscontrol.org/events/Join-ACA-June-4-Our-Annual-Meeting%20#panel

40. Rick Gladstone, "Israeli Defense Chief Says Iran Postponed Nuclear Ambitions," *The New York Times*, Oct. 30, 2012.

41. William C. Witt, Christina Walrond, David Albright, and Houston Wood, "Iran's Evolving Breakout Potential," Institute for Science and International Security, October 8, 2012.

42. Interview with Amb. Hossein Mousavian, October 16, 2012.

43. James Walsh, Remarks at "Iran 2013: Making Diplomacy Work" conference sponsored by ACA and NIAC, Nov. 26, 2012.

44. Rolf Ekeus, Remarks at "Iran 2013: Making Diplomacy Work" conference sponsored by ACA and NIAC, Nov. 26, 2012.

45. Stephen Hadley, "Eight Ways to Deal with Iran," *Foreign Policy*, September 26, 2012. http://www.foreignpolicy.com/articles/2012/09/26/eight_ways_to_deal_with_iran

46. Peter Crail, "The IAEA Outlines a Path for Iran to Come Clean, But is Tehran Ready?," Arms Control Association *Issue Brief*, Vol. 3, No. 2, March 7, 2012.

The Arms Control Association (ACA), founded in 1971, is a national nonpartisan membership organization dedicated to promoting public understanding and support for effective policies to address the threats posed by the world's most dangerous weapons. Through its research, public education, and media outreach programs, including the monthly journal, *Arms Control Today*, ACA provides policy-makers, the press and the interested public with authoritative information, analysis and commentary on arms control proposals, negotiations and agreements, and related national security issues.

Nearly 10 years have elapsed since the International Atomic Energy Agency (IAEA) confirmed that Iran, a signatory to the NPT, had secretly built a uranium-enrichment facility in violation of its commitments under the treaty to comply with safeguards designed to detect diversion for military purposes.

Since then, the IAEA's reports have documented the steady but slow progress of Iran's uranium enrichment program and other sensitive nuclear fuel cycle activities, which create the potential for a nuclear arsenal.

Iran apparently has still not made a strategic decision to pursue nuclear weapons and does not yet have the necessary ingredients for a nuclear arsenal, but its capabilities are improving.

Effective international nonproliferation strategies require a clear understanding of the risks, benefits, and limitations of the available policy options. This briefing book is designed to provide an overview of Iran's nuclear history, the status of its nuclear program, the role of international nonproliferation sanctions, the realities of potential military options, and the history and challenges of diplomatic efforts to prevent a nuclear-armed Iran.

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