Israel and a Nuclear Iran:
Implications for Arms Control,
Deterrence, and Defense

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Ephraim Kam, Editor

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ישראל ואיראן גרעינית:
השלכות על בקרת נשק, על הרתעה ועל מדיניות ביטחון

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Table of Contents

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Introduction

This collection of essays on a nuclear Iran complements a comprehensive monograph published in early 2007 by the Institute for National Security Studies entitled *A Nuclear Iran: What Does it Mean, and What Can be Done*. The monograph examined ways and prospects for stopping Iran from achieving a nuclear capability. Its principal focus, however, was the various implications of an Iran in possession of nuclear weapons and an analysis of ways to grapple with this potential situation.

The developments of the past year regarding the possibility of a nuclear empowered Iran reinforced the widely held view that time is on Iran's side. True, Iran is subject to several weaknesses. Despite its oil-based wealth it is economically vulnerable and feels exposed to specific threats, first and foremost from the United States. It has no significant allies other than Syria. Its conventional military strength is limited and it is confronted by a host of countries that aim to prevent its achieving a nuclear capability, including the US and European countries, Russia and China, Arab Muslim states, and Israel. These countries have invested in extensive diplomatic efforts and have even supported imposing certain economic sanctions on Iran unless it suspends its nuclear program. The International Atomic Energy Agency has also helped to expose Iran's nuclear activities, and there is a degree of general criticism in Iran of the way the government, particularly President Ahmadinejad, has handled the issue.

These difficulties notwithstanding, Iran has made good use of both its own strengths and the weaknesses of its rivals to further its efforts to achieve nuclear weapons. First, the Iranian regime has demonstrated clearly that no amount of pressure will prevent it from exercising its right to enrich uranium as part of its endeavors to devise a complete fuel cycle – officially for peaceful purposes. In the course of 2007 Iran made further significant progress towards developing nuclear weapons, mainly through

uranium enrichment. Second, although various countries, including Russia and China, are essentially ready to impose economic sanctions on Iran, there is disagreement over the severity of the sanctions, and many are not willing to go further than imposing light sanctions on Iran. Thus, the sanctions imposed to date through the Security Council are not sufficient to motivate Iran to suspend its suspicious nuclear activities. Currently, the imposition of more severe sanctions is not expected.

In addition, the United States' stature in the Middle East has weakened, principally due to its entanglement in Iraq. This state of affairs limits the administration's ability to undertake a military operation against Iran, particularly as it approaches the end of its tenure, and adds to the reservations by the American defense establishment over such a move. The US National Intelligence Estimate of December 2007 makes it even more difficult for the administration to execute a military move if that was its intention. In turn, if Iran also believes that the risk of US military intervention is not high, its determination to maintain its nuclear activities will be reinforced.

In the face of Iran's efforts to achieve a nuclear weapons capability, the prospects for preventive action are not auspicious. The diplomatic route is the preferred approach for all the countries involved. However, experience indicates that negotiations alone will not persuade Iran to stop its program, since in Iran's eyes, obtaining nuclear weapons is a supreme objective that it does not intend to forego unless compelled. Therefore, in the context of diplomatic efforts, several channels – or a combination thereof – remain. A significant increase in the economic sanctions imposed on Iran is the most promising mode of action, particularly as Iran's difficult economic situation is of prime concern to Iranians and was the main issue in the March 2008 parliamentary elections. However, the current prospects of achieving international agreement for imposing heavier and more prolonged sanctions on Iran are not encouraging.

A second option is direct talks between the US and Iran on the nuclear issue. This possibility has yet to be attempted, due to constraints on both the United States and Iran. Even if dialogue between them does evolve it will be difficult to achieve Iran's consent to stop its efforts to develop nuclear weapons. A third alternative is to upgrade benefits proposed to Iran as part of a package deal, in return for Iran's suspension of its nuclear program.

Economic and technological benefits were already offered to Iran as part of a package devised in 2003 by European governments and approved by the US, and further packages were offered in 2006 and 2008, but Iran rejected the deals. It is not clear if additional significant proposals can be devised that will change Iran's stance on the topic. In any case, one should assume that a US-European commitment to neither attack Iran nor undermine the Iranian regime would be included in such a package.

A military option is particularly complicated and problematic. Only two countries – the US and Israel – have stated they have not ruled out a military option if Iran is not stopped from achieving nuclear weapons by other means. Other countries do not support a military move and some explicitly oppose it, although a few European governments have acknowledged that the option might nonetheless be pursued. Some principal elements that may impact on a US or Israeli decision to undertake a military strike against Iran include:

- The chances of the diplomatic route, and an assessment that it will fail in the future. An assessment that the diplomatic approach has been exhausted and there is no real chance of its leading to a halt in Iran's efforts to achieve nuclear weapons is a precondition of a decision to undertake military action against Iran. However, it is difficult to reach agreement on when the diplomatic approach has outlived its usefulness, as there is always anticipation of additional – and more successful – diplomatic steps.
- An evaluation of the potential gain versus the risks involved in a military strike is of crucial importance in the decision about whether to undertake an endeavor of this sort. In this context, the operational capabilities necessary for a successful attack on the nuclear sites and Iran's ability to respond to a preemptive attack should also be examined. However, it is difficult to evaluate in advance the balance between the risks and opportunities involved in the move, partly since there is no precedent for military action of this sort that can contribute to an assessment of the results.
- In this regard, the intelligence needed for such a measure is of prime importance, particularly with regard to the status of Iranian nuclear activity, how close it is to obtaining nuclear weapons, and to the

features of the nuclear sites, whose critical installations are situated below ground.

- The relevant timetable for carrying out a military strike. The timetable will be affected by an assessment of the time remaining until Iran obtains either its first nuclear bomb or a sufficient amount of fissile material to enable it to build the first bomb. The assumption is that subsequently it will not be possible to carry out a successful attack on Iran's nuclear sites.
- The Israeli decision will be influenced by two additional main considerations: first, the decision of the US administration whether or not to undertake an attack on Iran, and its attitude toward an Israeli strike; and second, the assessment of whether Iran's obtaining a nuclear capacity creates an intolerable threat for Israel or instead presents a security problem that can be accommodated.

The corollary to understanding the difficulties involved in trying to stop Iran before it obtains nuclear weapons is that Iran may in fact eventually obtain this capability. In such a situation, Israel will be forced to deal with unprecedented security and political problems, and it is important for it to prepare for them in advance. Such a situation will also involve an examination of a number of issues. What is the significance of a nuclear empowered Iran – with regard to Israel, other regional countries, the US, and European countries? What will be the severity of the threat generated by Iran against Israel? Can there be successful rollback so that Iran dismantles its nuclear weapons after it obtains them? What will Iran's nuclear policy be – with regard to exposing its nuclear capabilities and, principally, the issue of using the nuclear weapons? In what scenarios is Iran liable to use nuclear weapons? What steps should Israel take before and after Iran achieves nuclear weapons? How can it limit the risks involved in a nuclear empowered Iran? Can a stable nuclear deterrent be devised against Iran?

The following collection of papers comprises five essays. Ephraim Asculai summarizes the technical aspects to Iran's development of a nuclear weapons capability, and considers how Iran would act in the international arena in light of its non-proliferation commitments. Against the background of these commitments, the essay then analyzes the alternatives available to Iran regarding deployment of nuclear weapons.

In the essay that follows, Emily Landau looks at the implications of a nuclear empowered Iran with regard to arms control and non-proliferation efforts and initiatives in the nuclear realm. Beyond the ramifications for the non-proliferation regime, the essay considers the possibility of individual states acting to compensate for the weaknesses of the non-proliferation regime, and explores the implications for future non-proliferation efforts and the impetus for forging new arms control strategies toward stability in the Middle East. In the third essay, Yair Evron analyzes the reasons that are liable to generate instability in future nuclear relations between Iran and Israel, and the factors that can impact on the stability of the nuclear balance between Iran and Israel. The essay also considers the effects of Iran's nuclearization on Israel's nuclear posture.

The final two essays deal with elements of defense against a nuclear threat. Uzi Rubin evaluates the central role of missile defense in the deterrence of a nuclear empowered Iran. Assuming that Iran is a fanatical – but also pragmatic – country whose decisions are influenced substantiuely by considerations of profit and loss, the essay argues that a missile defense system can be more significant against a nuclear threat than against a conventional threat. In the final essay of this collection, David Klein reviews the question of building civilian bomb shelters against a nuclear attack based on the experience of other countries. He concludes that since these shelters do not constitute a practical option, it is not justified on a national level to invest in them, and it is preferable to focus on developing other solutions, especially boosting the deterrent ability.

This volume joins the previously published INSS monograph in the effort to explore the principal challenges associated with Iran's potential acquisition of nuclear weapons.

Ephraim Kam

Nuclear Sites in Iran

Chapter 1
How Iran Can Attain its Nuclear Capability – and Then Use It

Ephraim Asculai

Iran has been proceeding steadily on its quest for a nuclear weapons capability, and as little seems to motivate it towards abandoning its ambitions, it will likely get there, possibly at the turn of the present decade. Although the international community has been taking coercive action, mainly by economic – fiscal, monetary, and trade – sanctions, it has not been successful in persuading Iran to abandon its program or at least suspend it. True, there have been reports that the sanctions have a perceptible effect on the Iranian population, but as yet these have not translated into government action or, as some hope, a change in government. Tehran has been aided, albeit inadvertently, by the International Atomic Energy Agency (IAEA), which has avoided serious condemnation of Iran, and by Russia and China, which were reluctant first to impose sanctions and thereafter to strengthen them. The realistic if pessimistic view must be, then, that Iran will probably succeed in its quest for nuclear weapons in the foreseeable future. Thus, the time is right to take another look at Iran's nuclear program and to assess the possible trend of future developments.

Any country seeking a military nuclear capability needs to obtain three major capabilities: the production of fissile materials; the development of the explosive mechanism; and the adaptation of existing delivery mechanisms or the development of new, special purpose mechanisms to deliver a nuclear weapon to a pre-designated target and explode it there. Accomplishment of the first two capabilities is sufficient for the production of a nuclear explosive device. The addition of the third one will turn the device into a weapon.

The first part of this paper will describe the route Iran has been taking toward the development of nuclear weapons. The second part will be devoted to the possible ways Iran will act in the international arena vis-à-vis its international non-proliferation commitments, and the third part will detail the possible deployment and utilization of its acquired capabilities. The present work is descriptive in nature, describing the possible alternatives Iran has for proceeding on the development and utilization of its growing potential. Political motivations, actions, and reactions to the deeds of others are discussed elsewhere in this volume, and are mentioned here only as warranted.

Fissile Material Production

Iran's activities in the production of fissile materials are probably only partially known, notwithstanding the abundance of details that have been disclosed by numerous sources, particularly the verification activities carried out and reported by the IAEA. Moreover, comparing the case of Iran with the cases of India, Pakistan, or North Korea is of limited value, at best. Although there are similarities, each of these is a stand alone case, replete with its particular problems, achievements, and political and technical constraints. In addition, it is expected that Iran, which received much technical support from several sources, will be able to perform better, having learned from others' mistakes.

There are two major materials that can serve as the core of a nuclear explosive device, i.e., the essential and indispensable part of any such device: uranium, enriched in the isotope 235 to a high concentration – HEU; and the plutonium isotope 239, which is produced from uranium in a nuclear reactor. According to IAEA criteria, 25 kilograms of HEU or 8 kilograms of plutonium are designated as "significant quantities," sufficient to serve as the core of a nuclear explosive device.

Uranium Enrichment

Iran has embarked on an ambitious large scale uranium enrichment program allegedly intended for the supply of low enriched uranium (LEU) for the nuclear fuel for its nuclear power reactor(s). This large scale activity is located at an underground facility near the town of Natanz. When completed, this facility could certainly supply nuclear fuel for a nuclear

power reactor, albeit at an unreasonably high, clearly uneconomic cost. However, because of its size, once completed the enrichment facility also has the potential to produce a vast quantity of HEU within a short time, sufficient for the production of several nuclear explosive devices within a single year.

The enrichment facility is not a stand alone unit. It needs the feed material, in Iran's case a chemical compound called uranium hexafluoride, and the product treatment facility for the conversion of the enriched compound into metallic uranium, suitable for the use in the core of an explosive device. Both the production of feed material and the conversion of the enriched compound into metal take place at a uranium conversion facility (UCF) located near the city of Esfahan. To date, Iran has a sufficient quantity of uranium for the production of HEU for numerous explosive devices.

Plutonium Production

The uranium enrichment route is at present the shortest one for the achievement of a nuclear capability in Iran. However, Iran has not neglected the second alternative, the plutonium route. In the future, Iran will have two possibilities for producing plutonium. The first and least desirable is the utilization of the irradiated nuclear fuel from its Bushehr nuclear power plant. It is less desirable because of the lower quality of the plutonium produced therein, and because the nuclear fuel, at least for the foreseeable future, will be Russian-produced and under a contractual obligation to be returned to Russia. The utilization of the Russian fuel for the production of plutonium would cause another major international complication for Iran.

Because of the drawbacks of using the power reactor as the source of plutonium, Iran embarked on another project – the construction of a heavy water natural uranium-plutonium production reactor, the so-called research reactor. It is under construction at the site of Arak, which already hosts a heavy water production plant, essential for the operation of this reactor. The fuel for this reactor will be produced at the UCF. In order to separate plutonium from the fuel after it has been irradiated in the reactor, a "reprocessing" plant is needed. At present, no construction of such a plant has been reported. All in all, such a project would take between six and ten years to accomplish, and that is still way into the future.

Parallel Routes

The above description suffices if there are no other, concealed activities to produce feed material and to enrich it. However, one cannot assume that there is no such parallel activity, given Iran's past record of concealing and operating an undeclared facility. The main difference between the large declared facility and small, concealed activities would be in the scale of the operation. Consequently, the output of smaller scale activities to produce HEU would be much less than the potential of the large ones. Depending on small scale activities for the production of HEU would be more hazardous for Iran, given the longer time of operation required to achieve the required total output, which would put it at a greater risk of detection and subsequent possible military action.

Another however unsubstantiated fear is that Iran illegally managed to acquire fissile materials originating from the former Soviet Union (FSU). The probable cause of these rumors is the assessment that some nuclear weapons are still unaccounted for because of the lax accounting methods of the FSU, especially regarding small "tactical" weapons, which were at the disposal of small field units and not centrally controlled. Rumors to this effect have been circulating for some time, but as yet are unfounded.

Timetables

By February 2008, Iran had been operating the UCF for the production of feed material for its enrichment plant for some four years. According to the IAEA report, by February 2008, Iran had produced some 309 tons of UF_6, the feed material for the enrichment process. This amount contains about a ton and a half of the isotope U-235, about 40 percent of which can be produced as HEU. This is a huge amount. Iran started operating its first enrichment cascade, capable of producing only a small amount of LEU, in April 2006. By August 2007 it declared that it achieved 4.8 percent enrichment. If all goes as planned and if it so decided, Iran could be expected to enrich its first significant quantity of HEU around the turn of the decade. However, the IAEA report noted that the throughput of the facility has been well below its declared design capacity. Arriving at highly enriched UF_6 gas is not the ultimate aim of the whole operation. The enriched gas must first be turned into HEU metal, and then machined into the shape that is fit to be inserted into the explosive mechanism. The IAEA inspectors reported

that they had uncovered a document in Iran "describing the procedures for the reduction of UF_6 to uranium metal in small quantities, and for the casting of enriched and depleted uranium metal into hemispheres, related to the fabrication of nuclear weapon components.…Although there is no indication about the actual use of the document, its existence in Iran is a matter of concern."[1]

Although the Bushehr nuclear power plant is expected to start operation sometime in late 2008, there is no indication that the essential reprocessing plant is under construction. Building such a plant would probably take between four and six years. If construction began at the beginning of 2008, this would mean that the production of plutonium could begin in 2012-14. This would also fit into the research reactor schedule, which is already underway. Thus, the earliest date for the production of the first significant quantity of plutonium would be in 2012-14.

Development of the Explosive Mechanism and Warheads

Evidence of Iran's occupation with the development of a nuclear explosive device is limited, primarily because the activities are not exclusively nuclear and are mainly concerned with "conventional" explosives and their testing. Iran has extensive experience in working with explosives, and connecting it to nuclear-related activities is not so simple. The most direct evidence that Iran has been engaged in the development of the explosive mechanism needed for the production of a nuclear explosive device is the uncovering of its activities in the development of the initiator – the "trigger" mechanism that is an essential part of any explosive device.

The first and perhaps the most damning piece of evidence is the Iranian production of an isotope called polonium-210, whose major use is in the production of neutron sources – the initiators for nuclear explosive devices. Further evidence that Iran is occupied with the development of neutron sources came from a media report on the acquisition of other isotopes suitable for the development of another type of neutron trigger. Additional indications of an ongoing program for the development of the nuclear explosive mechanism and possible nuclear warhead development were presented in the IAEA February 2008 report and in a briefing by the head of the IAEA Department of Safeguards.[2]

The first nuclear weapon used in anger, detonated over Hiroshima, was a very primitive but extremely reliable weapon that used a large amount of HEU. Iran's main activities in the development of a nuclear explosive device are probably directed at the perfection of a more advanced, less voluminous explosive device that will use much less HEU for the same effect, one that will be easy to fit into a bomb or a missile warhead. Some evidence of this activity has come to light in the media.

The IAEA has not succeeded in finding evidence at sites where "cold" tests (without fissile materials) are taking place, since there exists little or no telltale evidence that can be uncovered when visiting such sites, especially when Iran conducted ample preparatory cleaning activities prior to IAEA visits.

Iranian Weapons Delivery Means

A nuclear explosion can be conducted without any military involvement and without packaging it in a "bomb" configuration. Thus, a nuclear explosive device can be transported to any site by civilian means, such as in a cargo airplane, a shipping container, or the like. However, when a state has a nuclear weapons development program, it will use the above means of transportation only as a last resort, when it must deploy and use nuclear explosives without having packaged them in a military deliverable weapon.

The medium range ballistic missiles are perhaps the best indicators of Iran's intention of having a non-conventional weapons delivery capability. It can be assumed that if anyone goes to the expenditure, technical complexity, and financial outlay needed for the development of these missiles, their sole intended use is not the delivery of high explosives (HE).

According to official Iranian sources, the Iranian missile program made significant progress in 2007. The older Shahab 3 missile has an approximate range of 1,500 kilometers; the newer missile, which is called either Ghadr or Ashura, was displayed in October 2007, and declared to have a range of up to 2,000 kilometers. Although the medium range ballistic missiles can be used against Iran's neighbors, especially those with large area territories, the ever increasing range of these missiles signals that the possible targets for these military missiles could extend beyond the neighbors' borders. These could therefore be designated as strategic, not tactical weapons

delivery systems. The probability that HE warheads could achieve positive strategic results for the aggressor is rather low. Thus, it is reasonable to assess that the missiles developed by Iran have a strategic purpose, i.e., the delivery of strategic, or WMD, warheads.

Coupled with the IAEA February 2008 report and the Safeguards briefing, it can be assumed that there is a significant probability that the purpose in developing medium (and possibly long) range missiles in Iran is the delivery of nuclear weapons to states not neighboring Iran. Only nuclear weapons can cause wide ranging long term destruction and large scale casualties that could decimate the military capacity of a country to retaliate and recuperate from such an attack.

A single nuclear weapon would be practically useless to Iran, since the probability of the failure of a first nuclear weapon could be significant. From all the above it must be concluded that Iran has a project of having several nuclear warheads, deliverable by missiles and possibly also by fixed-wing military aircraft. It is also conceivable that Iran will develop other delivery systems such as longer range cruise missiles and naval launch systems, if it is not already doing so.

Iran's International Non-proliferation Commitments and their Implementation

Iran has the following international nuclear-related non-proliferation commitments:

- Iran is party to (signed and ratified) the Nuclear Non-Proliferation Treaty (NPT).
- Iran has a full-scope safeguards agreement with the IAEA that came into force in 1974.
- Iran is party to the Partial Test Ban Treaty (PTBT), which includes the ban on testing nuclear explosives on the surface and in the atmosphere.
- Iran signed but has not ratified the Comprehensive Test Ban Treaty (CTBT). However, Iran, angry at the US failure to ratify the treaty, stopped providing timely monitoring data to the CTBT Organization in Vienna.
- At the end of 2003, Iran signed but has not yet ratified the IAEA's Additional Protocol to the Safeguards Agreement. At first it decided

to abide by its requirements but later reneged on its promise and reverted to its old and unsatisfactory full-scope safeguards agreement.
- Iran agreed (twice) with three European Union countries – France, Germany, and the United Kingdom (the EU-3) – to suspend all activities related to the enrichment activities in Iran. It did not, however, abide by these agreements and recommenced converting uranium ore into uranium hexafluoride – the feed material for its enrichment facilities.

In the non-nuclear non-proliferation arena:

- Iran is party to the Biological Weapons Convention (BWC).
- Iran is party to the Chemical Weapons Convention (CWC).
- Iran is not a member of the Missile Technology Control Regime (MTCR).

The NPT

By becoming a party to the NPT, Iran undertook "not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices."[3] At the same time, the NPT treaty language contains an "escape clause": Article X of the NPT states that each country shall "have the right to withdraw from the Treaty if it decides that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country." Only one country, North Korea, used this article to withdraw from the NPT.[4] Notwithstanding North Korea's nuclear test, the United Nations Security Council (UNSC) has taken no punitive action, although much time has passed since its misdeeds came to light.

The implementation of adherence to the NPT is through the verification activities of the IAEA that are mandated by the NPT and formally initiated by national safeguards agreements. The full-scope agreement is a very mild one, with much dependence on the goodwill of the inspected state. Because of the shortcomings of these safeguards agreements, several countries could conceal activities, materials, and facilities with impunity, in the knowledge that they cannot be indicted for misdeeds that cannot be verified.

Iran certainly utilized the shortcomings of the agreement to its benefit. Subsequent to the public disclosures of Iran's undeclared activities, the IAEA demanded and gained access to facilities and activities it knew nothing about previously. In many instances the IAEA found Iran to be in violation of its safeguards agreement obligations. However, because the IAEA secretariat (the implementation body of the IAEA) refrained from using the specific term "non-compliance" when reporting on its activities in Iran, the IAEA governing body – the Board of Governors (BOG) – did not transfer the issue to the UNSC. A change in the formulation that could have enabled the transfer of the issue to the UNSC occurred in September 2005, when the BOG found "that Iran's many failures and breaches of its obligations to comply with its NPT Safeguards Agreement…constitute non compliance in the context of Article XII.C of the Agency's Statute." However, because this resolution was not adopted by consensus, even then the issue was not transferred to the UNSC. For all intents and purposes, at that time no effective international measures aimed at halting Iran's nuclear project were taken.

On July 31, 2006, the UN Security Council adopted resolution 1696, which makes it mandatory (under Article 40 of Chapter VII of the UN Charter) for Iran "to take the steps required by the International Atomic Energy Agency Board of Governors…which are essential to build confidence in the exclusively peaceful purpose of its nuclear programme."[5] On December 23, 2006 the UNSC unanimously adopted resolution 1737, which imposes sanctions on Iran for failing to comply with previous SC demands. In March 2007, a further resolution (1747) was adopted by the SC, but this one too did not have the hoped-for result of forcing Iran to abandon its nuclear development program. On the contrary, public pronouncements by Iranian leaders only became more vociferous, insisting that the enrichment program will never be abandoned. The third round came when on March 3, 2008 the Security Council adopted resolution 1803, further tightening its sanctions against Iran. However, these sanctions are still far short of the actions that would make Iran reconsider its nuclear stance against the international community.

IAEA Safeguards

Iran previously demonstrated that it was not afraid to go back on its commitments when it reneged on its commitment to the Additional Protocol. Admittedly, this commitment is voluntary (as were the agreements with the EU-3), but nonetheless it was an indication of Iran's willingness to use the possibility of withdrawing from commitments either as blackmail, as an indication of intentions, or when not being in formal contradiction with them, should Iran go its own independent way. In this context, Iran is probably heartened by the world's reaction to North Korea's withdrawal from the NPT.

Abandonment of the commitment to abide by the Additional Protocol occurred when the Iranian issue was transferred to the UNSC, and at this point, the verification regime in Iran reverted to the old, ineffective, full-scope safeguards regime. In order to supplement the less effective verification activities, the IAEA could utilize its prerogative of demanding "special inspections" in Iran. The drawback herein is that every request for a special inspection needs the approval of the BOG. Given the uneven attitude of the BOG members towards Iran, it is not certain that these requests would always be approved. Furthermore, even if approved, there is no certainty that Iran would grant a request for a special inspection.

Should Iran choose to withdraw from the NPT, this would not constitute a withdrawal from its safeguards agreement with the IAEA. The agreement does not include a clause terminating the inspections when a country withdraws from the NPT. The only conditions under which inspections can be terminated are when there is nothing more to inspect. Again, however, and learning from the experience with North Korea, a country cannot be forced to proceed with inspections should it decide to withdraw from the NPT.

The CTBT and Other Commitments

Another treaty that could have relevance to the situation in Iran is the CTBT. By signing this treaty, Iran "is obliged to refrain from acts which would defeat the object and purpose of a treaty when…it has signed the treaty."[6] It is not certain if a state that has signed but not ratified the treaty can formally withdraw from it. In a related vein, Iran has long been suspected of acting in contravention of its obligations under the CWC and the BWC.

However, in the chemical weapons case, no state brought an accusation to the Organization for the Prohibition of Chemical Weapons (OPCW) demanding a challenge inspection in Iran.

From the above it would appear that Iran would not let any international commitment stand in its way should it decide that it needs to abandon its obligations to achieve its purposes. The only fact that could make it hesitate is the possibility that the international community would use this as the pretext for imposing international action, such as sanctions.

What will Iran do with its Nuclear Capability?

Why is Iran developing nuclear weapons? It can be estimated that there are four main motivations behind Iran's efforts: deterrence; promotion of regional hegemony ambitions; promotion of internal support of the government; and the threatening of "enemies," and the possible use of its nuclear weapons, either without provocation or as a retaliatory measure. The utilization of the first three needs the proof or apparent proof of the potential to deploy and use nuclear weapons. The fourth would probably need a credible self-assurance of this capability, since failure could lead to grave consequences for Iran.

In the interim stage, before achieving a military nuclear capability, Iran has a variety of options, whose pursuit would determine the world's attitude towards Iran and would also influence the Iranian public's attitude towards its government. Generally speaking, these options are: demonstrating the Iranian potential for enriching uranium to military usable levels while not reaching that stage; enriching a "modest" quantity of uranium to reactor levels (LEU) and suspending any further overt, safeguarded, enrichment of uranium; and enriching uranium to military levels, while declaring the process and placing the product under IAEA safeguards. Iran is almost at the stage of the first option. If it succeeds in enriching a few hundred kilograms of uranium to reactor grade (LEU) it will have demonstrated its capability to produce military grade HEU. This is a technical fact since the same gas-centrifuge machines could be used (albeit in a slightly different enrichment-cascade configuration) for the advanced enrichment process.

The second option is a more advanced one, since Iran would be then in a position to arrive at a small quantity of military grade HEU, sufficient for one or a few nuclear explosive devices. There is, of course, the variant

of this option by withstanding all external pressure and proceeding to expand the enrichment capacity to its present design level and amassing a large quantity of LEU. This would give Iran the potential to enrich large quantities of the LEU to HEU within a short time. In both these options there is always the possibility of proceeding with a parallel covert enrichment program. Without an intensive safeguards program, at the very least the Additional Protocol, there would be little chance of proving an allegation of the existence of such a program.

According to the NPT there is no prohibition on enriching uranium to military usable levels, as long as the product remains under IAEA safeguards. Only the Security Council could demand the halt to such a process, and it is uncertain whether such a demand would be heeded, given past experience.

The following discussion addresses the recurrent question of what would happen if and when Iran acquires a military nuclear capability. To be sure, at this time no scenario is predictable with a high degree of certainty. Many factors will determine Iran's course of action; some factors will be internal, such as the ruling regime's plan of utilizing this capability, and some will be purely external, mainly the course of action (or inaction) the world takes in response to Iran's moves. The description of Iran's options is general in nature rather than comprehensive, since the variety of options constitutes a continuum and their closer description is a work for decision makers. The aim of this discussion is not prescriptive, but descriptive of a general picture of how events could unfold. It is also quite conceivable that at this stage, the Iranians themselves do not have a clear idea on utilization of their capability if and when it is realized. It is conceivable that their aim at present is to keep all options open.

Three major courses of action will be open to Iran once it has acquired the capability to explode a nuclear device: concealment, public declaration of the fact, and declaration by demonstration.

Concealment

Perhaps the least probable course of long term action is concealment of Iran's capability. As of early 2008, true concealment means that Iran suspends its uranium enrichment activities without having produced a sufficient quantity of LEU for further enrichment to HEU level for the

production of a single nuclear explosive device. Any further work for the production of HEU would be totally concealed. In doing this, Iran would never be able to clear itself of a suspicion of wrongdoing, unless it opens itself to inspections along the lines of the post 1991 Gulf War inspections in Iraq. The three main reasons for keeping an advanced status of Iran's nuclear project a secret are: fear of international action; the wish for silence prior to a surprise attack or a demonstration; or as a temporary measure until a considerable nuclear arsenal has been amassed and perhaps deployed. When discussing the possibility of international action Iran has to assess whether a) the world could be unaware of the actual situation, and b) whether the world will take action that would be more severe than the action taken hitherto. If the response to either of these questions might be positive, Iran could decide that its best course of action would be to hide its capabilities and the status of its nuclear project.

However, concealment would not promote any of Iran's reasons for developing nuclear weapons in the first place. Short of actual use in anger, where total surprise would be an asset to the attacker, Iran needs the world to be aware of its capabilities. Therefore, declaration will more probably be the course of choice, and timing will be the important issue.

Declaration of Capabilities

A declaration does not have to be made in so many words. It can be done by inference, such as the celebration of a national holiday in honor of the "completion of the nuclear project," or the proclamation of national heroes, or any other inventive way in which the government of Iran can convey to the world that it probably has nuclear weapons. To be sure, an inferred declaration does not have the power of an outright one. Depending on the purpose of the declaration, its manifestation and timing will need to be determined. For internal consumption, an inferred declaration would suffice. For use in the international political arena, a stronger declaration would probably be needed. Indeed, a declaration by inference would also make it harder for Iran's international opponents to initiate UN-related action, since there will always be those countries who support Iran, mainly because they dislike the others, and not because they want Iran to have nuclear weapons. These countries could certainly prevent acceptance of

action proposals by consensus, and if any of the opponents holds a veto power at the UNSC, no resolution mandating action could be accepted.

Iran, a wily and experienced actor in the international bargaining arena, could use a declaration of nuclear capabilities in a straightforward way, or it could use this as an additional tool for furthering Machiavellian purposes. Should Iran assess that it needs a declaration of nuclear capabilities as a deterrent, it could opt for an early declaration, perhaps even before it actually achieved the ability to deploy and use a nuclear weapon. In assessing the outcome of such a declaration, there could be those who say that without proof, the declaration is not believable. There would also be others who say that the consequences of the declaration are so bad for Iran, that it would not take the chance of declaring nuclear capabilities and causing itself a lot of harm, since the world would surely take action against it.

In addition, a declaration by inference would not require Iran's withdrawal from the NPT, since it could always claim not to possess nuclear weapons, that the celebrations had other meanings, or other deceptions.

Proof of capabilities, partial proofs, and declarations of potential could be presented in many ways:

- Intentional provision of data to IAEA inspectors proving that Iran has succeeded in the large scale enrichment of uranium, first to LEU and then, possibly, to HEU
- Withdrawal from the NPT
- Notification of the decision to withdraw from the obligation under the CTBT not to carry out a nuclear explosion
- Documentation of non-nuclear explosions of devices that would become nuclear when fissile materials are inserted therein
- Non-nuclear documented tests of military means of delivery

According to the NPT, a country is not prohibited from producing any fissile materials, even of military usable grades, as long as the production work is carried out under IAEA safeguards and the produced materials are placed under IAEA safeguards. A country can amass large quantities of these materials, without disregarding any international obligation. The only obligation a Non-Nuclear Weapons State (NNWS) has is to refrain from the acquisition or the development of nuclear explosive devices. Indeed, had Iran declared all its activities, and had it placed them under

IAEA safeguards, no legally based action, such as declaring Iran to be in non-compliance, could be taken against it.

Therefore, Iran had the option to gather as much material as it wants and to carry out secretly the development of the explosive device (which does not come under safeguards, as long as nuclear materials are not inserted into it) with legal impunity. Admittedly, this has the drawback of being under international scrutiny, with the quantities and shapes of the fissile materials known to the inspectors as well as the places where these materials are stored. These drawbacks must be weighed against the benefits of the implied or strongly implied declarations. In Iran's case, however, the "legal" route was closed when the Security Council called for the suspension of all enrichment related and plutonium production activities, which Iran failed to do. A variant on this option would be for Iran to divert some of the fissile materials, without the IAEA inspectors being aware of this. This certainly can be done, since under the full-scope safeguards, the inspectors check books more than anything else, and these can easily be doctored.

Withdrawing from international legal obligations is certainly not proof of action but at the same time it is a strong declaration of intent. It is both a political act of defiance and the manifestation of the will to still abide by international law and act within a country's prerogatives. By withdrawing from the treaty, a country maintains that it is in its supreme interests not to abide by NPT-mandated obligations, in other words, to develop nuclear explosive devices or weapons. If it also declares its intent not to abide by its CTBT obligations, it declares that it intends to carry out a nuclear explosion. These are strong, albeit implied, declarations.

Of course the strongest declaration could be when Iran has credibly demonstrated its ability to produce HEU in sufficient quantities or even produced it, as discussed regarding the interim stage.

A particularly ominous conclusion that emerges from this discussion is that Iran has the possibility to acquire all the necessary materials and equipment "legally," if it declares all its activities to the IAEA, places these and the materials that it produces under safeguards, and does not get caught in any illegal activities, such as trying to produce plutonium from Russian fuel, irradiated at the Bushehr power reactor. This would be

contrary to its contract with Russia, and would be a very foolish act. Iran would probably not do it.

Thus the declaration of capabilities could achieve much in the way of deterrence, regional influence, and the acquisition of internal support for the regime, while still not providing absolute proof of acquisition of an actual nuclear military capability. This sort of ambiguity would support those who claim that without actual proof of misdeeds, they are unable to censure Iran or take political actions against it.

Declaration by Demonstration

Iran's strongest way of letting the world know that it can explode a nuclear device is to explode one. Iran is party to the PTBT, and only a signatory to the CTBT. This could be a factor in a decision to carry out an underground nuclear explosion, since the PTBT does not prohibit it. It should also be noted that Iran would need such an explosion in order to prove to its own satisfaction that it has a viable weapon in hand.

What would such a demonstration look like? India and Pakistan carried out multiple rather than single underground nuclear explosions. Each demonstration was claimed to consist of several explosions, but these claims were never completely verified. The probable reason for this course of action is the fact that there is a high probability of failure or near-failure, because of the complexity of the explosive mechanism. Thus, the scientists wanted to make sure of at least one substantial explosion. Of course, there were other reasons for having parallel explosions, including the common infrastructure for these underground tests, safety and security arrangements, and the testing of several physical concepts of the explosive mechanisms. In addition, if all went well, the scientists could boast a great versatility and variety in the nuclear weapons capability.

What is known about the first North Korean test explosion can be summarized as follows: it was a plutonium-based explosion and its yield was small. The small yield could indicate a near-failure, and not the intentional result. If this is so, the North Koreans would probably need another test to verify any weapon's modifications. Otherwise they could have a dud on their hands.

An interesting question would be when, within the timetable of the nuclear project, Iran would want to perform an underground nuclear

explosion. The two extreme situations are a) when it had just produced sufficient fissile material for such an explosion and b) when it had acquired a sufficient quantity for its military needs – i.e., when it had a strong enough nuclear arsenal for deterring any military action against it or for internal or regional demonstration purposes.

In its February 2008 report, the IAEA made "the identification of an explosive testing arrangement that involved the use of a 400 m shaft and a firing capability remote from the shaft by a distance of 10 km, all of which the Agency believes would be relevant to nuclear weapon R&D."[7] It is difficult to assess when Iran would choose to demonstrate its ability to explode a nuclear device. Much of this decision would probably depend on the political situation. The external political situation, including international pressure, the possible threat of military situation, and so on would have the most influence on this decision. The internal situation in Iran, for example, the reemergence of a strong reformist movement, could make the ruling forces need a nuclear explosion in order to sway public opinion back to the support of the government.

It is difficult to conceal preparations for an underground nuclear explosion, especially when the world is looking for indicators of intentions to carry out such an explosion. Only if a country has many natural deep caves or caverns is there a chance of hiding preparations for such activities. It is even possible that Iran would want to publicize and prepare the world for this event. It is not conceivable that Iran would want to demonstrate a comprehensive capability for delivering a nuclear weapon to a target. Therefore it would need to demonstrate a delivery capability and leave the marriage of the two capabilities to the imagination of the world.

Using Nuclear Explosives in Anger

In answering the question of "what can Iran do with it," one cannot avoid the possibility that Iran would use its nuclear capabilities against others. It is certainly a technical possibility. Is it also a viable proposition? In order to deter, it is sufficient that nuclear weapons be viewed by all, including the owner of these weapons, as a weapon of last resort. The case of Iran cannot be viewed in the same way.

Many experts claim that "the government of Iran is rational." That may well be true in a very general way. The history of recent years demonstrates,

however, that the Iranian government's rationale is not always similar to that employed by others, for example Western governments. The basic aims of the state, the basic values of Iran, and the methods used to achieve these aims differ markedly from those of today's Western states. The theological state, the support of terrorism, the abuse of human rights, the unwillingness to even negotiate a solution to the nuclear issue, the fierce statements against Israel, and many other facts demonstrate this. On the other hand, the Iranian negotiating tactics and their use – if not manipulation – of the international community's institutes and approaches are admirable, in that they try to present a "sensible" point of view that succeeds in winning precious time for Iran. Thus, the government is behaving in a rational way, according to its own beliefs and political aims.

Does the Iranian government view its nuclear weapons in the same way that most of the world does? The common wisdom is that nuclear weapons are weapons of deterrence, and are not intended for use in anger. What are the Iranian internal constraints; what are its checks and balances on the deployment and use of nuclear weapons? Would Iran also view nuclear weapons mainly as a deterrent and not as a weapon in a usable arsenal? Iran must also take into consideration the retaliatory capabilities of those the weapons would target, their allies, and those who would find themselves in an untenable situation should Iran demonstrate its political capability to attack others with nuclear weapons. What is the price Iran would be willing to pay for such an action? These questions are not answerable at the present time. Therefore, it must be assumed here that there is a possibility the Iran would put its nuclear weapons to direct use.

However, in order to be considered as an option for use, these weapons must first demonstrate, at least to Iran's own satisfaction, a reasonable probability of reaching their target and a high expectancy of reasonable performance. Iran's development of a major missile capability, as described above, is well known and publicized by Iran itself. Iran also has a limited long range aircraft capability for delivering a nuclear weapon aided by some airborne refueling capability.[8] Although Iran has a small submarine force, it is not certain whether it could deliver a nuclear weapon to distant targets.[9] In an extreme case Iran could also use a nuclear explosive device in a crude, non-military form and place it inside a commercial airplane, a container, and so on, and transport it to its destination in a non-military fashion.

There are three main ways that Iran could launch a nuclear attack: from its own territory (including from a vessel at sea), from the territory of an ally, and by an agent. Launching a nuclear attack from Iran's territory towards a designated target on foreign territory is an act of war, even if Iran's intention is to designate the explosion target where no significant material damage is expected, such as over a desert area. An explosion over international waters would probably not constitute an act of aggression, if no one was hit and no material damage to property was incurred. Such an explosion would, however, constitute a contravention of Iran's obligations to the PTBT.

An alliance with another country, providing it with a "nuclear umbrella," is a possibility. In the situation of early 2008, an alliance with Syria would not be surprising. It would have to be publicized, and would be supported, if the alliance contains a nuclear clause, by declaration or even proof of Iran's capabilities. However, though it is not inconceivable, it is not easy to foresee the possibility that Iran would transfer nuclear explosives to a non-state entity such as a terrorist organization. The advantage to Iran would be that such a weapon could be viewed as an "orphan" weapon that would not be immediately and definitively attributed to Iran, although any assessment would assign a high probability that its origins were Iranian. On the other hand, once the weapon is attributed to Iran, the consequences could be very serious since a preemptive strike against it by a large coalition of nations would become a very realistic possibility.

Conclusion

It is quite certain that Iran is proceeding on a well-laid technical plan to acquire a military nuclear capability. While the previous regime in Iran did permit international pressure to influence the timetable of its nuclear development project, it is apparent that the reemergence of a conservative, fundamentalist regime brought about a decision not to let international political action influence the way Iran is proceeding towards the completion of its aims.

It can be estimated that Iran will continue with its program with minimal regard of international obligations, until it is necessary to act otherwise. Iran will likely strive to achieve the maximum potential for quickly producing nuclear weapons under the IAEA safeguards, while not ostensibly acting

outside its legal obligations. However, it is also quite probable that Iran will develop a concealed parallel enrichment program. This will certainly not be on the scale of the overt enrichment program at Natanz. Therefore, Iran would need much more time for the development of a viable nuclear arsenal. It is also reasonable to assume that Iran will continue with the development and later production of the nuclear explosive mechanism. This would certainly be ready when the necessary amount of HEU would be produced. Moreover, if and when Iran would declare its nuclear weapons capability, its Natanz facility could have already provided enough LEU for the rapid conversion to military grade HEU. Iran would then be the owner of not only a minimal military nuclear capability, but a considerable versatile nuclear force, consisting of many warheads, deliverable by the variety of means at its disposal. In order to extract all benefits from this situation, Iran will need to declare and perhaps even demonstrate this capability. It will do so, however, only when the time is ripe, according to its own assessment of the situation.

As time goes on, it will become more and more difficult for the world to deter or stop this development. There are many means the world could use to this end, but viable options will become limited in direct proportion to the progress of the Iranian program. The hope for using carrots as a means of persuasion is already almost nil, and one-sided concessions would certainly backfire.

Notes

1 http://www.iaea.org/Publications/Documents/Board/2006/gov2006-15.pdf.
2. http://www.iaea.org/Publications/Documents/Board/2008/gov2008-4.pdf; and http://www.isis-online.org/publications/iran/IAEA_Briefing_Weaponization.pdf.
3 The Nuclear Non-Proliferation Treaty (Article II).
4 There is some legal debate whether North Korea has really left the treaty, or it has only notified of an intention to do so, and still needs the approval of the UNSC.
5 Quoting Article 40 of Chapter VII is a first step "before making the recommendations or deciding upon the measures provided for [in other Articles]."
6 Vienna Convention on the Law of Treaties (Article 18).
7 http://www.iaea.org/Publications/Documents/Board/2008/gov2008-4.pdf.
8 See, e.g., http://www.globalsecurity.org/military/world/iran/airforce-equipment.htm.
9 See, e.g., http://www.globalsecurity.org/military/world/iran/ships.htm.

Chapter 2

A Nuclear Iran: Implications for Arms Control in the Nuclear Realm

Emily B. Landau

Introduction

The essay that follows examines the implications of Iran's achievement of a nuclear weapons capability for arms control and non-proliferation efforts and initiatives in the nuclear realm.

If Iran becomes a nuclear weapons state, it will of course not be the first to have done so since the Nuclear Non-Proliferation Treaty (NPT) came into force. Still, the case of Iran is unique in several respects, and the negative implications for the non-proliferation regime will be more severe than was the case with extra-NPT proliferators, such as India and Pakistan. As a party to the NPT, Iran's acquired nuclear status would be in direct violation of its commitments, and thus a more serious challenge. Even if Iran acted in accordance with Article X and withdrew from the treaty, it would be clear that it had cheated and lied for years. A nuclear Iran would thus highlight the inadequacy of the NPT, due to its inability to function as an effective non-proliferation tool. While geared to stopping the spread of nuclear weapons, the NPT would be exposed as incapable of directly confronting the nuclear ambitions of a specific state party to the treaty.

Even when compared with North Korea, the other nuclear state that set out on a nuclear path while a party to the NPT, the ramifications of Iran going nuclear would be harsher. Iran is situated in a potentially more explosive region, and has been positioned at the center of international concern as a perceived threat to an array of regional and extra-regional states with different sets of interests – including Israel, the Persian Gulf states, Europe, and the US. The reality of a nuclear Iran is also widely viewed as a development that would very likely spark additional attempts

at proliferation in the Middle East. The fact that many Middle East states have given notice since autumn 2006 that they intend to develop civilian nuclear programs as a solution to their energy problems has raised the level of concern considerably.[1] These civilian programs could then be used as a cover for future military applications, as occurred in the case of Iran itself. The scenario of more nuclear states in the Middle East would mean not only further breaches of the NPT, but the potential for serious deterioration of regional security.[2]

The particular manner by which the Iranian nuclear file has unfolded since August 2002 will significantly enhance the assessment that non-proliferation efforts have been dealt a serious blow. Losing the Iran campaign after several years of intensive negotiations – carried out primarily by the IAEA and EU-3 (France, Germany, and Britain) – and decisions on sanctions by the US, Europe, and UN Security Council would render this failure especially severe.[3] It would demonstrate in the starkest terms not only the worrisome limitations of the global arms control regime itself, but also the constraints that the international community faces when strong states and relevant international organs attempt to apply different means of statecraft in order to convince and/or compel a determined proliferator to reverse course. Overall, the frustration – if not the helplessness – of the international community in the face of nuclear proliferation would be that much more pronounced.

So while not the only nuclear proliferation concern, Iran is probably highest on the list in terms of international preoccupation and perceived threat. As such, it is likely to be regarded as a watershed for dealing with suspected proliferation, and the way this case ultimately plays out will have a significant impact on the future direction of non-proliferation efforts.

With this in mind, implications of the nuclear Iran scenario are considered below from three main perspectives. The first involves the implications for the current non-proliferation regime: both the effectiveness of the NPT as a non-proliferation tool and its normative value. The second perspective considers the implications as to the ability of individual states to step in and compensate for the weaknesses of the non-proliferation regime, by holding proliferating states to their commitment to remain non-nuclear. Third are the more general implications for the future direction of non-proliferation efforts and the impetus for forging new arms control strategies.

The first two sets of implications are retrospective, assessing the implementation of arms control efforts (whether treaty-based or state-assisted), and the manner and degree to which they would be affected by the failure to stem Iran's nuclear ambitions. The final question looks more to the future and to the prospects of controlling and limiting the destructive potential of nuclear weapons down the road. Assuming that the current non-proliferation regime will be exposed and criticized as basically impotent as far as stopping a determined proliferator, new strategies for controlling the spread of nuclear weapons will be needed.

The Non-Proliferation Treaty and Regime

Entering into force over thirty-five years ago, the NPT is the centerpiece of the non-proliferation regime. When considering the NPT, at issue are both its effectiveness as a specific policy tool – to stop proliferation – and its normative value as an instrument that has helped entrench the idea that nuclear weapons are a negative phenomenon in the international sphere.[4] The question, therefore, is what will happen to both dimensions. In other words, at stake is not only the credibility of the NPT as a non-proliferation tool, but also whether states continue to regard non-proliferation as a worthy endeavor. The difficulties involved in actually achieving the goal could begin to erode its perceived value as well, particularly if states (and analysts) begin to accept the new reality of additional nuclear states as more or less inevitable.

As a major non-proliferation tool, the NPT has successfully weathered challenges in the past, when states outside the NPT went nuclear. But failure in the case of Iran – a state party to the NPT that sits in a very dangerous neighborhood – might constitute a devastating blow to the treaty. The NPT would not cease to exist, but it could be undermined to a degree that it would no longer be regarded as having any real clout as far as stopping a state from attaining nuclear weapons capabilities. This scenario would make it imperative to address disturbing questions about the basic bargain upon which the NPT rests: primarily, the enshrined right of non-nuclear states parties to enrich uranium and to otherwise engage in peaceful nuclear activities, as long as they remain non-military. The soundness of this provision will be strongly discredited in light of what will be firmly established as long term and cynical abuse on the part of

Iran. From what seemed a firm pillar of a fair bargain between nuclear and non-nuclear states parties to the treaty, the protection of this right will be reduced to a naive aspiration that opened a gaping loophole for states to abuse.

The limitations of the NPT began to be exposed in 2003 when the EU-3 and the US intervened and assumed a more prominent role in the effort to curb Iran's ambitions. But in fact, the treaty's provisions have been structurally handicapped from the start. The NPT was not designed with a proliferator like Iran in mind; its provisions are not geared to seeking out and stopping suspected defectors, as can be inferred from its lack of precise criteria for dealing with these suspicions when they arise. Instead, the NPT depends to a large extent on the de facto acceptance by states parties of the idea that nuclear weapons are an inherent cause of insecurity in the international arena. Relying on the assumption that non-nuclear states will basically concur that it is in their interest to maintain their non-nuclear status, little attention was devoted to the prospect that a state may nevertheless develop a strong interest to go nuclear. If it did, the assumption seems to have been that it would have had legitimate (i.e., security) reasons for doing so, and would withdraw from the treaty. Generally speaking, when an arms control instrument focuses exclusively on the denial of capabilities, a state that decides that it *does* want nuclear weapons will invariably find a crack to slip through. And because the NPT wasn't at all focused on minimizing the *motivation* to proliferate, the loopholes in the NPT were tempting for such states. In this sense, more than weakening the NPT, the case of Iran starkly exposes its inherent weaknesses.[5]

Nevertheless, for many years it has been widely accepted not only that nuclear proliferation is inherently dangerous and destabilizing, but that the NPT itself registered a fair degree of success in upholding this principle, by limiting the extent of additional proliferation that took place over the years beyond the five recognized nuclear states. Though it is not clear what role the NPT actually played in keeping the numbers down, the fact that very few states went nuclear deflected attention from the treaty's inherent deficiencies, which will now be very much in focus.

Can the NPT be strengthened and improved? Probably, but it is difficult to envision improvements that will successfully address and repair the basic weakness in its logic that enabled Iran to abuse it.[6] More important,

perhaps, is that time is of the essence, and at this point commitment to the goal of treaty improvement does not seem to be particularly strong or widespread.

As far as the normative value of non-proliferation, the limited degree of proliferation over the years helped to strengthen the norm against nuclear weapons. And while the case of Iran demonstrates the deficiencies of the NPT as a non-proliferation tool, it is at the same time likely to strengthen the normative dimension of the treaty, even as the practical difficulties of ensuring non-proliferation are exposed.[7] This is because the very real dangers associated with the particular case of a nuclear Iran will be most pronounced.[8]

Individual State Efforts: EU-3 and US

Assuming that the motivation to stop the spread of nuclear weapons remains strong – due to the continued importance attached to the norm – a primary challenge for arms control in the nuclear realm will be how to carve out alternatives or at least supplementary arms control approaches to prop up the NPT. To this end, the strong powers on the global scene are destined to play a central role. Therefore, it is important to examine how their role is likely to be affected by their failure to stop Iran.

The reality of a nuclear Iran will no doubt be a serious blow to the abilities of strong international powers to step in and patch emergent holes when weaknesses in international treaties surface full force. The US and the EU-3 made significant attempts to bring Iran into line: together with the IAEA, these self-appointed powers assumed the (virtually unopposed) role of primary executors of the NPT, using negotiations and sanctions to convince and compel Iran to reverse course and uphold its commitments. Their abilities were put to the test – and will be exposed as having failed.

Negotiations between the EU-3 and Iran have been dealt with at length;[9] what is important for the present analysis is the fact that for two years (from the summer of 2003 until the summer of 2005), the EU-3 carried out focused negotiations with Iran in the attempt to devise a package of incentives that would be acceptable to Iran and sufficient to convince it to back down from the nuclear route. The role of the EU-3 was predicated on the fact that there was no other effective instrument available: the NPT cannot enforce itself, and while Iran could have been referred to the UN

Security Council back in 2003, the IAEA at that time was not fully up to the challenge of the inevitable political ramifications of presenting potentially controversial evidence of Iran's deception, and was quite happy to allow the EU-3 to step in and begin negotiating with Iran.

The EU was highly invested in the diplomatic process, which it viewed as affording it a relative advantage over the US as far as strategies for confronting proliferation challenges. Indeed, beyond its belief in the value of diplomacy for its own sake, advocating and practicing diplomacy was a way for Europe to concretize its independent mode of international influence vis-à-vis the US. Moreover, the case of Iran was an important test case for the EU for its new Strategy against the Proliferation of Weapons of Mass Destruction, which it adopted in 2003,[10] and for the notion of "effective multilateralism."[11]

Significantly, the efforts of the EU-3 focused on securing Iran's commitment to a suspension of uranium enrichment in order to demonstrate to the international community its benign intentions in the nuclear realm. While two such agreements were reached over the course of the two years, negotiations were fatally hampered by a gap that was temporarily glossed over, but that in reality could not be spanned: the different meaning that each side attached to "suspension." The EU-3 understood suspension to mean "termination"; Iran viewed it to mean a "temporary confidence-building measure." Iran in fact was absolutely steadfast in its message that it had no intention of permanently ceasing uranium enrichment, and the strength of its conviction was such that nothing offered was considered an acceptable incentive or compensation.

Some responsibility for the failure of the EU-3/Iran negotiations was attributed to the particular difficulties of dealing with Iran, especially once Ahmadinejad was elected and began to display his hard-line approach characterized by defiance of the West.[12] However, the problems encountered were to a significant degree a function of the structure of the negotiations, and the inherent difficulty of negotiating with a determined and skillful proliferator who proves adept at exploiting long and dragged out negotiations with a not wholly united and similarly determined international community. Indeed, Iran was able to maximize its relative advantage in the negotiations situation due to the fact that it was a single state, highly motivated and determined, and very careful not to push the

situation too far, in a way that would "force" the international community to take action against it. In fact, Ahmadinejad's approach in a sense helped the EU-3 by undermining the previously established sophisticated Iranian maneuvering. By assuming such extreme positions, the new president made it crystal clear that he was not interested in a deal, and negotiations quickly reached a dead end. Otherwise, the ultimate failure of negotiations would have been more stinging for the EU-3. This is because it would not have been able to blame Iran for the fact that European negotiators clung to a dynamic that was leading nowhere, while at the same time (unintentionally) enabling Iran to slowly but surely acquire the means to achieve military capability.

While a strong case can be made for concluding that the efforts of the EU-3 were exposed as deficient – reflecting on both the approach to negotiations that was adopted, and perhaps on the EU-3 itself – because of Europe's strong commitment to negotiations and diplomacy as the only option, Europeans were quick to place the blame on others, rather than recognize or admit the shortcomings of their own approach. Beyond Ahmadinejad, Europe blamed the US for not putting its full weight behind efforts to engage Iran, thereby undermining the effectiveness of negotiations.[13] Furthermore, in the face of Iran actually becoming a nuclear state, we can ultimately expect to hear voices claiming that *all* nuclear states are to a degree accountable for this outcome for not having lived up to their own NPT commitments to disarm.[14]

It should be recognized that part of the failure was actually due to the fact that the states were, oddly enough, constrained by the provisions of the NPT itself. Because they had to deal with Iran in relation to its treaty obligations, much of their initial energy was spent trying to find clear-cut evidence of non-compliance, the so-called smoking gun. This proved a very difficult endeavor, because while ostensibly focused on a purely technical issue, in practice, there were no precise criteria for making this call, and decisions were very much dependent on interpretations of evidence. This left much room for the ongoing dynamics of "giving Iran one more chance to prove itself" – especially as Iran itself well understood the dynamics, and was doing everything in its power to present a reasonable stance (at least up until the election of Ahmadinejad) and display a cooperative attitude when it could afford to do so. And after a two year hiatus, evidence over the

summer of 2007 began to surface that Iran was returning to this approach, highlighted by its willingness to cooperate with the IAEA in answering the "outstanding questions" relating to its past nuclear activities.

If Iran becomes a nuclear state, it will mean that the sanctions route failed as well. At the time of this writing, three UN Security Council resolutions have been imposed on Iran to no avail, and the US has taken the lead in imposing financial sanctions outside the framework of the UN. There are different views on the effectiveness of sanctions in persuading a proliferator to change course, as well as on the question of whether sanctions would work in the specific case of Iran. Moreover, there are questions that relate to the ability of the international community to even decide on the kind of sanctions that could conceivably stop Iran, due to conflicting interests among them. At this point it is difficult to speculate how the failure of the sanctions route would be interpreted, and whether it would invite an economic or political/diplomatic explanation.

Ultimately, there is good reason to believe that although "diplomacy" (ranging from negotiations to sanctions) will have failed, the US and the EU-3, and probably Russia as well, will continue to view themselves as the natural candidates for continuing efforts to stem nuclear proliferation among additional states. Unfortunately, there are no signs that serious consideration will be given to the reasons why diplomacy failed, and how it might be improved in the future. At best these states may have cause to review their strategies realizing the importance of formulating a more united front,[15] but interpretations of the failure are likely to be selective, differential, and politically motivated. Still, these states will undoubtedly continue to lead non-proliferation efforts down the road, and – in the absence of a good alternative – the international community will most likely continue to acquiesce.

New Arms Control Strategies

The final issue for consideration is the future focus and content of nuclear arms control efforts and strategies.

A central question in this regard, especially in light of a nuclear Iran, is the continued relevance of the arms control logic embedded in the NPT, namely, that all states should be equal in the non-conventional realm and no state allowed to possess nuclear weapons. The debate on this issue turns

on the distinction between treating this as an arms control *aspiration* and treating it as a *prescript* for concrete immediate action.

According to current international practices, different states *are* treated differently in the nuclear realm. This applies not only to the five recognized nuclear states, but can be discerned in the different attitude displayed toward Israel and India, for example, as compared with Iran. On the one hand, one could claim that this is precisely the reason why the NPT is so important. In other words, the fact that Iran is a party to the NPT is what makes it legitimate to focus on its violations, and to demand compliance. It is much more difficult to present demands to states that remain outside the treaty, like India and Israel. Clearly, however, the issue goes well beyond the question of "party or not" to the NPT. In fact, in practice states are judged in the nuclear realm in terms that go past the narrow issue of nuclear capabilities and extend instead to their overall profile as international actors, focusing on their rhetoric; reputation; and bilateral, regional, and international behavior.[16]

If states are in any case accorded differential treatment in the nuclear realm, perhaps arms control efforts also need to relate to states not only per their nuclear activities, but in terms of their security concerns, overall record of international behavior, and, especially, relations with other states. Significantly, as far as Iran is concerned, not only did the NPT not help the international community to confront Iran's nuclear ambitions, but it seems even to have interfered at times with that effort – for example, by elevating the importance of finding a smoking gun, which ended up legitimizing an ongoing search for such clear cut evidence and thereby delaying the process of firmly confronting Iran with its history of deception. More important, perhaps, is the fact that the provisions of the NPT itself enshrined what Iran referred to as its legitimate right to enrich uranium, enabling it to then abuse this right for military purposes.

Yet even in light of these realities, the normative pull of the "equality argument" in the nuclear realm is very strong. The "disarmament prong" of the arms control camp will be pushing for the nuclear states to disarm in order to come into line with the status of the non-nuclear states, along with their own explicit commitments according to the NPT. This tendency was given a serious push forward with the publication in early January 2007 of an article written by four prominent Americans called "A World

Free of Nuclear Weapons,"[17] and it would very likely be reinforced by the reality of Iran becoming a nuclear state. The argument would be that Iran was "lost" because of the double standard inherent in the NPT that makes it impossible to deal effectively with a determined proliferator. According to this line of thinking – which has the unfortunate side effect of relieving the proliferators themselves of full blame for their actions, as well as ignoring important differences among states as far as the threat they pose to others through their rhetoric and actions – the double standard will disappear only when the nuclear states comply with universal disarmament.

Even if one accepts the conceptual logic embedded in this argument, international realities dictate that universal disarmament is a distant goal, whereas dangerous new proliferation challenges need to be dealt with *today*. Thus beyond the dilemmas connected to the NPT and the conceptual and moral arguments that can be raised and debated, new arms control directions might begin to reflect a distancing from the constraints of "universal treatment." Indeed, some new arms control directions are already underway in light of the recent proliferation challenges. One such initiative – which is multilateral, though not global – is the Proliferation Security Initiative (PSI) that was announced by President Bush in May 2003. PSI is a multilateral effort to allow the search of planes and ships in order to intercept the transfer of sensitive technologies and materials. This initiative reflects the perceived need for additional proactive and dynamic measures on the part of like-minded states in order to help stem the proliferation of WMD and related technologies.[18] In February 2006, Secretary of State Rice described multilateral efforts centering on the PSI as the major tool for fighting the spread of WMD, and noted the intention to expand such measures. Also noteworthy is the November 2003 US/UK joint statement on "effective multilateralism" as the guide to their approach for confronting common security challenges, including the spread of WMD. These are arms control trends that are likely to be enhanced in the coming years.

Finally, there is a question of the prospects, if any, of moving in the direction of creating new rules of the game for a Middle East that includes a nuclear Iran. Once a nuclear Iran becomes a reality, the major arms control challenge will no doubt become regional stability – taking whatever steps possible to ensure that the situation in the Middle East does not get out of

hand, both with regard to Iran directly and with respect to motivations for further proliferation among states in the region.

States in the Persian Gulf have in the past two years been much more outspoken about their own concerns over the prospect of Iran becoming a nuclear power. An initial indication of this was reflected in research conducted at a prominent think tank in Dubai, which raised the idea of initiating discussion on a Gulf WMDFZ as the first stage in a wider Middle East WMDFZ, and the idea was echoed at the official level by the Gulf Cooperation Council (GCC) secretary-general in late 2005.[19] Following the 2003 Iraq War, additional moderate states in the region added their voices of growing concern with the regional implications of Iran becoming a nuclear state. Indeed, there have been clear signs of a converging mutual interest among moderate states in the Middle East to contain Iran, and in advance of the Annapolis meeting of late 2007, it was reported that the US hoped to use this opportunity to encourage dialogue and cooperation among these states.[20]

Ideas for initiating regional security dialogue are sometimes interpreted as requiring a demanding form of regional architecture that in order to work would have to replace balance of power politics.[21] In fact, security dialogue at the regional level does not have to be grounded in a concept of "collective security"; rather, the purpose of such dialogue is to develop new rules of the game in order to conduct inter-state relations under the threshold of hair-trigger alert. In this sense, the options of regional security dialogue and an essentially balance of power approach to international relations are not mutually exclusive paths, and the value of regional dialogue in the Middle East should not be undermined on this basis.[22]

Conclusion

The current diplomatic efforts geared to ensuring that Iran upholds its NPT commitment to remain non–nuclear, and stopping it from advancing its nuclear program to a military capability, are not succeeding. As such, Iran could become a nuclear state, with far-reaching implications for the Middle East and perhaps the world. This essay has focused on the implications for the current non-proliferation regime and for arms control efforts in the nuclear realm.

As far as prospects for regional stability in the Middle East with a nuclear Iran, Iran's president Ahmadinejad presents a particularly severe challenge due to his extremist positions toward Israel that seemingly lack any semblance of compromise short of Israel ceasing to exist. His hegemonic aspirations are a threat to all moderate states in the Middle East. This seems not to leave much room for a win-win strategy of coexistence, and the prospect of region-wide dialogue is a more distant possibility than ever.

Nevertheless, together with attempts to stop further proliferation, a major challenge for arms control in the years ahead will become how to manage the potential risks involved when new nuclear states appear on the international scene. If a regional framework for dialogue is in fact initiated in the Middle East – among moderate states in the first stage – once understandings begin to be forged, Iran may well have an interest to become involved as well, as it will make more sense for Iran to be part of new regional understandings than to remain outside them. But this is looking very far down the road.

Notes

1 See Emily B. Landau, "New Nuclear Programs in the Middle East: What Do they Mean?" *INSS Insight* no. 3, December 11, 2006, and Joseph Cirincione and Uri Leventer, "The Middle East's Nuclear Surge," *International Herald Tribune,* August 13, 2007.

2 There is also a danger of cooperation between new nuclear proliferators. In this regard, North Korea is also a major concern due to its willingness to sell missiles and share non-conventional technology. Its cooperation with Iran could have a synergistic effect, as reports on possible North Korean-Syrian nuclear cooperation demonstrate. See *Haaretz*, September 16, 2007.

3 At the time of this writing, negotiations and sanctions are the only strategies that have been attempted to stop Iran, and thus this future-oriented projection is limited to them. Of course it is conceivable that Iran might become a nuclear state after military force has been used as well, but as it does not appear on the immediate horizon, I have not included it as a strategy that failed prior to Iran going nuclear.

4 For an interesting and comprehensive account of the development of the norm of non-use in the nuclear realm, see Nina Tannenwald, "Stigmatizing the Bomb: Origins of the Nuclear Taboo," *International Security* 29, no. 4 (2005): 5-49.

5 See Emily B. Landau, "Approaching a Nuclear Iran: The Challenge for Arms Control," in Zvi Shtauber and Yiftah S. Shapir (eds.), *The Middle East Strategic Balance 2004-2005* (Brighton: Sussex Academic Press and Jaffee Center for Strategic Studies, 2006), pp. 59-60.

6 For a different view, which advocates that it is not too late to introduce essential improvements to the NPT, see Pierre Goldschmidt, "The Urgent Need to Strengthen the Nuclear Non-Proliferation Regime," *Policy Outlook*, Carnegie Endowment for International Peace, January 2006.

7 For a view that criticizes not only the lack of effectiveness of the non-proliferation regime, but questions the relevance of the non-proliferation norm as well, see Andrew O'Neil, "Nuclear Proliferation and Global Security: Laying the Groundwork for a New Policy Agenda," *Comparative Strategy* 24 (2005): 343-59.

8 Of course if Iran were to behave in a non-confrontational manner once it became a nuclear state, this might lend support to the idea (raised also in the India-Pakistan context) that somewhat paradoxically, the very possession of nuclear weapons acts as a restraint, and imposes more responsible behavior on states. This, however, is far from a foregone conclusion and would remain to be seen.

9 See for example Gary Samore, *Meeting Iran's Nuclear Challenge*, Paper no. 21, Weapons of Mass Destruction Commission, October 2004; Emily B. Landau and Ram Erez, "WMD Proliferation Trends and Strategies of Control," in Shai Feldman and Yiftah S. Shapir (eds.), *The Middle East Strategic Balance 2003-2004* (Brighton: Sussex Academic Press and Jaffee Center for Strategic Studies, 2004), pp. 62-67; articles by Gerrard Quille and Rory Keane, "The EU and Iran: Towards a New Political and Security Dialogue," and Shannon N. Kile, "Final Thoughts on Iran, the EU and the Limits of Conditionality," in Shannon N. Kile (ed.), *Europe and Iran: Perspectives on Non-Proliferation*, SIPRI Research Report no. 21 (Oxford: Oxford University Press, 2005); and Tom Sauer, *Coercive Diplomacy by the EU: The Case of Iran*, Discussion Papers in Diplomacy, Netherlands Institute of International Relations "Clingendale," 2007, pp. 6-15.

10 See Shannon N. Kile, "The Controversy over Iran's Nuclear Programme," in *Europe and Iran: Perspectives on Non-Proliferation*, p. 2.

11 Espen Barth Eide (ed.), "*Effective Multilateralism": Europe, Regional Security, and a Revitalised UN* (London: The Foreign Policy Centre and British Council Brussels, December 2004).

12 "The collapse of Europe's diplomatic initiative reflects Tehran's calculation that the balance of power has shifted in its direction. In October 2003…when Tehran felt vulnerable to American pressure, Iran reached agreement with the EU-3…But after two years of fruitless discussion…Iran toughened its position with the June 2005 election of President Ahmadinejad and removal from office [of those] who may have been more willing to seek a compromise and avoid a confrontation," Gary Samore, "Stopping the Bomb – Part I," *YaleGlobal,* January 24, 2006.

13 Amir Taheri, "The Perils of Engagement," *Wall Street Journal*, May 9, 2006.

14 Hints of this argument can already be heard among strong proponents of disarmament.

15 See for example George Perkovich, *Toward Transatlantic Cooperation in Meeting the Iranian Nuclear Challenge,* Ifri Proliferation Paper, winter 2005.

16 See for example a statement made by Secretary of Defense Robert Gates at a conference in Bahrain in December 2007. When asked why the US adopted a

harsh approach on Iran but not vis-à-vis Israel, Gates answered: "Israel is not training terrorists to subvert its neighbors, it has not shipped weapons to a place like Iraq to kill thousands of civilians, it has not threatened to destroy any of its neighbors, it is not trying to destabilize the government of Lebanon," in "Gates Sees Iran as Still-Serious Threat," *New York Times,* December 9, 2007.

17 George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, "A World Free of Nuclear Weapons," *Wall Street Journal,* January 4, 2007. This was followed by a second piece by these four authors published in early 2008: "Toward a Nuclear-Free World," *Wall Street Journal*, January 15, 2008. For a longer, previously published analysis, see Selig S. Harrison, "The Forgotten Bargain: Nonproliferation and Nuclear Disarmament," *World Policy Journal* (Fall 2006): 1-13.

18 See the website of the US Department of State: www.usinfo.state.gov; and "The Proliferation Security Initiative (PSI) At a Glance," Arms Control Association, Fact Sheet, September 2005. The major success attributed to the PSI is the interdiction of the ship *BBC China* that was transferring centrifuge components to Libya in late 2003, which served to expose its illegal nuclear weapons program. Others claim that while this operation was carried out in the spirit of the PSI, it was not a PSI operation per se. See Wade Boese, "Key US Interdiction Initiative Claim Misrepresented," *Arms Control Today*, July/August 2005.

19 For the research undertaken, see "Security and Terrorism," Gulf Research Center Bulletin, no. 1, October 2005. For statement of GCC Secretary-General al-Attiyah, see "Gulf Leader Urges Iran to Make Region Nuclear Free," *Agence France-Presse,* December 18, 2005.

20 See for example David Brooks, "Present at the Creation," *New York Times,* November 6, 2007.

21 See Richard L. Russell, "The Persian Gulf's Collective-Security Mirage," *Middle East Policy* 12, no. 4 (2005).

22 At the conceptual level see Charles Lipson, "Are Security Regimes Possible? Historical Cases and Modern Issues," in Ephraim Inbar (ed.), *Regional Security Regimes: Israel and Its Neighbors* (NY: SUNY Press, 1995), pp. 3-32. See also Dalia Dassa Kaye, "Time for Arms Talks? Iran, Israel, and Middle East Arms Control," *Arms Control Today,* November 2004. In fact, some ideas raised by Russell toward the end of the article cited above are exactly the point: the need for reassurance, confidence in intentions, and so on. In contrast, see a commentary that posits that Iran would not agree to take part in such an endeavor: "With the Islamic constitution mandating Iran's solidarity with the liberation movements and struggles against the world's hegemons, the pitfall of media pundits who naively suggest that Iran could actually become a participant in a US-designed regional security apparatus is unmistakable," Kaveh L. Afrasiabi, "The IAEA and the New World Order," *Asia Times Online,* February 3, 2006.

Chapter 3

An Israel-Iran Balance of Nuclear Deterrence: Seeds of Instability

Yair Evron

Introduction

The following essay takes as its starting point the assumption that efforts to contain the Iranian nuclear effort will fail and Iran will eventually acquire a nuclear weapons capability. This is not to suggest that this development is unavoidable. In fact, there is still a good chance that international efforts to contain the Iranian project (either diplomatic or through sanctions, or possibly even military action) might ultimately succeed, or at least keep Iran at a low level of nuclear development for a long time. However, an analysis of the possible consequences of Iran's becoming a nuclear state can lead to several policy-oriented conclusions regarding different steps that could be taken to minimize the dangers resulting from such nuclearization.

An assessment of the potential ramifications of Iran becoming a nuclear power is by definition a speculative effort with many uncertainties. Furthermore, there are many difficulties in developing an analytical framework designed to assess decision making in a future Israeli-Iranian nuclear relationship. In the analysis that follows, the approach is first, to take as a starting point the superpowers' nuclear relationship during the Cold War and identify its basic structure and mechanisms; second, to consider briefly another regional nuclear relationship, the Indian-Pakistani dynamic and its lessons for the Israeli-Iranian relationship; and third, to assess to what extent the superpowers model is applicable to the Middle East in general and the Israeli-Iranian relationship in particular.

It is likewise still difficult to come to a definitive conclusion regarding the effects of proliferation on international stability or specific regional contexts, and many fundamental uncertainties remain.[1] The fact that since

Hiroshima and Nagasaki no nuclear device has been used in the course of hostilities might lead to the tentative conclusion that a third use of a nuclear weapon in war is of very low probability. This conclusion is based on the superpowers relationship during the Cold War – the only historical example of a relatively stable and long nuclear deterrence balance. But would this pattern recur in various regional nuclear conflicts?

Many decision makers and observers assume that a nuclearized Iran would contribute to instability. There is a need, however, to analyze in more detail the causes of such expected instability and on this basis derive policy oriented conclusions.

The Superpowers' Central Balance of Nuclear Deterrence

The superpower mutual nuclear relationship evolved gradually from the early 1950s and persisted for some forty years, until the end of the Cold War and the disappearance of bipolarity. It developed over time and underwent several phases. The notion of stable mutual deterrence developed slowly, and a search for measures designed to enhance nuclear stability began only in the late 1950s and continued thereafter through the development of second strike capabilities and advanced elaborate command and control systems on the one hand, and arms control and Confidence and Security Building Measures (CSBMs) on the other hand. But during the 1960s and 1970s there were several major superpowers crises that could have led to nuclear exchanges. Indeed, even in the phase of relative stability there were periods of severe competition – both political and also in arms buildup. And, in the first half of the 1980s, tensions yet again led both rivals to seek capabilities that would allow them to "win" the arms race, though these efforts appeared not unlikely to change the basic balance of deterrence.

Thus, one of the main lessons of the nuclear era has been that it was replete with dangerous points and that at various times decision makers on both sides erred and misconstrued the intentions of their rival. The stability of the "central balance of deterrence" has, therefore, always been a product of trial and error and of continued efforts to overcome dangerous situations and manage crises as they arise.

Voluminous literature has been devoted to the nature of nuclear weapons and their effects on politics and strategy, and fundamental disagreements remain on almost every aspect of these subjects. However, a structural

analysis of the superpowers' balance of deterrence suggests that there were several basic characteristics that contributed to its stability. Some of them were specific and context conditioned, some technical, and some related to the nature of societies and regimes. Altogether these could be divided into several subsets: political relations between adversaries; historical conditions; stability of societies and regimes; technical systems; characteristics of the nuclear weapon systems; strategic doctrines; and cognitive issues. There is broad agreement that some of these factors were essential and in their absence, the likelihood of escalation to the nuclear level would have been high. In contrast, there are many disagreements concerning first, whether the central balance of deterrence was indeed all that stable; second, which factors were essential for the creation of deterrence stability and whether they – or some of them – were dependent on the specific context of the superpower relationship; and third, whether regional nuclear deterrence relationships could be stabilized, were similar factors to obtain therein.

The following, in various degrees of importance, is a list of the conditions for stability**,** as derived from the "central balance of deterrence": bipolarity; stability of regimes and effective control over nuclear systems; socialization as to processes of learning in the nature of nuclear weapons; second strike capability; command, control, and intelligence systems (the current full title is command, control, communications, computers, intelligence, surveillance, and reconnaissance – C^4ISR); no direct territorial friction; elaborate systems of decision making in situations of crisis; open channels of communication; and arms control agreements and various CSBMs.

Lessons from the Indian-Pakistani Nuclear Relationship

India and Pakistan apparently succeeded in developing small arsenals of nuclear weapons already in the late 1980s or early 1990s (with India having fissile materials and components for the assembly of nuclear weapons much earlier). More precisely, it was assumed they had these capabilities though they did not explicitly admit it. In 1998 India and Pakistan tested nuclear weapons and thus became declared nuclear powers. En route to this status several major crises bordering on escalation to the nuclear threshold took place between them. In 1990, because of the situation in Kashmir, limited military confrontation began escalating and the possibility of a

major war was imminent. At the height of the crisis, Pakistan took initial steps towards the assembly of some nuclear weapons. Only substantial and intensive American diplomatic intervention defused the crisis.

In the post-crisis analysis, two interpretations emerged. One, it was the nuclear moves Pakistan undertook that ultimately deterred India from attacking.[2] Conversely, and more convincing, India was not deterred by Pakistan's nuclear signaling. Rather, India in any event was not seeking war, but was drifting towards it in response to Pakistani terrorism in Kashmir and extreme domestic pressures. Thus, once the US intervened and succeeded in convincing Pakistan to stop backing military activity in Kashmir, India was ready to forgo the military option. Furthermore, the Indian leadership was not at all aware of the Pakistani nuclear signaling, and to the extent that the nuclear issue was raised, Indian leaders did not consider it a sufficient deterrent against military action.

Several conclusions can be drawn from the 1990 crisis. First, the existence of some nuclear capabilities did not deter the escalation that led to the crisis. Second, the two adversaries had different interpretations of the effects of Pakistan's nuclear moves. Third, the crisis was managed only through very active outside diplomatic intervention, which led to limited resolution of its overt cause, namely, the Pakistani backing of the insurgency in Kashmir. Fourth, the existence of democratic regimes does not guarantee against miscalculations. On the contrary, weak democratic governments such as those the two countries had at the time are less likely to behave rationally than strong authoritarian regimes.

In 1999, after the two states were already open nuclear powers, the Kargil crisis erupted, some of whose basic characteristics were present four years later when the 2002 crisis erupted. The crisis escalated rapidly and the concern over it prompted Washington once again to intervene diplomatically to defuse the crisis.[3]

A post-crisis analysis suggests that the two adversaries interpreted the implications of the nuclear factor differently. The Pakistani military leadership assumed that its nuclear capability would deter India from escalation and would allow it to conduct limited war in Kashmir and support a terror campaign in India. The Indian leadership assumed that the only way to force Pakistan to halt its military campaign in Kashmir was by military escalation, and was not deterred by the potential Pakistani

nuclear threat. India thus planned a limited war, which presumably would not cross the assumed Pakistani tolerance threshold. However, there was no common understanding concerning the red line whose violation would trigger Pakistan's use of nuclear weapons. In addition, and contrary to the 1990 crisis, both before and during the evolution of the crisis Pakistan had an authoritarian regime, while India remained a democracy. This change of regime in Pakistan, however, was not necessarily a factor leading to instability. Indeed, during the crisis itself, the Indian government was under increased domestic pressure to toughen its stance and escalate. The common factor was the strong American intervention. Its ability to influence and pressure both India and especially Pakistan was greater than in the former crisis. Both adversaries moved closer to the US, and Pakistan became even more dependent on it.[4]

The Iranian Nuclear Posture

Iranian strategic leaders likely perceive security threats from different directions, some of them emanating, at least potentially, from nuclear powers: Iraq (until 2003 perceived as a potential nuclear power), the US, Israel, Pakistan, and Russia.

Until the American occupation of Iraq in 2003, the primary strategic threat that Iran faced was from Iraq, and this was probably the principal cause for the renewal of its nuclear project. Since the American invasion of Iraq and the destruction of the Iraqi armed forces, coupled with the fact that the Iraqi WMD capability ceased to exist, the potential Iraqi threat has disappeared in the short and medium terms. Iran's current nuclear development is probably aimed at deterring the US, balancing other nuclear regional threats, and deterring Israel. However, beyond deterrence Iran is pursuing an aggressive regional foreign policy and issuing threats vis-à-vis Israel, and is most likely searching for a dominant role in the Middle East. This is already perceived by several regional states – including the Gulf countries, Egypt, Israel, and Turkey – as a threat to their national interests.[5]

Since Iran denies its effort to obtain nuclear weapons capability, it has not as yet intimated what might be its nuclear strategic doctrine. However, an analysis of the history of the Iranian project coupled with the geo-strategic environment of Iran could lead to several tentative conclusions

as to the Iranian posture. One major constraint governing Iranian nuclear behavior is that for quite some time its nuclear arsenal and delivery systems would be limited. Hence it will face difficult choices in the allocation of capabilities for different missions.

Israeli-Iranian Nuclear Deterrence

Presently, Israel and Iran – as leading regional powers – perceive each other as major adversaries. The extreme ideological stance that Iran has adopted vis-à-vis Israel, Iran's support and encouragement of armed hostilities against Israel, and its effort to sabotage the peace process has turned Iran into one of Israel's staunchest enemies. Iranian nuclearization, therefore, appears as a major existential threat to Israel. In turn, the Israeli international diplomatic efforts against Iranian nuclearization and the implied military threats to destroy the Iranian nuclear facilities have enhanced Iranian hostility toward Israel. A potential source for confrontation might result from a clash between Israel and a neighboring state allied to Iran, or between Israel and a sub-state armed organization (Hizbollah).

There is no scientific way of assessing the probability that an extreme Iranian regime would attempt the first use of Iranian nuclear weapons out of an ideological drive to destroy Israel. Hypothetically, a regime that is totally devoted to the pursuit of its extreme ideological objectives and is even ready to sacrifice part of its population might entertain this option. This presumably might become a more viable option if Iran accumulated an arsenal with several dozens of bombs and credible delivery vehicles, and on this basis, might hope that using all of them against Israel would destroy all of Israel's nuclear capabilities. If some remained, then Iran would be ready to absorb a limited Israeli counterstrike. However, in view of Israel's widely assumed large nuclear arsenal and numerous delivery vehicles, including various protected platforms that form a second strike capability, it appears highly improbable that even a fanatic leadership would choose such a policy. The dangers are enormous, not only to Iran as a country but first and foremost to the regime itself. No regime, even if endowed with the most extreme ideology, chooses to commit suicide.[6] Moreover, Iran must consider not only Israel's second strike capability, but also the high probability of a devastating American response.

Putting this scenario aside, therefore, the following analysis focuses primarily on the nature of a possible deterrence relationship between Israel and Iran.

Main Determinants Affecting Stability of an Israeli-Iranian Nuclear Balance

Regional political context. It is a commonplace that the Middle East has long suffered from political instability in the form of conflicts, arms accumulation, and wars – between Arab states, between Israel and the Arabs, and between Iran and Iraq – as well as intensive domestic instability in many areas. However, certain long term and mid range processes have introduced important modifications to the regional system, which thus departs in some significant ways from what existed until the 1980s. The Arab state system has undergone radical changes, and Arab states as a group have lost much of their influence over regional developments. Among Arab states, the influence of Syria has deteriorated. The United States has gained an unprecedented power position in the region. Most of the Arab regimes are clearly oriented towards the West; Egypt and Jordan have peace treaties with Israel; and in general Arab nationalist radicalism has declined as a mobilizing and unifying force. All the Arab regimes presently perceive of radical militant Islam as their main threat and share a vital interest in resisting it. These trends appear to enhance the prospects for greater political and strategic stability. On the other hand, the continued Israeli-Palestinian conflict, the pressure of domestic forces backing militant Islam, the rise of Iran under a radical fundamentalist Islamic regime, the uncertain future of Iraq, and the possibility that region-wide terrorism would increase following the expected withdrawal of American forces from Iraq all continue to serve as sources of instability.

Currently, the only neighboring Arab state hostile to Israel is Syria. It is of course difficult to predict what Syria's international orientation and its relationship with Israel will be in several years time, once Iran acquires a nuclear capability. But if it maintains its current foreign policy and if it establishes a defense alliance with Iran, the potential for Israeli-Iranian escalation will increase.

Number of Main Actors. The deep suspicions that most regional actors have about Iranian intentions might lead to further proliferation were Iran

to nuclearize. Saudi Arabia (with possible help from Pakistan), Egypt, and Turkey are considered possible nuclear contenders. Multipolar "anarchical" systems (namely devoid of a central power imposing stability) would severely complicate rational decision making during nuclear crises.

Territorial Contiguity. Similar to the superpowers context, Israel and Iran do not have common borders and have no direct conflicting territorial claims. This reduces to an extent the potential level of friction between the two states and the potential for direct military friction. A possible future deployment of Iranian forces in Syria as part of a defense alliance might increase the danger of direct conflict.

Regime, Society, and Socialization in Nuclear Affairs. At issue is to what extent the type of regime and the degree of social coherence affect control over nuclear systems and the nature of decision making. Past experience suggests that authoritarian regimes can have as effective control over nuclear systems as democratic ones. The problem with Iran regarding control, therefore, is not its lack of democracy, but the possibility of violent domestic political changes and also frictions between different regime agents regarding control of nuclear assets. Extreme ideological positions and distorted and paranoid perceptions of the adversary's intentions might lead to irrational decisions during times of crisis. Finally, it is not clear to what extent the Iranian leadership and the high level bureaucracy in charge of defense policy have undergone a process of socialization (i.e., education) in the nuclear "facts of life." This usually takes a long time, and – as the Indian-Pakistani crises demonstrated – opponents' diverse interpretations of events could lead to quite different understandings of the role played by nuclear weapons.

It can be assumed that after almost forty years of purportedly having a nuclear capability Israel has adopted effective means of control over its nuclear systems. However, there is still a broad need for further effort to be invested in the socialization in nuclear affairs and the study of various contingencies involving nuclear affairs. Furthermore, the extreme ideological positions of Iran coupled with continued existential concerns that haunt the Israeli public and leadership might adversely affect rational decision making.

Second strike capability is an issue that has been enshrined in the theory and practice of nuclear deterrence. In its absence by one side, a nuclear rival

might entertain the hope of destroying completely the nuclear assets of its opponent and consequently expose it to unlimited military and political demands. At the same time, the party lacking second strike capability might be tempted to strike first, in the hope that it would at least curtail the expected damage that might be caused by the inevitable first strike by its adversary. Thus, theoretically, for the balance to be stable both sides need a second strike capability. Under conditions of uncertainty about the second strike assets of both sides, mutual anxieties might lead to first strikes.

At the same time, there is no need to emulate the superpowers model exactly for a regional nuclear balance to be stable. The classic triad of strategic forces with all its components is not essential. Rather, what is surely necessary is that each side has sufficient known or assumed capabilities to create a significant measure of certainty by its adversary that it has the capability to strike back and thus cause unacceptable damage to the other side. Conditions for accomplishing this vary from one context to the other. In the Israeli-Iranian case, unacceptable damage would mean a high level of destruction to the main urban centers and especially to the centers of government and the command and control facilities. There is possibly an asymmetry between Iran and Israel in regard to the effect of second strike capabilities. In view of repeated declarations by Iranian leaders that Israel should disappear from the map, versus the complete absence of interest on the part of Israel in causing devastating damage to Iran and its people per se, the need for an Israeli second strike capability is more emphasized for mutual deterrence stability. The absence of an Iranian second strike capability would not therefore "invite" an Israeli first strike per se.

The mutual images the parties have of second strike capabilities would be based on some calculations, be they even crude, about the survivability of the rival's nuclear systems. Israel maintains a veil of ambiguity over all its nuclear capabilities, but international sources have suggested that it has a large arsenal of warheads (60-80, according to one American official estimate, up to 200 according to the IISS, and more according to other possibly less reliable sources).[7] In addition, it has been widely suggested by foreign sources that Israel's warheads are carried by both aircraft and missiles, with sufficient ranges to hit Iran. Both the airports and the missile silos are presumed to be hardened. Thus, it can be assumed that no rational

decision maker would doubt the Israeli capability to strike back at Iran if the latter decided to launch a counter force first strike.

Command and control comprises two dimensions: the technical systems for early detection, warning, and control; and the decision making process responsible for the activation of nuclear weapons.

It has become a common assessment in the context of the superpower model that reliable C^4ISR systems are critical for the stability of nuclear deterrence. On the most elementary level, if early warning systems do not operate correctly, there is the danger of an undetected nuclear surprise attack. Conversely, if these systems mistakenly signal an incoming nuclear strike when in fact nothing occurred, decision makers in the target country might try to respond with the nuclear capability under their command before being hit first. This might lead to a nuclear war by mistake. Another possibility is that nuclear launching systems would be activated but no actual attack would be executed. However, if these preparations are detected by the other side, they might raise undue alarm there and lead it to dangerous nuclear moves.

In the Israeli-Iranian context, the dangers of early warning failures are much higher than was the case in the superpower context. First, because of the short distances, the warning lead time is much shorter, and therefore the scope for mistakes is wider. This might be even worse were Iranian nuclear missiles or aircraft to be deployed in areas nearer to Israel. Second, while Israeli early warning systems are developed and sophisticated, this cannot be said about the Iranian counterparts. Third, since additional actors might be involved in an Israeli-Iranian crisis, the ability of early warning systems to carefully detect and differentiate incoming flights or missile launches from the outside would be much more complicated than was the case in the superpowers context. Fourth, it would be virtually impossible to determine what kinds of armaments are carried by incoming aircraft or missiles: conventional, biological, chemical, or nuclear. Different munitions, however, require different responses.

These points relate primarily to the technical dimension of early warning systems. Equally important is the ability of decision makers to make rational decisions upon receiving early warning signals. Misperceptions about the intentions of nuclear adversaries could easily lead to disastrous consequences. Thus, for example, the image of Israel as the "small Satan"

that is invoked regularly among the current Iranian leaders might lead to mistaken conclusions about Israeli military steps.[8] Any early warning of incoming flights from the assumed direction of Israel might be construed as an Israeli nuclear attack, or alternatively of a conventional attack designed to neutralize Iran's nuclear capability.

It is likely that the conceptual background of Israeli decision makers would be at least partly affected by images of Iran's presumed desire to destroy Israel. This might provoke an Israeli decision to launch a preemptive counterforce nuclear strike against Iran if there are signals that an Iranian first strike is imminent. Extremely short time spans for making such decisions and the possible built-in technical problems involved in any early warning system coupled with the relatively short distances involved might cause very significant difficulties for rational and cautious decision making.

Interactions. Any miscalculation in a crisis situation will be further aggravated against the background of previous threats by decision makers calling for the annihilation of their opponents on ideological grounds (while Iran's president has not said as much, his repeated assertions that Israel is doomed to disappear could be construed as implied threats to use Iran's capabilities for that purpose). These threats might in reality be empty rhetoric, but their utterance could naturally be perceived as representing real intentions.

The danger involved in loss of control over nuclear forces is enormous. In addition there is a critical danger that rivals or even neighbors of the nuclear power might react preemptively against nuclear forces of the rival when its regime appears to be under threat of violent domestic change, for fear that an irresponsible group within the rival party is likely to make miscalculations that might affect decisions of the other party. If party A assumes that there is a high likelihood that its opponent (party B) would miscalculate or behave irresponsibly, party A might take precautionary actions, such as, for example, striking first.

The Israeli Nuclear Posture: Effects of Iranian Nuclearization

Because of its official strategy of ambiguity, the Israeli nuclear posture has never been formally articulated. Indirect evidence, however, coupled with

a body of observations and speculation based on rational analysis leads to several assumptions about it.[9] In the first place it comprises *general deterrence*, that is, deterrence against a general Arab attack on Israel that constitutes an existential threat. A second component is *a weapon of last resort posture*, either as a deterrent or in actual use under conditions of imminent defeat. The application of such a strategy raises tremendous problems: definition of the threshold where "last resort" uses should be invoked; to what extent effective deterrence could be achieved at a very last stage; and most problematic, the implications of the actual use of nuclear weapons. Third, there are various possibilities of *specific* or *immediate deterrence*, namely direct deterrence in times of crisis. Finally, there is deterrence against the use of other types of weapons of mass destruction.

Currently, the probability of situations in which nuclear general deterrence is relevant and even more so the posture of weapons of last resort is extremely low. On the political level, Egypt and Jordan have peace treaties with Israel; Syria is isolated and very weak; and Iraq has no military power. In addition, due to many developments, Israeli conventional superiority over its opponents is highly defined. Finally, the American-Israeli strategic cooperation contributes considerably to Israel's overall deterrence. Given this background, general deterrence could be based primarily on conventional superiority. The nuclear capability should be considered as an additional safeguard against major adverse changes (though apparently at present with very low probability) in regional politics.

However, the situation might become more complicated were Iran, for example, to become involved in defense commitments in conjunction with an Arab military coalition. Here specific deterrence is relevant. Adversarial regional actors might perceive the role of Iranian nuclear threats as a component in their armed conflict with Israel. They might assume that an Iranian deterrent "umbrella" would undercut Israel's "escalation dominance" capabilities. Consequently, they might assume that Israel would be constrained in its responses to Arab military attacks. Were deterrence to fail and should Israel escalate with all its military might under conditions of military superiority, escalation to the nuclear level might ensue.

In this context, Israel might be less confident in either employing highly offensive measures to bring about the complete destruction of adversary

forces or deeply penetrating its territory. To be sure, such exercise of Israeli force may in any event not be beneficial from Israel's point of view, since the experience of all prior Israeli-Arab wars has already demonstrated that an Israeli total victory is very problematic. Israel has always found it difficult to translate military victory into a major political achievement. (The Israeli-Egyptian peace process did indeed take place following the occupation of the Sinai by Israel in 1967, but only after Israel agreed to withdraw from the Sinai and with the convergence of additional conditions).

In all these potential situations mutual nuclear deterrent threats might be invoked. Preventing escalation to the nuclear level would depend on several factors, many of them described here. Delineating some rules of engagement accepted by both regional nuclear powers might become necessary in order to prevent dangerous escalation.

Israeli nuclear deterrence against the use of chemical and biological agents would become much more dubious. If deterrence failed, it would be irrational for Israel to use nuclear weapons and thus cross a dramatic threshold, providing legitimization for the use by opponents of similar weapons.[10] This line of reasoning could be followed by adversaries and lead to the conclusion that Israel's nuclear deterrence against the use of chemical and biological agents is not credible. This implies that Israel should develop a posture of escalation dominance where nuclear deterrence is limited only to deterrence against adversarial use of nuclear weapons.

Measures to Enhance Stability

The first measure to enhance stability involves political relations. There are sufficient reasons why Israel should have an interest in securing peace with Syria and managing its relationship with the Palestinians, but in addition such developments would considerably curb the dangers resulting from a nuclearized Iran. The second measure involves American and international efforts that could contain further proliferation in the Middle East, including the extension of American defense guarantees to regional countries and the strengthening of the global non-proliferation regime, which might constrain proliferation inclinations. On the other hand, global drifting towards wider proliferation, be it even to status quo powers, might enhance regional tendencies towards proliferation.

In addition, establishment of direct communications between Israel and Iran could serve as an important mechanism in redressing dangers involved in the nuclearization of Iran. This presumably will have two functions: first, improving the overall relationship between Israel and Iran in order to reduce threats of friction leading to escalation. Whether such an improvement is possible given the significant gaps between the two countries remains to be seen. Second, even in the absence of political improvement, communication designed to manage critical crises should be developed. Third parties could also play a role in communicating between the parties. Were American-Iranian relations to improve, the US could act as a crisis manager, receiving and delivering messages between the two adversaries. Alternatively, a neutral organization might act as a conduit.

There is a difference between two types of crisis management: first, when an impending potential crisis is monitored and attempts are made to defuse it before it materializes; second, dangerous escalations in which there is an immediate development requiring response. The hot line established between the superpowers was designed to contend primarily with the second type. Ultimately, in order to preempt potential catastrophic results of the second type, direct lines of communications are necessary.

In addition – and the following comments touch only on the Israeli dimensions – is the issue of nuclear socialization. It is important for decision makers to consider much more intensively the various scenarios and possibilities that might arise within the context of an Israeli-Iranian nuclear relationship. Indeed, under conditions of crisis, decision makers tend first to rely on standard operating procedures that were already formulated beforehand. A doctrine for nuclear behavior will then gain high prominence in the decision making process. A "bounded rationality" model fits this crisis behavior.

Formulating various contingency plans and an overall doctrine is also part of the socialization of decision makers on nuclear issues. There are some very general issues that merit more extended discussion. First, the actual use of nuclear weapons is such a momentous event with many unexpected and potentially devastating consequences that it should be avoided in almost all circumstances. Therefore there should be a gap between deterrence threats and the actual exercise of the threats. While Israel might find it necessary to issue deterrence threats that could be

interpreted as nuclear, the actual exercise of such threats should be left to further discussion should deterrence fail. At the same time, the realization of this critical gap between threat and its exercise should also inform the nature of the deterrence signals. Second, Israel should not automatically emulate the strategies and their underlying rationales adopted by the United States. For example, in contrast to current American strategy, Israel should not threaten nuclear retaliation for adversarial use of chemical and biological weapons.

Deterrence relies to a certain extent on uncertainty. However, both sides should perceive the other as primarily a rational actor. Contrary to the famous formulation of the "rationality of irrationality" and to notions of "crazy states," nuclear deterrence should be conducted primarily as a rational instrument, and hence exercised only in the most critical circumstances. These observations should reflect also on various scenarios for "last resort" and battlefield uses.

The possibility of an American-Israeli defense treaty requires a separate analysis. Such a treaty could probably enhance deterrence against Iranian irrational behavior. Finally, there is the question of "no first use," which also requires a separate analysis. An agreement for no first use would arguably serve the strategic interests of both parties. It could materialize either through formal agreement or through unilateral steps such as declared doctrine for no first use.

Concluding Observations

Nuclear relations between Israel and Iran would be inherently unstable due to several contextual conditions Chief among them are: the nature of the Middle East state system in a conflict-ridden region with several foci of violence; the extreme ideological position of the current Iranian leadership against Israel and the likelihood that it would also try to apply coercive diplomacy vis-à-vis its neighbors; the lack of socialization in nuclear affairs primarily on the part of Iran, though to a lesser extent on the part of Israel as well; the inherent problems of C^4ISR systems in the Middle Eastern context; the difficulties in successfully communicating nuclear tolerance thresholds and consequently in formulating rational strategic responses; the absence of any direct channels of communications; and the lack of crisis management mechanisms.

The example of the India-Pakistan nuclear relationship demonstrates, first, that the introduction of nuclear weapons does not by itself lead to more cautious behavior on the part of adversaries. Second, the existence of nuclear weapons might even encourage irresponsible behavior, on the assumption that the adversary would be deterred from conventional retaliation for fear of crossing a nuclear threshold. Third, there is a high probability that nuclear signals will not be understood and that mutual misperceptions would lead to nuclear escalation. Fortunately for both India and Pakistan, the United States intervened and helped the parties to deescalate. Moreover, both India and Pakistan are currently trying to establish various CSBMs designed to reduce the fear of another dangerous escalation.

Nuclear optimists argue that the introduction of nuclear weapons immediately or ultimately stabilizes conflict relations (though some suggest that such stabilization depends on several additional conditions). In contrast, nuclear pessimists regard nuclear weapons as not inherently stabilizing conflict relationships, with life in a nuclear world (or regions thereof) as necessarily permeated by the threat of nuclear escalation. Only great and focused efforts could contain such threats.

Notes

1 There is a rich body of literature on nuclear proliferation. For some initial theoretical contributions as to the structure of the international system see the various chapters in Alastair Buchan, ed., *A World of Nuclear Powers?* (Englewood Cliffs, NJ: Prentice Hall, 1966); and Richard Rosecrance, "International Stability and Nuclear Diffusion," in *Problems of Nuclear Proliferation*, Security Studies Papers no.7, UC, 1966. For early work on the potential stabilizing effect of proliferation see Pierre Gallois, *The Balance of Terror: Strategy for the Nuclear Age* (Boston, 1961). For a well known debate on the effects of proliferation, see Kenneth Waltz and Scott Sagan, *The Spread of Nuclear Weapons: A Debate* (New York: Norton, 1995).

2 Several observers have argued that nuclear deterrence in fact operated in the crisis and led to its diffusion. See for example Devin T. Hagerty, "Nuclear Proliferation in South Asia: The 1990 Indio-Pakistani Crisis," *International Security* 20, no. 3 (1995-96): 79-114. For an opposed view see George Perkovich, *India's Nuclear Bomb* (Berkeley: University of California Press, 1999).

3 There have been many accounts of the Kargil and 2002 crises. For a very good account of the 2002 crisis see Steve Coll, "The Stand Off," *The New Yorker*, February 13, 2006 and the interview with him, "The Nuclear Edge," *The New Yorker*, February 13, 2006. For an argument that the nuclearization of the Indian subcontinent has contributed to the crises, see for example Pervez Hoodbhoy and

Zia Mian, "The Indian–Pakistani Conflict: The Failure of Nuclear Deterrence," *Znet*, November 24, 2002. For an assessment of the Indian-Pakistani nuclear relationship see Michael Quinlan, "India-Pakistan Deterrence Revisited," *Survival* 47, no. 3 (2005): 103-16. For an account of the American diplomatic effort in the crises, see Strobe Talbot, *Engaging India* (Washington D.C. Brookings Institution Press, 2004).

4 For some general accounts of the Indian and Pakistani nuclear programs and strategies see the various contributions in Jasjit Singh, ed., *Nuclear India* (Delhi: IDSA, 1998); Perkovich *India's Nuclear Bomb*; Peter Lavoy, "Pakistan's Nuclear Posture: Security and Su*rv*ivability" (Washington, D.C.: Nonproliferation Policy Education Center, 2007); Syed Rifaat Hussain, "Analyzing Strategic Stability in South Asia with Pathways and Prescriptions for Avoiding Nuclear War," *Contemporary South Asia* 14, no. 2 (2005): 141-53; Waheguru Pal Singh Sidhu, "India's Nuclear Use Doctrine," in Peter Lavoy, Scott Sagan, and James Wirtz (eds.), *Planning the Unthinkable* (Ithaca: Cornell University Press, 2000).

5 There have been several attempts to gauge the intentions of the Iranian leadership in pursuing its nuclear program. See for example Ephraim Kam, *A Nuclear Iran: What Does it Mean, and What Can be Done*, Memorandum no. 88 (Tel Aviv: Institute for National Security Studies, 2007).

6 For some analyses pointing out the rationality and pragmatism of the Iranian leadership, see David Menashri, *Post Revolutionary Politics in Iran: Religion, Society and Power* (London: Frank Cass, 2001), chs. 7 and 8; Shireen T. Hunter, *Iran after Khomeini* (New York: Praeger, 1992).

7 See *The Military Balance* (London: IISS, 2007).

8 On the perceptions of the radical conservatives led by Ahmadinejad concerning the outside world, see Ali Ansari, *Iran Under Ahmadinejad* (London: Adelphi Paper 393, IISS, 2007).

9 For studies of the Israeli nuclear posture see Shai Feldman, *Israeli Nuclear Deterrence* (New York: Columbia University Press, 1982); Yair Evron, *Israel's Nuclear Dilemma* (Ithaca: Cornell University Press, 1994); Yair Evron, *Weapons of Mass Destruction in the Middle East*, Occasional Paper 39 (Washington D.C.: The Henry Stimson Center, 1998); and Zeev Maoz, *Defending the Holy Land* (Ann Arbor: University of Michigan Press, 2006). For the history of the Israeli nuclear project see Avner Cohen, *Israel and the Bomb* (New York: Columbia University Press, 1998); for the history of the diplomatic relations between Israel and the US on the nuclear project, see Zaki Shalom, *Israel's Nuclear Option: Behind the Scenes Diplomacy between Dimona and Washington* (Brighton: Sussex Academic Press and Jaffee Center for Strategic Studies, 2005).

10 It is not clear to what extent the Israeli ambiguous threats against Iraq during the 1991 Gulf War deterred Iraq from launching chemical weapons against Israel. Shai Feldman has argued that Israel's implied nuclear threat did indeed deter Iraq from attack. See Shai Feldman, "Israeli Deterrence: The Test of the Gulf War," in Joseph Alpher, ed., *War in the Gulf: Implications for Israel* (Tel Aviv: Jaffee Center for Strategic Studies, Tel Aviv University, 1991), pp.170-89. For a counter argument see Yair Evron, *Israel's Nuclear Dilemma*.

Chapter 4
Missile Defense and Israel's Deterrence against a Nuclear Iran

Uzi Rubin

Israel's national security doctrine has been molded in a reality of gaping asymmetry, both geographic and demographic, between itself and its hostile neighbors. The security environment of a tiny country with a small population surrounded on three sides by substantially larger states and overwhelmingly larger populations has perforce bred an offensive military doctrine and the preference for offensive rather than defensive weapons. Lacking protective geographical features such as mountain ranges, large rivers, or surrounding seas, Israel, like other small countries in the same situation, could not afford the huge costs of permanent, costly defensive fortifications. Preemptive wars, of which the Six Day War was perhaps the most outstanding example, were always seen in Israel as the preferred military doctrine.

It is not surprising, therefore, that public debate in Israel on deterring a prospective nuclear Iran is conducted in aggressive terms and focuses on offensive capabilities. The few analysts who examined the issue of defense against the evolving threat of Iran's long range missiles judged strategic defense as trivial or even detrimental to Israel's security. Missile defense was described as a useless "strategic fallacy" that contravenes the IDF's longstanding military doctrine[1] and an anachronism that is easily suppressed, "since in the era of missiles, offense holds an absolute advantage over defense"; as a danger to stability and an incentive for a preemptive strike on Israel;[2] and as irrelevant since it cannot guarantee against the penetration of one single nuclear missile and is in fact an admission of weakness.[3]

Nuclear deterrence theory evolved in the United States at the start of the Cold War. The debate on credible deterrence against a nuclear antagonist lay at the core of the wider debate on national security doctrine. Much attention was given to the issue of defense systems, their feasibility, and their implications for deterrence, and to the stability of the confrontation between the two superpowers. Occasionally the debate on strategic missile defense intensified to overshadow all other dimensions of the nuclear debate, for instance following President Reagan's announcement of the Strategic Defense Initiative (SDI – "Star Wars"). While a consensus was never reached on this subject, the extensive analysis of the value of strategic defense and the accompanying wide public debate, which was waged by the best military and political brains in the US, were quite thorough and addressed the issue from every conceivable aspect – political/military, technological, and economic.

Israel, in contrast, has to date seen no significant debate on deterrence against nuclear threats, not to speak of the prospective role of missile defense in such deterrence. As in the early 1980s when Iraq was on the verge of attaining a nuclear capability, so today public debate in Israel vis-à-vis Iran focuses on how to stop Iran's nuclear program – by political or other means – rather than on how to deter Iran if the attempts to stop its program fail. It is hardly surprising, therefore, that defense in the nuclear age has not been addressed in Israel more deeply than at a superficial level, and that whatever conclusions were drawn were colored by traditional concepts of conventional rather than nuclear conflicts.

This paper strives to correct the situation and analyze in detail the role of missile defense in the overall deterrence doctrine against a nuclear Iran. This will be discussed from the perspective of the survivability of Israel's retaliation force rather than the minimization of damage to Israel's population. It will be argued that in Israel's specific environment, missile defense stands to play a key role in Israel's deterrence doctrine. In fact, missile defense is destined to be the most visible measure among all the survivability measures and will therefore have the most important position in the gain versus loss calculus of any nuclear aggressor concerning the prospect of its own survival following a strike on Israel.

Originally conceived to counter the threat of chemical missiles from Syria, Israel's missile defense array is apt to be even more significant

against a nuclear Iran. Yet defense is not an end in itself. Defense should augment offense rather than replace it. Thus, the question is not whether defense is preferable to offense, but rather how to combine the two for optimal results. Israel must retain all its offensive assets to deter a nuclear Iran. The role of defense will be to provide viable survivability to the offensive assets, thereby leveraging their deterrence value.

The Evolution of Israel's Missile Defense

The quest for defensive responses against the looming missile threats started in the late 1980s, when then-Minister of Defense Yitzhak Rabin decided on Israel's participation in President Reagan's Strategic Defense Initiative. Rabin viewed the emerging missile threat as one of the most dangerous future threats to Israel's security[4] and supported the notion of deploying an active defense system against it. Later, he approved launching an R&D program that eventually led to the Arrow program. The Iraqi missile attack in 1991 found Israel devoid of any means of defense. This compelled then-Minister of Defense Moshe Arens to direct the Israel Ministry of Defense (IMOD) and the Israel Defense Forces to acquire the US-made Patriot PAC-2 extended air defense (with some capability of intercepting ballistic missiles) and to embark on a full scale development program of the indigenous Arrow missile defense system. Rabin, on his return to the post of defense minister (as well as to the post of prime minister), confirmed Arens' directives and allocated the necessary budgets for implementation.

Following a string of failures in its first three years, the Arrow program finally hit its stride and accumulated a growing record of successful tests. To date, the Arrow has scored fourteen successes in sixteen tests, a success rate of about 88 percent. Initial operational capability was achieved in December 2000, with full operational capability achieved not much later. The system is currently in operation by the Air Defense Command of the Israel Air Force (IAF) in conjunction with the US Patriot system, which serves as the lower tier in a combined two-tier missile defense array protecting most of Israel's homeland territory.

The Arrow program was not a solo venture, and Israel invested in other concepts of defense against missiles. During the 1990s Israel's Ministry of Defense studied the concept of destroying missiles during their boost phase by specialized air-to-air missiles – dubbed MOAB – launched from

deep loitering UAVs. While showing promise, the study was terminated by the IMOD. Another concept, using high energy laser to shoot down incoming missiles, was jointly investigated by the US military and the IMOD but after scoring some spectacular successes in the test phase was subsequently abandoned. However, the high energy laser concept was aimed to defend against tactical, short range rockets (e.g., Katyusha) and not against ballistic missiles from Syria or Iran, and is thus irrelevant to this paper.

The decision to develop and deploy an indigenous missile defense system was not reached easily and was accompanied by a sharp and sometimes shrill debate, mostly behind the closed doors of the IMOD but in some cases also in public. The most incisive criticism of the concept of missile defense for Israel was aired by Dr. Reuven Pedatzur in a comprehensive study published in 1993 by the Jaffee Center for Strategic Studies (forerunner of the Institute for National Security Studies).[5] The arguments made in that study conformed to the opinions of numerous defense officials and analysts, and echoed many of the arguments made by the SDI critics in the US.

Pedatzur argued that it was exceedingly simple to fool an Arrow-type defensive system with simple, cheap, and easily installed countermeasures that would render the Arrow system ineffective. He doubted Israel's defense industries could rise to the challenge of such a complex system, citing anonymous experts in the IDF who predicted that the system would not be able to be deployed before 2010. He envisaged enormous costs that would distort budgeting priorities and divert funds from vital enhancement of the IDF's warfighting capability, thus forcing a profound revision of Israel's national security doctrine. He further argued that even if effective against conventional, chemical, and biological missiles, the Arrow would not be relevant against future threats of nuclear missiles, since it would never be able to supply hermetic defense and the impact of even one single nuclear missile in Israel's dense urban area would be an existential threat to Israel.

Following the first Shahab 3 test in Iran, Pedatzur contended there was no reason why a credible mutual deterrence could not be achieved, since Iran would have no real interest to attack Israel – on the contrary, it would have an interest in reducing regional tensions. In his opinion, Israel should

aim to dissuade Iran from launching missiles against it rather than defend itself against such missiles. The way to do it, in his opinion, was to rely on an explicit threat of devastating retaliation. In his view, missile defense will contribute nothing to the balance of deterrence vis-à-vis Iran.[6] Pedatzur and other critics argued that other countries also refrain from developing or deploying missile defenses, and called upon the government of Israel to follow suit.[7]

With the passage of time, most of Pedatzur's pessimistic predictions proved unfounded. Israel's defense industries overcame the technical challenge, the system's development was completed a full decade ahead of what was predicted, and there are no indications that the expenditures for the Arrow harmed other IDF procurement plans to any degree whatsoever. Israel's national security doctrine has indeed undergone fundamental changes, but these are due to the dramatic developments in the region – the war in Iraq and the ascent of Iran as a regional power – rather than to anything to do with missile defense.[8] Compared with those tectonic changes in the Middle Eastern theater, the purportedly destabilizing effect of Israel's missile defense is at most minute.

Contrary to the assertions of Dr. Pedatzur and other critics, Israel's policy of active defense against missiles parallels rather than counters worldwide trends: Japan, India, and Turkey formally adopted active defense policies and all three are engaged in developing or procuring such systems. Major European countries, whether as NATO members or individuals, are developing, buying, and integrating deployable missile defenses. The European parliament accepted a recommendation to favor a continent-wide defense against missiles. Most of the Gulf states, driven by the same concern as Israel, are seeking defense systems against the Iranian missile threat.

Israel's missile defense is now an established fact, and most of the warnings issued by critics have failed to materialize. One could rest at this point and regard the entire debate as an historical anecdote. Nevertheless, and in the face of the looming threat of a nuclear Iran, it is worthwhile to revisit one of the critics' major arguments, namely, that against the threat of a nuclear tipped missile, active defense is meaningless because it cannot guarantee against a single nuclear missile evading the defense and

wreaking havoc in Israel. The focus of this paper is the examination and discussion of this claim.

Prerequisites for a Credible Israeli Deterrence

Before discussing the role of missile defense in the establishment of a credible deterrence posture, the question arises whether a nuclear Iran will be deterrable at all. Iran is frequently referred to as an "irrational" state, a state whose decision making processes do not proceed along rational lines and that might choose to act in a suicidal manner. Since a suicidal actor cannot be deterred, it follows that if the assumption is that the Iranian regime is suicide-bent, Iran as a state is undeterrable.

A cursory examination of the Iranian regime's record and way of doing business casts a significant doubt on the hypothesis of a suicidal Iran. A full discussion of the nature and modus operandi of the Islamic republic is beyond the scope of this paper, yet it is enough for our purposes to take note of two aspects of Iran's conduct and grand objectives: first, Iran's cool and calculated management of the uranium enrichment crisis vis-à-vis the international community, and second, Iran's vision of itself as the leader and prime mover of the Islamic world. Both aspects do not support the portrait of a suicidal regime, eager to sacrifice itself for the cause of global Islam, rather of a pragmatic regime that aspires to become the leader of global Islam. It is more plausible to assume that Iran, fanatical and radical as it is, will continue to be a rational player that will do the utmost to advance its radical agenda but will do so pragmatically and with a careful weighing of gains versus losses.[9] Judging by Iran's actions rather than its rhetoric, it can be assumed that Iran is deterrable. With this assumption we can now proceed to discuss the conditions for establishing a credible deterrence against a nuclear Iran.

Europe and the US wield considerable levers over Iran, including political, economic, and military. This is not true in the case of Israel. By itself, Israel cannot exercise any influence over Iran's economy and only a slight influence over its international ties. On the other hand, and judging by numerous expressions of Iranian officials, it can safely be assumed that Israel wields a significant military lever. Iran claims that Israel is a nuclear state and demands that it denuclearize. In Iran's perception, Israel has a strategic air arm with sufficient range to inflict unacceptable damage on

Iran's major cities. It is reasonable to assume that for a rational leadership – regardless of its radical worldview – this perceived Israeli capability would act as a significant deterrent, *but only if* that leadership is entirely convinced that an Israeli retaliation is inevitable and that there is no way to evade this retaliation. Iran's own perception of Israel's strategic capability can be exploited to establish a credible deterrence, pending Iran's perception that it has no way to frustrate an Israeli retaliation.

The above hypothesis might be rebutted with an argument that whatever damage is universally perceived as unacceptable is from Iran's standpoint quite acceptable. In December 2001 Hashemi Rafsanjani, one of the most influential leaders of the Islamic Revolution in Iran, preached a Friday sermon in a Tehran mosque, stating that a nuclear Iran would have the advantage since "Israel could be destroyed by one single nuclear bomb while the Islamic world could absorb many nuclear hits."[10] If this represents the Iranian leadership's belief in a "winnable nuclear war," then Israel's deterrence would be entirely reliant on nuclear guarantees from Europe and the US. On the other hand, official Iran remained mute on the subject and no official confirmation of the "Rafsanjani doctrine" has ever surfaced. It is thus not impossible that Rafsanjani's statement expressed a personal opinion that did not necessarily represent a consensus among the leadership. Assuming with some confidence that this is indeed the case, we can propose that Israel's own military levers could, under certain conditions detailed below, serve to establish credible deterrence against a nuclear Iran.

Deterrence and Crisis Stability

By themselves, military levers are necessary but not sufficient to ensure a stable deterrence posture. The stability of the Cold War confrontation relied not only on the mutual fear of total annihilation, but on an extensive network of communication channels between the antagonists and on the crisis management mechanisms established by them almost from the outbreak of that conflict. From an historical perspective, there was no "ancient foe" syndrome between the US and the USSR, both being relatively new political entities in the world's history. Furthermore, immediately prior to the Cold War both superpowers allied themselves in a bitter and bloody war against Nazi Germany. The Cold War itself did not alter the formal state of

peace between the superpowers, which continued to maintain fully staffed embassies in each other's capital cities. When both countries realized that they could bomb each other to oblivion, they created real time, confidential communication channels between their national leaderships to ensure against misunderstandings. Both superpowers readily negotiated and often concluded arms control treaties (i.e., the ABM treaty) to reduce tensions and alleviate economic burdens. The Cuban missile crisis was resolved not by the actual use of force but through engagement and negotiations that drew on the entire spectrum of the communication channels between the two superpowers, set up to resolve exactly such situations.

None of the characteristics and mechanisms that prevailed during the Cold War prevail today between Iran and Israel, nor are they likely to prevail in the foreseeable future. The two countries were closely allied before the Islamic Revolution of 1979; following the revolution, the new Iranian regime adopted the Islamic world's legacy of hostility towards Israel, embellishing it with the most virulent anti-Semitic propaganda since the 1930s. The prospects of arms control agreements between Israel and Iran are practically nonexistent. There are no direct, rapid, and confidential communication links between the two governments and none appear on the horizon. Indirect communications channels – through third parties or the UN – could be too slow and thus ineffective in crisis situations. In short, and contrary to the proposal of some Israeli analysts,[11] the Cold War cannot be taken as a model or serve as a guide to a stable mutual deterrence in an Israeli-Iranian standoff.

In the absence of any "external" Cold War-type stability mechanisms, the stability of the deterrence equation between Israel and Iran will be wholly dependant on "internal" mechanisms – namely, the intensity of Iran's own concerns of surviving Israel's retaliation following an Iranian first strike. Lacking external mechanism, stability will be wholly dependant on the question of how Israel is perceived by Iran. To achieve stability, Israel must project an image of its retaliatory forces' invulnerability to any Iranian strike. Furthermore, Israel must strive to make sure that Iran's leadership is convinced beyond any doubt of the inevitability of Israel's aggressive response, of Israel's capability to launch such a response on its own (and not by a third party), and of the intolerable damage that will be generated by that response. Finally, Israel must strive to cause Iran to gain

this perception on its own, through its own national intelligence means and by its own internal debate and decision, rather than through Israeli declarations of policy (like the futile threats aired by Israeli leaders on the eve of the Iraqi Scud attacks in 1991).

There are no winners in a nuclear war, and from Israel's perspective the required achievement is not how to "win" a nuclear war but how to avoid it. Pedatzur's observation that "Israel's policy should be that no nuclear missiles are launched"[12] – by either side – is very apt, both in times of tranquility and in crisis scenarios.

The supreme test of deterrence occurs in crisis situations. It is not illogical to suppose that a rational leadership, as fanatic as it may be, will recoil from launching a surprise nuclear attack "out of the blue" if the anticipated reprisal outweighs the gains from such an attack. In crisis situations, however, the calculi of gains versus losses and of advantages versus disadvantages acquire a totally different flavor. In the heated atmosphere of a crisis, factors like national prestige, personal pride, and sheer panic play prominent roles, tending to cloud rational judgment and push towards dangerous threshold policies. Moreover, when there is no way to exchange official messages between protagonists, as is the case between Israel and Iran, huge gaps in respective perceptions of reality are possible. Overheated statements to the press, routine military activities, satellite launches, natural disasters, or industrial accidents can all be misinterpreted in the distorted thinking process typical of a crisis as a telltale sign of a forthcoming nuclear strike. When deterrence is exclusively based on offensive weapons and doctrines, the temptation of "use them or lose them" can overpower rational gain and loss calculations and precipitate a nuclear first strike.

Finally, and especially since Iran views Israel as a Western appendage, economic or political steps taken by other countries against Iran might be misinterpreted by Tehran as Israeli plots and precipitate a strong reprisal. Israeli deterrence must be strong enough to mitigate any aggressive impulse from Iran even in crisis situations that are not directly connected to Israel.

The Contribution of Israeli Missile Defense to Deterrence Credibility

Military victories are predicated on the actual use of force. In contrast, the essence of deterrence is the non-use of force to achieve what we might call "cognitive decision." Israel's missile defenses must be demonstrably capable of intercepting and destroying incoming missiles, and Israel's retaliatory forces must be capable of overcoming hostile air defenses and delivering devastating blows on the aggressors' territory, but their very use – even if they score stellar results – will be synonymous with the failure of deterrence. The primary measure of effectiveness for Israel's strategic assets, whether offensive or defensive, is how threatening they are perceived by the other side; how they fare in actual conflict is secondary.

Retaliatory systems that would be considered vulnerable to a surprise attack are not likely to achieve the cognitive decision that is a prerequisite for stable deterrence. In the Cold War both superpowers achieved cognitive decision by deploying multiple families of retaliatory systems and by using their huge land masses for dispersion, with multiple basing modes on the ground, under the sea, and in the air and heavy sheltering in silos (and also, at least in the case of the Soviet Union, by extreme land mobility). This secured the survivability of their strategic retaliation weapons beyond any reasonable doubt. War games conducted on both sides demonstrated that a second strike from the other side was bound to come, no matter how devastating the first strike. Once this cognitive decision was reached, investments in further survivability measures yielded diminishing returns. This made missile defense superfluous at the time, paving the way towards the ABM treaty.

In contrast, Israel's tiny land area cannot offer the wide spaces needed for dispersion, and its relatively modest economy cannot afford a superpower-style multiplicity of retaliatory measures. Israel's population, economic assets, and military bases are all concentrated in an area not much larger than Rhode Island. This, and the perception that Israel's investments in defense are declining over time, could act as powerful temptations for an aggressive action by Iran. A rational aggressor, fanatic as it might be, will strive to wipe out Israel's retaliatory means before it proceeds to launch a nuclear strike on Israeli cities. This, of course, would be a grave error on the side of Iran, an error that would incur terrible consequences for Iran

(as well as Israel). The prime objective of Israel's deterrence is, then, to dissuade Iran from making such an error in the first place.

To illustrate the point, consider Israel's main strategic strike asset – the Israel Air Force fleet of long range attack aircraft. Open literature on the IAF force structure and disposition[13] reports that it deploys in twelve air bases, six of which host the more modern types of aircraft (names and locations of those air bases are provided in the literature). Theoretically, then, a first strike by no more than six nuclear Shahab 3 missiles – one for each prime air base – would be enough to knock out Israel's airborne second strike option, paving the way to an entirely immune follow-up strike against Israel's centers of population.

It is reasonable to assume that the Iran would plan on launching some extra Shahab missiles to compensate for malfunctions and inaccuracies, but in any event, it is obvious that the concentration of Israel's strategic assets in a small number of locations requires just a handful of Shahab missiles to take them out, not much more than the salvo of Iraqi missiles that hit Israel during the Gulf War in 1991.

Enter Israel's missile defense system, which changes the situation completely. As pointed out by Pedatzur, rational Iranian planners would have to factor in an efficient defense system with an upper performance limit equal to what Israel has demonstrated in repeated tests – any lesser assumption would be tantamount to gambling with Iran's continued existence. In concrete terms, this means that the Iranians will have to factor in a kill rate for the Arrow of at least 80 percent in each individual engagement. According to open literature,[14] Israel has now deployed three Arrow batteries. Each battery includes eight launchers each holding six interceptors, for a total of 144 Arrow interceptors deployed and ready to fire. In addition, Israel deploys several Patriot PAC 2 batteries, to be upgraded to PAC 3 capabilities, providing the second tier for its missile shield.[15]

A simple statistical analysis indicates that if every single Iranian Shahab aimed at an IAF base is engaged by one single Arrow missile, three out the six targeted bases will survive with absolute certainty and that there is a 90 percent chance that four bases will remain untouched (figure 1, curve 1). With the launching of only six interceptors, the bulk of the Arrow and Patriot missile will remain ready to face a follow-up strike. From the point

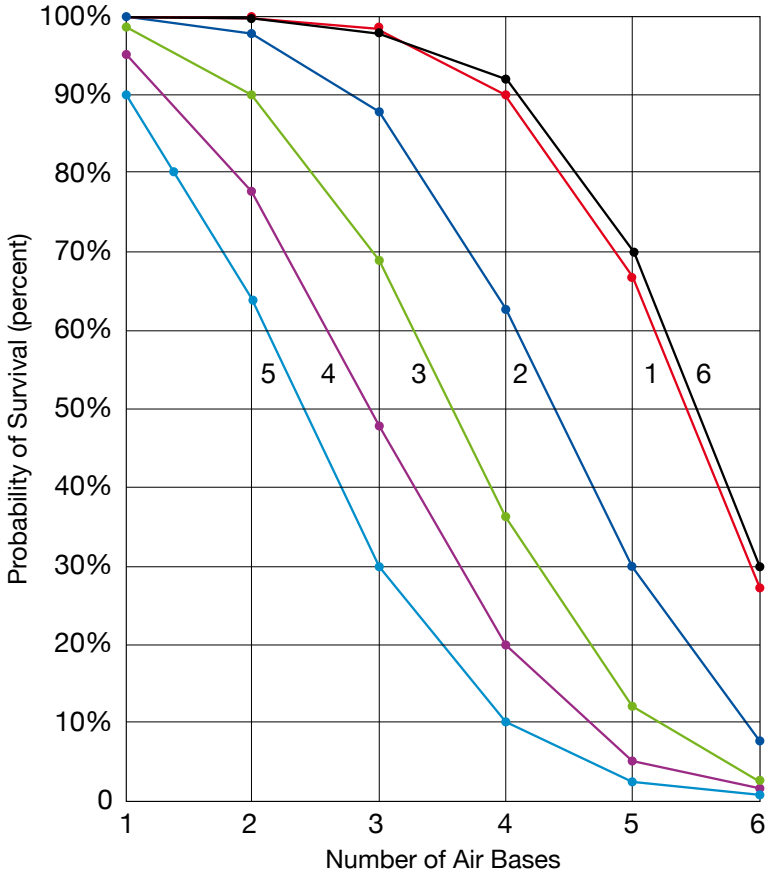

Figure 1. Air Base Survival Probability in Shahab Attack

of view of the aggressor, this is tantamount to failure, since enough air bases will survive to launch a massive retaliation.

Iran could increase its chances of taking out the IAF on the ground by launching several Shahab missiles at each air base. Curves 2, 3, 4, and 5 in figure 1 show the chances of survival of the IAF prime bases against salvos of 12, 18, 24, and 30 Shahab missiles, respectively, when each is engaged by a single Arrow or Patriot interceptor. In the case of a massive salvo of

30 nuclear Shahabs, each engaged by one Israeli interceptor, there is a 90 percent chance that five out of the six prime IAF bases will be hit, seriously eroding Israel's capability to launch a retaliatory strike.

However, professional Iranian planners will have to take into account a multi-tier defense system that can engage each incoming Shahab twice, three times, and even more.[16] Again, simple calculations show that when engaging each of the thirty incoming threats by two interceptors, Israel's missile shield could destroy the vast majority of the incoming Shahab missiles and ensure the survival of at least three bases and possibly four, as seen in curve 6 of figure 1. This simple war game could be extended even further with increasingly heavier salvos, countered by increasing number of engagements, with the same disappointing results from Iran's perspective. Diluting the salvos with conventional Shahabs to exhaust Israel's interceptor stockpiles will decrease the prospects of destroying the IAF, since the impact from a conventional warhead is not likely to impede its air operations seriously. A preliminary strike at the missile defense assets (provided the Iranians know their location) will again yield disappointing results since the system will defend itself with the same efficiency – and between the strike on its missile defense and the subsequent strike on its air bases, the IAF could slip through a devastating strike package.

It should be noted that launching a massive 30 nuclear Shahabs salvo is a major undertaking even for a much more advanced nuclear power such as France or the UK. The lethal effect of thirty nuclear bombs going off almost simultaneously – near the ground or in the upper atmosphere – will be devastating not only to Israel's population but to the Palestinian, Lebanese, Jordanian, and Egyptian populations. Under certain meteorological conditions, the lethal effects could spread to Iraq and even to Iran itself.

This simple war game can be repeated by any Iranian science student with a $25 calculator and access to the internet. Without the need for Israeli leaders to make detailed or threatening declarations, it brings home the truth: that Israel's missile shield, by its very existence, overturns the strategic equation in two ways. First, it transforms the IAF with its small number of prime bases from an easy prey (in Iran's perception) to an almost impregnable objective. Second, it raises the ante for Iran, forcing its planners to specify ever-increasing salvos of nuclear Shahabs, the collateral effect from which could seriously risk Iran's own security and safety. Since

all the information needed to make such somber evaluations is readily available to Iran from its own sources, its stands to reason that the calculus of gains versus losses will be sobering enough to dissuade Iran, even in the midst of an ongoing crisis, from making a potentially disastrous mistake. The cognitive decision, the crucial condition for effective deterrence, is thus achieved.

The stabilizing effect of Israel's missile shield goes beyond the dry arithmetic of gains versus risks. The Arrow system was co-developed with the US and is reportedly designed to interoperate with US missile defense systems. The IAF holds frequent and well-advertised missile defense exercises with the US Army and US Navy. Any Iranian planner must factor in the presence of unknown numbers of US ground and naval missile defense assets at the time of the planned strike. Such assets could take part in the defensive action and catapult the effectiveness of Israel's missile shield even beyond its published performance. Furthermore, an Iranian offensive action that would result in US casualties might draw US retaliation in kind, even in the unlikely case that Israel's retaliatory assets are overwhelmed.

Missile Defense vs. Other Survivability Enhancement Measures

In a nutshell, then, Israel's missile defense is essentially a survivability enhancement measure for Israel's retaliatory assets. The question arises whether the investment in missile defense is more cost effective than other survivability enhancing measures such as dispersion, multiplication, or shielding.

There is no simple answer to this question, yet three significant advantages of missile defense come to mind. First, missile defense has a high public profile, in contrast to other lower profile and often confidential measures. Missile defense tests are closely followed by the general public and are therefore extensively and sometimes sensationally covered by the press. Noticeable successes in the test range tend to influence the thinking and judgment of analysts and decision makers. For example, when the Arrow system succeeded in destroying a real Scud B missile in a test, Egypt's leading paper *al-Ahram* concluded that Israel's missile defense system was changing the balance of power in the Middle East in Israel's

favor.[17] Since what we are seeking here is cognitive decision, investment in such a high visibility measure as missile defense is a better return on investment.

Second, Israel missile defense already exists, most of the heavy investments for its development and fielding have already been made, its capabilities have been put to the test, and its operators gained experience in field exercises and in the preparation for the Iraq War of 2003. New survivability measures might demand investments of the same order of magnitude as those already spent on the Arrow.

Third, the Arrow is a joint US-Israel program, with its costs shared between the two governments. The significant US share in the Arrow costs is in addition to the annual military aid allocations. Improving the Arrow for better performance and tightened defense, as is currently planned by the Arrow 3 concept,[18] is likely to gain significant US financial support. Other survivability enhancing measures, on the other hand, might not gain US financial support, and it is more likely than not that Israel would be reluctant to discuss them at all.

Conclusions

This paper has examined the critics' charge that a missile defense system that does not hermetically seal Israel's skies against each and every single nuclear missile is worthless. Assuming that Iran is a fanatic yet pragmatic enemy, the argument put forth here is that missile defense is even more significant against a nuclear Iran than against the conventional missiles of Israel's other enemies. The "single missile that gets through" argument is a logical consequence of the hypothesis of a suicidal aggressor. We believe this is not the case of Iran.

The ultimate concern that motivates most critics of Israel's missile defense is the fear that its costs will come at the expense of retaliatory weapons. In reality, deployment of the Arrow did not, as far as is known, block or slow down any other Israeli R&D or acquisitions program. From various statements of Israeli officials as well as from hints in the public domain, it can be reasonably assumed that Israel has not given up any offensive option against Iran. The zero sum game feared by the critics concerning investment in offensive versus defensive weapons is illusory. In Israel's particular situation, missile defense is not slated to replace

offensive options – on the contrary, it is deployed to protect them. The task of Israel's missile shield is not to ensure against the penetration of a single nuclear missile – this cannot be achieved with confidence in any case – but to enhance the survivability of the retaliatory assets, thus posing an existential dilemma to any aggressor.

In the absence of any communication channels with the leadership of a nuclear Iran, an Israeli missile shield will serve as the most visible survivability measure, and each successful test will send another powerful reminder of Iran's dilemma. At the same time, defense must not be seen as a comprehensive solution for achieving deterrence. The first and foremost condition for a credible deterrence is devastating retaliation assets. Missile defense's mission is to secure the survivability of those assets.

It would be better for Israel and the entire world that Iran remain non nuclear. Iran's nuclearization will pose a powerful challenge that requires significant national resources to establish a credible and stable deterrence posture. The missile defense shield that Israel has been prescient enough to deploy ahead of time is a key element in this deterrence, and the continued investment in its enhancement should be seen as necessary and unavoidable, part of the cost of safeguarding Israel's continued existence and prosperity against any odds, including a nuclear Iran.

Notes

1 Aryeh Stav, ed., *Ballistic Missiles: Threat and Response* (Tel Aviv: Yediot Ahronot, 1998), Preface.
2 Mark Heller, "Is the Arrow Really Needed?" *Jerusalem Post*, November 5, 1999.
3 Reuven Pedatzur, "A Dangerous Failure in Thinking," *Haaretz*, August 20, 2000.
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5 Reuven Pedatzur, "Arrow and the Active Defense against Ballistic Missiles – Challenges and Questions," Jaffee Center for Strategic Studies, Paper No. 42, Tel Aviv University, October 1993.
6 Reuven Pedatzur, "New Thinking against New Threats," *Haaretz,* July 17, 2000.
7 Reuven Pedatzur, "Like Europe, Not Like the US," *Haaretz*, July 12, 1999.
8 Ironically, the 2006 Second Lebanon War did cause a fundamental shift in Israel's military doctrine but in an opposite direction to Pedatzur's recommendation. Missile defense was endorsed as the "fourth leg" of Israel's revised doctrine, alongside the traditional triad of deterrence, warning, and decision. As a logical follow up of this shift in doctrine, the IMOD embarked on no less than three new missile defense programs.

9 Two of Israel's leading analysts, Dr Adir Pridor, founding head of the Institute for Industrial Mathematics, and Dr. Oded Brosh, Director of Studies at the Institute for Policy and Strategy in the Interdisciplinary Institute of Herzliya, voiced similar views on the rationality of Iran's way of doing business. See addresses at the 2008 Herzliya Conference on the Balance of Israel's National Security, January 22, 2008.
10 Iran News in English, December 14, 2001.
11 Reuven Pedatzur, "The Iranian Threat – Is It so Dire?" *Nativ* 2, no. 109 (March 2006): 39.
12 Reuven Pedatzur, "New Thinking against New Threats," *Haaretz*, July 17, 2000.
13 See for example www.globalsecurity.org.
14 See for example www.army-technology.com.
15 Barbara Opall–Rome, "Israeli Defenses to Use Artificial Intelligence," *Defense News*, January 21, 2008.
16 A two-tier system operates in the shoot – look – shoot mode. However, if conservation of interceptor stockpile is not a prime consideration – which would be the case in a nuclear strike – Israel missile defense could switch to a shoot – shoot mode and engage each incoming threat with three or more interceptors.
17 Galal Nasser, "Testing Arrow," al-Ahram Weekly Online, issue # 706, September 2-8, 2004. See weekly.ahram.org.eg.
18 Rubin Hughes and Alon Ben David, "Tier Pressure," *Jane's Defence Weekly*, July 11, 2007, p. 29.

Chapter 5
A Nuclear Defense Policy for Israel, Without Shelters

David Klein

Background

The intensive and wide ranging coverage of the Iranian effort to obtain a nuclear capability and the possibility that diplomatic efforts will not achieve success demand discussion of Israel's strategic approach to the nuclear threat.

Dealing with a nuclear threat incorporates four levels of response: deterrence, prevention, mitigation, and recovery. Discussion of mitigation necessarily addresses the issue of passive defense of the home front in general and the need for nuclear bomb shelters in particular. There have been discussions of this topic in the past in countries that were under nuclear threat. In the United States a decision was made not to construct shelters. Switzerland, despite not being under direct threat, prepared shelters for the entire population.

Constructing shelters for Israel's civilian population is not a new idea. Protective facilities for civilians have been built in Israel over the years (e.g., shelters, protective spaces, security rooms) based on different engineering specifications, ability to withstand damage by conventional weapons, and with suitable sealing specifications to protect against chemical and biological weapons. To date, public discussion about nuclear shelters has been negligible. A number of years ago the head of the protective defense department in the Home Front Command considered Israel's technical ability to construct shelters as if it were only a matter of making the right decision and allocating the necessary resources.

This paper addresses the issue of Israel's building shelters to protect civilians against a nuclear attack. It reviews the possible levels of contending

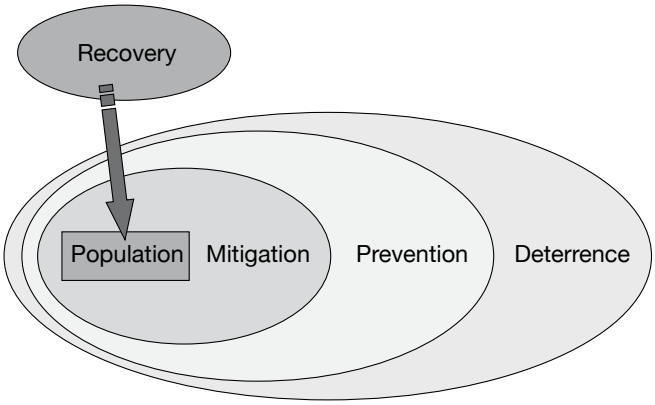

Figure 1. Layers of Response to the Threat

with the nuclear threat, surveys the approaches of selected countries to dealing with the threat, and analyzes the value of investing in shelters. The answer to the question of whether Israel should build shelters suitable for withstanding a nuclear attack depends on an analysis of the national implications of the results of such an attack. And in fact, from a national perspective, it is not correct to invest in nuclear shelters, and Israel should focus on other aspects of the response.

Layers of the Response to the Threat

The Iranian nuclear threat to Israel comprises a wide spectrum of possibilities, from a daylight strike on Israel using powerful nuclear weaponry, to an attack on Tel Aviv using a sole warhead when the civilian population has received ample warning and is suitably protected, to the use of nuclear arms as deterrence only.

Deterrence, prevention, mitigation, and recovery are levels of response vis-à-vis the Iranian nuclear threat, with each level offering several possible measures (figure 1). Israel can adopt different measures at the various levels, though not all of the steps merit development and investment of resources.

Deterrence involves ongoing, multidimensional activity and encompasses a large number of varied areas (political, military-strategic, economic, and so on), designed to deter enemies from taking action against Israel. Deterrence theory was developed during the Cold War by superpower strategists facing the nuclear escalation, and "the balance of

terror" formulated to underlie it deterred the superpowers from using such weapons against each other. Would this strategy also work when smaller nations are in a situation of conflict?

The 1999 Kargil crisis between India and Pakistan over the Kashmir region is an example of how nuclear deterrence can influence a conflict. An analysis of the case[1] shows that deterrence has limited the conflict and prevented it from escalating into a war.

Today, Israel employs a policy of ambiguity with regard to its nuclear capability, which thus far is adequate for providing a deterrent.[2] It is possible that if Iran achieves a nuclear capability, Israel's policy will have to change, for example to an open declaration of its nuclear capability and the subsequent generation of a balance of fear, just as emerged between the superpowers, followed by a development of second strike ability, and so on.

Prevention refers to active measures executed in order to prevent an attack with nuclear weapons. These measures should be employed while complementing the deterrence component. Measures that can be taken on this level include:

- Taking action when the weapons are in the development stage. There are two possibilities here: the first is "sitting tight," which will ultimately result in Iran's achievement of a nuclear capability. In such a case, as between the superpowers during the Cold War, deterrence will play a crucial role in Israel's strategy. The second option is action to prevent development, that is, action on the diplomatic level or offensive action to prevent the achievement of a nuclear capability (such as in the attack on the Iraqi nuclear reactor).
- Action after the weapons have been produced but have yet to be launched, namely, offensive action designed to impede the launch of the weapons.
- Action to prevent damage after the weapons have been launched, i.e., interception systems to prevent the weapons striking Israel once launched. Israel has developed capabilities on this level, including a missile interception system (the Arrow system).

Mitigation encompasses the framework of passive measures designed to limit the damage once the explosion occurs. The defense means against a nuclear threat on this level include: evacuation of the civilian population,

shelters (against shock waves or nuclear fallout, be they fixed or temporary shelters), dispersion or reinforcement of industrial facilities, and economic assets. Clearly, it is not practical to evacuate the population or to disperse and reinforce industrial facilities in dealing with a nuclear threat. Likewise and in a similar vein, shelters for the civilian population are not an appropriate solution for the nuclear threat.

Recovery: the damage that a nuclear attack will inflict on the fabric of life vis-à-vis its social, financial, and personal dimensions is incomprehensible. It is also not clear whether it would be possible to undertake a process of recovery and restore normal life. Certainly recovery would take a long time – many years – during which extensive physical recovery work would be carried out, and which would include cleansing wide areas of radioactive fallout, enormous investment in financial infrastructures, and considerable investment in health resources. It is clear to all that for now, there is no possibility of Israel's investing resources in this level of deployment.

Measures Taken by Other Countries

Various countries have emphasized different aspects of the response to the nuclear threat. The United States adopted the offensive approach; in other words, it focused on the deterrence layer and did not invest in building shelters for the civilian population. Switzerland, on the other hand, took a defensive approach and focused on the mitigation layer and, as such, invested in the construction and maintenance of shelters.

United States

The main area of American activity was in the development of its offensive ability for the purpose of bolstering deterrence. The US increased the number of its nuclear warheads, increased their power (megaton hydrogen bombs), and developed a second strike capability (primarily by developing a fleet of nuclear submarines).

An overall analysis of the required balance between the various dimensions of the American strategy was submitted to President Eisenhower in the Gaither report.[4] The report determined primarily that the best way to protect the American nation was to maintain and guarantee an effective response capability.

The United States also attempted to address the prevention layer. During the Cold War the Americans tried to develop and deploy missile interception systems, even though some American strategists thought such systems were actually detrimental to deterrence. This effort ended with the ABM treaty, which allowed each side to deploy only two anti-missile systems. In practice, the Americans deployed only one system, which was shut down after a few years. A "Star Wars" concept developed during the Reagan presidency years and attracted considerable resources, although no weapon systems were deployed. The US currently does not have any national missile interception systems, primarily because of the heavy costs involved.

The main components of passive defense examined by the United States in the process of attempting to formulate American nuclear strategy were: population evacuation; shelters (against shock waves or radioactive fallout, permanent or temporary shelters);[3] and dispersal and reinforcement of industrial facilities. In order to implement these measures, warning systems, civilian communications systems, damage control systems, and other such systems must also be provided.

The main issues raised in American strategic discussions on the subject of passive protection of the civilian population in general and on shelters for the civilian population in particular were:

- The right way to protect American civilians: are shelters an appropriate means?
- Can passive means of protection be developed at all that would be effective and significantly reduce the number of casualties and the extent of damage to the country in a nuclear attack?
- Can large numbers of civilians be transferred to the shelters in real time?
- How would life be conducted during prolonged stays in the shelters?

It is significant that with all the investments by the US and other countries in various military technologies, the technology of shelter construction has not changed meaningfully since World War II. Several features are needed to withstand a nuclear threat: thick concrete walls, deep excavation, and a filtering and ventilating system, and even then the occupants' survival is not guaranteed if the strike is close to the shelter.

In accordance with the strategy that was eventially adopted, investment in civilian protection in the US was very limited and was conducted according to the intensity of the threat on the country. In this regard three budgetary outlay peaks can be noted in the area of civilian protection, all very small in comparison to other defense expenditures:[5]

- During the Korean War in the early 1950s, when the annual outlay peaked at about $150 million.
- With the launch of the first Soviet satellite (Sputnik) in 1957, when the annual outlay peaked at about $190 million.
- The Cuban missile crisis in 1963, when the annual outlay peaked at about $475 million.

The US policy was ultimately based on deterrence. Means of protection such as anti-missile systems, shelters, and other measures were considered to be elements that upset the balance of power. Congress consistently opposed proposals by various administrations to invest in civilian protection measures due to the high cost and the low level of benefit expected from such investment.

During President Bush's term of office, there was a new interest in developing and deploying missile interception systems against limited threats inflicted by "rogue states" such as North Korea and Iran, as a supplement measure of deterrence. However, there is no intention of developing a national widely deployed missile defense system.

Switzerland

Switzerland opted to build up its military strength based on its defense capability. The Swiss strategic concept focuses on demanding a high price from a potential attacker, which places a question mark over the value of attacking Switzerland. This capability comprises several strata: maximizing the cost a potential attacker will pay if it decides to launch an offensive; limiting the rewards to be gained by a potential attacker; limiting the loss incurred by a potential attacker if it does not attack; maximizing the rewards gained by a potential attacker if it does not attack; and limiting the damage suffered by Switzerland and its population if an attack does take place.[6]

In order to realize the latter objective it was decided that every citizen should have a chance to survive violence that might be leveled against

Switzerland. One of the means of implementing this defense concept was the construction of an extensive system of shelters for the civilian population, whereby the shelters are also designed to provide protection against weapons of mass destruction (nuclear, biological, and chemical weapons). This approach did not substantially change even after the fall of the Soviet Union and the Eastern bloc. Some changes, however, were introduced:[7]

- Redefining the balance of threats to Switzerland – the low probability of conflict between countries compared with the increase in the threat of terror or the threat of natural disasters, such as earthquakes and snow avalanches.
- Financial adjustment – the national component in building new shelters decreased and outlay by the individual on shelters increased.

In 1979, around 80 percent of the population[8] had ventilated shelters, while the rest had standard shelters. 1974 was a peak year in terms of national spending on civilian defense – about 750 million Swiss francs (about $300 million). As of 1981 the residents themselves assumed responsibility for the outlay on construction of shelters, whereby those who do not build shelters in their homes pay a shelter charge designated for the extension and maintenance of public shelters. Public outlay on shelters (construction and maintaining existing shelters) in 1998 was 22 million Swiss francs (about $15 million) per annum.

Value of Investment in Nuclear Shelters in Israel

The relative value of investing in nuclear shelters in Israel comprises two dimensions: the benefits of the shelters and the cost of the system.

The Benefits Offered by a System of Nuclear Shelters

The need for passive means of protection – shelters and masks – for the Israeli population, and the extent of investment needed in such means, has been examined with regard to other conventional and non-conventional (chemical and biological) threats.[9] The conclusion drawn was that it was possible to limit the number of casualties to an acceptable national level by relatively simple means. Thus, there was no benefit to be gained by increasing investment in such means.

Building nuclear shelters could seemingly be a relevant component in dealing with a nuclear threat if in national terms shelters limit the number of casualties to an acceptable level (without discussing here the issue of how many casualties is considered acceptable).

It is clear that there is no need for shelters for scenarios where the chances of protecting the population in them are negligible. These scenarios include all surprise attack scenarios and scenarios in which the shelters are located in remote places and the population must be evacuated and relocated there before the attack. A surprise attack on Tel Aviv on a regular weekday, for example, could cause 250,000 fatalities and 500,000 injuries – an estimation published in the press[10] – but such a scenario clearly makes shelters irrelevant, as the population would not be able to access the shelters in time and protect itself. This scenario, however, where the population would not reach the shelters in time, is far more likely than other scenarios that give the population sufficient time to reach the shelters.

Scenarios where nuclear shelters may be relevant in dealing with a nuclear threat are those that represent a family of military conflicts that deteriorate to actual nuclear attacks, but not before the population has placed itself in nuclear shelters.

A scenario in which a singular bomb of several kilotons – the equivalent of the atom bombs dropped on Hiroshima and Nagasaki in 1945[11] – is dropped on Tel Aviv and its natural population (without the daily influx of workers and people visiting for leisure purposes) is the most suitable for the discussion of the feasibility of shelters protecting against a nuclear threat for the following reasons:

- If there is no benefit to be gained from investing in shelters for the civilian population against even a relatively small nuclear warhead, as featured in the scenario, there is certainly no benefit to shelters if the attack is more powerful.
- In such a scenario, one can easily compare the extent of damage to Tel Aviv and the damage inflicted on Hiroshima and Nagasaki.

Documents that analyze the results of the nuclear attack on Hiroshima and Nagasaki and experiments conducted by the Americans on such weapons allow assessment of the damage that would be inflicted by a nuclear bomb on Israel. The scale of damage that could be inflicted on Tel Aviv by a 20 kiloton nuclear bomb comprises:

Shock wave damage to buildings:[12]

- A large portion of buildings within a range of about 500 meters from the strike (an area of about 750,000 sq meters or about 180 acres) would be completely destroyed and severe damage would be inflicted on an additional distance of several hundred meters.
- Buildings 1,000-2,000 meters away from the strike location would suffer moderate to light damage.
- Severe damage would be caused to electricity, communications, water, and sewage infrastructures by the shock wave.

Fires: the immediate fireball radius, a result of thermal radiation released by the explosion, would be about 100-150 meters, followed by a firestorm spreading to far larger areas.

Casualties: the explosion would cause fatalities and injuries because of the shock wave, heat radiation, and ionization radiation. Table 1 indicates the expected number of casualties in Tel Aviv caused by a bomb of 20 kilotons (similar to the bomb dropped on Nagasaki) in accordance with the current engineering profile of shelter for the population of Tel Aviv. Again, the calculation is based[13] on Tel Aviv's natural population and those of the surrounding cities, without considering the number of daily visits for work and other purposes.

Table 1. An Estimated Number of Casualties in a Nuclear Attack on Tel Aviv

Distance from strike (km)	No. of local residents* (thousands)	Population density* (residents/1,000 sq m)	Casualties** (thousands)		
			Dead	Severe injuries	Light injuries
0-1	53	15-16	20-30	6-9	5-8
1-2	55	8-9	8-16	6-10	10-12
2-4	255	6-7	2-3	9-18	15-30
Total	365	7	30-50	20-35	30-50

* 2005 Tel Aviv Statistics Yearbook
** Figures rounded off

For purposes of comparison, tables 2 and 3 present the number of casualties at Hiroshima and Nagasaki.[14] Note that as these bombs exploded in the air about 500 meters above the ground, a relatively small number of casualties were due to ionization radiation following radioactive fallout.

Table 2. The Number of Casualties in the Nuclear Attack on Hiroshima

Distance from strike (km)	No. of local residents (thousands)	Population density (residents/1,000 sq m)	Casualties (thousands)	
			Fatalities	Injuries
0-1	31,200	10-11	26,700	3,000
1-2.5	144.800	8-9	39,600	53,000
2.5-5	80,300	1-2	1,700	20,000
Total	256,300	3-4	68,000	76,000

Table 3. The Number of Casualties in the Nuclear Attack on Nagasaki

Distance from Strike (km)	No. of local residents (thousands)	Population density (residents/1,000 sq m)	Casualties (thousands)	
			Fatalities	Injuries
0-1	30,900	10-11	27,300	1,900
1-2.5	27,700	1-2	9,500	8,100
2.5-5	115,200	about 2	1,300	11,000
Total	173,800	2-3	38,000	21,000

Other Effects: A nuclear explosion generates electromagnetic radiation with special properties (EMP – electromagnetic pulse), which causes damage to the electronic components of various instruments, thereby causing them to malfunction. The significance of the expected damage to electronic components is:

- Damage to computers and cellular telephones, which will cause extensive functional breakdown in information systems and communications systems within the range of the EMP effect.
- Damage to transistors operating on batteries would likely be limited, though radio transmitters are expected to be damaged. As a result, a considerable decline in the ability to forward messages to residents is expected.
- Damage to the electricity supply will interfere with the operation of electrical devices – TV, radio, internet, and so on – and will affect the ability to transmit messages to the public.

This assessment of damages must be followed by an assessment of the possible benefit of shelters. The more reinforced the construction and the more circumscribed the structural damage, the more the number of

casualties is expected to be limited, as indicated by table 4, which shows the severity of the casualties at Hiroshima and Nagasaki based on the extent of damage to the structures in which they were located during the attack.[15] The table is based on statistics of 1,600 people who were located in reinforced concrete structures at a distance of up to 1,000 meters from the strike.

Table 4. Severity of Casualties at Hiroshima and Nagasaki from Structural Damage

Damage to building	Severity of injury based on damage to buildings			
	Fatalities	Severely injured	Lightly injured	Uninjured
Severe damage	88%	11%	-	1%
Medium damage	14%	18%	21%	47%
Light damage	8%	14%	27%	51%

Shelters for the civilian population would reduce the expected number of casualties in Tel Aviv. The question is how efficient the shelters would be and by how much they would lower the number of casualties. If shelters are built to accommodate all of Tel Aviv's natural population and are suitably reinforced, the number of casualties among civilians located in the shelters could be significantly reduced. Table 5 includes an estimate of the casualties in Tel Aviv if the residents took cover in shelters.

Table 5. Estimated Number of Casualties in Tel Aviv with Residents in Shelters

Distance from strike (km.)	No. of local residents* (thousands)	Population density* (residents/1,000 sq m)	Casualties** (thousands)		
			Dead	Severe injuries	Light injuries
0-1	53	15-16	5-10	1-2	2-3
1-2	55	8-9	3-4	3-4	8-9
2-4	255	6-7	1-2	5-6	10-15
Total	365	7	7-14	9-12	20-27

* 2005 Tel Aviv Statistics Yearbook
** Figures rounded off

In this scenario shelters are expected to reduce the number of fatalities from about 30,000-50,000 to around 7,000-14,000, and the number of wounded from 50,000-85,000 to 30,000-40,000. In other words, protection would reduce the expected number of fatalities fourfold and the total number of wounded (severe to light injuries) twofold. The shelters as a hypothetical solution for the scenario analyzed here achieve an impressive reduction in the number of casualties. However, even with such protection the number of casualties in such an attack would be on a level and intensity hitherto unknown. The number of fatalities is similar to the number expected from a powerful earthquake that Israel is prepared for. In scenarios in which the attack originates from a number of nuclear facilities or more powerful nuclear warheads, the severity of the disaster would be greater.

Cost of Constructing Nuclear Shelters

The scope of national investment in shelters in Israel in order to achieve this reduction in the number of casualties renders the plan impractical. A quick calculation of the cost of construction alone of the shelters – without necessary routine annual maintenance – shows that Israel would have to invest at least NIS 50-100 billion in the project,[16] up to twice the Ministry of Defense annual budget. Even a world power like the United States was not able during the Cold War to meet the costs of passive defense of its population.

Analysis of the Implications

This discussion has focused on the value of constructing nuclear shelters for the civilian population and has indicated the lack of inherent value, both in terms of the cost – an impossible outlay – and in terms of the benefit, as even when the population is protected, the damage caused by a nuclear attack would be a national disaster, and should be regarded as unacceptable.

Analysis of implications would not be complete without relating to the problem in a wider sense. While vis-à-vis the threats to which Israel has been exposed thus far – conventional, chemical, and biological – the mitigation level could have been maintained as part of contending with the threats, examination of the nuclear threat clearly indicates that the

mitigation component is not a sustainable element, and Israel has to prevent the actual attack.

In conclusion, in a nuclear confrontation between powers, deterrence is the main component of the adopted strategy. Shelters for the population of a country under threat were never a practical option. Thus investing in nuclear shelters for the population is not a viable economic option, and should not comprise a component of the basket of measures worthwhile investing in to deal with a nuclear threat. Since, therefore, the mitigation component is not a realistic element in terms of nuclear threat, deterrence and prevention are the only practical ways of dealing with a nuclear threat against Israel.

Notes

1 Micha Bar, "The Effect of Nuclear Deterrence on Military Options: The Kargil Crisis," *Ma'arachot* 414 (September 2007).
2 According to foreign sources, Israel possesses a nuclear capacity.
3 F. K. Berrien, Carol Schulman, Marianne Amarel, "The Fallout Shelter Owners: A Study of Attitude Formation," *Public Opinion Quarterly* 27, no. 2 (1962).
4 The Gaither report was submitted to President Eisenhower in 1957. See further reference in David Alan Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960," *International Security* 7, no. 4 (1983).
5 William H. Kincade, "Repeating History: The Civil Defense Debate Renewed," *International Security* 2, no. 3 (1978).
6 Dietrich Fischer, "Invulnerability without Threat: The Swiss Concept of National Defense," *Journal of Peace Research* 19, no 3 (1982).
7 *Swiss Civil Protection Concept*: *Report of the Federal Council to the Federal Assembly Concerning the New Civil Protection Concept*, October 2001.
8 The population of Switzerland is around 7.5 million.
9 David Klein, *Home Front Defense: An Examination of the National Cost*, Memorandum no. 58, Tel Aviv: Jaffee Center for Strategic Studies, 2001. See also David Klein, "Israel's Home Front Defense Policy," in Shai Feldman (ed.), *After the War in Iraq: Defining the New Strategic Balance* (Brighton: Sussex Academy Press and Jaffee Center for Strategic Studies, 2003), chapter 14.
10 Reuven Pedatzur and Yaakov Yatzah: "250,000 Dead; Half a Million Wounded," *Haaretz*, April 4, 2007.
11 The bomb dropped on Hiroshima was about 12 kilotons, and the bomb dropped on Nagasaki was about 22 kilotons.
12 Samuel Glasstone and Philip J. Dolan, *The Effects of Nuclear Weapons* (prepared and published by the United States Department of Defense and Energy Research and Development Administration, 3rd edition, 1977), Figure 5.140: Damage-Distance relationships for above ground structures. Severe damage to structures means a building that is destroyed or requires overall repair (generally demolition

and rebuilding). Moderate damage means damage that requires fundamental repairs before the building is usable. Mild damage means broken windows, damage to the facade, and other damages that require limited repairs.

13 Glasstone and Dolan, *The Effects of Nuclear Weapons*, chapter 12.

14 Glasstone and Dolan, *The Effects of Nuclear Weapons*, chapter 12.

15 Glasstone and Dolan, *The Effects of Nuclear Weapons*, Table 12.21. Casualties in reinforced-concrete buildings in Japan related to structural damage.

16 For an extended stay in a shelter, each occupant needs an area of at least 1-1.5 sq m (taking into account sleeping areas and a public area); 7 million residents have to be housed in shelters; the cost of constructing 1 sq m of an underground shelter is NIS 5,000-10,000. Total cost: NIS 50-100 billion.