The twin themes of this study are modernization and nuclearization. Specifically, the collection in this volume explores how the former is applied to the latter in various states, with a view to drawing conclusions about progress towards nuclear disarmament. In the case of Israel, far more is known about its approach to modernization (in the most general terms and in the military context) than about its approach to nuclear issues. Whatever factual information is publicly available relies on sources outside of Israel.

The analysis below will first explore relevant foreign sources in an effort to summarize the factual information available regarding Israel’s nuclear weapons programme and plans for its modernization. It will then draw on relevant domestic sources in order to provide a broader context for these issues. Finally, it will attempt to extrapolate from Israel’s general approach to modernization and then apply the conclusions of this exercise to Israel’s nuclear policy.

**ACCORDING TO FOREIGN SOURCES**

**STATUS OF ISRAELI NUCLEAR FORCES**

Since 1970, when the New York Times published revelations based on US intelligence assumptions, it has been widely assumed that Israel possesses nuclear weapons. Because Israel has never officially confirmed or denied having nuclear weapons, the scope and nature of its nuclear arsenal is based on the assessments of foreign sources, which vary widely. Based on available foreign information, the current status and modernization plans of Israel’s nuclear program are outlined below.

**Nuclear weapons and fissile material**

Estimates about the size of the arsenal are based on the power capacity of the nuclear reactor near Dimona (which, like the overall program, is subject to secrecy and uncertainty) ranging from 24MWt to 70MWt or more and on assumptions about production that in turn are based on speculation, scientific calculations, and unconfirmed revelations dating back to 1986.

The Institute for Science and International Security has calculated that by the end of 2003, Israel could have produced approximately 510–650 kg of weapons-grade plutonium, depending on assumptions about the reactor. Estimates about highly enriched uranium are even more difficult to make, although public information suggests that Israel has a uranium enrichment programme. Estimates of current nuclear weapons forces range from 60–80 at the low end to over 400. The most frequently cited figure is 100–200 warheads.

**Delivery systems**

The Sdot Micha Air Force Base is believed to host nuclear-tipped missiles. It is also assumed that Israel has a triad of delivery systems: land, air, and sea. Specifically, Israel is believed to have deployed a cumulative total of 100 Jericho-I (500 km range) and Jericho-II (1,500 km range) ballistic missiles, both of which are nuclear capable as well as mobile by land or rail. The range of the Jericho-II and its 1,000 kg payload “make it well suited for nuclear delivery,” Israel’s space-launch rocket, the Shavit, which is similar to the Jericho-II, could also be conceivably modified to deliver a nuclear weapon, thus granting Israel the ability to deploy an intercontinental ballistic missile if there were ever a political desire to do so, although there is no indication of such a desire at this time. In terms of modernization, Israel is currently developing a new ballistic missile, the Jericho-III, which is believed to have a maximum range of 4,000–6,500 km.

Israel’s aircraft capabilities give it the option of using its F-16 Falcons or F-15 Eagles to deliver nuclear weapons. Both have a range of 2,500 km. As of late 2008, Israel was believed to have well over 200 Falcons, which it had purchased from the United States, although “it is assumed that only a fraction of this number will have the modifications, trained crews, and practiced procedures necessary to make them suitable for the nuclear mission.” Israel’s 87 Eagle fighter and ground attack aircraft were more recently purchased from the US, which itself designated the F-15E Strike Eagle for delivery of nuclear weapons, an indication that Israel could do the same.

Israel’s sea-launched nuclear capability is based on three Dolphin-class submarines that were bought from Germany, all of which were received and deployed by the year 2000. These submarines are believed to be armed with dual-capable cruise missiles that were developed in Israel, with each missile having an estimated range of 1,500 km. Reports claiming that these submarines are armed with modified US Harpoon anti-
ship missiles (some of which could have been modified to deliver nuclear weapons to land targets) have been denied, but “[i]n 2003, in an interview with the Los Angeles Times, Israeli and American officials announced that Israel had deployed U.S. supplied Harpoon ASCMs on its Dolphin submarines and modified the missiles to carry nuclear warheads.” In terms of modernization, in November 2005, Israel reportedly signed a contract worth $1.7 billion (USD) with Germany for the construction of two more submarines, with the first one to be completed by 2012. In light of current and planned nuclear capabilities, “it seems clear that the country is continuing to enhance its own triad of land, sea, and air launched nuclear systems.”

**Infrastructure**

The Israel Atomic Energy Commission (IAEC), “among the most secretive organisations in Israel,” is the government agency that oversees the country’s nuclear activities. All factual information about its operations, including budget, organizational structure, relations with other military and defense organizations, and parliamentary oversight, is classified. The IAEC is chaired directly by the prime minister and operates “to a certain extent under a dual identity,” serving both as the government agency that executes national nuclear policy and as a body staffed by nuclear scientists that carries out Israel’s nuclear research. The IAEC also represents Israel in international nuclear fora.

The IAEC oversees the operation of Israel’s two national nuclear research facilities. The Negev Nuclear Research Center, located near the southern desert town of Dimona, “includes working units for a full array of nuclear-weapons-related activities, from uranium conversion, fuel fabrication and uranium enrichment, to a plutonium-production reactor and reprocessing mechanisms, and possibly weapons-specific facilities” and is reportedly believed to serve as “Israel’s national laboratory in the nuclear field.” As noted above, estimates vary regarding the reactor’s capacity. The original capacity of 24MWt was reportedly expanded to 40MWt and later to 70MWt.

The Soreq Nuclear Research Center, located approximately 40km south of Tel Aviv, was purchased from the US as part of the “Atoms for Peace” program. It was originally constructed as a 1MWt light-water research reactor and later expanded to 5MWt. It is the only facility in Israel under IAEA safeguards. According to the Soreq website:

- Its R&D activities include laser and electro optics, nuclear medicine, radiopharmaceutics, non-destructive testing, space components characterization and testing, crystal growth, development of innovative radiation detectors and sophisticated equipment for contraband detection. It offers radiation protection training, and operates personal dosimetry service. It is a major distributor of radio-pharmaceuticals for medical diagnostics and therapy.

In sum, Israel is assumed to have “full fuel-cycle capabilities” but specific details and current information is not available. It is also assumed that other nuclear activities related to weaponization are “carried out in other secret facilities.” It is further believed that “Israel is upgrading its deterrence capabilities.”

**Policy**

The secrecy surrounding Israel’s nuclear activities serves the policy of nuclear “ambiguity” or, as it is increasingly being described, “opacity.” Nuclear opacity has been defined as a situation in which “a state’s nuclear capability has not been acknowledged, but is recognized in a way that influences other nations’ perceptions and actions.” In Israel’s case, this policy was the product of a compromise with the United States that emerged during the years leading up to conclusion of the nuclear Non-Proliferation Treaty (NPT), the period during which Israel was reportedly developing its first nuclear weapons. The NPT was opened for signature in 1968 and entered into force in 1970.

Israel had reportedly completed its first nuclear device by May 1967. Despite US pressure, in 1968 Israel informed the US that because of its security needs, it could not sign the NPT at that time. A nuclear option was seen as an existential necessity. In 1969 Israeli Prime Minister Golda Meir and US President Richard Nixon reached a secret agreement that laid the foundation for a tacit “don’t ask, don’t tell” policy between the two states with respect to Israel’s nuclear-weapons capability. The US accepted that Israel felt a security-based need to have a nuclear-weapons capability, and Israel agreed not to undermine the NPT by openly declaring its nuclear capability.

Accorded to domestic sources, the policy of opacity has shaped and circumscribed Israel’s non-proliferation, arms control, and disarmament policies. Despite this opacity, however, Israel does participate publicly in some non-proliferation activities and agreements. In fact, Israel is generally supportive of the non-proliferation regime, and particularly in recent years, has made efforts to be recognized as a technologically advanced, mature state committed to the “spirit of the NPT.” Interest in participating in...
international nuclear activities (including an India-like exception to Nuclear Supplier Group guidelines) and a recurring but fledgling interest in exploring nuclear energy options have informed this new approach. Similarly, domestic discourse, though far from democratically free and open, exists but is also circumscribed by the policy of opacity.

International Law

Israel has signed but not yet ratified the Comprehensive Nuclear Test Ban Treaty (CTBT). It actively participates in verification activities of the CTBT Organization Preparatory Committee. Israel is a signatory or party to a number of non-proliferation-related (safety and security) agreements, including the Vienna Convention on Civil Liability for Nuclear Damage, the Convention on the Physical Protection of Nuclear Material, the Convention on Early Notification of a Nuclear Accident, the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Convention on Nuclear Safety, the Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA, and a Safeguards Agreement applicable to the Soreq nuclear facility.

On the basis of the above legal commitments, in combination with its NPT non-party status and its emphasis on security and secrecy surrounding nuclear activities, Israel projects itself both domestically and internationally as a responsible non-proliferant (in the sense of not supplying nuclear technology to others but, rather, having an interest in sharing safety and security expertise). Not having signed the NPT, Israel is not bound by its article VI disarmament obligations under a strict treaty-based interpretation of international law, which is the prevalent view in this context. Arguments based on customary international law that posit a universal obligation to disarm have not gained ground or drawn attention (or a rebuttal) within Israel, but they would likely be countered by the argument that Israel is not bound by agreements that it has not signed (a view consistent with Israel’s general approach to international legal norms and obligations) and has, in fact, systematically rejected. The “persistent objec tor” exception to a customary international legal norm would likely be invoked in the event that customary international law is given consideration. In this context, any modernization of nuclear weapons would not be perceived by Israel as a conflict with international legal commitments.

Security and space modernization

Nuclear weapons modernization is related to modernization activities in the security sector generally, for example through the underlying infrastructure of C4I (command, control, communications, computers, and intelligence). Modernization efforts in this sector can be expected to serve the nuclear weapons infrastructure as well. In this area Israel is regarded as very advanced. Information technology and advanced military technology are among Israel’s main exports, including to other technologically advanced countries. The government also encourages and enables research and development in information technology.

Outer space is another area in which military and civilian capabilities overlap. Rocket science is in part missile technology, and advances in the former are applicable to the latter. Israel has advanced missile capabilities, as noted above, and engages actively in outer space activities with both civilian and military applications. In its own words, “Israel attributes great importance to international cooperation in the area of space technology, and believes that it is necessary and essential.” The government says it continues “to share the vision and broad objectives of the United Nations’ efforts in this field, namely to secure, promote, and broaden the peaceful use of outer space.”

The Israel Space Agency has signed cooperation agreements with the space agencies of Canada, France, Germany, India, the Netherlands, Russia, Ukraine, and the United States as well as the European Space Agency, and agreements are pending with Brazil, Chile, and the Republic of Korea. Israel launched its first satellite in 1988, and the space agency’s description reflects the proud self-perception of modern, cutting-edge capabilities inherent in this development.

The history of Israel in space is short but remarkable. It started in 1988 with the launch of Ofeg 1 by the Shavit launcher, affiliating Israel to the exclusive club of seven countries who launched a self-developed satellite with their own made launcher.

Israel has several satellites in orbit and more in development, serving a variety of purposes, some of which have direct military (C4I) applications. The use of outer space and dependence on space-based vehicles also create new vulnerabilities, such as disruption of essential communications that can, in turn, pose serious security challenges. For this reason, space security has been the subject of increasing attention in recent years. Here too, Israel is an active participant. At a recent UN conference on space security, for example, two of the twenty-two speakers were from Israel.

The capabilities and developments described here do not provide evidence of nuclear weapons modernization, but they do indicate that Israel has the military and technological capabilities and the stated security interests that make nuclear weapons modernization possible.

Discourse

The policy of opacity entails a nuclear weapons capability about which “everyone knows” (domestically and internationally, with the former reliant on the latter) and an umbrella of secrecy covering the physical and doctrinal elements of this capability. The nuclear-
and surrounded by the hostile Arab world, not to [acquire a nuclear weapons capability] would have been irresponsible. Historically, public opinion polls have indicated support for the nuclear option, more recently reinforced by a belief (among 66% to 82% of Israelis) that Iran would use nuclear weapons to destroy Israel. Most recently, however, a new survey has indicated that 65% of Israelis would be willing to give up nuclear weapons if Iran waived its own programme—that is, they would prefer a nuclear-weapons-free Middle East to the current situation.

A somewhat superficial but nevertheless telling example illustrates the difference between Israel's domestic and international discourses as well as the potential for change within Israeli policy. Following the recent and first-ever IAEA forum on a nuclear weapons free zone (NWFZ) in the Middle East, which Israel had resisted for 11 years, an editorial was published in the newspaper Ha'aretz (relatively elite mainstream newspaper, comparable to the reputation of the New York Times within the US) observing that, in the words of a participating Israeli delegate “the sky didn’t fall on us.” The secrecy born of the policy of opacity had bred a fear of discussing the issues that turned out to be unfounded. What is most telling about this editorial, however, is that despite a faithful translation between the Hebrew and English versions, the headlines differed.

In English the editorial was entitled “Israel is clinging dearly to its policy of nuclear ambiguity” and the subheading went on to state, “Israel has never claimed that there is no possibility it will change its nuclear policy one day. But for Israel that’s a vision for the distant future.” The Hebrew version was identical except for the headline, which directly translates as “Disarmament, But Not Now.” Ha'aretz is a daily newspaper published in both Hebrew and English, and not surprisingly, the emphasis in coverage differs slightly: a foreign-language target audience is not likely to seek an Israeli newspaper for coverage of news that has no direct bearing on Israel, whereas Hebrew-language readers are more likely to rely on Ha'aretz if it is their newspaper of choice for coverage of any news, domestic or foreign. What is telling in the case of the editorial mentioned above is the difference in emphasis when the same editorial is packaged for foreign vs. domestic or foreign. What is telling in the case of the editorial is on maintenance of the old nuclear policy, and the words “clinging dearly” imply a near-desperate tone (not actually reflected in the body of the editorial). In the latter case the emphasis is on disarmament, a relatively new idea for a domestic audience.

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NWFZ/WMDZ

The NWFZ goal is not a new idea among Israel's diplomatic representatives, however. Israel has joined the consensus UN General Assembly resolution on a Middle East NWFZ since 1980, but with reservations. As stated in Israel's most recent explanation of vote on this resolution.

It has been Israel's longstanding position that the essential preconditions for the establishment of the Middle East as a mutually verifiable zone, free of weapons of mass destruction and delivery systems, are comprehensive and durable regional peace, and full compliance by all regional states with their arms control, disarmament and non-proliferation obligations. During the UN General Assembly meetings Israel annually asserts that "it remains committed to a vision of the Middle East developing eventually into a zone free of Chemical, Biological, and Nuclear weapons as well as ballistic missiles" but that these issues can only

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be “realistically addressed within the regional context.” A NWFZ, or a WMDFZ (which, as Israel notes, is unprecedented) “must be based on arrangements freely arrived at through direct negotiations between the states of the region and those directly concerned, applying a step by step approach.”

As noted above, Israel recently reversed its position of refusing to participate in an IAEA forum on the NWFZ issue. The conference was academic and non-binding, with the stated goal of learning from other NWFZs, but nevertheless Israel had resisted such a meeting for 11 years. It has also participated recently in other conferences aimed at exploring this issue, including an August 2010 meeting in Cairo, sponsored by an Australia- and Japan-led initiative, and a June 2011 meeting in Brussels initiated by the European Union. These developments indicate a more relaxed attitude towards participation in governmental meetings on the issue of a WMDFZ or NWFZ, possibly because of increased international attention and effort surrounding this issue since the 2010 NPT Review Conference and the decision to hold a conference on the topic in 2012.

As of the time of this writing, however, Israel does not intend to participate in the 2012 conference. Following the 2010 NPT Review Conference, the government of Israel announced:

As a non-signatory state of the NPT, Israel is not obligated by the decisions of this Conference, which has no authority over Israel. Given the distorted nature of this resolution [the 2010 final document decision convening the 2012 conference], Israel will not be able to take part in its implementation.

Israel’s reasoning, reportedly, is that it did not take part in formulating the terms of reference for the 2012 meeting, nor is it a member of the NPT, whose 1995 Resolution is at the basis of this meeting. From Israel’s perspective, the terms of reference deal only with part of the regional security dilemma (which includes conventional weapons and strategic threats to Israel) that Israel is interested in addressing and which would have been included in the terms of reference had Israel participated in their formulation. Nevertheless, the 2012 conference has been the subject of discussion in security circles within Israel and has succeeded in drawing attention to this issue.

Opacity, secrecy, and legitimacy

The domestic discourse on nuclear issues is characterized by what has been termed the “enigma of opacity”: ignorance is a qualification for speaking on nuclear issues. Anyone who “knows” cannot speak openly about the issues, while anyone who speaks must first profess ignorance by asserting reliance on foreign sources.

At the basis of nuclear policy is the question of legitimacy (Israel’s right to exist). Perceived existential threats informed, drove, and shaped the development of a nuclear programme and pursuit of a nuclear deterrent. US-led non-proliferation efforts shaped the further development of this deterrent in secrecy. Deterrence, however, requires that others (the target audience) be aware of Israel’s capability. Thus it relies on foreign sources and indirect references because a strictly secret nuclear programme would have no deterrent value. This interaction between secrecy and opacity is further shaped by questions of Israel’s legitimacy or right to exist. On the one hand, Israel still perceives deterrence as a guarantor of its existence, that is, opacity as an existential issue. On the other hand, international criticism of Israeli nuclear policy, which is unique in the global arena, feeds into and reinforces challenges to Israel’s legitimacy. The trilateral interplay among these issues—opacity, secrecy, and legitimacy—is represented in the figure below:

One presumably unintended consequence of the internalized secrecy within Israeli society is that the phrase “according to foreign sources” has come to imply sensitive and secret information about internal domestic issues. It is ironic and perhaps unique among nations that the term “foreign sources” in Israel refers to “our own innermost secrets”.

Modernization and Nuclearization

At its inception, Israel’s nuclear programme was perceived as being ahead of its time for the small, newly established state: “It took more than a little chutzpa to believe that tiny Israel could launch a nuclear program.” The sense of subdued pride over the technological capability permeates references to the nuclear programme. Publicly available information, as characterized by the description of activities at the Soreq facility referenced above, reflects a wide range of technologically advanced research projects. Israel is generally perceived to be a modernized and technologically advanced state, including in the military sphere, and this perception applies to the nuclear sector as well.

At a popular, admittedly cursory level, a Google search serves to illustrate the point that efforts towards modernization in general are promoted and viewed positively in Israel, and that modernization is a salient...
theme in the military sector. Google is no substitute for in-depth research, of course, but by definition it can provide a snapshot of popular perception within the computer-literate sector, which is a very relevant sector in the context of modernization. The first several pages of a Google search on "Israel" and "modernization" produced the following results:

- Articles on modernization in the military sector: 43%
- Articles on modernization in the high-tech civilian sector: 25%
- Articles on modernization in the social, political, and sociological sectors: 32%

The first category includes articles about modernization within Israel's own military (68% of this category) and articles about Israeli services provided for the modernization of foreign militaries' assets such as tanks and aircraft (32%).

The results indicate that, within a society where modernization is a salient aspiration, it is most prominent in the military sector and includes an exportable expertise. Combining the first two categories above indicates that modernization is particularly associated with technological innovation, both military and civilian. Only one-third of the references to modernization related to sociological, social, or political dimensions.

**CONCLUSION**

The history of Israel's nuclear programme and its current status indicate that this programme has always been a priority project at the national level and has benefitted from the input provided by advanced, innovative technology and skilled human resources. Indications of modernization plans, in particular with respect to land and sea delivery systems, suggest that the nuclear programme will continue to be a priority project that benefits from cutting-edge technological advances and specially recruited and trained human input. The cultural context, with its emphasis on technological modernization, is fertile ground for modernization in the nuclear sector.

Israel's international legal commitments as these are perceived domestically pose no obstacle to such modernization. In fact, Israel's status as non-state party of the NPT is a hindrance to development of a nuclear power programme because Israel would need international support and trade in nuclear materials for such a programme. Nonetheless, Israel seeks to become a more active participant in the global nuclear marketplace, where its potential contributions would be along the lines of technological innovation rather than raw material. The publicly known aspects of Israel's international nuclear activities are centered on safety and security issues (the latter in particular being a natural consequence of the nature of Israel's own program) and on verification activities. These capabilities suggest potential disarmament-related functions that could be further developed in the appropriate political context.

In sharp contrast to the technological aspects of Israel's nuclear programme, its nuclear policy has never been modernized. The policy of opacity developed in parallel to and simultaneous to conclusion of the NPT. By 1970 the NPT had entered into force, Israel was assumed to have nuclear weapons, and the policy of opacity was established. More than 40 years later, the NPT is still in force but has become nearly universal and—despite its shortcomings—has played a key role in constructing a global non-proliferation norm, defying predictions that there would be dozens of nuclear-weapon states. Israel's nuclear programme has advanced in quantity and quality. Only the policy of opacity remains unchanged, despite changing political and technological contexts.

**NOTES**

2. Ibid., p. 130.
3. Before the revelations by former Dimona nuclear technician Mordechai Vanunu were published in the London Sunday Times in 1986 it was generally estimated that Israel had two to three dozen nuclear weapons. Ibid., p. 130
8. IISS, op. cit., p. 131.
9. BASIC, op. cit., p. 28.
12. IISS, op. cit., p. 133.
13. Ibid.
14. BASIC, op. cit., p. 28.
17. Ibid., p. 28, quoting Norris et al., ibid., p.75: “In June 2002, former Pentagon and State Department officials told the Washington Post that Israel was arming three diesel-powered submarines with cruise missiles capable of carrying nuclear warheads.”
18. Ibid., p. 28, n. 125, quoting Nuclear Threat Initiative, Israel Profile,
22. Ibid.
23. Ibid., p. 130.
24. Ibid.
27. IIS, *op. cit.*, p. 131.
28. Ibid.
29. Ibid., p. 109. See also BASIC, *op. cit.*
30. Historically the term most frequently used was "ambiguity" but in recent years "opacity" has gained currency. The latter is closer to the Hebrew term (*amimut*), which implies something "unclear" or "opaque." Avner Cohen has advocated use of the term "opacity" (originally in 1987-88 in an article with Benjamin Frankel), and this term has been increasingly accepted in recent years, particularly in academic circles. See Avner Cohen, *Israel and the Bomb*, New York, 1998.
32. Ibid., pp. 277-321.
37. See, for example, Israel Aerospace Industries, http://www.iai.co.il/22031-en/Homepage.aspx (including the sections "Business Areas" and "Customer Services"), and Tadiran Telecom (telecommunications technology), http://www.tadiran.co.il/tadiran-telecom/home.aspx (including the section on "Customers," which includes customers and governments throughout the world).
43. IIS, *op. cit.*, p. 128.
47. Admittedly, an example is not proof. Without speculating as to the source or reason for the different headlines, they are offered here as illustrations of a difference in approach to nuclear issues at the domestic and international levels, whether by design or unintentionally.
49. http://www.haaretz.co.il/news/politics/1.1574564
51. Ibid.
52. Statement by the Government of Israel on the Middle East Resolution, 2010, at the NPT Review Conference, 29 May 2010, http://www.pmo.gov.il/PMOEng/Archive/Press+Releases/2010/05/spokies29052010.htm. The statement above incorrectly refers to the 2010 decision to convene a conference in 2012 as a "resolution." In Hebrew "resolution" and "decision" are the same word (and Israel might be unfamiliar with NPT processes).

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