

# Operation Opera: an Ambiguous Success

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## Operation Opera: an Ambiguous Success

### **Author Biography**

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### **Abstract**

To assess the efficacy of Israel's strike on Osirak, one must determine Israel's strategic objectives and their material effects on Iraqi capabilities. The capacity of the facilities to produce fissionable material without detection remains in dispute. So, too, does the timeline—and therefore the imminence—of Iraqi acquisition of a nuclear option. The political cost-benefit equation in this case requires a fair dose of subjective judgment. How much did the Israelis delay the program? How much did Iraqi motivation increase post facto? Is military counter-proliferation a viable strategy? Was the potential Iraqi bomb worth risking a bold, unprovoked attack that inevitably drew the condemnation of the world? Did the raid, in toto, raise or lower the risk of regional proliferation in the Middle East? All of these considerations must factor into an informed opinion on the retrospective wisdom of Begin's decision.

# Operation Opera: an Ambiguous Success

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## Abstract

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## Introduction

On June 7, 1981, on the order of Prime Minister Menachem Begin, Israel Defence Forces (IDF) jets bombed the Osirak nuclear installation at Tuwaitha, outside of Baghdad. The attack destroyed the complex, comprising a French-built Osiris-type Materials Testing Reactor (MTR), as well as a smaller adjacent reactor. The two reactors were known in Iraq as Tammuz-I and Tammuz-II. The Israeli jets returned to their bases

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unscathed, and Iraq, which was in the midst of a war with Iran (which had the year before bombed but not destroyed the site), did not retaliate militarily.

Analyzing the bombing of Osirak one year later, Israeli political scientist Shai Feldman was ambivalent: "It is exceedingly difficult to weigh the various short- and long-term gains and costs associated with the Baghdad operation. The element of speculation is predominant, since many of the considerations involved are in the realm of the intangible."<sup>1</sup> Feldman's article remains one of the best on the subject, and many of the considerations involved remain in the realm of the intangible. To assess the efficacy of Israel's strike on Osirak, one must determine Israel's strategic objectives and their material effects on Iraqi capabilities. The capacity of the facilities to produce fissionable material without detection remains in dispute. So, too, does the timeline—and therefore the imminence—of Iraqi acquisition of a nuclear option. Moreover, the implications of Operation Opera are hard to measure.<sup>2</sup>

Borrowing from Dan Reiter's framework,<sup>3</sup> the three central areas of assessment are the following: 1) the plutonium production capacity of Iraq's facilities over time (and Iraqi intentions to make a bomb); 2) the likelihood of detection and subsequent interdiction; and 3) the effect of the destruction of the reactor on the subsequent course of the Iraqi nuclear program. A fourth element is also crucial: the broader political implications of pre-emptive military action as a component of Israeli nuclear security doctrine.

The political cost-benefit equation in this case requires a fair dose of subjective judgment. How much did the Israelis delay the program? How much did Iraqi motivation increase *post facto*? Is military counter-proliferation a viable strategy? Was the potential Iraqi bomb worth risking a bold, unprovoked attack that inevitably drew the condemnation of the world? Did the raid, *in toto*, raise or lower the risk of regional proliferation in the Middle East? All of these considerations must factor into an informed opinion on the retrospective wisdom of Begin's decision.

What is clear is that Israel chose to attack Osirak at a moment of perceived strategic advantage, not because Iraq was on the verge of possessing enough fissile material to construct an atomic weapon. Israeli decision-makers traded one set of risks—the immediate and unpredictable effects of a preemptive strike—to thwart or possibly eliminate a longer-term strategic shift, the rise of a nuclear-armed adversary. The merits of the strike were in dispute in 1981, and remain so nearly thirty years later, in significant part because they stem from political decisions

grounded in imperfect and fallible intelligence, and on individuals' subjective interpretation of the known facts. In hindsight, Israel enjoyed a significant reprieve from a nuclear Iraq and suffered few of the potential repercussions to its bold action. Yet this may owe as much to luck as to foresight, and the Israeli security establishment has never resolved for itself exactly what type of precedent Osirak represents.

While there is no scholarly consensus on the relative success or failure of the Israeli operation, it was certainly a tactical masterpiece and a strategic enigma.

## Intentions and Capabilities

Very few experts would claim today that Iraq under Saddam Hussein in 1981 was anything but intent on building a deliverable nuclear bomb. One 1983 account by a prominent Harvard physicist, on the other hand, accepted credulously the Iraqi claim that Osirak was intended for peaceful research. The physicist, Richard Wilson, visited the destroyed Tuwaitha facilities, but he had admittedly little background in nuclear weapons and proliferation, and he was apparently misled by Iraqi authorities on his tour.<sup>4</sup> The scholarly consensus has since discredited this view.<sup>5</sup>

Iraq first wanted to buy a large gas-graphite reactor from France, which could produce plutonium for use in a nuclear weapon. Only when the French rejected this request did Iraq, in 1976, purchase their Osiris-type light-water MTR.<sup>6</sup> This was a strange decision for a country without an existing nuclear power program, as MTRs are used for research purposes to complement large power reactors. The switch made it appear that Iraq was desperate to find a route, however circuitous, to the bomb.<sup>7</sup>

Later reports by top Iraqi nuclear scientists largely bore out this interpretation. Mahdi Obeidi, a high-ranking Iraqi nuclear scientist, asserted that he was told in a private meeting with a superior that Hussein wanted the bomb, and he inferred that this was the purpose of Osirak.<sup>8</sup> Khidhir Hamza, another scientific defector, wrote in a joint 1998 piece with David Albright, "The Iraqis believed that the safeguards on the [Osirak] reactor, which would have included periodic inspections and surveillance cameras, could have been defeated."<sup>9</sup> He later amended his story, arguing that the Osirak plant was a "decoy" whose design Iraqi scientists would "copy" for the building of another "secret reactor."<sup>10</sup> Unfortunately, scholars lack good sources on Iraqi decision-making, and it is therefore impossible to discern which drivers motivated the Iraqi push for a nuclear weapons capability.

There were two possible ways that Osirak could contribute to the Iraqi quest for fissionable material: uranium diversion or plutonium separation. The reactor ran on highly-enriched uranium (HEU) fuel (approximately 93 percent uranium 235), which was already of a weapons-grade purity, and the Iraqis may have hoped to utilize it to construct a weapon. The risk of HEU fuel diversion was not a major concern, as the French required the Iraqis to account fully for each quarterly shipment of spent fuel before they would release the next fuel shipment. And each twelve kilogram (kg) shipment would not provide the critical mass of uranium necessary to set off a nuclear explosion in a bomb.<sup>11</sup> The possibility that the reactor's normal operations could mask a hidden plutonium production program, on the other hand, greatly worried the Israelis.

Israel claimed that excess neutron flux in the reactor could have been leveraged to irradiate natural uranium targets to produce plutonium.<sup>12</sup> Natural uranium targets could not be configured directly into a weapon. However, Israel claimed that natural uranium targets posed a plutonium production threat, and undeclared natural uranium targets, unlike French-supplied HEU fuel rods, would not be subject to International Atomic Energy Agency (IAEA) monitoring. This scenario was their primary concern about Osirak.

Iraq had in fact purchased hundreds of tons of natural uranium from Brazil and other sources.<sup>13</sup> An Italian company sold the Iraqis a fuel fabrication laboratory that could serve to fashion natural uranium targets, as well as hot cells that could be used for small-scale plutonium separation experiments. There was also a larger facility that the Israelis claimed could be used for large-scale plutonium processing if properly modified with radiation shielding.<sup>14</sup> Estimates vary as to how much plutonium Osirak could produce, and how quickly, but it appears probable that within a few years' time, the Iraqis—if not detected and stopped—could accumulate enough plutonium for at least a couple of bombs.

The total quantity of plutonium that Osirak could have produced depended on the power of the reactor (Israel believed that it could be expanded from 40 to 70 MW); the capacity of the cooling system; the amount of natural uranium that could be irradiated by the neutron flux aimed at the fuel in the core; and the arrangement of the targets.

Iraq's plutonium separation capacity was shrouded in mystery. Richard Betts even concluded that the Iraqis lacked a separation capability at the time of the strike. He argued that "the reprocessing plant, rather than the reactor, would have been the appropriate target," for without separation facilities the radioactive material would have been useless.<sup>15</sup> Israel

believed that facilities at the Osirak complex—which were destroyed in the air strike—could be converted for active plutonium separation work. Because the Israeli leadership worried that Iraq could obtain this capability swiftly, on or off-site from the reactor itself, they preferred that Osirak be destroyed before spent uranium was stockpiled for plutonium separation and weapons use.

Israel had good reason to believe that, sooner or later, Iraq was going to obtain multiple bombs' worth of plutonium, barring discovery. One might question the possibly premature timing of the raid,<sup>16</sup> as figures in the Israeli cabinet and opposition did. But Israeli decision-makers were unanimous in the view that the Osirak project, if left undisturbed, would eventually produce an Iraqi bomb. The more interesting and confusing half of the equation lies in the field of inspections and detection. This question has also generated some of the most vitriolic and impassioned polemics of the Osirak affair.

## Inspections and Timing

Operation Opera was perceived as a "vote of no confidence" in the global nonproliferation regime, which comprised the Nuclear Non-Proliferation Treaty (NPT) and the IAEA inspections system. Israel posited the utter inadequacy of existing safeguards. Ultimately, the effectiveness of the safeguards system was never put to the test. The terms of Iraq's agreement with France mandated IAEA inspections of the site every few months. Inspections were intended to account for the HEU fuel and related activities. For this reason, Israel worried that the natural uranium targets, produced from yellowcake freely and legally purchased on international markets, would be outside the purview of the IAEA's inspectors. The IAEA had the right to request additional inspections of other areas, but all such visits needed to be approved by the Iraqi hosts. Round-the-clock video-camera monitoring was to provide an additional layer of security, but an agreement had yet to be reached on the cameras by the time of the Israeli attack.

A verdict on the efficacy of the attack hinges in large part on the likelihood that the irradiation of natural uranium targets would have come to light. The Israelis feared that this was unlikely, while the IAEA claimed that such concerns were far-fetched. Iraq would have to remove the natural uranium before each inspection and then replace it as soon as IAEA inspectors left. This complex physical task would have to evade video cameras and the hundreds of foreign technicians on site. Even if the Iraqis managed to spirit away the irradiated targets and secretly process it, there

was one other crucial indicator that could tip off foreign observers. Use of the neutron flux to irradiate natural uranium in addition to the HEU fuel would noticeably lower the efficiency of the reactor, resulting in an elevated consumption of French fuel. Outside observers would be sure to notice this, the IAEA and French argued, which would accordingly impel the French to cut off fuel shipments, thereby ceasing reactor operations.<sup>17</sup>

The Israeli Government, as Shai Feldman points out, neither trusted in the ability of the IAEA to detect clandestine activity nor in the will of the international community to do something about it were such activities to be uncovered. The Israelis chose to nip the problem in the bud, although the cabinet decision was a close one, with major figures such as Yigael Yadin and Yehoshua Saguy voting against.<sup>18</sup> Shimon Peres, in a private letter to Begin that was leaked to the press, argued that there was still time for inspections to have a positive influence. Equally important in his mind was the election of François Mitterand to the French presidency. Peres believed that Mitterand was both friendlier to Israel and more concerned with nuclear proliferation than his predecessor, Giscard d'Estaing. Therefore, Peres argued that Israel should wait to see if the French would cut off the fuel supply if Iraq was caught seeking plutonium.<sup>19</sup>

Begin may have had a number of reasons for deciding to strike precisely when he did, not least of which could have been his sincere fear of spreading radiation once the reactor was operational. The Israeli Government justified the timing based on intelligence reporting that Osirak was soon to receive its first shipment of fuel and commence operations. According to Begin, once active, the reactor's destruction would have spread radiation fallout throughout Baghdad.<sup>20</sup> Many sources, including the Congressional Research Service and Brookhaven Laboratory, have since rebutted this claim.<sup>21</sup> Further scientific study on this matter would help clarify one of the key points in the Osirak debate.

Surely Israel's frustrations in raising the diplomatic profile of the issue, which dated back to the late 1970s under Prime Minister Rabin, contributed to pessimism regarding the diplomatic efforts to halt Iraq's nuclear ambitions. Nonetheless, the attack was not made with Israel's back against the wall, at the eleventh hour. It is more accurate to say that Israeli decision-makers chose the strategic time and opportunity that they believed ideal, for reasons that have yet to be fully clarified. The American nuclear scientist Albert Carnesale, in his testimony at the Senate Foreign Relations Committee hearings on the strike, best encapsulated the strategic calculus. It is most likely that inspectors would have warned of any



plutonium production, he said, but the Israelis were not willing to live with the odds that Saddam might get the bomb. Whether that justified the attack, he went on, depends on how one calculates the odds.<sup>22</sup>

## Quantifying the Delay

Iraq irrevocably lost the plutonium option when the Osirak reactor was destroyed, as it was subsequently unable to reach a deal with France or another foreign supplier to build a new reactor. Soon after the attack, Saddam Hussein initiated an ambitious and covert uranium enrichment program. The budget and personnel for uranium enrichment were several times the scale of the Osirak effort, indicating a redoubled Iraqi commitment to the bomb. The public humiliation of the bombing, in which Iraqi defense forces were inert and helpless as Israel destroyed the country's prized technological showpiece, no doubt increased national will and motivation, at least among the leadership. Hussein and other Arab leaders issued several statements on the intolerability of Zionist monopolization of nuclear technology, indicating a clear increase in the political salience of the issue. Yet in 2010, remarkably, Israel still maintains its regional nuclear monopoly, and no Arab state possesses an advanced nuclear program.<sup>23</sup>

How much time did Begin really buy? Jeremy Tamsett and Richard Betts made opposing arguments on this score, and the truth lies somewhere in between. Tamsett argued that the delay was significant, as subsequent Iraqi efforts entailed countless funds and man-hours poured into futile endeavors. The uranium enrichment route was technically more difficult and involved parallel efforts (electro-magnetic isotope separation, gaseous diffusion, and finally gas centrifuges);<sup>24</sup> Iraq never mastered the technology. Additionally, much of the budget was dedicated toward preserving secrecy and dispersion, which presented severe logistical challenges that sapped the program's efficiency.<sup>25</sup>

By contrast, Betts argued that the secret uranium effort likely brought Iraq closer to a bomb than the more visible plutonium program ever would have. He was somewhat sanguine about the prospects of detection at Osirak, and he therefore believes that the Israeli strike was counterproductive, in effect pushing the Iraqis toward a more discreet, harder-to-monitor uranium-based bomb program. Despite increased international attention to Iraqi proliferation, and the refusal of European countries to cooperate with the Iraqi program following Operation Opera (arguments utilized by Tamsett), Betts pointed out that Iraq was still able to procure centrifuge components on the European and international markets (and

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with the help of the A.Q. Khan network). Had the Gulf War taken place in 1993, Betts wrote, Saddam "might have [had] a nuclear weapon in his holster."<sup>26</sup> Betts's conclusion: "It is hard to determine in fact whether the strike against Osirak retarded Iraq's nuclear weapons program or spurred it."<sup>27</sup>

If one accepts the Israeli Government estimate of Osirak's yielding a bomb by 1985, then Israel bought many years, since Iraq did not possess atomic weapons in 1991. If one accepts Betts's argument, then Iraq may have been pushed from a slow, easy-to-monitor program into a more dangerous, stealth approach. Most likely, Israel achieved a delay of several years at the cost of pushing Iraq into a more covert program.

In 1991, following the American ouster of Iraqi forces from Kuwait, then-Defense Secretary Dick Cheney sent David Ivry, who headed Operation Opera as an Air Force General, a photograph of the destroyed Osirak reactor, with a note of appreciation for denying Saddam a nuclear bomb and making the Americans' job one decade later easier. The timing of the Gulf War before the Iraqi Atomic Energy Commission perfected its centrifuge designs was serendipitous. Had Iraq not invaded Kuwait in 1990, Iraq may very well have learned to enrich bomb-grade uranium out of sight of foreign intelligence agencies and international supervision. The effect of Operation Opera was one of delay—precisely how many years it is difficult to say—but not of insuperable impediment. So too the regional and global political repercussions of the raid were complex and even contradictory.

## Political Implications

An international uproar ensued after Israel accepted responsibility for the destruction of Osirak, with not just Arab and Muslim states but also the Europeans and even the United States strongly condemning the bombing. Arab representatives attempted to have Israel removed from the IAEA, but U.S. opposition blocked the move. The UN Security Council passed a strongly worded condemnation, yet the U.S. was able to convince Iraq to support a Chapter VI resolution (which does not carry Security Council sanctions) in order to avoid a U.S. veto. Perhaps more importantly, the bombing came in the midst of the Egyptian-Israeli peace process, only days after Sadat met with Begin, and during a delicate time leading up to the handover of the Sinai Desert. Israel soon exacerbated Arab antipathy by bombing, with civilian casualties, an apartment building in Beirut that served as Palestine Liberation Organization (PLO) headquarters. The following year, 1982, Israel launched a full-scale invasion of Lebanon in

response to PLO terrorist attacks on Israeli towns. The Begin era gave Israel a belligerent, aggressive image, with Osirak merely one in a series of military activities.

Interestingly, the bombing of Osirak increased the political "salience" of nuclear weapons in the Middle East without launching a regional arms race. None of Israel's Arab neighbors (neither Turkey nor Iran) moved in the aftermath of the bombing to aggressively pursue the nuclear option. It is possible that Israel achieved the desired deterrent effect, although that supposition is belied by Iraq's determination to reconstitute its program in secret. It is also possible that other Middle Eastern states did not see the Israeli bomb as a threat to their security, and that Israel's posture of ambiguity effectively communicated the intention never to brandish the weapon, except to stave off the elimination of the state. It is also possible that Israel's bombing did in fact motivate its neighbors to get the bomb, but that they were simply unable to do so for financial, scientific, or other reasons. More research on the programs of neighboring states, and their reaction to Operation Opera, is needed.<sup>28</sup>

The attack did bring international attention to Israel's possession of nuclear arms and its refusal to sign the NPT or submit its facilities to IAEA inspections, but Israel was never compelled to submit. The United States gave Israel a slap on the wrist when it temporarily suspended a shipment of planes, but it never found Israel in formal violation of their arms agreement (which stipulated that American-made F-15 and F-16 fighter aircraft were to be used for defensive purposes only). The main political effects of Osirak, then, were increased diplomatic isolation, temporary tensions with the United States, and the addition of fuel to the fire of Arab animosity. Iraq was unable to retaliate militarily, its conventional army fully engaged on the Iranian front and its asymmetrical or unconventional capabilities at that time nonexistent.

## A "Begin Doctrine"?

Did the Begin government act on the assumption that it would be possible indefinitely to deny nuclear weapons to Israel's enemies? Or did he presume more modestly that he could simply put off the inevitable? The two premises would recommend sharply different strategic thinking. If military strikes are the final word in counter-proliferation, then the Israeli Government may have thought it established a model for future, repeated strikes on other countries, or again in Iraq. Yet if Begin accepted that one day an enemy state would eventually get the bomb, then he could have hoped only to buy time, with starkly different implications for strategy.

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When the Israeli Government announced the Osirak raid, it declared: "Under no circumstances would we allow the enemy to develop weapons of mass destruction against our nation; we will defend Israel's citizens, in time, with all the means at our disposal." Later in the year, then-Defense Minister Ariel Sharon had this to say:

"The third element in our defense policy for the 1980s is our determination to prevent confrontation states from gaining access to nuclear weapons. Israel cannot afford the introduction of the nuclear weapon. For us it is not a question of a balance of terror but a question of survival. We shall therefore have to prevent such a threat at its inception."<sup>29</sup>

Sharon and Begin, at least in declaratory policy, seemed to believe that a system of stable deterrence was impossible and the advent of an Arab Bomb not merely dangerous but apocalyptic (Begin supposedly saw a bomb in Saddam's hands as a sure replay of the Holocaust). On the other hand, their policy could be interpreted to apply only to "enemy" or "confrontation" states, meaning they would not react similarly to nuclearization of a country that recognized and made peace with the Jewish State.

The Labor opposition under Shimon Peres and Yitzhak Rabin, on the other hand, took a more nuanced view. Here is Rabin in a 1981 interview:

"Israel must do everything to prevent an Arab state [from] reaching a serious potential for building a nuclear bomb or acquiring one. Israel must first exhaust all diplomatic means and covert operations. Yet, if these measures fail, I do not preclude Israeli direct military action designed to obstruct or delay the realization of a nuclear option (its elimination once and for all is impossible), particularly in a country whose leaders are of the Saddam Hussein or Muammar Qaddafi kind."<sup>30</sup>

Rabin saw the Osirak strike, and the American attack on Iraq's nuclear infrastructure in the Gulf War, as creating a window of opportunity to further improve Israel's conventional advantage and, ultimately, to achieve a regional settlement via peace negotiations. He became increasingly concerned with Iran and its nuclear program in the 1990s, and hoped to conclude talks with the Palestinians before Iran went nuclear (this was one of many considerations that led him to endorse the Oslo process). Internal Israeli Government deliberations in 1981 will be declassified in the coming years. Those documents should do much to illuminate Israeli strategic thinking at this juncture.

Then there is the matter of precedent setting. Many observers at the time of Operation Opera worried that the Israeli decision would set off a wave of preemptive strikes on nuclear installations, with the most dangerous venue being the Indo-Pakistani arena. Arab states might attempt to take out the Dimona reactor in retaliation. As *Commonweal* wrote in a brilliant editorial some months after the attack,<sup>31</sup> the Israeli operation had grave consequences for the international community, but this was in large measure a result of the inadequacies of the international nonproliferation regime. They could understand why Israel would value its national security over considerations of global stability, and in closing hoped that the attack would create pressure to improve IAEA safeguards and clamp down on commercial sales of nuclear technology. This to some extent happened. IAEA inspectors today have stronger tools to demand complete access. Sales in nuclear technology have declined, especially with the breakup of the A.Q. Khan network. And yet it is still possible, as North Korea and Iran have shown (Iran is only midway through the sequence), for determined states to avoid or refuse inspections, clandestinely advance their capabilities, and then pull out of the NPT at the time of their choosing. This unpleasant fact raises questions about the long-term viability of the current regime of haves and have-nots.

## Osirak Redux

And that set the other precedent—the urge, in the words of a 2007 article, to pull off an "Osirak Redux" on a larger scale, this time at Natanz, Esfahan, and Bushehr.<sup>32</sup> The writers argue that Israel most likely possesses the necessary ordnance (BLU bunker busters) and intelligence to disrupt the Iranian nuclear program severely and set it back several years. In short, while the Iranians learned the lesson of Osirak and dispersed, hid, and hardened their nuclear facilities, the Israelis have not been sitting still. Their air force, in the author's assessment, has kept pace. They have made a military, and not a strategic, analysis. More recently, Anthony Cordesman's study reached the opposite conclusion.<sup>33</sup> Yet any attempt to set back the Iranian program, even if successful, is fraught with political and strategic hazards. It is likely that Iran could reconstitute more quickly than Iraq did because its nuclear technology, and the program's knowledge base, is more heavily indigenous. There would be any number of unpredictable political consequences, both internal to Iran (the strike would likely strengthen the current regime, and the hard-line elements within it) and international (global Muslim anger at Israel and the West). Iran also has the capability to respond to Israel directly, with long-range Shahab missiles, and indirectly, with shorter-range missiles via its Hezbollah proxy.

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Can Israel live with an enemy bomb? Does it have a choice? The legacy of Osirak is a tactical success and a strategic riddle. There are no easy answers, quick fixes, or models for general replication.

## About the Author

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## References

- 1 Shai Feldman, "The Bombing of Osirak—Revisited," *International Security* (Autumn 1982): 141.
- 2 The Israel Air Force initially coined the secret plans to strike Osirak "Ammunition Hill" (the site of a famous battle in the Six-Day War of 1967). The strike was delayed several times, and as knowledge of the plans spread, they were given the new code-name "Operation Opera." The action is also known in English as "Operation Babylon." Amos Perlmutter, Michael Handel, and Uri Bar-Joseph, *Two Minutes Over Baghdad*. London: Frank Cass, 2003. For a general overview of the operational side, see also Shlomo Nakdimon, *First Strike*. In Hebrew, see Tsachi Ben-Ami and Amos Dor, "Operation Opera," *Air Space*, available at: <http://www.iafe.net/ma/yad.htm>.
- 3 Dan Reiter, "Preventive Attacks Against Nuclear Programs and the 'Success' at Osirak," *Nonproliferation Review* (July 2005): 357–358.
- 4 Richard Wilson, "A Visit to the Bombed Nuclear Reactor at Tuwaitha, Iraq," *Nature* (March 31, 1983).
- 5 The Dan Reiter/Richard Betts view (an exposition of Betts's take follows shortly) that the air strike was counterproductive was based on the premise that Iraq's later covert uranium separation efforts were more dangerous than the publicly declared, IAEA-monitored facility at Osirak; and that the proper target of a strike against a potential plutonium-production program would be an active plutonium separation facility, not the reactor itself. Reiter and Betts did not assert that Osirak was designed for peaceful purposes.
- 6 Iraq's Osiris-type reactor came to be called by the portmanteau of "Osirak."
- 7 Lucien Vandenborucke, "The Israeli Strike Against Osirak," *Air University Review* (September–October 1984).
- 8 Mahdi Obeidi, *The Bomb in My Garden* (Hoboken, New Jersey: John Wiley & Sons, 2004).

- 9 Khidhir Hamza and David Albright, "Iraq's Reconstitution of Its Nuclear Weapons Program," *Arms Control Today*, October 1, 1998.
- 10 Khidhir Hamza, *Saddam's Bombmaker* (New York: Scribner, 2000).
- 11 Feldman, p.117.
- 12 Jed Snyder, "The Road to Osiraq: Baghdad's Quest for the Bomb," *The Middle East Journal* (Autumn 1983): 570.
- 13 Particularly incriminating was Iraq's requisition of metal fuel pins for the uranium. See Snyder p.578.
- 14 "More recently, an Italian firm supplied Iraq with...a large-scale separation plant in which uranium targets can be processed at the rate of 25 tons a year. However, this particular facility was designed without radiation shielding, and some of its components are unsuitable in their original form for 'hot' work. For these reasons it is considered a mock-up or training facility.... The possibility of adding radiation shielding to the facility and modifying some of its components cannot be ruled out. In any event, the construction of a special 'hot' plant is always possible at a later stage, using all the suitable processing equipment from the THFCER [the existing plant] and adding the few required items." Government of Israel, *The Iraqi Nuclear Threat: Why Israel Had to Act* (Jerusalem: Ministry of Foreign Affairs, 1981).
- 15 Richard Betts, "The Osirak Fallacy," *The National Interest*, Summer 2006.
- 16 Much speculation has surrounded the timing of the raid—only three weeks before the election. Begin's Likud was trailing in the polls to Labor but pulled ahead after Operation Opera. Labor charged Begin with manipulating public opinion. However, the operation had been in the planning stages for a number of years, and Begin had authorized the raid on numerous occasions before, only to cancel it each time. There is a more probable and different kind of political motivation for the timing only three weeks before the elections. Begin likely feared that a Peres-led Labor administration would not use force and thereby allow Iraq's efforts to succeed.
- 17 Christopher Herzig, "IAEA Safeguards," *International Security* (Spring 1983). Herzig wrote the official IAEA response to Shai Feldman's article. For a view that evasion of detection was extremely unlikely, see also Betts, "The Osirak Fallacy."
- 18 *Two Minutes* discusses the cabinet votes, p.171. The final decision was ultimately made by a group of three hardliners, Begin plus Yitzhak Shamir and Rafi Eitan; see p.70.
- 19 The brief and cryptic letter is quoted in full in *First Strike*. Peres did not explicitly say that the French will cut off the fuel supply. He made reference to "replacing materials" with "other materials." He also wrote that there was still time, that the "deadlines" assumed by more hawkish Israeli decision-makers were not "realistic."
- 20 Government of Israel, "The Iraqi Threat," p.2. "[The] timing was dictated by the fact that the reactor was due to become critical between July and September of 1981, after which radioactive release could have entailed injury to civilians."
- 21 See Snyder for a summary of the CRS and Brookhaven findings.

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- 22 "The Israeli Air Strike," *Hearings Before the Committee on Foreign Relations, United States Senate, Ninety-seventh Congress, First Session, June 1981.*
- 23 It is debatable how much the salience of Israel's nuclear arsenal spurred the Iranian weapons program and the Syrian effort to build a North Korean reactor at Deir ez-Zor. The resort to a preemptive airstrike at the Syria site in 2007 (branded Operation Orchard and known colloquially as a "mini-Osirak"), depending on one's point of view, either reflects the unsustainable nature of militarized counter-proliferation or demonstrates its utility.
- 24 Obeidi's account can be construed as reinforcement for Tamsett's argument. Obeidi himself was elevated to his position because of his invention of a new barrier material for gaseous diffusion, but this, like Jafar's preferred EMIS method, went nowhere. Only when the Iraqis obtained Pakistani centrifuge technology did they come close to enrichment, although they never achieved industrial-scale cascades. On the other hand, as Betts points out, they were likely closing in on success, although the number of months or years they needed in 1991 is unknown.
- 25 Jeremy Tamsett, "The Israeli Bombing of Osirak Reconsidered," *Nonproliferation Review* (Fall-Winter 2004).
- 26 Betts, "The Osirak Fallacy."
- 27 Richard Betts, "Striking First: A History of Thankfully Lost Opportunities," *Ethics & International Affairs*, 17 (2003).
- 28 Libya did continue its rudimentary efforts in this field.
- 29 Sharon and Begin are quoted in Feldman, p.122.
- 30 Quoted, p.122, in Ephraim Inbar, *Rabin and Israel's National Security*. Washington, D.C.: The Woodrow Wilson Center Press, 1999.
- 31 "After the Israeli Strike," *Commonweal*. July 3, 1981.
- 32 Whitney Raas and Austin Long, "Osirak Redux? Assessing Israeli Capabilities to Destroy Iranian Nuclear Facilities." *International Security*, Spring 2007.
- 33 Anthony Cordesman and Abdullah Toukan, "Study on a Possible Israeli Strike on Iran's Nuclear Development Facilities," March 14, 2009, available at: [http://csis.org/files/media/csis/pubs/090316\\_israelistrikeiran.pdf](http://csis.org/files/media/csis/pubs/090316_israelistrikeiran.pdf).