Istituto Affari Internazionali

Iran's Nuclear Programme after the 12-Day War: Options and Challenges

by Michele Gaietta

ISSN 2610-9603 | ISBN 978-88-9368-368-5

IAI PAPERS 25 | 15 - JULY 2025

ABSTRACT

As the ceasefire between Israel and Iran appears to hold, a preliminary assessment of the military campaign's impact on Iran's nuclear programme becomes possible. The Israeli–US strikes have inflicted substantial damage on the nuclear infrastructure, yet critical uncertainties persist regarding the status of enriched material, the availability of advanced centrifuges and Tehran's future stance on international oversight. The two military operations represent a high-stakes gamble, premised on the expectation that Iran might yield under pressure and stop sensitive nuclear activities. However, Iran's past behaviour suggests a consistent pattern of resilience and calibrated engagement only from a position of relative strength. If the campaign has failed to alter that calculus, the gradual and covert reconstitution of nuclear capabilities should not be ruled out. Against this backdrop of uncertainty, reviving a credible diplomatic track becomes all the more urgent to avert Iran's potential withdrawal from the Nuclear Non-Proliferation Treaty, which would further erode the global non-proliferation regime and undermine the authority of international institutions.

Iran | Nuclear programme | Israel | US military policy

keywords

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by Michele Gaietta*

Introduction

Prime Minister Benjamin Netanyahu justified Israel's decision to launch *Operation Rising Lion* on the night of 13 June as a direct effort to target Iran's nuclear programme. This rationale aligns with the so-called "Begin Doctrine", which seeks to ensure that Israel remains not only the "first" (albeit unofficially declared) but also the "only" nuclear-armed state in the Middle East, calling for pre-emptive strikes against any regional adversary perceived as approaching nuclear weapons capability and thus posing an existential threat to Israel through the possession of weapons of mass destruction.

As the fog of war partially lifts and the ceasefire between Israel and Iran appears to hold, a preliminary analysis can be offered of the past twelve days of conflict, along with an initial assessment of their implications for the future trajectory of Iran's nuclear programme and the associated proliferation risk stemming from its remaining nuclear activities.

1. Israel's evolving strategy against Iran's nuclear programme

In the past, the "Begin Doctrine" has provided the basis for Israeli airstrikes on Iraq's Osirak research reactor in 1981 (*Operation Opera*, preceded by a failed Iranian attack in 1980) and on a "suspected" Syrian research reactor in 2007 (*Operation Outside the Box*). Both facilities were considered – based on their design and characteristics – to pose proliferation concerns, as they could be used to produce plutonium-239 for subsequent extraction through reprocessing activities.

The application of this doctrine to Iran has always assumed a broader dimension than in these earlier cases, which were only partially addressed through surgical airstrikes. Indeed, the geopolitical, strategic and operational complexities –

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ISSN 2610-9603 | ISBN 978-88-9368-368-5

combined with international pressure – have led Israel, since the early 2000s, to develop a wider and more sophisticated array of countermeasures in trying to at least slow down Iran's nuclear capabilities.

These efforts have relied on an increasingly advanced capacity to infiltrate Iran and gather intelligence on undeclared nuclear activities – culminating in the 2018 acquisition of the "Nuclear Archive" stored in a warehouse outside Tehran.[1] The "Nuclear Archive" refers to a vast collection of materials that Israel managed to extract from Iran, covering the country's most sensitive military nuclear activities. These activities were part of a structured scientific programme, the so-called AMAD plan, which was mostly carried out at the feasibility study level from 1999 to 2003, with the aim of giving Iran a potential nuclear weapons option.

This acquisition of information has always served a dual purpose: on one hand, its selective and gradual release has allowed Israel to maintain international pressure on Tehran, repeatedly prompting the International Atomic Energy Agency (IAEA) to initiate verification procedures and, in cases of non-cooperation, to refer the matter to the United Nations Security Council (UNSC). This has been true in the past – as occurred in 2006 – and may also apply to the future, as potentially exemplified by the IAEA Board of Governors resolution adopted on 12 June 2025.[2] This prolonged investigation process, still ongoing, has been criticised by senior Iranian officials as a "bottomless pit".[3]

On the other hand, the intelligence gathered has provided a foundation for operations and attacks conducted within Iran by Israeli agencies, often in collaboration with Iranian resistance groups, especially during periods of heightened tension. For instance, between 2010 and 2012 – following the revelation of the underground Fordow facility and Iran's decision to increase uranium enrichment to 20 per cent – a series of targeted assassinations of nuclear scientists took place alongside a sophisticated cyberattack – jointly conducted with the United States – that damaged several centrifuges at the Natanz fuel enrichment plant (FEP).

In 2020-2021, a new wave of intelligence operations followed Tehran's decision to cease compliance with certain provisions outlined in the Joint Comprehensive Plan of Action (JCPOA), one year after the United States' unilateral withdrawal from the agreement in 2018. The JCPOA – finalised in 2015 between Iran and the E3/

[1] Aaron Arnold et al., "The Iran Nuclear Archive: Impressions and Implications", in *Belfer Center Reports*, April 2019, https://www.belfercenter.org/publication/iran-nuclear-archive-impressions-and-implications.

[2] International Atomic Energy Agency (IAEA), *Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran* (GOV/2006/14), 4 February 2006, par. 2, https://www.iaea.org/sites/default/files/documents/gov2006-14.pdf.

[3] International Crisis Group, "Is Restoring the Iran Nuclear Deal Still Possible?", in *Crisis Group Middle East Briefings*, No. 87 (12 June 2022), https://www.crisisgroup.org/node/19560; IAEA, *NPT Safeguards Agreement with the Islamic Republic of Iran* (GOV/2025/25), 31 May 2025, https://www.iaea.org/sites/default/files/25/06/gov2025-25.pdf.

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EU+3 (France, Germany, the United Kingdom, China, Russia and the United States, alongside the EU) – aimed to curb Iran's nuclear programme through technical constraints and provide the IAEA with enhanced verification capabilities, in exchange for broader relief from international sanctions imposed on Iran.

In November 2020, Mohsen Fakhrizadeh, widely regarded as the architect of Iran's military nuclear research under the AMAD plan, was assassinated.[4] Additional sabotage operations followed, including a blackout at Natanz FEP in 2021, which damaged some centrifuges, as well as explosions at the nuclear centrifuge assembly centre (ICAC) at Natanz in 2020 and at the manufacturing plant operated by TESA (Iran Centrifuge Technology Company) in Karaj in 2021. These actions were clearly aimed at slowing Tehran's expansion of centrifuge installations, particularly following its declared intention to exceed the JCPOA's agreed threshold of approximately 5,000 operational IR-1 centrifuges at the Natanz FEP in January 2020.

Israel has strongly opposed the JCPOA, as well as any preliminary agreement or diplomatic solution that might recognise – even while attempting to contain – Iran's right, as enshrined in Article 4 of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), to fully develop the nuclear fuel cycle, including uranium enrichment activities. In this context, Israel launched its recent military attack on Iranian territory just prior to the sixth round of negotiations between the United States and Iran, mediated by Oman and scheduled for 15 June 2025. This underscores Israel's deep scepticism regarding the prospect of a mutually agreed diplomatic solution to the entire nuclear dossier with the current Iranian regime. Although these talks lacked concrete guarantees, and the prospects for finding common ground diminished as technical discussions progressed – also influenced by the US's firm stance against recognising Iran's enrichment capabilities – the negotiations nonetheless kept the diplomatic process alive.

2. Options spinning out of a window of opportunity

Israel's decision to carry out direct airstrikes against Iranian nuclear sites reflects less a shift in political intent and more a desire to exploit a "window of opportunity" created by a favourable regional context and the protracted internal fragility of the Iranian regime. This action comes at a time when the perceived risk of a nuclear breakout has been particularly elevated, driven both by Tehran's accumulation of significant quantities of uranium highly enriched to 60 per cent – approaching the military-grade threshold of 90 per cent – and by (unverified) intelligence gathered by Israel suggesting the alleged reactivation of research aimed at constructing a nuclear weapon.[5]

[4] Ronen Bergman and Farnaz Fassihi, "The Scientist and the A.I.-Assisted, Remote-Control Killing Machine", in *The New York Times*, 18 September 2021, https://www.nytimes.com/2021/09/18/world/middleeast/iran-nuclear-fakhrizadeh-assassination-israel.html.

[5] Alexander Ward, Lara Seligman and Dustin Volz, "Exclusive: Israel Built Its Case for War with Iran

ISSN 2610-9603 | ISBN 978-88-9368-368-5

In this context, the resolution adopted by the IAEA Board of Governors on 12 June – though strongly critical of Iran – does not appear to have decisively influenced Israel's decision to proceed with the attack. The resolution reiterated Tehran's persistent lack of cooperation since 2019 in providing clarifications about nuclear materials and undeclared activities at three sites – Lavisan-Shian, Varamin and Tuquzabad – potentially linked to the AMAD plan.[6] While this constitutes a serious concern for the Agency – which, for the first time since Iran's dossier was removed from the UN Security Council, has found Iran non-compliant in its obligation to provide all relevant information ensuring full declaration of its nuclear-related activities and materials – this issue primarily pertains to the reconstruction of past activities rather than serving as a decisive indicator of an elevated imminent nuclear proliferation risk.

Operation Rising Lion aligns both with the foundational premises and the formal objective of preventing Tehran from developing nuclear weapons, fitting within the broader framework of the "Begin Doctrine". However, it surpassed the scope of the targeted limited strikes conducted in the past – such as those against Iraq and Syria – and of intelligence operations mentioned earlier, extending to the decapitation of Iran's military leadership and the degradation of the country's ballistic and drone offensive capabilities. This reflects the conviction that despite potential damage to nuclear infrastructure, only a structural weakening of the regime could fundamentally alter Iran's nuclear policy and compel it to abandon its nuclear ambitions, as happened in Libya (where Israel had no direct involvement) and Iraq in the 1990s. Yet, neither the Iraqi nor the Libyan cases constitute fully adequate precedents.[7]

From a technical standpoint, the features of Iran's nuclear programme render its complete and irreversible dismantlement through airstrikes alone highly challenging. The 1981 Israeli airstrike on Iraq's Osiraq research reactor, for instance, only prompted Saddam Hussein's regime to pursue nuclear weapons via a parallel, undeclared programme. It was not until the US-led ground intervention – *Operation Desert Storm*, launched in response to Iraq's 1990 invasion of Kuwait – that the full extent of Baghdad's nuclear ambitions was uncovered, and their dismantlement was made possible through the work of the UN Special Commission (UNSCOM) and the IAEA – conditions that are hardly replicable in the Iranian case.

From a political perspective, it is equally improbable that the current Iranian leadership – under conditions tantamount to "unconditional surrender" –

on New Intelligence. The US Didn't Buy It", in *The Wall Street Journal*, 17 June 2025, https://www.wsj.com/world/middle-east/israel-built-its-case-for-war-with-iran-on-new-intelligence-the-u-s-didnt-buy-it-55592e81.

[6] IAEA, *NPT Safeguards Agreement with the Islamic Republic of Iran* (GOV/2025/38), 21 June 2025, https://www.iaea.org/sites/default/files/25/06/gov2025-38.pdf.

[7] Michele Gaietta, "Detriti dell''asse del male' sull'ordine nucleare: origini e conseguenze", in Andrea Plebani (ed.), *Dinamiche geopolitiche contemporanee. Ce.St.In.Geo. geopolitical outlook 2023*, Milano, EDUCatt, 2023, p. 163-187.

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would agree to negotiate the regime's future survival in exchange for an almost total abandonment of its nuclear programme, given the symbolic significance the programme holds for the regime. Unlike Libya, Iran has spent the past four decades developing its nuclear capabilities primarily as a tool of structural long-term deterrence – focusing on achieving and preserving technical mastery over fissile material production – and only secondarily as a bargaining chip, tactically employed at critical moments and always within the boundaries set by the Supreme Leader, Ali Khamenei. Consistent with this posture, Iran has demonstrated some negotiating flexibility since 2003, seeking to balance strategic and economic interests by limiting or constraining selected portions of its nuclear programme in exchange for sanctions relief, as reflected in the interim agreement of 2013 and the JCPOA of 2015.

Iran's firm commitment to preserving its stated "right" to enrich uranium has been clearly reaffirmed even amid Israeli airstrikes during the meeting on 20 June 2025, in Switzerland, where French, German, British and European Union representatives met with Iranian Foreign Minister Abbas Araghchi.[8] This posture reflects a broader unwillingness to capitulate in negotiations under coercion, aimed at avoiding any precedent that could signal submission to military pressure – a stance with long-term implications extending well beyond the nuclear file.[9]

3. Israeli strikes on Iran's nuclear programme: From covert action to open escalation

If a total "political surrender" by Iran in the nuclear domain is deemed unlikely, the focus shifts to assessing the extent of the damage that have been inflicted by Israel's airstrike campaign. Within this context, two distinct scenarios unfolded over the twelve days of conflict: one in which the United States appeared to refrain from any declared or direct participation in the attacks; and a second, ultimately materialised on the night of 22 June, in which US involvement became overt.

3.1 Continuity: The targeted assassination of nuclear scientists

The initiation of Israel's military operation coincided with targeted strikes against key nuclear facilities – marking a crucial escalation and reflecting the official rationale presented by the Israeli government to destroy Iran's nuclear capabilities – as well as with targeted killings of nuclear scientists, in line with prior intelligence operations. As mentioned, this latter campaign continues the long trail of assassinations of scientists involved in Iran's nuclear programme,

[8] Patrick Wintour, "Macron Lays out Broad European Offer for Iran to End War with Israel", in *The Guardian*, 20 June 2025, https://www.theguardian.com/p/x2h2b7.

[9] "Khamenei Says Iran Will 'Never Surrender', Warns off US", in *Al Arabiya*, 18 June 2025, https://english.alarabiya.net/News/middle-east/2025/06/18/-israel-made-a-huge-mistake-khamenei-.

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which intensified starting in 2010, during a critical phase following the discovery of the Fordow enrichment site.

The most significant victim of the renewed wave of assassinations linked to *Operation Rising Lion* was Fereydoon Abbasi-Davani, who had survived previous assassination attempts and, for this reason, served as head of the Atomic Energy Organization of Iran (AEOI) between 2011 and 2013 in a symbolic gesture of resistance and protection. Abbasi-Davani was affiliated with Shahid Beheshti University and had been under UN Security Council sanctions since 2007 for his role in the "Institute of Applied Physics", working alongside Mohsen Fakhrizadeh.[10] His killing was justified by Israeli sources based on unverified intelligence suggesting the resumption of activities connected to the military dimension of the nuclear programme starting in late 2023.[11] Under the same logic, Israel targeted Mohammad Mehdi Tehranchi – a prominent theoretical physicist and president of the Islamic Azad University of Tehran – along with Abdollamid Minouchehr, dean of the nuclear sciences faculty at Shahid Beheshti University, and Ahmad Reza Zolfaghari, professor of nuclear engineering. Several other Iranian scientists and engineers were also targeted and killed by Israel.[12]

These operations targeting nuclear scientists are part of a broader strategy aimed at disrupting – or at the very least slowing down – Iran's atomic programme. The strikes focus not only on eliminating advanced expertise but, above all, on neutralising key figures – such as Fereydoon Abbasi-Davani – who might be difficult to replace due to their alleged possession of critical knowledge concerning highly sensitive and classified aspects of the programme, particularly those linked to the AMAD plan.

3.2 Escalation: Direct strikes on nuclear infrastructure

Regarding the attacks on nuclear facilities, Iran's fuel cycle can be categorised into three main "macro-categories". The first encompasses sites and facilities "upstream" of the conversion and enrichment processes, including uranium mining, milling and the production of yellowcake. These facilities pose limited proliferation risks in the short term and have therefore not been targeted by Israel. This macro-category includes the plants near Saghand, Ardakan and Gchine.[13]

[10] UN Security Council, *Resolution 1747 (2007)*, 24 March 2007, Annex I, https://docs.un.org/S/RES/1747(2007).

[11] David E. Sanger and Julian E. Barnes, "Iran Is Developing Plans for Faster, Cruder Weapon, U.S. Concludes", in *The New York Times*, 3 February 2025, https://www.nytimes.com/2025/02/03/us/politics/iran-nuclear-weapon.html; David Albright and Spencer Faragasso, "Renewed Activity at the Sanjarian and Golab Dareh Amad Sites", in *ISIS Reports*, 12 September 2024, https://isis-online.org/isis-reports/renewed-activity-at-the-sanjarian-and-golab-dareh-amad-sites.

[12] Francesca Regalado, Euan Ward and Farnaz Fassihi, "These Are Iranian Generals and Scientists Killed by Israel", in *The New York Times*, 13 June 2025, https://www.nytimes.com/2025/06/13/world/middleeast/iran-military-generals-killed-israel.html.

[13] Iran's domestic uranium infrastructure includes several key sites: Saghand, an underground

ISSN 2610-9603 | ISBN 978-88-9368-368-5

The second macro-category comprises nuclear facilities "downstream" of conversion and enrichment. This includes Iran's two operational reactors: the 5 MWt Tehran Research Reactor (TRR), located at the Tehran Nuclear Research Center (TNRC), and the 1,000 MWe Bushehr nuclear power plant, used for electricity generation. Given their active status and use of nuclear fuel, Israel has not targeted these reactors. This is especially true for Bushehr, due to the significant risk of radioactive contamination in the event of a malfunction in its safety and cooling systems – a hazard that would disproportionately impact countries along the southern Persian Gulf coast, given prevailing wind patterns.[14] Within this macro-category, only smaller research centres or non-operational reactors have been targeted by Israel, as exemplified by the strike on the Arak site. This facility, which includes a heavy water production plant and a research reactor under construction (the Khondab Heavy Water Research Reactor – KHRR), sustained significant damage on 19 June, as confirmed by the IAEA.[15]

The third macro-category, by contrast, is central to Iran's nuclear activities and involves the nexus between conversion and enrichment processes. The conversion stage includes chemically transforming milled uranium (yellowcake) into a gaseous form – uranium hexafluoride (UF_6), an essential precursor for enrichment by centrifuges – and subsequently converting this gas back into solid metallic uranium. This metallic uranium can serve either as fuel for certain reactors or, depending on the enrichment level, for military applications.

Enrichment itself is the quintessential dual-use process, enabling the concentration of the fissile isotope uranium-235 from its natural 0.7 per cent level up to 20 per cent (covering most civilian needs) and beyond 90 per cent for military-grade highly enriched uranium. Three key Iranian sites are pivotal to these processes: the Esfahan conversion site, which houses the Esfahan Nuclear Technology Center (ENTC), and the two enrichment sites at Natanz and Fordow. Due to their critical role in Iran's dual-use nuclear capabilities, all three were targeted by Israeli strikes beginning on 13 June 2025, with varying degrees of damage, and subsequently by US strikes on 22 June.

Satellite imagery and IAEA statements following the initial attacks on the Esfahan site report damage to four primary facilities as a result of the strikes on 13 June: the central chemical laboratory and three plants involved in uranium conversion

uranium mine in Yazd Province; Ardakan, which processes ore from Saghand into yellowcake; Gchine, a smaller mine and mill near Bandar Abbas, historically linked to concerns over possible military dimensions; and lesser-known sites such as Jang-e Sar and Narigand, associated with the country's uranium exploration programme.

[14] "A Simulation Showing a Hypothetical Radiation Propagation Path from the Bushehr Nuclear Reactor in Iran", in *ArabiaWeather*, 17 June 2025, https://www.arabiaweather.com/en/content/a-simulation-showing-a-hypothetical-radiation-propagation-path-from-the-bushehr-nuclear-reactor-in-iran.

[15] David Gritten, "Israel Strikes Unfinished Arak Heavy Water Reactor in Iran", in *BBC News*, 19 June 2025, https://www.bbc.com/news/articles/c8rpd6p7v0po.

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and metallic uranium production – a uranium conversion facility, a reactor fuel manufacturing plant and an enriched uranium metal processing facility under construction.[16] The strike caused visible damage to nearly all these structures; however, no significant changes in external radiation levels were detected, as confirmed by the IAEA.[17]

The targeting of these facilities was intended to hinder the potential production of highly enriched metallic uranium – an activity Iran has neither officially undertaken nor decided to pursue. A subsequent Israeli attack on 20 June further targeted additional buildings at the ENTC, including a natural and depleted uranium metal production facility that had not yet begun operations, a fuel rod production facility and a building for low-enriched uranium pellet production.

Israel also struck centrifuge production facilities at this site, as part of a broader effort to disrupt Iran's centrifuge capabilities. This campaign included a facility within the TNRC, where advanced centrifuge rotors were manufactured and tested, as well as a workshop in the city of Karaj responsible for producing various centrifuge components.[18]

Similarly, the attack on Natanz was specifically aimed at damaging Iran's largest enrichment facility, which comprises two main plants: a surface-level pilot plant (pilot fuel enrichment plant – PFEP) and an underground industrial facility (FEP). The pilot plant is used for research and development, including testing various types of centrifuges (IR-2m, IR-4, IR-6) arranged in cascades and production lines designed to enrich uranium to approximately 5 per cent and 60 per cent.[19] This plant was heavily damaged by Israeli missile strikes, resulting in the likely destruction of about 1,800 installed centrifuges.

The case of the industrial facility at Natanz FEP differs significantly. Constructed approximately 20 metres underground and reinforced with roughly seven metres of concrete, it was specifically designed to withstand conventional airstrikes. Consequently, on 13 June, Israel targeted the facility's supporting infrastructure instead – namely, the electrical substation and the emergency gas power unit. This strike caused a sudden blackout, which appears to have damaged a substantial portion of the roughly 15,000 operational centrifuges (out of about 18,500 installed), due to the extreme sensitivity of these machines.[20] Satellite imagery also

[16] Specifically, the last two facilities may refer to a UF_4 conversion line still under construction and to a new fuel production line for the Tehran Research Reactor located within the Fuel Plate Fabrication Plant (FPFP).

[17] IAEA, *IAEA Director General Grossi's Statement to UNSC on Situation in Iran*, 20 June 2025, https://www.iaea.org/node/221840.

[18] IAEA, *Update on Developments in Iran (2)*, 21 June 2025, https://www.iaea.org/node/221955.

[19] IAEA, *Verification and Monitoring in the Islamic Republic of Iran in Light of United Nations Security Council Resolution 2231 (2015)* (GOV/2025/24), 31 May 2025, paras. 10-12, https://www.iaea.org/sites/default/files/25/06/gov2025-24.pdf.

[20] IAEA, *Update on Developments in Iran*, 19 June 2025, https://www.iaea.org/node/221373.

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reveals signs of an attack on a structure adjacent to the underground elevators and a personnel access point. Although the precise extent of the damage depends on how many enrichment cascades were irreversibly compromised, the impact seemed sufficient to disrupt enrichment activities on site in the short term.[21]

The last nuclear site that Iran reported the IAEA as having been targeted by Israel was the Fordow enrichment plant (FFEP). Situated inside a mountain about 80 metres underground, Fordow was allegedly conceived in the early 2000s as a secret uranium enrichment installation.[22] Construction work on Fordow – like other projects linked to the AMAD plan – was halted in 2003, but the site was not declared until 2009, following its disclosure by the United States, France and the United Kingdom. Since 2010, Fordow has operated under IAEA supervision, hosting Iran's most sensitive nuclear activities, including enrichment to 20 per cent starting in 2012, and more recently, enrichment to 60 per cent – initiated in July 2022 using older IR-1 centrifuges, and in November of the same year with the more advanced IR-6 models.[23] Iran's decision to "challenge" the international community from this facility during periods of heightened tension is rooted in the site's design, which prioritises maximum passive protection and is intended to withstand both the kinetic and operational effects of most conventional missile strikes.

For this reason, Israel was unable to damage on Fordow, as confirmed by satellite imagery and IAEA statements. The only country possessing the non-nuclear weaponry capable of compromising the facility was the United States – specifically with deep-penetration bunker-buster bombs, most notably the GBU-57 Massive Ordnance Penetrator, a roughly 14-ton weapon deployable by B-2 strategic bombers. Consequently, Fordow – along with Natanz and Esfahan – became a primary target of the "surgical" strikes ordered by President Trump during *Operation Midnight Hammer*.

[21] Some activities and nuclear materials from the Natanz site – or elsewhere – could potentially have been partially relocated to a nearby facility currently under construction beneath Mount Kolang Gaz, where a new centrifuge assembly centre is nearing completion. This facility is intended to replace the above-ground ICAC at the main Natanz site, which was destroyed by an internal explosion in the summer of 2020. The new complex features halls buried deeper than those at the Fordow uranium enrichment site and may, in the future, be adapted also to host a pilot enrichment plant. David Albright and Sarah Burkhard, "New Security Perimeter Around Mt. Kolang Gaz: La Secret Nuclear Tunnel Complexes", in *ISIS Reports*, 23 April 2025, https://isis-online.org/isis-reports/new-security-perimeter-around-mt-kolang-gaz-la-secret-nuclear-tunnel-complexes.

[22] David Albright, Frank Pabian and Andrea Stricker, "The Fordow Enrichment Plant, aka Al Ghadir", in *ISIS Reports*, 13 March 2019, https://isis-online.org/isis-reports/the-fordow-enrichment-plant-aka-al-ghadir.

[23] IAEA, *Verification and Monitoring in the Islamic Republic of Iran in Light of United Nations Security Council Resolution 2231 (2015)* (GOV/INF/2023/1), 1 February 2023, https://www.iaea.org/sites/default/files/documents/govinf2023-1.pdf.

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4. The US airstrikes: Military targets and operational outcomes

On the night of 21-22 June, the second day of the fourteen-day period during which President Trump declared he would decide whether to authorise direct US involvement in degrading Iran's nuclear programme, *Operation Midnight Hammer* was launched. The operation reportedly involved over 125 US aircraft, dozens of aerial refuelling tankers, a guided-missile submarine and the deployment of approximately 75 precision-guided munitions – including seven B-2 Spirit bombers that dropped fourteen GBU-57 on target areas at Fordow and Natanz (FEP). Following the bomber strikes, previously launched Tomahawk missiles targeted the ENTC, destroying several of the remaining structures at the site.[24]

While the use of these bombs at Natanz may have destroyed the underground hall of the industrial plant (FEP), completing the damage initiated by Israeli strikes, claims that the Fordow facility was "obliterated" by the United States remain difficult to verify. Although Iran acknowledged the impact, it contested the extent of the destruction. At present, it is not possible to assess with certainty whether the penetrative capability of the GBU-57 was sufficient to reach Fordow's operational halls, particularly since available satellite imagery shows only the entry point of the bomb. It should also be noted, as reported by the IAEA Director General Rafael Mariano Grossi, that indirect damage must also be considered, given the explosive payload used and the extreme vibration sensitivity of nuclear centrifuges.[25]

4.1 Preliminary assessments and technical evaluations

Since the attack, there has been a flurry of declarations regarding the overall impact of the US strikes. Beginning with President Trump's immediate statement that "Iran's key nuclear enrichment facility has been completely and totally obliterated", a broader and more nuanced range of assessments has gradually emerged.

In particular, the leak to the press of the contents of a preliminary Battle Damage Assessment (BDA) – produced by the Defense Intelligence Agency (DIA) of the Department of Defense and based on intelligence gathered up to 22 June – reveals a more "cautious assessment" consistent with standard military evaluation practices. While this damage assessments remain ongoing and subject to new intelligence – as clearly stated in subsequent declarations – early DIA findings indicate the destruction of surface facilities, uncertain damage to Fordow at the infrastructural level and the possibility that Iran relocated its stockpile of enriched

[24] Ashley Roque, "Operation Midnight Hammer: How the US Conducted Surprise Strikes on Iran", in *Breaking Defense*, 22 June 2025, https://breakingdefense.com/?p=390251.

[25] While centrifuges can, in principle, be replaced within the enrichment hall, a total structural collapse of the underground area would imply the annihilation of the site. Francois Murphy, "IAEA Chief Expects 'Very Significant Damage' at Iran's Fordow Site", in *Reuters*, 23 June 2025, https://www.reuters.com/world/europe/iaea-chief-expects-very-significant-damage-irans-fordow-site-2025-06-23.

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uranium. Taken together, these factors suggest that the damage to Iran's nuclear programme may delay key progresses by only a few months.[26]

The DIA's preliminary assessment has been loudly decried as "flat-out wrong" by Secretary of Defence Pete Hegseth and contested by senior figures within the broader US intelligence community, including Director of National Intelligence Tulsi Gabbard and CIA Director John Ratcliffe, who asserted that "a body of credible intelligence indicates Iran's nuclear program has been severely damaged".[27]

Finally, Joint Chiefs of Staff Chairman Gen. Dan Caine – speaking at a Pentagon press conference on 26 June – provided further details supporting the US strike on Fordow. He stated that the GBU-57 bomb had been specifically designed to destroy the facility once it was discovered fifteen years ago. Moreover, a team from the Defense Threat Reduction Agency (DTRA) – a branch of the Department of Defense specialising in counterproliferation operations and underground targets – concluded, with a high degree of confidence, that the mission achieved its intended objectives.[28] However, DTRA's assessment too remains – inevitably for now – based on modelling and simulation rather than direct or indirect on-site verification.

Given that it may still be too early to fully assess the long-term effects of the US strikes – due to both physical access constraints and Iran's political unwillingness to allow inspections – a more prudent approach, at this stage, is to evaluate the potential political consequences on Iran's nuclear strategy and the broader effectiveness of these actions in preventing Tehran's acquisition of nuclear weapons.[29]

5. The political fallout: Non-proliferation risks and scenarios

From a political standpoint, direct US involvement in the conflict could further erode Iran's commitment to the NPT, potentially precipitating formal withdrawal or de-facto hollowing out of its related commitments with the IAEA. Foreign Minister Araghchi's immediate declaration that "the NPT failed to protect us" signals the possibility of a broader set of consequential decisions. For now, however, Iran is primarily denouncing what it perceives as Israeli violations of international

[26] Natasha Bertrand, Katie Bo Lillis and Zachary Cohen, "Early US Intel Assessment Suggests Strikes on Iran Did Not Destroy Nuclear Sites, Sources Say", in *CNN*, 25 June 2025, https://edition.cnn.com/2025/06/24/politics/intel-assessment-us-strikes-iran-nuclear-sites.

[27] Amy Mackinnon and John Sakellariadis, "Trump's Spy Chiefs Say New Intel Shows Iran's Nuclear Facilities Were Destroyed", in *Politico*, 25 June 2025, https://www.politico.com/news/2025/06/25/new-intel-irans-nuclear-facilities-destroyed-00424942.

[28] US Department of Defense, *Defense Secretary Pete Hegseth and Joint Chiefs of Staff Chairman Gen. Dan Caine Hold News Conference*, 26 June 2025, https://www.defense.gov/News/Transcripts/Transcript/Article/4227366.

[29] Natasha Bertrand, Katie Bo Lillis and Zachary Cohen, "Early US Intel Assessment Suggests Strikes on Iran Did Not Destroy Nuclear Sites, Sources Say", cit.

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norms, rather than explicitly renouncing the treaty.[30] Nevertheless, once the red line constituted by a US direct attack on nuclear facilities has been crossed, the regime's cost-benefit calculus may shift. Indeed, one of the main strategic reasons Tehran has historically regarded withdrawal from the NPT as a last resort lies in the potential risk of providing a legal and political pretext for US military intervention – whether targeting the country as a whole or specifically its nuclear infrastructure.

Reports indicate that, from the early stages of the Israeli military operation, some members of the Iranian Parliament began drafting a motion to steer the country toward withdrawal from the NPT. As an "intermediate step", on 23 June, the national security committee of the Parliament proposed a bill to fully suspend Tehran's cooperation with the IAEA. The bill was subsequently approved by the Parliament on 25 June and could carry de-facto implications amounting to formal withdrawal.[31] Historically, similar proposals have faced resistance from the Supreme Leader, who has consistently prioritised preserving the continuity of the revolutionary regime – also in light of his *fatwa* against the possession of nuclear weapons. However, as a result of twelve days of broad and direct conflict – further exacerbated by the potential reduction or suspension of executive powers exercised by Ali Khamenei, which, at the peak of confrontation, were partially delegated to the Islamic Revolutionary Guards Corps (IRGC) leadership for operational continuity – the last political barrier appears increasingly fragile. Under such circumstances, Iran might invoke Article X of the NPT, which permits withdrawal if "extraordinary events [...] jeopardize its supreme interests".[32]

The North Korean case, marked by its withdrawal from the NPT in 2003, exemplifies the transition from partially considering a nuclear programme as a contingent option for acquiring military capabilities – pursued through both declared and undeclared activities constrained by secrecy and limited in scope – to a strategic priority mobilising significant national resources. However, this does not imply that a potential Iranian withdrawal from the NPT would rapidly lead to the operational development of a military nuclear capability. North Korea itself took approximately three years to attempt its first nuclear test – partially unsuccessful in 2006 – and an additional three years to conduct a successful second test in 2009, which enabled the establishment of a small atomic arsenal and thus a more credible deterrent.

In the Iranian case, despite the regime's current internal fragility and the significant damage inflicted on its nuclear infrastructure by Israeli and US strikes, certain

[30] "Iranian Foreign Minister: Washington Caved to Netanyahu's War Agenda", in *Roya News*, 22 June 2025, https://en.royanews.tv/news/60598; "With Araghchi in Moscow, Iran and Russia Forge United Front against US-Israeli Warmongering", in *Tehran Times*, 23 June 2025, https://www.tehrantimes.com/news/514825.

[31] "Iran Says Parliament Is Preparing Bill to Leave Nuclear Non-Proliferation Treaty", in *Reuters*, 16 June 2025, https://www.reuters.com/world/middle-east/iran-foreign-ministry-says-parliament-is-preparing-bill-leave-npt-2025-06-16.

[32] "Supreme Leader Khamenei Bars All Communications, Fears Assassination", in *The Jerusalem Post*, 22 June 2025, https://www.jpost.com/middle-east/iran-news/article-858516.

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factors could considerably shorten the timelines for nuclear weapon development – at least with regard to the production of fissile material.

5.1 Key post-attack variables: Enriched uranium stockpile

The first variable concerns the quantity of enriched uranium still in Iran's possession. According to the latest IAEA report published in May 2025, Tehran stockpiled approximately 7,700 kilograms of uranium enriched up to 5 per cent, 270 kg enriched up to 20 per cent and 400 kg enriched up to 60 per cent – all in the form of UF_6. In recent months, Iran has progressively converted a portion of its uranium enriched to 20 per cent into significant quantities of UF_6 enriched to 60 per cent, for which there are currently no clear civilian applications – though it remains below the 90 per cent military-grade threshold.[33] The only concrete peaceful function of this stock appears to be as a "negotiating lever", consistent with the precedent set in 2012-2013, when Iran traded 20-per cent enrichment UF_6 for access to frozen assets under the Joint Plan of Action, the preliminary agreement that paved the way for the JCPOA.

Before the Israeli attack, Iran could have converted its entire stock of uranium enriched to 60 per cent into approximately 230 kg of uranium enriched to 90 per cent – an amount theoretically sufficient to arm around nine nuclear warheads – within an estimated timeframe of just three weeks, using only the Fordow facility.[34] It is, of course, impossible to precisely estimate how much of the enriched uranium stock, at various levels, has thus far survived the military operations.

IRGC Major General Mohsen Rezaei stated in an interview on 20 June that Iran had relocated its enriched nuclear material to secure locations to prevent its destruction.[35] This assertion appears intended to signal to Western audiences that completely eliminating Iran's nuclear stockpiles would entail a prolonged, complex and potentially futile effort to locate concealed caches, thereby underscoring the necessity of negotiating with Tehran. US officials have acknowledged this uncertainty, admitting they do not know the exact status or whereabouts of Iran's uranium stockpile. This position has been echoed by the IAEA Director General, who stated that the Agency has had no access to Iran's facilities since their closure following the attack, while expressing hope that its personnel will be allowed to return promptly to resume full accountability and control over Iran's nuclear material.[36]

[33] IAEA, *Verification and Monitoring in the Islamic Republic of Iran in Light of United Nations Security Council Resolution 2231 (2015)* (GOV/2025/24), cit., par. 23, Annex I.

[34] David Albright, Sarah Burkhard and Spencer August Faragasso, "Analysis of IAEA Iran Verification and Monitoring Report — May 2025", in *ISIS Reports*, 9 June 2025, https://isis-online.org/isis-reports/analysis-of-iaea-iran-verification-and-monitoring-report-may-2025.

[35] Ben Rezaei et al., "Iran Update Special Report, June 21, 2025, Evening Edition", in *ISW Iran Project*, 21 June 2025, https://www.understandingwar.org/node/7172.

[36] David E. Sanger, "Officials Concede They Don't Know the Fate of Iran's Uranium Stockpile", in *The New York Times*, 22 June 2025, https://www.nytimes.com/2025/06/22/us/politics/iran-uranium-

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In this context, the US strike on 20 June employed precision-guided missiles to target, among other objectives, the entrances to underground tunnels constructed since 2004 adjacent to the nuclear facilities at the Esfahan site – located at the base of a nearby mountain ridge – where significant quantities of UF_6-enriched uranium had been stored. These tunnels had reportedly been the subject of IAEA requests for enhanced monitoring due to the high enrichment levels achieved by Iran.[37] In this instance, the use of Tomahawk missiles, rather than bunker-buster bombs, appears to have been intended to entomb the facility – at least temporarily – given that the tunnel's depth may exceed the penetrative capacity of the GBU-57, as reportedly confirmed by Joint Chiefs of Staff Chairman Gen. Dan Caine.[38] Satellite imagery shows that, prior to the strikes, Iran sought to mitigate the impact on tunnel entrances by filling them with sand – a measure also observed at the Fordow site.

While the effectiveness of this tactic remains uncertain, the IAEA has confirmed that the entrances to the underground tunnels at Esfahan were indeed impacted. However, it has not detected any increase in off-site radiation levels at Esfahan or at the other two sites targeted by US strikes. This may suggest that the nuclear stockpiles – particularly at the Esfahan tunnel complex – were not directly compromised. It is also possible that the nuclear material at Natanz and Fordow had been relocated prior to the strikes, given that uranium enriched to 60 per cent in the form of UF_6 is stored in cylinders small enough to be relatively easy to transport and, consequently, extremely difficult to track.

5.2 Key post-attack variables: Centrifuge stockpile and IAEA cooperation

The quantity and enrichment level of UF_6 still available to Iran represent critical variables in determining the timeframe within which the country might seek to acquire military nuclear capabilities, in the event that a formal political decision is taken to pursue such a course. In parallel, a second, equally decisive factor concerns the quantity and type of nuclear centrifuges Iran retains for this purpose. In this regard, the IAEA was aware of the total number of centrifuges planned, installed and operational, as these had been subject to standard monitoring procedures prior to the attack. Therefore, it will be essential to assess how many of these centrifuges were actually damaged by Israeli and US strikes on key enrichment sites.

What remains unknown, however, is the actual quantity and types of nuclear centrifuges manufactured by Iran. This information is critical for the IAEA to

stockpile-whereabouts.html; Francois Murphy, "UN Nuclear Watchdog Has Limited Oversight in Iran. Here's Why", in *Reuters*, 23 June 2025, https://www.reuters.com/world/middle-east/limits-un-nuclear-watchdogs-oversight-iran-2025-06-23.

[37] IAEA, *NPT Safeguards Agreement with the Islamic Republic of Iran* (GOV/2025/10), 26 February 2025, par. 40, https://www.iaea.org/sites/default/files/25/03/gov2025-10.pdf.

[38] Natasha Bertrand and Zachary Cohen, "US Did Not Use Bunker-Buster Bombs on One of Iran's Nuclear Sites, Top General Tells Lawmakers, Citing Depth of the Target", in *CNN*, 28 June 2025, https://www.cnn.com/2025/06/27/politics/bunker-buster-bomb-isfahan-iran.

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reconstruct a comprehensive picture of Iran's nuclear programme and to ensure the so-called "continuity of knowledge" regarding its centrifuge inventory. The issue was addressed through specific negotiations and included in the JCPOA as a supplementary measure beyond standard verification obligations, before being unilaterally suspended by Tehran in 2021.[39] This suspension was part of Iran's broader retaliation following the failure to realise any of the promised benefits of the JCPOA after the United States' unilateral withdrawal in 2018.

In the "worst-case scenario", Iran could further enrich its stockpile of 60 per cent highly enriched uranium to weapons-grade levels, producing a sufficient quantity for a nuclear device within approximately one month.[40] Under other plausible – though not improbable – conditions, the production of such material could still occur in a matter of months, as also stated by IAEA Director.[41] This enrichment process, particularly if conducted using the more advanced IR-6 centrifuges, could take place at a small, undeclared facility that Iran may have already established as part of a contingency plan.

In this context, another significant consequence of Iran's waning commitment to the JCPOA is the suspension of the provisional application of both the Additional Protocol and Modified Code 3.1 of the Subsidiary Arrangements General Part to Iran's NPT Safeguards Agreement. While the Additional Protocol enabled broader IAEA monitoring of ongoing nuclear-related activities, Modified Code 3.1 required Iran to submit design information to the Agency for any new nuclear facility as soon as the decision to construct or authorise construction has been made.[42] Iran's failure to comply with this provision has prevented the IAEA from receiving early design information regarding several new nuclear facilities that Tehran has publicly announced its intention to construct. Among these is the so-called "new enrichment facility", which Iran declared it planned to equip and activate shortly before the onset of the Israeli attacks and in the aftermath of the IAEA's June resolution. The IAEA, which understood this major fourth enrichment plant to be located in Esfahan, was prepared to conduct inspections. However, these were postponed or indefinitely suspended due to the commencement of military operations.[43]

[39] IAEA, *Verification and Monitoring in the Islamic Republic of Iran in Light of United Nations Security Council Resolution 2231 (2015)* (GOV/2025/24), cit., par 31.

[40] @james_acton32, "A single cascade of 174 IR-6 centrifuges could produce a bomb's worth of 90% highly enriched uranium", X post, 25 June 2025, https://x.com/james_acton32/status/1937967140990075334.

[41] Patrick Wintour and Ashifa Kassam, "Iran Will Probably Be Able to Produce Enriched Uranium 'in Matter of Months', IAEA Chief Says", in *The Guardian*, 29 June 2025, https://www.theguardian.com/p/x2tn46.

[42] IAEA, *NPT Safeguards Agreement with the Islamic Republic of Iran* (GOV/2025/25), cit., section D.2.

[43] Francois Murphy, "IAEA Chief Identifies Isfahan as Iran's Planned Uranium Enrichment Site", in *Reuters*, 19 June 2025, https://www.reuters.com/world/middle-east/iaea-chief-identifies-isfahan-irans-planned-uranium-enrichment-site-2025-06-19.

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It is therefore plausible that Iran retains additional centrifuges stored at locations unknown to the IAEA, which could be deployed in the future at new enrichment facilities currently under construction but not yet declared. Furthermore, with respect to weaponisation activities specifically aimed at developing a nuclear device, it is likely that – despite the targeted assassinations of key scientists previously involved in the AMAD plan – Tehran still possesses archived information on the subject. While these materials are most probably limited to feasibility studies, they could nonetheless shorten the time required to define critical components and processes essential for nuclear weapon development, should the regime eventually decide to take the "revolutionary" decision of acquiring such a weapon.

Conclusions

Although Iran's overall nuclear infrastructure may have been set back in a manner that would require years to rebuild at its previous scale – a clear military achievement for both Israel and the United States – a new and equally challenging phase is now beginning. This phase involves managing the consequences of these operations, including the potential covert and "sneaky" evolution of Iran's nuclear capabilities.

Indeed, military actions cannot guarantee the complete and permanent termination of the most sensitive components of the nuclear programme, unless accompanied by a clear political decision by the ruling regime. Although the diplomatic path to achieving this goal has not been abandoned by the United States, it is first necessary to evaluate the genuine willingness to offer Tehran a viable diplomatic exit – beyond offering substantial economic incentives falling short of political and security guarantees, such as those allegedly explored by President Trump.[44]

The joint military attacks by Israel and the United States represent an all-in gamble, premised on the expectation that the Iranian regime will either bend to military pressure and coercive diplomacy – or break consequently. Since 2003, however, Iran's leadership has consistently adopted a defiant posture during periods of maximum pressure and direct confrontation over its nuclear programme, agreeing to negotiations only when it could do so from a position of relative strength. If the regime succeeds in absorbing the blows inflicted by Operation Rising Lion and Operation Midnight Hammer, its remaining leverage will likely rest on three pillars: a significant stockpile of nuclear material that survived the attacks, a reserve of advanced centrifuges that can be assembled and activated at undeclared facilities, and, ultimately, the threat of withdrawal from the NPT or of effectively scaling back cooperation with the IAEA, justified on security grounds.

[44] Kanishka Singh, "Trump Dismisses Reports US Is Weighing up to $30 billion Civilian Nuclear Deal for Iran", in *Reuters*, 28 June 2025, https://www.reuters.com/world/us/trump-dismisses-reports-us-is-weighing-up-30-bln-civilian-nuclear-deal-iran-2025-06-28.

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Should the gamble taken by Israel and the Trump administration fail to yield short-term results, systemic risks stemming from the structural weakening of the 2015 JCPOA will become increasingly evident. Iran's enrichment of uranium to 60 per cent – and the erosion of IAEA monitoring – can be traced to the Trump Administration's unilateral withdrawal from the agreement in 2018. If the current regime – or even closely aligned successor – retains a credible nuclear capability after these strikes, it could present an even greater challenge to the non-proliferation regime.

Updated 1 July 2025

List of acronyms

AEOI	Atomic Energy Organization of Iran
BDA	Battle Damage Assessment
DIA	Defense Intelligence Agency
DTRA	Defense Threat Reduction Agency
ENTC	Esfahan Nuclear Technology Center
EU	European Union
FEP	Fuel enrichment plant
FFEP	Fordow fuel enrichment plant
FPFP	Fuel Plate Fabrication Plant
IAEA	International Atomic Energy Agency
ICAC	Iran Centrifuge Assembly Center
IRGC	Islamic Revolutionary Guards Corps
JCPOA	Joint Comprehensive Plan of Action
KHRR	Khondab Heavy Water Research Reactor
Mwe	Megawatts electrical
MWt	Megawatts thermal
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
PFEP	Pilot fuel enrichment plant
TESA	Iran Centrifuge Technology Company
TNRC	Tehran Nuclear Research Center
UF_6	Uranium hexafluoride
UN	United Nations
UNSC	UN Security Council
UNSCOM	UN Special Commission
US	United States

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