

RSIS Commentary is a platform to provide timely and, where appropriate, policy-relevant commentary and analysis of topical and contemporary issues. The authors' views are their own and do not represent the official position of the S. Rajaratnam School of International Studies (RSIS), NTU. These commentaries may be reproduced with prior permission from RSIS and due credit to the author(s) and RSIS. Please email to Editor RSIS Commentary at RSISPublications@ntu.edu.sg.

Iron Beam: A New Chapter in Israel's Missile Defence Saga

By Jean-Loup Samaan

SYNOPSIS

Israel's armed forces are expected to soon deploy Iron Beam, a new laser-based air defence system. Thanks to its technology, it could significantly reduce the financial burden of existing systems such as Iron Dome. However, technical uncertainties remain and suggest that it may not yet represent a game changer for missile defence strategies. In the meantime, it deepens the Israeli reliance on defensive systems, begetting fundamental questions about the ways missile defence programmes affect countries' strategic culture.

COMMENTARY

Last May, Israeli company RAFAEL showcased at [IMDEX Asia in Singapore](#), the latest developments in its new energy-directed air defence system named Iron Beam. Using laser technology to intercept incoming missiles or drones, Iron Beam is expected to be deployed by the Israel Defense Forces (IDF) by 2024. In recent years, the system has garnered much interest from policymakers and the defence industry. US President Joe Biden was given a tour of the system during his [visit to Israel](#) in July 2022.

The Promise of Laser-based Missile Defence

Laser technology has long been expected to be a potential game changer in the field of missile defence, but the current Israeli experience suggests that we might not have reached that paradigm shift yet. Iron Beam opens a new chapter in the history of Israel's missile defence, but its laser-powered interceptor will not replace existing programmes such as Iron Dome, David's Sling, or Arrow.

Instead, Iron Beam will add a new layer to the country's missile defence architecture that has grown more complex amid the increased use of sophisticated weapons by

terrorist groups such as Hezbollah, Hamas, and Islamic Jihad. Against that backdrop, the development of Iron Beam highlights not just the changes in the Israeli defence strategy but some of the key challenges other countries will face with regard to missile defence.

At first sight, the biggest asset of Iron Beam is the financial affordability it promises in the long term. Because laser-based missile defence is designed to use energy instead of a traditional interceptor to destroy its target, it could prove much more cost-effective than the current systems: whereas terrorist groups in the Gaza Strip can launch rockets for less than US\$1,000, the Tamir interceptor used for Iron Dome is said to cost about [US\\$50,000](#), and a Patriot missile goes up to [US\\$3 million](#) per piece. Meanwhile, engineers argue that thanks to the laser technology, the cost of one interception with Iron Beam would be much cheaper, with some reports suggesting [US\\$2,000](#).

Iron Dome may have been effective at intercepting Palestinian rockets, but the constant need for its replenishment makes it a huge cost to bear. Although Israel initially designed and developed Iron Dome on its own, by the mid-2010s, its previous governments had to turn to the US to share the financial burden. Today, US support for Iron Dome involves financial aid, co-production of the interceptors, as well as US procurement of the system for its own armed forces. Overall, it is estimated that the US provided [US\\$3 billion](#) to Iron Dome development as of 2023.

From that perspective, Iron Beam could ease the reliance on other systems and provide a cheaper option to protect Israeli territory. This led former Prime Minister Naftali Bennett to [declare in 2022](#), "this is a game-changer: (the enemy) can invest tens of thousands of dollars in a rocket and we can invest two dollars to cover the cost of the electricity in shooting down the rocket".

The Limitations of Iron Beam

However, Iron Beam's performance is not so clear-cut. As of today, laser technology cannot replace the existing systems Israel operates, but rather complements them. Iron Beam still faces a series of technological issues that constrain its operational relevance.

First, weather conditions significantly affect its ability to operate. The sensors of Iron Beam are said to work effectively in optimal conditions such as a sunny and cloudless day, but less so in cases of rain and clouds. This questions the choice of relying on a system that could be made suddenly – and quite randomly – inefficient. In Israel, one might argue, thanks to the Mediterranean climate, that this would mostly be an issue during the winter season. But elsewhere, as in Southeast Asia – where annual rainfall can be ten times higher than in Israel – it may curb enthusiasm for the technology.

The second technical issue relates to the range of the interception: as the laser beam travels through air, its energy is absorbed by molecules and aerosols in the atmosphere and eventually loses power. This means that the system, as of today, could only destroy rockets at short range (reportedly less than 10 km).

Finally, another major limitation relates to the pace of intervention: the process of

generating a laser beam may take only a few seconds but that makes the system slower than Iron Dome and less effective when facing a salvo of rockets.

These shortcomings have been acknowledged by Israeli engineers who are working on ways to address them but for the time being, it also means that Israel needs the financial and scientific support of the US for new upgrades on Iron Beam – hence the tour accorded President Biden last summer. This suggests that the argument for Iron Beam on the basis of financial affordability may not be so certain – at least for now.

Missile Defence Changing Israel's Strategic Culture

In its current form, Iron Beam will not be a gamechanger, but it will certainly play a growing role in the national missile defence architecture. For the IDF, this has many implications.

Today, the IDF might be the military with the most experience worldwide in the use of missile defence. Since its deployment in 2011, Iron Dome has been frequently tested by rockets launched from Gaza. The IDF also relies on David's Sling (for mid-range ballistic and cruise missiles) and Arrow (for long-range missiles).

The expansion of the missile defence architecture implies new institutional arrangements that are not just bureaucratic in nature. Over time, the growing reliance of the IDF on these systems has reshaped its strategic culture.

Initially, the idea of a defence system to counter such threats was not supported by everyone in Israel's national security establishment. For decades, the IDF had cultivated a strategic culture that emphasised offensive and preventive operations, and which considered investments in expensive defensive systems a dangerous waste of resources.

Nevertheless, in the new security environment, rocket and drone attacks are not a mere nuisance, they have become the central strategy of organisations like Hamas and Hezbollah. This now leads Israeli scholars to [argue](#) that the IDF has shifted towards a defensive posture "as the preferred way to protect Israel".

But Israel's growing reliance on missile defence systems coincided with brewing frustrations from soldiers that the IDF no longer fights to win wars but merely to manage them or to "[mow the grass](#)" to use the title of a much-discussed article by Efraim Inbar and Eitan Shamir. Skeptics argue that no matter how well Iron Dome performs, it does not deter Hamas and the Islamic Jihad from firing rockets at Israel. In fact, the number of such attacks keeps increasing.

Former IDF Chief of Staff, Aviv Kochavi, tried to address this conundrum by introducing in 2020 a [new operational concept](#) calling for "decisive victory". Kochavi meant to re-emphasise swift offensive operations relying on the use of small units supported by massive firepower. The ambitious reform had ramifications in terms of training, inter-operability among the services, weapons procurement, and civil-military relations. But to date, the results have not been conclusive.

For the time being, Israel is still experimenting with rebalancing between the offensive

and the defensive. In that context, Iron Beam will surely add a new layer to its air defence coverage but ensuring the readiness of the IDF for high-intensity operations will still be deemed a necessity.

Jean-Loup Samaan is a senior research fellow at the Middle East Institute of the National University of Singapore. He previously worked as an advisor for the French Ministry of Defense and NATO and was most recently an associate professor in strategic studies at the UAE National Defense College.

S. Rajaratnam School of International Studies, NTU Singapore
Block S4, Level B3, 50 Nanyang Avenue, Singapore 639798
T: +65 6790 6982 | E: rsispublications@ntu.edu.sg | W: www.rsis.edu.sg