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The Iron Dome versus the Missiles of the Palestinian Resistance

Capacities and Limitations

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Introduction

On the morning of 7 October 2023, the Hamas military wing, the Ezz al-Din al-Qassam brigades, fired around 5,000 missiles and rockets into the area surrounding Gaza as part of Operation Al-Aqsa Flood. The barrage focused mainly on the headquarters and bases of Israel's "Gaza division."[1] The purpose of firing such a large number of missiles compared to previous engagements (2008-2009, 2012, 2014 and 2021), was to provide air cover for the ground incursions of the brigades' fighters into the bases and kibbutzim in the Gaza envelop.[2] This manoeuvre marked the first large-scale face-to-face military confrontation between the Qassam Brigades and the Israeli occupation army and, hence, a radical change to the previously existing rules of engagement. As the operational plan of the offensive played out, it became clear that the brigades had achieved the elements of surprise and shock, which contributed to delaying the Israeli army's response both to the offensive on the ground and to the intensity of the missilery piercing Israeli defence systems and, above all, the Iron Dome system.

Once Israel had absorbed the shock, it attacked Gaza by land, sea, and air, stating that its aim was to wipe out Hamas and end its regime in the Strip. It is important to underscore, here, the asymmetric nature of this military confrontation. This is not an engagement between two states and their respective standing armies, but between a national liberation movement with a paramilitary wing and the armed forces of a state. This is evident in the disparity between the two sides' military capacities and in the tactics and strategies the Palestinian resistance forces have been applying in face of the brute force of the Israeli war machine.

In response to the full-scale assault on Gaza, the Palestinian resistance fired more barrages of missiles and rockets at Israeli towns in the Gaza environs and beyond, as Hamas authorities stated in their military communiques. Israel had unleashed a particularly vindictive aerial bombardment indiscriminately targeting residential buildings and other civilian structures. It had also begun a limited ground incursion along a few axes in Gaza. Palestinian forces fought back tenaciously while continuing to fire salvos of their homemade rockets into Israel. Every salvo triggered sirens in Israeli cities and the Iron Dome, Israel's main defence against the resistance's missiles, kicked in. Even so, many of the rockets made it through, falling on towns in the Gaza environs and other cities (Greater Tel Aviv, Jerusalem, Safed and Eilat), causing material and human losses – albeit of a scale not remotely comparable to the damage the Israeli war machine was inflicting on Gaza.

These breakthroughs raise questions, firstly, about the resistance's ability to develop its missilery from rudimentary unguided rockets to missiles with greater destructive power and equipped with sophisticated guiding systems, and secondly, about the efficacy of the Iron Dome against the

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1 "Audio message from the Qassam commander launching the Al-Aqsa Flood operation," *Aljazeera.net*, 7/10/2023, accessed on 16/10/2023 at: https://bit.ly/40Vl5Qc

2 For further information on the plan of Al-Aqsa Flood, which we constructed based on military communiques issued by Qassam Brigades Chief of Staff Mohammed al-Deif who announced the launch of the operation; statements by the Qassam Brigades military spokesman, and video recordings published on the Qassam Brigade's official website, see: Ahmed Qasem Hussein, "How Did the Qassam Brigades Take Control of the Gaza Division? The Combat Performance of the Palestinian Resistance and Obstruction of the Israeli Military Ground Offensive," Case Assessment, ACRPS, 29/10/2023, accessed on 31/10/2023 at: https://bit.ly/3sQobZk

resistance's missiles and, accordingly, its ability to protect the inhabitants of Israel's urban areas should the scope of the confrontation between Israel and the Palestinian resistance expand in the framework of the current conflict or in the event of a future round. Should Hezbollah and other Palestinian factions enter the fray, Israel would be exposed to missile fire from both the northern and the southern fronts.

I. Israel's Three Security Complexes

Geography is a critical factor in the design of a country's defensive and offensive military strategies in times of peace and war. Israel has had to deal with a complex set of geopolitical issues since its establishment in 1948, displacing the indigenous Palestinian people from their land. Occupied Palestine is situated in a narrow coastal strip sandwiched between two water barriers (the Mediterranean to the west and the Jordan River and Dead Sea to the east). It is surrounded to the east and west by two countries with which it shares long land borders (Jordan to the east and Egypt to the west) and to the north by two more countries (Syria and Lebanon) where the borders are characterized by rugged terrain. Such factors greatly complicate and hamper the design and implementation of defence strategies, especially when considering the possibility of a multifront missile assault. In addition, Israel has always sought to fight its battles with Arab states outside occupied Palestine; it lacks the necessary strategic depth that gives it sufficient room for manoeuvrability and control during wars on multiple fronts.

In its determination to contend with its border security dilemma, Israel first occupied the Golan Heights in 1967. This strategically important region forms a natural barrier that protects Israel and gives it the advantage of a perch that overlooks Syrian cities to the east (Damascus, Daraa, and Quneitra), Israeli cities in the Upper Galilee and to the west, as well as parts of Lebanon and Jordan. Israel formally annexed the Golan Heights on 14 December 1981,[3] and the administration of former US President Donald Trump recognized this annexation in March 2019. Israel then resolved its border problems with Egypt and Jordan through peace agreements. The Camp David and Wadi Araba accords impose on the signatories various political and security obligations that safeguard against security breaches. However, there are three remaining security challenges that could put Israel in an awkward position in a military engagement, especially one involving a possible missile attack:

- **The "chronic security headache" – the southern front (Gaza)**: The Palestinian resistance in Gaza has developed its military capacities, especially its missile capacities, over the course of many outbreaks of military engagement with Israel, most of which were brought to a fragile end through regional and international mediation. Most recently, Hamas has also developed an offensive capacity involving commando operations behind enemy lines. The 7 October operation dismantled all previous rules of engagement by dint of the incursion against

3 "Pompeo's Declaration on the Legitimacy of Israeli Settlements: Rationale and Motives," ACRPS, 21/11/2019, accessed on 30/10/2023 at: https://bit.ly/3QZRjp7

positions of the Gaza Division and the kibbutzim in the Gaza envelope, which inflicted heavy losses on the Israeli army, including the capture of many of its senior officers and soldiers. The attack galvanized Israel into forming a national emergency government and war council to set the aims of the retaliatory operation, foremost among which was to eliminate Hamas and end its rule over Gaza.

- **The "soft flank" – the West Bank complex**: Grassroots and armed resistance has burgeoned in the West Bank recently, especially in the towns of Jenin and Nablus. The emergence of the Jenin Brigade in the former and the Lion's Den in the latter during the past two years marked the return of organized militant action to the West Bank. Setting its crosshairs on the Jenin Brigade in particular, the occupation army launched a military operation in Jenin which Israeli Defence Minister Yoav Galant described as a tactical success. The operation, he said, had achieved its aims, which were to extend the army's operational control over the vicinity of Jenin and the refugee camp there, kill or arrest the Palestinian resistance fighters, and destroy the resistance's infrastructure and combat capacities.[4] Israel may have achieved some of these aims - it killed many resistance fighters and destroyed Palestinian public property – but, a few days later, the Ayyash Brigade fired a rudimentary rocket toward the Shaked settlement west of Jenin.[5] This signalled that the art of manufacturing homemade missiles had found its way to the West Bank despite the tight security restrictions and the many obstacles hampering resistance activities there. The evolving capacities of the resistance in the West Bank are a further indication that eliminating Hamas and its military wing is an unachievable goal. Even if the transfer of rudimentary missile technology to the West Bank has been slow and limited so far, Israeli military and security decision-makers are a looking at a new and perhaps unanticipated challenge from that direction. West Bank cities have seen several military confrontations involving small arms and light weapons since the Al-Aqsa Flood operation. But the complex surveillance, tracking, and security control networks that Israel has in place in the West Bank are still strong and have the power to obstruct the development of militant action there, especially when compared with Gaza.
- **The "fragile flank" – the northern front complex**: The presence of the Islamic resistance organization Hezbollah in Lebanon is a challenge that Israel has to factor in carefully in all its strategic calculations when assessing security risks. That factor came to the fore following the Al-Aqsa Flood operation. Israeli concerns were reflected in the threats and sabre rattling by Israeli political and military leaders aimed at deterring Hezbollah from entering the battle. Hezbollah launched a war in July 2006 in which it pelted Israel with some 4,000 rockets in a single month: an experience Israel has no desire to relive, and one which it fears would be much worse the next time around because of the considerable advances Hezbollah has achieved

4 "Galant claims to have 'achieved all aims of the operation' in Jenin and states: It was hard to be surprised,'" '*Arab 48*, 5/7/2023, accessed on 30/10/2023 at: https://bit.ly/40VXWNv

5 "The Ayyash Brigade announces launch of two missiles from Jenin toward an Israeli settlement in the West Bank," *al-Quds al-'Arabi*, 10/7/2023 accessed on 30/10/2023 at: https://bit.ly/47MZX0Q

in its military capacities in the intervening years. Meanwhile, in the current confrontation, Hezbollah has maintained certain rules of engagement whereby the tit-for-tat missile fire is kept from escalating into a full-scale conflict. Hezbollah Secretary-General Hassan Nasrallah made this intent clear when he said that Hezbollah's role in the current battle is to distract and wreak attrition on the Israeli army.[6]

II. How Israel Manages the Three Security Dilemmas

Israel has always tried to develop its advanced technological capacities and harness them in surveillance, command, and control over the fronts where it perceives potential security threats. One of its main aims in this is to compensate for the lack of strategic depth which would give space for manoeuvring and shaping the battlefield in the event of a military confrontation, especially one involving missilery. Israeli cities have experienced rocket attacks at many junctures of the Arab-Israeli conflict (1970, 1980, 2006, 2008, 2012, 2014 and 2021); it is this threat that plagues Israeli military decision-makers, especially should it come from more than one front at once. Israel has monitoring and surveillance systems in place along the northern border to keep track of the Lebanese side from where there has been a noticeable uptick in Hezbollah attacks at Israeli targets since the Al-Aqsa Flood operation. In the West Bank, Israel has designed a tight and cohesive security system involving close security coordination with the Palestinian Authority. The occupation has also tightened its surveillance and control of West Bank residents who continue to resist in whatever ways they can. Still, the restrictions and clampdowns have not kept militant confrontations from expanding in Jenin, Nablus, Tulkarm, and elsewhere. For Gaza, the "chronic security headache," Israel developed a range of military, technological and intelligence tools. The latest chapter in this brought the construction of a steel wall which the resistance breached on 7 October. The Iron Dome, which was designed to protect Israeli citizens from missile attack remains the most effective instrument. It may not be perfect, but it continues to minimize the impact of the missiles incoming from the resistance in Gaza.

III. The Iron Dome: The Idea, Development, and Operability

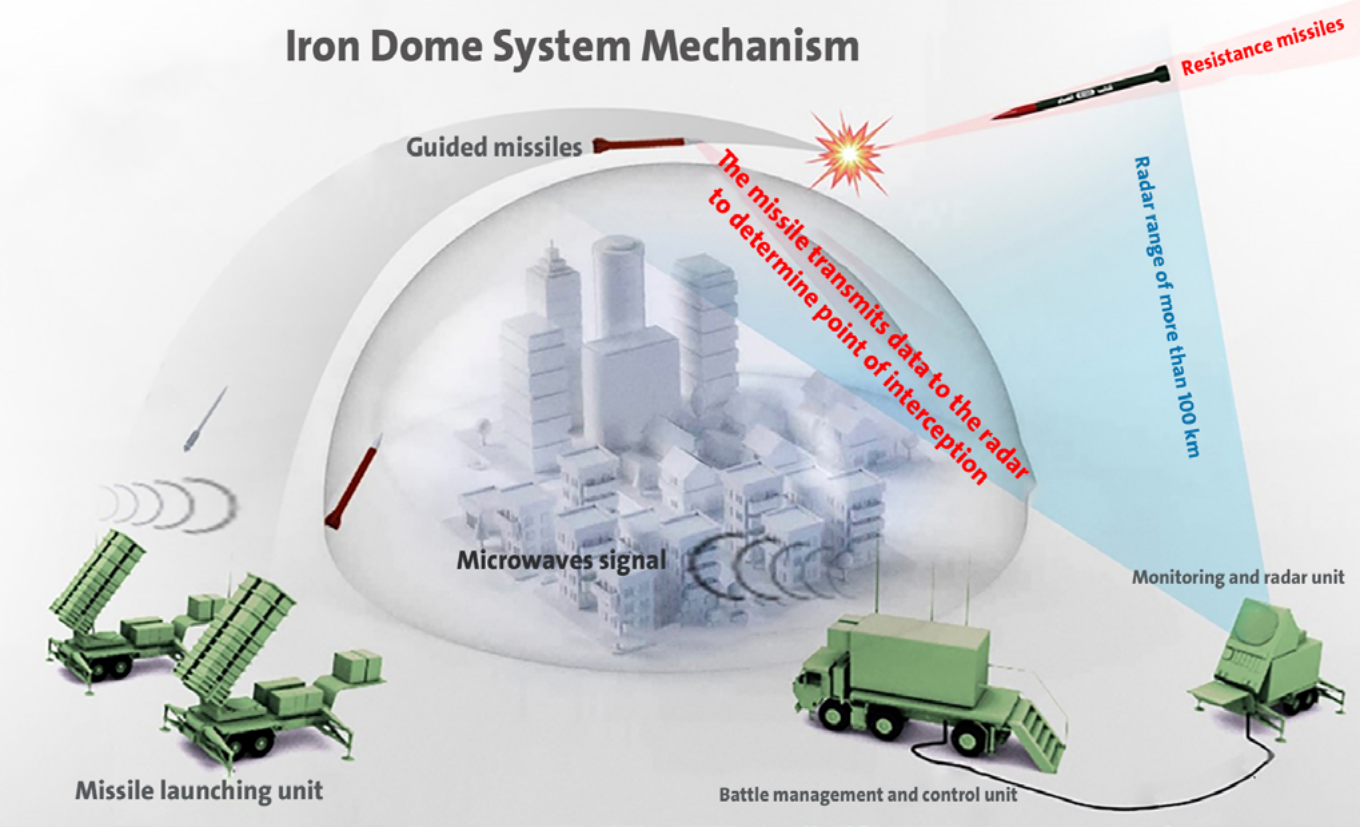
The Iron Dome missile shield was conceived by the head of the Israeli Ministry of Defence's research and development unit, Brigadier General Danny Gold, in 2005. His idea generated broader political support in the aftermath of the July 2006 war in which Israel's northern cities sustained a barrage of around 4,000 rockets coming from Lebanon. The Ministry of Defence decided to pay for the system and accelerate its development. This was carried out by Rafael Advanced Defence Systems[7] in collaboration with Elta Systems, which produces radars and other defence electronic equipment, and mPrest, which was responsible for developing the command-and-control system. The Iron Dome

6 "Hezbollah Secretary General Hassan Nasrallah on Al-Aqsa Flood," YouTube, Al Araby TV, 3/11/2023, accessed on 4/11/2023 at: https://bit.ly/47APRAr

7 For further information, see the company's official website: *Rafael Advanced Defense Systems*, accessed on 27/11/2023at: https://tinyurl.com/mb8x9kp2

works by firing interceptor missiles at incoming rockets from Gaza, for instance. The components include a radar system, a command-and-control centre, and three batteries, each loaded with twenty Tamir missiles (See the illustration below).

Figure 1: Israel's Iron Dome missile defence system – how it works



Source: Ahmed Qasem Hussein, "The Qassam Brigades and the battle of 'The sword of Jerusalem': Strategy Paper 4, Arab Centre for Research and Policy Studies, 24/6/2021, p. 9, accessed on 5/11/2023 at https://bit.ly/47tlICZ .

Missiles fired from Gaza into Israel during the 2008 - 2009 confrontation led Israeli authorities to step up the development and production of the system. In late 2010, the Israeli army conducted the final tests on the batteries and the first battery went into operation in March 2011. The first missile it intercepted was fired from Gaza towards Ashkelon on 7 April 2011. But the Israeli attack on Gaza on 14 November 2012 was the first real test of the Iron Dome. On that occasion, the resistance in Gaza fired 1,573 locally made missiles into Israel. Of these, 152 failed to launch because the resistance's missile development was still in its early stages. Another 875 missiles fell in unpopulated areas while 421 were successfully downed by the Iron Dome. With this, the system scored an 85 per cent success rate, as 58 missiles struck residential areas in the vicinity of Gaza, killing two Israeli soldiers and four Israeli civilians.

The following day, 15 November, Kiryat Malachi, 25 km north of Gaza, came under rocket attack from Gaza, killing three Israelis.[8] Despite the small number of casualties inflicted by the resistance's rockets, the Iron Dome won the approval of politicians and public opinion in Israel. It would win additional praise with its success in the 2014 war on Gaza, in which the missile defence system received a score of 90 per cent. On that occasion, the Palestinians fired 3,621 missiles and rockets into Israel. Of these, the Iron Dome intercepted 584 while 115 fell in populated areas, 2,542 in open areas, and 119 inside Gaza by mistake. According to Israeli army figures on that confrontation, 112 missiles targeted the greater Tel Aviv area. Of these, 60 were intercepted and 52 fell in open areas.[9]

We should note rockets the resistance fired into Israel in the confrontations so far (2008-2009, 2012, 2014) had more of a psychological than a physical effect. Israeli authorities now felt confident that the Iron Dome's success in intercepting incoming missiles would have a decisive impact at the following levels:

1. It would **deter the resistance from firing missiles**. The expectation was that the resistance deem it pointless to fire missiles if the Iron Dome was going to down most of them.
2. It would **dispense the Israeli army of the need to mount a limited or extensive ground operation** into Gaza in response to rocket fire.
3. It would **showcase Israeli defence products and market Israel as a regional power** with high-tech defence and security manufacturing capabilities, which would help Israel expand its diplomatic relations. After Indian leaders saw the Iron Dome's efficacy in intercepting the resistance's missiles, New Delhi expressed in interest in working with Israel to develop an Indian Iron Dome as a precaution against a confrontation with Pakistan.[10] South Korea has also indicated a willingness to purchase an Iron Dome system to ward off the threat of missile attack from North Korea.[11] Israel is also keen to promote itself as a reliable military power with major capacities and insights into the military technology industries. It believes that the Arab countries which have begun normalization processes would be interested in this technology and in collaborating with Israel against shared threats.

IV. The Operability of the Iron Dome: The Limitations of Capability and Efficacy

The Al-Aqsa Flood operation exposed some of the flaws of the Iron Dome. It is not as one hundred percent effective as Israeli politicians and military brass have tried to promote – there are important details the occupation army has not publicly disclosed, which makes the evaluation of the system's

8 "Two missiles fall near Tel Aviv as the casualties mount in Gaza," Reuters, 15/11/2012, accessed on 30/10/2023 at: https://bit.ly/40Y4kDV

9 Yiftah S. Shapir, "Lessons from the Iron Dome, Military and Strategic Affairs," *Military and Strategic Affairs*, vol. 5, no. 1 (May 2013), pp. 82 - 86.

10 "New Delhi seeks to develop Iron Dome in collaboration with Israel," *al-Raya*, 23/11/2012, accessed on 30/11/2023 at: https://bit.ly/47TiWXJ

11 "South Korea interested in buying an Israeli Iron Dome system," Reuters, 10/8/2014, accessed on 3/11/2023 at: https://bit.ly/3sJOvnZ

performance quite imprecise. It is true that the Iron Dome has prevented many missiles from reaching their targets. But it did not give Israel security. It did not deter the resistance from continuing to use missiles and develop their missile capacities. It did not keep the missiles from inflicting casualties in Israel urban areas. In fact, Ashkelon has been almost entirely evacuated and most of the residents of the kibbutzim surrounding Gaza left their homes in anticipation of the Israeli ground assault into the Strip. It might now be difficult to convince the people in those kibbutzim as well as in the towns and cities near the Lebanese border of the Iron Dome's ability to keep them safe in the event of a war. It is important to add that the Iron Dome system is intended to protect civilians; it does not cover vital military, technological and governmental facilities.

The following are the system's operational shortcomings:

- **A technical error could cause one of the batteries to malfunction**, inviting a torrent of enemy missiles.[12] Also, it takes a relatively long time to reload a battery of up to 20 Tamir missiles. The resistance forces could take advantage of this interval.[13] Each Tamir missile weighs about 90 kg and has a range of over 40 km.
- **The system's ability to handle heavy missile barrages (whether short or long range) is relatively limited**. The resistance's operations room demonstrated this when it sustained a rapid, intensive barrage of some 5,000 missiles against locations inside Israel, throwing the Iron Dome system into disarray.
- **Considerable attention is being given to studying the Iron Dome's efficacy in intercepting intensive barrages of hostile missiles from multiple fronts**[14] in view of the possibility that a confrontation could spiral and expand to other fronts. This spectre has already reared its head in the current confrontation. A Qassam Brigades contingent in Lebanon fired a fusillade of missiles that struck their targets in the Upper Galilee while Hezbollah initiated a diversion and attrition operation along the northern front, firing missiles and assault drones at several Israeli military sites and other targets.[15] Israel was forced to create a four km-deep buffer zone in anticipation of the confrontation potentially expanding to involve Hezbollah and the Palestinian resistance in Lebanon. Several missiles were also fired towards Israel from inside Syria.
- **The interceptor missiles are very expensive**, estimated to cost USD 20,000–100,000 each.[16] The Iron Dome might be put into operation to fire a couple of Tamir missiles, costing tens of thousands of dollars, to down a Qassam rocket which costs only a few hundred dollars to

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12 "The Iron Dome fails to intercept Gazan missiles due to 'technical error,'" *Sputnik*, 11/5/2021, accessed on 3/11/2023 at: https://bit.ly/3gnYtCt

13 Hussein, "How Did the Qassam Brigades Take Control of the Gaza Division?"

14 Charles Levinson & Adam Entous, "Israel's Iron Dome Defense Battled to Get off Ground," *The Wall Street Journal*, 26/11/2012, accessed on 4/11/2023, at: https://on.wsj.com/36kyrrx

15 "Missiles and wounded in Galilee and a Hezbollah drone hits two Israeli soldiers," *Aljazeera.net*, 3/11/2023, accessed on 4/11/2023 at: https://bit.ly/3Rf00gv

16 David Hambling, "Under the Iron Dome: The Problem with Israel's Rocket Shield," *Forbes*, 12/5/2021, accessed on 5/11/2023, at: https://bit.ly/3wmGJN7

manufacture. Most likely, the Qassam, which comes in three versions, was used to provide the air cover for the ground incursion during the Al-Aqsa Flood operation.

- **The Iron Dome has no noticeable impact in fending off hostile mortar fire during battle.** This type of artillery was used against Israeli forces in the Gaza envelope and it disrupted life in the kibbutzim in the border area of the Upper Galilee. The Qassam Brigades also deployed military drones during the 7 October operation. These posed a considerable challenge to the Iron Dome as they fly at low altitudes and have a low radar cross-section (RCS), which makes it hard to detect and track them.[17] The resistance also unveiled a new hang glider-based assault technique, known as the Saqr Squadron, which was used to infiltrate enemy lines in the Gaza envelope. This has exposed a major Israeli intelligence failure: the Iron Dome could not intercept the hang gliders either because they fly at altitudes too low for the system to detect.[18]

Conclusion

The Iron Dome epitomizes the technological advances that have accompanied the evolution of Israel's defensive and offensive strategies in the past two decades. Yet, as sophisticated as this system is, the Palestinian resistance managed to expose its flaws in spite of limited capacities. The last two confrontations, in which the Qassam Brigades launched the Sword of Jerusalem (May 2021) and Al-Aqsa Flood (October 2023) operations, showed that not only had the Iron Dome failed to deter the resistance from firing missiles, it had also pushed the resistance to devise ways to dent the new technology's defence capacities. Thus, the resistance began working to develop its missile capabilities and soon unveiled new versions of their long-range rockets, the latest of which is the Ayyash-250. They also developed new tactics for deploying the missiles which, on many occasions, managed to penetrate the Iron Dome shield by flooding it with a torrent of missiles fired simultaneously, causing the system to jam. Then, after the Israeli army began its land offensive against Gaza, the resistance trained its missile fire on the geopolitically central Tel Aviv, thereby demonstrating the inability of the ground offensive to deter the resistance and exposing the failure of the Iron Dome to intercept the resistance's missiles. Moreover, due to a technical glitch in the system, one of the Iron Dome's own missiles fell on the Rishon LeZion settlement near Tel Aviv.[19]

In light of the foregoing, one wonders how confident Israeli citizens feel about their military establishment's much vaunted defence system and, above all, the Iron Dome's ability to protect them. This applies in particular to the people living in the vicinity of Gaza as well as those living in populated areas in northern Israel because of the possibility of fronts opening up in that direction. Then there is the

17 Seth J. Frantzman, "Iron Dome Intercepts Drone during Combat for First Time, Says Israeli Military," *Defense News*, 17/5/2021, accessed on 4/11/2023, at: https://bit.ly/2SxfiSb

18 Saleh al-Na'ami, "Hand gliders as a surprise assault instrument for the Palestinian resistance: How did it evade the Iron Dome?" *al-Arabi al-Jadid*, 8/10/2023, accessed on 15/10/2023 at: https://bit.ly/3STY6mI

19 "Friendly Fire: An Iron Dome missile fails to intercept rockets from Gaza and falls on Tel Aviv (video)," RT (Arabic), 5/11/2023, accessed on 27/11/2023 at: https://bit.ly/3GiipTe

question of the Iron Dome's efficacy should the resistance in the West Bank develop a missile capacity, which would put the inhabitants of Israeli settlements at risk. West Bank resistance fighters have already tried to follow in the footsteps of their Gazan colleagues in the manufacture of locally produced rockets.

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