FROM OPERATION PILLAR OF DEFENSE (2012) TO OPERATION GUARDIAN OF THE WALLS (MAY 2021): A CRITICAL APPRAISAL OF ISRAEL'S IRON DOME DEFENSE SYSTEM

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Abstract: *The present study is undertaken to critically appraise the capability and performance of Israel's Iron Dome during different campaigns till the recent Gaza war of May 2021. The study shows that during different military campaigns since the deployment of Iron Dome, Israel Defense Force has claimed significant interception figures for the system. However, the system critics refute the interception rates claimed by IDF on the basis that these are not independently verified. Operation Pillar of Defense (2012) shows that though IDF released statistics for Iron Dome interception were high, but anti-missile defense analysts and experts observed that given that only 20% of collisions were front on, hence the interception ratio was likely 5 percent or less for Iron Dome during 2012 campaign. During Operation Protective Edge (2014) again IDF claimed a higher interception ratio for the air defense system, but system critics criticized its ability on the basis that Iron Dome has a limitation particularly when it confronts ultra short-range and low trajectory rockets and mortars. The May 2021 conflict shows the military and technological superiority of Hamas and IJMP to launch mass saturation rockets attacks against Israeli settlements indicating the growing capability of non-state actors to overwhelm the defensive system (Iron Dome). Operation Guardian of the Walls (2020) also raised questions regarding the capability of the Israeli lower-layered defense system to counter rockets and mortars in the future particularly when confronted by a possible two or three front on rocket warfare involving Hezbollah.*

Keywords: Israel's Iron Dome, Operation Pillar of Defense, Operation Protective Edge, Operation Guardian of the Walls.

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INTRODUCTION

The purpose of the present research study is to critically review Israel's lower-layered anti-missile defense system: Iron Dome. The current research work is divided into three parts i.e. the first part sheds light on the building of the said lower layered air defense system by Israel. The next part focuses on the debate between the supporters and critics of the system. Lately, Iron Dome's credibility and effectiveness have been critically appraised by analyzing available secondary data on Iron Dome's performance during the 2012 military campaign, the campaign of 2014, and the recent military campaign in May 2021. For that purpose, the present study has reviewed secondary data available on Iron Dome performance in the form of reports published by different think tanks. Additionally, journal articles (Online) and reports written by journalists in newspapers and magazines (Online) have also been consulted for study purposes. Regarding the nature of the present research study, it is descriptive in its outlook.

PART ONE: DEVELOPMENT OF IRON DOME (ANTI-MISSILE DEFENSE SYSTEM)

The 2006 conflict showed the military superiority of Hezbollah as it launched some 4,200 rockets targeting Israeli settlements, with resulted in the killing of 53 Israeli's and hundreds more were wounded.[1] Jean-Loup Samaan (2015) stated that the program (Iron Dome) was initiated in February 2007 by Rafael Advanced Defense Systems.[2] The Iron Dome was deployed in March 2011, and within two weeks span it shot down the

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[1] Jacob Nagel and Jonathan Schanzer, "Assessing Israel's Iron Dome Missile Defense System," *Foundation For Defense Of Democracies,* (November 13, 2019).

[2] Jean-Loup Samaan, "Another Brick in the Wall: The Israeli Experience in Missile Defense," Monographs 309 (2015), https://press.armywarcollege.edu/monographs/309

first rocket.[3] According to Jeremy Sharp, by 2020 it was estimated that the U.S. had granted Israel with military aid of $1.6 billion for the purpose of battery manufacture, with about 60 to 70% of parts of the interceptor also being made in America.[4] Regarding the installations of the Israel's lower layered air defense system, the first battery was deployed on March 28, 2011, followed by a second battery after a week, while the third and fourth were added in June 2011 and March 2012 respectively.[5] At present, Israel has deployed ten batteries throughout the country.[6]

FUNCTIONING OF IRON DOME, MAIN COMPONENTS, & SYSTEM CAPABILITIES

The lower layered air defense system of Israel is built to intercept lower range rockets i.e. Qassams and Katyushas. Besides that, the Arrow systems intercept long-range missiles i.e. Scud missiles, while for intercepting medium range ballistic missiles David's Sling is being used.[7] According to Jean-Loup Samaan (2015), an Iron Dome battery consists of an ELM-2084 S-Band phased-array radar, three launchers having the capability to carry upto twenty Tamir interceptor missiles, and a fire control center.[8] According to Sebastien Roblin, the Iron Dome system measures the incoming missile trajectory to assess if it could possibily strike a populated urban area or detonete without any harm in the uninhabited center.[9] Sebastien Roblin further stated that Tamir

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[3] Sebastien Roblin, "Israel's Iron Dome Is a Rocket Killer (And the U.S. Military Wants It)," *The National Interest*, February 2, 2019.

[4] Jeremy M. Sharp, "*US Foreign Aid to Israel"*. *Congressional Research Service* (November 16, 2020): 13.

[5] Yiftah S. Shapir, "Lessons from the Iron Dome," *Military and Strategic Affairs* 5, no. 1 (May, 2013).

[6] Gwen Ackerman and Roxana Tiron, "What Is Israel's Iron Dome Anti-Rocket System?," *Bloomberg*, May 21, 2021.

[7] Gili Cohen, "Why Does Israel Need Three Different Missile Defense Systems?," *HAARETZ*, April 2, 2015.

[8] Jean-Loup Samaan, *Another Brick in The Wall: The Israeli Experience in Missile Defense*, (Carlisle: Strategic Studies Institute, US Army War College, 2015).

[9] Sebastien Roblin, "Israel's Iron Dome Is a Rocket Killer (And the U.S. Military Wants It)," *The National Interest*, February 2, 2019.

interceptors move towards the incoming threat approximately at two point five times speed of sound, directed by radar, furthermore when a missile closes its proximity to the pinned rocket/mortar, then its nose-mounted electro-optical sensor takes control of it (Interceptor missile) to give more accurate terminal guidance.[10] The said researcher further stated that after that, a proximity fuse explodes the rocket's/missile's 35 pounds warhead when it is in the range.[11]

Regarding the capabilities of this air-defense system (Iron Dome), Krishn Kaushik stated that according to Rafael's website Iron Dome can give protection to the deployed and maneuvering forces, to the FOB (Forward Operating Base) (FOB), and also to populated and urban localities against any kind of aerial dangers.[12] Avi Mayer, a former IDF spokesman, while talking on Israel Iron Dome system told Insider recently that as this air defense system is good, but it cannot properly counter the threats as there is a possibility of its being overwhelmed during certain situstions.[13] Ian Williams while speaking on Israel air defense told Insider regarding the optimism associated with the Iron Dome that this system may bring about stabilization,but again stated that we can argue that the system (Iron Dome) enables the state of Israel to be much more hostile because it can resist a rocket onslaught, thereby stating that it is harder to prove which is the case.[14]

PART SECOND: DEBATE B/W SUPPORTERS & CRITICS OF IRON DOME

This part of the research study focuses on the debate between the supporters and critics of Israel's lower-tiered anti-missile defense system (Iron Dome) over its effectiveness. The initation of this system started after the conflict of 2006 (Lebanon

[10] Ibid.

[11] Ibid.

[12] Krishn Kaushik, "Explained: How Israel's Iron Dome air defence system intercepts rockets," *The Indian Express*, May 25, 2021.

[13] Ryan Pickrell, "Israel's Iron Dome has been put to the test in more ways than one amid intense fighting with Palestinian militants," *Insider*, May 20, 2021.

[14]Ibid.

Conflict), and particularly after the significant losses sustained during the 2008 conflict.[15] The installation of the lower layered air defense system has ignited the debate between the supporters and critics of the system regarding its effectiveness to intercept diferrent types of short range projectiles aimed at Israel. The studies conducted by researchers and military authorities i.e. Jean-Loup Samaan[16], Jeremy Sharp[17], Jacob Nagel, and Jonathan Schanzer[18] supported U. Rubin's stance, as they acknowledged 80-90% effectiveness of the system in the 2012 and 2014 military campaigns. According to Michael J. Armstrong, the system critics have objected on 2 grounds, first criticism is that interception claims for the system is unrealistic given the nature of the task (Challenging), and the second objection is that these interception claims are not independently verified by others.[19] Likewise, Globes, regarding the Iron Dome interception rate, also observed that there is a possibility that the real performance of the system was inferior than claimed.[20] Regarding vague statistical figures on interception, Aharon Lapidot noted that one military interviewee said that Israel Defense Force has successfully intercepted 85% out of 1,500 rockets during the 2012 military campaign (Pillar of Defense), while during Operation Protective Edge (2014) it intercepted 90% of 4,700 rockets.[21] However, contrary to that, Aharon Lapidot further stated that one military interviewee said that majority of those rockets were not engaged.[22] Among the critics of Iron Dome's, Richard Llyod[23] and

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[15] Yael Elster, Asaf Zussman, and Noam Zussman, "Effective Counter-terrorism: Rockets, Iron Dome and the Israeli Housing Market," *Journal of Policy Analysis and Management* 38, no. 2 (2019): 312.

[16] Jean-Loup Samaan, *Another Brick in The Wall: The Israeli Experience in Missile Defense*, (Carlisle: Strategic Studies Institute, US Army War College, 2015).

[17] Jeremy M. Sharp, "U.S. Foreign Aid to Israel," *Congressional Research Service*, (November 16, 2020).

[18] Jacob Nagel and Jonathan Schanzer, "Assessing Israel's Iron Dome Missile Defense System," *Foundation For Defense Of Democracies*, (November 13, 2019).

[19] Michael J. Armstrong, "The Effectiveness of Rocket Attacks and Defenses in Israel," *Journal of Global Security Studies*, (2018), doi:10.1093/jogss/ogx028

[20] Globes,"Defense Prize Winner Moti Shefer: Iron Dome is a bluff," *Globes*, July 13, 2014, https://en.globes.co.il/en/article-defense-prize-winner-shefer-iron-dome-is-a-bluff-1000954085

[21] Aharon Lapidot, "Iron Dome Brought Sanity to the Homefront," *Israel Hayom*, July 3, 2015.

Theodore A. Postal[24] scientifically analyzed Tamir's behavior and then inferred Iron Dome's interception ratio by analyzing different available images and videos online. Based on Tamir's approach trajectories and design, both researchers (Llyod and Postol) in their separate studies explained that majority of attempts most likely didn't destroyed projectiles. Richard Lloyd assessed 30 to 40% interception for Iron Dome.[25] The Postal and other critics reports about the effectiveness of Iron Dome is refuted by Yiftah S. Shapir on the ground that Iron Dome critics extensively depends upon low-quality pictures and videos made by ordinary civilians through their smartphones, and hence it is very intricate to carry out an accurate investigation and to know exactly from the videos regarding the trajectory and geometry of the rockets/missiles flight.[26]

Theodore A. Postol by discrediting the effectiveness of Iron Dome to avert losses stated that the minimum loss inflicted by Hamas rockets is due to the presence of sophisticated defensive measures (i.e. early warning and quick-sheltering systems) employed by Israel, similar to what the UK did during 2nd World War against V-1 and V-2 attacks on London.[27] Theodore A. Postol further stated that Iron Dome didn't have any effects whatsoever on improving the chances of people's (Israeli) evading injury or death from the rocket attacks of Hamas.[28] Reuven Pedatzur while analyzing the Iron Dome interception rate during Pillar of Defense stated in his article that according to three

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[22] Ibid.

23 Richard Lloyd, *Iron Dome: It's All in the Endgame,* technical report, (Arlington, VA: TeslaLaboratories Inc, May 21, 2014).

24 Theodore A. Postol, "The Evidence that Shows Iron Dome is not Working," *Bulletin of theAtomic Scientists*, July 19, 2014.

25 Richard Lloyd, *Iron Dome: It's All in the Endgame,* technical report, (Arlington, VA: TeslaLaboratories Inc, May 21, 2014).

[26] Yiftah S. Shapir, *How Many Rockets Did Iron Dome Shoot Down?*, (Tel Aviv, Israel: Institute for National Security Studies, Insight No. 414, March 21, 2013).

[27] Theodore A. Postol, "The Evidence that Shows Iron Dome is not Working," *Bulletin of the Atomic Scientists*, July 19, 2014.

[28] Ibid.

prominent scientists (Postol, Dr. Mordechai Shefer, and D, a scientist of Raytheon) in more than one case the system's (Iron Dome's) interceptors were seen taking a sharp plunge and were even pursuing the rockets from behind, thus in such a scenario the chances that the interceptor could come close enough to destroy the incoming missile or rocket warhead is minuscule.[29] Reuven Pedatzur further stated that these scientists' claims should not be ignored without remembering the period after Gulf War (1991), when early reports after the war claimed a 96% successful interception rate for Patriot missiles, but subsequently, Professor Postol revealed that actual success rate was zero.[30] Yiftah S. Shapir while criticizing the reports of Professor Theodore Postol, Dr. Mordechai Shefer and another unidentified engineer regarding Iron Dome low interception rate during Pillar of Defense (2012) stated that their report's claims appear puzzling especially the notion that Iron Dome was unsuccessful in exploding missile's and rocket's warhead.[31] Yiftah S. Shapir further stated that claims like that are reminiscent of claims directed against Patriot Missile systems during the second Gulf War (1991) regarding its ineffectiveness to intercept Scud missiles for the simple factor that the defensive system i.e. Patriot was built to destroy aircraft instead of missiles.[32]

PART THREE: A REVIEW OF IRON DOME EFFECTIVENESS FROM 2012 TILL 2021: AN APPRAISAL OF THE SYSTEM DURING 2012 MILITARY CAMPAIGN

According to Shlomo Brom, surging violence was the catalyst force behind the November 14, 2012, military operation which continued for 8 days until clashes between Hamas and state of Israel were ended on November 21, 2012 on account of Egypt's

[29] Reuven Pedatzur, "How Many Rockets Has Iron Dome Really Intercepted?," *HAARETZ*, March 9, 2013.

[30] Ibid.

[31] Yiftah S. Shapir, *How Many Rockets Did Iron Dome Shoot Down?*, (Tel Aviv, Israel: Institute for National Security Studies, Insight No. 414, March 21, 2013)

[32] Ibid.

efforts.[33] According to Michael J. Armstrong, the results from Tables 3 and 4 indicated that 31.09% of rockets were intercepted, 4.28% fell in populated/urban centers, and 64.62% hit uninhabited areas, which indicates that 35.37% (479 rockets) incoming projectiles were considered as threats, in which some 87.89% were intercepted.[34] Wikipedia report on the Israel lower layered defense system in 2012 military compaign indicated that according to IAF Iron Dome intercepted 421 projectiles.[35] The problem with interception figures released by either IAF or IDF is that these figures are rarely verified by independent experts and researchers as there is no public access to the information. In that regard, even Theodore A. Postal stated that without providing credible data by Israel to support the system effectivness effectiveness, it is clear that the Israeli government is deceiving its citizens about the effectiveness of Iron Dome.[36]

Regarding Operation Pillar of Defense, Yaakov Lappin stated that it was the 1st moment, since second Gulf war (1991) when Iraqi Scud missiles targeted the Israeli capital, when Tel Aviv was hit by rockets.[37] It just shows the ability of Hamas to target the Israeli capital even though it was the first conflict when Israel deployed Iron Dome batteries. According to William J. Broad after the last Gaza war in 2012, Mr. Lloyd (Tesla Laboratories scientist & former employee of Raytheon) stated that his uncertainties regarding Israel's air-defense system (Iron Dome) were further entrenched when he saw different pictures of the Tamir's interceptors racing rockets in the air and when he had found images of fallen rockets/mortars and undamaged rockets warheads.[38]

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[33] Shlomo Brom, ed., *In the Aftermath of Operation Pillar of Defense, the Gaza Strip*, (Tel Aviv, Israel: INSS, November 2012), 7.

[34] Michael J. Armstrong, "The Effectiveness of Rocket Attacks and Defenses in Israel," *Journal of Global Security Studies*, (2018), doi:10.1093/jogss/ogx028

[35] Wikipedia, Iron Dome, accessed December 27, 2021, https://en.wikipedia.org/wiki/Iron_Dome

[36] Theodore A. Postol, "The Evidence that Shows Iron Dome is not Working," *Bulletin of the Atomic Scientists*, July 19, 2014.

[37] Yaakov Lappin, "Gaza Terrorists Fire Two Rockets at Tel Aviv," *Jerusalem Post*, November 16, 2012.

[38] William J. Broad, "Weapons Experts Raise Doubts About Israel's Antimissile System," *The New York Times*, March 20, 2013.

William J. Broad further stated that based on these facts and also because of rocket/warhead basics Mr. Lloyd suggested that the system had only successfully destroyed 30-40 enemy rockets warheads.[39] The criticism of Mr. Lloyd about Israel's defense system has some credibility, as his stance that Iron Dome had a 30 to 40% success rate during Operation Pillar of Defense was also supported by Postol in his study when he (Postol) asserted that except for front-on collision, the possibility of the system destroying rocket warhead will be close to zero.[40] Postol further asserted that observations he and his colleagues have made in 2012 identified twenty percent interception engagement geometry that was front-on to the incoming projectiles, he further stated that because even fewer than twenty percent of the interception that they managed to acquired data were front-on collision, so their somewhat accurate assessment was that the system interception ratio was five percent or even less than that.[41] The analysis of both Lloyd (As stated in William J. Broad's article) and Theodore A. Postol's statements about the system interception rate during Operation Pillar of Defense shows a dichotomy between the figures claimed by these independent experts and the IDF about Iron Dome. The study of Theodore A. Postol was criticized by Yiftah Shapir in his article, where he stated that the study's results are founded on the analysis of different video clips and which were not even recorded in advanced trials, rather these were obtained by ordinary people via their personal phones.[42] The critical analysis of Yiftah Shapir response to Postol and Israeli researcher Dr. Mordechai Shefer studies indicated that Shapir criticized their articles on the basis that their analysis of Iron Dome interceptions was mainly based on some random videos of interceptions uploaded by people, but the fact of the matter is that they did so because it was the only data available on Iron Dome interception as there was and still there is no independently verifiable data

[39] Ibid.

[40] Postol, "Iron Dome is not Working,".

[41] Ibid.

[42] Yiftah S. Shapir, *How Many Rockets Did Iron Dome Shoot Down?*, (Tel Aviv, Israel: Institute for National Security Studies, Insight No. 414, March 21, 2013).

released by Israel. Regarding the volume of missiles escaped during 2012 military campaign, William J. Broad noted that Dr. Reuven Pedatzur found an Israeli police report stating that a total of 109 rockets (during Pillar of defense), as opposed to 58 reported by IDF, hit urban areas.[43] By responding to that accusation against the air defense system during 2012 military campaign, Yiftah S. Shapir stated that police reports did not indicate anything clearly, but critics consider it as evidence that Israel's defense department is concealing the truth i.e. that the actual number is 109 instead of 58.[44] Yiftah S. Shapir again stated that how many reports were actually about rockets is difficult to ascertain, he concluded his statement by stating that out of 1,500 rockets launched against Israel even 109 rockets hitting urban areas is not an underachievement,[45] which indicates that Shapir by reluctantly agreeing to the critics' claims about the actual number of projectiles hitting Israeli settlements stated that even 109 rockets penetrating Iron Dome do not signify system failure. Quite contrary to his statement about the effectiveness of Iron Dome during Operation Pillar of Defence, Yiftah S. Shapir in his another article himself acknowledged that Operation Pillar of Defense proved that Iron Dome, despite its success, did not provide complete protection, as rockets pierced its defenses, causing immense damage.[46]

A REVIEW OF IRON DOME DURING OPERATION PROTECTIVE EDGE (2014)

The said military campaign (2014) continued for seven weeks, beginning on 8 July and ending on 26 August 2014.[47] According to Uzi Rubin during Operation

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[43] William J. Broad, "Weapons Experts Raise Doubts About Israel's Antimissile System," *The New York Times*, March 20, 2013.

[44] Shapir, "Rockets Iron Dome Shoot Down,".

[45] Ibid.

[46] Yiftah S. Shapir, "Lessons from the Iron Dome," *Military and Strategic Affairs* 5, no. 1 (May, 2013).

[47] Israel Ministry of Foreign Affairs, "Operation Protective Edge: The facts," accessed December 26, 2021, https://mfa.gov.il/MFA/ForeignPolicy/FAQ/Pages/Operation-Protective-Edge-The-facts.aspx#blank

Protective Edge more than 4500 missiles/mortar bombs targeted Israel.[48] Regarding the number of projectiles that hit urban areas, Ron Notkin stated that 244 rockets hit urban areas, while 735 projectiles were intercepted by Iron Dome that headed for Urban settlements.[49] The IDF disclosed information that indicated that Iron Dome was successful in intercepting 90% of rockets/mortars targeting Israeli settlements.[50] However, again without any complete and verifiable Intell supporting the claims of IDF regarding Iron Dome interception, there is no certainty about to what extent this system is successful because, as what Subrata Ghoshroy observed that once comprehensive data regarding the functioning of the system is accessible, this system may be regarded as an advanced defense system.[51] Regarding the total number of rockets fired at the Gaza Envelope (the hinterland to the Gaza Strip), Uzi Rubin article indicated, as mentioned in Table 01, that majority of rockets and mortars targeted Israeli settlements in Gaza Envelope i.e. 2,248 with only 67 rockets and mortars were intercepted by Iron Dome there.[52] So it could either indicate the limitation of the Iron Dome to successfully intercept short-range projectile or Israel priority to safeguard distanced urban areas first. The border area of Gaza is called Gaza Envelope which according to Joanna Zych is the populated area around the Gaza border extending up to 7–10 km.[53] If the statistical figures as provided by Uzi Rubin in his article concerning the maximum volume of

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[48] Uzi Rubin, *Israel's Air and Missile Defense During the 2014 Gaza War*, no. 111 (Tel Aviv, Israel: Begin-Sadat Center for Strategic Studies, Bar-Ilan University, Mideast Security and Policy Studies, 2015).

[49] Ron Notkin, "50 Days of Fighting, Roger and Out?," *Ynet*, August 27, 2014, http://www.ynet.co.il/articles/0,7340,L-4564529,00.html.

50 Emily B. Landau and Azriel Bermant, "Iron Dome Protection: Missile Defense in Israel's Security Concept," *The Lessons of Operation Protective Edge*, eds. Anat Kurz and Shlomo Brom (Tel Aviv: INSS, 2014).

51 Subrata Ghoshroy, "Iron Dome: Behind the Hoopla, a Familiar Story of Missile DefenseHype," *Bulletin of the Atomic Scientists*, December 13, 2012.

52 Uzi Rubin, *Israel's Air and Missile Defense During the 2014 Gaza War*, no. 111 (Tel Aviv, Israel: Begin-Sadat Center for Strategic Studies, Bar-Ilan University, Mideast Security and Policy Studies, 2015).

53 Joanna Zych, "The development of the Israeli national missile defense concept," *Kwartalnik Bellona*, (November, 2020), DOI: 10.5604/01.3001.0014.4757

projectiles fired at Gaza Envelope during 2014 military Campaign is accurate, then it might indicate that most of the short-range rockets and mortars targeted the Gaza envelope. As Uzi Rubin himself stated that if complete volume of rocket strikes on settlements near Gaza were 2,248 then volume of fifteen km projectiles targeting Israel (In 2014 campaign) was 2,316.[54] Thus it could mean that the interception figures released by IDF (90% interception during Protective Edge 2014) is exaggerated and baseless because during that conflict many projectiles were having short-range which mostly targeted Israeli settlements in Gaza Envelope itself, as Uzi Rubin already noted, and also because most of the researchers and military analysts have already raised apprehensions regarding Iron Dome inability to intercept ultra short-range rockets and mortars. In that regard, even Emily B. Landau and Azriel Bermant noted in their article regarding Iron Dome during Protective Edge that the system was failed to effectively intercept ultra short-range Rockets/Mortars targeting Israeli communities bordering Gaza.[55] Another researcher i.e. Joanna Zych also commented on the possible limitation of the Iron Dome by stating that paradoxically the shortest-range projectiles still poses an issue even if it can intercept limited range missiles inside fifteen seconds, as the space between the Strip and the areas that is accessible by the missile is even less than two kilo-meter, hence it is difficult to respond to the threat quickliy and to activate the system.[56] This just shows the limitation of the Israel lower layered air defense system to intercept limited range missiles and mortars targeting Israeli communities near Gaza border. The drawback of the system to effectively intercept and neutralize very short-range projectiles during 2014 military campaign is further evident from the statement of Uzi Rubin, who observed that even though this air-defense system is built to counter missiles between 4-70 km range, yet during 2014 campaign it was not utilized to intercept mortar bombs having 4 km

54 Rubin, "Israel's Air Defense During 2014 Gaza War,".

[55] Emily B. Landau and Azriel Bermant, "Iron Dome Protection: Missile Defense in Israel's Security Concept," *The Lessons of Operation Protective Edge*, eds. Anat Kurz and Shlomo Brom (Tel Aviv: INSS, 2014).

[56] Joanna Zych, "The development of the Israeli national missile defense concept," *Kwartalnik*

ranges.[57] Uzi Rubin further stated that whether it indicates a technical flaw (Possible limitation) or intentional policy of Israel's to not activate lower-layered air defense system (Iron Dome) against somewhat low lethality rockets remains vague.[58] The fact of the matter is that even if it is assumed that it was a deliberate policy of Israel not to engage mortars during that conflict, then a question arises as to why did Israel initiated a new defensive project i.e. Iron Beam to counter threats posed by the ultra short-range rockets and mortars? In that regard, Joanna Zych stated that a team of Israeli defense industries has (Since 2014) reportedly launched a defensive project with a purpose to fill the gap in Israel's lower-tiered anti-missile defense system, the researcher further stated that the capabilities of the new system (Iron Beam) is yet to be displayed and its deployment date is also vague.[59] According to Sebastian Maslanka, Iron Beam utilizes laser rayes to identify and demolish rockets having limited range of 10 km.[60] Thus it can be inferred from both the statements of Joanna Zyck and Sebastian Maslanka that Israel is developing Iron Beam since 2014 to fill the gap left by the Iron Dome, which raises the question of the credibility of Israel lower-tier defense system (Iron Dome) to effectively tackle shorter-range rockets/mortars having a minimum range. If Iron Dome gives optimal results, as claimed by the system supporters, then a question arises as to why Israel is spending millions of US dollars on a new defensive project i.e. Iron Beam?

APPRAISING THE SYSTEM PERFORMANCE DURING MAY 2021 CONFLICT AND ITS FUTURE PROSPECTS

Meir Elran, Carmit Padan, Gili Shenhar, and Hilik Sofer stated that according to Israel Defense Forces (IDF) disclosed report during recent May 2021 Gaza warfare

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[57] Uzi Rubin, *Israel's Air and Missile Defense During the 2014 Gaza War*, no. 111 (Tel Aviv, Israel: Begin-Sadat Center for Strategic Studies, Bar-Ilan University, Mideast Security and Policy Studies, 2015).

[58] Ibid.

59 Joanna Zych, "The development of the Israeli national missile defense concept," *KwartalnikBellona*, (November, 2020), DOI: 10.5604/01.3001.0014.4757

60 Sebastian Maślanka, *Geneza i rozwój obrony przeciwrakietowej*, ed. Sebastian Maślanka(Warszawa: Akademia Sztuki Wojennej, 2019).

approximately 4,360 projectiles targeted Israeli settlements in 11 days, in which 3,400 projectiles crossed the Gaza strip, and those rockets mostly targeted the Gaza Envelope, Ashkelon, and also Ashdod.[61] The said researchers (already mentioned above) further stated that during this conflict Iron Dome successfully intercepted some 1,100 rockets/mortars which were heading for urban and populated settlements, thus indicating 90% successful interception for the system.[62] The statement of IDF that the majority of rockets were fired at Gaza envelope during the war of 2021 and that the Iron Dome successful interception rate was 90% is obscure at best, because that if the majority of rockets and mortars targeted Israeli communities near the Gaza border (as stated by IDF), then claiming 90% interception for Iron Dome in May 2021 conflict is absurd and baseless, because Iron Dome has possible limitations particularly to successfully intercept short-range and low flight mortars targeting Gaza envelope, as Emily B. Landau and Azriel Bermant[63], and Joanna Zych[64] in their studies had already hinted.

According to the JINSA report, it was the advancements in intelligence acquirment and investigations that strengthened Israel's defensive capabilities i.e. the timely data obtained via sophisticated F-35s crafts, and Unmanned Aerial Vehicles (UAVs) on rockets launched from the Gaza was transferred to the air defensive system (Iron Dome) commanders which significantly assisted them in early warning, besides that, the information also helped them (Iron Dome commanders) accurately aiming Tamir interceptors by geo-locating the sources of missile fires.[65] The JINSA report further noted

[61] Meir Elran, Carmit Padan, Gili Shenhar, and Hilik Sofer, "Operation Guardian of the Walls: Lessons for the Civilian Front," *INSS*, (June 2 2021).

[62] Ibid.

[63] Emily B. Landau and Azriel Bermant, "Iron Dome Protection: Missile Defense in Israel's Security Concept," *The Lessons of Operation Protective Edge*, eds. Anat Kurz and Shlomo Brom (Tel Aviv: INSS, 2014).

[64] Joanna Zych, "The development of the Israeli national missile defense concept," *Kwartalnik Bellona*, (November, 2020), DOI: 10.5604/01.3001.0014.4757

[65] JINSA, "Gaza Conflict 2021 Assessment: Observations and Lessons," *The Jewish Institute for National Security of America* (October, 2021).

that countering mortar fire was still a major challenge for Israel's defensive system (Iron Dome) because of its low trajectory, less time for warning, and its relatively short distance.[66] Regarding the Guardian of the Walls Operation, Judah Ari Gross (2021) stated that despite the claims of the Israeli military of unprecedented achievements in the fight, the fact of the matter is that the results were mixed, as during the conflict more than 4,360 projectiles targeted central and southern settlements of Israel, which is three times higher than the previous 2014 conflict.[67] Judah Ari Gross further stated that during the recent conflict hundreds of projectiles targeted Israeli settlements in Ashkelon (Nearer Gaza border) including some 150 simultaneous rockets (Last Tuesday) overwhelming the otherwise successful air-defensive system of Israel i.e. Iron Dome.[68] From the JINSA report and Judah Ari Gross statement, it can be deduced that though during the recent Gaza conflict (2021) on account of technological advancements (i.e. Intelligence collection & analysis) Iron Dome proved to be a success, again it faced problems (similar to in previous conflicts) in intercepting and countering short-range mortars, which is evident from the statement of Judah Ari Gross when he stated that barrages of rockets targeted Ashkelon settlement (Near to Gaza border) effectively overwhelmed the system. Thus, this indicates the obvious limitations of the system to provide shelter to the citizens of Israel living near the border against limited range missiles and mortars attacks. According to Jean-Loup Samaan, the recent conflict (Gaza war) showed the evolving capability of non-state actors to overpower the air-defense system, as Hamas and other militant groups have demonstrated their's ability cum resolve to initiate Mass Saturation onslaughts.[69] In that regard, the said researcher further stated that Hamas and IJMP (on May 11) launched some 137 projectiles at Tel Aviv in the space of just five minutes, but these barrages of rockets didn't make Israel's lower defense system (Iron Dome)

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[66] Ibid.

[67] JUDAH ARI GROSS, "Guardian of the Walls' wasn't the resounding victory the IDF had hoped for," *The Times of Israel*, May 23, 2021.

[68] Ibid.

[69] Jean-Loup Samaan, "The Military Lessons of the Gaza War of May 2021," *Trends*, July 01, 2021.

extraneous, yet still, for Israel, it denotes that long warfare can make it difficult for her to defend its areas against such attacks.[70] Regarding the saturation point of Iron Dome, Jean-Loup Samaan explained that given the rockets depository of Hezbollah, which is somewhat 150 000 Rockets/Mortars, the initiation of a two or three-fronts rocket warfare in which one is Irani supported actors from the Golan area (Syria) can rapidly deplete the capability of Israel's lower layered defensive system (Iron Dome) to successfully intercept rockets and mortars heading for populated (Urban) areas.[71] It can be inferred from the statements of Jean-Loup Samaan that though Hamas and IJMP did well by launching mass saturation attacks, Iron Dome did provide a shield against these rockets attacks. Yet a future case of a two or three-front war could severely limit the effectiveness of a lower-tier defense system to intercept projectiles heading for urban areas. Regarding Iron Dome's performance during the recent Gaza war i.e. May 2021, Hamas and her allies in Iran consider the current conflict as a victory for them was a success, as during this conflict more than 60 projectiles bypassed Israeli's air defense umbrella i.e. Iron Dome.[72] Seth J. Frantzman while recognizing the limitations of Israel lower-tier defense system during the recent war and in future stated that the alarming thing after this conflict is that defense systems of Israel may be ineffective one day to counter the storm of missiles, the researcher further stated that Israel is not ready to accept it but even that technology is not without its limitations.[73]

CONCLUSION

The study shows that supporters of the system contend that it has been successful in effectively countering misiles and mortars throughout different campaigns. However, others refute the interception figures released by IDF on the plea that these are not independently verified. Operation Pillar of Defense (2012) shows that though IDF released statistics for Iron Dome interception were high, anti-missile defense analysts and experts observed that except for front-on collision between incoming rocket and Tamir

[70] Ibid.
[71] Ibid.

[72] Seth J. Frantzman, "Israel's Iron Dome Won't Last Forever," *FP*, June 3, 2021.

[73] Ibid.

interceptor, the possibility of interceptor destroyed rocket warheads is close to zero. Operation Protective Edge (2014) again reflected the commendable performance of Israel's air defense system, but system critics criticize its ability on the basis that it has a limitation particularly when it confronts ultra short-range and low trajectory rockets and mortars. The recent May 2021 military operation Operation shows the military and technological expertise development of Hamas and IJMP to launch saturation rockets attacks against Israeli settlements indicates a future potential ability to possibly overwhelm Iron Dome in the future. Operation Guardian of the Walls (2020) also raised questions regarding the capability of the Israeli lower-layered defense system to counter rockets and mortars in the future when confronted by a possible two or three front attack using rocket warfare involving Hezbollah (A Shiite Islamist Political party & militant group backed by theocratic state: Iran)