

# Israel and the F-35

Gur Laish

Does the IDF really need the F-35, its high cost notwithstanding?

To tackle this question, the essay below first identifies the F-35's unique features as a fifth generation fighter jet. It then examines the operational need for the F-35 through the prism of the Israel Air Force, specifically, the aircraft's ability to complete missions successfully in today's reality. The premise is that the ability to achieve aerial superiority is a key to effective use of the airpower: the discussion clarifies what precisely is necessary to achieve in order to enjoy aerial superiority and the effect that superiority has on how the force is used. Although a full discussion of the radical change in today's threat and its effect on achieving aerial superiority lies beyond the scope of this essay, the growing strength of Israel's enemies, both in theory and in practice, poses a central challenge to what once seemed assured: the IAF's achievement of aerial superiority. The essay clarifies whether the F-35 can provide a solution to the problem and whether a sufficient response might be provided by other alternatives.

The discussion of alternatives to the F-35 is limited to options that will be available in the near future, and does not examine alternatives in the initial planning stages, whose capabilities and costs are impossible to predict. This focus is essential for an informed, concrete discussion of IAF force buildup in the IDF's five year plan. Future alternatives cannot play a role in fighter jet contracts signed today. However, a discussion of advanced (and distant future) alternatives to the traditional understanding of aerial superiority as a key to the effective deployment of the air force is not irrelevant and may, in fact, be essential. However, it requires separate and comprehensive deliberations and should not

Gur Laish is an expert on the Israel Air Force.

influence present force buildup; the defense establishment would do well to engage in that debate regarding future force buildup.

The F-35 is a fifth generation fighter jet. Its unique advantages include:

- a. Stealth technology / low signature, which allows the jet to deal with airborne and land-based radar and perform even in areas defended with surface-to-air missiles or advanced planes. Its edge lies in the capability to handle threats independently while flying through the operational spheres, as opposed to fourth generation planes, which are dependent on a system-wide response.
- b. Network capability: The plane has information sharing and shared operational capabilities with other planes and means of combat, thereby allowing greater operational output.
- c. Sensor fusion: The plane allows the pilot to deal with a large amount of information gathered by the plane itself that arrives through the network, thereby allowing for full utilization of the plane's and the system's capabilities.
- d. The plane is built with economic considerations in mind, i.e., operation at reasonable costs (compared to advanced technologies and capabilities).

The need for the F-35 is derived from the Air Force's missions, which are driven by the need to deter Israel's enemies from embarking on a war and to serve as a central means of victory in the event that a war nevertheless breaks out.

### **The Strategic Effect of the Aerial Balance of Power**

The decision on whether or not to go to war is affected primarily by a comparison of power between the sides, with airpower being a primary factor in this equation. For example, Sadat was prepared to launch the Yom Kippur War only after he was guaranteed aerial superiority that could protect Egyptian forces on the east bank of the Suez Canal. The understanding that he would not have aerial superiority outside the range of the surface-to-air missiles was what made him curtail his goals for the war. Similarly, the absolute superiority displayed by the Israel Air Force in the First Lebanon War in attacking the surface-to-air missile batteries on the Syrian-Lebanese border and the aerial battles that followed was a significant factor in Syria's decision not to open a second front on the Golan Heights. The fact that the Syrians managed to delay the IDF's

advance on the eastern front of Lebanon might perhaps have encouraged them to think they could deal with the IDF on the Golan Heights as well, yet they remained deterred.

The very fact that the Israel Air Force operates the most advanced planes is a deterrent in the balance of power, and thus the element of deterrence, central in Israel's security concept, almost automatically requires the military to equip itself with the most advanced planes available. In fact, this is what Israel has always done in the past. Deterrence is especially strengthened by fifth generation planes, capable of dealing with advanced aerial defenses and fourth generation planes (such as the MiG-29, the F-15, and the F-16).

### **The Meaning of Aerial Superiority in War**

In order to become an effective force in the combat theater, an air force must both attain sufficient capability of action and deny the enemy its capability of action. A situation in which an air force has effective capability of action in the sphere under discussion is called "aerial superiority." The F-35 has been constructed in order to attain just such aerial superiority, and that is its primary asset.

Aerial superiority is not a fixed, immutable quality. Capability of action is a function of the weapon systems operated and the manner in which force is deployed. In order for the Allies (particularly the United States) to carry out the daytime attacks undertaken in World War II in Europe, they needed to be escorted by interception planes and fly in tight attack formations. The significant firepower allowed them to create local aerial superiority at the time of the attack. As long as the Luftwaffe operated effectively, this form of attack granted sufficient aerial superiority to the Americans, even at the cost of considerable numbers of downed planes and pilots. The reliance on escorts limited American operations to the maximum range of the escort planes, which was significantly less than the range of the bombers (hence the importance and the decisive effect of the long range Mustang). The British Royal Air Force chose to attack by night, thereby greatly decreasing the effectiveness of German intercepting planes and the need to deal with them, albeit at the expense of the quality of nighttime attacks. Obviously, there were tradeoffs in the use and effectiveness of force and the degree of aerial superiority. In the Yom Kippur War, the Israel Air Force found it very difficult to assist the

ground forces because it did not succeed in achieving aerial superiority by attacking the missile batteries on the front.

Aerial superiority thus changes according to the nature of the action. The manner of operating the aerial force is a function of the aerial superiority it has. To ensure that the aerial force is effective, it requires sufficient aerial superiority for its operational capabilities. Consequently, the effect of new weapon systems on the need for aerial superiority is an important factor. Autonomous precision guided weapons (self-guided munitions, directed to the target without a pilot) with gliding capabilities, such as the JDAM (a GPS-guided gliding bomb), make it possible to attack targets from ranges of 20 km and up. This sharpens the question of the extent of aerial superiority needed in the classic sense of flying over the target region: on the face of it, it is possible to attack the targets from outside the region defended by missiles (standoff attack). One could theoretically say that aerial superiority is not necessary on the front because it is possible to attack targets from one's own territory, without the need for entering missile-defended areas. However:

- a. The ranges of anti-aircraft missiles are growing. It is therefore impossible to ensure that the bombs' glide range would provide a full response to an attack.
- b. The nature of the targets on the front is varied. Some are stationary, which can be easily attack by standoff attack, but others are mobile and cannot be attacked with JDAMs.
- c. The number of targets is large. Moreover, any enemy that understands the attack capabilities of the Israel Air Force is increasingly scattering its targets in order to prevent devastating damage by a limited number of sorties. In addition, efforts are made to conceal the targets so that it is difficult to pinpoint them with precision (e.g., it is possible to know that a particular force is located within a said site but not precisely where in that site). The combination of these two factors requires the use of a great deal of ammunition, and at times precision is no substitute for quantity (e.g., when there is uncertainty about the exact location of the target). This combination greatly increases the cost of relying on standoff precision weapons (e.g., the JDAM, and even more so when more expensive and sophisticated weapons are at stake).
- d. The greater the reliance on standoff weapons, the greater the need to remain above the target with unmanned vehicles in order to gather

intelligence and locate the targets. This need intensifies further in relation to “the disappearing battlefield,” the manner the enemy chooses to overcome aerial superiority. In order to allow for longer flight times for aerial vehicles above the battlefield, a sufficient measure of aerial superiority is required, because while risks to unmanned aircrafts are acceptable, it is impossible to operate them if their attrition rate is too high.

Thus in order to operate effectively above the ground front, standoff fire alone is insufficient. A level of aerial superiority that will allow fighter plane activity above the targets is necessary, which will also enable sufficient aircraft activity at tolerable attrition levels.

From the point of view of defense, it is important to look ahead and recognize that the enemy too will have standoff capabilities (more or less effective). Therefore, it will be necessary to defend not only from the air above the battlefield but also to down the enemy’s planes while they are still in enemy airspace (standoff from their perspective). To attain this, enough aerial superiority is necessary to allow the flight of interceptors on the front. In addition, there are situations in which it is impossible to use long range air-to-air missiles and it is necessary to reach the targets themselves in order to down them. The reason may be operational, e.g., the need to identify the target by sight, or technological, e.g., the counter-means to disrupt radar missiles that require the use of heat-seeking missiles. Hence, also from a defensive viewpoint, the Air Force is required to achieve enough aerial superiority above the front.

### **Types, Numbers, and Dynamics of Targets**

In addition to fighting on the front, the Air Force is required to act deep in enemy territory. Enemy rocket and surface-to-surface missile systems are stationed in and operated from the rear of its territory. The classic military infrastructures, such as airfields and concentrations of enemy reserves, are far from the front. Operations in the depth will encounter a defense system that is less dense than the one on the front (because it is impossible to concentrate defenses throughout the sphere), but there is

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no doubt that where the enemy has significant assets there will be aerial defense systems.

The method of operating deep in enemy territory depends on the nature of the targets. Fixed targets, such as airfields and strategic installations, may be attacked even in the absence of aerial superiority by standoff attacks (usually this involves a limited number of high quality targets). Numbers and mobility are additional factors when dealing with rocket and missile systems; as these may require being airborne in the enemy's rear for an extended period for intelligence gathering and attack, a level of aerial superiority deep in enemy territory is necessary as well. The ability to operate in the enemy's rear also has strategic value because attacking Israel with firepower from the rear is a central pillar in the attempt by Syria (and Hizbollah) to curtail Israel's strategic advantage. The F-35 would allow penetrating and operating in the depth because of its stealth capabilities. The aerial superiority the F-35 would achieve would allow effective action of other systems, such as drones and fourth generation fighter planes. The more the enemy relies on mobile, concealed rocket and missile systems in their territorial depth, so the need for continuous action in the rear increases. The F-35 would be the central component of this capability.

Accordingly, the F-35 is needed for both direct action and attainment of aerial superiority in the enemy's depth. Sometimes Israel needs to be able to operate in enemy territory even in the absence of a wartime confrontation. Such activity cannot rely on early attacks of aerial defense systems, because the intention would usually be to carry out a surprise operation limited in time and with low chances for escalation. The ability to penetrate areas defended by missiles without having to attack them on the one hand, and with high chances of success and survivability on the other, has critical implications for the decision to carry out such an operation to begin with. Therefore, such ability has strategic importance. The F-35 is well suited to the nature of such operations (possible alternatives will be examined later in the essay).

The need to attain aerial superiority must be examined in context of how the force is used and the challenges posed by the enemy in terms of targets (their numbers and quality). The need for aerial superiority is not axiomatic. However, because the enemy adapts to improved fire capabilities, it is still necessary to have a significant level of superiority,

and the ability to achieve it is the basis for attaining the Air Force's missions in the foreseeable future. Moreover, beyond the significance in terms of how airpower is used is the strategic significance for the enemy's willingness to continue to fight. If the enemy becomes convinced that it does not have sufficient aerial defenses, the enemy is likely to end the war.

### **A Threat to the IAF's Ability to Attain Aerial Superiority?**

The struggle between "the missile and the wing of the plane" is not new, and has in fact recurred repeatedly since the introduction of surface-to-air missiles in the early 1960s. Missiles had almost no effect on the Six Day War, and the IAF attained absolute aerial superiority immediately at the start of the war. To a large extent, the War of Attrition revolved around the fight between missile systems and IAF capabilities to prevent these from being deployed along the Suez Canal sector. The War of Attrition ended with Egypt's deployment of missiles along the Canal, which in 1973 allowed it to cross the Canal and establish itself defensively on the eastern bank.

During the Yom Kippur War, "the missile bent the wing of the plane" and the Air Force understood the need for developing missile attack capabilities. Such capabilities matured and were demonstrated in the First Lebanon War, and both sides improved their capabilities at the end of the war and immediately afterwards: the Syrians introduced SA-8 mobile missiles and the SA-5 countrywide defensive systems, while the IAF expanded its countermeasures. Over the next 25 years, Israel had absolute aerial superiority in the arena. Recent years have shown an upswing in Syrian (and Iranian) construction of aerial defensive capabilities, prompted by a number of factors:

- a. The recovery of Russia (and its military industry) from the collapse of the USSR and the return of Russian industry to the forefront of technology, where it is engaged in the development and implementation of aggressive attempts to market advanced defensive systems.

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- b. Significant economic support for Syria by Iran, thereby allowing Syria to equip itself, following a long lapse, with imported weapon systems.
- c. Syrian understanding that it must change the strategic balance of power with the Israel Air Force if it wishes to be a significant player in the region.

These strategic changes have already been reflected in purchases of defensive systems. Iran procured the SA-15 systems for advanced localized defense; Syria bought the SA-17 for defending high interest targets, such as the front. In addition, there have been contacts, which have not yet developed into signed contracts, for the purchase of the S-300 systems by both countries. This general trend and the related new challenges are slowly questioning the IAF's previously assured capability of attaining aerial superiority.

The chief capability of the F-35 – its stealth technology – allows it to operate with much greater immunity in areas defended by surface-to-air missiles. As such, it is designed to be a central factor in attacking defensive systems and in attaining the required superiority. In addition, its other features – e.g., networking, sensor fusion – turn it into an effective tool against aerial defensive missile systems. Currently the Air Force can attain sufficient aerial superiority, and means for dealing with advanced surface-to-air missiles other than the F-35 are being developed. However, in the long term, stealth capabilities are at the forefront of future technology. The Israel Air Force must acquire stealth capabilities that will allow it to penetrate defended areas and create sufficient aerial superiority. In this context, one may look at the alternatives to the F-35 as improved versions of fourth generation planes. To the extent that these will allow fourth generation aircraft to operate effectively in areas defended with advanced surface-to-air missiles, they represent relevant alternatives. However, it is not at all clear how one improves a platform like the F-15 such that it will have stealth capabilities without going into a whole new plane development project (e.g., the F-22).

### **Maintaining the Qualitative Edge**

Russia's renewed production and sale of high quality weapons, sales by countries in the Far East, and the economic situation in the United States and Europe makes the American (and European) need to sell advanced weapons to states in the region that are not direct enemies of Israel,



e.g., Saudi Arabia, more acute than ever. In order to compete with other weapons manufacturers, the Americans must sell the most innovative systems, as with, for example, the recently publicized arms deal to sell and upgrade F-15s to Saudi Arabia. Such weapons deals affect the region both directly and indirectly: directly, in that the very sale of these weapons to the Saudis makes it easier to sell similar weapons to other countries; indirectly, because weapons such as these in Saudi hands spark an arms race among its enemies and motivates them to attain the same weapons. It also legitimizes sales, so that at the end of the process, the entire region is armed with better weapons than before.

However, maintaining Israel's qualitative edge over the region's armed forces of enemies and non-enemies is an important component of Israel's security concept, and the United States is even obligated to this principle by law. When weapons that are identical and at times even superior to what Israel has are sold to other actors in the region, this challenges Israel's qualitative edge, and the only way to maintain the gap in quality in the air is by purchasing and operating the next generation of weapon systems. Maintaining the qualitative advantage has strategic significance for deterrence and may have concrete effects in a confrontation. The regional arms race forces Israel to equip itself with the next generation of weapon systems.

### Renewal

The need for the F-35 also stems from the much more prosaic aspect of lifespan: the IAF fleet is aging. The lifespan of planes is limited even if programs to extend it are implemented. When looking at the IAF ORBAT, the first and most important question from a budget standpoint is its size, which has operational significance determining the capability to carry out missions in a given timeframe. However, it also has a strategic impact. Benny Peled, commander of the IAF during the Yom Kippur War, was quoted as saying that one additional day of attrition would bring the Air Force to a red line, under which it would be appropriate to seek a ceasefire. Whether such a red line in fact

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exists is immaterial; what is important is the ORBAT's effect on decision makers.

However, almost without any connection to the size of the ORBAT, aging and obsolescence require ongoing ORBAT renewal. As such, a purchase is required every decade. The scope of the deal relates to ORBAT size, but the very need for a fighter jet deal is a direct derivative of ORBAT age and the possibility of extending its lifespan. Once one understands the need for a purchase, it is possible to examine alternatives to the F-35. Note, though, that even if one contends that the Air Force's ORBAT ought to be reduced in favor of the increased ORBAT of unmanned vehicles, a fighter jet deal is still a necessity.

### **Examining the Alternatives**

Against this discussion of the primary reasons the Israel Air Force needs the F-35, it is necessary to investigate whether there are alternatives that can provide a different response to the operational needs.

#### ***Improved F-15s and F-16s***

Periodically various proposals are heard such as "F-15s with low radar return," but these do not provide an actual response to the question of whether the improved airplane can operate independently over advanced aerial defense systems. Moreover, were it possible to come up with such an effective improvement, it would have been the first to compete for the tender that was won by the F-35, as the high cost of the latter is a burden also to the Americans and their partners – who clearly do not have a magic solution to the challenge.

#### ***Surface-to-Surface (or Sea-to-Surface) Missiles***

The enemy's development of firepower as well as very advanced capabilities of the Israeli military industries at times raise the need to examine alternatives to the F-35 (and perhaps even to fighter planes generally) in the form of attack capabilities by surface-to-surface missiles.

This alternative seems to have the advantage in terms of durability in the face of the enemy's firepower in that it is not dependent on air bases that are (erroneously, in my opinion) seen as vulnerable to enemy attack and in its capability of meeting the enemy's most advanced air defense systems. This essay will not expand on this point, but the Air

Force's bases are not so vulnerable to enemy fire if it is not highly precise, primarily because since the 1960s the Air Force has been prepared to act under aerial attacks.

On the face of it, it would seem that the surface-to-surface missile provides a good solution for attacking stationary targets. The real test must include an examination of the size of the warhead and its penetration ability against the targets and also an examination of the number of targets it would be necessary to attack. However, surface-to-surface missiles are liable to be problematic when it comes to mobile targets; even if it is possible to pinpoint the targets, the time it takes for a missile to reach the target (a few minutes) can allow the target to move and the missile to miss its mark. Updating the missile during its flight time is not impossible, but it is not simple and an updating of this kind is also limited. Large warheads are usually not required to destroy moving targets, as they are not fortified, but there is a tradeoff between the size of the warhead and the degree of uncertainty about the precise location of the target. For example, in order to attack a surface-to-air missile system, a very precise pinpointing capability is required of the radar or warhead with a very large kill radius. One may compromise on the kill radius by relying on systems with independent precision homing capabilities or with human intervention (a person receiving intelligence and directing the weapons accordingly), but these systems are themselves vulnerable to missiles, as they are quite slow.

Similar to the discussion about aerial superiority, when one examines the need to confront mobile enemy systems, unmanned aircraft are required to stay aloft in the area of the targets. Such flights may be logical if in tandem activity takes place to attain aerial superiority in the area. If the concept of aerial superiority is exchanged for use of surface-to-surface missiles, unless a supporting effort is made to attain aerial superiority to ensure the activity of the unmanned vehicles, it is not clear that it is at all possible to pinpoint the moving targets.

Finally, it is necessary to examine the numbers of targets to be attacked. Precision surface-to-surface missiles (unlike mid-range non-precision rockets held by the thousands both by Hizbollah and Syria) are not cheap when compared to aerial weapons (not the platforms). The present discussion cannot include the actual numbers, but such a

financial evaluation would conclude that it is impossible to exchange all aerial attacks for attacks by surface-to-surface missiles.

Thus, although surface-to-surface missiles can indeed serve as an effective if not important means of firepower in the IDF repertoire, it cannot serve as a complete substitute for the F-35 in particular and fighter planes in general, and therefore cannot be discussed as an alternative but only as a complement to the military's firepower.

### *Unmanned Vehicles*

Some publications depict the F-35 as the last manned vehicle, and some people argue that even now it is unwise to invest in so expensive a manned airplane, and it would be more appropriate to expand the use of drones and other unmanned vehicles (UAVs). However, the term UAV includes many different types and therefore a more detailed discussion is in order.

When UAVs made their modest entry into the aerial arena, the craft were cheap and used only for observation. Later development endowed them with many new capabilities, both in terms of observation and attack (most American attack activity in Afghanistan is carried out by the Predator drone equipped with Hellfire missiles). However, as capabilities improve, costs rise. While it was relatively easy to risk the cheaper models, the more expensive vehicles are also few and far between. Although their use in threatened areas does not endanger human lives, it does become impractical militarily if their rate of attrition is high (i.e., they are used up before a mission is accomplished). Moreover, if drones are weighed as an alternative to the F-35, they are also required to carry heavy weapons (or intelligence gathering equipment, for example). This means that a large platform is needed, and that is by no means inexpensive (though certainly nowhere near as costly as the F-35). For the larger UAV to be resistant to advanced defense systems (and advanced airplanes), it must have advanced technologies, be they evasive or defensive systems. As such, manning aerial vehicles does not dramatically affect the cost or the ability to operate them in the arena of interest.

This is not to say that no worthwhile operational product is possible from UAVs in general and from advanced UAVs in particular. However, inexpensive models whose attrition can be sustained are of limited capabilities; on the other hand, costly vehicles have no significant advantage as an alternative to the F-35 (beyond the fact that the latter

do not yet exist). In other words, the contribution of the UAV would be in certain fields and areas; the UAV does not seem as a complete replacement for the F-35, and therefore the discussion must focus on it as a complement rather than an alternative.

It is not impossible that the future will offer a more complete solution to missions deep in enemy territory by a combination of intelligence gathering from the air, standoff capabilities, and advanced UAVs with varied fire capabilities – missiles, flights over enemy territory, and standoff fire – but these capabilities certainly do not yet exist and therefore cannot be relied on as alternatives to the F-35. There is also no guarantee that when they do develop they will in fact provide a sufficient response.

### Conclusion

Equipping the Israel Air Force with the F-35 has strategic importance in terms of deterring the enemy from starting a war and in terms of maintaining Israel's qualitative advantage in the arena. Effective use of the IAF in a war requires aerial superiority that allows activity for fighter jets on the front and above choice regions deep in enemy territory. Aerial superiority is required to allow the continuous operation of unmanned vehicles at a reasonable rate of attrition. In light of the development of aerial defense systems in Syria and Iran, attaining aerial superiority faces unprecedented challenges. The main features of the F-35 would allow it to operate before aerial superiority is achieved and be the primary tool for attaining it.

The regional arms race requires Israel to equip itself with the next generation of weapon systems in order to provide a response to new weapons entering the arena now and those that will be introduced in the future. An examination of alternatives in the form of surface-to-surface missiles and advanced UAVs demonstrates that despite their expected contribution they cannot serve as complete substitutes to fifth generation fighter jets. This support for the purchase of the F-35, however, should be joined by a discussion about the gamut of the response in the more distant future. It may provide solutions in other directions of force buildup.