TRANSCRIPT

Event

“Missile Defense in Israel: A Conversation with Moshe Patel”

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FEATURING
Moshe Patel
Director, Israel Missile Defense Organization

CSIS EXPERTS
Tom Karako
Senior Fellow, International Security Program and Director, Missile Defense Project, CSIS
Tom Karako: Well, good morning, all, and welcome to our event on missile defense in Israel and bilateral U.S.-Israel cooperation on the same.

This cooperative effort is both one of the most important for the U.S. missile defense enterprise, and also one of the longest-standing. Last month, here at CSIS we did an event commemorating the 40th anniversary of Reagan’s kicking off the Strategic Defense Initiative back in 1983. And U.S.-Israel missile defense cooperation dates really to the very beginning of the Strategic Defense Initiative Organization, I think in 1985. The United States, of course, benefits considerably from this relationship, both from the technical side but also from the operational experience and lessons. And because Israel’s in a tough neighborhood, there’s unfortunately quite a lot of that from over the years.

To talk to us about these issues, we could have no better interlocutor than Moshe Patel, director of the Israel Missile Defense Organization, or IMDO. IMDO was part of the Israeli MOD’s Directorate of Defense Research and Development, and is the organization responsible for the development, management, and improvement of Israel’s active missile defense systems. Moshe Patel’s a retired colonel from the Air Force, 25 years active duty. But he also had active direct experience in the development of Arrow, of David’s Sling, and Iron Dome during both his service in the Air Force and in defense industry. He took over as director of IMDO in 2016, about seven years ago, which is quite a tenure.

I’ve got a lot of questions, and we want to dive into them, but I also encourage folks to submit their questions online from the event page. And that will come here to the tablet through the magic of Combined JADC2, so I can give them to our speaker. Moshe, welcome to CSIS. We’ve been on panels together over the years and I think this is the first time you’ve come to CSIS. So, welcome.

Moshe Patel: Yes. Thank you very much. Thank you for having me. Of course, and over the years we read a lot of your analysis and the researchers of this institute. Thank you very much for having me here.

Dr. Karako: Thank you for coming.

Well, why don’t we just dive in with the threat? How would you characterize the threats that that Israel faces today? How’s it changed over the years, even since you took over as director?

Mr. Patel: What I can say is that we are facing, or we are learning to face, a threat which will be very, very complicated. In one hand, we’re going to face
short-range attacks, like what we faced in the recent confrontation, Shield and Arrow. We’re going to face accurate targets, maneuvering threats, ballistic missiles from different ranges – short, long range – from all the arena that we are facing, all of our neighborhood, cruise missiles, UAVs. So we need to be prepared for all those kinds of threats.

Dr. Karako: So I think recently Iran made a declaration that they had tested a missile of, I think, over 2,000 kilometers in range. I wonder how you think about that continuing, emerging ballistic missile threat from Iran. But also, how you balance that with different aerial, and UAV, and cruise missile type threats.

Mr. Patel: We were not surprised. We built our system to be ready for those kinds of developments that happened in Iran and happened in all of our neighbors. And you are right, the most difficult challenge here is how you integrate all your systems to intercept all those kinds of threats, which is both airborne and ballistic threats. And this is something that we are working day by day in order to bring the best that we can from our systems.

Dr. Karako: How would you characterize – I’ve heard you talk about this before – kind of your philosophy of what to defend, the defended asset list, as it were? What do you prioritize from that perspective?

Mr. Patel: First of all, our systems are very, very sophisticated. So we are trying to predict where the threat will land. And if it is going to be landed in an unpopulated area like sea or, you know, desert, or places that people are not living there, then we are not wasting any interceptors. I can give an example. During the last confrontation from Shield and Arrow, out of the almost 1,500 of rockets that have been shot into Israel, at least 25 percent were landed in Gaza, and killed and wounded a lot of people in Gaza. So for those kinds of threats, we are not wasting any interceptors. There are rockets that have been landed at sea. So also for those kinds of threats, we are not sending interceptors.

So we are trying to understand, according to our systems – our detection systems, where the threat’s supposed to hit. And if it’s a kind of area that we need to protect, protected area, of course we are sending our interceptors.

Dr. Karako: And that kind of adaptability, let it go if it’s going to the desert, applies really to those predictable ballistic trajectories of rockets and artillery. But the less predictable maneuvering and aerodynamic things, it’s harder to know where they’re going to ultimately end up.

Mr. Patel: This is exactly the challenge that we are going to face in the future. And we know that our enemies, with a very, very minimal of expenses, they can
acquire navigation system, and they put in their rockets and missiles. And we are having solutions for that as well. And, of course, I cannot elaborate on all the solutions that we have, but we are planning ahead for those threats as well. This is a challenge, but we are trying to be all the time with our hands on the upper side.

Dr. Karako: And I’ve heard you talk about the – just the very high intercept rate, the success rate, for things like Iron Dome, but also other systems as well. Let me talk a little bit about kind of the relation between active defense and deterrence. It’s something that we talked about here the United States, in terms of our missile defense efforts. You have this very significant intercept rate, but they keep coming. Why are these active defenses not deterring them from launching, from investing in the capability? Why are they not dissuading the attacks in the first place?

Mr. Patel: It’s a good question that they need to be asked. With the defense that we have – with our missile defense capability and our offensive capability, if I were them, I would immediately stop whatever I’m doing. Maybe they have other reasons. But we need to be ready, anyhow. So I really don’t understand that.

Dr. Karako: (Laughs.) Is it a cost imposition strategy on Israel? You guys spend a lot of funds on this, as a result.

Mr. Patel: You’re right, but over time you’re looking not at the price of the interceptor, or the price of the defense. You’re looking at the price of the damage that could happen. So for us, human lives are in the highest priority. And this is something, when you take all the last confrontations, Iron Dome interceptor saves thousands of lives in Israel. And for us, this is the top priority. And, of course, when talking about other arena[s], we – defense is not the only vehicle that Israel is using. So we are going to be prepared for everything.

Dr. Karako: So maybe talk a little bit about the mission of IMDO. I think it was stood up in 1991. What are you focused on within DD R&D? And how do you – you know, what is your mission, fundamentally?

Mr. Patel: Our mission is, first of all, to deploy – for the Israeli Air Force, the Israeli Defense Forces, the Navy as well – air and missile defense capability, a layered kind of capability, that we need to protect from very low-range targets up to ballistic and long-range threats. We are responsible to take the threat and to plan accordingly. We are responsible to deploy, to train, and to bring our operational forces with the right capabilities. So our goal is to give them the whole suit in order to be prepared in a kind of a layered defense.
And the way we are doing that, and this is the advantage that my organization, my program office, is part of the Directorate of Defense is such a development. We are enjoying the benefits that other parts of my organization, our organization, is building, the future building blocks. And we are adapting them to our system. Iron Dome started from an idea that started back in research and development, and it was adapted in the multitier architecture. And I can give you a lot of examples – radar detection systems, command and control, a lot of other areas that we are enjoying the benefits of building a kind of prototypes, of building blocks. And we are adapting it to our layered defense.

Dr. Karako: You mentioned prototypes.

Mr. Patel: Yes.

Dr. Karako: There's something, I would say, within the several U.S. services, the Army – really, all the services – standing up rapid capability offices of different kinds. And the Army has an entity focused on developing prototypes, and things like that. So how would you characterize your acquisition philosophy in terms of you got a higher urgency, obviously. How would you characterize kind of your approach to defense acquisition generally?

Mr. Patel: First of all, we act a little bit differently because our threat is there, immediate. And we need to be – to deploy as soon as possible, and to be ahead of the threat, as I mentioned. So, in a kind of development cycle, we are working very closely with the defense forces, with our planning agencies, that are together with us building the threat – or building the threat that we need to protect. And we, from our building blocks, are trying to bring the best capability of defense systems.

Of course, in cases that we are doing it together with the U.S., like the Missile Defense Agency, which are supporting us for more than 30 years with the kind of a huge cooperation, is something that all the feasibility studies are done together and the decision to go ahead with new programs are being done together. And whenever, you know, we are feeling that we are in the right stage to move into production, after we finish kind of certain tests and certain capabilities that the system are ready, we are going into full-rate production. So this is the philosophy. It's a little bit – a little bit faster than what here in the States you're usually to do. But because we're feeling that the threat is there, and we need to be ready.

Dr. Karako: It's fair to say a greater focus on urgent speed and schedule, but also kind of a philosophy of get something that is good enough, and also keep the cost down. That's also very much in the mix.
Mr. Patel: Yes, we believe that we need to have something good enough that it will be faster deployed. And in order to bring it to completeness, we will do it on the run. And while we are achieving experience for a while in a combat lesson learned. This is the philosophy. And this is something that we are doing that until today it was very, very helpful.

Dr. Karako: And you mentioned, your mission is to is to give them, the warfighter, the capability. You’re within the Research and Development Directorate. And so that hands off to the Air Force for the ground-based operations and sustainment. Can you talk a little bit that relationship between the R&D and the operations and sustainment?

Mr. Patel: Of course. It is the Air Force and, just recently, we’re also working with the nice friends from the Navy, because they’re operating our Iron Dome on their Sa’ar 6 as well. I can tell you that the big, big advantage that we have here in Israel is that most of our operational people are after retirement or finished their duties going into school learning engineering, and then being recruited or in the industries, or in our organization, for example. And they are bringing their operational experience together with the engineering skills that they receive from the universities to the best systems that we can have.

But, of course, it’s not enough. You need a good, good partner in the requirements organizations, like the Defense Forces, our planning agency, the Air Force requirements agency, or the naval requirements agency. But working shoulder to shoulder, day by day, examining the threats, examining the gap, deciding what really we need to develop. And it’s something that we are monitoring it almost every – let’s call it, even every day – every day. They are part of our effort along the year. And once they receive the system, the product, they’re fully trained, fully adapted to whatever we develop. They’re not they’re not surprised by our systems.

Dr. Karako: You focus on the material piece of this, but obviously Israel has much operational experience. So can you talk a little bit about the doctrine, the organization, and the training? And how that provides a feedback to you in terms of what you develop, how you develop it? The fact that you’re moving from just one service to two services, that’s going to introduce some challenges, I would expect, including on the doctrine, organization, and training.

Mr. Patel: Of course. We are investing a lot in our training efforts. All of our systems have training capability embedded in our systems. So whenever an officer is being trained in our systems, it feels that he is in a real war, in combat. So he feel exactly what he is supposed to feel in a real combat. So this is in one hand. The second hand is that we have a lot of labs, and a lot of better
labs, that they train themselves in building their concept of operation, together with us. They are doing a lot of exercises. By the way, you have – we have exercise that we’re doing internally in Israel. We are having a lot of exercises that we’re conducting with U.S. deployed forces, that we gain a lot from those exercises as well. So all this actually build the right doctrine, and build the language that they need to talk between each other, between themselves, and between U.S. forces that are being deployed to Israel as well. So we are giving them all the umbrella that they need in order to be trained the best way.

Dr. Karako: Great. So maybe shift a little bit to current events. I wonder what you are thinking, what you’re learning by watching the air and missile war in Ukraine. Just a couple weeks ago, maybe last month, Admiral Grady, the vice chairman of the Joint Chiefs of Staff was here. And he said you know, we’re learning that air defenses is Ukraine's number-one need. As an observer of the kind of attacks being conducted there, what insights are you getting about the salience of these threats and how maybe to do something different?

Mr. Patel: First of all, we are learning a lot, and watching, and thinking what can be better in our arena from what we are seeing there. I think that the combat that we suppose we’ll face will be – consists from all types of threats, from very low-altitudes kinds of threats, UAVs, cruise missiles, long range, short range rockets, maneuvering. And we need the systems – all of our systems – to be ready against those threats. And since we are having different systems, and it’s a kind of a layered missile defense architecture, we need that all of our systems need to have – to have fully interoperable between themselves, want to have common picture, and the best engagement coordination that they can have between themselves.

And of course, whenever we have U.S. deployed forces, we’re supposed to have much good coordination, as we trained. So this is something that we learn, that we need to be ready to a lot of kinds of threats, and we need to be ready for mass effects. And this is something that we’re investing a lot of time to get right.

Dr. Karako: Of course, I have to ask you about the Russian-Iranian axis, and Iran’s purported supplying of Russia with the Shahed 136. Anything you’re seeing, learning there that will help you develop your own defenses better in the future?

Mr. Patel: We are watching and predicting. And I can tell you that we are trying all the time to be ahead of what they are building. And until today, we succeeded.
Dr. Karako: So one of the other, I would say, themes of the Ukraine conversation here in the United – in the in Washington, for instance, is mass production and munitions production rates. So you know, the Ukrainians are just reportedly being strapped for capacity. So what kind of lessons might we learn in terms of, again, the good enough, the cheap enough, and the plentiful enough? You’ve been doing this for years. Ukraine is facing this today. Broader lessons on that front?

Mr. Patel: First of all, you are trying to use the best, affordable interceptor that can do the mission for each of threat that it need to face. So if I will take our example in Israel, in the cases that Iron Dome can intercept, it will be better to use Iron Dome. If Iron Dome won’t be enough, we have the upper layer of the David’s Sling. If David’s Sling won’t be enough, that we have level two, level three, level four. So this is the way you need to solve the issue of, you know, unbalanced kind of war between, let’s call it, cheap threats compared to the value of the interception. And again, defense is not the only – or active defense is not the only solution. There are other solutions that you need to bring to the table.

Dr. Karako: Yeah. So let’s talk about that question of aid to Ukraine. Of course, the U.S. has sent Patriot, and there’s NASAMS, and HAWKs, and all kinds of other things over there. I’m going to quote our mutual friend, your predecessor, Uzi Rubin. He wrote an article in February for the Begin-Sadat Center about apparent reported American requests for Israel’s assistance in helping to supply Ukraine with air defenses. And this is what Uzi said, quote, “Israel has a vital interest in preserving amicable relations with Russia,” end-quote. Including specifically the issue of, quote, “the Russians’ ability to disrupt Israel’s military efforts to prevent Iran’s takeover of Syria.” I would get your reaction. Is Uzi correct? Is the Israel posture on the air defense supply to Ukraine – is that best understood as a foreign relations issue?

Mr. Patel: I admire Uzi. He brought me to IMDO when I was a young officer. Uzi now is a private person. I’m working as a civilian in the Ministry of Defense. This kind of question is more policy. And it’s above my paygrade to answer.

Dr. Karako: Yeah, no. I appreciate that. I knew, of course, that was the case, but I also appreciate your pointing out that this is a policy issue first and foremost – a foreign policy matter.

So let’s move to Israel’s missile defense architecture. We talked about your philosophy on acquisition generally. Everybody usually runs to, you know, the missiles, the interceptors. But I wonder if we could start with the other parts of the kill chain, the sensors, for instance. You’ve spent time in industry at ELTA for instance. What kind of radars support Iron Dome,
David’s Sling, Arrow, and the like? And how have the various radar and other sensors evolved over the years?

Mr. Patel: Actually, in ELTA, which is our main – it’s the main contractor that build for us and developed for us the radars until today. They have kind of families of radars. There is the Green Pine family, which help us a lot with our long-range detection capability. This is the Green Pine family. And there is the multi-mission radar family that help us a lot with the Iron Dome and David’s Sling. Both of the families along the years have been developed and become – to become more modernized, better algorithms, and a lot of lessons learned have been implemented along the years.

And all the radars are working as – first of all, as a fire control radars for us and also as a kind of a detection system. Because in Israel we have some of the radars that are not connected to a battery or to missile defense system, but it’s part of the architecture and it gives the information to the net. And our system is getting the information from the net. But of course, the fire control radars are part of a battery, and they’re part of all the activity. In a battery, you have the kind of certain requests for fire control radar that you’re using. So until now, they prove themselves in a lot of confrontations, a lot of detections, a lot of flight testing. And they were very satisfied with the radar that we have.

Dr. Karako: So I think you’re highlighting surface-based radars, ground-based, sea-based, for instance. But last year you also had a ceremony for the high availability aerostat sensor, a tethered aerostat. Kind of like the U.S. JLENS program from some years ago. Talk to us about why that program - I just heard you highlight the UAV and the Shahed threats a minute ago - why is that important? What’s that going to add? And where do you see that program going?

Mr. Patel: First of all, it’s an aerostat that also will include the ELTA radars on board. It’s a very unique kind of aerostat. One kind of all over the world, with its – you know, its capability. The intention of this system is to detect lower-flying targets, like cruise missiles or any other aerial targets are flying very low, and the ability to detect them from long ranges compared to ground radars. So this is the intention. It will be part of the detection system of Israel and will be connected to the net, together with all the radars and all detection systems that we are having in Israel. It’s a very, very unique system. Together with the Missile Defense Agency, we are continuing the development, and the adaptation, and evaluation of the system – and the integration, together with Air Force.

Dr. Karako: Well, that’s great. And, likewise, the other piece of this that – again, everybody runs to the missiles – is the command and control. And you were very careful in your introduction. You talked about the single
integrated air picture and you talked about the interoperability between these several systems’ command and control. But could you describe for us the several command-and-control – the several fire-control systems here and how you bring them together for fires deconfliction, and the like? How does that work?

Mr. Patel: First of all, we have our own command and control for each of our systems. It was done like that in order to ease the process of development, in order to develop all the systems independently, and to fill them as soon as we can. And this is what we are all the time saying, it’s better to have some progress instead of completeness. Having said that, we are having a huge advantage of survivability. It’s better to split your capability and not to be concentrating on one command or control.

Dr. Karako: For resilience.

Mr. Patel: Of course. Of course.

Dr. Karako: Yeah, yeah. Got you.

Mr. Patel: But what is very, very important, all of our command and control are sharing the sky picture and the full engagement cooperation capability. By the way, and this is something that I’m totally thankful to U.S. government, U.S. Congress, that back in the early ’90s, when they gave us more funds to develop the whole system, they insist that we will build our interoperability capability in our system. I was sent to Hanscom Air Force Base to link – to study Link-16 crews. And we adapt it, first of all, with all of our connections to U.S. systems and also in our architecture.

And it gives a very huge advantage that you have the right algorithms and very, very efficient kind of sharing the information and sharing the engagement, which is – this is very important. We mentioned earlier that we prefer to use the best affordable interceptors, or suitable interceptor. This is a way our system are working. Everything is being done automatically between the command and controls, with the capability of the operator to intervene. There are cases that the system will say Iron Dome is enough, but the operator will think: No. I think that I will need to shoot another – David’s Sling, just to make sure. So we are giving the operator this capability, besides the automatic structure.

Dr. Karako: Right. And that’s very important, because you’ve got the single integrated air picture that everybody’s tapping into. And you’ve got the common, perhaps, communication, swivel chair integration as they say. But the control part of command and control is to not shoot – to tell somebody to not shoot. And you can have the interoperability, but is it fair to say that –
is there more to be done there? Or do you have the fires deconfliction? How do you manage that?

Mr. Patel: We – and this is something that we are – we need to continue the investment. It’s not a one effort, and that’s it. Because, for example, when we move from ballistic missile defense to air and missile defense, we need to extend the capability of our interoperability, because now you need to take into account intercepting any airborne targets. You need to be careful not to intercept civilian aircraft or friendly aircraft. So the integration, and interoperability, and the coordination is essential in that matter. And of course, when we are talking about dense combat, that you have debris from higher parts of the of the infrastructure, that higher tier intercept, the lower tier receive the debris. Or when we need to coordinate some of the activities, this is something that all the time you need to keep and upgrade your interoperability and capability.

Dr. Karako: Got you. You mentioned automation. And, of course, for some of these, especially the artillery things, very short timelines. And so is it fair to say that Iron Dome, for instance, has a degree of automation built in, that if they see something coming, it's getting launched? Describe that process.

Mr. Patel: Even the Iron Dome that, you know, all the human engineering, thought originally that we don't have enough timeline for an operator intervene, we also have this capability in the Iron Dome. So the system actually recommends to shoot or not to shoot, the operator can enforce. For example, if the system will say, listen, here, it’s kind of 50 percent of chance to intercept, the operator can say no. Even with 50 percent I would like to launch an interceptor. Or in cases that the system will say, I have 100 percent that I can destroy this target, and from any other reasons operator will decide, no, I don't want interceptor to be launched. He can intervene.

So and this is why our officers need to be very skilled. Most of them are not engineers. You know, they just finished high school. Not all of them study physics and mathematics. And they need to operate those system and they need to be trained well enough that – to get the system automated recommendation, and in a very short time to react, to decide to shoot or not to shoot, or to force shooting.

Dr. Karako: Right. So let’s kind of move now to the to the interceptor piece of the architecture. Before we get to the particular programs, I wonder if you could just talk about the relationship between all these different layers. How many different, you know, interceptors do you have defending Israel, from Iron Dome to Arrow 3? But, more importantly, you’ve emphasized repeatedly the interoperability between them. But talk to us about the
philosophy of the layering, why is it important to have a layered defense here?

Mr. Patel: The layered defense is important, first of all, because we mentioned the affordability and the need to use the best interceptor to do the mission with minimal costs. So this is, in one hand, the advantage of doing a kind of a layered defense. We found out that, in any case, if we take, for example, our exoatmospheric Arrow 3 interceptor, which intercepting in very high altitudes. That there are cases that we want to shoot or to launch these kind of interceptor. But, just in case, if it is a kind of a threat that we believe that we need to fire another interceptor, we can have it in a different layer. The layered defense is mainly against different threats. And when you have different threats, you need to have different layers. But if they are all connected and sharing the information, you will see the maximum benefit from that.

Dr. Karako: You mentioned the Arrow 3. Could you talk a little bit – differentiate Arrow 2 and Arrow 3, and kind of how those came about and what they do differently?

Mr. Patel: OK. Arrow 2 was our first codeveloped program back in '91. Actually started when Israel joined the President Reagan initiative of Star War, just on feasibility study. At that time, it was developed against the threats from Iraq, Scud missiles. And the system was developed against these kinds of threats. And it was operational since 2000. Arrow 2 is a kind of an endo-exoatmospheric interceptor. It could do the work either in the atmosphere or above the atmosphere.

But when we face the Iranian emerging threats, and that they will have nuclear capabilities, we understood that we need to have a kind of an exoatmospheric capability, a shoot-lock-shoot, in order to minimize the leakage rate and to have another higher-altitude kind of interception option or even two shoot-lock-shoot capability. So this is why we start the development of Arrow 3. So those systems, both of them, are covering all the long-range defense capabilities that will need against those kinds of threats.

Dr. Karako: And how does Arrow 4 relate to that? How's it going to be different from, especially, Arrow 2?

Mr. Patel: Arrow 4 is going to be – to replace Arrow 2 in the future. It will be part of the Arrow 2 kind of endo-/exo-atmospheric interceptor. And one can ask, OK, why you go ahead and start with development of Arrow 4? It was a feasibility study that we conducted together with the Missile Defense Agency for almost two years. We came to the conclusion that we need to
produce and to have a high volume of this layer, the layer of the endo-
exoatmospheric layer.

And since we developing our Arrow 3 and in all of our systems new
capabilities, we decided that all those capabilities can be adapted to the
new intercept. The new interceptors will be – I’m careful to say – but it
will be a little more affordable, compared to Arrow 2 or to Arrow 3. And
it’s a kind of price objective development that we are doing together with
MDA, and monitoring it almost day by day, that it will be according to our
price objectives, and that it will be to the level of the performance that we
need it. So the reason was, first of all, producing in high volumes and
having better capabilities in the endo-exo layer.

Dr. Karako: So, David’s Sling. I think you recently had some intercept success with
David’s Sling. That’s the characteristically snub-nosed missile. Talk to us a
little bit – you’ve also had experience in your career developing that –
what does that do differently as well?

Mr. Patel: David’s Sling system – by the way, it was initiated together with Iron
Dome back in 2006, after the Lebanon War. The reason behind developing
the David’s Sling system was in order to intercept, first of all, short-range
missile(s) in a kind of national kind of missile defense; to protect against
cruise missiles, maneuvering targets, or maneuvering threats. And the
differences between David’s Sling and Iron Dome, is that David’s Sling is a
kind of a national system.

So if there are gaps that Iron Dome batteries are not covering, David’s
Sling can do better coverage, longer range, longer footprint – larger
footprint, and detect and actually intercepting in longer ranges the threat.
So this is the reason behind developing this system and these operations
since 2017. And, yes, we were very glad that we have two successful
operational interceptions during the Shield and Arrow combat that we
have recently.

Dr. Karako: Great.

Mr. Patel: And, again, they wonderful officers from the Israeli Air Force that actually
operate the David’s Sling and let the David’s Sling interceptor or system
do the work.

Dr. Karako: Wonderful. And, of course, the missile that goes to that is in other
countries kind of co-located with the Patriot system, for instance. You also
operate the Patriot PAC-2. How do you – how do you see PAC-2 fitting into
that architecture, with the Arrow 2 and these others? And you have had
some combat intercepts with that as well, over the years. How does that
fit together?
Mr. Patel: First of all, I have a lot of good feeling for PAC-2. It’s an excellent system. My son, my oldest son, was a Patriot PAC-2 officer. He’s now doing it in – he’s Reserves. So we are very proud of this system. It’s a system that it is operational in Israel until today. Its main objectives is air defense capability. It has full interoperability with other – with the other layers that we have in Israel, Since we’re talking about air defense effort, so all the sky picture need to be coordinated with our headquarters, with our managing all the air picture of Israel. So, of course, we need to have fully coordination between Patriot, Iron Dome, and David’s Sling that, in some of the cases, the need to share the same threats and to do engagement coordination between themselves.

Dr. Karako: So now Iron Dome, which has been, I think, operational since 2011. What are you up to in terms of the intercept count these days?

Mr. Patel: It’s almost close to 5,000. I know that maybe our Webs are not accurate enough with the number, because we are – we need to keep – follow the numbers all the time. But we are almost with 5,000 successful interception up to today. I can tell you that my people, and of course all the industry that are helping us – mainly Rafael and ELTA and Empress (ph) – are receiving all the information from all the combat, all the lessons learned. And we are learning from successful interceptions, and with a small amount of occasions that we did not intercept. All lesson learned are being implemented either during the combat or a few hours later or few days later.

Depends on the thing that, you know, you want to fix. And the system had huge progress, because of this huge experience. So until today, until 2011, all of our upgrades to the Iron Dome systems were done by better algorithms, better software. We upgrade the radar and see them there, but the interceptors remain the same interceptor with different and better algorithms. In the future, we’re looking at some options that could be suitable for the emerging threats and to take into account obsolescence and other things that we need to take into account. So we’re thinking about some options for the future. But until today, it’s only software upgrades.

Dr. Karako: But you’re alluding, therefore, to kind of block upgrades to the Tamir interceptor for Iron Dome.

Mr. Patel: Yes.

Dr. Karako: OK.
Mr. Patel: Yes.

Dr. Karako: We talked a little bit about the Navy taking over the C-Dome, and how that at first the Air Force will help them and then they'll be operating on their own. What challenges are you seeing between the Navy and the Air Force, more on the – I guess, the transition of that new mission, really.

Mr. Patel: I think that, first of all, the Navy receive a huge advantage that they received an interceptor that was developed for almost 10 years, with a lot of combat-proven capabilities, and it was adapted, first of all, in this on their Sa’ar 5 corvettes and now on their Sa’ar 6 corvettes. In Sa’ar 5, we, we took the Iron Dome launcher and integrated on the Sa’ar 5 with the same command and control, but we used the connection to their radar of the ship. And it’s something that our Air Force actually helped the Navy actually to adapt. In Sa’ar 6, it was a totally different kind of effort.

What we did, we did fully integration of the of the Iron Dome inside the Sa’ar 6. We are using the launchers of the ship. We are using the command and control of the ship. We’re using the radar of the ship. So it’s fully integration of the Iron Dome interceptor inside the Sa’ar 6. And it’s fully operated by the Israeli Navy. Of course, all our systems are fully interoperable between themselves and they are sharing information with Sa’ar 5 and with the systems that are on the ground, but this a little bit the difference between the Sa’ar 6 and Sa’ar 5, with regards to the adaptation of the Iron Dome system.

Dr. Karako: We’re going to close out the effector piece of this. We have a question from Alex Waxman, who asks, you know: What systems are being developed to counter swarm attacks by drones, for instance, either with kinetic kill or some other means? Is that – to what extent is that could be within IMDO or something else?

Mr. Patel: As I mentioned, we have a huge organization, which is – this part is still under the organization of the Defense R&D. There are very, very nice solutions. Not all of them I can elaborate here.

Dr. Karako: Great. Maybe just sort of in a – in a comprehensive way, whether it be PAC-2, now David’s Sling, Arrow 2, and of course the thousands of Iron Dome, this is very considerable combat experience you’ve had over the many years. What are some of the broad lessons that you’ve taken away from that, and then perhaps we and other folks can learn from that?

Mr. Patel: We have a lot of lesson learned, operationally, technically. I can tell you that every lesson learned is being fully shared with the Missile Defense Agency, because they’re our partners on day one. Even, you know, during the combat – the just recent combat – every day I made a video
conference, classified video conference, and update our colleagues. So this is something that we are in a continuous kind of sharing information. I can say that – I mentioned that it's both operational and technical-wise. We took all those lessons learned and some of it was adopted, not just in the Iron Dome, which is the most experienced system. It was adopted in our other systems as well. Especially the area of integration between radars, between command and control, between the architecture.

This is something that we learn a lot during the combats because, you know, in your labs you cannot simulate everything that you will see in combat. And this is one of the lessons learned, by the way, is that invest as much as you can in your backyard, in your – in your peacetime in your labs. But there is a limit on how much you can invest because when you are coming to combat, things are different.

So one of the biggest lesson learned is to try and expect all the unknown that you’re supposed to experience during combat. This is something very, very important. So we are going to automated kind of flight – I mean, testing before launching new blocks, and investing a lot in kind of integration between the systems. We establish a connection between the labs. All of our labs are being connected in Israel, even if they are in a different organization, different companies. All the labs are connected, not just the systems. So this is something very, very important to extend the capability.

Dr. Karako: So actually, nice transition there between the experience to international cooperation more broadly would be, I guess, combined testing. For instance, I think you had an Arrow 3 test up in Alaska recently. Can you tell us a little about that?

Mr. Patel: Of course. First of all, before I will reach that, again, huge thanks to U.S. administration, U.S. Congress, for supporting us along the years with all of our systems. Without your help along the years, we will not be where we are. So this is a huge thanks.

And why I’m saying that, because we try to conduct a flight test of Arrow 3 in Israel. And we have our own regulations in Israel. And since we're talking about – and we have a very, very severe safety regulations. We reached MDA, and we did not receive their approval to conduct the flight test that we want to conduct in Israel, because your safety regulations are a little bit higher than us. And together with them, we came to the conclusion that we need to go to Alaska and conduct a flight test there, and to test our ability to do fully to kill kind of interception, something that in Israel because of the debris, because of the Mediterranean Sea, we cannot conduct.
It was not only kind of testing the interceptor. It’s for the first time that it was a full engage on remote kind of flight testing. And, again, I’m not talking about the all the logistics to bring the system to Alaska, but we use the wonderful U.S. AN/TPY-2 radar, the THAAD radar, together with the U.S.’ C2. Most of them were connected to our C2. We brought our C2, and our launches, and our interceptors. And in a matter of two, three weeks, all the system, you know, worked together.

Again, we invest a lot in our lab testing in advance, and all of our systems are fully certified to work with the protocols of Link-16. And because of that, it was very, very smooth. And it was full three engage on remote kind of successful interception in Alaska. And we gain a lot from this campaign.

Dr. Karako: Well, that’s a great detail to socialize. I don’t think it’s gotten much attention, the fire control quality track coming off of TPY-2 for a non-U.S. system. Appreciate that – appreciate that detail. But, again, also there’s Juniper Cobra. And I think the U.S. Army sent a THAAD battery to Israel in 2019. What kind of efforts are going on there in terms of the testing, the exercises, and then also that THAAD deployment?

Mr. Patel: Yes. Those exercises are very, very important. They start way back in 2001, it was the first Juniper Cobra – Juniper Cobra 01. I can tell you that engineering, technical-wise, it’s important. But the most important role of this – those last exercise is that our soldiers, our operators, our officers are working together; shoulder to shoulder, with the system. They speak the right language. They speak the right dialogue between themselves. Of course, the system are there to support, but this is the first priority that the operators will talk and operate together.

The second is the engineering benefit that we have from those exercises. That all the time was trying to stretch the limit, to bring more and more capabilities to those exercises, and to test them in a kind of operational environment. So a lot of new initiatives are being implemented during the exercise to have the benefits of this kind of architecture to help us better build our future architecture and, of course, the interoperability between the systems.

We have battle lab that was developed together with the Missile Defense Agency since late ’80s called the, ITB Integrated Test Bed. We are conducting in the test bed, like, four or five exercises per year. It has the advantage that it’s not up in the field. It’s not with the real systems. Everything is being simulated, but you are preparing yourself for the real exercises in this battle lab. Again, it’s operators that operate the systems. It’s the systems themselves that are being emulated in this lab. And it’s very helpful in preparing ourselves for the combat and for the real exercises.
Dr. Karako: So let's talk about the U.S. military and how the Marines, for instance, and their MRIC program were using the Tamir missile. They're putting it together with the G/ATOR radar and THAAD C2. Can you talk a little bit about your partnership with the U.S. Marines on that program?

Mr. Patel: Yeah. We found a very, very good partnership. We thought that we have good – excellent relationship with a Missile Defense Agency over the years, but we found also very good partners in the – with the Marines. They prefer to buy lower-tier kinds of systems. And this is why Iron Dome was attractive to them. During the recent two years we conducted three demonstrations with the Marines here, in White Sands. We brought, just the interceptor as you mentioned. They developed a kind of expeditionary kind of launcher. They, as you mentioned, both radar, brough the G/ATOR. And the interceptors and some of its algorithms have been implemented inside the Marines command and control.

And the demonstration were very, very successful. I cannot elaborate about the threats. We test a range of threats, very, very sophisticated, that fit whatever the Marines need to have. And we are in the process of building a kind of contract, according to their budget constraints and planning, to give them the system. And, again, the planning is not to bring them any radar, any command and control, any launcher, all of them. It will be – the Marines, it will be the interceptors and the kind of suit that can be implanted inside their command and control.

Dr. Karako: Exactly. So a little bit different relationship with the U.S. Army. IMDO has got a long-standing relationship with the Army. The Army’s acquired two Iron Dome batteries, complete batteries with the radar and the fire control and all that sort of stuff, as their interim kind of cruise missile defense capability. At the same time, the Army’s expressed concern kind of about the full integration ability, because it’s not just the missile it’s the full thing. And they’ve indicated they probably won't get more Iron Dome batteries as such. They have two and they're not getting 20, as it were. So I wonder if you can help us understand this.

And to do so, I’m going to turn to a question submitted by Jen Judson, who’s an Army reporter from Defense News. And she asks, quote, “Do you believe Iron Dome can be integrated as opposed to merely interoperable with the U.S. Army? And what would you be willing or interested to do in order to achieve that, so the Iron Dome as a system could be used more effectively by the United States?”

Mr. Patel: First of all, I can say that Israeli has also a very good relationship with Army. I remember times that in our flight tests we used the Israeli Patriot,
together with the Arrow flight test, and there were a lot of lessons learned from the Patriot – from this flight test have been shared with the U.S. Army, the U.S. Patriot office, and later THAAD office as well. You know, all the – all of our maintenance and relationship with the Patriot system is being done with Army. There were times that the Army PEO brought a huge team to Israel, the THAAD engineers, to share information and to see how we learn from each other. So it’s excellent relationship. Even though with what was written in the newspapers and a lot of places, we have excellent relationship.

More than that, I can tell you that just recently we solve all the issues and problems that they have. And we are going to give them the right solutions. And whatever they need in order to integrate – fully integrate the capability of Iron Dome inside their systems. More than that, we deploy – we deployed two Iron Dome batteries already that are there. We are willing to fully integrate those two Iron Dome batteries into the IBCS and whatever is needed. And the higher officials in the Army knows what are the solutions. It’s better that I’m not going to elaborate it here. They are really satisfied with what we offer, and they will receive whatever they need accordingly.

And I can give you just a few examples. One example is the Marines. Everything was integrated inside without any – and the other example is the Navy, with Sa’ar 6. I mean, the algorithms of the Iron Dome have been implemented inside the command and control of the Sa’ar 6. So what I’m trying to tell, we have this experience of integrating the system. And we are going to give the Army, again, I’m emphasizing it, whatever is needed. And what I’m saying is not was – it is not only by level. It’s by higher levels that really approve it. You know, whatever we can help you – I mean, the United States – to have better defense and to fill you a gap, we will do. I mean, with all the support that we’ve received from you along the years, I think that is our obligation.

Dr. Karako: Well, great question, Jen. I think that is some very good news to hear. And appreciate hearing more about that capability integration, whether it be just a missile or whether it may be more than that. Very closely related to that, the day after Finland officially joined NATO, they announced that they were acquiring David’s Sling. And there's also been some press reports about Germany and their acquisition of Arrow 3. How are you thinking through kind of some of the integration problems or potential challenges within the NATO air defense network as well?

Mr. Patel: And the answer for Finland and Germany is almost the same, but there is a slight difference. Germany at the beginning what they declared, they want to have a protection for German civilians. This is the first step. The second
step will be sometime in the future, will be fully integrated into NATO in the Sky Shield, whatever. This is the next stage.

Finland are talking differently. We are, again, integrating our algorithms inside the Finnish command and control. And from day one, they are planning to integrate their command and control with NATO systems. And since we are having, you know, all the capabilities there, and what – and I don't know if it will be in day one in Finland, but at least they will have the capability to do so – we are giving them all the tools to do so. And since they’re developing the command and control, for them it will be easier.

With the Germans in the future, whenever they want to have these kind of connection, they either can use our experience – when I’m saying “our,” it's not just Israel. It’s also the U.S. I must emphasize, part of our interoperability capability was developed here in the Navy, in the U.S. Navy. I’m not sure if you are aware, but it was developed here. And the Germans can adapt whatever was developed here and implement it by themselves, or by a U.S. company, or by the Navy. But it’s – for them, it’s in a later kind of stage.

But of course, before – all what I’m responsible is technical and engineering-wise. All the policy of connecting those systems to NATO, again, it’s above my paygrade. It’s those countries that need to solve all the policy issues with NATO.

Dr. Karako:

Let me kind of close up here a little bit more future-looking things. You’ve got, for instance, the Iron Beam laser program, perhaps some interest in hypersonic, Arrow 4 and that endo-exo thing. How are you thinking about directed energy? How are you thinking about emerging or, in some cases already here, hypersonic threats of various kinds?

Mr. Patel:

I think that the future will be based on directed energy. It's not that us, the engineers of kinetic energy, will be out of work. Even with directed energy kind of war, still you need to have your kinetic capability. And, you know, all the directed energy have their own limitations, and we are not going to elaborate here all the limitations. But when talking about volumes, when talking about capability, cost of interceptions, directed energy is the solution that all of us need to invest. And I'm sure as well – it was published that Israel has as a huge progress with that. And also, we are having good dialogues with the Missile Defense Agency about our technologies and capabilities there.

With regards to hypersonic threat, what I’m – I will defer this question into two. First of all, we – in our plans, whatever will be the threat, we will be ready, OK? I can tell you that there is a huge intention for a lot of nations to have kind of solutions for hypersonic threat. Our industries,
because of their experience and their technology capability, they are willing to – you know, to invest by their own. So they have – they might have those capabilities. So this is the simple answer that I can give you.

Dr. Karako: Fair enough. Fair enough. Well, we’ve covered a lot of ground today. Thank you for being so generous with your time. You’ve, again, been the director of IMDO for about seven years now. I wonder if you might just round us out by saying, what do you think the future holds for the institution, for other priorities, anything else you’d like to emphasize?

Mr. Patel: OK, perfect. First of all, since both Israel and the United States signed an MOU, and now it is – will be valid until 2028, together with the Missile Defense Agency we develop a kind of a roadmap. We develop the road even beyond 2028, to develop the roadmap until 2030. And now we are updating it up to 2033. We are going to invest in all the arenas in our detection systems, in our interceptors, to make them more modernized, more efficient, more affordable. We are going to invest in our command and control. I mentioned that command and control is – in one hand, it’s zeros and ones, and it is just computers. It’s not something physical. But again, the coordination is very, very important because of the complexity of the combat the future combat. So we need to invest a lot on that as well.

We need to modernize our – and to go into new technologies everywhere. So this is something. I can tell you that part of the – our roadmap has already been agreed. First of all, it has been approved by Israeli officials. And it is being agreed between us and the Missile Defense Agency. Part of it still under feasibility study. And whenever we’ll be ready with the outcome, of course, we will decide to go to a kind of program of record, and the full-scale development. So and, of course, whatever we will gain from new technologies that we are going to receive, either from the defense industries or from our own organizations, IMDO organization, and we can adapt it to our system, we will do accordingly. And all the time, as I mentioned, we need to be ahead of the threat. Any kind of threat or any kind of situation that we need to fill the gap, this is where we are going to invest our efforts.

Dr. Karako: Well, thank you again for coming over. Appreciate your friendship. It’s a very important, again, partnership between the United States and Israel. And one that, from the sounds of it, is being extended in a lot of detail for the – for the foreseeable future. So thank you again, Moshe, and please join me in thanking him for coming out. (Applause.)

(END)