

020515 Missile Defense Advocacy Alliance Forum on “The Current Status and Future Modernization of U.S. Homeland Missile Defense Systems,” with retired Lt. Gen. Richard Formica, former Commander of U.S. Army Space and Missile Defense Command; Carlos Kingston, former Senior Executive Service and Program Director for the Ground Based Midcourse System at the Missile Defense Agency; and Riki Ellison, founder and CEO of Missile Defense Advocacy Alliance

MR. RIKI ELLISON: Ladies and gentlemen, welcome. I appreciate your taking the time today to come visit us. My name is Riki Ellison. I’m the founder and CEO of the Missile Defense Advocacy Alliance.

I have been involved with missile defense since 1979 as a young boy at USC. I had Governor Ronald Reagan’s defense adviser, Dr. Bill Van Cleave, who was my entrance into the concept that we could actually kinetically hit metal on metal, and the creation of the SDI, Strategic Defense Initiative, with Dr. Teller. From that, I worked on the second interceptor that was ever done, the Exo-atmospheric Re-entry Interceptor System, during the ‘80s. In the ‘90s I was part of the lead systems integration team for the Ground-Based Interceptor and GMD system in Alaska. In 2000, when our country withdrew from the ABM Treaty, I formed this alliance to educate the American public on the deployment and development of missile defense.

And since that time, we have visited over 300 missile defense bases around the world and in our country. We’ve been to 46 states and advocated in 50. We’ve advocated in 27 countries. We’ve been to over 26 missile defense tests. We had 15 annual events with seven different countries of our allies on the recognition of missile defense. And we’ve built two memorials, one for Senator Inouye at PMRF in Hawaii; and one for President Reagan at Vandenberg Air Force Base.

I also, on top of all that, because I’m a big team player and believe in the team concept -- and this is probably one of the most challenging teams that we have in the Defense Department with all four services contributing -- I was also during my time with missile defense, was drafted to the San Francisco 49ers and played 10 years in the NFL and won three Super Bowl championships with some great teams during that time period. I was a kinetic interceptor as well, body on body, on that aspect of it.

(Laughter).

So today we’re really honored that you’re here. We’re going to discuss U.S. homeland missile defense and we want to give you some great perspectives that are independent, unbiased, and we’re going to start off with what actually the system is. It’s a very complex system. We’re going to talk about how it’s engineered, what exactly it is, and how it works. Then we’re going to give you the operator’s viewpoint from the war fighter’s perspective on how it works for them and what their assessment is and their confidence, etcetera, with that system. And then we’re going to talk a little bit about the

modernization, the requirement and need to modernize the system.

We probably have, I think, the two greatest experts that are not in uniform and do not work for the government out of the missile defense business. We have Carlos Kingston, who was the senior executive for the Ground-Based Midcourse Defense program, the chief engineer, the program manager from 2008 to 2014. He just retired in August. He oversaw that program with General O'Reilly as well as Vice Admiral Syring. He know the program and its technical merits better than anybody, I believe, that is around.

And then from our operator perspective, we have retired three-star Lieutenant General Dick Formica. Dick was the SMDC Commander, a three-star. He was the highest missile defense soldier -- in fact, I would say across the board, Army, Navy, Air Force, in the command that would advise our strategic combatant commander and our NORTHCOM combatant commander on the defense of the United States homeland. He is the integral part. Underneath him are all the missile defense soldiers that man the systems in Alaska and Vandenberg and Colorado Springs, and also the TPY-2 around the world. He just retired in 2013. His predecessor is in the office now.

So I thought these two gentlemen can give you a great perspective on those issues. And this is a really informal discussion. We really want to just have a brief five or seven minutes on each of those subjects then open it up to the floor to engage discussion, because this is a very complex subject material, and we want to get your thoughts so we can answer this properly. I think we really made a concerted effort -- none of them work for big industry. They're freshly out of it, so they're going to give you a real concise overview of the system.

So I'm going to start off first with Carlos to begin the presentation.

MR. CARLOS KINGSTON: Great. First of all, thank you for inviting me to this discussion. It's an honor for me to sit here with Riki and General Formica and participate in this. And thank all of you for your interest by being here and your interest in this program, interest in homeland defense and missile defense. It's certainly a capability that matters, that makes a difference, and is certainly needed for the nation to protect the homeland and protect the values that we have.

What I thought I would do initially is give a brief overview of what GMD is and how it works. And then there are five points I want to make that may help shape our follow on discussion, at least from an acquisition standpoint. You know, I'm not the operator. I'm not the war fighter. I'm from the acquisition community developing material for the war fighters that General Formica represents.

So first of all, how does GMD work? Many of you are certainly aware of this, but the Ground-Based Midcourse Defense System today has interceptors in Fort Greely, Alaska and Vandenberg, California, interceptors that are designed to engage a ballistic missile threat, with primary focus on North Korea and Iran. So today, roughly 30

interceptors are deployed.

There's a lot of discussion about interceptors, but there's a lot of other things that make GMD work. It's a very complex, geographically dispersed system of communications, terrestrial communications through fiber optics and satellite communications that tie the systems together. There are at Fort Greely, Alaska and Colorado Springs, Colorado, large mainframe computers that do all the calculations to make the GMD system work: GMD fire control, there are command launch equipment, there are many communications nodes.

And we have to tie it all together with a set of eyes. So the set of eyes is radars and sensors. So it's a large, very complex set of equipment on the ground that is required to make the system work and make the system effective.

So how does all that tie together in terms of operations, how it works? Think about a potential threat launched from North Korea, as an example, coming towards the United States. With the threat launch the first thing that happens is there are satellites that will detect that launch.

The satellite detects the launch and it informs the system and tells the GMD system that there's a threat launch that's a potential threat to an area in the United States. And by the way this system is 24/7 operations, warfighters at consoles, and (assuring we can handle that ?). That's how the system works.

So you have this launch. The satellite detects it. That is communicated to the system and then there are a series of radars that will then pick up where is that threat object at? Where is it going? Is it still on the trajectory to impact somewhere in the U.S., Alaska and Hawaii?

That information is fed into some of those mainframe computers either at Fort Greely or Colorado Springs. It starts through the calculations of where is this object going, when is the best time to launch an interceptor to intercept that threat object. The threat object continues through space on some trajectory, and there are Aegis ships that are part of the architecture.

Aegis ships with so-called SPY radar that will detect that launch and start to provide track information. Further in the trajectory, there are other sensors such as the Army's AN-TPY 2 radars that are deployed in Japan, will also start to track that object and provide some more detailed information about the threat complex. It's never just one thing, it's usually just one thing that you're really worried about, but there's a series of other things around it that can be confused as the real threatening object.

Somewhere along this process the GMD fire control says I need to launch a missile. I need to launch a missile at a certain time so I can engage that threat object somewhere in space. As the threat object continues, then there's other sensors such as the SBX radar. There's also other radars in Shemya, Alaska that we call UEWR. All that

is continuously providing data to GMD fire control.

Once an interceptor is launched, because you'll come up with a firing solution, that firing solution from the GMD fire control is provided to command launch equipment. That is provided to the interceptor. The interceptor launches. It knows it needs to go to a certain point in space to have an opportunity to engage the threat object.

As that interceptor -- of course you've got the three stages of boost. The first stage drops off. The second stage drops off. The third stage drops off. Now you have the kill vehicle in space heading towards where it needs to be intercepted.

The system through all that communications that I described: satellites, terrestrial communications, is provided by a link up to the kill vehicle to inform the kill vehicle of later information. And with the SBX it will provide more detailed discrimination data. So as I said, there's one object you're really worried about, but there's other things, tanks and other things, that might be around it. And the radar is able to say, this is the one you really need to go after.

That information, again, is passed up to the kill vehicle, so the kill vehicle will know that. The kill vehicle opens its eyes, as we say, and is able to see -- given the classification level here I won't get into the details -- but far out in space the kill vehicle through a very sophisticated telescope basically, can see that threat complex out in front of it. So it continues on its trajectory. The kill vehicle also has the ability to sort out or discriminate the complex set of objects in order that it knows I need to go to this particular point.

So all this is taking place roughly over -- I mean, when you think about a North Korea launch to the U.S., it's roughly 5-6,000 miles. We're somewhere over -- depending on the trajectory, depending on where the threat object is, it might be aimed for an impact area whether it was Miami or whether it was Houston or whether it was Seattle -- it would depend upon the trajectory and where the intercept point might be. So ultimately the kill vehicle zeroes in on the object and intercepts the object through the discrimination algorithms that it has to be able to sort out which objects are which. And with kinetic energy, the kill vehicle intercepts the threat object. That's the goal.

So I know it's a simplistic overview of the way it works. It's obviously much more complex than my simple explanation, but fundamentally it's detect, track and engage the threat object to defend the United States. So we can talk more about that, any questions, but before I turn it back over to Riki I do want to hit five quick points that I think might be able to help shape the discussion.

One, the system is deployed today. The system is in operation today. The system will work. The system can defend the nation against a ballistic missile threat today. It's operating 24 hours a day with soldiers in Colorado Springs and Fort Greely, Alaska. That's point one.

I'd say also along with that, I'd say it works. It has been proven to work through many tests. Certainly FTG-06b this past summer is highlighted in terms of demonstrating that it works. And that was a very stressing test, high closing velocity.

In other words, how fast is the threat object and the kill vehicle coming together? It varies. The faster, it's more stressing, more difficult. But the bottom line from my view, and seeing lots of engineers work this program, this system works.

Second point, we need to continue to build interceptors, keep the production line going. I talked about FTG-06b and the success of that flight. That particular configuration of interceptor we need more of, and that's in the plans, to build more of those over the next three years. I'd also say we need to continue that production line beyond that, both to support warfighter needs and to keep a stable industrial base, and we can talk more about that.

Third point, the program needs to continue to test. Great success with FTG-06b and there was a lot of other tests before that, but we need to continue to test on at least one -- in terms of an intercept type test -- at least once a year. There's a lot of other detailed testing below that, but obviously the intercept test is what gets a lot of attention, and they're very costly. But they clearly need to be done to continue to demonstrate the system, more stressing scenarios, to show the capability of the system.

The fourth point, we need to sustain and maintain that capability. There's a lot of aspects to the system that I described earlier, the ground systems, communications systems. These systems have been in place for 10 years now, so a lot of the system is -- call it '90s technology: big mainframe computers that can now be done in suitcase size computers.

So there's challenges with obsolescence. There's challenges with the computer operating systems. So without going into a lot of detail, the nation needs to make sure that that system stays ready and available. We need to continue to modernize it just from the standpoint of sustainability and maintainability.

Finally, the fifth point, the last point, in addition to all those other things we need to improve, we need to improve the capability of the system. We need to improve -- I talked about the simple analogy of the discrimination capabilities. We need to continue to invest in more robust algorithms to improve that discrimination because one, the threats today are less complex and the enemy is going to continue to develop more complex threats making it more difficult to discriminate. We've got to stay ahead of that.

Along with that is the deployment of a more robust sensor architecture, radar architecture. And I certainly applaud the department's plan, the agency's plan, to deploy a Long Range Discriminating Radar somewhere in Alaska over the next, I believe, targeted for a 2020 capability.

And along with that, improving the capability of a redesigned kill vehicle. The

kill vehicle out there today, although it's been through some issues, we've knocked a lot of those issues off and certainly demonstrated that with FTG-06b and CE-1, if you're familiar with some of the details of the program, in a very capable kill vehicle that's out there today. We need to build more of them, but we can't rest on that. We need a redesigned kill vehicle for more reliability, increased inter-reliability, producability, best ability, performance improvements and lower cost. The current kill vehicle, while a very sophisticated instrument, is still fundamentally a prototype and was not designed for some of those things I just described: producability, testability, improving the reliability.

So that, in summary, is my opening comments. There's a lot of other things we could get into, but I believe with that we'll allow more time for questions because I'm really interested in hearing your thoughts and what questions you may have so we can maybe better inform you of the programs. So, Riki, I'll send it back to you.

MR. ELLISON: Thank you, that was a great explanation. Let's go to the warfighter's operator perspective with Lieutenant General Dick Formica.

MR. RICHARD FORMICA: Good afternoon, by four minutes. You can loosen up a little bit now and we'll try to make this a little informal. Good afternoon.

One of the things I learned early on in my public speaking engagements is you've got to know your audience. So we were here in September with a similar panel, but it was more broadly focused on missile defense. Today we're honing in on missile defense for the homeland.

Many of the point that I'm going to make are similar to what I said in September, but I want to know, first of all, how many of you were in the room in September? I want to know how many repeat offenders there are here? I know Jason was here. You're the MDA guys, you don't count. I mean, you count. Only one, so that validates.

Jason, you're going to get a little bit of a repeat of some of what I said because the kinds of things that I talked about in September have applicability here. And then the other question I have is, how many of you are professional staffers or personal staffers for either Senators or Congressmen? Raise your hand.

And then, industry? Industry is kind of over here. The majority are staffers. Any others, anybody besides -- who do you work for?

MR. : I work for Senator Cruz.

MR. FORMICA: Okay, you're in my first category. Okay, so that's helpful. I'd like to also thank Riki Ellison and the Missile Defense Advocacy Alliance for what they do to inform the public about missile defense, the need for missile defense and how it should prioritize its efforts in missile defense.

But I'm a soldier, or at least I was. And one of the things I always end my

comments with is every time we talk about missile defense, like today, we'll spend 99 percent of our time talking about the technology and the equipment, the systems, that enable us to provide missile defense. But I don't want us to ever forget that the most important missile defense capability the United States has are the soldiers, sailors, airmen, marines and civilians who develop, deploy and operate those systems.

And you support them as well. The Congressional funding for our services directly impacts their ability to keep up with the demands for this capability. It's not just how many GMDs we have or how many THAADs or how many Aegis ships. It's how many operators do you have for that THAAD battery? How many sailors do you have to go on those Aegis ships to deploy? So I just ask you not to forget that.

And I start with that in my intro because again, as a former commander of SMDC, one of the things that I applauded MDAA the most for wasn't their advocacy for systems and education, but Riki Ellison has traveled around the world to recognize our soldiers, sailors, airmen and marines. He's got an award program for Missile Defender of the Year that he's given both here nationally in the national capital region, out in the various combatant commands, he's expanded it to include our coalition partners. Our servicemen and women who provide missile defense know that Riki Ellison has got their back, and I just want to thank him publicly for that.

Okay, with that said, I told you that -- as Riki introduced me, I was formerly the commander of Army Space and Missile Defense Command. There were three hats associated with it, but the easy version of it is that number one, I was a force provider for Army's space and missile defense capabilities to U.S. Strategic Command. That meant the soldiers that operate the GMD brigade -- the brigade headquarters in Colorado Springs, the battalion at Fort Greely, Alaska -- anybody here from Alaska? Yeah, excited about Alaska.

And then, the detachment from Vandenberg. Anybody here from California? Yeah. So there's a detachment in California. Those soldiers, Army National Guard soldiers, were assigned to Space and Missile Defense Command and we were responsible for the provision of those capabilities.

So the Missile Defense Agency is a material developer. They're on the acquisition side, R&D, do the acquisition, field a piece of equipment. And then the soldiers that man it, in this case the GMD system, are Army National Guard soldiers that were assigned to SMDC.

But with that responsibility, with that job, also came an operational assignment. It was actually a third hat, but it was an operational assignment to be the operational commander for integrated missile defense for the commander of U.S. STRATCOM. And that put me in a position where I was the senior voice for the warfighter.

So as MDA was designing how they were going to spend their money and go into their budget deliberations, and they would bring those budget deliberations to the

warfighter and to the building, I was the guy that had an opportunity to help with -- obviously the combatant commanders got their vote -- but we were the ones that had an opportunity to help shape, from a warfighter perspective, how that money was being spent. And I had the pleasure of testifying three different times with the director of the Missile Defense Agency. So again, much like this panel, they're talking from the material development standpoint and I'm talking from the warfighter standpoint.

Mr. Kingston just talked about how the GMD system works. And every step of the way there was a soldier or a sailor on point operating those systems, whether it was a sailor in the Sea of Japan, on an Aegis ship with the SPY-1 radar, or soldiers in a remote and austere locations manning a AN/TPY 2 radar in Japan and in other locations around the world, to the soldiers in Fort Greely -- and those of you who are either from or support Alaska -- the best way it was characterized for me is Alaska is a state with four seasons: spring is in June, summer is in July, fall is in August, and winter is the rest of the year. For those soldiers operating --

MR. : And construction season.

MR. FORMICA: -- and construction season. Okay, so we're lightening it up here. You're leading the way. I'm proud of you.

(Laughter).

So 40 degrees below zero, living in darkness, but they're up there so they can man this GMD system. And the decision points -- the hard part of this -- the hard part, this is rocket science, by the way, which is why we've got to continue to invest in it. But while all of that mechanical deployment was going on from identify to track to discriminate to engage, there's a decision process associated with release, and soldiers manning the radar. So we did that.

Our priority has been and remains consistent with the 2010 Ballistic Missile Defense Review: first, defend the homeland, which the GMD system is defined to defend against a limited attack against the United States; and then second, to defend our forces, allies and friends in the regions. And that has been a consistent priority and the focus of MDA and the warfighter always needs to remain true to those priorities. The point that I wanted to make briefly, before we turn it over to questions is -- and especially this comes down once you start getting into talking about missile budget to reflect those priorities -- there are a series of what I call tensions that need to be managed

When I talk about them, these apply across all ranges of missile defense, but it really gets to the money that you expend on GMD is money that you're -- unless you grow the budget or unless you increase missile defense spending as a percentage of the Department of Defense, which by the way I would not be against -- there are these series of tensions. The first one was global versus regional. So every dollar that you invested in GMD is a dollar that you are more likely not investing in the region.

And it can't be all or nothing. You can't take all the missile defense dollars and invest it in the GMD system and not develop or improve Aegis ships, Aegis Ashore, THAAD, Patriot. You've got to do both. The priority has to reflect first and foremost, defend the homeland. But at the same time, you continue to invest in a regional capability against a lesser threat. So that's the first tension.

The second tension is capability versus capacity. There's never going to be enough. We have a certain amount. Do you invest the resources that you have in improving the capability that you have, or do you buy more of what you've got already?

You really need to do both. There's no either/or here. Again, it's the same as global and regional. There's a tension that you've got to balance and the guys that are making those recommendations at MDA, and then ultimately making the budget decisions, are focused on that.

And then there's the balance between operational capability and tests. If you spend more of your money on operational and take it away from tests, you can get more capability or you can get more capacity. But the warfighters would tell you, you want to balance that with tests. It's in the execution of tests that first of all the system demonstrates its capability, war fighters get confidence in that capability, and the users get practiced on having to go through the whole system. Everything that he talked about, you exercise that system during a test similar to how you do it in the real world. So again, there's a balance between investing in operational capability and capacity, or investing in tests.

And then the last tension that I talked about when I was in command is the tension or the discussion between, do you invest in more straight missile defense capability or more offensive capability? You'll hear the term, "left of launch." Well you'll never get - it's not just all left of launch, it's left of launch and it's having enough capability to be able to deal with somebody.

If they decide to do something, they need to know that there's capability on the other side of that that's going to come back for them. There's going to be a price to pay. So you've got to balance how much do you spend.

And that gets to the whole, what percentage is missile defense part of the defense budget? But you've got to invest in missile defense. You've got to have a robust capability to defend the homeland so that we're not held hostage by somebody else's capability. And if we were to get into a regional fight, we want to have confidence that they couldn't launch an ICBM against us to distract us from that regional fight, the essence of having capability for limited missile defenses.

So the fourth balance is offense-defense mix. So that takes me or took me to what I early consistently identified as my priorities that I testified to and advocated with the Missile Defense Agency. My stated priorities were and are, if I were making a recommendation today: first, to improve GBI reliability; and second to obtain persistent

sensor coverage in depth to be able to not only identify it and track it until we engage it.

And then side two, like Carlos, I'm very encouraged by the decision to field a Long Range Discriminating Radar. That was one of the things we were advocating for. When we lost the space-based sensor discussion, we did a sensor study and we knew that we needed to have a Long Range Discriminating Radar. So the second is persistent radar coverage in depth.

Third is a robust test regimen that includes what we could call for, at least an annual cadence of GBI testing. And again, there's a lot of reasons why it doesn't always happen annually, but the war fighter wants to demonstrate that confidence and wants to see that and maintain that confidence. And it calls for an annual cadence of GBI testing.

And then the fourth, you've got to balance it with a continued investment in Aegis, THAAD and Patriot capability and capacity. Combatant commanders will come testify and they will tell you that they don't have enough regional missile defenses, they're just not enough capacity. So there's a balance.

So you have your reliability, greater coverage in depth, a robust test regimen for the GMD system, while maintaining a continued investment in Aegis, THAAD and Patriot capacity. I'll close with that, and my final reminder that we're going to talk a lot about systems, I'm sure. But please, don't forget soldiers, sailors airmen, marines, civilians, collaborate, deploy or develop and deploy.

Thanks.

MR. ELLISON: Thanks, Dick. Carlos do you want to add a couple of things on the modernization of the GMD? What exactly are they proposing to modernize, technically the GMD system, from your perspective? And do it pretty quickly so we can open it up for the room.

MR. KINGSTON: Let me talk about GBI reliability for a second. There's a fleet out there today. As I mentioned earlier, we conducted a testing in July, very successful. That interceptor is -- if you do all of the calculations, we had addressed issues that we knew about. And therefore, it was a higher reliability interceptor than what's in the fleet today.

So what we need to do now is bring all that current inventory up to that configuration that was successfully flown, to get the entire fleet reliability up. And that's in the plans over the next -- it's part of this path to 44 by the end of 2017. There are a couple of other issues that we know about, and you probably heard Admiral Syring talk the improved divert thruster -- the alternate divert thruster, that did not fly on the FTG-06b, but that particular component was --

MR. ELLISON: Carl, that's the component on the kill vehicle that adjusts it at the last second, correct?

MR. KINGSTON: That's true, yes, thank you for that. So on the kill vehicle it needs to adjust itself in space so you have these thrusters. That's another aspect of -- it's to be flown next year on another flight test. So suffice it to say, there's a strategy laid out to continue to improve the reliability of the interceptors.

Further down the road, I mentioned earlier about the redesigned kill vehicle. If you had another piece to replace the current vehicles with a new vehicle called RKV or a redesigned kill vehicle, that's from an interceptor's standpoint a force multiplier, as I call it, to this interceptor fleet.

So you pick whatever point in time you want to for the interceptor fleet -- whether it's today or whether it's in 2017 or whether it's when RKV comes along -- a force multiplier is improved discrimination. And improved discrimination, once again, enables the system to better sort out from a very complex threat scene what the right object is that the kill vehicle needs to engage, needs to intercept. So that's certainly in the plans.

And improved discrimination, it's in the sensors and radars where investments have to be made. It is in the GMD fire control where different algorithms need to be changed and adjusted. And it is also in the kill vehicle. So that's a thread, that's a critical part of the overall strategy to improve the system, to make the interceptors that you have more capable -- increase your probability of engagement success of the interceptors that you have.

We talked about the LRDR. Again, it's part of the central architecture for what General Formica talked about, that persistent in-depth coverage so you can track the threat objects continuously on its trajectory. I mentioned the ground systems, and to bring all that up -- as an example, if you have a laptop is has an operating system. And from time to time you get this download of information that updates and provides cyber security patches onto the operating systems.

Those kinds of things, with some of the operating systems we have out there today, are older. And whether it's Sun or IBM, they're not keeping up with that configuration. So we need to move to the next generation of computers, if you will, whether it's in fire control or command launch equipment or communications equipment. It's certainly needed, and then you've got obsolescence issues for basic supportability and basic logistics support.

So in summary, I think that's key pieces and I'll leave it at that for now.

MR. ELLISON: Okay, thanks, Carlos. Let's not go back in the history of the system, if we can. It is what it is today. You can probe as much as you want on the engineering part of it and the operating part of it, on any question you want to throw at these gentlemen. So let's open it up and have you ask questions.

MS. : Looking forward, obviously you have the nomination of Ashton Carter.

There is some concern about his views on missile defense authorization. Could you please speak to that in terms of what you've received in the Defense Department and what you're doing in light of this possible incoming leadership?

MR. ELLISON: I'm going to give that to Dick. She's talking about Ash Carter's movement to the left of launch over the current capacity in statements that were done a couple of years ago. But as you know, he made a pretty strong statement yesterday.

MR. FORMICA: He made a pretty strong statement yesterday defending missile defense, not defending it but identifying the need for a current, capable and relevant missile defense. I think he's always been a supporter of missile defense. But like other senior leaders in the building who have been part of that discussion, the fact of -- one of the four tensions that I was talking about -- how much do you invest in missile defense and how much do you invest in other capabilities?

And I think that the answer, again, is not -- nothing in this business is all or nothing. In fact, we all learned growing up, it's pretty much like the Three Bears. It's a little too hot, too cold -- usually the answer is somewhere in the middle.

And this may or may not be in the middle, but there's clearly a decision point. You want to invest in other capabilities. You can't just invest in missile defenses.

I think the secretary -- and I won't speak for him, I'll let him speak for himself -- but my sense is he will continue to support missile defense. I think that the requirements for missile defense are clear, both to defend the homeland and for the investments in the GMD system. And the regional requirements -- the combatant commanders aren't going to let him forget about missile defense. So I think he'll continue to try to invest in both.

It is an expensive system. And a lot of times -- this isn't directly related to your question but it comes up frequently -- how much longer can we continue to invest in systems that a very inexpensive, unsophisticated missile can threaten us with? And for me, that is an important question. But the dollars that we invest in missile defense aren't related to the cost of the missile that we're intercepting. The dollars we invest in missile defense are directly related to the value of what we're protecting. That's what makes the cost of missile defense much more appropriate, I think.

I hope that answered your question.

MR. : I understand that this decision hasn't happened yet, but could you talk about some of the potential advantages a third GMD site could have on enhancing our homeland missile defense ability. We talk a lot about the importance of developing it for a shoot-look-shoot capability and how geographically dispersed systems can help with that. I'd be interested to hear your comments.

MR. FORMICA: I'll give a quick operational thought and then I'll let Mr. Kingston talk from a technical standpoint. This is something that Admiral Syring and I

both dealt with when I was still the commander when this first came up. Our positions were fairly consistent then and mine hasn't changed. I won't speak for Admiral Syring, but I'll speak for myself.

There's no doubt that a third site provides additional capability. It gives you extended battle space. As you talked about shoot-look-shoot, there's no doubt there's a benefit to that. But also it reduces the vulnerability of our systems by having more platforms from which to deal with a launch. So there's clearly a benefit to it.

The question is, how are you going to pay for a third site and at the expense of what? And that becomes another tension area inside global. Do you increase the reliability of what you have first, and then think about expanding to a third site?

Again, when I was making my recommendations, and consistent with my priorities, while I accept and agree that a third site would be very valuable and operationally useful, it is not the most immediate need for the dollars we have. The most immediate need for the dollars we have is increasing the reliability of the current system, persistent sensor coverage in depth, a regimen of annual testing of the GBI system, and the continued investment in regional. Then we can go on to the third site.

MR. KINGSTON: I would just add that the key component is it does give you increased battle space and opportunity for look-shoot-look, as you described. With the system that's there today and as it is improved and evolves over the next few years, then you have a proven material system that you can now replicate, if there's a policy decision to deploy a third site.

MR. ELLISON: Carlos, does that help us defend against Iran better than what we have, if Iran goes forward, having a third site?

MR. KINGSTON: First of all, today there is a capability to defend against a potential Iranian threat with the system we have today. A third site would give you more depth, give you more depth in inventory, and certainly increase the overall probability of engagement success with the third site, because of, again, more battle space, look-shoot-look opportunities. You run all the numbers, yes you would have increased probability of engagement success.

MR. : Cobra Dane, (on the Near Islands ?) is really old. I don't know if MDA has an idea of what they can do with that radar. How long do you think it has left and what are the options for either replacing it or building something new, seeing that the LRDR is kind of not a replacement for it but just an upgrade to the radar system?

MR. ELLISON: The Cobra Dane, just for everybody in the room, that's the furthest one on the Aleutian chain that's out there.

MR. FORMICA: Again, I'll talk operationally and then Mr. Kingston can talk more from the MDA perspective or his experience on the acquisition side, the developer

side. There is no doubt that Cobra Dane is a critical asset. We don't talk much about theater missile warning, but it's part of missile warning and that's an integral part of what we do and what we need in missile defense.

And just as importantly, one of the radars that MDA has invested in to upgrade those missile warning radars and make them even more useful in the missile defense system. It was a topic of hot discussion when I was in command. I'm about two years dated now so I don't know what decisions have been made since or how they've changed. I would only say from my perspective and during the tenure that I was in command, we would continue to advocate for investment in Cobra Dane and for Cobra Dane-like capability because of its critical importance in missile warning and to the missile defense system.

MR. KINGSTON: And I'm probably not the right one to address that. I understand your point, and it along with LRDR is better than LRDR alone. I think that's a decision somewhere in the future. But at least for now, it's being sustained and maintained as part of the architecture. If a decision has been made on that, I'm not aware. I would think it's still in the decision space.

MR. : I know you mentioned the cyber part of it and how the cyber mechanisms are becoming aged and obsolete. How big of a priority is that? And what would be the timelines for upgrades, especially since a lot of our folks seem more sensitive to force-on-force engagement where they use attrition, hacking and what-not to disable our systems before (they come online ?).

MR. KINGSTON: A couple of comments. The system we have today and all the protections we have in place from a cyber standpoint is very robust. We monitor it 24/7 with technicians from Boeing and Northrop Grumman. And we test that with Red Teams-Blue Teams and so forth. So today I'm going to give everyone assurance that from a cyber standpoint the GMD system is very well protected today.

And by the way, it's also more of a closed system, so it's not like it's tied into the Internet, so to speak. There are plans in place to do some of the upgrades that I talked about. Some of it was in the '15 budget. Certainly as I look at the '16 budget it's in there to replace those systems. And I would say generally over the next three years when they would be developed, integrated, tested, and then deployed generally in the 2018 timeframe.

MR. : I have a question. To what extent should we start thinking about maritime threats to the homeland, missiles from that area?

MR. FORMICA: Yeah, we really didn't talk much about that today. We focused mostly on GMD. There are a lot of threats to the homeland. The maritime threat is clearly one of them. A rogue ship with -- I know that's one of the things the NORTHCOM commander worries about. Part of that is our coasts. I mean, we've got to maintain adequate defenses of our coasts, and defending it against a missile threat from

the maritime.

MR. : Does a maritime add-on to what we now have make sense to you, in part with that threat?

MR. FORMICA: Say that again.

MR. : Let's say that you had a maritime threat that you've identified, or you think it may come -- whether from the four kilometers off North Carolina or from Venezuela or some place in the Caribbean. Does missile defense play a role in terms of defending against that, as opposed to just finding bad ship at sea?

MR. FORMICA: So the GMD system does not, right Carl?

MR. : My question is should we look at it?

MR. FORMICA: We should. The answer is yes, we should, absolutely, because we want to defend the United States and missile defense is bigger than just the GMD against a limited attack from North Korea or Iran. So there are other threats that need to be dealt with.

One of the ways to deal with them is having the greatest navy in the world. And we're putting a lot at stake in that today. The problem is, it would be impossible to defend all of the -- first of all to identify and defend that critical asset list, and then figure out how to defend them. But having some capability and being able to deploy a capability to defend against a threat is certainly something that's worth making our way through. And I know that was something that when General Dakota was NORTHCOM commander, he was concerned about.

MR. KINGSTON: And some of the regional capabilities that we're investing in, by the way, that again play that balance between the global and the regional, some of those regional capabilities are the capabilities are the capabilities that you'd probably want to employ, or deploy, for that.

MS. : I have a question, the site that's being built in Poland, the similarity of it to the current system that we have, and are we offsetting costs with some of our European partners there. Not that they have much money, but has that been part of the discussions? Do you want to talk about that?

MR. FORMICA: Yeah, we can talk about it. They're two different systems with different requirements. They're to defend our forces and regions in Europe against a regional threat, from Iran for instance, as opposed to the GMD system in Alaska which is to protect the homeland of the United States.

MR. KINGSTON: One is an Aegis ship regional type of defense system, and the other one is an ICBM protection system.

MR. FORMICA: Sure, it's a much lower capability than an ICBM capable --

MS. : There's no cost-sharing, there's no --

MR. FORMICA: Well it's all part of that balance. What you invest in that, you're not investing in GMD. What you invest in GMD -- so it's all part of maintaining a balance of global versus regional.

You bring up cost sharing. Our allies do contribute to missile defense. You see an increasing discussion of missile defense in NATO, for instance. And you're seeing more investment of that.

But like us, they're all challenged with how much do you invest in missile defense? So we, the United States, would always want to have more coalition capability. But one of the things I think you'll find in the discussion is even if you had more coalition capability, does that come in lieu of a U.S. investment in missile defense? Or, does it complement the investment that we already have?

And I think you'd find most combatant commanders will come down on the argument of we need to complement what we already have because we don't have enough now. If we had enough, and our allies invested in it, and they were going to defend areas that we're currently defending, then we could trade off. But there's not enough. And we need the capabilities of both what we're investing in and what our coalition partners invest in.

MR. KINGSTON: I would add just on the complementary thing, we have the Aegis Ashore site in Hawaii, in Kauai, that was built to replicate what's in Poland and Romania. There is discussion of operationalizing that site to give protection to Hawaii, along with and complementary with our GMDs site. So that is something that's moving forward in that position. I just wanted to add that on.

MR. : General, could we get into your first tension maybe a little more. All the contractors will come into our offices and advocate for what they think are the RKV, for building more interceptors, or for re-tipping. In a budget constrained environment, which of those is first, second and third?

MR. FORMICA: What's the third one?

MR. : Re-tip the interceptors on the ground, or build more?

MR. FORMICA: Re-tip with CE-2s, you mean? Upgrade the CE-1s to the CE-2s? Yeah, I think Mr. Kingston kind of address that a little bit already. So the answer is, yes. And you all have your fingers on this budget constrained environment and you can solve that problem by making other choices. But I think GBI reliability is critical. I'm very encouraged by the current budget and the investment that they're making. So again,

when you spread your dollars do you invest today? How quickly do you upgrade the CE-1s? We definitely want to invest in the RKVs and I would say to me that's the priority one. GBI reliability long-term -- sustained GBI reliability comes with that, and that's something that we absolutely want to invest in while you continue to upgrade the fleet like Mr. Kingston talked about earlier.

MR. KINGSTON: I mean certainly the redesigned kill vehicle is where we want to get to, but it takes time. It's got to go through development. It's going to be three to four years in order to get to testing it at a system level.

So we don't want to wait. We need to continue with the one we have today, which again we've made significant improvements in reliability with it and clearly demonstrated its capability. So that's what we have today.

So our first priority in terms of delivery is that one. Build more with it, which are on contract, about 20 more. Upgrade the older CE-2s that are in the fleet today to that configuration.

Then you still have some CE-1s left circa 2018. Then by that time the redesign redesigned kill vehicle is hopefully complete and tested and demonstrated. Then you want to start building it and replace the older CE-1s that are still left

MR. FORMICA: And the one thing that I would say, again, I was encouraged during my time that the Missile Defense Agency had a continuous program of improvement and reliability. The investment in this budget to do that is better, and I applaud that. But they're always improving the reliability of the systems on the ground. That's why you've got varying capabilities even today, because they continue to improve the reliability.

MR. ELLISON: Carlos, where would you put the LRDR? That's a billion dollar investment. Is that in the priority that you just talked about? You just kept that on the interceptor. I think that also needs to be -- or is that after the --

MR. KINGSTON: So I think you've got to take care of the current fleet, the current interceptors, and bring those up. So LRDR, if you force me into those three, then I'd probably -- the redesigned kill vehicle and LRDR are kind of at the same level. I'd kind of flip back and forth in my mind as I think about that question. But LRDR is clearly important because sensor architecture, again, is a force multiplier: better discrimination, persistent coverage. So it's part of the trade that has to be worked. But I think at the end of the day those two would be a flip of the coin for me.

MR. FORMICA: But that's one where I would hope as a war fighter we don't have to answer the question, do we want GBR reliability or do we want the discriminating radar? That's one where we need both of those capabilities.

MR. : In Admiral Syring's budget released earlier this week there some early

investment into a common kill vehicle. Could you explain what that is and where does that fit into all this?

MR. KINGSTON: My understanding, at least the discussions when I was still with the agency, is it's really common kill vehicle technologies. So it's not like you're going to have a common kill vehicle and you can put it here for regional or you can put it here for homeland. But a lot of the fundamental technologies that can be common, but then you have to tailor the overall integration and system engineering for that particular regional application or homeland defense application.

So those technologies -- they're investing in various technologies, whether it's divert and altitude control systems, discrimination, they're investing in those technologies that can be applied more in the 2020, 2022, 2025 timeframe.

MR. ELLISON: Carlos, what would it cost for a new kill vehicle like that, the total cost investment?

MR. KINGSTON: The redesigned kill vehicle, I believe if you look at the overall budget for it, to get through a couple of tests -- round number, I mean I can look in the budget books and see -- but I think overall it's about \$700 million to design, develop and test the redesigned kill vehicle.

MR. ELLISON: And that's using current technologies?

MR. KINGSTON: That's using the current technologies, yeah. So looking out in terms of future common technology investments leading to the development of kill vehicles into 2025, I'd be speculating, Riki. So I would not want to put a number out there on that one.

MR. ELLISON: But suffice to say it's too much -- if we're going to do the redesign, the redesign is the most efficient way to do this when spending our tax dollars? Because there's people out there who want to make the jump right to (redesigned ?) kill vehicle and just re-tip and skip that step. So what's the justification?

MR. KINGSTON: I think you're trying to go to what's envisioned as the kill vehicle of the 2025. If you just do that, once again you're waiting. So it's newer technologies that need to be invested in, (not for another day ?).

So the redesigned kill vehicle, I won't call it an interim step, but it's certainly a step in the overall evolution of kill vehicles. So it's kind of a phased approach. You have what you have now. The next phase is the redesigned kill vehicle using technologies that exist today, a low risk approach, something that you can accomplish in three to four years, the 2018 timeframe.

In parallel with that you need to be investing in technologies focused on needs and threats up to 2025. So it's one of those that you need to be doing a phased approach,

parallel efforts, in each of these lanes, from my view.

MR. : When do we need to put a LRDR facing Iran? When's that? Are we okay with -- what's that timeframe when we start looking in that direction seriously with investment in terms of sensor discrimination?

MR. KINGSTON: It comes down to, when is the Iranian threat to be expected? The intel community and all that is certainly not my expertise, but my understanding is first focus is the North Korean threat, putting in the LRDR in Alaska.

We've planned, even though I don't believe it's in the current budget request, but certainly thinking that you'll need a similar type of radar for protection against an Iranian threat beyond the 2020 timeframe. And I think as this LRDR is developed and fielded for Alaska, then you have a design that works, that's been fielded, that's been demonstrated. Now phase one in for somewhere in the northeast. Whether that's in Fylingdales or whether that's in Greenland or whether that's somewhere in northeast Alaska I don't know. The trades will have to be done for where that might go. But my view is that will be needed as part of the overall architecture somewhere in the future.

MR. ELLISON: Any other questions? We good? Well thank you, everybody, for taking your time to come and listen to this. We'll be doing another one of these on Aegis and sensors. We appreciate and know how important it is for you. You're the foundation of the movement of knowledge in Congress, so thank you for your attendance and we look forward to seeing you again.

MR. FORMICA: Thank you very much.

MR. KINGSTON: Thank you.