

# **Center for Strategic and International Studies**

## **Press Briefing**

### **“Options for the Ground-Based Leg of the Nuclear Triad”**

#### **Featuring:**

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#### **Moderator:**

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COLM F. QUINN: All right. (Inaudible) – you guys for coming. (Inaudible) – Colm Quinn. I'm the deputy director of strategic communications here.

This is very much Todd's day. (Laughs.) But if you do need any – (inaudible) – we are transcribing this, and of course – (inaudible) – Todd cannot answer myself. And so we'll be able to direct you to the right people.

(Inaudible.)

TODD HARRISON: All right. I'll get started. And I know you're all familiar with what ICBMs are, so maybe I'm going to skip the first chapter of the report, except to say, you know, what we wanted to put together with this chart is to show the evolution of the U.S. nuclear arsenal over time. And the green part of the fan chart there, that's the nuclear-capable bomber force. The yellow is the subs, the sub-launched missiles. The blue is the ICBMs. And the red dashed line, which corresponds to the right-hand axis, is total stockpile of nuclear weapons, or – (inaudible).

And you see that there's been significant reductions. We've had various arms control treaties over time.

The other thing I'm going to point out here is if you look at where we are today, the fraction of our nuclear delivery systems that are ground-based ICBMs is larger than it has been historically. We are more – a larger percentage of our arsenal is the ICBM force, relative to the others. The bombers have given up the most.

(Inaudible.) (Laughs.)

Yeah. So that's where we are today. Of course, we're at a point also where all three legs of the triad are scheduled to be modernized at about the same time. Now, this is a particular problem for the Air Force, because the Air Force owns two legs – (laughs) – of the triad. And we've got some other major modernization programs that you might have heard of as well.

I'll just take the four biggest Air Force modernization programs. And this is the funding that's actually in their FYDP in the most recent budget request. This is what they're actually showing. So the blue is the F-35A, just the Air Force's part of the program. The red is the new bomber. The green is the tanker. And the yellow is the GBSD program, the new ICBM. Now, you see where we are right now is GBSD is really pretty small, but it projected to grow to be a substantial program by FY '22. And it actually sort of rivals, going to be almost equal in the annual budget as the bomber program by '22. This is a major program.

And, you know, this is going to require a pretty good increase in Air Force funding, in their acquisition funding for major modernization programs. If they don't get extra funding, if they're not able to increase funding as they planned, they're going to have to make choices. Now, there are a lot of other acquisition programs they're talking about around the same time as well – the new trainer. I mean, you guys were probably all at the conference this week, probably heard about lots of these programs.

So this – the GBSD program, because of its size, it could force some tradeoffs within the Air Force.

Q: We're talking about – this is FY '18 request. So this is assuming the 54 billion (dollar) sort of plus-up –

MR. HARRISON: Yeah, assuming that they get 54 billion (dollars) above the budget cap year after year after year.

Q: Right.

MR. HARRISON: Right now, the budget caps expire in 2021. Yeah, so even with the generous assumption that they're going to get the extra funding, this is what it looks like. If they don't get all of that budget relief, they're going to have to cut back.

Q: Yeah, on something else they do.

MR. HARRISON: Right.

So here's kind of why I wanted to do this report, is the Air Force back in 2014 did their own analysis of alternatives, which is normal with a major acquisition program like this. And it came out with a counterintuitive finding. This is a direct quote here. They're saying that the cost to develop a brand-new ICBM that's even more capable than the one we have today, that that cost is actually less than just extending the life of the missiles we already have. When you think about that, it kind of doesn't make sense, right? It seems counterintuitive.

So I – (inaudible) – it out a bit. So it actually does make sense if you look at the constraints that were put on their analysis. And this is normal for analysis of alternatives, but given terms of reference, they were looking at the total cost of each option over 60 years. So the total cost, 60 years of the program. And they assumed they would achieve a minimum of 450 missiles deployed at any given time. We have 400 missiles today. (Laughs.) So they assumed 450, not the 400 that's under the New START treaty limits. And they did not look at varying the test rate of missiles. If you're familiar with the Minuteman-III, we test between four and five a year, OK?

So what all of this means is that if you look at the life-extension options that they analyzed in the report and you take the existing Minuteman-III missiles – (inaudible). (Laughter.) (Inaudible.)

So if you look at the life-extension option, the way they analyzed it, they said, OK, we'll extend the life of the current Minuteman missiles. That means (pouring ?) a new solid rocket, (another core ?), upgrade some of the guidance systems that are going to expire.

And then you what know? Because we're testing four or five a year, we're going to run out of missile bodies by the year 2035, right? They're going to go below 450 by then. So you know what you have to do? You have to design and build a brand-new missile. So the life extension option that they analyzed includes not only extending the life of the missiles but designing and building a brand-new missile. So now it makes sense – right? – this statement. The cost of building a brand-new missile is less than the cost of extending the life of the missiles and building the brand-new missiles. That's what their analysis actually concluded.

OK, now, there's also been some issue with the cost of what the Minuteman-III replacement will be. The – (inaudible) – for GBSD program is 62.3 billion (dollars) – point-three, I like that. They

say, you know, it kind of signifies it as a high degree of fidelity in the estimate. Of course, there's not been any cost estimate. Cost-estimating – I've taken one class in cost estimating, years ago, and I quickly concluded that it is the art of trying to predict the future, which it is not precise.

Now CAPE did an independent cost estimate. They said the cost will be at least \$85 billion. At least. That was actually their bottom of their cost estimate. Now there were some reports that leaked out that said the upper end of the CAPE estimate was as high as 140 billion (dollars).

So what's the difference? Well, in their report to Congress – I've got it quoted in the paper – CAPE said that the reason for such a huge difference between their cost estimates is that they used different data when they were formulating their cost estimates. The Air Force relies primarily on cost data from the previous Minuteman-III program, which was in the '60s and '70s, and I think some of the older ones, the Titans and the Atlas which were in the early '60s. CAPE also included cost data from the ground-based interceptors, which are not really an ICBM, but they're like an ICBM because it's a solid propellant missile, and the Trident II D5 missiles. So CAPE used some more recent data. But CAPE admitted that there is just not enough good data. There's not enough good cost data to come up with a reliably accurate estimate, a high degree of uncertainty. So the truth is, we don't really know.

And I think that this come out with some of the comments this week General Hyten made to a conference – Was it Hyten? It might have been someone else – that, you know, they're funding the initial development program \$18 billion, and during that time they'll get a better idea of what it's really going to cost.

OK, so what I did in this report is, I basically did an outside analysis of alternatives. I looked at four different options to compare to the baseline program of records. Of course, I'm not limited by current requirements, and so that's, you know, something the Air Force team did not have the luxury of doing. I look at this and say, hey, requirements, you know what they are? They're a matter of strategy and policy, right? You can say, you know what: We're going to have fewer missiles, or we'll be willing to take a gap in missiles, or we'll be willing to go down to a diad. Those are all strategy and policy decisions. And so I wanted to leave that open as I did my analysis, just to see what the effects would be.

And I will go ahead and give you a spoiler alert here. I didn't try to do the impossible and predict the cost of each of these options with any kind of fidelity, because I looked at this myself and – (inaudible). There's just not enough cost data. So, you know, think of it this way. If you're comparing two different options and you want to know which one costs more, let's say you do your estimate and one costs 5 percent more than the other, but your confidence interval is plus or minus 30 percent on each cost estimate, you don't really know which one costs more. So all I'm doing in the report is providing kind of a qualitative comparison based on costs.

I am looking, though, quantitatively at what it means for the inventory of missiles that we're going to have. And I really just focused on the missiles. Of course, there are all sorts of related systems that go along with the ICBM force – the new helicopters that we're going to need, the warheads, et cetera. Those will be largely constant across these options anyway, except for option one, where you end up getting rid of the ICBM force, yeah.

Q: Just on the warheads, which warhead – (inaudible)?

MR. HARRISON: Yeah, OK. I always get confused on the numbers.

Q: Yeah, me too.

MR. HARRISON: Seventy-eight, 88, yeah. (Inaudible.)

Q: OK, but they're also trying to figure out development cycle on that, but obviously (there ?) would be fallout on development time for this, right?

Q: Are they going to upgrade those warheads? Because that has not gone through DOD earlier, right?

MR. HARRISON: (Inaudible) – through Department of Energy. They're going to go ahead with the upgrade programs regardless, unless we got rid of all the missiles. And, you know, probably won't do it. But I think, regardless of the schedule here, they're going to go ahead.

Q: So they're going to replace all the ICBM warheads?

MR. HARRISON: Yeah. Those are the plans.

Q: OK. Yeah.

MR. HARRISON: OK. (Inaudible.)

So the baseline for comparison here is the GBSD program of record. Now, the blue bars here are the Minuteman-III missiles. And so this is – this data comes directly from an Air Force report. This is how the missiles are going to age out right now. So this whole – if you see here, that's the test rate of the missiles. The red line here is 400. That's our New START level that we've chosen to maintain. And then the steep drop-off you see here, that's when – that is driven by the (solid cores ?) of the missile aging out. Once they get to be about 30 years old, their reliability starts to go down, and so we're going to pull them out of the inventory. So this is what would happen.

And then the GBSD program, they've not given us a detailed procurement plan or, you know, how many missiles we're buying this year. So I had estimate this myself, but we have a lot to go on. So we know they say they're going to start fielding operational – excuse me – operational missiles in 2029. So that's when – (inaudible). We know that they do not want to go below 400 in the inventory at any time. And so the idea from that is I constructed a typical acquisition ramp rate and then level off at a max production.

It's also been reported that they plan to procure a total of 642 missiles, total procurement. So that is where we reach the maximum here. Now, you'll notice the maximum in the inventory at any given time never gets above 600, because even though you're buying 642, as you're fielding them you're testing them. And so you test more than 50 before you end up finishing the production run.

Q: So, Todd, the START limit, though, is 400 operational missiles?

MR. HARRISON: Four hundred deployed, right.

Q: So they can have more as long as they're not deployed.

MR. HARRISON: Right. They can just be in the inactive inventory. And I should also point out the limit on 400 is how we've chosen to implement the New START route. So New START is actually 700 deployed delivery vehicles total. We've chosen 400 will be our ICBMs, and then I forget the number of bombers –

Q: And subs, OK.

MR. HARRISON: So we just – so if you decided you could take the level of missiles up and make cuts in other parts – (inaudible) – or you can go lower and then increase in other parts. So there is that flexibility in the treaty.

It's also worth pointing out that the treaty ends currently – it expires in '21. Presumably, we will extend it. But, you know, if nothing happens, the new treaty will go out of effect anyway by 2021.

OK, so this is the baseline. And again, I assume here with the new missile that we continue our test rate of about four or five per year. So this is the easiest option to analyze: What if we just kill the program and don't replace it at all? (Inaudible.) This is what it looks like. You go down to – (inaudible) – by 2037. And it doesn't take a genius to figure out that this is by far the lowest-cost option. (Laughter.)

All right. So, you know, I put this in there because that is always a policy option. Folks have talked about this in the past. As I was doing some research, I was reminded that General Kehler, who we had here a couple of weeks ago speaking at a conference, when he was STRATCOM commander, he looked at this and said, you know, someday we might want to go down to a diad. So it's not inconceivable. There are a lot of folks in the arms-control community that have been pushing for this for a while. Even some folks in the military are concerned that, under the Obama administration, after – as part of the agreement to get New START passed, the Obama administration had a deal with Republicans in Congress that they would modernize the ICBM leg of the triad. So that's why we're on the path that we're on now.

Q: Also, the Trump administration – I mean, that's one of the few defense issues that Trump seems to actually be kind of passionate about is nuclear modernization. So do you think that that –

MR. HARRISON: Yeah, his first order apparently as president. (Laughter.)

Q: So, I mean, do you think that makes it less likely that – I mean, Obama maybe deep down wanted – would be – have perfectly been willing to scrap it – (inaudible) – political position he staked out would kind of mitigate against actually scrapping the –

MR. HARRISON: So we've got the Nuclear Posture Review that's under way right now. I don't think that they are seriously considering eliminating this leg of the triad.

Q: Well, the matter is before the secretary and (he threw ?) out there. Recently he –

MR. HARRISON: Two years ago he said that he would – that it should be considered. Now he has said I don't think so. He's been convinced to keep it.

Q: (Inaudible.)

MR. HARRISON: So I don't think that this is a realistic option, that they're going to consider – (inaudible).

What are some other options? Well, the – another option is, what if you delay the GBSD program. Now, toying with the number of years you delay it by, I started out at five, what if we need to do a five-year delay. And then actually you end up getting down to almost zero missiles because of just the drop-off and the expiration of the current missiles. So I've hacked it down to a three-year delay to show something that might be a little more realistic.

So what happens here? Three years away in the program, you end up with this bathtub where you drop below 400 missiles. OK. Now, that's perfectly allowed under New START. In New START, there's a maximum limit. You can go below if you want to.

Also we could use a different platform. We could – around this time period in the 2030s, we're going to have a hundred new nuclear-capable bombers coming online, right. What if you put them all – assign them all towards the nuclear mission and keep all your B-52s and B-2s that are already in the arsenal? So if you add a hundred new bombers, that largely fills the bathtub here during this time period. There's actually a year you drop below, but that would be one way of mitigating it, is with other parts of the triad.

Q: And it's my understanding that under New START that strategic bombers only have basically one missile. But if you have an air-launch cruise missile, you could theoretically put, you know, a dozen missiles or 24, whatever the number is. So you could actually have more nukes in the deployed arsenal without, you know –

MR. HARRISON: Bombers are – you're right. Accounting rules of New START, a bomber only counts as one delivery vehicle, even though it could have 10 or 20 nuclear-armed cruise missiles or direct-attached (B61 ?) bombs on it.

Q: And does an ICBM only count as one?

MR. HARRISON: ICBM counts as one.

Q: And a sub?

MR. HARRISON: Sub – a sub-launched ballistic missile counts as one.

Q: Oh, so it matters how many tubes there are on the subs.

MR. HARRISON: Yes. Yeah, how many –

Q: But not on – but not on the bombers and not – so the – you could have multiple warheads on a –

MR. HARRISON: Yeah, nothing prohibits us from going – from going back to multiple warheads on our ICBMs. And we do reserve the option to have multiple warheads on our SLBMs. We decided unilaterally years ago to make our Minutemen 3s unitary warheads.

Q: So there's no prohibition on MIRVs and the historic –

MR. HARRISON: Yeah.

Q: That had been my understanding, but I would defer to you.

MR. HARRISON: No, we could go back to multiple warheads if we wanted to. But yeah, the step-back didn't think, you know, what is the value of the ground-based leg of the triad, what are you using it for. One use is you use it as a missile sink, right. It's a bunch of targets that an adversary has to hit. They have to hit all of them, all of the silos, if they want to make sure that they've taken out your ground-based leg of the triad.

So having multiple warheads in each hole doesn't change that calculus, right. Having more holes in the ground does change the calculus for an adversary.

OK, so three-year delay. Now, I would also point out here that a three-year delay may happen even if we don't want it to happen. Has anyone here ever heard of a major acquisition program being delayed? Yeah, this happens quite a bit.

So what – to set out the need for doing this analysis is we're already at risk of this bathtub, whether it's a policy choice or not, because a three-year delay in an acquisition program is not on time.

So one of the things that policymakers might want to consider in the NPR is if this happens, even though we don't want it to happen, how are you going to mitigate it? What are you going to do? Are you going to accept the temporary reduction? Are you going to try to, you know, put more bombers in to be nuclear-capable? How do you want to make it?

So then when I thought about it, I thought, well, what about those ICBMs that are expired? We think 30 years is about their max. But I did some digging, and I actually found the analysis that the Air Force had done where, again, really statistical model that they've been updating throughout the years of the Minuteman-III test program. This shows how the increased risk of failure at launch goes up over time.

So I ran through the equations. And I looked what if we keep some of the expired Minuteman-III missiles up to three years after expiration date to fill the gap? So some of them, you know, which you – in each of these little light blue bars, some of the missiles are one year past their expiration. Some are two years. And a few are three years past their expiration date. None are more than three. If you look at the increased chance of failure on launch, it goes up – at 30 years of age it's less than 1 percent chance of failure because of the solid rocket motor degrading. You extend the life out to 33 years, and it goes up to a little bit less than 4 percent chance of failure on launch. So it's a notable increase in risk.

But if you apply that to a fraction of the missile force here that would be past its expiration date, it doesn't make that big of a difference in the risk of failure if you actually had to launch them all. And so, you know, at the worst point here, where we have the most number of expired missiles, I found that if you launched all the missiles at once – so, this is do it today, right? This is the big war. We see the Russians have launched everything at us. We push a button, we launch everything at them. So all 400-and-something missiles are launched at once. You would expect that about three or four of them would fail on launch out of 400. That's not too bad of a failure rate.



What does that do to the deterrent calculus of your adversary? Can they disregard our ICBM force? No. They still have to target all 400 silos, right, because no one knows – we wouldn't even know – which missiles would fail. (Laughs.) We wouldn't even know that. We know which ones are older and more likely to fail. But it's a relatively low failure rate.

Q: And when you say fail, does that mean – I mean, could it actually detonate over U.S. soil –

MR. HARRISON: No, the worst that would happen is the missile in the silo are coming out of the silo would.

Q: And it would just destroy the warhead, but not –

MR. HARRISON: But not the –

Q: But not the nuclear head.

MR. HARRISON: It would spew, you know, radioactive debris. It would be really bad for the cornfield. But, you know, that would only happen if you launch it. (Laughter.)

Q: We've got other problems. (Laughter.)

MR. HARRISON: Yeah. So I think that's the least of our concerns if we're launching all of our nukes that, you know, three or four cornfields have – (inaudible).

Now, again, we joke about it, but – (inaudible) – you know, this sounds like it might be a logical option, but there would be some serious policy concerns about doing that. So I'm not sure that people are willing to do this. But I pointed out that we may – we may not have a choice if we want to keep a minimum force of 400 deployed missiles and we end up with a delay because of technical problems with the program, we may end up doing this.

OK, then alternative for what if we do a life-extension program of the Minuteman-III? So we could do it like the Air Force did in their analysis, keeping testing and at four or five a year you run out of missile bodies. If your limit is 400 though, instead of 450 like in the Air Force's analysis, it gives you a little more time before you need to start buying a new missile. But that still costs a lot of money because you're still buying a whole new missile and it's not that different than the baseline option.

So what I did I said what if we slow down our test rate and we only tested three missiles a year? Now, you don't get as much test data. You have a little bit less confidence in the reliability of the missile because you're not getting as much data over time. But three missiles a year for a system that's been in our inventory since the 1970s, I think we probably have a good amount of data. If you slow that test rate to three missiles per year, it extends the amount of time that you have enough missile bodies. You don't fall below 400 missile bodies until the year 2050.

And so the green bars here are just taking some of those missile bodies and upgrading them. And you do have to do a fair amount of upgrades. You got to pour a whole new solid core for the missile. We've done that before. We did that in the 2000s – late '90s, early 2000s. You have to upgrade the guidance system on it, and there's a few other things you have to do. And regardless, we're going to have to upgrade ground centers. The launch control facilities, the silos and things that have to be upgraded as well.

So this really becomes a piecemeal modernization program, right? You're not designing and building a whole new missile. You don't have all the tests and uncertainty that comes with a brand-new development program. It's just a life extension and an evolutionary modernization program. You could do that, and slowing your test rate extends your life out. You don't fall below 400 until 2050. And then you continue to decline relatively gracefully out to about the late 2050s, and then those solid rocket cores are to age out themselves, right? So then you have another cliff.

So what it really does is the decision to make a new – the decision to start a new acquisition program for the missile, you can push that off until the 2030s. You don't have to start a new program. So will it cost as much, you know, over time? Well, yeah, if you add in that eventually you do buy a new missile out in the future and you extend that cost window out far enough, yeah, you eventually pay the bill. The advantage in this option, though, is that you don't have as big of a bill in the 2020s. It's –

Q: You're not competing with those other programs.

MR. HARRISON: You're not competing with those other major modernization programs, and you're able to kick the can down the road a bit.

Q: So how much – I assumed you tried to figure out how much it would actually cost.

MR. HARRISON: And there's too much uncertainty.

Q: Yeah.

MR. HARRISON: So that's why I say it's a qualitative comparison. This would be a lower level of funding in the 2020s relative to the program of record. And you can push off making the decision about a brand-new missile until the 2030s.

OK. Now, you know, I have to point out there are all sorts of other alternatives possible, and you could do hybrids of the ones I presented. I did not consider options that would cost significantly more because that doesn't appear to be in the cards. It's already been discarded by the Air Force. In their earlier analysis, they looked at road-mobile missiles, rail-mobile missiles, accelerating GBSD. I'm assuming those are off the table at this point. And as I mentioned before, I didn't include the related modernization programs that go along with these because those are constant. Those are needed regardless of what you do with GBSD, except for alternative one. In alternative one, you don't have to do the warhead modernization program, or at least part of it you don't have to do, and you wouldn't need to do helicopters because you're not going to have ICBM fields anymore.

OK, so my conclusions here. I don't recommend a way forward, because I think it really depends a lot on what our strategy is and what we think the role of ICBMs is going to be in our future nuclear arsenal, and that's all in flux right now. Here are the big factors, I think, to consider. Of course, the total cost is important, but the peak years of funding is probably more important. (Laughs.) And that's just, you know, a reality of the appropriations process and looking at when it overlaps with other programs. I think we ought to look at sensitivity of delays – sensitivity to delays in the program and what that will mean. I think that's something that may not have been adequately considered so far.

And we also need to look at what gives us strategic flexibility in the future to reshape our nuclear force. So I think key questions that the NPR should address related to the ground-based leg of

the triad is, number one, what's the primary role of our ICBM force. Is it to be a missile sink, where we just need a lot of silos in the ground, a lot of targets for an adversary to have to hit? Or do we want it to be a quick-response ICBM force? If you just want it to be a missile sink, options for keeping those expired missiles should be considered. If you want it to be a quick-response force, then probably you don't want to consider keeping expired missiles.

What's the contribution of the ground-based leg of the triad to our overall nuclear umbrella that we extend to other countries? Would other countries feel less secure if we had fewer ICBMs in our arsenal? That's a question we should ask. Or do they feel more secure by other legs of the triad, like bombers and the sub-based leg of the triad?

Do we want to leave the door open with further reductions? So we've had a long history now, since the '70s, of arms-control agreements. We've made significant reductions in the past. ICBMs have been part of all those reductions in the past. If we're going to make further reductions in ICBMs, or if we want to leave the option open for that, then that should affect the decision we make here. We want to make a decision that leaves the door open to that.

And, of course, we're at a point now where I think further bilateral reductions with just us and Russia may not be enough or may not be satisfactory to all the parties. I think we're at a point where we're going to have to start looking at multilateral reductions. Now, that's going to be really hard, but imagine, like, a P5 treaty with all the major nuclear powers in it, so – including China, because if we start making reductions much below the total of 700 delivery systems that we have, then we're getting closer and closer to where China is. So I think we would want reductions in China. Of course, if you include China, they're going to say, hey, what about the U.K.? What about France? And maybe others.

Do we want to change the mix of our nuclear delivery system? So even under the New START level of 700 total, maybe we want to shift the balance, go back to something like we've had in the past that was a little more heavily weighted toward bombers. And then what's the relative priority of GBSD with these other major conventional acquisition programs, because, you know, as we discussed at the beginning, if the budget does not materialize out in future years, like it's currently planned – you know, more than 50 billion (dollars) above the budget caps through the end of the budget caps – if that doesn't happen, we're going to have to make choices, and the Air Force is going to have to make choices among these major programs.

So that's all I have prepared. Do you have any questions?

Marcus (sp).

Q: One of the notions that's been thrown out there for the last few years is, like, making a separate, like, OCO-like budget for all this stuff. How was this done in the '70s, I guess, or '60s when they did this? Was it all Energy? Was it a mix of Energy and DOD, like it's currently planned to be, or how?

MR. HARRISON: Yeah. So it's – the way it's always been done in the past is the warheads, the bombs, are funded out of the Department of Energy and the delivery systems are funded out of DOD. And so there was no separate budget, no separate accounting system in the past. So we've done this in the past. Now, a lot of it – you know, like, in the Reagan buildup in the '80s, you know, we had

a huge procurement buildup, and so some of that was going to modernize different parts of the triad. But we've done it in the base budget in the past.

Q: Do you think the notion now is just being done just due to the budget caps –

MR. HARRISON: Yeah, absolutely. It's due to the budget caps. I mean, that's part of the incentive that the budget caps provide, is to try to go around them.

Q: Todd, normally when you talk about, you know, replacing one system with another – so you got the GBSD replacing the Minuteman – you talk about a change in capabilities. Is there – what is the discussion on what does the GBSD provide? Does it do something better or some – you know, how is it different from the Minuteman-III? Or is it just – it's just time to build a new missile doing the same thing that Minuteman-III does?

MR. HARRISON: It's basically the same. I mean, you can get some performance improvements. You don't even have to have a new missile to get some of the performance improvements. If you can get a more accurate missile that can hit a target more accurately, then you can use a smaller-yield warhead. And we do have the dial-a-yield capability in our warheads.

And so, you know, there's an argument to be made in deterrence theory that that becomes more credible. If you could hit a target more precisely, more reliably, with less collateral damage, than an adversary would look at that as something –

Q: Because you're more likely to use it.

MR. HARRISON: – you might be more likely to use it. You don't have to have a whole new missile to do that, necessarily. That's really more about updating the guidance system.

Q: Sorry. Go ahead.

Q: Oh, yeah. James from Aviation Week.

I just wanted to know your opinion on should they choose to phase out the nuclear ICBMs, do you think there's opportunity for something to go in its place, perhaps, you know, a devastating conventional weapon, which would obviously be much cheaper, because you wouldn't have to add nuclear – nuclear-certified, not only the missile, the vehicle, but you also wouldn't have to nuclear-certify the crews. And the whole enterprise would be much cheaper.

MR. HARRISON: So you're talking of if we phase out the ground-based leg of the triad entirely –

Q: Yeah.

MR. HARRISON: – and replace it with something like a conventional ICBM?

Q: Yeah.

MR. HARRISON: I don't know that it would be that much cheaper. (Laughs.) Yeah, you do have a whole nuclear certification and everything. That's kind of a headache in the O&M of it. I also

don't know the advantage that gives you. It doesn't – it's not really comparable in effects when you're talking a conventional – conventionally armed ICBM. So I don't think that that's a fair tradeoff to be making.

Q: You haven't heard that spoken about anywhere?

MR. HARRISON: I've heard folks talk about how they want a conventional-prompt global strike capability –

Q: Yeah.

MR. HARRISON: – but not as substitute for the nuclear ICBM.

Q: Yeah, I see.

MR. HARRISON: Yeah, not as a substitute. If you wanted to substitute something for the ICBMs, you would do it with the other legs of the triad or just take a reduction, either unilaterally or in a treaty.

Q: And you –

MR. QUINN: Can we get – sorry.

MR. HARRISON: Oh, there's folks in the back here, OK.

Q: Hi. Sorry.

MR. HARRISON: Sorry, didn't see you back there.

Q: When you were looking at the option of keeping Minuteman around a little bit longer if GBSD is delayed, what are – what are the costs inherent in that? Because your report says, you know, policymakers not – might not be great with the policy, you know, environment that that would create. But I'm curious what the funding would look like for that, like what the difference would be, you know, between either just waiting for GBSD or, you know, how much – you know, what the cost differential would be.

MR. HARRISON: So this gets back to all the cost estimating here. There's such a high degree of uncertainty. I don't think you can know precisely what the cost difference would be.

Qualitatively, I think you can say in the 2020s the life-extension option or just keeping the expired missiles and delaying GBSD would cost less in the 2020s. Keeping the expired missiles doesn't really cost you much because you're not doing anything to them. You're just keeping them in the silo, so that's no different than the, you know, regular O&M costs that we already incur. Delaying the program, you just shift the funding out into the future. And we're at a point in the program right now, it's still early enough that you're not going to incur, you know, significant penalties with the contractor. We haven't gotten through milestone B and all of that yet.

Q: OK.

MR. HARRISON: OK. I think you were next, and then you. (Laughs.)

Q: OK. You know, you mentioned the possibility that they could give more weight to the bomber force. It seems like with the B-21, for example, and the other bombers as well, because, you know, they've been primarily used and are expected to be used primarily for conventional missions, it seems like the size of that force might not necessarily depend at all on the results of the NPR, what the policy is with regard to nukes. So does that make it kind of less likely that the bomber force is going to be reduced in size at all, kind of regardless of –

MR. HARRISON: Yes. So that's one of the interesting things about the triad, is there's different dual-use capabilities for each leg. And so you're right, the bomber leg, the size of the bomber force is almost entirely driven by the conventional mission of the bombers. And so the NPR, I think, is highly unlikely to affect that. I mean, at most they might say, you know, we don't keep as many bombers coded as nuclear, or maybe they say the opposite that we keep more coded as nuclear. But I don't think it affects the size of the inventory. That's driven by conventional missions.

With the sub-based leg of the triad, it has very limited dual-use capabilities. In theory, those subs could do ISR missions undersea while they're also doing the nuclear mission, or maybe when they're not doing the nuclear mission. And we have converted SSBNs in the past to a conventional mission. Some of the Ohio-class boats we converted to carry conventional missiles and to carry SOF as well.

The ICBMs, though, only one mission: They only do the nuclear mission. That's it. And when we've retired them in the past, some of them, you know, we ship off and we use them for space launch, and there's arguments over there – (laughs) – undercutting the market there. But they really have no other military use, right? And we have decided not to deploy a conventionally armed ICBM in the past because we're worried that if we launch it, it could be confused with a nuclear missile.

Q: Right. And so do you think the fact that the bomber force is going to kind of be maintained for these conventional missions and it's not really that difficult to give them the nuclear capability, I mean, do you think it's likely that the emphasis will be shifted to the bomber force in terms of, you know –

MR. HARRISON: Yeah, I don't – I don't know how to read the tea leaves yet. They haven't said a whole lot on the NPR. I think that it is a possibility that we could see a shift in the overall nuclear inventory towards more bombers. And if you were going to do anything – if you were going to make a reduction in any part of the existing force, you would probably do it in ICBMs. I think most people agree the SLBMs are kind of –

Q: Sacrosanct, yeah.

MR. HARRISON: Yeah, they're sacrosanct. You're not going to touch them because that is the most survivable leg of the triad. I mean, I have said before that my personal opinion, if I was building a brand-new military from scratch and I didn't have much money, the first capability I would try to buy is sub-launched nukes – (laughs) – because you can ensure your sovereignty with that. Can't do a lot else, but you can ensure your sovereignty, you know, with a massive retaliation force. So I think those are very safe in the review.

If there's any room for trade at all, it probably is to make more nuclear-capable bombers and fewer ICBMs. But again, I don't know if they're really looking at that seriously.

Q: So I want to just touch on two things you said. The first is the question of, you know, if there was a three-year delay – say a planned three-year delay instead of expected delay – what that does to industry, because obviously you’ve got the initial contracts to (down-select ?), but they’re in this kind of tech maturation phase. I mean, do you think there’s any industrial base concerns with pushing that phase from the plan, 2021 to, say, 2024?

MR. HARRISON: Yeah. So at this point it depends on how you do the delay. Do you stop work and do you, say, stop TMRR, and then try to restart it in three years? Or do you say, you know what, I’m going to keep you all going on TMRR at a low level of funding? I think most likely they would just continue them, stretch it out at a lower level of funding. Now, that’s going to cost you a little more in the long run because you’re keeping armies of engineers working in two different companies, but TMRR is a relatively low level of funding. So we’re talking, you know, a few hundred million a year during that time period. If you do that, then I don’t think it has a big industrial base impact.

What could have an industrial base impact on GBSD is what NASA does with their SLS program, because the Space Launch System uses basically an extended version of the solid rocket boosters from the old Space Shuttle. And that has – DOD has been counting on that to help shore up the solid rocket motor industrial base. (Laughs.) So if that program slips or is cancelled under the new administration, that could have a significant impact on the industrial base here for solid rocket motors, because there aren’t a lot of customers for solid rocket motors of this size.

Q: Because I never really tracked NASA properly. So is that something that they’re talking about cancelling or something? Or is that just a – (inaudible)?

MR. HARRISON: They’re not so far, but we don’t have a NASA administrator confirmed yet. It’s something that’s been looked at, at times in the past. The nickname for SLS, if you’re not familiar, has been the Senate Launch System, because the Senate kept pushing NASA to put more funding in it. And so the Senate is highly supportive of the program. It’s not clear if NASA is so much. And quite frankly, you look – so, SLS provides a really super-heavy launch capability. We have some commercial companies that are not trying to build something quite that big, but they’re getting close, all right? So the Falcon Heavy, the Blue Origin, what’s their heavy one? I forget the name of it now. They’re looking a really heavy –

MR. QUINN: New Glenn.

MR. HARRISON: What’s that? Yeah, New Glenn, right, yeah. So they’re looking at pretty heavy launch capabilities. There are folks that have made the argument – you know, that are commercial space people – they’ve made the argument that, hey, why is NASA going and developing a brand-new heavy lift launch vehicle – ultra-heavy lift – (laughs) – when they could instead just use what’s going to be commercially available. Folks in NASA responded and said, no, no, no, ours is even heavier lift. And we do need that. And there’s, you know, the industrial base concern that I just highlighted. So, for now the program has been safe because the Senate has been putting extra money in it every year. Will it be safe in the future? You never know. So it’s something to watch, and it could impact this program.

MR. QUINN: Haven’t they cancelled like four of them since the Satin (sp) program, I think?

MR. HARRISON: Yeah, there's a –

MR. QUINN: They've cancelled so many of those.

Q: There's Ares, and they cancelled that.

MR. HARRISON: Yeah, there's – yeah, the whole constellation program. When the Obama administration came in, they cancelled that. So it's – you know, it's entirely possible the Trump administration comes in, they get a new NASA administrator, they've got some time to work it, and they come out with a new space exploration plan that may or may not include SLS. We'll have to see. My hunch is that they'll keep SLS, though, because I think it's got good support on the Hill.

MR. QUINN: I got another one.

Q: So when you're talking about the effect on the bomber fleet that these changes could have, are we talking the effect on the deploying ones that the Air Force already owns? Or are we talking procurement amounts for, like, B-21? Because I guess I'm wondering how this affects the debate about, you know, the 100 per bomber, you know, if that's a ceiling or a floor, or whatever?

MR. HARRISON: Yeah. Well, yeah, so I guess what I was just saying before is I think the number of the bombers will be driven more by the conventional missions. And nuclear – well, we're just going to make them nuclear-capable anyway. And it's a matter of when do we pay to certify them as nuclear, and how many of them do we end up coding as nuclear at any given time. So I think that's going to be primarily driven by conventional missions. And at this point, I think the Air Force is making a strong case that they need a – that 100 is a floor. It's a minimum. I mean, keep in mind, though, that a few years ago they were saying 80 to 100. So it seemed like 80 was the floor. Now, they've come out and said 100 is the floor. They may need more than that. So they're going up.

Q: Of course, B-2 had a floor too, so. (Laughter.)

Q: So I guess – well, so I guess my question is, how drastically – you know, given that it has gone up from 80-to-100 to now 100-to-?, you know, do you think that if stuff happens with GBSD we can see, oh, we want 120 as the floor?

MR. HARRISON: It could add to the justification. And you say, you know what, we need – for the conventional missions we also, if we're going to have a bathtub in the GBSD program – maybe because of an unanticipated delay, maybe a policy choice – we need more bombers to help cover that because we're going to have more of them assigned to the nuclear mission. So it could all come together to signal, you know, a high bomber force. And, I mean, the timing – if you look at it, the timing is about right, because the bomber program – of course, they don't – they haven't released a detailed funding plan – but they say in the mid-2020s is when they'll start fielding bombers. And so you imagine there'd be a production ramp through here. So we're probably getting – you know, we're into full-rate production by the mid-2030s. And you could just extent that production run in the late 2030s if wanted to buy more bombers. So the timing would start to work out.

And then also there's the question of what do we do with the legacy bombers, right, the B-52s, the B-2s. When are we going to retire those? I think the B-52s now, their life is out to 2040.

Q: They don't have a specific retirement. They just say 2040s.



MR. HARRISON: Yeah. So you could keep upgrading them over time. But at some point, you know, they're becoming less and less useful with advances in radar systems. So, you know, that's another argument there.

Yeah.

Q: How sensitive would the GBSD program cost be to the number of missiles they decide to build? What, if instead of the 600-whatever number they said, well, we'll build half that, still have ICBMs, shift more responsibility to the bomber force. But, you know, we'll have a next generation ICBM system, just not as much as, you know, originally planned. I mean, how much of the cost is just, you know, the per-unit cost of a missile versus all the development costs and all that?

MR. HARRISON: The development cost is significant. And so keep in mind, your development and test cost is your upfront cost. If you're going to buy even one of a new missile, you have to pay all the development costs. And so that – you know, for major programs like that, like this, it can be, you know, a quarter, even a third of the total cost of the acquisition program can be in the upfront development and testing. I mean, we've seen that with the joint strike fighter. It is a significant part of the program's overall cost.

And the variable part of the cost, the part that varies with the number that you buy, is that production cost. And then also keep in mind your production costs are going to start off higher and then as you go down the learning curve they'll get cheaper and cheaper. So when you scale back the number of total missiles you procure, the ones you're cutting are the cheapest ones, because they're at the end of the production line when you've come down the learning curve. So I think reduction in quantity that you end up buying doesn't save you as much as if you just kill the whole program or you delay the program. And delaying the program doesn't really save you money, it just gives you time and it smooths out the bow wave of modernization programs, so.

Q: One of the things you really emphasized in the report – and you kind of touched on it a little bit, but I wanted to just have you circle back for a second on it – is the question of encouraging the Air Force to keep the alternatives open in the short-term, which – I mean, you obviously don't want to go out and say this is the solution they should pursue, but that's –

MR. HARRISON: Yeah.

Q: – pretty up-front that that's something you feel they should do at least, and they're looking to do that.

Is there a window when some of these alternatives start to really close, in your mind? And given the fact that the NPR is apparently going to be done by Christmas, you know, has that window closed?

MR. HARRISON: So I don't think the window has closed. The one thing I'm pretty up-front in recommending in the report is the easy thing you can do to help keep options open is slow your test rate right now.

Q: Right.

MR. HARRISON: Stop testing so quickly – (laughs) – because as you’re losing missile bodies, you are pulling back the date at which you can possibly extend your force.

So go ahead and put yourself on a different glide slope. You can always come back. And next year, two years from now, you can go back to a higher test rate if you want. So slow your test rate now. It’s kind of – I think it’s a no-brainer.

In terms of the GBSB program, you know, do you keep with the program of record? Do you delay it? Do you keep some of the missiles longer than their expiration date? You’ve got years that you can make up your mind. And delaying the program – if you’re going to do that, you need to do it before milestone B, or you’re going to start to incur a heavier penalty.

Q: What’s the test rate now?

MR. HARRISON: We alternate. We average four and a half a year, four/five in different years, so averaging four and a half a year. And what I’m saying is we take it under three per year.

Q: And milestone B is 2021?

MR. HARRISON: I believe that’s right, yes. Yeah. Yep.

Q: And I know just aside from, you know, sort of delaying things, you’re not really recommending among those four alternatives one specific one right now because of the uncertainties. But just, you know, looking at the political situation, you know, budget forecast, which one do you think is the most likely among those four?

MR. HARRISON: Yeah, I mean, I always bet on the status quo, so the baseline. (Laughs.) Always bet on that, I mean, and the reason being that if you really are committed that you’re going to keep a minimum force of 400 missiles and you don’t think it’s realistic that you’re going to negotiate any kind of new reductions in the foreseeable future and you’re not going to do them unilaterally, then that is the best option, is you stick with the baseline program of record and just be ready for the fact that if you have an unanticipated delay, you may end up with – you know, with option two here.

So be ready for that. But you know, I don’t think that’s what they’ll plan for.

Q: Well, it’s a little bit different. Sort of – that’s not what they’ll plan for, but in terms of most likely, that may be a more likely scenario –

MR. HARRISON: Well, or –

Q: – because of – not planned delay, but as you said –

MR. HARRISON: If we could fast-forward to the year, you know, 2040 and say, OK, what is most likely to have happened by then, I would bet it’s some variation of a slip in the program, yes. I think the plan coming out of the NPR, though –

Q: Right.

MR. HARRISON: – I think is likely to be the baseline. And I mean, among these, probably the most realistic alternative to the program of record would be this one, that would actually be feasible. I don't think it's the most likely necessarily, but it could be feasible. The others, I think, have real political challenges, particularly alternative three. I think that's got real political challenges to go out and say we are intentionally going to keep missiles that are less reliable. (Laughs.)

Q: Ask you to extrapolate a little bit here for a second. So you talked about the (diad ?) a lot.

MR. HARRISON: Yeah.

Q: And you said it's going to be almost – if everything stays on track, by 2022, I think you said it'll be same as tanker almost, same as –

MR. HARRISON: The bomber.

Q: Bomber. So with all those and with TIAX (ph) and LRSB and all that stuff, do you see another program that would lose out to GBSD if it comes down to it?

MR. HARRISON: One of these others that might take a hit?

Q: Or one of the ones not here.

MR. HARRISON: Yeah.

Q: I mean, given the focus this administration at least has on nuclear stuff –

MR. HARRISON: So it's interesting that every time the Air Force has said their top-three acquisition priorities, they've been very consistent for years that F-35, B-21, and KC-46A –

Q: Right.

MR. HARRISON: – they don't prioritize them on those, but they're very consistent in saying those are the top three priorities. I've never heard them say the GBSD is in their top priorities. So that's why I point this out. If they're serious that these are their top-three priorities, then GBSD and all these other programs like TX – those – that's where the trade space would be in their budget.

So, I mean, you know, there's been the whole brouhaha over Air Force One replacement.

Q: Right.

MR. HARRISON: We'll see what happens with that. That's a major program, but you know, it's relatively short-term. You know, it's not going to be a multi-decade program like these. And the total value apparently will be less than 4 billion (dollars) –

Q: And the KC-46 – I mean, with the fixed-price contract that the Air Force has with that, it really doesn't make a lot of sense for them to monkey with that program.

MR. HARRISON: You don't want to monkey with it.

Q: They're getting a very good deal on that aircraft –

Q: But only for the first 18, right?

MR. HARRISON: I think they've already got – I think they've got options built in and limits for the others.

Q: OK.

MR. HARRISON: The other thing with KC-46 is that's only enough to replace about a third of the tanker fleet.

Q: Right, they still have two follow-ons. Right.

MR. HARRISON: So in all likelihood, what's in the program of record for the KC-46, they're just going to have to extend that and keep buying that plane much longer than –

Q: Right. Yeah, they've got Bs and Cs – I mean, right? There's two other increments here.

MR. HARRISON: Right. Yeah, I mean, they talked about a KC-Y in the past. I don't think we'll see a totally different platform. (Laughs.) They'll just keep the production line running for a while. So that one – yeah, I don't know that there's a lot of room to fiddle with it.

So the F-35, you know, among these – that's one where you do have some wiggle room, because you've got some insulation because of international orders and the other services, and also you can stretch it out. And so they're already doing that. It looks like they're not going to get to the planned production – full production rate for the Air Force, which was 80. You could keep it at 60 or even lower than that.

Q: And they've already said it was 2038, and now it's 2044, I think.

MR. HARRISON: Right.

Q: Yeah, they've already –

MR. HARRISON: Right. When they lowered the production rate, they extended it out. You could do that again – or again. That is an alternative.

Q: OK.

Q: And – sorry, I just wanted to clarify something you said earlier. You know, Air Force officials have been saying, well, it's actually cheaper to build a new system than to life-extend the Minuteman-III. But are you saying that that's –

MR. HARRISON: That's because of the constraints they put on that analysis –

Q: Oh, okay.

MR. HARRISON: – because their option to extend the life also included the option of building the – also included building the new missiles, the cost of building new missiles, because of the 450 level rather than 400 and because they keep the test rate. So you run out of missile bodies even if you extend the life.

Q: Gotcha. So that was – that's only if you look at, you know, a 10- or a 15-year window, right? It's when the Air Force – you know, the life-extension thing is actually – would actually be cheaper if you look at the shorter window versus the long window where you have to do life extension and then eventually build a new one anyway? Is that –

MR. HARRISON: Well, no. So the only way the life extension becomes a viable option is if you do this and you reduce the test rate.

Q: Oh, OK.

MR. HARRISON: And then it extends your window out to 2050.

Q: Okay, gotcha.

MR. HARRISON: So a slight change in the test rate gives you a lot more option space here. So that's the main difference, and they didn't consider that. That wasn't part of the terms of reference at the analysis.

Q: OK.

MR. HARRISON: That also – in their – in their AOA and their report to Congress about it, they just report the cost over 60 years. And that's great. That's important, but the peak years of funding is ultimately what constrains programs. When are the peak years of funding? And so with the life-extension program, if you did it this way, you smooth out those peak years of funding and push them out into the future.

Q: Gotcha.

MR. HARRISON: But I'm not criticizing the Air Force AOA, because the team did what they were told to do. You put constraints on it. And also, I'm not sure why they were given the constraint of 450 missiles, quite frankly. It was 2014. They had not made the final decision how to implement New START and to go to 400, but everyone kind of knew that that's where we were headed. So –

Q: But we only have 400 right now.

MR. HARRISON: Right now we've already taken down the deployed inventory to 400. We have a total inventory of about 500.

Q: Oh, OK.

MR. HARRISON: Yeah. So the other hundred we are burning down with tests until they get to the end of their life, and then we're going to retire them early. Well, no, I shouldn't say –

Q: OK, so the Air Force – but the Air Force in their consideration considered 450 deployed.

MR. HARRISON: Right.

Q: OK, yes.

MR. HARRISON: Right.

MR. QUINN: OK.

MR. HARRISON: All right?

MR. QUINN: All right.

MR. HARRISON: Any other questions?

Q: Oh, I had one more. There is a technology roadmap that goes along with the new GBSD that includes – that starts quoting future devices and things that you can plug into GBSD along the way. Do you think that there'll be lots of different attachments to GBSD program that aren't necessarily funded under this baseline effort as we go along, you know, potentially new reentry vehicles and revived programs from the Cold War that might come and shore up some of the budget too?

MR. HARRISON: I'm not sure. I mean, I haven't seen a lot of talk about that. I mean, I think that the main focus in GBSD program initially is just getting a missile, a new-designed missile developed and tested and reliable. And the things you can do to tweak the operation and performance later, things like the reentry vehicle – that's down the road. So I'm not sure. I mean, there's too much uncertainty there.

Q: OK.

MR. HARRISON: Yeah.

Q: And sorry to go back to this point, but I just want to make sure I understand this fully. I think that, you know, Air Force officials – unless I'm misinterpreting what they're saying, I think that they have argued that the cost of the Minuteman-III life extension itself, you know, whatever that period would be, before building a new system would actually be more expensive than just going ahead and building GBSD. Is that – am I misunderstanding, or is that –

MR. HARRISON: There's a footnote that's missing there –

Q: OK.

MR. HARRISON: – is that their cost of the life-extension program is over 60 years –

Q: Oh, OK.

MR. HARRISON: – which by definition includes also building a new missile.

Q: OK.

MR. HARRISON: That's how they ended up where – now, in fairness, the life-extension program is not cheap. You have to do a lot. I mean, we went through this in the late-'90s and the 2000s. And you know, it – you are incrementally replacing just about everything in the missile over time. You could do it slower, though, so it stretches out the cost.

But if you slow the test rate, you can push out that new missile design way into the future.

Q: OK.

MR. HARRISON: Yeah.

Q: So that isn't, like, looking out over the next 20 years, saying GBSD is cheaper. They're taking –

MR. HARRISON: Their look – their look was at 60 years.

Q: OK, gotcha.

MR. HARRISON: Yeah.

Q: Yeah. Sorry, I just wanted to clarify that.

MR. HARRISON: Yeah. Yeah. I mean, and that's the odd thing – I'll go to this chart – that if you extend the life of the missiles, you still – you're still going to be on this slope with the number of missile bodies. So you extend the life of the missiles, and you can see where it goes. It doesn't go very far.

And with their limit of 450, you actually hit it right around here. So it doesn't help you much at all to extend the life in the missiles if you keep the test rate where it is and keep 450 missiles. So it's kind of odd that they analyzed it that way, because, like, why would you extend the life of missiles and then just replace them within a few years anyway?

Q: Gotcha.

MR. HARRISON: But those were the constraints. Like I've said many times before, I've never seen an analysis of alternative that wasn't rigged for a particular outcome by the terms of reference. (Laughter.) That's just the way the building works.

MR. QUINN: OK. Todd, do you have anything in conclusion? You're good?

MR. HARRISON: No, I think that's it. If anyone has any follow-up questions, feel free to email me or give me a call later.

Q: Are we going to get the slides?

MR. HARRISON: Sure.

MR. QUINN: Yep. And just one final thing, as you're coming out, if you want to put down your email, we'll send you the transcript. It's being live-transcribed right now. So it should be available in a few minutes actually.

(Off-side conversation.)

Q: So, Todd, here's a question for you.

MR. HARRISON: Yeah?

Q: Has there ever been a working system discussed on Capitol Hill that has looked at more than just dollars, where they've actually looked at, like, you know, what the enemy has and all that sort of stuff, or does that just go out of their heads completely?

MR. HARRISON: No, I don't – I don't think that's fair. I think they do consider – yeah, I think they do consider, OK, you know, what cost does it impose on an adversary, how does it compare to what an adversary is doing. They do consider the threat environment and will our weapon system actually perform well, given, you know, the – (end of available audio).

(END)