



Mitchell Institute for Airpower Studies

**Presentation: “Triad, Dyad, Monad? Shaping the US Nuclear Force for the Future”
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Dr. Rebecca Grant, Director, Mitchell Institute

Dr. Christopher Bowie

Dr. Robert Haffa

Dr. Dana Johnson

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Mitchell Paper: [Triad, Dyad, Monad?](#)

Grant: Good morning. I’m Rebecca Grant. I am the Director of the Mitchell Institute which is part of the Air Force Association, and it is my great pleasure this morning to have a super panel of some of the top scholars in Washington, D.C.

What I’ll do is tell you first a little bit about the institute itself, introduce the authors, and then it will be over to them for their presentation which will take about 30 minutes or so and then we’ll have plenty of time for your questions.

The Mitchell Institute was founded in order to celebrate the leadership and the role of airpower as personified by General Mitchell. Mitchell is a very well-known name. What some people don’t realize is that he was the first to command a coalition force of aircraft assembled for the Battle of San Miguel in September 1918. This was the first real integrated air offensive, including fighters, aircraft performing interdiction behind the lines. It was the first example of what we would call a modern air campaign.

As most of you know, the aircraft in this were not all U.S. aircraft. Billy Mitchell had to borrow quite a number of aircraft from the British and the French and others to make this offensive happen. In the end he had about 1100 aircraft available for that three day campaign that began the modern age of air campaigns as we know them.

After that Mitchell served in Washington which wasn’t any fun at all, even back then, and later led developments in bombing and the development of bombing aircraft and weapons themselves, through the famous experiments including the sinking of German battleships off the coast down in the Norfolk area.

He was court-martialed and later resigned. Died in 1936. It’s interesting that one of the pall bearers at Mitchell’s funeral was George Catlett Marshall who rose to fame in World War II, but had in World War I been the lieutenant colonel who planned the San Miguel offensive for which Mitchell provided the airpower.

Mitchell's legacy, perhaps the greatest piece of it, was his influence on subsequent leaders of the United States Air Force, the Army Air Forces of the United States Air Force, individual associates Hap Arnold, Ira Eaker and Tooey Spaatz.

So with the Mitchell Institute we celebrate his interest in airpower in all its forms today — air, space and cyber space. We celebrate that record of leadership. And we do this through timely research and writing on topics in airpower and all its forms.

Today's topic is not only timely, but fascinating because we have three truly eminent scholars who are here to discuss some rather startling but well-founded recommendations for what to do about our nuclear deterrence posture. Let me introduce them.

We have Dr. Bob Haffa, Dr. Chris Bowie, Dr. Dana Johnson. They all share in common having spent some time associated with the Air Force. Bob Haffa, a retired colonel with over 25 years of service; Chris Bowie worked on the Air Staff and later served in the Senior Executive Service in Air Force Plans; and Dana Johnson also served some time on the Air Staff as well. They all three have PhDs. Dr. Haffa's from MIT, Dr. Bowie's from Oxford University, and Dr. Johnson from the University of Southern California. They all have what I can only describe as a copious record of publications in the area of airpower and space as well. You really will not find three more distinguished scholars. They are currently colleagues at Northrop Grumman's Analysis Center, Northrop Grumman's independent corporate think tank that deals not only across the corporation but with other think tanks as well.

So the scholarly weight of these three individuals is tremendous, indeed, and with that I turn it over to them so that they will give you their conclusions on the triad, dyad, or the monad. Thank you.

Haffa: Thank you, Rebecca. Wonderful introduction. We'll see if we can live up to it.

Thank you all for joining us today. It's a pleasure for us to be here. You heard the long-term associations we all have with the United States Air Force. And to work closely with the Air Force Association to have them publish this work that we did is really a treat for us.

It's nuclear forces that we are going to talk about here today. That's what the briefing and the paper focus on.

You've been reading the papers just as we have. There are two events ongoing right now that are probably going to affect the future of what U.S. strategic deterrent forces, nuclear forces, look like. One of those is the Nuclear Posture Review being conducted by the new administration in conjunction with the Quadrennial Defense Review. It's about the third NPR now that the U.S. Department of Defense has come out with, and each one of them has brought significant changes to our nuclear forces and to theories of deterrence and stability. It's an important document. We all wait to see what it will bring. And the work that we did here was an effort to contribute to that thinking.

There is a parallel effort going on, also a repeat of some efforts we've seen in the past, and that is what's been called a new START Treaty. That's the Strategic Arms Reduction Talks being carried on now with the Russians in order to again shape both U.S. and Russian nuclear forces for the future. If you are taking note of this, the existing START Treaty just expired on the 5th of December. The agreement between the two parties has been that we'll continue to abide by that treaty. There's also another treaty that's in existence that was signed by the Bush administration that has capped operationally deployed nuclear weapons. We're going to use both of those as framework. Dana Johnson's the arms control expert here and she'll talk to that. I'll try to do most of the talking but this was a joint effort and I'll let my colleagues both bring me up to date when I get something wrong, and deal with their areas of expertise as we go on.

So we're going to look at what should the triad look like in the future. When we're talking in the future, the NPR is a long-range look—although it often has impacts within the FYDP, within the budget. Arms control treaties last for a long time, so the START Treaty that just expired was 1991. So these are not just short-term issues. What the NPR and the START agreement will come out with will affect America's deterrence for a long time.

Although we're seeing references to the Nuclear Posture Review and to the new START agreement, what we haven't seen much about, although I'm sure our friends in the Pentagon are working hard, is what American nuclear forces look like and what should they look like under these new caps.

So what our contribution attempts to be here today is to think about what should an effective force look like for the future, given that nuclear reductions are a fact of life.

When we talk about numbers, here's what we're hearing and there are two principle categories. First of those is operationally deployed weapons. We'll use the acronym ODW. The SORT Treaty, the reduction treaty signed by the Bush administration had numbers of about 2,200 operationally deployed weapons. We're there, the United States is there at that number right now, and we'll sort through these a little bit as we go for you.

The agreement last year or in the statement here this year talks about bringing both deployed weapons, reentry vehicles on submarines, bombers, and intercontinental ballistic missiles down to this range of 1,500 to 1,675. Secretary Gates has said 1,500 is about as low as I'm willing to go, so in this study we took 1500 as our point of departure. So the question is how do we get from 2,200 to 1,500, and we'll suggest some approaches to that.

The bottom bullet is important, too. START treaties are with Russia. The Nuclear Posture Review will probably focus principally on nuclear deterrence regarding Russia. We always have to consider China as well. These are the two states that exist currently that could attack the United States with intercontinental strategic nuclear systems. Russia remains the only state on Earth that could essentially destroy the United States

with its nuclear arsenal. So NPRs and START Treaties focus on those principal challenges to what our nuclear force should look like in the future to ensure deterrence and stability.

There's a whole range of other issues here, also important, that we didn't touch on in this paper. That's what Dana and I in the previous work that we did called "The Second Nuclear Age", that's proliferation. That's the challenges of Iran and Korea and others. We don't deal with that here. We'd be glad to send you that other paper if you're interested along those lines, because their ideas of conventional deterrence and missile defense really come into play. But we're going to stay with the nuclear issue and the strategic one this morning.

I gave Dana a cue here. Talk a little bit about where we are in arms control.

Johnson: This is a chart that shows the current elements of the triad. The ICBMs, SLBMs, and bombers. You'll note that most of our warheads are in the submarine force, the SLBMs. And there are about a quarter in ICBMs and a quarter in bombers.

These are the two sets of numbers between the START Treaty which did just expire, and SORT, otherwise known as the Moscow Treaty. So these are the numbers that we started with in doing our analysis of alternative force postures, starting from 2,200 and moving down to 1,500.

You'll note also that the SLBMs are MIRVed at about a four to one ratio, but the ICBM force is moving towards single warhead because that is considered far more stabilizing.

We'll get into some of that. Some of those discussions are part of the attributes of the current triad against which we evaluate the different options that we're going to examine.

Haffa: Here's where we are. The triad as we all know it, so just to briefly review that, here's the status of each of those legs. Each of those legs over the years have been extremely important in establishing deterrence and stability in the strategic nuclear relationships that we are talking about.

Our current ICBM force, as you can see the idea is to extend that force through sustainment and modification up until 2030. Those are the plans that are currently on the books. It's a possibility of extending that force even further. No plans for a new ICBM in any defense plans that we've seen, although it is interesting to know that both Russia and China are building new ICBMs.

SLBMs, yes. There is a modernization program here being planned by the Navy to replace the current Ohio-class strategic ballistic missile submarine. They start to move out in 2027. The lead time being such as it is, the Ohio replacement program is already making itself known in Navy plans and budgets with delivery by 2025. Also of concern there is the missile—the Trident II D5 currently on the Ohio-class submarines and alive to 2042.

So of the three legs, the SLBMs are probably in the best shape in terms of looking out to the future and establishing deterrence and stability as we've been used to it.

Bombers, conversely, are probably in the worst shape in terms of looking out to the future for our contributing to the strategic nuclear deterrent. There's been lots of talk over the years about a next generation long range strike system, NGLRS, but most recently that was placed on hold by the Secretary of Defense. We may see some hopes of encouragement in the QDR. I saw a statement by the [Air Force] Chief of Staff, General [Norton A.] Schwartz, in the paper a couple of days ago that said as the Air Force continues to fight for dollars for long range strike, a new program may be initiated in the QDR. We can all hope that that's the case.

In the mean time we have B-2 upgrades ongoing. A small force, as you know, 20 airplanes. And also extension to the venerable B-52H that no matter how young we are or how old we are, the B-52 has been around forever and it looks like it's going to continue to be that way.

The trouble with the B-52, a great airplane, is not only its own age and the need to keep it flying, but the fact that given it's a non-stealthy aircraft, it relies on air launched cruise missiles—nuclear cruise missiles—to contribute to the triad. That ALCM is bringing up its own concerns. It's an old missile and we would probably have to do something to that as well if we're going to modernize that for the future. So the B-52 has a couple of things weighing against it in terms of its strategic nuclear contribution as we look to the future.

So how should we approach thinking, which is what we did in this paper, about what the future of the triad should look like? We took what might be somewhat of an unconventional framework for analysis, but it's one that allowed us to do some comparisons about what future forces look like. And future, we're talking 2040, 2050.

The triad has terrific attributes in terms of deterrence and stability, and probably the best of all worlds would be to maintain those capabilities across those three legs. But as I just suggested, plans to do that are not in place.

So we said well let's take a look at some opportunities to shape America's nuclear forces differently and one thing that you can think about was what we termed a monad, a single leg on which strategic nuclear deterrence would depend.

If you think of that and you look at current plans on the books, the only thing that really makes sense there would be to have a monad based on the submarine launched ballistic missiles, so that's what we did. If you're going to do one of those, for a number of reasons probably an all submarine force makes sense.

So let's compare, and what we're going to do is compare each one of those sources in terms of what the triad brings us today — deterrence and stability.

Then we looked at a couple of combinations that we called a dyad. If we took the three legs down to two, what do those combinations look like? Again, in their contributions to deterrence and stability.

When you work with Rand people as I have learned to do — [laughter] — they like this graphic. We call it a spider chart. It is a very useful analytical tool when you're doing multi-variant kinds of analyses to compare a wide variety of capabilities across a single or multiple system. So thanks to my Rand colleagues we are going to use this mechanism, this diagram for you to talk about deterrent effect and how those monads and dyads and triads compare.

Because this is pretty important and because nuclear fluency seems to be somewhat of a lost art these days, let me just take a spin around the spider with you and talk about some of these categories so that when we compare them we're on equal footing.

The first one at the top, at 12 o'clock, we've already referred to, that's operationally deployed weapons. A key part of that in terms of contributions to deterrence is the number of warheads that are on alert. What we are interested in as we reduce, which is a fact of life, are nuclear weapons, how are those operationally deployed weapons going to change, in smaller numbers, and what percentage of those will be on alert.

Today we have 829 deployed warheads on alert. That's a combination of nearly 100 percent of our ICBMs in the three wings that exist and the submarines that are on station that are available to launch promptly as well.

Survivability, both day to day and generated is an important contribution to deterrence. Remember your history. Remember what assured destruction was about. The whole weight of deterrence rested on the ability to launch a second strike. That's what assured destruction was about. To be able to suffer a first strike, and nuclear planners who are among the most conservative people you can imagine owing to the weight of the cataclysmic results that could occur, have always planned conservatively to ensure that assured destruction rested in a survivable force.

Survivability today, extraordinarily strong day to day with our submarine force. That's why we give them high marks and if you can talk about a monad why the submarines would make sense, but our ICBMs certainly subject to first strike, given the fact that they're in a single position, and our bombers are not on alert at all. Both of those, the bomber leg could be generated. So if we took not a worst case example, but one in which some warning was given, we could add some value to the bomber leg by vertically or horizontally dispersing it.

Aim points — now you've got to put yourself in the shoes of a nuclear adversary — are very important to stability. Right now we have 555 aim points. Those are a combination of single ICBMs in their silos and sub ports and bomber bases. Sub ports, two; bomber bases, three; don't give us very many aim points. That could solve an enemy's targeting problem and could make a first strike very attractive. 500 other aim points makes it very

difficult to plausibly conceive of a splendid first strike that would leave us no alternative in recovery.

So when you think about stability you've always got to think about complicating the adversary's briefing when that adversary's general goes in to his president and says we've got them, it's because they could launch a first strike and take out nearly all of our nuclear capabilities. I know this sounds like Dr. Strangelove, but when it comes to calculating nuclear deterrence and stability, those are the kinds of force planning thoughts you have to go through.

Ability to penetrate is key. That's holding the other nuclear systems at risk. Very high probability for penetration on the part of ICBMs. As we know, both Russia and the United States stepped away from antiballistic missile defenses. The ballistic missile defenses that you see the United States deploying these days are not against Russia or China.

The bombers' ability to penetrate is more problematic, particularly non-stealthy ones with non-stealthy cruise missiles. So when we come around to thinking about dyads you'll see a lower grade for bombers.

Promptness is key also to deterrence. You want the ability to launch as quickly as you can, again, to deter that adversary. ICBMs are the highest mark here, nearly always on alert, able to respond. For example, a launch under attack which could be an important contribution to deterrence.

I don't think there are very many submariners out here. When you talk with the submarine community they don't like the rap that they're not prompt. In fact submarines on station could launch very quickly, and in strategic nuclear exercises in receipt of practice emergency action messages they've done very well, and my submariner friends remind me of that. So you'll see the grade that we give them. But they're not designed to do that. They're designed to be survivable. They're designed to be second strike systems.

Signal of alert readiness changes. This is important. Certainly it's important when you get away from the bolt from the blue kinds of scenarios. So flexibility in your nuclear forces to send messages. Remember when you talk about deterrence and what goes into deterrence — capability, intention, communication — those are all important aspects of deterrence. So if you want to convey your resolve to an adversary in a nuclear scenario, being able to signal alert increases or your readiness to commit forces or your ability to have a greater number of those forces survive is very important. Bombers do very well here.

Crisis stability. Crisis stability is all about not having that plausible brief of a nuclear war-winning strategy. So a number of these factors play into that. Survivability of the force, promptness, number of aim points. What you don't want in the nuclear business is for anyone to be tempted to strike first in times of crisis. You don't want them to think ah, they're asleep, they're not on alert, their forces are vulnerable, there are only a few

targets that we have to hit. It is plausible for our side to strike them with very little chance of a very ragged response that could be tolerable. You don't want that to be briefed on either side. Stability is a two-way coin.

You also don't want one side to be so disadvantaged — that's why arms control talks are bilateral — that they think they would gain by striking first in times of nuclear crisis. That their forces are so diminished in terms of relative strategic stability which Henry Kissinger once wondered what that was. But you don't want them to think in times of nuclear crisis, I need to strike first. Because if I wait and he strikes, I lose. It's nuclear warfighting. It's nuclear deterrence. It's nuclear stability.

Connectivity, ease of retargeting. Again you have to think flexibility in terms of warfighting. All of these systems have different kinds of commands and control systems that they depend upon. We normally think of opportunities to communicate with the ICBM force as being extraordinarily prompt, redundant, very effective. Bombers, pretty good, but in a nuclear crisis you probably would have a pretty narrow window to talk to those bomber forces, depending upon what's happening in the atmosphere owing to nuclear explosions. But obviously retargeting works well for the bomber force. Submarines, again, I need my submarine friend by my side to assure you that they have worked very hard on the connectivity issue over the years and can provide assurances in terms of their communication. But again, in a nuclear environment it could be difficult to talk with our nuclear submarines.

So keep those in mind. What just happened? We shaded it in for deterrent effect. We're going to do that as we go through each one of these steps. What we argue right now is the triad, as composed, with those capabilities we just walked around, is extraordinarily effective in terms of deterrence and stability. We wouldn't want it any other way. So let us make it clear as we start to examine these alternatives, and thinking about future nuclear forces, we don't want to diminish that. The fact of life is that nuclear weapons are coming down. The fact of life is the United States is deliberating in its own Nuclear Posture Review as to what those future nuclear forces should look like. The fact of life is we are engaged in consultations and conversations with our principle nuclear adversary, Russia, to take down these numbers.

So how do we maintain the best of this deterrent effect as we look at different combinations, smaller numbers of strategic nuclear forces?

Suppose we just went to submarines. Probably pretty inconceivable to most of these in the audience as I look around, but if you were going to go to a monad, it's submarines that probably make the most sense. Why? They're most survivable? Why? Because of the large number of weapons that we could provide. Remember, we're looking to go down to 1,500 operationally deployed weapons. Expect that number in the START Treaty. Expect that number in the NPR. So what would you need to do? It's not very hard to get up to that 1,500 in an all submarine force.

Right now we count 24 tubes per boat, four reentry vehicles per missile. All you'd have to do is go to one more reentry vehicle, easy to do, on the Trident II D5, and you could

get very close to 1,500. The Navy would probably say oh, we'll just build a few additional submarines. And by the way, they're going to do that in the Ohio replacement class, so that could be on the books as well.

But what's the problem? Remember the aim point discussion? Most of the submarines, strategic missile submarines that we have are in port. East Coast/West Coast. Very vulnerable to surprise, bolt out of the blue. Remember the conservatism of nuclear force planners. So that's a problem to consider if you were going to put all of your nuclear eggs in one basket.

Yes, we could sortie more boats from those ports, as long as you were given warning. Secure second strike. But remember, once a submarine launches an SLBM, its position is given away, making it subject to counter-attack. So the flexibility that you'd like to have your nuclear system, launching maybe just a few missiles in response or in resolve, we lose the asset here.

And what would the adversary do? The adversary always gets a vote. Well, swing all of its resources towards anti-submarine warfare. So the ability to keep that force secure over the long term becomes more problematic.

So we think even if this was a choice that was available to our planners, it would probably be rejected because of the high degree of risk you'd get in putting all of our nuclear deterrence and stability calculations in a single leg of the triad.

Here's what's happened. Here's the deterrent effect being the shaded view of what you would get with just the SLBM force. As you go around the triad, and I'm not going to do this for each one, you'll see the number of warhead on alert. From 829 today it would drop to 480 if we kept current practice of submarines on station. Then you can see, and again, these are subjective evaluations, these are qualitative, these are my Rand colleagues over here who told me what to put on these charts. [Laughter]. You could well disagree and we could get into arguments, as we did, on where to apply very subjective low, medium high grades to these. But based on the discussion that I went through earlier, you can see why. Aim points, you drive it down to two. Talk about solving an opponent's targeting problem. You just did that. And you can see we've given them other grades, mostly medium. The submarines do best in terms of survivability which of course is their biggest plus. But a considerably diminished deterrent effect with going to a monad of SLBMs.

So let's plus that up a little bit. Let's look at some other combination of other legs of the triad that would increase that deterrent effect a bit. So one that we as an Air Force Association audience might be interested in, let's combine submarines and bombers.

Now we get too many warheads, so we have to take some down and make that 1,500 level. What could we do? Retire a couple of submarines. They're going to come out of the force anyway. We could retire them on schedule in this START Treaty, for example. Or keep that 14 SSBM force and retire some bombers. You could also de-MIRV submarines.

Just as we talked about adding RVs to submarine launched ballistic missiles, we could take some warheads off.

What do we gain? We keep those advantages that a bomber force has with it in terms of signaling. One of the cases we're going to reemphasize for keeping bombers as long as we can in the strategic deterrence is the fact to use them for discreet strikes. That gets into off-design scenarios from deterrence and stability against a classic nuclear adversary, but it's probably a capability that we want to retain.

But boy, in the case of survivability, this is not a robust solution. We go from two submarine bases to now a whole total of five targets for an adversary to essentially deplete entirely other than forces on alert, the U.S. nuclear arsenal.

So what does the bomber leg get us on our spider chart? Not much. It doesn't do anything for penetration or promptness. It does give us a plus on alert and readiness change. But in key areas, crisis stability, survivability, warheads on alert, it doesn't give us anything because the bombers aren't on alert on a day to day basis.

So the combination doesn't appear to be one that solve all of the challenges that we will face in the future.

Let's set the submarines aside and look at the combination that exists between ICBMs and bombers. Most responsive with the most flexible. That sounds good. We retire all of the submarines, don't do the Ohio replacement program. Phase them out. We'll need to add some additional warheads to the ICBMs. We have a few empty silos we could do that with. And we need to make more robust the bomber force. New ALCM for the B-52, new next generation long range strike system, a new nuclear bomber.

One of the things I didn't mention but needs to be mentioned in terms of stability is that over the years the United States has moved towards single RV ICBMs. Single warhead on an intercontinental ballistic missile. Why is that the case? Recall the Peacekeeper that had ten. The most lucrative target you could imagine for at that time the Soviet Union was a single ICBM in a hardened silo with ten RVs on it. One strike or two gets an enormous target ratio in favor of the adversary, which prompts first strike kinds of calculations.

So for our stability situation, what you'd really like is one RV on each ICBM and the Air Force has gradually moved in that direction on Minuteman III.

If you go back to MIRVing ICBMs in order to get that 1,500 number, you are fooling with stability in the wrong direction, and you probably have to increase your alert rate on bomber bases if you really were going to count on the bomber being a reliable asset in a nuclear scenario.

So better in terms of deterrent effect, but still not complete. ICBMs clearly do add a great deal to the deterrent effect here and make up for a lot of shortcomings in the bomber force. We still get the readiness changes that the bomber gives us, but most of

the other highs around the perimeter have all been added by the ICBM force, particularly aim points and ability to penetrate. A better combination.

Last one. This one turns out to be the best in terms of our deterrent value triad. Most survivable, most responsive. We have to reduce 200 RVs. If you had a dyad of ICBMs and SLBMs. Similar kinds of choices. Not very difficult. Take a couple of submarines out, reduce their MIRVs or what another submariner friend has told me, you can actually take some tubes out. You can fill tubes up to 24, you can take them down to 20. You could fill them with concrete or whatever a submarine needs to do, and not count them as filled with a missile. That could be verified. So you could take tube down. You could reduce the ICBM force.

What would you do with bombers? Convert them to conventional role. B-1B, not a bad case study. Where are bombers flying today? In what sort of roles? Conventional roles. What might a future bomber force do as we look out to the future? My bet is probably conventional missions. And you get survivability, low vulnerability, lots of aim points, prompt response. Still can't recall an ICBM, but you get an enormous plus in terms of crisis stability. So when we fill in our spider, it looks pretty good. You've lost that bomber ability for signaling alert and readiness changes, but we're very close to warheads on alert without making any other kinds of changes and high marks generally all the way around.

Again, let there be no mistake in our analysis of our alternative here, we are strong supporters of the triad. To have that in the future absolutely requires significant investment in the bomber leg. That's an investment we have not been willing to make, the United States has not been willing to make, since the B-2. There have been lots of proposals. No money.

The monad just doesn't do it for us in terms of stability and aim points. And we look at combination of dyads, the strongest one under a 1,500 warhead limit and also under an 800 launcher limit, if we go to those numbers, appears to be an ICBM and an SLBM combination.

I haven't mentioned once cost, other than saying there hasn't been any money for a new bomber. Chris Bowie can talk to that issue.

Bowie: Just briefly, if we're going to keep the triad, if you take a look at the operational support cost for it plus the modernization costs, you're looking at over the next 40 years roughly half a trillion dollars, and as the defense budget looks like it's heading downward, as our procurement and R&D dollars are contracting due to the high cost of operations, we start to look at are there other alternatives we'd want to explore.

In terms of the triad, these are unclassified estimates. All of this is in current FY10 dollars. The operating costs come from a mix of CBO and GAO reports. They're probably pretty close.

In terms of the modernization costs, the Ohio replacement, that would include the development cost for a new submarine plus I believe 14 or 12 new subs. Twelve new subs. That's the plan. Plus you need to buy a new Trident-class system which is a not inexpensive undertaking. So that Ohio replacement is both the boats plus the missiles.

For the bomber, that assumes roughly a medium sized aircraft. These are estimates done by Steve Kosiak at CSBA before he went into the government. It's roughly \$25 billion development costs, roughly \$500 million per bomber. We assumed buying 100. For the ALCM we assumed you would, basically you'd need to buy an ALCM to keep the B-52s viable until the new bomber comes into service. The cost of the advanced cruise missile which was recently retired that was a stealthy system. Those were \$15 million apiece. Buy 1,000, it's roughly \$15 billion. Not an inconsequential sum.

Finally, on the ICBM, now we had some internal debate on this. The belief is that with modest upgrades you can keep the Minuteman IIIs out to 2030. The Air Force is looking and believes that it can probably be extended to 2050 with roughly \$250 million a year investment. If you decided you wanted to replace it, that cost would be roughly \$40 billion.

Those are the elements, and then these are the costs of the various mixes. Again, for these, if you wanted to replace the ICBM as well, add another \$40 billion to those totals.

Haffa: So here's what we concluded. The purpose of this exercise was to optimize that deterrent value which we described to you on the spider charts with a new directed number of 1,500 operationally deployed warheads. You want deterrence, you want stability out of both START and the Nuclear Posture Review.

To do that we recommend strongly that the ICBM force be retained for all those reasons that we've pointed out; that the SLBM force be retained in those numbers. We are not at all advocating that the bomber be removed from the triad, but the writing on the wall and the budgets that exist and the plans that are in the making suggest that it's going to occupy a narrow, the bomber leg will occupy a narrower contribution to strategic nuclear deterrence.

So keep the B-2s, keep them modernized, keep that niche capability. And then as far as the B-52 goes, not only the age of that aircraft but the age of the ALCM, and the opportunity costs that it would take to invest that, we reevaluate the B-52 and the ALCM in terms of cost.

So the term we coined was a de facto dyad. We're nearly there today. And it looks from our judgment like we are headed in that direction. Maintain the ICBM and the SLBM force.

What is the future of the bomber? We suggest it might be to the best advantages of the nation and the Air Force to take costs that might be swung to a strategic nuclear bomber which will one, make a marginal contribution; and two, be captured by START numbers that are driving the U.S. nuclear force down. Take those dollars and put them in a new

conventional bomber which will fulfill the roles and missions as we look to the future and that the bombers are fulfilling today and probably are going to be needed and counted upon in the next 40 years.

It's been our pleasure talking to you and we welcome your questions and comments.

Grant: Thank you very much. I'm going to ask the first question, if I may, then we'll open it up and let you acknowledge the questioners.

What do you think would be lost by reducing the bomber participation in the triad? What if anything would be lost in that? Particularly in extended deterrence.

Haffa: As we showed you on the triad, not a great deal is lost. The flexibility of the bomber force, the ability to alert it, the ability to move it, the ability to send signals, all are positive. Who do you want to send signals against? It may be not the principal strategic adversaries we are talking about here, but it may be a new proliferated future and obviously North Korea and Iran are clearly on people's concerns.

So what does extended deterrence look like? There is a very good study that I got to participate in coming up from CSIS that you all might want to watch for.

In our view — my view. [Laughter]. Extended deterrence is probably going to depend a great deal in the future on extended conventional deterrence rather than extended nuclear deterrence. When we talk about defending our allies — Well, look at what's third site in missile defense been all about? It's been about reassuring, extending deterrence to our allies in Europe against a nascent nuclear threat that could hold them at risk. The choice that we made thus far is to increase missile defenses. I would argue that the role of the strategic bomber, the strategic conventional bomber, could be very strong in extending conventional deterrence that's capable, that's credible, it's reliable, that reassures our adversaries, and perhaps has much more possibility in terms of use, as we have demonstrated, than a nuclear bomber might bring.

Grant: We're open for questions.

Voice: As an operator, if you were to ask me, not having read your report, I would have said flexibility is more important than you've given it credit for, and that I would proceed apace with a bomber that is nuclear capable and I would, if I had number problems I would slightly de-MIRV the subs because once they launch they're no longer hidden any more.

I think General Lowe in his Omaha Journal piece that came out this week would agree with me on that.

Can you address the flexibility side of the house? And secondly, is there money to be saved by not having a nuclear capable wing? How much money is that?

Bowie: It's a good question on the money side. What you could do would be to acquire the bomber as a conventional system but put in provisions that should you want to make it nuclear, you could at a reasonable cost. If you try to go into an aircraft after it's built and then harden it, it's very, you basically have to tear it apart. So by doing it smarter you could minimize those costs.

In terms of the flexibility, the bomber had distinct advantages there, but you are retaining the 16 B-2s which carry roughly 16 nuclear weapons per aircraft. So is that enough? Is that enough for you? Or do you need the 100 with 16 weapons?

Voice: I'd just point out that the B-2 is 20 years old today. The first one was delivered almost 20 years ago.

Bowie: Right, but it's good for another 40 years, roughly. It has very good signature, it can be further improved. They're putting additional enhancements into it. So it should be viable for a significant amount of time.

We are basically right now at an effective dyad with the SLBMs and ICBMs and the 16 B-2s, and the B-52s are fading unless you choose to put the ALCMs, acquire new ALCMs. But that's a significant opportunity cost.

So is 16 B-2s sufficient for the flexibility you seek in the future?

Haffa: Where are we going to need flexibility in the future? In nuclear forces or in conventional forces? Our conclusion when we came to thinking about the future of the bomber force was you probably need more flexibility in conventional bombers than we do in nuclear bombers.

If we could just buy as many bombers as we wanted, and they were dual capable. Great. But the writing on the wall in the NPR, in START, tells us that the numbers are coming down. And we're being pretty generous here in taking the 1500 number. There are pressures to go to far lower numbers than that.

Why if we demand flexibility from long range precision strike force should we include those under counting rules that will limit the numbers that we have?

Voice: Are you asking me? [Laughter].

Haffa: No, sir. But you're welcome to —

Voice: Let me as one more follow-up question. If there was some new technology out there, some new technological breakthrough, aren't you at risk? Let's say somebody comes up with some new way to keep track of subs. Aren't you a little bit at risk with this kind of recommendation?

Bowie: That's why we've gone with the triad. Now you do have, the SLBMs and the ICBMs do have a different basing mode and so on, so that would be your hedge against

the breakthrough in ASW technology. That's why we adopted the triad back in the '60s was each had a new set of attributes, raised a unique set of defensive challenges to the adversary. And if you go to an SLBM, ICBM, you could be at risk to a breakthrough in missile defense technology. However, against large mass launches we have not come up with any way to successfully deal with that. We have enough trouble with small launches.

So whether that's, I think the chances of that being a significant, of a significant breakthrough occurring are very slim right now.

Voice: A quick follow-up on the bomber comment. Could we go to Slide 10? Is that possible?

The idea that you have to retire a portion of the B-52s to get your ODSNW [Operationally Deployed Strategic Nuclear Weapons] down, as you know, the counting rules for the bomber weapons is that anything on base that's collocated with the bombers counts, right? Another way to get your ODSNW, you move the weapons somewhere else, or build, do like the Russians do. Build a fence between the weapons and their airstrip and call it a separate base.

So the idea that you'd have to cut your actual aircraft inventory to get your ODSNW down, at least under the current counting rules is a —

Bowie: START or SORT?

Voice: START. And a joint count under SORT, you also don't count weapons not at a bomber base. So that's one way you can get around that.

And just another question on your bomber numbers. It looks like when you're doing your comparison of alternatives on the bomber force, on your dyads you don't include the cost of the bomber, even though you recognize the need for a conventional and possibly even nuclear capable bomber in the SL/IC dyad, you don't include any cost for that. But then you transfer the entire cost of the bomber into those alternatives that do have a bomber, even though there's significant synergy between the conventional and the nuclear mission.

So wouldn't a fair comparison just include the cost of nuclearizing the next generation bomber instead of the entire cost of the entire bomber cost, out and follow-on programs?

Haffa: We didn't really consider cost in the spider. That was —

Voice: I'm not talking about the spider. I'm talking about the cost.

Haffa: Then when we talked about cost, yeah, that's one way that it could be looked at. As far as I know it isn't being looked at that way. Maybe this discussion about a conventional versus a nuclear capable bomber would illuminate those cost differences.

No doubt about it, the bomber had a big advantage in terms of the triad in terms of being able to carry out the convention mission. And it does that every day.

So we would, I think, agree with you that all calculations should not have a singular mindset. The problem is the way that the bomber has been presented in its budgetary efforts thus far has been as a strategic nuclear bomber and that's the cost that is attributed to it.

Voice: At risk of making an editorial comment rather than asking a question, I'm the Air Force Force Structure representative to the NPR, and I understand you folks are working out of what's widely or maybe not so widely thrown out there. But I would say that some of the assumptions, a lot of the numbers in math were off significantly enough to I think color your outcomes. I would also say that the conversation around bomber cost and the fact that we're going to buy a conventional bomber. And what is the marginal cost of making it nuclear.

I would not typify the positions of the department, from OSD down to the Air Force, as being what you have characterized them in your presentation.

So with respect to the need for standoff, with respect to the need for a future bomber. So the question comes down to if you're going to have a future bomber, and you are; and if you're going to have to have standoff, and you are; then what is the added value and what is the added cost of providing a nuclear capability, especially in a world that emerges where the flexibility to address multiple adversaries or multiple combinations of adversaries, given the geographical constraints of a missile going anywhere from a missile field in the United States to any place else in the other hemisphere, having to transit Russia, whether or not they are the adversary, makes flexibility a very valuable asset and an asset that comes at very low cost.

So I would heartily disagree with the typification of the bomber as a future niche capability in the NPR's findings as they come out or in the Air Force's thinking about the future.

Haffa: It's great to be corrected by people in the know. We are not, admittedly, up with what you all are doing. And just what you are doing doesn't get out into the public. The only point that I think we make that both supports you and that we slightly differ on is great, I think everyone in this room champions a new bomber. Our concern is that that new bomber, in numbers, is going to get captured by START. And all that flexibility you just talked about wanting to have against a whole range of different adversaries who may be conventional or nuclear, will be limited by that new bomber's numbers which are likely to be in the 20s, not in the 100s.

So if you want a long range precision strike system that flies all the places you want it to fly, holds at risk all the targets you want it to hold at risk, and look at the practicality of the future conflict spectrum it's likely to engage in, I'd like a lot of them. If you call it nuclear, you're not going to get a lot of them.

Voice: You touched on one of the strategies for dealing with that. Not all the bombers that you build have to be made nuclear capable. If you approach the problem a little bit differently and think of the problem in terms of how we will do things in the future rather than how we must modify our weapon systems from the past to comply with accounting rules. And I would also argue that we've learned a lot about counting rules over the years. As we negotiate future treaties, we'll take that into account, rather than necessarily continue to make the same, have the same sorts of positions that we've had in the past where they hinder us from an appropriate strategy for the future environment. A future environment, which I agree, is probably lower numbers than we're talking about here.

So that actually does get me to a question which is, did you look at, as we get down to very small numbers, at distant periods in the future, what the best force structure looks like there? And might you not be in danger of precluding yourself from reaching an appropriate force structure at that point in time by making inappropriate decisions early along the path to that goal?

Haffa: We just looked at 1,500 because that's the number that's —

Voice: So you looked at 1,500 in 2040.

Haffa: Yes. That's as far as we go.

Voice: I have an observation that may be somewhat related to the conversation that's been going on, and that's on the spider charts themselves as an analysis tool. I recognize they're a tool, and not perfect in that respect. But one of the things that, using them visually to try to compare different options, you're basically looking at the area that you cover in the different options. And that obviously assumes that the different spokes of the wheel are more or less equal in value. And so that's one issue. And like I said, it's a tool, you've got to start somewhere. I'm sure you recognize that.

Bowie: You don't do a scientific calculation from the area covered. But it's a visual —

Voice: Right. It's a visual tool to indicate which are your best options. And if, for instance, one spoke is twice as important as another, or ten times as important as another, the spider chart methodology doesn't tend to capture that. And that's not a criticism, because I know you're aware of that.

But more relevant, I think, and relevant to the comments that were just made is, some of the things you've identified as the spokes, in my mind are correlated in a strategic sense. What I mean by that, in particular as an example, and there may be more examples, is aim points and ability to penetrate. Your first option there, the SLBMs and bombers, looks particularly bad on the spider chart because the aim points go down to 555 to five, and so you get no area there. But the ability to penetrate is very high.

I would argue that those are really correlated strategically and could be captured by a different concept, ability to counter a first strike, or ability to strike at all. And by

correlating those two, that's a more important effect-based type of outcome because aim points itself is ignoring the fact, for the SLBMs, if you're just saying okay, I'm going from 555 down to five aim points and that's bad, is ignoring the fact that there's all these SLBMs, or some number of SLBMs out there that are safe.

So to my mind, those two correlate in a strategic sense, so actually your option there that looked the worst isn't as bad as it seems as depicted on the spider chart. That would be my argument.

Voice: I was about to say the same thing, but also I think you're triple counting, for example, pre-launch survivability. You have one spoke for generated, one spoke for day to day, and then you have one spoke for what you call crisis stability. Well surely pre-launch survivability is a very important component as you've mentioned in your paper of crisis stability. However, for competency you only have one case. Whether or not it's day to day or generated, it makes a big difference there but you're only counting it once. So a lot of things are getting triple counted. The probability to penetrate is another thing you double count. You have one spoke for that, but that's also part of survivability. And the way that we calculate survivability and all those sorts of things.

And then on the spokes, sometimes you add them right, for the ones that are countable; then sometimes you take the one that's the maximum. So when you have a high and low survivability do you average them out and get a medium? No, you pick the maximum one. All of that is too above my level of intelligence.

Haffa: We'll admit it's very subjective.

Johnson: They're intended to generate discussion.

Voice: Successful. [Laughter].

Voice: I'll ask a political question. Do you have any concern that if you push hard on the case that we don't need the next bomber to be nuclear, that you're in fact undermining rather than strengthening the case for actually building that next bomber?

Haffa: First of all we don't answer political questions. [Laughter].

Bowie: The question is, would you have a higher probability of success fielding a new bomber which we need to do if it's nuclear or conventional or [inaudible]. My personal belief is the conventional makes it more politically attractive.

Voice: It's important to remember, though, to support Dr. Bowie on this one, the B-2, the numbers were limited, and despite making the case for the conventional nature of the aircraft, the numbers were limited in large part of the anti-nuclear forces, not only in the administration but on the Hill. And so it's important to understand there is a little bit of history to trying to birth a nuclear bomber.

Voice: And if I could continue the discussion, maybe it's unconventional for someone in the audience to answer a question instead of the panel, but I, and maybe it's just the way you worded it or semantics, but I kind of take issue a little bit with the premise of the question which is are you worried that you'll undermine future buys, because that's not what an analysis is supposed to be worried about. An analysis is supposed to look at the options and do it analytically and not be worried about whether you're undermining a potential acquisition program.

Grant: Let me give the last word to our panelists, if you have a further comment.

Haffa: It's just a great opportunity to be with you. Thank you for your attention. And as Dana said, the purpose of the work was to spawn conversations. I think we were successful.

Grant: This ends the formal part of our discussion. I want to thank our audience and also all our authors for a tremendous discussion. Please feel free to stay around and have a cup of coffee and grill them a little bit more. Thank you all very much.

END TEXT

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