

Vice Admiral Thomas J. Moore  
Commander, Naval Sea Systems Command

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**DWG:** I'll turn it over in a minute to our moderator, Otto Kreisher, but I just wanted to thank you for coming, and thank everyone for making it early in the morning on what is the first day of the week this year, this week. And mention that these programs are made possible by the Carnegie Corporation of New York which has funded the Defense Writers Group for many, many years now out of a belief that knowledge is power, that it's important for the country that there be well-informed, well-sourced and well-written journalism about national security. I've had a lot of fun being the person running this for the last year and a half and hope to do it for a little while longer. I've gotten to meet a lot of interesting people, many of them in uniform.

**DWG:** Our guest this morning is Vice Admiral Thomas Moore. He's the Commander of Naval Sea Systems Command, commonly known as NAVSEA. He's responsible for just about everything that sails on and under the sea. We're on the record, as usual.

Navy's top priority procurement program for quite some time, and I assume still is, is the Columbia SSBN program. You're approaching, a year away from construction of the first one. Had some minor glitch with the bad welding on the missile compartments. Could you give us an update on how that program is going, and are we still on track to meet that very critical operational date?

**VADML Moore:** We're still on track to deliver the ship on time to start its first patrol as it starts relieving the Ohio Class. But you're still talking ten years out. Like any program of this magnitude, we won't breathe easy until we get the ship actually

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delivered.

We did have the issue with the welding on the missile tubes. We've come through that technically, working with Electric Boat and the vendor there. We have a way ahead there.

We've got a large land-based facility up in Philadelphia that we're testing the motors out that will drive the ship through the water as a risk reduction effort. Electric Boat is well underway on the design efforts working with the Program Executive Officer for Submarines.

Right now the program's on track. It doesn't have a lot of margin so it's important that we execute the milestones as they're laid out today and we'll continue to do some of the risk reduction efforts we're doing right now, in particular with the motor for the ship.

**DWG:** One of the concerns, particularly for Members of Congress and I assume for you folks, is the funding stream. When you go to full construction, looking at the 30-year shipbuilding budget, it hasn't changed. The FY21 cost of \$4.2 billion. And then \$4.2 the second year and then \$3.9 after that. So you're a big hunk of money. And Members of Congress on the Sea Power Committee have been concerned about the drain on the overall shipbuilding fund. They created the sea-based nuclear deterrent fund which supposedly was to help fund your program without tapping the rest of the shipbuilding, but that doesn't seem to be getting much money into it.

Do you have any concern that when you go into full production of the Columbia that you're going to be draining the rest of it, leaving very little margin for the rest of the shipbuilding programs?

**VADML Moore:** I think we're a supporter of the National Sea Based Defense Fund. If you look at where Columbia comes into the budget, it also comes at a time where we'll be doing Flight 3 DDGs, we'll still be building frigates, the Future Service

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Combatant will be on the horizon, looking to issue the RFP in about the '23 time frame. And then we just have a two-ship buy for the aircraft carriers, 80 and 81. So it's an aggressive shipbuilding program and clearly the cost of Columbia on top of that makes it a challenge. I can't forecast what the budgets are going to look like five, six years from now, but certainly the Navy has been very supportive of the Sea Based Defense Fund for the very reasons that you said, because we think it is a national priority, and taking that off the shipbuilding budget would at least allow the rest of the shipbuilding SDN account to be focused on the other shipbuilding programs that we're going to need to get to 355 ships.

**DWG:** But it's up to Congress to actually put money into that fund rather than just in regular, in shipbuilding, and so far they haven't been particularly good at doing that.

**VADML Moore:** I'm happy to comment on what I can control. We certainly would be supportive of funding, and we'll certainly have a vigorous debate in the Congress and we'll see what happens.

**DWG:** Tony?

**DWG:** Good morning. A couple of questions. The two-carrier buy contract, what hooks are in the contract to put HHI's profit on a greater risk if they don't meet cost and schedule for the two ships? There's a lot of skepticism. You've still got problems with 78 and we're putting in two more contracts. What hooks on the share line or seven business entities that you can discuss?

**VADML Moore:** The contract that's out had a lot of share lines. It's a fixed price, firm incentives over the share line, and my experience over the years in shipbuilding is that the share lines are the simplest way to attack cost control. It's pretty straightforward, it's pretty hard to argue. You hit a certain cost target, you make a certain fee. You hit another cost target that's above that, you lose fee.

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So I think the biggest incentive on 80-81, the two-ship buy, will be built into the share lines itself.

As far as meeting ships [backs] et cetera, I mean the shipbuilder's required to build the ship in accordance to spec. If during the course of the building or the construction or the testing of the ship we find errors that were not built in accordance with the spec, then that bill is on the shipbuilder.

**DWG:** To what extent -- you understand the [inaudible]. Is the point of total consumption on this one tighter or lower than the past where HHI would be --

**VADML Moore:** I don't know what the specific number is because I wasn't involved in the contract negotiations. But it does have a ceiling price associated with the [inaudible] assumption where Newport News would assume all cost.

The first ship in the cost is a cost-plus contract; the second ship, Kennedy, is a fixed price incentive fee contract with a 50/50 share line and they're not coming anywhere near PTA. So their performance on Kennedy is pretty solid. I'm not worried at all about Newport News' ability to build 80 and 81 and stay well above what the point of total assumption or the [CI] price on that contract could be. I'm more interested in delivering the ship at the target price of the ship. At the end of the day, I hope they deliver it at the target price and make the maximum fee they can. In fact if they can under-run, that's great as well.

**DWG:** On the CBN 78, you're going to get asked this a lot, but it hasn't gone through shock trials, it has to go through operational test and evaluation. It's had major issues with EMALS and AAG according to the latest DOT&E report. Why are we putting two more on contract?

**VADML Moore:** First of all, I'm not here to debate DOT&E but I think EMALS and AAG like any major technology, we're working our way through the issues. I read your recent article, I read the DOT&E reports. We've got more, we did more launches and

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recoveries than we had planned, almost double, during the shakedown period, and the performance of that system got better as we learned how to operate it, like any complex system out there.

So I'm not at all concerned that EMALS and AAG eventually will ring out the technical issues for that ship and that the reliability of that will go up.

It's a little bit of a chicken or egg. People want to complain that the reliability's not good, but you can't get the reliability up until you operate it. I think if you're going to operate it you're going to see that a lot of the systems continue to -- we're learning about the system each and every day.

I did note with interest that the Chinese put out an article the other day that their carrier build program, you'll note they've also chosen to go with EMAL. I think that's the wave of the future and I don't think there's any concerns on the Navy's part relative to the performance of EMALS and AAG which is why we went ahead with the two-ship buy. We were going to build the carriers anyway, so why wouldn't we want to have saved the taxpayers \$4 billion? I think it was a pretty simple calculus on the Navy's part to save a significant amount of money in return for ships that we were always going to build anyway.

**DWG:** One common build issue, you have the main thrust bearing [inaudible] back in January. GE was identified for poor workmanship. A year later what efforts are being made to get money back from GE for the [inaudible] for their rotten workmanship on the --

**VADML Moore:** The main thrust bearing issue is, they are subbed to Newport News Shipbuilding. I can't speak to the specific things of what Newport News is doing with GE other than the two of them are in discussions about costs and who is liable for that.

In the meantime, our focus is get the MTB fixed so that we can

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get the ship back out to sea here in the summer when she finished PSA and then get on with all the things that you talked about, getting through the IOT&E period, getting through shock trials. All of that.

Those discussions are ongoing. IN the meantime we'll pay the contractor to finish the work up while he finished negotiating because they have to, the work has to get done.

**DWG:** IT's unclear, though, the Navy's paying for the repairs of this thing while GE and Huntington are fighting over what GE pays -- they're going to reimburse the Navy at some point maybe.

**VADML Moore:** It's a cost contract, and so we'll pay the cost of the repairs until GE and Newport News figure out who has the liability for it. At some point you've got to pay them to get the work done, so we are on a cost-plus contract, we're paying for the work that's being done on the ship today.

**DWG:** There's no [inaudible] on how you get --

**VADML Moore:** Absolutely. This isn't trying to give industry a pass. This is about trying to ship-build, at the same time holding the shipbuilder accountable, so you have to do both.

**DWG:** Mark?

**DWG:** Just staying on the carriers. Can you give us an update on the Advanced Weapon Elevators?

**VADML Moore:** One of them has been certified completely and turned over to the ship. I think CNO was down on the ship last week to watch it. There's a second one that will be turned over here shortly. We have nine more to go after that to finish the 11 of them up. We are learning as we go there. I think what you're going to see is an accelerated, we're going to start to accelerate the turnover of some of these to the ship as we start learning where the challenges were.

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Most of the challenges, once we got them built from a construction standpoint, were really in the software and the control systems. So as we round out those bugs on the first stage, the upper stage weapons elevator that we turned over to them, we're learning, and we're rolling those lessons immediately into the other ones as we go.

As you know, the goal is to get them all finished and delivered before the ship comes out of post shakedown this summer, and that hasn't changed.

**DWG:** What was the actual problem that you're trying to address?

**VADML Moore:** It's a series of issues with the control system and the elevator itself rides on an electric rail. There are control systems that keep the platform level, there are control systems that determine when various doors open, there are control systems that determine when the thing stops, there are control systems in there designed for safety of the crew. I don't know, off the top of my head I can't tell you what specifically were the last problems that we saw, but they fell into those broad categories. So the majority of the problems at the end of the day after we got the mechanical clearances and the alignments done were all software related.

Again, this is a relatively complex system. Back to my comments on Columbia. I think in hindsight the Navy would say one of the big lessons learned coming out of Ford is we did not choose to have a land-based test facility for the Advanced Weapons Elevator similar to what we had on EMALs, AAG and the dual-band radar which all had land-based test facilities that we could go test and run and get significant run-time on the systems in advance. In hindsight, I think we'd like to have that.

Now we are going to build a land-based test site for future carriers for the Advanced Weapons Elevator up in Philadelphia. We're going to go take the original prototype and purchase it and send it to Philly and put it together so we'll be able to test it out.

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Back on Columbia, we're going to go test that motor out, the main motor for the ship before we actually put one on the ship. So we would have been better, frankly, to have had a land-based test site for weapons elevators on Ford. If that had been the case we wouldn't be where we are today, I'm convinced of that.

**DWG:** I'm sorry, what are you going to put in Philadelphia? The elevator test site?

**VADML Moore:** Yeah, we're going to build a land-based test site for the Advance Weapons Elevators in Philadelphia so that we have a place in the future to continue doing testing, and as we have software changes we can go put them up there and test them out in advance. So again, in a perfect world, in hindsight, 20/20, we would have built this back in probably 2008 and not today. But having said that, having that out there and up there as a place to go test and train crews and mechanics and in-service engineering agents, you know, the Ford Class is going to be around for, until 2110. So these Advanced Weapons Elevators are going to be around for quite some time. So it would behoove us to have a place that we can go, in the future go test new things out, do maintenance, train people before they actually go to the ship.

**DWG:** When did you decide to build that test site, and when will it be up and running?

**VADML Moore:** I don't the answer of when we decided, off the top of my head.

**DWG:** Recent?

**VADML Moore:** It was probably towards the end of my tenure as PO Carriers back in 2016, but of the top of my head I don't know -- we can get you an answer back on that. I don't know what the current plan is in terms of when it's going to be installed up in Philly.



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**DWG:** Yasmine?

**DWG:** The 355 number [inaudible] in time now, and obviously that's going to entail don't lose any ships and maintain the ones we have. I think the question of how to maintain a healthy industrial base and so forth.

What concrete steps has the Navy taken so far to make sure that the shipyards will be able to make that happen?

**VADML Moore:** It's probably the thing I spend most of my time on, to be honest with you. I think the new construction side is well understood. You can look around at what we're building -- LCS and frigates and destroyers. But I think as we testified last year, even if we were to build the maximum rate we think we could build today, it would take us until about 2052 to get to 355 ships, just by building new ships alone.

So we've got to do a couple of other things. One, if you want to get there sooner you've got to figure out how to keep the ships that you have today a little bit longer. We completed a study last summer for the CNO that went and looked at that, and we concluded that through all the ships that we have if you're willing to do the maintenance of them you can keep them longer. So there was a concerted effort out there going forward, and we'll start with the DDGs. The first ones in about the '24, '25 time frame, to extend the surface life of those ships out to a minimum of 4 years. We might get a few more years out of them.

It's pretty simple. It may sound complex, but we keep aircraft carriers for 50 years today. We kept Enterprise for 52 years. So it's not an issue of do we have any experience in keeping platforms around longer. It's really an issue, does the combat system on the ship maintain its relevance.

An aircraft carrier is pretty unique in that its combat system is the aircraft. What flew off of Nimitz in 1975, A-6s, A-7s, F-14s, and what's flying off of Nimitz today and will be flying off of Nimitz before she decommissions in 2026 looks markedly

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different.

So with open architecture and Aegis and in particular with vertical launch, those platforms today can maintain their relevance from a combat systems standpoint well beyond what we originally had planned for the service life of the ship.

I don't think anybody thought back in 1989, 1990 when DDG-51 was delivered that we would be talking about the Arleigh Burke Class is our primary ballistic missile defense platform today, which is what it is.

So you'll see going forward with Future Service Combatant and the frigate is a move to have ships that have margins built into them for electrical power, you'll see I think vertical launch will be standard going forward, obviously open architecture, all that goes into it.

The second piece of it is you've got to be able to do the maintenance. We can build 355 great ships, but if I can't get them through the maintenance, then they don't do the combatant commander any good. We're pretty stable and improving in the public yard right now, to do our SSNs and CVNs because we have over the last three or four years built the capacity that we need. We're finally up to 36,100 people in the shipyards, so we're working there with a bunch of other efforts going on in the public yards to stabilize that work force and get them better. I think you're starting to see some trends there that are improving.

The private sector surface ship repair side is frankly the bigger challenge for us right now. We don't have the capacity we need right now, and a lot of that's, frankly, driven by the strategy that we used to obtain maintenance from them. It's one contract at a time, one ship at a time. So if you're in industry out there and you don't know until 90 days before I award the contract whether you're going to get the maintenance or not, you're not incentivized to hire because if you don't get the, I mean you can say you're laying people off, so they get into this

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vicious cycle. Some of that was driven by many years ago when we shifted out of our cost plus, give industry five years of work at a time, driven by the fact that the Navy was not satisfied from either a cost or a schedule perspective with industry's performance. So we went to this fixed price award them one at a time. And while we've gotten some improvements on the cost side of the house, we clearly aren't getting schedule performance. And right now that's really hurting us. [Inaudible] was talking to the reporters. Only 30 percent of our DDGs deliver on time today, so that's something that we can't live with if we really want to get the ships out to the combatant commander. And as you grow the number of ships in the fleet and now you add all these surface life extensions in there, that only complicates and makes the private sector maintenance more challenging.

So we are going to have to really focus on the private sector maintenance side over the next two to three years and work with industry and come up with a collaborative acquisition strategy that gives them enough stability and predictability that they can build a backlog and hire the people they need and make investments in their facilities while at the same time giving us the cost and schedule predictability that we need on our side of the house. So it's the number one challenge that I have in NAVSEA right now, to be honest with you.

**DWG:** Dmitry?

**DWG:** I was hoping you could speak a little about Russia and China as we you see those two countries in your current capacity. Are you thinking about them purely in terms of the great power competition? Or you also think that there is a chance that there might be another role, an opportunity for some sort of cooperation and coordination and things of that nature?

**VADML Moore:** I'm on the NAVSEA side of the house, I don't really spend a whole lot of time on the policy, international relations piece of it. So rather than make a headline that the NAVSEA Commander is now making policy, I would say my focus in this era of great power competition is to make sure that I'm delivering to

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the fleet the best ships possible, that have the maximum combat capability, and that we maintain the ships that we have in a way that ensures that we have the force out there that we need to provide stability around the world. I think I would leave it at that.

**DWG:** All right. May I ask you as a follow-up, how all those doctrinal documents adopted by the United States affect your work in terms of how you view the Russians and the Chinese?

**VADML Moore:** We are always aware of the capabilities that our competitors have out there, and we certainly take that seriously and we study that carefully, as I assume they do.

So as we build ships and weapon systems, we're always aware of what the competition has and we certainly take that into account when we're designing and building our ships.

It's pretty hard to predict more than about three or four years down the road of what things are going to look like. One of the reasons we build ships that have significant margins for power and weight in them is because you don't know exactly what the future's going to look like, so you really would like a platform that can evolve over time, and in particular in the combat system side of the house. So that's kind of been our thinking for many, many years with vertical launch, and the aircraft carrier has been a classic example of a platform that, where the combat system can evolve over time. I don't think there's anything earth-shattering about that.

**DWG:** I want to ask you sort of a broader question. You've got the [CMOP] program that just had another test last year and it's transitioning. You've got Ghost Fleet program, you've got several different efforts to create unmanned systems on the sea. Can you give us a little bit of an overview as to where you see that overall development, and being able to field unmanned ships? And more broadly, conceptually, how do you see that those are going to be integrated into the fleet capacity?

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**VADML Moore:** It's pretty clear that's going to be a key component of what we do going forward. You can go read the CNO's design for maintaining maritime superiority. There's a lot of open source documents where the Navy and the Department of Defense has publicly stated its support for unmanned vehicles. It's in all three domains. It's certainly in the air, it's on the surface, and it's on the subsurface.

So there's a number of efforts ongoing. Some of them -- will we evolve to where we have unmanned ships out there? Possibly. Will we evolve to where we have unmanned aircraft out there for use as tankers, ISR platforms? Almost certainly. Then on the undersea domain, we have smaller vehicles that are out there designed to, minehunters and data collection sources and we don't know how far we are going down the path in terms of the size of the undersea vehicles. But conceptually, I think you'll find that we're interested in all three domains, and I think it will be something that integrates in with the rest of the force in terms of how we operate.

I don't foresee a day where, for instance, you would have all unmanned aircraft on an aircraft carrier. But you can certainly foresee a day where there would be a pretty good mix between manned and unmanned. I don't know that we've reached the point today where we would completely take the man out of the loop. But clearly if you listen to the Navy leadership talk about machine learning and artificial intelligence and et cetera, we're just scratching the surface on that today. So it's hard to predict what it would look like five to ten years from now. I think all options are open for us. I don't have a crystal ball other than I would tell you we absolutely are committed to continuing to pursue unmanned technology in all of the various warfare domains out there.

**DWG:** How close are we to being able to field something, let's say on the surface, that would be unmanned?

**VADML Moore:** We already have things out there today that can operate unmanned. It just depends on the scale of things that

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you're looking at. We're testing things in almost all those domains today.

**DWG:** And the secondary sort of legal question when you get into man in the loop, if anything's going to be armed, et cetera Has anything come close to triggering the [3000 09] review over man in the loop questions? Or do you see any of those issues in terms of the legal ability to field things that are unmanned right now? Or is that still a truly future problem?

**VADML Moore:** You're kind of out of my lane there. I just build stuff. So not only am I not an international diplomat, but I'm absolutely not a lawyer.

**DWG:** Have there been any reviews --

**VADML Moore:** I'm assuming good intent by my leadership, and I would assume that we're looking at all of those things.

**DWG:** To follow-up on the combat system part, I know that Sea Hunter, recently it was announced that it autonomously sailed from San Diego to Hawaii. I was wondering if you might be able to share a little bit more details on that, and then what happens going forward. Obviously I know it's very classified but what you want to see, the performance that you want to see from it.

**VADML Moore:** To be honest with you, I'm really not an expert on Sea Hunter other than I probably have read the same thing you're reading, so I know we're out there testing it, but I don't spend a whole lot of time on that particular program, so I'd be probably selling you short by trying to give you information I don't really know about.

**DWG:** Okay. Maybe can you speak on the importance of Sea Hunter at all for operations?

**VADML Moore:** I'd prefer to stay out of the operational side of the house because it's not my area of expertise. I don't think I could tell you -- there's probably a lot better people to go ask

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about Sea Hunter than me.

**DWG:** I have a question about the LHA-9. [Inaudible] monitors [inaudible], and I'm wondering if you can speak to this. I believe Mr. Wittman and Mr. Courtney have asked for again procurement in the FY20 budget. I'm just wondering if you have a status update for --

**VADML Moore:** I don't want to get into the '20 budget. The last time I did that I got yelled at. So no. The Navy's always interested in where we can block buy and buy things in advance because it clearly saves you money. In terms of the amphibious ships, I can't get into what's going to be in the FY20 budget. We're committed to the 38 amphibious ships. There's various ways to get after that. We clearly hear the message pretty loud and clear from Rep Courtney and from Rep Wittman. I know the PEO Ships in the pentagon are looking pretty closely at what they're asking for, but I can't speculate on what we would do going forward on that.

**DWG:** Do you expect to have any more insight once the budget comes out?

**VADML Moore:** I think when the budget comes out they'll have more insight.

**DWG:** On that specific --

**VADML Moore:** I don't know on that specific topic. Again, I'm trying to stay away from what's in the budget. I'm not privy to all the discussions that goes on on the amphibious side of the house other than I can tell you we're building them today and HII is building, we're happy with the platform both on the LPD side of the house and the LHC side of the house. They've proven out to be pretty good platforms and we expect to continue to build amphibious ships down there at Ingalls.

**DWG:** Marcus?

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**DWG:** Sorry for being late this morning. I'll blame the Metro.

I want to go back to what Zack was asking about, whether unmanned should count towards the fleet size number. Just kind of in your mind, what, and I apologize if the question's been asked already. What in your mind does that sort of need to do in order to be counted?

**VADML Moore:** I guess I would leave that up to the policy guys and talking to the Hill. I remember a couple of years ago when we changed the way we were going to count the ships and it caused a little bit of a kerfuffle over on the Hill. So rather than speculating about how big does it have to be or when does it count as part of the 355 or not, I think I would leave that up to OpNav and having their discussions with the Hill. So I really don't have a good answer for you, and I frankly don't even have an opinion on it. It's really not my lane to determine whether, you know, if it's over X tons it counts a part of the 355; if it's below, it doesn't. So.

**DWG:** I was thinking more along the lines of capability.

**VADML Moore:** I don't think we've come through that, so rather than speculate, I think that's a discussion that we would want to have with the defense committees and with Congress. We know that the law of the land is 355 ships, and we want to make sure we get there and follow the clear intent of what the Congress is, so I think that's probably a discussion that has to happen with them, and reach an agreement with them on what that, what counts and what doesn't count. So it probably doesn't do any good for me to give you an opinion on that because no one's going to ask me at the end of the day what my opinion is on that.

**DWG:** Another one completely unrelated to this. Just thinking again to the era of great power competition. We've seen the Brits sailing their carriers, doing F-35 trials off the U.S. coast. We've seen China taking lots of photos of their ships. How come we haven't seen more pictures of the Ford?



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**VADML Moore:** I'll send you a bunch.

**DWG:** They've been [inaudible] and tight shots of people on the ship. I think if we wrote about the Ford we'd need --

**VADML Moore:** Part of it, she's been in the yard since last August time frame. I suspect once she comes out you're going to see plenty of pictures of the ship. I saw plenty of them in the time between the time she was delivered and the time she went into her first shakedown availability. March of '18.

We're not shying away from Ford. I'm excited about the Ford. Look, I lived her for five years. I'm well aware of some of the criticisms of the ship. But 15, 20 years from now we're going to look back and go we are happy to have that Ford Class carrier around. It is an amazing platform, it's going to do incredible things. I daresay if you rewound the tape when CBN-65, the Enterprise, was first built back in '59, there was a lot of hammering, what that meant as well. And 52 years later, and you know, a dozen deployments, we decided we were pretty happy to have that platform. I'm very bullish on Ford.

We will work our way through the technology challenges we've had with that ship. This is a completely new ship in almost every aspect besides the design, the shape of the hull itself. So there's a lot of learning to go on there. It's second and third generation technology, leap ahead stuff. I don't know why we haven't put more pictures on it. I see a lot of them. And I think when the ship comes out in July here and gets out operating, you're going to see a lot more. But if you haven't seen pictures it's not because we don't want to talk about Ford. I think we're pretty excited about what that ship's going to bring to the fight.

**DWG:** A couple of follow-up questions. One on the Ford. There's been some concern among Congress and others that Ford was too much of a leap ahead. Too many new things. We've done this before in other systems. We always not only reinvent the wheel but go one step beyond. Did we try to put too many things into

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that program? That's one of the reasons why we're still struggling?

**VADML Moore:** That's probably a fair assessment. If you remember, the original plan of record did not - the Navy's original strategy was not to put all of the technology on the very first ship. We were supposed to build this in stages, between 77, 78, 79. And then back in the early 2000's the decision was made to put it all on the first ship. So we pulled a bunch of technology that was originally not designed to go on 78 and put it on 78. We bit off an awful lot on Ford, and you can see the net result of that.

Having said that, wince we have endured the pain associated with 78, the good news is we've now got that stuff out there and I think what that means is that for 79 and future ships that we have gotten through the technology hurdles significantly earlier than we would have otherwise in the other strategy. Now the other strategy would not have been as contentious and we probably would have been a little bit more smoother sailing than we've seen on 78. But that's kind of, that's water under the bridge at this point. We're going to make the best of it.

So we're getting 79 and 80 I think, in hindsight we'll look back and say we're glad we had all the technology there. I'm not sure we were glad to go through all the growing pains that we had with 78, but again, it's going to be a great ship. We'll be glad we have it for the next 50 years for sure.

**DWG:** And as the Marine Corps respondent for Sea Power, I want to go back to the amphibs. The Marine Commandant was talking about the fight to get to the fight. With the possibility of China, the long-range defensive system, that sort of thing. The question is whether we need to arm the [gaters] or how we're going to protect them so that they can operate forward. Do they have to be more survivable? Do they have to have self-defense capabilities? Do they have to have an offensive capability to help with the sea-controlled fight?

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**VADML Moore:** I'm not a requirements person, so that debate's going to happen within the Pentagon. The platforms are robust, they're survivable like all the ships that we build. They do have self-defense capability built into them already.

In terms of do we want to have offensive capability on that, I think I'll leave that discussion up to the CNO and the Commandant. Then if they decide that's what they want, then they'll come back to me and say build me a ship that has this in it. We'll go do that.

That's not something -- I'm not a requirements developer and for good reason. I just build the ships for them. So I'll leave that debate up to them. Other than I will say up front that the platforms are robust with a lot of reliability and survivability built into them, and I feel pretty confident we can take them anywhere into the fight and the way we operate, we will operate safely and we will prevail.

**DWG:** There's been some discussion as to whether there's space available in the LPDs and on [Flight 2s]. Is there space there if they wanted to put the LS or something like that, or would we have to completely redesign?

**VADML Moore:** Could you? Sure. We can do just about anything. We backfit DLS and stuff on previous ships. You'd have to give something up. It's not designed for it. In my experience most of these things, backfitting, the reason we build ships in flights is for the very reason that backfitting is in general not a very efficient way of doing things. The ship wasn't originally designed for it. Could we go put it in the yard and could our engineers figure out structurally how to do it? Sure. Absolutely. But you'd give something up for that and it becomes a little bit of a zero sum game.

My preference always is if you're going to do it, do it by building these ships in flights so you can incorporate the technology like we do on Virginia Class or like we're doing with DDGs right now. That's generally a better way of doing it.

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It's certainly possible from just a naval architecture, ship construction standpoint. Is it practical or cost effective? Probably not.

**DWG:** Another program of interest, particularly to the Marine Corps and the Army as well is our logistics ships, prepositioned ships. Sealift Command has the ultimate owner of ships sailing the ocean. With that three-step program to rebuild or modernize the sealift fleet, sealift and prepositioned fleet, how are you guys doing as far as construction?

**VADML Moore:** The military sealift ships are the one piece that I don't own from a construction standpoint, so you'd have to go talk to [Ahmed] [inaudible] Military Sealift Command. I don't deal with anything that they're doing. I couldn't comment on that.

**DWG:** CBN-79 is supposed to reduce labor hours by 18 percent. Is it going to hit 18 or is this one other area where it's not going to meet the spec?

**VADML Moore:** The goal is still to hit 18 percent. There's still, we'll christen the ship and put her in the water here I think this fall, and we'll see. We're not satisfied with 16 percent, although 16 percent based on historically compared to almost any other shipbuilding program is still pretty darn good. But the goal is to hit 18 percent. That's what the contract was signed for, that was the target that we needed to get to to keep the ship and manage the cost cap. I can just tell you that every day the [PEO] [Carriers] and the companies are working to do that. So can you get 2 percent over the last 35-40 percent of the ship? Sure. You can get that. So I would say let's see how that goes going forward. If we can get the ship christened and in the water this fall, which is the goal, I think the ship will be in pretty good shape. One of the things we learned from 78 was to build as much of the ship as possible before you put her in the water, so 79 is actually going to be even, we're going to have a higher percentage of completion on 79 than we even were on

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78 coming out of the water.

**DWG:** How many --

**VADML Moore:** I think it's in, I want to say it's in the high 60s to low 70s, but let me take a look at that, and we'll go ask [Carriers]  
We can certainly get you an answer.

**DWG:** If they don't hit 18 percent is there anything in the contract that penalizes them for missing it? Or it's just like an --

**VADML Moore:** It's not an OG. They lose money. The 18 percent reduction is what they have to achieve in order to hit the target cost of the ship. So if they only get a 16 percent reduction in hours, that's going to show as a cost overrun on the contract and they will bear that on a pretty steep share line -- 50/50. So they'll eat 50 percent of the cost of any overrun on the man hours. So they're incentivized, for sure, to hit the target cost of that ship.

**DWG:** DDG-1000 has been criticized quite a bit. [Inaudible] public affairs group has called it a titanium tin can. What lessons do you take broadly from that program that shipbuilding in general would benefit from?

**VADML Moore:** I don't know that there's a shipbuilding program since Noah built the ark that wasn't highly criticized. A lot. We're learning a lot from DDG-1000. Here's my analogy to this. We built three Sea Wolves because they got to be extraordinarily expensive. So what the submarine fleet did is said okay, rather than crying over spilled milk let's figure out what did we learn about Sea Wolf? What's really good about this? And let's roll that into our next design.

Now Virginia Class turned out to be very successful. There's lots of good things on DDG-1000 From a signature standpoint, low observability. Fantastic. The hull shape, I don't know whether

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we'd use that exactly again, but we've learned some things about hull design and the tumble-down hull that we didn't use before. So there's a real concerted effort on all platforms, and you can go look at the RFIs went out on Future Surface Combatant on Friday, what we've learned on DDG-1000 in terms of low observable, absolutely want to repeat that going forward. So we're going to learn some stuff there.

Secondly, we are headed toward an era of electric drive. So DDG-1000 is electric drive, Columbia is going to be electric drive. There's no doubt in my mind that the Future Surface Combatant is probably going to be electric drive. We're going to get out of steam turbines, diesels as the most efficient way for us to drive ships to the water.

In conjunction with that, DDG-1000 has this integrated power system which generates an enormous amount of power relative to the size of the ship and distributes that power throughout the ship.

So while the gun didn't pan out the way we wanted it to pan out, that ship generates an enormous amount of electrical power and has an enormous amount of space and weight available to it to handle future weapons.

So when you go watch us design the Future Surface Combatant and even the frigate coming out, a lot of what we learned on DDG-1000's already being factored into those ships. I think in the end one, the three ships we built, they're going to have a niche mission much like the Sea Wolf Class does today. And we're going to make good use out of those ships. But I think the Future Surface Combatant will look back on the DDG-1000 and say hey look, while DDG-1000 didn't pan out in terms of the number of ships, we took a lot of really good lessons learned off that ship and we've put it into a class of ship which will be the workhorse of the Navy after DDG-51 retires for probably the next 60 to 70 years.

**DWG:** Was it a quality issue with the gun? Or was it mostly the

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bullets became too expensive?

**VADML Moore:** I think it was a cost issue. We built the weapon, before we built the delivery vehicle, before we really figured out what we were going to shoot out of it so I think the cost of the, at the time, to be able to shoot these projectiles 700 miles. When it came down to the end of it, the cost of those things, I forget what it was, but it was enormously expensive. I think it was over \$100,000 apiece. I'd have to check that.

**DWG:** I've seen up to a million, which is way too high.

**VADML Moore:** Depend on how many we're going to build. I think the average person said compare that to a five-inch shell on a DDG today and I think that got to be too expensive.

But there are other things, because that ship generates an enormous amount of power, that you could use that ship going forward.

Talking about unmanned vehicles, something I think is not that far down the road is the use of lasers. We had a test one on Ponce. Almost all the industry out there today is competing to be the person that can get up to about 300 kilowatts which is where I think you have to be to start really using it to shoot things down. But you think about the Ford Class carrier, for instance, if you can generate lasers and you can generate enough power and you have enough space and way to distribute the power around, you basically have an unlimited magazine.

So it would not surprise me if in the next 10 to 15 years we're employing lasers on our ships in some sort of self-defense capability first, and then eventually as we learn more about them I think we would probably venture into the offensive realm as well.

But from a self-defense capability standpoint, laser technology offers an awful lot of great things. You don't have to worry about magazines, as long as you can generate the power you're

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good to go.

**DWG:** And keep it small enough.

**VADML Moore:** Some of this will go, the weight and the size will improve as we learn more about the technology. Just think about your cell phone or think about your computers and what they weighed, the computers, the UYK-7's on the first DDGs took up a room this big to shoot missiles, and now you could probably shoot it off of something the size of your iPhone.

So the technology will follow. I think it's a game-changer.

**DWG:** What happens to the guns on the frigate? The 1000, 1002 and 1003? Do you take them off and keep the hole there on the deck or what?

**VADML Moore:** I don't know -- that's a good question. I'm not trying to dodge the question, I just don't know what ships, what the plan is for that right now. It's probably better asking PEO Ships or [inaudible] 96 what the plan is for that going forward.

But I'm enthusiastic of what DDG-1000 can do for us going forward, but just as importantly, what we've learned from that ship that we'll use in the ships going forward. Down the road we'll look back on it and say, similar to Sea Wolf. Hey, look, we learned a heck of a lot out of that ship that's turned into something that's pretty useful for us.

**DWG:** Mark?

**DWG:** I was going to ask about lasers, so I guess kind of a slightly different question. Has the LaWS been officially, I don't know, removed or dismantled from the Ponce? And what has happened to it? Someone said there was going to be firing of a new laser from a ship this year. I was wondering if you could elaborate on that.

**VADML Moore:** Let me take that. I think there is a plan to go



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test another one out on another ship, but I don't know the specifics off the top of my head. So rather than give you false data, we can just take that as a lookup. I don't think that's any secret. I've heard the same thing too, I'm just not intimate with the details.

**DWG:** And LaWS, the laser that was on the Ponce, has that been dismantled or --

**VADML Moore:** I don't know. I know we took it off the ship but I don't know what we've done with it since then. We can certainly get you a look-up on that.

**DWG:** One of the things that the DOT&E report mentioned, [inaudible] in the last several years has been almost a systemic issue with an inadequate number of people to test new systems when it comes to cyber security and hardening systems adequately, and all sorts of hiccups with finding vulnerabilities.

On a broader sense, what are you doing to ensure that the new systems that are being developed are adequately tested? Do you have the manpower to do that right now? And because that threat is ever-evolving, how do you ensure that whatever testing you're doing now will be adequate for future threats?

**VADML Moore:** A couple of questions in there. On the cyber side of the house I think we know every ship, every system that's designed today, you kind of factor that into your thinking. Individual systems [inaudible] have to be hardened. There's a broader view of kind of building, if you will, an enclave or a big kind of firewall around the ship, and then what you're trying to do is protect things from getting inside the enclave and then once it gets inside the enclave if it does is contain it so it doesn't move around. So that's kind of where we're headed.

In terms of the manning and how you go do that, we stood up the Information Force. We stood up 10<sup>th</sup> Fleet. That is something if you go talk to CNP, Chief of Navy Personnel today, and our thinking on how all the sailors have to be trained and where you

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get your cyber warriors from, I think you go look at where we're building the Cyber Center up at the Naval Academy, the recognition that we need to train the next generation of officers to be a lot more fluent in cyber.

So that is going to continue to be a challenge for us, for sure, but I think we're trying to take a holistic approach on the manpower side of the house to make sure we've got a work force that's trained to manage that. At the same time, both NAVAIR and NAVSEA spend, and SPAWAR spend a considerable amount of time in the design of our new systems factoring cyber in as kind of a core requirement on everything we're building in terms of hardening it and then making sure as you update it going forward that you can manage the evolving cyber threats that are out there.

**DWG:** And do you feel the effort that's currently being made is adequate to protect? Or do you think more needs to be done? DOT&E reports have questioned whether that effort's been adequate.

**VADML Moore:** I think that always in the cyber area more needs to be done. That's for sure. Do I think that we've made a good faith effort so far? Absolutely. I don't think there's anybody on the Navy side of the house who would disagree with what DOT&E said. It's a relatively new threat. It's a quickly evolving threat. Our practices and the way we acquire things aren't designed to be as agile as you probably need to be in that area, and that's something that we're thinking our way through. Because the way we go procure ships and aircraft and take several years to get to an RFI and then another two-year study in AOAs, you just don't have that luxury in the cyber realm.

So we've got to be able to react and think our way through this a lot quicker than we are today.

We've got a lot of experts on it and I think that's why the CNO talks a lot about machine learning and artificial intelligence as ways to kind of help us in that particular area. But it's

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certainly something that we're thinking about all the time. I don't think there's anybody inside the building that would say we're satisfied where we are in that particular area.

**DWG:** I believe it was last year we saw a plan to retrofit destroyers with a hybrid electric drive system. Make it more fuel-efficient perhaps due to budget issues. Can you talk about where your priorities lie as far as making the Navy more fuel-efficient moving forward? Are we going to see that plan returned?

**VADML Moore:** I don't know, one, we have hybrid electric drive on a couple of DDGs, and you're correct in that they've gotten cut for budget reasons. But we're out testing them today and we'll gather some more data on that going forward. Clearly, fuel efficiency is important to us. If you go look at the RFIs for Futures Surface Combatant and frigate and range of the ships is really important, in particular where we're going to operate. And as you work your way through discussions about what the ConOps are out there, you'd like to have some margin in terms of your ability to go operate independently without a tanker near you because you may not have a tanker near you if you get into a fight.

So we clearly would like to become more fuel efficient on the ships. And so I think hybrid electric drive as we collect some data, we'll determine what the return on that investment is. I think it was a good effort. I'm glad we tried it. Whether we go back to putting that wholesale on the ships I think will be driven by what data we collect and the lessons we learned on the ones that we have installed going forward. But I think both the Future Frigate and The Future Surface Combatant are going to have range requirements built into them that a lot of that's going to be driven by improved hull forms and becoming more fuel efficient in the systems that we put on those ships.

I think electric drive will also help in that particular area as well.

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**DWG:** You talked about extending the service life of some of the ships as you fill to 355. Is there a possibility that we're going to see any inactive ships resurrected?

**VADML Moore:** We've looked at that. I don't think -- we looked pretty closely at the frigates. I was just up in Philadelphia last Friday, and concluded that the cost to bring them back was pretty extensive. But more importantly, the capability of the platform itself just really didn't lend itself well. And it's not just about the numbers piece, it's also about having ships that can do what you need it to do.

We looked pretty closely at the entire list of inactive ships last summer when we were also looking at the service life extension, and the Pentagon concluded that the best way for us to get to 355, and by the way, we can pull that 2052 date back into the early 2030s if we can, if we're willing to extend the service life of the existing platforms. I think the conclusion was let's extend the service life of the ones that we currently have and bringing them back, the ones that are inactivated, out of service, the cost and more importantly the capability they would bring was just of limited value to us.

**DWG:** I wanted to ask you what do you think about the Poseidon, that nuclear underwater drone created by the Russians and announced recently publicly. And whether the U.S. Navy is developing similar systems.

**VADML Moore:** I don't really have -- I don't know much about Poseidon, and I couldn't talk specific about anything that we're doing in that area.

**DWG:** You mentioned frigate just before, the FFG(X). Do you have any update on how it's going? Do you see the schedule proceeding apace with the down-select and everything?

**VADML Moore:** On track, fourth quarter FY19 the RFP will go out; and then 4<sup>th</sup> quarter of '20 we'll make a selection. I talked to Admiral Neagley just last week, and that's proceeding apace. So

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I think it's going to be a good program. You can talk to PEO USC for more details, but we expect to meet the milestones that we've currently laid out.

**DWG:** Is it going to be winner take all? Or is it possible to --

**VADML Moore:** I have no idea. I think when we did LCS I think we originally thought that was going to be winner take all, and look where we ended up.

So I think we'll cross that bridge when we come to it. I don't want to speak for Secretary Geurts and I'm certainly not in the decision loop on that, what the Navy's going to decide to do. I think we'll see. I think if we get out there and we get a couple of designs that are all interesting to us, could we head in that direction? Sure. So I don't know that anybody's made any decision on the Navy side of the house on that one.

**DWG:** I'm thinking back to my younger days as a reporter and being assigned to cover the first sea trials of the Ohio Class. I was with ABC News, and so the boat was coming down a body of water, a river I guess, and Admiral Rickover was on the conning tower. We had a helicopter, two speedboats and a couple of cars going along the side of the river. I'm not going to quote what he said, but I could lip read him. He was not pleased about the helicopter coming so close. But I remember the excitement about the innovations in the Ohio Class sub, primarily the propeller and speed and so forth, and how classified it was, and how it was covered and all the rest of it.

Are there ships that are coming along about which we should be as excited as that in terms of an innovation that is just going to change the way sea warfare is done? What would you point to as kind of the most exciting thing you're working on.

**VADML Moore:** I'm a little parochial. I think the Ford Class Carrier is going to be really a platform that's going to lead the way in terms of the next generation of aircraft that will go on board, how the ship fights. It's a great time to be a surface

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warrior right now.

I'm a big fan of LCS. I know like I said earlier, it has a lot of critics, but go to Mayport today or to San Diego. Their waterfront is filling up with those ships. We just I think delivered the 17<sup>th</sup> ship. This is going to be a big year for that program. I think once we get out and operate them, where we operate them in the 5<sup>th</sup> Fleet AOR or out in the Far East, they're going to be pretty neat little platforms.

And then I think the frigate's going to be a great platform. I'm encouraged at the early discussions on what the Future Surface Combatant looks like.

On top of that, we've been building Virginia Class successfully for years and so people tend to forget about that as we head into Block 4 and then Virginia Payload Module for Block 5. That's a game-changer from a warfighting perspective for us.

And then everything I see about Columbia, even though we haven't cut and bent any steel right now is kind of as cutting edge as Ohio was at the time. Columbia's going to be many times more than that.

So it's a great time to be in the Navy and just on the shipbuilding side of the house, just across the board with the new platforms coming on board. I go up to the Naval Academy and talk to the midshipmen, I tell them I wish I could rewind 38 years and start over because they really have an opportunity here to go operate some really new platforms and make a difference.

**DWG:** What about hypersonic missiles?

**VADML Moore:** Absolutely. That's clearly a technology that I think everybody is pursuing and we certainly are pursuing that as well. We see that as a game changer as well.

I can't get into the specifics of what we're doing there, but clearly hypersonics is a technology that we're very interested

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in.

**DWG:** Thank you for coming.

**VADML Moore:** I appreciate it.

**DWG:** We appreciate your time.

**VADML Moore:** One thing more, I should have said this up front. I know many of us were friends with Jeff [Fine], of Janes. I think since I've got a lot of you around the table who I've known for many years in the defense industry, just to all of you say our heartfelt thoughts and prayers out to his family. A big loss for the people that work in this industry to lose Jeff.

**DWG:** Thank you, sir.

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