Final Transcript

AGILE: ACTUV Christening Embargoed Media Roundtable

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SPEAKERS

Rick Weiss
Jared Adams
Scott Littlefield

PRESENTATION

Moderator

Ladies and gentlemen, thank you for standing by. Welcome to the DARPA's Embargoed Media Roundtable for the ACTUV program. At this time, all participants are in a listen-only mode. Later, we will conduct a question and answer session. Instructions will be given at that time. (Operator instructions.) Also, as a reminder, today's teleconference is being recorded.

At this time, I'll turn the conference over to your host, Communications Director for DARPA, Mr. Rick Weiss. Please go ahead, sir.

Rick Alright, Tony. Thanks. Hello, everyone, it's Rick Weiss here from DARPA. Welcome to our media call to describe a really exciting program that has been going on for a few years and has reached an important milestone today out here in the Portland area.

I'm just going to quickly introduce first Jared Adams, who many of you know is our chief of media affairs at DARPA, who will go over the ground rules for the call quickly. And then, turn it over to Scott Littlefield, the program manager for this program, who will talk for 10 or 15 minutes, describe all the basics of what's happening, and then we'll open it up. We've got a lot of time for questions to clear up details with you.

So, Jared?

Jared Hi, everybody. This is Jared Adams. We're really excited, like Rick said, to join you and to talk to you today about this event, which is really rather pretty unique within DARPA. Just really quickly, the ground rules for the conversation. As Rick mentioned, Scott's going to talk very briefly. For the record, Scott's name is Littlefield, his last name is Littlefield. It's

spelled as it sounds, L-I-T-T-L-E-F-I-E-L-D. Scott is a program manager in DARPA's Tactical Technology Office. All the remarks today will be on the record, of course. Again, the embargo lifts tomorrow morning, at 9 a.m. Eastern, which is 12 noon Pacific tomorrow.

Rick You mean 9 a.m. Pacific.

Jared Oh, 9 a.m. Pacific. Sorry, I'm getting my times all mixed up; 9 Pacific/12 Eastern. Tomorrow's remarks, we're going to have quite a few people both from the Navy and ONR and DARPA be speaking tomorrow. So, I'll let Scott talk a little bit about that. But, if there is anything else, I think we can go ahead and get started. Thanks.

Scott Great, Scott Littlefield here from DARPA. So, we're here in Portland, Oregon tomorrow. We're going to do the christening ceremony for ACTUV. ACTUV is the ASW Continuous Trail Unmanned Surface Vessel. It's a large unmanned surface ship, or boat. It's a vessel, so it's sort of a big boat or small ship, depending on how you want to draw that line.

A christening ceremony traditionally signifies the completion of construction, and in the past was normally done simultaneously with the launch. We've actually launched ACTUV on January 27th, so it's been floating in the water for a while. But, this does signify the completion of construction and the start of the next phase of the program, which is an extended test phase.

Let me just talk a little bit about what ACTUV is and then I think we'll turn it over to Q&A. So, the Navy has been experimenting with smaller unmanned sea vehicles of many different kinds for at least a couple of decades, unmanned undersea vehicles and unmanned surface vehicles. But typically with the idea that they're relatively small vehicles that are launched and recovered from another ship.

So, what we are doing in this program is building something that's substantially larger; that's actually designed to go directly from the pier out to an objective area and come back. It has enough range and endurance that it can get anywhere in the world from US territory. It doesn't rely on a host ship to launch and recover it. So, that's one of the important aspects of the program.

One of the things that that essentially requires and that we've been focused on in the DARPA program is providing ACTUV with a high degree of autonomy. We didn't want to simply build a remote control boat; we actually wanted something that could behave appropriately and do complicated missions under what we call sparse supervisory control. That means that there's still a human being in control but the human being is not joy-sticking the vessel around.

There's a number of things we had to do to achieve that. One of the key things we wanted to show in this program is the ability of an unmanned surface vehicle to reliably obey the rules of the road at sea, which are called COLREGS. Those are the International Maritime Organization rules for avoiding collisions at sea. A lot of the testing that we've done up until now has been on a smaller vessel, which we call the surrogate boat, which is just a 40-foot work boat, but basically has the same software, similar computing plan, and the same sensors that will be on our full scale ACTUV prototype. We've been taking that out to sea to show that it can in fact obey the rules of the road at sea and not run into other vessels and do that without a human being piloting it around.

Where we are now, essentially, as I mentioned is that the completion of construction will actually be leaving Portland in a couple weeks and moving the vessel down to San Diego. When we get to San Diego, that will start a two-year extended test phase that we're doing in cooperation with the Office of Naval Research. Actually, that testing will be done in a joint program with ONR and will include a lot of technologies and payloads that the Office of Naval Research is developing. All of that is really intended to give the Navy a chance to see it, understand the technology, and eventually, make some decisions about whether or not to go beyond a science and technology prototyping program and actually build ACTUV as an acquisition program.

I guess I'll stop there and take your questions.

Rick Before we go to the calls and Q&A, we did ask you and some of you responded by sending in some questions by email. So, we can go through a few of those first as you folks follow Tony's instructions for queuing up for your own.

Moderator (Operator instructions.)

Rick So, as you do that, Scott, Rick Weiss here, how will ACTUV communicate with human operated vessels for purposes of making passing arrangements or handling bridge-to-bridge communications? This person also wants to know, does it perceive to find whistle signals, bell signals, light, shapes, distress signals, the way a crew of a normal ship would?

Scott Those are great questions. Up until now, we've mostly focused on the COLREGS behaviors, meaning if ACTUV is approaching another vessel, ACTUV has to decide whether it is the gateway vessel or the stand-on vessel and do an appropriate maneuver. That's primarily a geometry kind of question.

Getting to the question of bridge-to-bridge communications, we actually do have a way to do that basically by patching the bridge-to-bridge radio through a satellite communications link to remote human operator. We decided to do that rather than create some kind of a Siri-like artificial voice capability. Bridge-to-bridge radio isn't strictly part of COLREGS but it is customary and it's something we wanted to include and that's the way we had implemented it on ACTUV.

Getting to the other question which was does it recognize bells, whistles, and gongs, when operating in conditions that limit visibility vessels are required to do that. We have done some experimentation on a separate test platform to show that that's technically feasible, up until now we haven't implemented that on ACTUV. That's something that's in our plans going forward in the future.

Rick — Great, so Tony, why don't we see who's on the line?

Moderator — (Operator instructions.) First question will come from Sydney Freedberg. Please go ahead.

Sydney — Hi, Sydney Freedberg here from Breaking Defense. To hit on the autonomy question, what kind of decisions can ACTUV make autonomously and what things does it have to get a human to tell it to do? I mean, I presume it's not going to, I don't know, transform into something with legs and walk up and destroy Tokyo autonomously, which is sort of the science fiction scenario. It sounds like it's able to actually make some level of decision to at least avoid hitting things.

Scott That's right. It operates like any system within some defined bounds of decisions that it's allowed to make. I mentioned that we have this concept of spar-supervisory [ph] control. So there's still a human being at the end of that satellite link who is monitoring and controlling what ACTUV does. But we try to put that in terms of mission planning, rather than actually piloting the vessel. For example, the human being would make a decision for ACTUV to go to a particular place in the ocean and loiter and wait for further instructions, and then ACTUV would plan the way points to get to that place in the ocean and would take appropriate maneuvers to avoid collisions with other ships on the way there.

Then, once it's at that loiter point waiting for further instructions, then a human being would have to intervene to give it a specific mission, which might be go to another point in the ocean and commence a search looking for a submarine. Once it detects a submarine, then it would get into trail on that submarine. So, it could do those kinds of defined missions without continued human involvement, but anytime it changes mission, those would be in response to human commands.

Sydney But it could do an ASW sweep autonomously and then report back I found something or—

Scott Exactly, that's correct.

Sydney I presume, you mentioned satellite to an operator, I presume that's on land. I imagine in the future this might be going in company with a [indiscernible] group, [indiscernible] group, surface action group. So, the human being might well be in the line of sight even on a [audio disruption] vessel nearby.

Scott That's correct. We do have a line of sight radio as well. So, really our intention as part of this test phase that's coming up is to start to work through some of those kind of questions. How do we operate ACTUV in coordination with manned vessels and where should the operator be? Should they be in a shore station? Should they be onboard a ship? In the near-term testing, they'll be at a shore station. But over time, I think we want to have the flexibility to move that human operator wherever makes best sense for the kind of mission that ACTUV's doing.

Sydney Understood.

Rick Sydney, did you have a follow-up there?

Sydney I could go on all day, but I'll let someone else have a chance. Thanks.

Rick You could. We'll get back to you if we can. I've got another question online to intersperse with the call-ins here from a local Portland reporter interested in why Portland. Was the technology developed here? Is it being built here? How does the city factor into the ACTUV program?

Scott That's a great question. So, ACTUV really was a national effort. There are lots of performers in lots of parts of the country. But what's significant about Portland is that this is where we actually built the prototype vessel. Construction was done here in Portland under the leadership of the bigger industries and that's where the vessel was launched. So, that's really the Portland connection and that's the reason we're having the christening ceremony here.

Rick Tony, do you want to take the next one?

Moderator Thank you. That next question will come from Rick Burgess. Please go ahead.

Rick B. Yes, thank you. Since the US Navy doesn't operate any diesel submarines, do you plan to use foreign diesel submarines as part of the test program over the two years?

Scott That's a good question. I think there are two possible ways that we could get what we would call target services for testing of ASW system. One is to use US nuclear submarine as a surrogate for somebody else's submarine. Then, we could obviously provide some limitations on speed, for example. The other would be to do testing with some other foreign navy through a cooperative program. We haven't really gotten far enough down the road to figure out which of those or whether we probably would end up doing both of those. But, either of those is possible.

Rick B. Okay, just a quick follow-up, you mentioned tomorrow would be the christening ceremony. Are you allowed to announce the name now? I've seen the term Sea Stalker before.

Scott Yes, well, the name is Sea Hunter. So, we have chosen the name.

Rick B. Okay, thank you.

Rick Tony, you can go ahead.

Moderator Thank you. Next is Phil Stewart. Please go ahead.

Phil Hi there, Phil Stewart from *Reuters*. Just really quick on the name, does the name come—is there any kind of methodology that came with choosing the name? I know that certain ships are named after states or—

Scott It's a little bit informal. We kicked around a lot of potential names. I'd say the thing we liked about Sea Hunter is that it does sort of follow in a series of experimental vessels that both DARPA and the Navy have built over the years, going back to experimental vessels like the Sea Shadow, or more recently, the Sea Fighter that was built about a decade ago by the Office of Naval Research. There have been some others that followed that naming convention. Sea Hunter seemed appropriate in this case.

Phil What kind of payloads were you thinking of putting on there? You said you were looking at different kind of payloads.

Scott Sure. So, one of the things that we have figured out through our interactions with the Navy is that we don't want ACTUV to be a one-trick

pony. We really want to build a truck that's versatile to carry lots of different kinds of payloads. Under the DARPA program, the primary payload that it comes delivered with is an anti-submarine warfare system, so basically, a sonar system that helps it find submarines.

But, as part of our cooperative program with the Office of Naval Research, we're also looking at some mine countermeasures payloads, and in particular, a mine-sweeping payload. Some of that is really to show the versatility of the vessel to do a lot of different kinds of missions. I think that's going to evolve over time; we'll think of new ways to use it. Because it's big, it's got the space and weight carrying capacity and electric power that's needed to host a lot of different things.

Phil Do you see it working with other ships, maybe other ships of the same kind? Are you designing the idea of having maybe—

Scott Yes, I think one of the things we really want to start exploring with the Navy is how do we use it cooperatively both with other unmanned vessels but also maybe even more importantly with manned vessels. So, this whole concept of manned/unmanned teaming is a place that the

Department of Defense is trying to go. I think ACTUV is a great platform for learning how to do that, working cooperatively with manned vessels.

Phil One last thing, what are the kinds of things that this kind of ship being unmanned could do that wouldn't be possible with manned vessels? What kind of advantages does it give for [indiscernible]?

Scott Sure I think there's a couple things that distinguish this from a manned vessel. Obviously, people are necessary and vital for a lot of things we do. But at the same time, when you put people on a ship and send them into harm's way you have to do a lot to protect them. So, one of the benefits that a vessel like ACTUV brings is it reduces the requirement for survivability features that are primarily there to protect the crew. Potentially, it allows you to build a smaller and less costly vessel, and also potentially put it in situations where you would not be willing to put a manned vessel. ACTUV isn't exactly expendable but in an all-out war you certainly would consider it to be attritable, and it would okay to lose some of these if as part of the overall campaign that reduced the threat to your manned ships.

The other thing that's important about unmanned is really trying to reduce the cost to operate. We want to build something that is very affordable and that then allows potentially the Navy to procure them in large numbers, which helps us to solve some capacity problems. We have tremendous capability in our manned warships and I don't know that we're going to go beyond that capability, but it's limited because we have a finite number of ships and the Navy isn't expected to get a lot bigger. We just can't be everywhere at once with a manned vessel, and this gives us the ability to be a lot more places and do a lot more things simultaneously.

Phil Great answer. Thanks. Can you give us just a cost difference between manned and unmanned, or, this vessel and the manned ships? I've seen some figures out there.

Scott I'll talk about what our targets were for the ACTUV program. At the beginning, we said that we would like to get to a series production cost of about $20 million a copy, which isn't cheap but certainly is much less expensive than a manned warship. Through the process of actually building the first prototype, we've been trying to keep track of what the actual construction costs were and it looks like we're going to deliver the

first one for a construction cost of somewhere between $22 million and $23 million. We're getting pretty close to that goal and we think that through economies of scale and learning curve that we can keep getting better.

Now it's important to point out that price is not the total program cost. That was really just the cost of the construction; it doesn't include all the design and software. But, those things you essentially have to do once.

Then in terms of the daily cost to operate. We've done a cost model and we think that when you get into an operational mode with a platform like this it's in the ballpark of $15,000 to $20,000 a day.

Phil Thanks so much.

Moderator Thank you.

Rick I have a question here sent online. This person is asking, "What stops an adversary from stealing an ACTUV or is it able to give a distress signal?" I think that would be basically an act of war.

Scott That's right. I think it's important to point out that ACTUV as a government-owned vessel is still covered by doctrines like Sovereign Immunity Rights. Rick's correct that it would be a very provocative act for somebody to steal ACTUV.

I'll talk a little bit about the practicalities of that, though. Because of ACTUV's collision avoidance software, if another vessel tries to approach it, it will actually avoid being approached within some sort of threshold distance. So, in effect, it'll run away from anybody that's trying to get too close. If some people were able to get onboard the ACTUV, once we get to a fully operational system, there's no human operable controls for anybody to grab onto and use. It's more likely to see that somebody could disable the vessel than they could really take it over and drive it into a foreign port.

Beyond that, it's certainly possible and some of it gets to the concept of operations and tactics. We have cameras on board and we do have a satellite link. So, we've got attribution if people are doing those kinds of things. Potentially we could respond with manned vessels and airplanes that may be nearby.

Rick All yours, Tony.

Moderator Thank you very much. Our next question then will come from Patrick Tucker. Please go ahead.

Patrick Thanks. My big question was answered earlier. Following up on what everyone else has talked about, what is the duration of potential voyages that you're looking at now and how might you expand those out? Also, can you speak to some published reports that both China and Russia are working on a similar type of program? Would that neutralize the advantage that ACTUV brings?

Scott Let me start with the first question, which was about the length of the mission. We designed ACTUV for a notional 70-day mission that involved leaving a port, going out to a point in the ocean, loitering for some period of time, doing a submarine track and trail mission, and then returning back to port. The actual mission duration is really a function of how fast you burn your fuel. So, if you're going at top speed the whole time, certainly you're not going to go for 70 days. If you have more loiter time built in, you potentially could have missions that are longer than 70 days.

Getting to the question of whether other countries are investigating or building unmanned vehicles of different types, clearly they are. No military advantage is permanent.

Rick All yours, Tony, for the rest.

Moderator Okay, thank you. Next is Dee Ann Divis. Please go ahead.

Dee Ann Hi, I'm with *Inside Unmanned Systems*. Can you please speak to cross to manned communications either now or down the road? Do you have common software built in, common communication links that can be used for that? And, I'd also like to hear you talk about on-ramps for new technology as things evolve.

Scott Good question. I think the first one really gets to commonality and the desire to have things like common control stations. That's an important thing that we should all be striving. Let's say you're a manned vessel and you're trying to control multiple different kinds of unmanned vessels, and unmanned aircraft and other unmanned systems, you don't want to have a unique control system with unique software for every one of those. So,

there's a big push within the Navy to try to drive toward commonality, and we support that and we want to get onboard that.

Some of those standards are still really evolving, though. So, for where we are today, ACTUV is a standalone system with its own control station. But, where we can, we have adapted some specs and standards that would allow us to be effectively an open architecture for integration with other systems.

Dee Ann And technology on-ramps? Ways to add stuff in?

Scott Right. Technology on-ramps for putting new sensors and payloads on the vessel, I think we've built in the hooks to be able to do that in our software architecture. If people understand that architecture and comply with it, we can bring new sensors and payloads onboard and integrate them with ACTUV's autonomy system.

Dee Ann Thank you.

Moderator We'll move on to our next question. It will come from Sandra Jontz. Please go ahead.

Sandra Hi. Thank you very much for doing this. A couple questions, could you please tell us a little bit of what the benefits are of a larger vessel over the smaller ones that are already operational within the Navy? And, are you able to talk about some of your industry partners? And then, maybe address the cyber security, how do you keep this from being hacked?

Scott Right. Those are all really good questions. Let me start with the benefits of a larger vehicle. When you're out at sea, and the sea is really big, some of the things that are important are endurance and range, persistence, sea keeping, which means the ability to continue operating when the weather gets bad and the seas get worse, and then also, payload capacity. So, all of those things get better as you get to a larger vehicle.

There is a fundamental decision about do you build something that's small enough that you could easily launch and recover it from another ship, which is kind of to the large degree that's where we've been, or do you build it big enough that it could leave the pier and go distances of thousands of miles on its own. What really drives the size is the payload and the endurance needed to carry that payload to the place you want to be and stay there as long as you want to be there.

So, that was the first question, I'll go to cyber security. It's a concern, right? It's not only a concern with unmanned systems, it's really a concern with any software intensive system that DoD operates. We're trying to do all of the things that people generally understand about avoiding and preventing cyber intrusions. But, I don't know that we're doing anything beyond what the rest of DoD is doing for that. Certainly, it's an area we've got to focus on a lot in the future.

There was another piece of the question.

Rick Sandra, you had a middle question there.

Sandra Industry partners, are you able to name any?

Scott Yes. So, our prime contractor on this was Leidos, which when we awarded the contract was SAIC, but I think you know that SAIC broke into two companies, and Leidos was the piece that took this. Leidos had the overall responsibility for developing the software and building the full scale prototype. They had a number of subcontractors. The one that actually built the vessel for them is here in Portland, which is Vigor

Industries, which at the time we started was Oregon Iron Works. Then Oregon Iron Works was procured by Vigor.

Sandra Thank you very much.

Rick A question, Tony?

Moderator Thank you. The next question will come from Chris Cavas. Please go ahead.

Chris Hi, just quickly a few details of the ship. What's its tonnage? One at a time, what's the tonnage?

Scott Sure. Full load displacement is about 135 tons, 140 tons. That includes about 40 tons of fuel. So, light ship, meaning without fuel, is just under 100 tons.

Chris Okay, diesels?

Scott It's got—right, so propulsion is diesel. There are two diesel engines; one port, one starboard. Two shafts, two reduction gears, so two completely

separate propulsion trains. With both engines, we can get up to speeds in the ballpark of 26 or 27 knots.

Chris You published 27 knots on your—

Scott Yes. Actual top speed is somewhat a function of sea-state [ph], which of course we haven't really tested yet because we've been in the Columbian [indiscernible] Rivers. So, sea-state and then how much fuel you're carrying. So, we'll get official sea trial numbers when we get to San Diego in a few weeks. But we feel pretty comfortable about getting into the 26, 27 knot range.

Chris And, this is aluminum, steel, alloy composite.

Scott It's actually composite. We looked at both aluminum and fiberglass, which are both plausible materials for vessels in this size class. Then based on some studies early on in the program decided that there were some advantages of going to a composite fiberglass construction. So, it's foam core with fiberglass skins. It's pretty—it's a very standard process called vacuum assisted resin transfer molding that's also used for a number of naval vessels and high-end yachts and kind of in this size range.

Chris Okay. The supports for the outriggers, is that composite, too, or is that metal?

Scott Yes, so the cross pieces, which are called akas, those are the things that [audio disruption] ships. Those are also composite; they're actually somewhat higher stiffness, higher end composite structure. You can probably tell by looking at the pictures of the vessel those things need to be pretty stiff.

The center hull and the two side hulls, which are called amas, were made using the fiberglass [indiscernible] resin.

Chris Those are terms that have come out of Australia.

Scott I think they come out of Polynesian work canoe terminology and they've been adopted by naval architects for this kind of craft.

Chris Okay, fair enough. And then also the sensor package on the ship, it looks like a FURUNO nav radar. Is that pretty much it? You must have cameras.

Scott Yes, that's a great question. So, the primary top side sensors for detecting and avoiding other ships, there are two FURUNO radars, an X-band and an S-band. We also have another smaller radar, so we have a lot of redundancy built in because we really want to be able to detect and avoid things under lots of different conditions, including conditions of failure of some of the sensors. We also have AIS, that's Automated Identification System. Any vessel over 300 tons is supposed to broadcast its position and classification.

You're right, we do have cameras. The camera development is still ongoing and actually that's one of the things that we're going to start testing when we get down to San Diego is both improved hardware and software for electro-optic and infrared detection of other ships. Right now, we're using radar as our primary tool for detection, and where we want to get to is using the cameras for classification. So, under COLREGS for example, it's important to know whether the other vessel is a power vessel or a sailboat. We've actually been developing software that can autonomously look at an image and classify it into the type of vessel that it is.

One of the things we've been cooperating with ONR on is a stereo camera system that does both detection and ranging of other vessels using basically two cameras and a stereo pair.

Chris I'm sorry, just one more and this is—then, I appreciate all those details. Is there an intended compatibility with any elements in the LCS mission modules, the ASW package, the MCM package, anything else? Is there anything there that you can use on your hull?

Scott That's a good question and I think we're still exploring that. My view of the world is that even though ACTUV wouldn't fit inside LCS it certainly could still be operated as an LCS mission module, using LCS as essentially the mother ship to control it. If you think about the way we might do mine countermeasures in the future, that might really be a great way to think about doing it. It gives you tremendous amount of flexibility both in terms of the things that are carried by LCS and the additional capacity and workload that you could accomplish using a large unmanned surface vehicle in tandem with it.

So, we've been kicking those ideas around. I don't think we've settled on exactly what the right [indiscernible] as yet.

Chris Thanks.

Rick And for those who are interested in some of those construction details, just on a visual level, there's a pretty fun video that should be up now. If it's not, it'll be up very shortly. A time lapse, construction video of the ship, in the shipyard here in Portland. If you go to the DARPA YouTube channel, you'll be able to see the whole thing being built in about a minute and a half. It's pretty fun.

Jared Tony, it looks like we have two more questions. So, the first one from Paul Benecki with *Maritime Executive Magazine*.

Moderator Certainly, his line is now open. Please go ahead, sir.

Paul Hi, how's it going? Paul Benecki, *Maritime Executive*. So, you mentioned that at the moment ACTUV isn't able to perceive whistle signals, determine whether vessels are restricted in their ability to maneuver or other things that a look out would ordinarily do. COLREGS requires the maintenance of a proper look out by sight and hearing at all

times. Do you guys intend to have a man on the boat until these type of COL issues can be resolved?

Scott Yes, for the near-term testing we will have a human being onboard. I think that's both a safety feature and really just sort of a back-up so that if we think the autonomy isn't doing what we expect it to be doing, a human being can take manual control. We have what we call a temporary operator control station, which is a removable cockpit, if you will, with a qualified operator onboard.

I've used sort of the analogy to the Google car. Even though they've been driving for over a million miles, they still have a human being sitting in the driver's seat. I think we'll be there for a while until we work through some of those kinds of questions of reliability and essentially completeness in terms of addressing each and every one of the COLREGS.

Paul Great. A quick follow-up question, have you guys collaborated with any of the private industry groups that are looking to do this in the civilian world, like, Rolls-Royce, or any of the others?

Scott We haven't been actively collaborating with Rolls-Royce. We've seen a lot of the press about what they're doing and I think it's synergistic. It's good to see that multiple companies are interested in working in this space. I think there is a lot of synergy between things going on the civilian side that really are motivated mostly by economics with the things that we're trying to do working with the Navy. I think that's a win-win eventually.

Paul Alright, thank you.

Rick Great. One last question from Rick Burgess with *Seapower Magazine*.

Moderator Thank you. Sir, your line is open. Please go ahead.

Rick B. Thank you. I was wondering, have you determined at what point this program will transition to the Navy or are you just going to wait and see how it goes?

Scott There's a two-part question there in terms of transition to the Navy. One is we have a memorandum or an agreement with the Office of Naval Research that actually says that we are going to be handing the lead for the

program and title to the vessel over to ONR by the end of this calendar year. So, that's actually coming up fairly soon. We haven't negotiated the exact date, yet, but our target is to do that sometime in the late fall. So, ONR will really take over the lead at that point and run with it.

The longer term question about whether the Navy would like to go into series production on some kind of a large unmanned surface vehicle, I think it's still an open question and one that to some extent will be influenced by the results of this extended test phase. The test phase starts essentially when we get to San Diego in a few weeks and then will run through fiscal '18. We've got a lot of time laid in to really ring out the ACTUV system and find out how reliable it is and how capable it is.

Rick B. Great, thank you.

Jared Thanks a lot, Rick. Tony, that's the last of the questions that we have. Again, I just wanted to remind everybody that the embargo lifts at 9 a.m. Eastern tomorrow. That's 12 Pacific.

Rick 12 Eastern and 9 Pacific.

Jared — I did it again. I'm sorry. This is what happens when you're operating on too little sleep. Yes, thanks for clarifying. The media kit that we sent out is pretty rich in terms of both video and photographs of the vessel. That should all be available for download now. Without any other questions, we thank you very much for your time and certainly your questions today, and look forward to your coverage.

Rick — I'll just add that if you do have follow-up questions afterwards, you can always reach us at DARPA Public Affairs by emailing us at outreach@darpa.mil. We'll follow-up with you.

With that, I think we're good to go, Tony.

Moderator — Thank you very much. Ladies and gentlemen, that does conclude your conference call for today. We do thank you for your participation and for using AT&T Executive TeleConference. You may now disconnect.