

AFRL AUTONOMY TRANSCRIPT PART 3

Jim Overholt

Hi! I'm Dr. Jim Overholt, I'm the senior scientist for autonomist systems at the Air Force Research Laboratory, and today I'm joined by Ms. Kris Kearns the portfolio manager for autonomous system at AFRL, and together we're going to talk to you about the technology strategy for autonomous systems and autonomous science.

Kris Kearns

So we've talked to you a few times about, in previous versions, about our vision and strategy and the goals that we've laid out to structure our autonomy program here in the Air Force Research Lab. We're going to briefly go through that, and then were going to dig into one of the goals we haven't talked about yet. So our vision like we talked about before is about intelligent machines seamlessly integrated with people. So again, were not talking about taking people out of their rolls but we are talking about making intelligent machines that we can integrate with people, so that we maximize performance in the complex contested environments that our military has to operate in. And when we take that vision and we say so what are the major challenges, what are the goals that we need to try to achieve in order to realize this vision. We break those into four; the first is about demonstrating highly effective human-machine teams. So again, how do you put people and machines together and get them to work together well. The second one is about creating coordinated teams of machines. So just like we want people and machine teams, we want machine and machine teams. Third goal is about getting these systems to be able to operate in complex, contested environments that we operate in. And then finally underlying that then our fourth goal is about making sure these systems operate safely and effectively. In other words how do we test and evaluate, verify, validate systems that are going to think and make decisions and do things on their own. So we've previously have talked to you about the highly effective human machine team goal. Today were going to take on talk about this coordinated teams and multiple machines and our ideas and our thoughts and the challenges that we've identified in how do we create these teams of machines that can work together and coordinate and perform their mission.

Jim Overholt

So with what we've talked about before is this notion of enduring problems in the effective human machining what we've talked about enduring problems and certainly when it comes to coordinating teams of machines their enduring problems phase. One of the first ones is this notion of machine intelligence but his idea of machine intelligence and how machines tackle problems, how they can think how they can basically come together and be able to coordinate their movement be able to apply their particular resources to a problem that they are having to face. And that's one of the most significant things were looking at. The second enduring problem is this notion that if we have these teams of machines in some cases were going to want them to be able to change and fractionate, or be able to take if they go from ten down to maybe groups of four or five, be able to tackle a problem or be able to distribute to handle certain tasks. That's going to be a real key feature, not only the intelligence in the machines but the ability to redistribute the collective so to speak and be able to tackle the machines. And the final enduring problem that were trying to look at when it comes to scalable machines is this notion of how do we facilitate excellent good reliable communications all through this phase. Because now you're going to have machines that need to communicate with each other and not just traditional communications. So we'll use any kind of modes and modalities that are available to us. So to us those are the enduring problems phase for really trying to realize this notion of coordinating these scalable machines together.

Kris Kearns

So if I can add to what you just said it's really about so how do we create a single Intelligent machine that can sense this world, can understand what that means, understands commanders intent, and then can take action, it can decide and it can take action, and it knows what the appropriate action is. So on its own it can do that. Now let's take one platform, put away the other platforms and now they need to come together and they need to plan, based on what their mission was, what their commanders intent said to do, go out and perform their individual missions, be able to coordinate come back together to do things as they need to do things, and be able to do that in that communication, and secure communication so that they know where each other are and where their at and what the state of the mission is.

Jim Overholt

All excellent points like you said, one machine is difficult now were going to look at multiple machines.

Kris Kearns

And make sure they behave themselves. So one of the underlying technologies I think in that is today's platforms in the Air Force we are taking thousands and thousands of data points on how subsystems are performing. What's the hydraulic pressure? What's the engine temperature? How is this the boards performing inside the electronics? But in today's systems we don't do a very good job of turning that into real time state. The machine does not understand, so based on these sensor readings across its subsystems and the platform itself what does this mean I can do? And can I report that? That says hey here's how much further I can fly, here's a maneuver I can't do. Here's there's a resource within the electronic intelligence capability I can't provide right now because I'm being tasked to do other things. So what we would say is what we would like to see is systems that are aware of their own state they can take all of this data and not turn it into knowledge about its state what it can do and what it can't' do. And this is important so that if a person is sitting there it isn't, I really don't care what they hydraulic pressure is engine temperature is necessarily. What I really care about is what does that mean that you're going to be able to; the system is going to be able to do to help perform the mission.

Jim Overholt

The performance actions of the machine right.

Kris Kearns

That is one of the underlying, we talk about autonomous systems I don't think it comes out and we don't highlight it a lot across the community, but it is going to be a key technology enabler in order for us to have systems that behave and act on their own

Jim Overholt

So self-awareness is what you're looking for through the, to be able to application of doing that kind of state measurement

Kris Kearns

Absolutely, and then when you say that's one system now it needs to be able to communicate that to a team. So if something happens in the military mission, if you get shot at, if something happens it can report back to its teammates what it can, what it's capable of doing. So then they can readjust to figure out how to perform their mission.

Jim Overholt

So an application of this kind of technology is something that we'd be looking at which would be manned unmanned teaming. So we envision a future certainly were looking at intelligence machines, a single intelligent machines, now were looking at collectives of intelligent machines but the real key piece is how do we integrate manned systems into this collective of unmanned intelligence systems. So that's going to bring about its own challenges in terms of being able to coordinate, distribute tasks, be able to assign to

the unmanned systems what they need to do. From either a human commander and or being able to self-organize and be able to distribute in order to handle a particular problem or issue that they're dealing with. So one of those particular significant problems were looking at is this notion of a manned unmanned wingman. So a manned unmanned wingman is the kind of thing that were interested in looking at where you could have a piloted aircraft that is supported by unmanned assets and then they have some kind of mission they're trying to accomplish. And be able to distribute the tasks based on what the desired mission content or mission outcomes are. And so this is something that folks at AFRL are looking at right now in terms of what are the technologies what's the intelligence of the machines. Because obviously we want these machines to be able to follow commander's intent, we want them to be able to disperse and do what they need to do, and there's going to be some amount of learning in this process as well. In other words, as the machines go out they understand again, back to our other things we talked about the tendencies of the human that they're dealing with, understand how to tackle the problem in the best way possible.

Kris Kearns

So what I think we just laid out is some of the ideas, some of the foundations enduring problems coordinated teams and machines. We've previously talked about what the highly effective human machine team is. So we will in the future recordings talk to you about the complex contested environments, as well as TEV&V are they safe and effective making sure things operate safely and effectively. And so with that were going to wrap up this one, and check us, come back and check in for the other two goals. If you haven't already seen the previous two please tie in and check those out too.

Jim Overholt

Thank you very much.