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WIRED FOR WAR

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Moderator:

CARLOS PASCUAL, Director
Foreign Policy Studies Program
The Brookings Institution

Featured Speaker:

PETER W. SINGER, Director
21st Century Initiative
The Brookings Institution

Discussant:

GENERAL JAMES N. MATTIS, USMC
NATO Supreme Allied Commander for Transformation

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ANDERSON COURT REPORTING
706 Duke Street, Suite 100
Alexandria, VA 22314
Phone (703) 519-7180 Fax (703) 519-7190

P R O C E E D I N G S

MR. PASCUAL: Good afternoon. My name is Carlos Pascual. I am one of the Vice Presidents of the Brookings Institution and the Director of the Foreign Policy Studies Program here. It is a real pleasure to invite you and welcome you to this event that is focused on a tremendous new book, *Wired for War* by Peter Singer. Peter has been one of our true stars here at the Brookings Institution. You will see copies of the book for sale outside. But we really wanted to use this as an opportunity to both talk about the book and talk about the concept of the future of war and the way that war has evolved over time and what we need to think about and look in the future and how to prepare for it.

Peter has very much been one of the most innovative thinkers who we have had at the institution, and one of the questions he is always asked is, What do we understand from the realities in which we are in today and how do we extrapolate that into the future? What kind of vulnerabilities does that create for the way in which we conduct our business as a country and the way that we think about our security? And how do we address some of the questions that surround that including the regulation of those issues and the morality of those issues?

He has done that brilliantly in his previous books. His first book was called *Corporate Warriors* and it really focused on this idea of

the contracting out of military capabilities and what does that mean in terms of liability and accountability. His next book was called *Children at War* and it put the question of child soldiers really on the international agenda. And now in this book, *Wired for War*, he has come and asked the question what do we understand about robotics and what does that mean for how conflict in the 21st century is going to play itself out.

There is a part of this book which is fascinating because it's sort of a science fiction thriller. It's the stories that you read about and you think is this what the world could actually be. But in fact he is going back to what he has had in previous methodologies which is he is actually understanding what is happening today as well, and if we look at what the nature of robotics has already -- the involvement of robots in the way that we consider and think about conflict today, there has already been a radical transformation in the nature and the conduct of war. The point that this brings us back to is how do we understand the role of technology but also the role of the individual? Who is making the calls? Who has responsibility? Who is accountable?

For me, I focused on some of those questions in a way that I had not necessarily had before, and Peter and I have discussed this a number of times in watching the documentary on Robert McNamara, "The Fog of War," when he talked about the firebombings over Japan. He

talked about the way in which the destruction that was happening on the ground had become disconnected from the individual human being so that that individual cannot understand the nature and the depth and the extent of the horror of what was happening. I think what Peter poses to us is are we at a point where those relationships between individuals and war are reaching a new point and does it have implications, will this have implications, for the conduct of warfare in ways that we have not thought of in the past.

Already what we have seen in war is a different way in which we have seen an interaction between civilians and the military, hence we are particularly lucky to have commenting on the book but on the concept of transformation General Mattis with us. General Mattis is the NATO Supreme Allied Commander for Transformation, and the Commander of U.S. Joint Forces Command. For those of who are not familiar with this, he wears two hats, one in the context of NATO, and in that context of NATO this man is the person principally responsible for understanding how does the alliance continue to need to transform and adapt itself to remain relevant, and at the same time asks that question for the United States as the head the combatant Commander for U.S. Joint Forces Command to say what is it that we have learned about war and its changing nature. One of the things that he personally has been a leader

on within the United States government in his various roles there has been the intersection and the interaction between civilians and the military, recognizing that war is not just an act that is performed with kinetic energy, but in fact it also involves in order to be able to win the participation of civilians and the ability to engage to produce a result that constructs something that is not just a military act, but has to be a positive act to allow something positive to take the place of that which has been destroyed.

So one of the things that he has been raising as a responsible commander in the U.S. military is not just how do we destroy the target, but how do we engage in the process of rebuilding. And in that sense has brought another perspective on transformation which he has seen personally in the roles that he has played with the Marine Expeditionary Brigade that he was commanding in Operation Enduring Freedom in Southern Afghanistan, later as the commander of the 1st Marine Division in Iraq, but then bringing those issues together as the Deputy Commandant for Combat Development at the U.S. Marine Corps which is where we had first met and where I watched him very personally engage these young soldiers on what it was that they were doing and what it meant to succeed and what it meant for not just to succeed on the battlefield, but what it meant for the United States government to succeed.

So I think we are going to have an absolute terrific event, and to kick it off we will then start with Peter walking us through "Wired for War" and some of the issues that he has addressed there, and following immediately after that having General Mattis pick up on these themes and help us understand some of the practicalities and challenges of transformation coming back to you for questions and answers. I think one of the things I hope all of us will challenge ourselves about as we go through this discussion is what does this mean for success in war, but what does it also mean for accountability, what does it mean for morality, and how do we address those questions today so that we are not in a situation that we found ourselves perhaps with the explosion of the first atomic weapon, where we found ourselves catching up with the security and the moral implications afterwards. What Peter is doing today is forcing us to think about this and look ahead into the future. Peter, we are indebted to you.

MR. SINGER: I wanted to thank you all for coming, and I particularly want to thank General Mattis. It is just an incredible honor for me personally to share the stage with such a leader. And thank you, Carlos, both for the very kind introduction, but even more so for the support that you have shown for what is admittedly not a traditional topic. If I had come in to a lot of other think tanks and said I want to write a write

a book about robotics and way I would have been laughed out of the room, and even more so if I had come in and said the way I want to approach this is going to be reflective of my personality and also my generation and trying in a sense not just to tell the stories and ask the hard theoretic questions, but also recognize that much of the scholarship in our field does not try and make itself accessible to those beyond our field, that is, we often turn important issues like war and talk about them in a very dry manner, an overly theoretic manner, and so this is a book that tries to both tell the stories, ask the hard theoretic questions, ask the hard ethnical questions, but also weaves in a lot of pop culture, movie references and the like, even a little bit of humor so that it is nontraditional in both ways.

With that in mind, I thought I would start us out with a scene from the book. It takes place in Iraq. There was little to warn of the danger ahead. Hidden alongside the road, the insurgent's improvised bomb called an IED looked like any other piece of trash. By 2006, there were more than 2,500 of these attacks every single month and they were the leading cause of casualties among both U.S. troops and Iraqi civilians. The team that was hunting for this bomb was called an EOD team, an explosive ordinance disposal team. They are the pointy end of the spear in the effort to suppress roadside bombings. In a typical tour in Iraq, each

EOD team will go out on two of these missions a day, every single day, defusing at least two bombs. Their value to the American war effort is perhaps best reflected by the fact that insurgents began offering a $50,000 bounty on the head of each EOD soldier. Unfortunately, this particular EOD call would not end well. By the time the soldier had advanced close enough to see the telltale wires protruding from the bomb, it was too late. The IED erupted in a wave of flame.

Depending on how much explosive you have in an IED, you have to be as far away as 50 yards to escape from the blast and the bombing fragments, and even if you are not hit, the explosive force can break limbs. So when the debris and flames cleared, the rest of the team advanced. Unfortunately, this particular soldier had been right on top of the bomb. There was little left. That night the unit's commander did his sad duty. He sat down to write a letter back to the States about the incident. In his condolences, the chief noted the soldier's bravery and sacrifice. He talked about how hard the rest of the team had taken the news, the loss of a beloved teammate who had saved their lives on several occasions. He even apologized for his inability to change what had happened. But he also expressed his thanks, and he went on in the letter to talk of the silver lining that he took away from the loss. As he wrote, "At least when a robot dies you don't have to write a letter to its

mother." The soldier in this case was a 42-pound robot called a PacBot and the chief's letter in turn went not to some farmhouse in Iowa like what often happens in the movies, but to the iRobot factory which is named after the Isaac Asimov book and the not-go-great Will Smith movie in which robots not only carry out mundane chores, but they also make life-and-death decisions. That was the world of fiction that is becoming a reality, and you shall see in these slides that follow the science fiction is becoming battlefield reality.

It is important to note if we are going to prove something here in fact that I was going to get to in a little bit -- technology is failing us right now so we are going to move on. And that is actually as we talked about Finagle's Law, and General Mattis will bring this up. In the slides that you are going to see here, I am not going to time them to them. It is like the traditional PowerPoint. We are not going to have bullet points. I know it is awful for those of you in uniform. I hope you will be able to follow not a traditional PowerPoint. But these pictures are to show you how far we already are. Everything that you are going to see here is either real in terms of operating right now or at the prototype stage. Another way of putting it is that there is nothing you are going to see here that is powered by Klingon power packs or teenage wizard hormones. This is the reality today.

So as we pull back from the story about one PacBot, it is easy to miss today that something bigger is going on in war. Let's talk about the numbers here. We went into Iraq with just a handful of unmanned systems in the air and now have 5,300. We went into Iraq with zero unmanned systems on the ground. We now have 12,000 in the inventory. And these are just the first generation. They are the Model T Fords compared to what is already on the prototype stage. And, yes, the tech industry term of a killer application does not just describe what iPods did to the music industry. The ones of these robots who are coming to a battlefield near you soon won't just pack a lethal armory of missiles, rockets, and machine guns, but they are going to be able to make their own decisions on when and where to use force. So for all the arguments you hear out there as one security analyst put it to me that, "Iraq proved how technology don't have a big place in any doctrine of future war," the reality is far different. As one robot company executive described to their Pentagon customers, "The user perception changed overnight from we don't want robots to holy crap, we can't do without them."

That is what is happening right now. Peering forward, one Air Force Lieutenant General that I interviewed forecast that, "Given the growth trends, it's not unreasonable to postulate future conflicts involving tens of thousands of robots." Let's be clear here. We are talking not

about tens of thousands of robots with the capabilities of today, but tens and thousands or robots with the capability of tomorrow because you have operative Moore's Law, basically that the power that can be packed into a microchip roughly doubles every 2 years. So when you calculate that out it means in roughly 25 years they will be a billion times more powerful than today, and we are not using billion in the Austin Powers billion sense, we literally mean a billion times. What this means is that what was once only fodder for science fiction conventions now has to be talked about seriously in the world of politics and war. A robotics revolution may well be at hand.

I need to be clear here. I am not talking about the fact that you need to watch out for the governor of California showing up at your door. This is a different kind of robots revolution. Indeed, when historians look back at this period they are going to conclude that we are at the start of the greatest revolution in warfare since the introduction of the atomic bomb. In fact, I think it may be even bigger. Our new unmanned systems don't just affect the how of war fighting, but they are starting to affect the who war fighting at its most basic fundamental level. That is, every previous revolution in war was about a system that should shoot quicker, farther, or with a bigger boom. That is certainly happening with robotics, but it's also reshaping the identity and experience of war itself. Another way of putting it is that humankind is starting to lose its 5,000-year-old

monopoly on war, and *Wired for War* is basically a book that tries to capture what is happening by going out and getting the stories of those who are living and experience this revolution and then shine a light on some of the questions and trends that are taking place in terms of policies, law, social, ethnical issues, et cetera, all these sorts of ripple effects.

So for me in many ways the most apt historic parallel to this current period may well be World War I. Back before World War I, there were strange, exciting new technologies that people described just as science fiction. Probably the best example of that was H.G. Wells' story about the land ironclad which then just a few years later, Winston Churchill, inspired by it, created tanks. Or you have a story by A.A. Milne, the creator of the Winnie the "Winnie-the-Pooh" series, which was one of the first to raise the idea of using these new things called airplanes in war. When they wrote these stories they were laughed at. They were scoffed at. People said, no, this will not happen in war. And as we well know with tanks and with airplanes or submarines, they were all quickly used in war.

But they did not change the underlying fundamentals of war, that is, war was still driven by human interest and human failings. But what was interesting to me is that even these earliest models quickly proved useful enough that they were not going away and that they were going to be used more and more. And beyond that, they were starting to

raise questions in all sorts of other areas, that the ripple effects were taking place not just in war, but off the battlefield as well. For example, the submarine which in 1914 the British Admiralty said would never be used in a blockade was. But then you had the fact that differing legal interpretations over the laws of war involving submarines is what drew the U.S. into World War I, and then in turn that is what led to our ultimate superpower status over the next few decades. Or for example you have the way that World War I spurred the automobile industry. Before World War I, Ford was making just a couple hundred Model T Fords every year. After World War I, they were making over a million every year. And that of course led to other second-order effects like global warming, suburbia, teenagers being able to go out on dates, all these sorts of things. So to me this example of World War I is instructive because a lesson of both war and technology that we have to watch out for right now is that there is no long-term first-mover advantage. If you don't believe me, how many in this room still use Wang computers? The same thing is true in war.

To continue that World War I parallel, the British and the French were the masters of tank warfare. They had the first-mover advantage, and a couple of years later they lost in the next round to the Germans who chose a different doctrinal direction with these new technologies. So what we have to think about is we are ahead in this

world, but there are 43 other countries out there working on military robotics today including Iran, China, Russia, and Pakistan.

There is another aspect of this. Robotic warfare is open-source warfare. The enemy still has a vote and they are already seeking out new weaknesses and new vulnerabilities. There is another aspect of this. These systems are also available to nonstate actors and it is made all the easier by the fact that so much of this technology may be revolutionary, but it is also highly commercialized. For example, with $1,000 you can go out and build a drone that has roughly the same capabilities that the Raven drones that our soldiers use in Iraq have. Another group that is featured in the book is a set of college students who raised money to do something about the genocide in Darfur. They were then offered by a private military company the opportunity to rent their own drone. This raises the question of how does this enter into the terrorism game?

During its conflict with Israel, Hizballah operated at least four UAVs. There is already out there a jihadi website on which you can win the opportunity to detonate remotely an IED in Iraq while sitting at your home computer. One of our EOD bots has already been captured and turned into a mobile IED. It gets even scarier than that. There was an Air Force study that found the most optimal platform for spreading WMD was

UAVs, and it went on to find that we did not have any effective defenses against it right now.

Another guy who I interviewed was a Pentagon scientist and he talked about giving him $50,000 and he can shut down Manhattan. I do not go into the details of this in the book, but it is a pretty scary and very real scenario. So for me I think this trend will, one, reinforce the current empowerment of individuals versus states and organizations. And two, it is going to eliminate the culling power of suicidal attacks, that is, you do not have to promise 72 virgins to a robot to convince it to blow itself up.

But there are ripple effects in all sorts of other areas. For example, what comes from being able to move more and more Americans out of harm's way and how does that affect our very decisions on when and where to use force? Many of the people who I interviewed worried that it was going to make us more cavalier about the use of force. As one Reagan-era assistance defense secretary put it, it is going to return us to the "cruise missile diplomacy of the 1990s. We will have more Kosovos and less Iraqs." Indeed, there was already an editorial in the *Washington Post* recently that argued we should use unmanned systems as a substitute for manned intervention into Darfur. The problem with that is that military operations, even the irony of humanitarian operations carried

out by unmanned systems, are still complex and they involve you in situations on the ground in the long term. Moreover, when you unman your intervention, you may show that you care, but you also show that you do not care enough.

For me, there is another aspect. They may be taking certain trends already in play in our foreign policy and democracy and take them to their final logical ending point. An example of the links that are supposed to exist in a democracy between the public and its military. What happens when you do not have a draft? When you do not have any more declarations of war? When you do not have your public have to sacrifice with taxes or war bonds? Then add in the fact that the Americans who are sending at risk are mainly just American machines. You take the already lowering bars to war and you drive them to the ground.

But technologies, especially these new technologies, don't just delink us. They also reshape the public's relationship with war, that is, we have the rise of YouTube war. They record all that they see. There are more than 7,000 clips out there of combat footage in Iraq, most of it gathered by drones. What happens then is that you could argue this building a better connection between the public and their military. The home front is seeing what is happening on the war front as never before.

But inevitably in our strange weird world, people turn this into a form of entertainment. They email around these clips of actual combat footage. One of the ones I got for example is a clip of a predator drone taking out a site, bodies going in the air, and it is set to Sugar Rae's song "I Just Want to Fly." Soldiers call this war porn.

The experience of being able to watch more but experience less widens the gaps between our perceptions of war and its realities. To make a sports parallel, it is like watching a basketball game on TV where the 7-footers are this high versus seeing the game in person at the stadium or even participating in the game. Even worse, when your experience of war is just through these clips, it is the ESPN Sports Center version of war. It is all just slam-dunks and smart bombs.

Long-term for me there is an irony in all of this and this is what Carlos referenced, that when you look at the ripple effects of war, incredible technology is being introduced into it with these robots, but it all needs to be looked at through the lens of human psychology. So a policy example of this is robots' impact on the very human war of ideas that we are fighting right now against radical movements. What is the message that we think we are sending with our systems versus what are those on the other side receiving?

I went around interviewing folks. For example, one was a Bush administration official who had this to say, "Our -- of war plays to our strength. The thing that scares people is our technology." But when you speak with people in Lebanon for example they describing our growing use of unmanned systems, as a news editor there put it, and he said it while there was a drone buzzing overhead, "This is just another sign of the cold-hearted, cruel Israelis and Americans who are cowards because they send out machines to fight us; that they don't want to fight us like real men, but that they're afraid to fight. So all we have to do is just kill a few of their soldiers to defeat them."

There is another change in terms of the experience of warriors themselves. I call this the rise of cubicle warriors. That is, you have a new form of combatants who have the novel experience of juggling the psychological disconnect of being at war, but they are physically at home. This is the words of one predator drone pilot describing their war experience, "You're going to war for 12 hours shooting weapons at targets, directing kills in enemy combatants, and then you get in the car, drive home, and within 20 minutes you're sitting at the dinner table talking to your kids about their homework."

Not everyone is having that sort of experience with war so it creates another form of tension between those who are serving in the field

and those who are off the battlefield. It also has some worried that it might make war crimes a lot easier to contemplate. More than a century ago Robert E. Lee said, "It's good that we find war so horrible or else we would become fond of it." He did not contemplate a time when war was about getting in your Toyota Camry, commuting to work, sitting at a computer screen, shooting these missiles, and getting back in your Camry and driving home in time to make it to watch an episode of "Friends."

It ripples out into the demographics of war. For example, one of the top drone pilots in the force who is highlighted in the book is a 19-year-old high school dropout and he's in the Army. That is not something that Air Force F-15 pilots like to hear, that this person, this youngster, is the future of war, and in many ways he has turned out to be more effective than some of the systems we have out there. In fact, this 19-year-old high school dropout enlisted man in the Army was so good that they asked him to come back and be an instructor at the training academy. That raises the question what are the attributes that you need for soldiers. As one interviewee put it, "Having a strong bladder and a big butt may turn out to be more useful physical attributes than being able to do 100 pushups."

There is also another ripple effect of this, the integration of robotics within our bodies. Several hundred soldiers who have been

wounded in action have returned to military service with robotic limbs, sort of the Luke Skywalker effect made real. But this is also leading out to ripples out onto fundamental aspects of military identity, for example, unit cohesion. One of the scenes in the book is about a strike that takes place outside Fallujah. In this strike, all the participants on the U.S. side never once meet in person. They never once talk. The entire operation is carried out via an internet chat room via text. I asked one of them to tell me about your friendships. Tell me about the band of brothers who you have come to know in this war. He talked about there is this person I know as Mother Goose. That is all they knew. They did not know their name. They just knew their handle in the chat room. So in many ways we see these kinds of ephemeral friendships that you have in Facebook moving on into war.

Must of what you are hearing, and this is something that General Mattis have argued in some of his team's work down at JFCOM, that there is always another side to revolutions and war. The age-old fog of war is not being lifted as the acolytes of former defense secretary Rumsfeld once argued that technology would make possible. We are gaining a amazing capabilities, but we are also experiencing all of these new very human dilemmas and questions with them. One of the ones that I would like to end on is this issue that Carlos raised, the ethical and legal

questions that surround it. For example, while we do have Moore's Law, we also have Murphy's Law, and sometimes these are just what they call oops moments. This is what an executive at a robotics company described, oops moments with robots. What is an oops moment with a robot? There was one time where they were testing out a machine gun armed robot and it spun around and pointed its weapon at a reviewing stand of VIPs like the scene in "Robocop" played out in reality. Fortunately it did not fire as it was unloaded. There are more tragic oops moments, like a little over a year during a training exercise in South Africa where an automatic anti-aircraft cannon had a "software glitch." Nine people were killed because of this software glitch as the weapon turned itself on and started firing in a circle. Those are oops moments.

As we move into the next step of this, we have to question where do you deal with the issues of accountability in this realm? As an illustration, we have had at least three incidents of what we could call unmanned slaughter, that is, where we thought we were getting a person with a drone strike and instead killed someone else, three times we thought we were getting bin Laden and instead got civilians by mistake. So as we move into systems that have more and more decision-making power, how do we take our international laws of war that came out of the 1800s and the 1900s and apply them to this 21st century technology? It is

not easy. There is a worrisome effect here, and this is what Carlos raised as well. One of the scenes in the book is where I went to interview folks at the International Red Cross, basically the holder of international war, and said, What are we doing about the laws that surround robotics and war? They said, "Really nothing." It is not that they were not aware of it, it was the fact that as they put it, there is so much bad going on in the world, why would we waste time on something like that right now?

We could have made justifiably that exact same argument back in the 1930s and 1940s. There is a lot bad going on in the world and why would we waste time trying to figure out the laws and ethics that surround this fictional thing of a bomb that is powered by radioactive material? We learned why, because it is a lot harder to deal with Pandora's Box once it is already opened. That is what I am hoping that the book will force us to do, force us to ask some of these questions that seem very science fiction but deal with them in a real manner. Of course I should add this may not be a problem in terms of legal accountability. One of the scientists who I interviewed worked for the Pentagon and he said, "There's no real legal or ethnical problems that we can contemplate with robots, that is, unless the machine kills the wrong people repeatedly. Then it's just a product recall issue."

I am going to end on that sort of logical scary point with this underlying issue. In 2003, the American Film Institute did a poll of the top 100 villains and heroes in all of Hollywood history, that is, the characters that best exemplified humanity at its best and humanity at its worst. There was only one character in all of Hollywood history who made it onto the top 100 list of both and that was the Terminator. My point here is this. Robotics both fictional ones and our real-world ones reveal the duality of humans, that is, what has distinguished our species has been our ability to create. It moved us past other species in terms of our technologies. It is also how we express our love and do art. It is our ability to create. Now we are creating something incredible, something new, maybe even a new species. But the sad fact of it is that we are creating it because of war and so that means that our machines may not be the only things that are wired for war. Thank you.

MR. PASCUAL: General Mattis (inaudible)

GENERAL MATTIS: Ambassador, it is always a pleasure to come to Brookings, and in light of some of my publicized remarks, it is an honor to be invited back to any polite company nowadays. I remember a time when you were still at State and we were working on trying to get the interagency process forward as we spoke about earlier. In those days we had to argue about doing this. We had to really argue that it was

necessary, and today it is all accepted, just how do we do it. The argument is over that we've got to integrate the interagency, the soft power with the military power. You will probably never get the credit you are due, frankly, sir, because you know how this town is, but the bottom line is at least to the Marines who worked with you in those days and all the military, we owe you a very deep sense of appreciation that we all feel and express it to you sometimes because it was like howling in the wilderness I think in those days.

I first met Dr. Singer right here in this building a couple of years ago, a very innovative as you can see young thinker, a brilliant young thinker, and he got me thinking about things that continue to guide my study. It is a superb book. I'll tell you, ladies and gentlemen, I don't get much chance to read anymore. Believe it not, I just read what people stick in front of me, and I've only skimmed through the book. I've read parts of it, but I'm going to read the whole thing because the capabilities he's talking about, the ethical or moral dilemmas that are going to confront us and the vulnerabilities we're going to incur as we go this direction and we certainly are, are real and this provides I think a framework to evaluate this emerging reality. And it is always easier of course to say I'm going to wait until I'm sick and try to cure the illness than to anticipate and prevent the illness, and what he is doing has given us an opportunity if the right

people read it and act on the questions he brings forward to give us from a firm historical base a framework for where we're going forward.

I don't have any PowerPoint slides. As I told the head of Microsoft when he visited me a few months ago, I consider PowerPoint a close cousin to the anti-Christ. That didn't go over well with him. But the bottom line is he recovered and we had a very interesting discussion. But the best part of Brookings always is the questions and answers, and we already heard I think the real keynote here and the introduction that puts so much in context.

I want to broaden the discussion just slightly and talk about the security environment and the threats we may face because as I do so you may see where you just heard fits in and where perhaps it does not fit in which is an equal which is an equal part of our challenge. What has changed? Seventeen years ago today as we're sitting here, Mr. Yeltsin announced that Russia would stop targeting U.S. cities with nuclear weapons. Think about that. We all remember, at least some of us do, some of you are too young to remember that probably, but most of us remember that. Seventeen years ago. And yet since then the "USS Coal," 7/7 in Britain, 9/11, Madrid, Mumbai, our embassies in East Africa, and I think an enduring aspect that we're going to have to address, and I'm going to talk about enduring and changing things, an enduring aspect

is that surprise will continue to dominate the national security situation. Surprise will dominate it. About the time we think we've got it all figured out, we are going to be surprised and it's going to be our duty to react very swiftly.

We will never be 100 percent correct in our predictions, but the bottom line is if we don't predict we're bound to be caught flat-footed so we must do our best to predict what's going to happen, and the sign posts in terms of human conflict are out there. You know them. Bosnia, Chechnya, second Lebanon, Georgia-Russia, the atomic arc of instability that seems to be developing in South Asia. And we are going to have to marry our time and match our resources to the challenges that we see.

On the U.S. side, my U.S. hat, what we did was we put together the Joint Operating Environment or what is called recently the JOE. I've already gotten a fair amount of criticism for it. Obviously some people are reading it, Ambassador, which is the first indicator that you've done something half good as you'll find Peter when your checking account goes up a little bit hopefully. But the bottom line is I won't get any money for it, but I learned when I was coming to this job, I said I'd better learn something about transformation so I sat down and read about how did militaries transform in the past, and every time a military transformed it did so on the basis of one thing, it identified a problem and set out to solve it.

Sometimes they anticipated the problem, sometimes they reacted to the problem. The U.S. Navy in the inner-war years anticipated the problem by losing war games as they tried to get across the Pacific Ocean against what they assumed would be an enemy, the Japanese, and in those days war games were real war games, you could lose, unlike today's which are generally expressions of American military might. And as they lose each war game time after time, they found they could win when they added these things called aircraft carriers, amphibious troops, and logistics trains. So they learned, and as a result we did very well in that war, as well as you can in any war. They did not learn about long-range submarine operations and the result was we lost hundreds of lads for no reason other than we just weren't ready for what challenges came.

The Germans in World War I tired of sending their boys into barbed wire and machine guns identified the problem, how do we restore maneuverability to the battlefield, and they solved it with small groups of assault troops and infantry, added armor to it in the inner-war years and unleashed what you and I call Blitzkrieg. Alexander did it in Persepolis. Every military throughout history that changed did so because they identified a problem.

We've identified the problem, we're quite certain we've got it, but we have to hold in balance and not be paralyzed by it the enduring

nature of war versus the changing character of war, and part of the changing character I think is what Peter has talked about here today. For example, just to throw out one example, Iran's surrogates, Hizballah, has got more missile stocks, rocket stocks, than many nation-states in the world and they're going to have to be dealt with, but if you think you can deal with them the same way we deal with a country and conventional war, a war run by convention, I think we would all admit that that's probably not going to happen. So what are the implications of the joint operating environment? What does it mean for us? I would suggest one thing as we risk being indominant and irrelevant at the same time. We're dominant in certain types of warfare, so the enemy has done what the enemy has done throughout the history of war. They have gone to our perceived weakness and worked against us not conventionally, not with nukes yet, but they worked against us with their irregular war.

So our problem is how do we make irregular warfare a core competency of the U.S. military without surrendering our competency in conventional warfare or in nuclear? The challenge is, the new DOD directive sums it up, it says irregular warfare is as strategically important as traditional or conventional warfare is today. So Admiral Mullen last week, having worked hours with me and my writing team and his staff, has just signed out the CCJO. The military has got a nickname for everything,

an acronym for everything, the Capstone Concept for Joint Operations. If the JOE, the joint operating environment, is the problem, the CCJO, the capstone concept, is the solution, how will the joint force operate in the future, and Admiral Mullen probably for first time since General Colin Powell was the chairman has put his thumbprint squarely on this document and said this is my intent as the senior military officer in the United States for how we are going to operate in an uncertain, complex, and changing future characterized by persistent conflict. He said basically how we're going to do it is by integrating and adapting combat operations, security operations, engagement operations, and relief and reconstruction operations.

So we see a hybrid form of warfare coming. What we don't want to do is all rush over to the irregular warfare side of the boat and say there we did it. Look at what happened to the British after the Boar War. They said no more state-on-state conflict, we're not going to have that, and that's 1904, they're writing like that, and 10 years later state-on-state conflict chews up an entire generation of British youth because they weren't prepared for it. If you get your concepts wrong, your strategic thinking wrong, I don't care how short the Marines cut their hair or how fast the Army troops run their physical fitness tests, I don't care about the courage, you get it wrong, and you're going to pay a heck of a price. So

we think we're getting it right and you can read out it, and Secretary Gates' latest "Foreign Affairs" article about balance being the key principle to the U.S. strategy, Dr. Colin Gray, the British-American strategist, a strategic thinker-writer, has mentioned that you cannot have a single preclusive view of war because if you do that then the enemy will go to your perceived weakness and you've actually encouraged the enemy to do the very thing you didn't want him to do and that's to steal the march on you.

I agree totally with Dr. Singer's central assertion that technology and network approach did not turn into the revolution in military affairs that many believed. I think it was wrong-headed and many of us thought that at the time it was being pursued. The reason is, ladies and gentlemen, it's not that we were brilliant, it's because the fundamental nature of war has not changed. The character of war changes. The fundamental nature is not going to change any more than the fundamental nature of water is going to change. You don't change it. And if you do a little reading on quantum physics and then you transfer over to some other aspects of complex theory, complex system theory, you can see exactly why this is the case. As Dr. Singer put it, war itself couldn't be turned into a perfect execution of commands merely by linking people by email. Instead, all of the various forces of chance, confusion, and error common in every pervious war, what is called Clausewitz's fog and friction, still

were present. The enduring aspects of war are not going away. The enemy does get a vote and we're studying very closely the second Lebanon war as an example of this hybrid war where battalions of well-trained infantry and irregular forces and rockets are being fired, high-tech weapons are being shot, UAVs are being flown, and yet there's this fundamentalist hatred, this zealotry, that is really driving it, this human aspect that's really driving the energy and that's the energy source for what's going on there. And the fog of war cannot be lifted by sensors faster than the enemy can restore the fog of war. It's just not going to happen, and we can go through many examples. We'll leave it to Q and A if you're interested.

But I'd also reinforce Dr. Singer's point that he made about halfway through his talk that we cannot -- I would call it from a Marine's point of view we cannot lose our honor by failing to put our own skin on the line to protect the realm, and the realm today isn't just geographic, the realm is the ideas, the concepts that grew out of the Enlightenment and if we cannot put our young folks on the line, could we, and look back at Hitler when he was a soldier in the Germany Army in World War I, they weren't really beaten were they? In his mind they were sold out by the Jews, they were stabbed in the back, and if that is the ultimate result of us employing technology in the American penchant for technological

solutions to war, are we in effect creating more problems than we're solving by our approach to warfare? And we've got to think about that because war is fundamentally a social problem that demands human solutions despite the American penchant for purely technological solution. I am not Luddite. I do not want to give up technology. I want the best possible technology in the hands of our troops, but the idea that this is going to solve the problem of war is a little silly if you study history as all of us, at least those of us responsible for writing those letters home, Peter, that you mentioned, if we don't study it then we're really letting our troops down.

So Dr. Gates' viewed balance is going to guide us and the view from Dr. Colin Gray that we're going to have to maintain defense planning that's not preclusive, we have got to maintain a very robust conventional force to that the enemy never gets brave. As expensive as it is, it's a lot less expensive than fighting a conventional war and so we're going to have to maintain this balance because of this accident of history for all of us in this room. We were in America when it was at this point of having worldwide responsibilities.

I recognize that the last American president was very unpopular in parts of the world and even in his own country, but I want to assure you in my NATO hat, I've used this example, that the problem

didn't start with President Bush and it's not going to go away the day President Obama takes over. The first time I can find jihad in presidential papers is when Thomas Jefferson was our Minister Counselor to the Netherlands. That was 15 years before as president he sent the frigate Navy and the Marines who got to the "Shores of Tripoli" and our song from that expedition. This did not start there. It wasn't obviously enhanced coming out of Riyadh in the about 1900 time frame in that period, the Wahhabi and the Tong (ph) coming out of Tehran for the Shia side with this fundamentalist view, but this is going to be a long-term problem and robots have a role. I was walking inside a camp out on the perimeter near the fence line after we had gotten there one day before dark. It had been a difficult day for us. The fighting in Fallujah was going on and I just wanted to cool it. I walked out there and I noticed six Marines drawn up in a formation and they had a little American flag and I walked over there to see what was going on and it was an EOD team, and there in the hole were pieces of a robot. They were giving it a full military honors funeral. And then they told me as background, they said it took six wounds. We were able to put back together six times, but it was blown up, and this time as you can see there's nothing left, and they were actually burying their robot out there. But it was probably less humorous than it may sound here today. That robot had saved their lives. It had crawled up next to

bombs how many times and they had actually developed a fondness that often times you develop for your shipmates when you're in tough times.

I want to just make mention of effects-based operations because in its own way it's connected to this. I was asked to address it. I'm probably going to be known as the guy who so unfairly shot effects-based operations through the head. I don't agree with it whatsoever because in my experience, mechanistic approaches to war do not work. Algebraic equations do not work. You do this, it equals this, this response from the enemy. There is no way you can make those kind of assumptions. If you study quantum physics, if you look at things like complex interactive systems, you move one piece and it's kaleidoscopic, everything shifts, the center of gravity shifts within it, and even thinking about the problem shifts the problem around, and the idea that you can anticipate and forecast the specific behavior of everyone in this room if all of a sudden somebody jumps through that window I think is silly. Some of you -- would run up to throttle him, some of us would head for the door to get out of here, and a lot of people would wonder what on earth is going on. If we can't even say what would happen on something as mundane as the surprise of some young guy jumping through the window, how can we forecast how an enemy is going to react based upon some quantitative assessment and all the data coming in?

So I didn't like it so I thought it was a superb idea for closed systems. If I go out and cut the fuel line on your car, a complex system, you're not going home today, but once you apply it to open systems, complex open systems where human will, imagination, courage, are involved, forget it. So again those mechanistic approach won't work, and if you read "Wired for War" you'll actually get a sense for the complexities that we are creating. We're not making a simpler world with these robots I don't think at all, I think we're making a more complex world, and that is something I got from this great book.

So let me just stop there because I'd really love to hear your questions. We've got a good half-hour for questions and maybe this will be the best part of the afternoon for us. Carlos, over to you.

MR. PASCUAL: (inaudible) have to understand it, but it doesn't make easier, it makes it more complex and harder in many ways, and that's very much one of the topics that we've been trying to get at today and Peter very takes on in his book. Let me turn to the floor and ask you to introduce yourselves and keep your questions brief. We'll start with the gentleman right here who is particularly anxious to get a question.

MR. HARRIET: Judd Harriet (ph), documentary film producer. My question is for the general. This may be a little bit too broad, but could you give us an idea how robotics are likely to change the

force structure? You could perhaps answer by saying in the typical Marine division.

GENERAL MATTIS: I think it's going to depend on the kind of war you're fighting. If you're fighting a war where you are trying to diminish reasons for the enemy to join an insurgency and it's dangerous enough that you cannot just send in NGOs, then the use of robotics would probably be as sensors. In other words they will augment the troops and the constabulary nature of a Darfur for example just to pull something out of the air -- the constabulary nature would demand a labor rich force because you've got to have human beings out there working with people who are vulnerable and you can't simply open up a free-fire area around the refugee camp and say we'll kill anybody who comes in to threaten these people. It's not going to happen. So the ISR, intelligence, surveillance, reconnaissance, role would be significant there. It would be just as significant in a conventional war, but you could also have robots working as fighters, as troops, that sort of thing. You'd get them and you'd program them in certain ways, put them in certain areas, and you could deny certain areas to the enemy without exposing your own people. But again I think that we have to think about this in terms of what will work best for the end state. The end state is not just to win that war. The end state is to have a better peace in that area, and if by putting these robots

in you can't just -- how discriminating can they be when an enemy as Rupert Smith put it fights wars among the people? Can a robot really distinguish between someone who just walked through an area where there were explosives laying around and someone who's carrying explosives? Robots are still binary. It's one or the other. So I'm not sure that you can make forecasts like that. If I were to sum up everything I've learned about war in three words in 35-odd-years of doing this, those three words would be improvise, improvise, improvise. So each war brings its own character and you never know an enemy until you fight them, no matter how many CIA briefs you get. So you're going to have to fight them and improvise to the specific situation, but I think you would see augmenting, not reductions in numbers of troops, at least not in the near term. Maybe in the long term if you've got them moral decisions and everything else, you might be able to change that.

MR. PASCUAL: Peter, do you want to add anything to that? Because in a sense one of the things you also mentioned was that there's going to be a back office in that force structure in the sense of those people who are playing a role back here. I don't know if you want to pick up on that point.

MR. SINGER: As a data point for example, the Army's FCS plan has that the structure will have more unmanned vehicles -- a unit will

have more unmanned vehicles than it will manned vehicles. That's already in the works right now in terms of their plans. You also have this question that Carlos raised of when you say force structure, where do you mean it is located? So you have that unit on the ground that, that force that's going into a Darfur or that brigade that's outside Fallujah, supporting it are unmanned systems overhead that are operated by people sitting in Las Vegas. Are they part of that structure? Are they part of that unit or not? They're integral to the operation. The team doesn't go out without them, but they're also not there. And so those are some of the sort of long-term questions.

And you could have the same -- each area of war at sea, the Navy's plan for the LCS is that it will be in a sense a mother ship for a host of other unmanned systems. So the ship itself, really its lethality comes from being a host for unmanned systems. The question for me is that we're purchasing these things without knowing which is the doctrine path that we want to go down yet. That mother ship model may be the right model, or it may be something like swarming, but we don't know that yet, and it's sort of the parallel to the debates that happened before World War I where with tanks, they could have been mobile pill boxes or the other direction was the Blitzkrieg approach. Our defense acquisition system

right now has taken us down one pathway without asking the question in terms of the doctrine of the structure.

MR. PASCUAL: Let's take a question here.

MR. OSGOOD: My name is Carl Osgood. I write for "Executive Intelligence Review." General, in reference to your final comments on EBO and to what Dr. Singer has described as to the new capabilities that are being developed for robotics, to what extent are these capabilities, this development, being driven by these -- ideas that you have so eloquently criticized still?

GENERAL MATTIS: I'd have to think about that one. I think that there are ways to bring advanced techniques, technologies, robots, into our organization without being mechanistic in our theoretical approach to war, so I don't believe that there is something fundamentally at odds with a humanistic approach to war, a humanistic decision-making model and high technology. If anything, I think it allows the technology to be used and integrated in a manner that is much more forthcoming for its potential. Otherwise, you're allowed to have great technology getting you contrary results to what you needed because you never integrated the human side of it. So I don't find the technology really contrary to a more traditional approach, von Clauswitzian or even a Sun Tzu approach, to war fighting. I would say that those who in the last century started thinking

that technology could solve the problem, therein lies the problem. They created the technologies without thinking about how to use them and the result is -- we've seen some of the results. We have made I think zero technological mistakes in these wars in the last 8 years. People would say we should have armored Humvees. We never armored a Humvee or a utility vehicle in the history of the armed forces. That's improvisation. That's normal. Got to do it faster. But we have made hundreds of human factor mistakes, so we've got to get our approach to warfare right so that we integrate technology as a tool that supports our ends, not as an end in itself and we think we serviced all the targets so the war is over, not so fast. I decided the war is not over, and now we sit there and say what do we do now. It's because we didn't approach the war correctly. I hope that helped.

MR. PASCUAL: Let me come over here.

MR. MAGNUSSON: Stu Magnusson with *National Defense* magazine. For Peter I'd like to ask two questions. The first is a lot of futurists out there, and I'm sure you've probably spoken to a few of them, recently I've heard some prominent people in the robotics field saying we're going to have humanoid robots amongst us, the iRobot vision, perhaps not as slick as the Hollywood version you referred to, before the end of the century. And I just want to know what you thought of that

prediction. And second of all, Japan is most people believe way ahead of us in this field. Do you agree with that? And if so what do we have to do to catch up in the so-called robotics arms race or robotics race?

MR. SINGER: That's a great question, and actually one of the info points in the book is a survey that was taken of both robotics scientists and then separately of U.S. military officers who'd worked with robots basically asking them that question of when will we reach humanoid-like systems basically equivalent to an infantryman out in the field. What was interesting was that the scientists said it will be somewhere around the year 2020. The military officers who had worked with robotics said somewhere around 2025. I don't know if they're right or wrong. They could be way off in terms of, as you've framed it, 100 years out. It could happen before then.

Two things I think are for me interesting from that. One is it's human equivalent but they're just thinking in terms of certain combat capabilities, not the gray thing in your head. That is, it can take out certain targets, but for example, it doesn't have empathy, cultural understanding. To a computer, the difference between an 80-year-old grandmother in a wheelchair and a T-80 tank is just a different ordering of zeros and ones. So that part to me -- I also think that long term we're not going to see a turning over. We're more likely to see what they call war fighter's

associates which is basically a team approach where unmanned systems do what they do best, humans do what they do best, working together. That seems to be where some of the latest war gaming is taking us. The parallel would be sort of like police dog teams.

To your second question, where does the U.S. stand. There's a chapter in the book called "Robots that Don't Like Apple Pie" and it's basically arguing that if this is a revolution, how might the U.S. potentially lose this revolution. One of the things as a reference, there are a lot of other countries working on these unmanned systems, what we have to worry about is the status of our science and technology education in the U.S. right now. Where are those trend lines taking us? What does it mean when the University of North Carolina, that system, not just UNC Chapel Hill but 13 other colleges, produced one high school physics teacher last year? What does that mean for the next generation of students? Another question is what happens when you take this and wrap it within our interesting defense-industrial complex? We specialize in building and buying systems that are very big, often very expensive, often very overpriced, often take years if not decades to develop. Is that the right industrial model for this future of war? So those are real tough questions.

MR. PASCUAL: Let's see if there are some questions from the back of the room. We'll come right here.

MR. DAVIS: Tom Davis from General Dynamics, representing the military-industrial complex. I've been in this a long time and several years ago I had a discussion with one of General Mattis's colleagues and the issue was he had made a statement that by the middle of the next century which is this century we'd probably not have any manned aircraft, they'd all be unmanned. Of course my question to him was why do you think it will take that long? That's the same chronological separation between the Wright brothers and Sputnik, and we know a lot more about unmanned systems than the Wright brothers did about orbital physics. One of the problems we've had in my business, and we make a few of these. I played a central role with Northrop Grumman in getting Global Hawk going, but at the time that was quite controversial in the company because the question was asked does somebody really want this vehicle? No. Is it in the Air Force budget? No. Is there an Air Force champion for it? Not that we've located. Is there an OSD person who's really pushing it? There's not. Of course, the CEO at that point said let's go for it. Why not?

That doesn't happen very often though. So the question I kind of have is it seems like to me in this domain here, and Peter you've

raised a lot of great questions than I ever thought of about the ethnical dimension and the moral dimension, but in this domain here I think those of us in industry have been pushing these systems sometimes against a resistant and reluctant customer for many reasons. I get a sense that that may be changing somewhat, but I'd like to know if there's any sense from you or the people you've interviewed, and General Mattis, your responsibilities, if you think that that change is beginning to pick up speed or is this something that we're going to have to keep advocating and pushing sometimes against unwilling customers?

MR. PASCUAL: Peter?

MR. SINGER: One of the scenes in the book opens with Billy Beane, the baseball manager from the A's, Moneyball, and it talks about how Billy Beane wasn't just successful because he picked the right people, but because there was cultural resistance to change even when people saw that it was superior, and that's happened in sports and we've seen the same thing with certain technologies. The machine gun for example was invented in the 1880s but it wasn't until the middle of World War I that we acknowledged that it brought change and we saw that customer pull as you put it be created.

The irony of the Iraq war is that it was that moment in time. While it showed all of our very real human mistakes, it's also the incident

that convinced the military that unmanned systems really did work and were useful. In all of the interviews that I did at the various companies, all talked about a real shift in customer attitude and they don't see that shift disappearing. As one officer put it, once you see Paris, you don't want to go back to the farm. I think you are going to still see cultural resistance within the military to various systems. You're certainly not going to see pilots disappear anytime soon. But every time you prove capability in a certain area, it opens it up just a little bit wider and that's the story of airplanes and I think it's going to be story of unmanned system.

A question for us from the acquisition side is right now we are buying systems that we are going to have for 40 if not 50 years and it's interesting to me that are they still going to be as relevant 40 or 50 years from now.

MR. PASCUAL: General, when you go into answering this question, I also want to pick up on Tom's excellent question. He used the terms enduring aspects of war and the changing character of war. In a sense, we saw this dilemma in very painful ways in Iraq, because in the initial conduct of the war, Secretary Rumsfeld put forward a concept that focused on the changing character of war and introduced technology in ways that we had not done before, to extent that we had not before, perhaps putting words into his mouth, but General Shinseki might have

said there was an enduring aspect of war as well which required a human presence in a way that wasn't necessarily recognized. I think Tom's question helps us maybe sort of reflect on this issue because on the one hand there's this changing character and the importance of having some receptivity to it, but in order to be effective in that changing aspect, we need to think about the enduring aspect of war as well and what needs to go with it in order to be able to maintain that balance so that in the end what we are doing is effective, it actually produces the kinds of changes that we want, and is moral. And this has to be an incredibly difficult combination set of issues to grapple with, but the other side of it that's your job, it's your job for NATO and it's a your job in the Joint Forces Command for the U.S. government. So I wonder if you can maybe elaborate on that a little bit more on how you've been going through this very complex assessment of how you deal with that balance between enduring aspect and changing character.

GENERAL MATTIS: Yes, sir. If you get your theory right, the fundamental nature of war is not going to change and it's going to have adversarial relationships. You can read -- and you can see what role passion and jealousy and all those human emotions have. We haven't made a whole lot of progress in human nature, and yet technology has progressed enormously. So in order to get this straight you need people

who are historically informed and have a theoretical basis, very rigorous. They need a disciplined approach, but a very unregimented approach. Then you have to look at first of all the system is only unmanned in the sense that there's nobody in the cockpit. I was at Creek Air Force Base 3 days ago and there's a lot of people manning those things, fixing them, flying them, studying them, all those things. So I would also say you have to remember that most of us traveled home for Christmas or if we didn't we may plan to travel home some other time, and we could have done a VTC with our family, but it's more fun to be there with them. Flying airplanes is fun, and on that I would say that line of thinking, we will keeping flying airplanes is the bottom line.

Now, would we have medevcas being run by UAVs into hot LZs? Absolutely. I think those days are coming. But I think there is a value to this balance between the human and the unmanned, the robotics, and the mix is what you're talking about I think. I don't think they're going away. I really think we'll always find a reason to have a human being else if for nothing else than the same reason Lewis and Clark walked across the country, they just wanted to see what's over the next hill, and flying airplanes is fun. I'm not trying to be in any way flip. I'm telling you that those human emotions are still something we have to factor in. Our acquisition programs, our R&D, are too ponderous. The enemy is able to

move faster than our systems can to turn out the kinds of things that you've brought forward. I was out in Columbia Gorge in situ a few days ago. A little company that wanted to launch a UAV, a robot really, off a tuna boat, find tuna fish, come back and be caught on a tuna boat off in the Pacific, a bunch of guys from Stanford, MIT, Harvard, all these guys out there living the good life in the Columbia River. They made it. We took it to Fallujah and it was a godsend for us. So there are areas where it's going to fit. What we have to be careful not to do is hammer this into an area that it doesn't fit in. There are times when it's right to have the human being up there, and as you approach this you have to get your best guess about the future and assume you won't get it completely right, you just don't want to get it completely wrong. In my NATO hat and like the JOE and the CCJO, we have a thing called multiple futures as we try to bring NATO forward and say this is what you're going to have to deal with, North Atlantic Council, these problems are coming to you. Global warming is opening up problems up in the high north. I'll be in Iceland tomorrow night, as a matter of fact, to go to a conference with the Secretary General. As you deal with this you will see where unmanned systems bring the answer, but if you define the problem first to appoint a Jesuit priest who wouldn't wrap your knuckles, you'll probably find the solution and it's appropriate for the unmanned system.

Our cultures are strong. DOD wouldn't have GPS right now if it had been left to the Army, Navy, Air Force, or Marines. We would not have it. Eventually it was forced on us, and look at how we use it today. Now the problem is when it gets shut down, not if, when the enemy shuts down GPS, when the enemy shuts down the data network, are we still going to be able to function. At that point you may see a lot of robots sitting in the warehouse as we see this reprimitivization of war as we fall back on what will work. And what's the most effective weapons system in the last 15 years if effective is defined as killing or maiming more people than anything else? Is it the IED, the aircraft carrier, submarine, the tank, machine gun? How about none of the above. It's the machete. We're going to have to be careful also as we think we're going to solve this problem even taking it down the road very far with that technology. Sorry to go on there.

MR. PASCUAL: All the way in the back.

LTC BATEMAN: Lieutenant Colonel Bob Bateman (ph), Office of Net Assessment. I'm sitting back here because that's where asked the bomb throwers to sit. One question for both Peter and then one for you, sir. On the idea of UAVs, fratricide has been historically one of our biggest problems. Anywhere from 12 to 22 percent in all of our wars until the current one of our casualties have been self-inflicted. If UAVs, if

robotic systems operating with artificial intelligence, with their own decision making, have a lower rate of accidental targeting, in other words they kill fewer people, few of the wrong people, wouldn't that make it a moral imperative that we have more of those than are making their own independent decisions? Then for Peter, the concept again of artificial intelligence. The world's greatest supercomputers are now used by our weathermen trying to figure out weather patterns over the United States and understand how hurricanes go. Those are horrifically complex systems, yet our supercomputers are starting to crack the model. If artificial intelligences or supercomputers can begin to model human behaviors in large groups, wouldn't that bring back General Mattis's recently deceased (inaudible)

MR. PASCUAL: I know that we don't have very much time so what I'm going to suggest is, General, that you begin and you can take on this question and leave us with any other general points that you want to, and then Peter, I'll give you the final word, give you an opportunity to address the question and any final points that you wish to make. Actually I'll keep the final word, but I'll tell you in advance what it is, which is you can buy the book just outside. General?

GENERAL MATTIS: I wish I could stay longer. I really enjoy the tone of these questions. I'm going up to Capitol Hill and talk to them

about some of these issues, by the way, to a couple of our representatives. As far as fewer friendly casualties and wouldn't that almost dictate if I heard you right, colonel, that we go to more of these systems, I think that's not the sole criteria. It's are we effectively achieving the results we want. I think the question itself perhaps shows, let me throw a bomb back, about this desire for almost a bloodless war on our side where we start protecting -- and in Bosnia had them living in fortified camps against the occasional stone thrower. There comes a point when you put your young folks at risk because you think it's important enough for your way of life to defend it, and I don't think that's the sole criteria. And if in fact what we're doing is inspiring people in the Fatah even deeper resentment against us for example or for inspiring people in any conflict because we're not willing to close with them, then we may find that quite the opposite is the case because that's not the sole criteria, friendly fire casualties. But you're right, in every war we've had them and in the complexities of a confusing battlefield we will always have them I believe so long as human beings are making the decisions, and I doubt if zeroes and ones are going to prevent any of that sort of thing in the future. War is just not going to be solved that way. Peter?

MR. SINGER: Real quickly I want to circle back and answer Tom's question (inaudible) which is you asked the resistance and where

people are going. There is one anecdote I wanted to bring up. I interviewed a robotic scientist about this question and he said, look, I'll be replaced before my barber is. So it's not just in terms of capabilities, but there are certain roles as General Mattis has raised which involve human interaction. He has a Ph.D. from Stanford and does some of the most sophisticated thinking in the world, but by a different standard, no one is going to be willing to trust a robot to do things like esthetic haircuts, talk to you about sports and all those sorts of things, so there are different values that we have.

Now to the question in the back. If you did reach a point at which A.I. is smart enough to start modeling these things out incredibly accurately, maybe it does bring back this debate over effects-based operations, but what's interesting to me is again the ripple-effect questions that come out of that in things like ethics and law. So for example if you have a system that models out a certain course of action and a human general says but you know what, I'm going to take this decision instead, if it works out right for the human general, then we go that's great. But what are the issues that are raised if it works out wrong? Do we say you failed to listen to our smarter A.I. and these bad things happened, you had a friendly fire incident which if only you had listened to your A.I. could have been avoided, and so then you're putting legal judgment and moral

judgment in the hands of again just a series of zeroes and ones. And this sounds like no, this is so futuristic, but actually one of the things that the book talks about is you already have these research programs at DARPA on artificial aides-de-camp, that is, they won't be the general, but it will serve as the aide-to-camp to the general which will provide just this kind of advice. So that's what I find interesting, where do the accountability issues flow out.

GENERAL MATTIS: My aide-de-camp just shrunk down in the chair over here.

MR. PASCUAL: Peter, general, thank you. A fascinating discussion. All of you, terrific questions. Buy the book. It's a great read. "Wired for War," by Peter Singer. Congratulations.

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

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