THE BROOKINGS INSTITUTION

BUILDING A LONG-TERM NATIONAL STRATEGY ON GROWTH THROUGH INNOVATION

Washington, D.C.

Wednesday, January 12, 2011

PANEL 3: THE FUTURE OF THE DEFENSE INDUSTRY

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P R O C E E D I N G S

MR. SINGER: Great. Well, why don't we go ahead and begin? I'm Peter Singer. I direct the 21st Century Defense Initiative here at Brookings, and I'm very excited to be moderating the session on the future of the defense industry as it is part of Growth Through Innovation.

Now, the broader defense and aerospace and national security industrial base is often thought of as the arsenal of democracy, the term that was first coined by FDR back in 1940. And in this role the industry has certainly played a major part in defending America. And that goes from the over 324,000 aircraft that were manufactured in WWII. At the same time, 88,000 tanks were manufactured. These numbers are pretty astounding to think about when you go to the current defense budget debates that are over literally whether we should buy 5 or 10 more jet aircraft, or whether the Marines should have 200 or 500 tanks, versus that 88,000 just a half century ago. But that role continues today to the MRAP vehicles and the Reaper drones that keep our service men and women safe in places like Iraq and Afghanistan.

But the defense industry also is a key engine in the American economy, and most especially as an engine of trade and innovation. To just use one example, if it wasn't for the defense industry's role in everything from GPS, the Internet, and jet engines, we wouldn't have these current global trading networks. We wouldn't have things like Just In Time strategy that's raised so many organizations' return on investment, quality, and efficiency.

Indeed, just a couple weeks ago the defense journal *Jane's*

Defense Weekly had an article on the connections between the defense industry and innovation. And it found that the typical major defense firm was spinning out about 60,000 copyrights in inventions. Just one firm. So, this role is really huge.

And for the last year Brookings has gathered a working group of public and private sector leaders and experts to wrestle with the questions of the future of the defense industry. And different from the normal approach of how these things are discussed in Washington, we didn't focus in on whether a single program should be bought or not. We didn't look at this year's budget or not, the way it's normally discussed. We didn't put it within a partisan framework. These leaders and experts gathered around the longer term, nonpartisan questions, to try and identify what were the key policy issues ahead.

And the three ones that they zeroed in on were these questions. First, what's the long-term future of the overall U.S. defense industrial base, and how might it evolve over the next decade? Second, what are the connections between the industry's future and the broader issues that are sometimes looked at as domestic issues of trade, export, education, immigration, visa policy. And then finally, what have been the keys of success in innovation within the defense industry, and how could these be applied to the broader economy?

And so what we're going to do today is actually take those questions identified by this private working group and wrestle with them here today by some great leaders. And really, we've got a fantastic lineup to delve a little bit deeper into these issues.

To my right I have David Cote, who is chairman and CEO of

Honeywell, a technology and manufacturing leader that provides everything from the engines that power the M1 Abrams tank, to the thermostats and control technologies for buildings, homes, and industries. Notable to the prior panels, approximately 50 percent of its technologies and products provide energy efficiency benefits.

Previously he's worked at TRW and GE in various manufacturing and finance and management positions. Also of note, he serves as co-chair of the U.S.-India CEO Forum, and he's a recipient of the Corporate Social Responsibility Award from the Foreign Policy Association.

To his right we have Walt Havenstein, who is CEO of SAIC, a scientific engineering and technology applications company that does everything from run the modeling simulation and analysis for the U.S. Army Space and Missile Defense Command to helping utilities build smart grids. Again, connecting across these different panels. Prior to joining SAIC he worked at other major firms in this industry, like BAE, where he was a COO, Sanders, Raytheon, and ITT.

Of note, he's also chairman of the board of FIRST, which is an organization -- FIRST stands for For the Inspiration and Recognition of Science and Technology. This organization is designed to inspire young people to find interest and then participate in science and technology. They do some fantastic work.

And finally, he's a graduate of the U.S. Naval Academy. He served in the U.S. Marines on active duty for 12 years, and then on reserve, retiring as a

colonel.

And then finally we're joined by my colleague Michael O'Hanlon, who is director of research and foreign policy studies and is senior fellow in the 21st Century Defense Initiative. I'm biased, but Mike is one of the true legends in the field. He's the author of 17 books on national security, including his most recent, *Toughing It Out In Afghanistan.* And I actually went to the Brookings website to count this. He's authored 567 magazine and newspaper articles. That number is actually, I believe, more impressive than the U.S. manufacturing 300,000 airplanes in WWII.

Before joining Brookings, Mike worked as a national security analyst at the CBO. And he also continues to serve as an advisor to the U.S. military central command, and the State Department's International Security Advisory Board.

So with that, what I'd like to do is actually go down the panel. And. Dave, turn to you first to weigh in on this first question of what do you see as the long-term future of the U.S. defense industrial base? And where it might evolve over the coming decade?

MR. COTE: Okay. I have a number of observations, but I'll try to group it into three or focus on three.

The first is, we have to resolve our debt issue. Now, it sounds -- it may sound counterintuitive, because we're here to talk about the defense, but as you probably also know I was on the President's deficit commission. And when we look at the role the debt is going to play over the next 10 years, it's going to

have a significant impact on the defense industry. Not just in how much we can spend, but how we're going to go about spending it.

And if you take a look at where we are currently on the current path that we are on, we're about -- debt about 60 percent of GDP today, public debt. Over the next 10 years it grows to 90 percent of GDP. About a $20 trillion debt, and we'll have an annual interest bill of about a trillion dollars a year.

Now, we talk about millions, we talk about billions. Trillion just seems like another number. So the way I've taken to describing it to get people's attention was that if you had spent a million dollars a day since Jesus Christ was born, 2010 years ago, you would still not have spent a trillion dollars. That will be our annual interest bill.

We have -- we are clearly on an unsustainable path. And I think it's as Ben Stein said it, if something's unsustainable, it will stop. And there's two ways it will stop. The first one is, we can do something about it now, thoughtfully, and proactively. The second is, we can wait until the bond market forces us to do it, like you see with Portugal, Spain, and some others.

You're not a world power if the bond market forces you to do something. And that's going to have as big an impact on the defense industry as anything that I think we're faced with.

A second one: need much greater speed, flexibility, and we need to be less costly. And we take a look at just all the routines, the processes, the systems that are put around everything today. And we have a system that is not fast, it is not flexible, and it is not inexpensive. And those are three dynamics, in

my view, that are going to have to change a lot going forward. And you think about the quadrennial defense reviews, the QDRs, that have been discussed in the past? They all talk about the need for speed, flexibility, asymmetric threats. And we still don't have a system that helps us there.

And you just look at all our procurement processes. And it seems like we're more than willing to spend $100,000 to make sure that the $10,000 problem never happens again. And we've got it totally backwards. We need to become a lot faster, more flexible.

The third area that, in my view, is going to become increasingly important for us is just number of engineers. If we take a look at where innovation is going to come from, it generally comes from engineering, it comes from technology. If we take a look at the number of graduates -- engineering graduates that we have today, the U.S. produces about 450,000 U.S. graduates in engineering. China today produces about 900,000. And they have a third the percent of college-age kids going to school, because the system is still catching up. When they get to that same percentage we do, they will be producing 3 million engineers a year versus our 450,000.

We need to start thinking a lot differently about how do we encourage technology, math, science -- how do we encourage this? In my view, we need kind of like a Sputnik-type effort that gets people mobilized and thinking again about all kinds of engineering. And we have enough lawyers. You know, we don't need more lawyers. We need more engineers. And that's a dynamic that's going to need to change, in my view. Not just for the defense industry, but

for the country in total.

MR. SINGER: Thank you. Well, a capstone to that -- an interesting number is that in 1986 compared to today we graduated actually less engineers and folks that majored in information technology. But since 1986 we've had a 500 percent increase in students who majored in leisure and fitness studies.

So, Walt. This actually -- this last point --

SPEAKER: I feel more competitive now. (Laughter)

MR. HAVENSTEIN: Is that the segue to me? Leisure and fitness side?

MR. SINGER: No. In terms of -- you actually have a special interest in this area of education. But also, I wonder if you could weigh in on not just education, but how trade policy and maybe other issues connect to this future of the defense industry.

MR. HAVENSTEIN: Yeah, I'd be happy to. First of all, I certainly would reinforce Dave's thinking here, and especially in the context if we're going to have to deal with a more constrained budget, and it remains to be seen whether that defense spending is going to look flat.

As we heard last week, we're out in -- the out years is actually going to go down. The reality is we're going to have to leverage more and more, and we've been doing that in the industry from the commercial industry.

We had an earlier conversation, it was very interesting, in the first panel. The big conversation around spectrum. All right? Well, spectrum is an interesting dynamic in 2011 as a commercial resource. It has always been a

tremendously critical resource when it came to defense.

Defense industry was using mobile -- was providing mobile communications 60 years ago. All right? And we were always in the context of contending in the spectrum. As we have to contend -- and our military forces have to contend in that spectrum even more so, we're going to have to rely more and more on the technologies and capabilities that come from the commercial sector to help solve those problems.

And that's not to say there aren't always going to be essentially military-only capabilities. There aren't a lot of people that operate nuclear power plants a couple thousand feet down, right? And in a very stealthy environment. So there's always going to be the need for explicit military and defense capabilities. But more and more, as we have over the last decade, we're going to be shifting more and more for information technology purposes to a warfare that necessarily is more dependent upon that resource. And so we will be more dependent upon the commercial solutions.

At the same time, we have to leverage the fact that we can export some technology that may not be as critical today as it may have been 15, 20 years ago. And I think our technology export policies have lagged. The speed at which technology not only becomes available, but becomes relevant and becomes not relevant.

And so I think as an industry we have encouraged government to review their ITAR policies, review the critical technologies that, no fooling, represent a future threat as opposed to what may have been a threat 10, 20

years ago.

Let me just talk briefly about education. I'm going to do a shameless shout out, first. Norm Augustine, many of you know. An icon in our industry for many, many years, still is today, five years or so ago issued a warning order on our education system and the state of our technology-based workforce, and just recently updated that gathering storm. And he characterized it, now we're in a Category 5 environment.

The issue isn't how many young people are graduating with a technical degree, per se. It's how many U.S. citizens are graduating with a technical degree for our industry. It's one thing if you're going to develop code for an iPad or an app for Apple. It's another thing if you're trying to develop electronic warfare systems or you're trying to develop material sciences for stealth. Very, very different. And the nature of those differences demand, for the most part, U.S. citizens. That's what we demand.

It is encouraging to see the amount of interest there is today around educating young people and getting them motivated in science, technology, engineering, and math; getting them motivated early enough in their life so they are willing to fight through the discipline that comes with taking algebra and calculus in high school. The discipline to actually say, gee, I am going to suffer through physics when I'm 17 years old so I can actually be qualified to take technical courses in college.

A lot of us in our industry have put a lot of emphasis on higher education at the university level and higher. But I got to tell you, it starts

somewhere between dinosaurs and puberty. If you don't capture young people's imagination like my imagination was captured during the space program when my dad was with NASA and I got to go down to Cocoa Beach, Florida, and watch -- during Easter break and watch rockets go up in the air, most of which blew up. I thought that was cool. Apparently it wasn't. (Laughter) But the idea of being part of that inspired me to think that was cool. Right?

Monday night, most -- I bet a good many of you sat around the television until midnight watching the University of Auburn and -- who did they play?

SPEAKER: Oregon.

MR. HAVENSTEIN: Oregon. (Laughter) We have got to change the emphasis of what we celebrate in this country, starting with our young people. I would tell you, on Saturday we kicked off the 20th season of FIRST robotics competition. This year, 90,000 volunteers, several hundred thousand young people from the age of 6 through 18 will be participating in robotics competitions throughout the country. With the -- and it is nothing more than a varsity sport of the mind.

And the day we can walk into our gymnasiums, instead of seeing won the ACC, you know, basketball championship 2011, 2012, and see something like won the regional FIRST competition, won the national competition, we start creating a cultural shift. That's exactly what needs to happen.

What Dave described as a *Sputnik* kind of -- we are a worse situation

today than we ever were when it came to the space race. And frankly, the reason I support FIRST -- and back to the -- it actively engages me, parents, teachers, the community, my engineers, the way football does in our booster clubs in high schools and junior high schools. And it has the best chance of changing culture.

That's my shameless shout out, all right?

Oh, by the way, if you have somebody going to college these days and you think about return on investment, put it in economic sense for you, and they end up in your basement? The year after they graduate? You want to be asking yourself, was that a wise investment?

We can hire virtually every engineer and scientist we produce that are U.S. citizens. Between our industry and the industries you saw in the last two panels. The fact is, we're going to need to hire a lot more of them. So, I would certainly encourage that as one of the critical issues facing our nation, and certainly facing the defense industry.

MR. SINGER: Thank you. And again, I actually was able to research FIRST in some of the work that I was doing for my book, and I find it striking that it's looked at as a sports competition. But also when you speak to a Bill Gates, he says that if he was young today he wouldn't go into computers, he would go into robotics. So these kids that are participating in FIRST right now are sort of the next generation of the Bill Gates of the world. And we better do a good job of supporting them, as I weigh in on this.

Mike, I wonder if you could handle this broader question of

innovation in the defense industry and some of the lessons there, and how it might apply to the broader economy. But also, maybe comment on some of these issues that have been raised in terms of debt, education policy, et cetera.

MR. O'HANLON: Thanks, Peter. And it's a real thrill for me to be a part of this panel. I know we had Sean Penn here at Brookings on Monday, and he was very good. But for me, the superstars of the week are here today. And maybe that reflects my biases and my preferences. But as you say, we've got to change a little bit the definition of cool in the country. Although Sean Penn is cool, you guys are, too. And it's a real treat to be part of this.

I think I want to comment, as you say, Peter, on some of the other issues that have been raised as well, very briefly. And one thing would be to pick up on what Walt and David have said a little bit and emphasize a flipside to it, which is not to disagree but to remind ourselves of our strengths. Because we have a lot of challenges. With the debt, with the deficit, with inadequate science and technology. With a cultural shift, perhaps, towards other things besides the hard sciences. And all these things do present challenges for our country.

But it's worth remembering that we don't need to throw up our arms in despair or feel like we're inevitably getting beat in the great competitions of the 21st century. It's true that too many of our graduate students are foreign nationals who then go home to their countries. But it's also true that by most measures, most independent assessments, we have maybe 58 or 60 of the best 100 universities in the world. That's a pretty nice place to start. And, you know, even in the hard sciences, half of the graduate students are American, roughly, in

broad terms. That number needs to go up and we need to incentivize more foreign graduate students to stay here once they're done. But this is a pretty good place from which to begin.

In terms of aggregate research and development across the economy -- and I'm including here defense and non-defense sectors -- in aggregate, the United States is still the R&D center of the world. That may seem a little funny and counterintuitive to everything we read and hear about, but in terms of where most innovation happens -- or at least where a large fraction of innovation happens, and in terms of where the most resources are devoted and spent, the United States still out-distances the European Union in aggregate or, let's say, East Asia in aggregate.

And again, the trends should cause us some concern. The trends are towards convergence or our losing our edge. But this is -- it's important to remember what our strengths are because if we get too depressed about how things are going, it may be tempting to just say, let us be the world's lawyers and entertainers and let somebody else build and go invent all this stuff. Well, other people are building more and more of this stuff. We're still inventing a lot of it and building a moderate share. Even as manufacturing, of course, has declined greatly as a percent of GDP we still make some pretty interesting things.

I just say that as a reminder that we need significant course correction, but not a radical change. And we must not forget what our strengths are, either.

Now I want to talk a little bit about other strengths that the defense

sector and the defense industry in the United States has displayed over the years and still has -- and this is a little bit of a shout out to our colleagues on the panel and in the audience. And again, it's not necessarily to draw perfect conclusions about the future, but just to set the table for the conversation we're about to have. And to remind you all of how much defense and non-defense sectors benefit from each other and have done so, historically. And I'm just going to very quickly tick through half a dozen areas in which defense has really spun off technology in the last 50 or 60 years, especially in the Cold War period. But also areas where defense today can still offer some lessons in innovation to respond directly to the question that Peter posed to me. And then, wrap up and look forward to the conversation.

First of all, as you all know -- and Peter mentioned this earlier himself -- defense has done a great deal to drive the history of invention, innovation, and development in sectors like aerospace, where everything from jet engines to helicopters to rockets basically were invented in the defense world, and in many cases improved, perfected, as well. And this has been something we've seen throughout the '40s, '50s, '60s, and thereafter. So, aerospace and big vehicles in aerospace is one big area of innovation where defense really has driven a lot of what's happened here in the United States and globally.

Another area is in sensor technology. And here we can cite the examples of the development of infrared sensors, certainly the development of radar, to a large extent the advancement of laser technology, little things like airbags in cars benefiting from some of the sensor innovations that came out of

the U.S. munitions industry. And so a whole broad area of impressive spinoff from defense towards civilian sectors has historically been in the area of sensor technology as well.

And then it's worth mentioning space. I already alluded to rockets, let me mention satellites as well. And of course, this was an area where defense really drove a lot of what was happening in the '50s and '60s. Now, you had this happy synergy of sort of in a funny way the Cold War plus the *Apollo* space program, which reinforced all these trends in space and meant that it wasn't just the defense sector but it was this modern day -- or, excuse me, earlier day, you know, grand national mission in science that David alluded to earlier that's been so central to generating the interest, the excitement, the resources. So it was both civilian and defense sectors that drove a lot of the invention and innovation in rocketry and space. But that's one other big area.

So this just proves the point that defense can do a lot. But for those of you who say I'm talking about ancient history and the tables have shifted -- and we even heard a little bit about that from a defense CEO a moment ago about how we have to keep looking within defense circles for benefits from the commercial world -- and that's true -- let me also remind you that much innovation today is still coming out of the defense sector, and the companies represented on our panel can exemplify that. And I'm sure my colleagues here can explain that in greater detail than I can, but let me mention areas like cyber -- not only the performance of computer systems, but cyber security, which is now so central to much of our economy, and where the defense intelligence and

homeland security sectors are doing a great deal to drive innovation and drive technology.

It continues to be true in aerospace. Maybe not so much in building stealth or in sort of pushing the flight envelope towards maximum speeds, as with an F-22, but certainly in terms of innovation with composite materials, innovation with trying to make engines more efficient, innovation with tanker aircraft, transport aircraft. Certainly Boeing and many other companies that are involved in the aerospace sector continue to work in these areas and drive a lot of progress. And certainly SAIC and Honeywell, also.

Just one or two others then I'll stop. Command and control networks. Where we have seen the military become so good in the last 10 to 20 years at integrating various intelligence sources in real time and doing real time data fusing. Now, certainly the commercial sector is good at this, too, and has a lot of incentives to get better at this. So I don't want to suggest it's a one-way street where defense is primarily generating the invention and where the commercial industries of the country are benefiting as recipients. It's certainly a two-way process.

But it's been impressive just how much real time information fusion dissemination has happened within the military in the last 10 to 15 years as we've taken the time from which we identified a target and then we're able to attack it, which used to be measured in days even in the 1980s and the early parts of the Persian Gulf War in 1991, especially with much of our naval technology of that day. We had to, as you may recall, fly out our flight plans

overnight to aircraft carriers. And they were based, to some extent, on imagery that had been taken days previously.

And this was at that point in warfare, a real-time, fast kind of targeting adaptation. Because our Cold War war plans were all based on, you know, the kinds of long-term intelligence gathering and analysis that we did over months and years, and then worked into the nuclear war plans and revised them maybe once a year. But by Desert Storm you were trying to revise things in a matter of days. And then as you got into the 1990s and the Balkans wars, there was maybe a process or a delay of hours or maybe one hour between when you would spot a new target and you could attack it with somebody else. And now we're getting to the point where it's minutes. And so certainly this kind of fusing is very interesting and important in the defense world.

Last point. It's not just the technologies, but it's the linkages between the technologies and the people. And here let me give a shout out to General Stanley McChrystal and to many of the people, especially down-range in the war theaters over the last decade, who have figured out ways to essentially flatten our corporate hierarchies and benefit not just from new technology, but form a tighter form of teamwork. And I think here, the defense sector broadly defined -- not just industry but also some of our operators in the field in uniform have taught a lot that can probably be of benefit to corporate America and to the civilian economy as well.

So I've just begun to tick off a few of the examples, Peter, but I'll stop there.

MR. SINGER: Thanks, Mike. Dave, before we turn to the broader audience I want to give you a chance to weigh in on some of the other comments that have been made here. Any thoughts that you want to react to?

MR. COTE: Yes. I'd say first one, I'm enough of a sports fan that I would like to see that robotics award hanging next to the state championship in basketball. (Laughter)

But I would like to reinforce Walter's point that -- I went to my 40th high school class reunion. And, yeah, yeah, yeah, you can give me grief about how old I am now. But anyway, one of the things that I've said to a lot of people is that one of the things that struck me as I saw the spirit awards, I saw the anti-bullying posters, I saw the art exhibit from the art class. And I've said to a lot of people, nowhere in my own high school did I see anything having to do with math and science competitions, awards, or anything like that. And I found it bothered me, because thinking back I actually think we had some of that at one point and we don't any more. And I really do, I agree. I think that's a fundamental dynamic that we have to change.

Second item, I think we can look at defense more broadly than just how do we defend ourselves against attack. I mean, one of the ways to prevent attack in the first place is by building trade ties. Some call it commercial advocacy. I'm a big believer in that to the extent you can keep the discussions commercial and arguing about currency, that's a lot better than trying to figure out whether you need to send ships.

And there's a lot of simple things you could do. I mean, China is

the one that everybody likes to be nervous about. And you get asked, are they a partner? Are they a competitor? Are they a supplier? Are they a customer? The answer, of course, is yes, they're all of those. But we need to have a more nuanced, thoughtful process for addressing how do we think about China.

And I'll give you a good example is Chinese companies buying U.S. companies. We should be in favor of that. Because to the extent that you now have a Chinese company back in Beijing saying, hey, hey, what are you doing? I have a lot of money over there -- you get a different dynamic. And you think about some of the -- I've oftentimes said that discussions down here surrounded by the three H's; hysteria, histrionics, and hyperbole. And you think about -- go back 20 years ago when the Japanese bought Rockefeller Center and the outcry that you saw in the press amongst politicians and others because they had the audacity to buy Rockefeller Center and what a threat that was to the U.S.

Now you only have to take a moment to think about so how big is this threat? What are they going to do with it? Take it to Japan? (Laughter) Nothing. Now you have the land and you have the money. But for some reason the three Hs dominate that conversation and it shouldn't. Commercial advocacy, greater trade ties, keeping things commercial discussion rather than a military discussion, I believe, could do a lot.

And just kind of pursuing Michael's point a bit on how we do have a lot of strengths. We do. But when I think about the three Hs you really need -- it seems like democracies are uniquely suited to putting up the traffic light after the fourth accident. We've already seen the first accident. Unless people start

screaming and getting attention, I swear it's tough to move a democracy. And unless we start surrounding some of this with those three Hs, I don't know that you get the country to move. It's kind of an astounding part of how we operate, but we really need to start mobilizing more attention to build on the strengths that we do have, which I would agree I think are considerable.

MR. SINGER: Walt, would you like to weigh in on anything not using the three Hs? (Laughter)

MR. HAVENSTEIN: Well, let me just add to what Michael was saying about the innovations that still come out of our defense industry. They are vast. Many times, kind of below the waterline in terms of visibility to the public.

The command and control that we apply to solving smart grid problems are almost identical to the nature of command and control that we solve to knowledge-based applications of targeting and weapons, right? And so there's a lot of nuance in that leveraging of technology from defense.

There was a question earlier in the day, and it had to do with privacy. It had come up in a conversation in the panel with IT, and how do we have privacy -- what I'll call information assurance around this vast network that's now ubiquitous in everything we do?

Well, a lot of the more what I'll call exquisite solutions to that problem have been worked on for decades within the defense industry. And I would suggest to you that over time many of those solutions that were historically leveraged to solve problems in the dot-intelligence or the dot-mil community and, subsequently, in the dot-gov community, are going to migrate necessarily both in

policy and in practice into the dot-com world -- the dot-com/dot-org world.

And it may not be as evident to you, but I can assure you that's what's going to happen. I can assure you that when AT&T as an Internet service provider thinks about securing the network, right? To solve the problems of privacy and to solve the problems associated with information assurance, they're going to look for many of those solutions to adaptations of solutions we've created in the defense industry.

MR. SINGER: Great, thank you.

We've got a little bit of time left for conversation. So -- and actually we've got our first hand back there. And if you could wait for the mic and stand and identify yourself.

MS. STERN: Okay, thank you. I'm Paula Stern. I used to chair the U.S. International Trade Commission, but I'm here asking a question on behalf of the National Center for Women and Information Technology.

The whole question about innovation and the fact that we don't have a pipeline that is supplying those jobs that you said are going begging, particularly in the computing science, information technology area. My question goes to your panel as a defense panel because national security has always, in our democracy, managed to trump a lot of other issues. And out of DARPA and out of other defense budget, we have incubated a great deal of innovation through money spent on training and on education.

My question is, what should we be doing today, 2011, in terms of the Defense Department? The Office of Naval Research, as I understand it, has

kind of been ahead of the game on some with STEM education, but we still don't have a curriculum throughout our country that teaches computing science. And in this Tea Party period, I'm wondering whether we're going to be able to tackle this innovation deficiency through the education door and whether we might need to go through the defense door.

I'm wondering if you would comment on that.

MR. HAVERSTEIN: I'd be happy to comment. The defense industry and our associated partners in government, I think, are equally committed to that initiative. The initiative how do we incentivize or at least recognize the need and then help through training and development?

We certainly do it in the military, right? Probably the most intensive training environment of any profession. And we certainly do it in support of technical capabilities.

I think the distinction is, what active role does the Department play versus what supporting role does the Department play? And I happen to be -- having come from New Hampshire, right? Live free or die is well and thriving in New Hampshire. I believe that is the role of the DoD is to support the initiatives that we take in industry and in partnership in our communities, right?

At the same time, I would -- I'm going to use the example I know, and that is FIRST, where bases and schools at those bases can adopt those kind of programs. And as long as they are encouraged to do that, I think that is an appropriate role for the Department of Defense, as opposed to the Department of Education. Okay?

MR. O'HANLON: If I could add to that. I know government efficiency is everybody's favorite oxymoron. And it applies to these STEM programs, also.

If you take a look at -- Senator Coburn has actually done some great work here. And I tried getting to the bottom of some of this in some of the Deficit

Commission work that we did, because we wanted to -- Andy Stern and I in particular had a lot of discussions about how at the same time we needed to reduce expenses we needed to invest more in overall infrastructure, not just roads and highways, but education and everything else.

When you get to the bottom of some of this, there's something like 110 different STEM programs, none of them coordinated. And nowhere is there a measure of effectiveness on are you getting something for the money you're spending? Nowhere. And I tried for a month or two to try to get this kind of data. And we actually had Senate aids trying to get us data. Nobody measures this stuff. And we need a more thoughtful process, again, a discussion. And it's not -- it seems like if you try to talk about STEM there's always -- again, the three Hs. Somebody to say, well, you're completely against education. It's like, no, I'm actually in favor of very thoughtful education and spending to get what it is that we want.

There's still a lot more opportunity in STEM in particular to generate much better measurable results than we see today.

MR. SINGER: I just wanted to give an example that might help

answer that as well. In this working group that we've assembled, we looked at the idea of crowd-sourcing, which is done in social networking, and how that might be applied over to the questions within the defense industry. And the example that's often pointed to is DARPA's Grand Challenge. Where the Pentagon, spending billions of dollars, was not able to build an autonomous robot.

It put out a $2 million prize, which to people outside the DoD seems like a lot of money. Within the DoD, that's the copy machine budget. And for $2 million they got hundreds of high school and university teams that competed in this program. And it was won by a team from Stanford, MIT, and, actually, the IT department of an insurance company from Louisiana, for $2 million. And what's interesting, the idea of spinning out innovation. That Stanford team that won, the technology is not just being used in Afghanistan today by soldiers, it's also being used by Google and also by the various Smart Car programs and the automotive manufacturers. So, we should be looking at more of these crowd-sourcing projects that are relatively cheap.

Let's get another question from this side, here. Anyone over here? Back there. Yes.

SPEAKER: This is for you.

MR. MEHAM: My name is Josh Meham with Romulus Group, a consulting firm. And my question is, I guess, for anybody, but it might be most appropriate for Mr. Singer.

I'm a very big fan of *Wired for War*, and one of the questions that

seemed to come up -- and I'd be interested in everybody's take, I guess -- is, what exactly engineers and what exactly these people who are interested in defense and get the appropriate education should actually be doing? I mean, what is it engineered to do, what?

Like, I have a lot friends who took a lot of science classes and are working on their PhDs now, and it's a question. So, what exactly am I putting my degree toward? And related, though, what comes up in the book that I think is really fascinating is, so what about the other side when we talk about, so, what are the values that are sort of motivating these things? Because I imagine in either of your companies, there would be no question as to this is where we stand and this is why we do what we're doing. But in terms of a national agenda and what defense is for, there seems to be less of that.

And so I'm curious as to when we talk about China, for example, and we talk about these other countries and where defense fits, what is sort of the stuff that we're looking for and what we should be thinking about? So, I guess that was a lot.

So the two questions are, so we need engineers to do what? And on the other side, what should we be thinking about ethically, politically, and et cetera to manage this? So, yes. Thanks.

MR. SINGER: Well, I'm a social scientist, which really means I'm not a scientist. (Laughter) So, I actually want to turn to our panelists to weigh in on that.

MR. HAVENSTEIN: Two things, right? To your questions.

Solving hard problems that are of national interest, right? And in the context of the aerospace and defense industry, solving hard problems that protect our freedom. Those are really two simple values that you can relate to young people. You're going to solve hard problems that are of national interest. They may be of global interest.

You solve -- you know, no matter how much you pay him, a basketball player at Miami is not going to find a cure for cancer. Not going to happen. If you want to find a cure for cancer, you better understand science and mathematics. That is a compelling issue even for young people. That's a hard problem, right?

Keeping our nation safe is not a trivial issue, either. And so, whether it's SAIC, Honeywell, BAE Systems, Rockwell Collins, Northrop Grumman, Lockheed, fundamental to what those companies do is solve hard problems of national interest or global interest.

And I think those are the compelling conversations I'd have with a 17- and 18-year old, right? We're not building a robot at first. We're finding a cure for cancer. We're creating the next global infrastructure. We're going to figure out how to do the next Metro better. And everybody in this room knows there's a better Metro to be built, right? That's what they're doing.

MR. SINGER: Real quickly, I just think that to echo that, the priorities that the military has today when you apply to engineering, as we've heard particularly from this panel, connect to the broader priorities that I think we see in the economy and the nation as a whole, whether it's the demand for green

energy, which the military is a prime mover in that because it's the biggest spender on energy today, to, as you've heard from Mike, the ability to fuse together data and make quick decisions, which is something that the military needs to be able to do, which a manufacturing company needs to be able to do.

We've got time for one last question. Right here in the front.

MR. JORNE: Bill Jorne is my name. I'm involved with an effort to create some telephone apps, cell phone apps, in emerging and developing countries.

But my question to this panel is -- and you've hinted at it a little. But knowing what you know without giving away any confidential information, are you willing to speculate on sort of the next generation of products from the government that are going to be, let's say, able to be commercialized in this area?

MR. O'HANLON: Not me. (Laughter)

MR. SINGER: Anyone else want to weigh in?

MR. COTE: I guess you stumped us.

MR. HAVENSTEIN: Yeah, I think you'll see some sensor technology. Back to what Michael was saying, there is without a doubt advancements -- you get them today, right? When you hit Google Earth, right? The nature of the sensor -- the overhead sensor that delivers that little picture that's Google Earth? Its genesis was in the defense industry and its enabler was the sensor, right? And I think whether the full range of the electromagnetic spectrum where defense industry excels in development of technology and

capability, you will start to see those new kind of sensors pop out.

Now, you may not recognize it as that, but it may be the three dimensional view from space. That's how it commercializes itself, right?

So I think those -- I think the sensor technology will continue to be spun out as commercial applications, right? You see those technologies in your GPS. You don't say, gee, I wonder how that works. You know? Most of us don't care, right? But everything from the display itself, right? The up and down links to the satellites, the algorithms that correlate the various different pieces that come from the satellites is all done -- is all government-invested technology through the defense industry that migrated to -- frankly, migrated to commercial sector.

I think you'll see more and more and more of that.

MR. SINGER: The quick answer I would give on that is, it's the adjective "smart." We hear -- Mike talked about smart weapons. We heard about previous panels talking about smart grids. And I think we're hearing one of the evolutions of the sensor is smart sensors. That adjective, I think, applies to the discussion that we've been able to have today, which has been a very smart discussion and a very enriching discussion.

And we at Brookings are told to drive home on not the three Hs, but the three I's, in terms of ideas and impact and independence. And I think this panel really does show that. It's been a good anecdote against the three Hs. So please join me in a round of applause. (Applause)