HEARING TO RECEIVE TESTIMONY ON ACCELERATING NEW
TECHNOLOGIES TO MEET EMERGING THREATS

Wednesday, April 18, 2018

U.S. Senate
Subcommittee on Emerging
Threats and Capabilities
Committee on Armed Services
Washington, D.C.

The subcommittee met, pursuant to notice, at 2:32 p.m.
in Room SR-232A, Russell Senate Office Building, Hon. Joni
Ernst, chairman of the subcommittee, presiding.

Committee Members Present: Senators Ernst [presiding],
Fischer, Perdue, Heinrich, and Peters.
OPENING STATEMENT OF HON. JONI ERNST, U.S. SENATOR
FROM IOWA

Senator Ernst: Good afternoon. The Subcommittee on Emerging Threats and Capabilities meets today to receive testimony from Dr. Michael Griffin, Under Secretary of Defense for Research and Engineering, on accelerating new technologies to meet emerging threats.

Welcome, Secretary. It is good to have you here.

The National Defense Strategy acknowledges that our increasingly complex security environment is defined by rapid technological advancements, which have the potential to change the very character of war. These technologies include advanced computing, Big Data analytics, artificial intelligence, autonomy, robotics, directed energy, hypersonics, and biotechnology.

Moreover, their development is increasingly dispersed, expanding both to near-peer competitors and other actors with the means to use these technologies against our warfighters.

These technologies also represent major opportunities for our own forces, and innovation has always been a major strength of the Department of Defense's research and engineering enterprise, which includes the DOD laboratories and organizations like DARPA and the Strategic Capabilities Office.
However, getting these technologies in the hands of our warfighters can sometimes be challenging for the Department of Defense, which has struggled to bridge the so-called "valley of death" for new technologies. This valley refers to the space between the research and engineering community and the acquisition community, which are responsible for fielding operational systems.

In his confirmation hearing, Secretary Griffin testified that this transition is the "hardest problem we have." I will look to Secretary Griffin to understand how he will use his own newly established position to help bridge this gap.

The fielding of these critical new technologies contained within the National Defense Strategy demands urgent attention and new approaches to ensure that our forces are postured to fight and win. Broadly, I look to Secretary Griffin to see how he plans to fulfill his charge as chief technology officer for the Department of Defense to sustain and expand U.S. technological superiority in the future.

Specifically, I hope to understand specific examples of research and technology efforts aimed at ensuring our forces are organized, trained, and equipped to succeed in our increasingly complex environment.

Opening comments, Senator Heinrich?
STATEMENT OF HON. MARTIN HEINRICH, U.S. SENATOR FROM NEW MEXICO

Senator Heinrich: Let me start by thanking Senator Ernst for holding this important hearing on technology transfer and the ways that we can move technologies and systems more rapidly into the hands of our operational forces.

Welcome, Secretary. It has been almost 2 months since you were confirmed for this job, so you may not have fixed everything yet, but we hope that you are making good progress.

I hope that today's hearing will help us to better understand the barriers to the smooth transition of next-generation technologies, whether they are from the funding point of view, legal, regulatory, cultural, or other things that we have not thought about.

We know that we are in a race to build future technologies and systems that our military will need to execute its missions against peer threats as well as emerging threats. We also know that the United States is still home to the world's most innovative companies, small businesses, research universities, and government labs.

The State of New Mexico alone is proud to host two national security laboratories, the Air Force Research Laboratory, White Sands Missile Range, and a number of high-
tech small businesses, each employing some of the best and
brightest minds in the country.

Yet, one of our Nation's biggest challenges remains in
determining how we can best connect those innovators to the
real current and future challenges facing our military, and
how to move the best new technologies into the hands of our
warfighters as quickly and effectively as possible.

All of the members of this committee have heard
frustrating stories of companies with great ideas or
universities and government labs performing cutting-edge
research that cannot seem to get traction and fight through
the Pentagon's arcane and bureaucratic procurement and
funding processes, only to get stuck in that valley of death
that Senator Ernst spoke about.

This committee has taken a number of steps to help
transition technologies, including strengthening science and
technology prototyping efforts; emphasizing weapons of the
future, like directed energy; supporting the Small Business
Innovation Research program; and trying to cut back on the
red tape and bureaucracy that slows this process. But I
certainly believe we can do more.

Tackling the issues that prevent the transition of
technologies is a key emphasis of your work, Dr. Griffin,
and you have an excellent opportunity to do so as our
Nation's Under Secretary for Research and Engineering.
Dr. Griffin, I hope we can hear today your early estimate of the biggest challenges to effectively transition technology and learn what steps you are beginning to take to address them and how we can help. I also look forward to hearing what hurdles you are encountering in terms of setting up your organization and staffing in the Pentagon, and deconflicting authorities with the services and other parts of the Pentagon.

Finally, I hope to learn what steps this committee and other committees in Congress can take to assist in these efforts. Our military's technological edge may not depend solely on your success, but your success can greatly alter the ability of our military to stay ahead of our adversaries.

I look forward to your testimony and learning more about how we can help.

Senator Ernst: Go ahead, Secretary. Thank you.
STATEMENT OF HON. MICHAEL D. GRIFFIN, UNDER SECRETARY
OF DEFENSE FOR RESEARCH AND ENGINEERING

Dr. Griffin: Chairwoman Ernst, Ranking Member Heinrich, Senator Peters, Senator Fischer, Senator Perdue, thank you for being here. I really appreciate this opportunity to talk to you about these issues. I am going to offer a very brief opening statement and ask that you submit my written testimony for the record.

Senator Ernst: Without objection.

Dr. Griffin: So the recognition of the erosion of U.S. technological superiority, which was once unquestioned in the world, is what led the Congress to establish the position that I now hold, the Under Secretary of Defense for Research and Engineering. Our mission is to ensure that we, if necessary, reestablish and then maintain our technical advantage. I am honored to be here today.

Now, frankly, my involvement with the national security community is of long standing, and so I feel that I come to this position reasonably well-versed in the threats that we face, and I am, therefore, concerned.

We are in constant competition, and the pace of that competition is increasing. In a world where everyone pretty much today has equal access to technology, innovation is important, and it will always be important, but speed becomes the differentiating factor. How quickly we can
translate technology into fielded capability is where we can achieve and maintain our technological edge. It is not just about speed of discovery. It is about speed of delivery to the field.

So this is a key tenet of my mission as Under Secretary. My organization will focus on closing the gap on current and emerging threats, on driving the disruptive innovation that provides the technical dominance on the scale and timeline called for in the National Defense Strategy.

In this role, I fully intend to establish the technical direction for the Department of Defense. This is more than just recommending the path forward. My organization must ensure that the future force has what it needs by working with warfighters to develop new concepts of operation through mission analysis and experimentation.

I believe that it is critically important for the DOD to utilize intelligence products, technology forecasting, and our own analysis to inform decisions on where we will invest, what we will prototype, what experiments we will do, and what emerging capabilities and concepts of operation will help us to succeed. To this end, we have established a strategic intelligence analysis cell within the organization that will help us do that.

I will focus on establishing processes and methods to
drive effectiveness and affordability by examining our
acquisition, testing, and sustainment processes in the
system design phase by setting and adhering to open
architectures and interface standards while implementing
good system engineering and cyber resiliency. Ultimately, I
plan to establish and embrace a collaborative culture
focused on piloting new acquisition pathways for speed and
providing capability to the future force.

The department continues to push research into new
technologies such as autonomous and unmanned systems;
artificial intelligence; biotechnology; microelectronics;
cyber warfare, both offense and defense. These technology
areas are not just important to the Department of Defense.
They are, in fact, the focus of global industry, something
we must learn to leverage.

The department is not short of innovators. We are
short of time, and we lack expertise in adapting commercial
market advances to military needs. We need to strike a
balance between bringing in new technology and getting
current technology out to the field. We need to deal with
conquering Senator Ernst's valley of death between
innovation and real applications.

One crucial step in this is a comment that the Deputy
Secretary made recently. He said, and I am quoting,
"Everyone wants innovation, but innovation is messy. If the
department is really going to succeed at innovating, we are
going to have to get comfortable with people making
mistakes."

Increasing the use of prototyping, demonstration, and
experimentation will help the department more rapidly mature
technology to assess the impact that innovative technologies
can have on the future force. Building prototypes and
testing them with operators allows the department to speed
innovation by driving down technical and integration risk.
It also enables us to refine requirements, evaluate new
concepts, and get warfighter feedback before we commit to a
major program.

Those are the obvious benefits. The less obvious
benefits include stimulating industry design teams with new
challenges, contributing to new methods of manufacturing,
and increasing the likelihood of a successful program by
ensuring that we better understand what the requirements are
to deliver a real system.

While our adversaries are presenting us with the
challenge of a sophisticated, evolving threat, we are
prepared to meet this challenge and restore the technical
overmatch of the United States Armed Forces through focus,
innovation, and rapid delivery to the field.

Thanks again for this opportunity to testify before you
on these important issues. I do look forward to your
questions.

[The prepared statement of Dr. Griffin follows:]
Senator Ernst: Wonderful. Thank you very much, Mr. Secretary.

We will go ahead and get started with the questions, and, hopefully, we will get a couple rounds in.

We were just talking a minute ago about the National Defense Strategy. It was recently released by Secretary Mattis, and it focused on competition with near-peer adversaries.

Dr. Griffin, how do you envision your position helping DOD to address the technical shortfalls in specific fields like A2/AD and other high-end capabilities being developed by our near-peer challengers, like China and Russia? What can we do there, in your position?

Dr. Griffin: Our adversaries have taken advantage of what I have referred to as a holiday for the United States. It has not been exactly that, but with the fall of the Berlin Wall -- I was in the Pentagon when the wall came down and when the Soviet Union broke up. We had won the Cold War, and we had no major adversary in the world. We declared a peace dividend, and we felt we had won.

The winners never learn anything, and the losers always do. So over the course of the 25 years since that has happened, China has understood fully how to be a superpower. We gave them the playbook, and they are executing. Russia, after a period of very difficult times for them, is now...
resurgent in the world of global competition, great power
competition. These are the things that our National Defense
Strategy calls out.

We have been occupied for 15 years in the Mideast
dealing with the urgent problem of terrorism and nonstate
warfare, and other very, very difficult problems, but
problems which are not existential for the United States.
They are difficult; they are important; they are concerning;
but they are not existential.

Our global power adversaries are existential threats,
and this is what the National Defense Strategy is saying. I
am tremendously pleased with that strategy. I regret to say
I did not offer a contribution to it, but I am delighted
with what they have put forth, and I think that should be
our bible.

Senator Ernst: Then in your position, how do we use
the expertise that you have to catch up to those near-peer
adversaries?

Dr. Griffin: Well, in certain areas, like you
mentioned A2/AD, anti-access/area denial, China has fielded
or can field, is close to fielding, hypersonic delivery
systems for conventional prompt strike that can reach out
thousands of kilometers from the Chinese shore and hold our
carrier battle groups or our forward-deployed forces on land
that we have bases, can hold those power groups at-risk.
We, today, do not have systems that can hold them at-risk in a corresponding manner, and we do not have defenses against those systems.

Should they choose to employ them, we would be, today, at a disadvantage. It is among my very highest priorities to erase that disadvantage, creating our own systems to hold them at-risk and to provide defense.

We will never win a man-to-man conflict with the Chinese, should that come about. We can only win by employing technical overmatch.

So, for example, in the areas of missile defense or air defense, or even with our ground forces, in order to deal with things like swarming drone attacks, we have to finish the development of directed energy weapons, which we, this country, started and some years ago decided we did not really need. Well, we need to decide that we really do need them and fund them to completion.

We need to have 100-kilowatt class weapons on Army theater vehicles. We need to have 300-kilowatt class weapons on Air Force tankers. We need to have megawatt class directed energy weapons in space for space defense. These are things that we can do over the next decade, if we can maintain our focus.

Senator Ernst: I appreciate that. We do need to maintain our focus.
With that, we will go to Senator Heinrich.

Senator Heinrich: Secretary, yesterday, you testified before the House Armed Services Committee, and I saw a little bit of that. I believe you said that the powers afforded to you in this new position are more like "broad and sweeping powers to offer advice."

Can you tell me a little bit more about exactly what you meant by that? And what do you think should be your authority and relationship with service research and engineering programs and activities?

Dr. Griffin: Well, that is a leading question, sir, but I will take a swing at it.

Senator Heinrich: It was meant to be.

[Laughter.]

Dr. Griffin: Yes, sir. The authorities that the USD(R&E) has do not include the ability to direct funding. They do not include the ability to direct programs or program direction. So, therefore, the office is persuasive or advisory in nature, and I think that is what I said yesterday. If not, it is what I should have said.

So, let me be clear. I think that in the NDAA 2017 and 2018 legislation that was passed, I personally believe it was a very good idea to delegate programs back to the services to run on a day-to-day basis, except for those few programs that the Secretary has determined should be held at
the OSD level. I am an unabashed supporter of that plan.

OSD, generally speaking, is not the place you want to run programs.

However, the industry analogy, which I have used, might be that OSD is what you might call in industry the vice president for programs, for all programs. You are not running the program, but if a given program or a given program manager gets off track, in industry, there is no fuzz on this. There is a vice president somewhere who will say, "What you are doing is not okay. I am not replacing you. You still have the program, but you cannot do what you are doing, and you are going to do this other thing instead, and the reason is because I am the boss and I said so."

In industry, one's very existence depends upon being able to do that. The wrong decisions can put you out of business. I have run two companies, and we did not run them on the committee system.

So that, I think, gives you a flavor of the kind of authority that we need to have. We do not in OSD, in my opinion, need to be running programs. But we need to be able to control the funding and the overall direction of those programs in a way that is collaborative, but in the end, when a decision is made, the decision is made.

Senator Heinrich: I think we agree that you should not be meddling in the day-to-day management, but we want to
make sure that the strategic direction that you set is how these programs execute.

I am also concerned that the services have not always prioritized the modernization of the testing infrastructure, which is incredibly important, if we are going to maintain our position in the world.

If you just look at one example that I am familiar with, White Sands Missile Range went 18 years straight without receiving a single milcon project. And it is not unusual. White Sands is not alone in seeing that sort of dynamic among our test ranges.

So I am curious, how can you help to ensure that Test Resource Management Center is not only planning for testing but planning to make sure that we are maintaining our test ranges, that we are investing milcon in them, and that we do not ignore that resource and expect it to be there forever?

Dr. Griffin: Senator Heinrich, you have hit one of my hot buttons. I was just speaking about conventional prompt strike and hypersonics and the need to develop both offensive and defensive capabilities.

I would tell you right now that DARPA, which reports to me and has done some of the most significant hypersonics work in the country, has basically one wind tunnel that they can use for hypersonic research today. It is at NASA Langley in Virginia. This is an unacceptable situation.
Your test range at White Sands that has not received milcon funding in 18 years, I could tell that story about 20 other test ranges, test facilities, and 20 is an undercount.

The Nation must invest in renovating our test facilities, our research facilities, and bringing them up-to-date. We must do that.

Now, it is not glamorous. But when I come to you with a budget that asks for money to renovate our test facilities, I really want you to take me seriously. It is not nice to have. We really need to bring these things up-to-date.

Senator Heinrich: These are fundamentals.

My time is up, but I look forward to continuing --

Dr. Griffin: I am sorry. I was possibly too long-winded, but you asked me things that I am passionate about.

Senator Heinrich: We are going to have a couple rounds, I hope.

Senator Ernst: Yes, absolutely. Thank you.

Senator Perdue?

Senator Perdue: Thank you, Dr. Griffin. I appreciate you being willing to take on this job.

Dr. Eric Schmidt yesterday testified that, if there were one variable to solve for, it would be speed. You mentioned speed this morning several times. I just got back from a trip to China, and I saw firsthand how they are
They put $152 billion, the government did, into creating a chip industry. They bypassed their entire telecom industry. There are no hardwired cables, et cetera. It is all moving to 5G.

We saw corporate businesses and their research aligned with defense research all under one umbrella inside the Chinese structure.

The way they are set up is entirely different from ours. They are able to build things and move more quickly than we are in a democratic society.

General Mattis said constrained budgets and acquisition regulations have limited our ability to keep pace with rapid changes that sustain our competitive advantage.

Combine that with the Defense Innovation Unit-Experimental releasing its report recently, it really concerns me because of having seen their ability to move very rapidly and our ability to build a 2-foot tall set of requirements to buy a new pistol for the Army.

So the question I have for you is, within our DOD procurement system, our DOD requirements system, and the ability to innovate within a system that has been choked up by all the things that you are talking about -- China is buying technology from us; they are stealing technology from us; and they are innovating on their own today at a level
that we have not seen.

When you look at the two domains, in space and in cyber, particularly, I am worried about whatever advantage we might have dreamed we had may have been dissipated already.

So my question is, in that environment, how do we develop, from your point of view in R&D -- I hear infrastructure first. I get that. What are the ways, in integrating with business -- you read the Defense Innovation Board report. What ways can we accelerate the innovation that we obviously have to have to be able to defend our country in this new technical world that we live in?

Dr. Griffin: That is a great question. Of course, I testified yesterday with Dr. Schmidt, and we did not pre-coordinate our views, but he and I are about as closely aligned as I think two people from very different backgrounds could be about what is needed.

So one of the things that we have both said is that, and I will use my words, we cannot punish people who take risks and break something. We should reward them.

I will offer the view, which may not be popular, that it is not actually, generally speaking, our laws and regulations that restrain us from moving more quickly. It is the cultural view of our -- and it is not even just within the Department of Defense. I saw many of these same
things at NASA, and I worked in the intelligence community. It is the view that we have taken in recent decades that any mistake that is made in the course of a new development is a punishable offense. So, therefore, any rational program manager, whether wearing colonel's eagles or an SES civilian, will do everything possible not to allow any step of the development to turn out wrong because they will be punished.

Senator Perdue: Do you think the new generation of military leadership at the top recognize that?

Dr. Griffin: I think that they do. The people that I work with every day recognize the cultural barrier that avoidance of risk has created for us. But I need your help as legislators to make sure that our people understand that failure is not okay, but failure is failure to reach the end goal.

If I fail to give you a 100-kilowatt laser weapon for an MRAP within a few years, you should ding me for that. You should not ding me if we go out into the desert and try a couple laser concepts, and one of them does not work, and we have to back up and try another. That is not failure. Failure is if I do not get to the goal.

All too often, we punish program managers because they take something out to the desert and they flight test it and it breaks.
Until I was 40, I was closely involved with hardware development. I will tell you, it is really hard to get it right the first time.

You have to have that freedom to take on new challenges, take new risks, let things break, figure out why, and move on to the next step without punishing the young folks who you want to learn all those lessons.

There is no more critical step than that to me, sir. That is how we can establish a new culture of speed and innovation.

Senator Perdue: Is that inside DOD? It is also in the procurement area as well, right?

Dr. Griffin: It is in the procurement area. It is inside DOD. It is really all across government. It really is.

You have given us a lot of new legislative permissions. And you know what? As Eric Schmidt said yesterday, you should ask us to keep count of the number of times we are using other transaction authorities instead of the regular FAR. You gave us permission to use them. You should require us to do so. You should not allow us to fall back on what we are culturally familiar with.

Another point that I will make, and I realize I am over time, another point that I will make is that the whole purpose of carving out or separating R&E and A&S from the
former acquisition, technology, and logistics was to provide
an organization which could do advanced development before
it got into the major production cycle.

So let us make our mistakes. Let us learn our
developmental lessons when it does not cost much. Let's not
learn it when the carrier is already in production. I am
not picking on carriers. You pick your system. Let's not
learn it when the system is in production. Let's learn it
while people are still experimenting.

That is a critical step. I am sorry I have overstayed.

Senator Ernst: That is okay. Good discussion. I
appreciate it.

Senator Perdue: Thank you, Madam Chair.

Senator Ernst: Senator Peters?

Senator Peters: Thank you, Madam Chair.

Thank you, Dr. Griffin, for being here. Your
discussion about failure as part of the process, as you are
talking, I am just reminded of Thomas Edison. I cannot
remember the exact quote, but I think he said that he spent
most of his career with failed experiments. But the ones
that worked were pretty big and changed the world.

Dr. Griffin: Well, the knowledge that a particular
approach does not work is every bit as valuable a piece of
knowledge as the knowledge that something does work.

Senator Peters: Absolutely, yes.
Dr. Griffin: And I am not suggesting that we embrace stupid decisions. I am not going to that place at all. What I always tell my people is, every mistake you make, I want it to be a new mistake. Make a new mistake. Just do not repeat the old one, and we are good.

Senator Peters: Right. As long as you are learning from it.

I wanted to pick up on your comments related to speed as well. I think the other thing that I think was significant was where you said that everybody has access to this technology, which has changed so dramatically. The area that I have spent a lot of time on, being a Senator from Michigan, is self-driving vehicles and autonomy, which is moving I think a whole lot quicker than people realize as well. The race with the Chinese, Senator Perdue comments, I know they are at full speed on this as well.

What has been told to me is the power of the self-driving cars is that, in order for it to work, you need to have further advances in artificial intelligence and machine learning that is able to process the massive amount of data that is coming in. In fact, it was described to me, in some ways, self-driving cars is the moonshot for AI. When AI can pilot that car through a street here in Washington or New York City safely with all of those inputs, that means AI is ready for prime time in every single industry and will
likely change everything about our world. That also means
the future of warfare as well. I know the Chinese are
working on that at a feverish pace as well.

So I wanted to ask you about reports that I have seen
that the DOD and the intelligence community are working to
create a Joint Artificial Intelligence Center that will
hopefully move us along quicker with some of these kinds of
developments.

I am currently working on some language for the NDAA
provision that will create some flexibility so that we can
move forward with AI and incorporate all that we are seeing
on the commercial side into applications that will change
the face of warfare in ways that I do not know that we can
fully appreciate at this time.

So my two questions are, first, can you speak to the
reports of this joint AI center, and how we can help here on
the committee to make that kind of effort a reality where we
are coordinating our activities and taking advantage of what
is available commercially?

Dr. Griffin: In answer, sir, to that question, yes,
the Secretary in his testimony, I believe just last week,
committed to the development of a joint AI center, meaning
across the services.

Really, there will be elements of it across government.

I think the DOD will take the lead. The organization of all
that has not been finally decided, as you might appreciate.

But the Secretary and the Deputy, I believe, had made the
decision that there will be such as center. I am working
right now with folks on my staff to answer questions, like
should who should lead it, where should it be, what projects
should it do, and, most importantly, how does such a center
fit into the overall AI strategy for the department and the
Nation, because there are 592 projects, I was told, in the
department, which have AI as some piece of them. They do
not all belong in the new AI center that we will create, but
some of them do.

We have things all the way from foundational research
to practical applications to put in theater tomorrow. So we
have to parse all that.

We owe the Congress a report, I think about 2 months
from now, on what our AI strategy will be. The JAIC, the
Joint Artificial Intelligence Center, will be a part of that
overall strategy.

I better asked than answered your question.

Senator Peters: No, it is good. Is there anything
that we should be doing here in Congress to move this along?

Dr. Griffin: No, I think we can do this with the
authorities that we have. If we stumble across a regulatory
issue where we need your help, I will be back on your
doorstep in a heartbeat, because I agree, this is a critical
area of research. If there is going to be a leader, we need
to be that leader. We are not going to let this slip
through the cracks.

Senator Peters: Like most technologies, being first is
a significant competitive advantage. But I understand, with
artificial intelligence, it is beyond a significant
competitive advantage. It may be everything, in a lot of
ways.

Dr. Griffin: Yes, I do not want to be in danger of
getting overly occupied with the new shiny object. I think
AI is critical.

I think, frankly, we are going to have self-driving
vehicles in theater for the Army before we will have self-
driving cars on the streets. But the core technologies will
be the same. We in the DOD absolutely must leverage, I do
not want to get into corporate names, but what the various
companies are doing in developing self-driving cars.

I will give you an example that I have heard the
Secretary use, and I will put numbers on it. In theater, 52
percent of our casualties have been from soldiers basically
delivering the mail, not literally the mail, but food, fuel,
logistics, things like that. You are in a very vulnerable
position when you are doing that kind of activity. If that
can be done by an automated, unmanned vehicle with a
relatively simple AI driving algorithm where I do not have
to worry about pedestrians and road signs and all that, why wouldn't I do that? Well, I will.

We do not have that capability yet, but that is the kind of thing that we could bring to bear fairly easily. And if you will forgive the expression, we do not have to solve world hunger with AI to be able to deliver a system that can deliver fuel.

So that might be an early win for us. That is just one example.

Senator Peters: Thank you. I appreciate it.

Dr. Griffin: Thank you, sir. I thought that was a great question. Thank you, sir.

Senator Ernst: That was very good.

And thank you, Senator Peters.

While we are talking about commercial technology as well, this is a nice segue. During World War II, as well, we saw that the United States needed to rapidly leverage the commercial industry to meet its wartime needs, and we were able to do that in World War II. The phrase "battle of production" encapsulated our ability to outproduce many of our adversaries. That was critical in securing our Allied victory.

In future conflicts, the ability to out-innovate those adversaries -- we have named Russia; we talked about China -- they will be just as important. And we still do have a
world-class tech sector. We really do.

So what we would like to see is that we are able to take full advantage of that world-class tech sector. But unfortunately, there seem to be some gaps there where we are not able to tap into some of those technologies.

So the department is starting to make an effort to engage the commercial sector and get into that innovation coming from places like Silicon Valley. We will not name any names out there. But they are trying to do that through organizations like the Defense Innovation Unit-Experimental, DIUx -- you mentioned them earlier -- and the department's Silicon Valley outreach office.

So as we are trying to do that, what are the biggest barriers that you see with being able to reach that goal of utilizing those technologies that have been commercially developed?

Dr. Griffin: One of the barriers that we have is that, whether in AI or any other kind of information technology type of thing, or whether in fundamental material science or microelectronics, most of the innovators are innovators in small companies. Most of those companies fail.

I used to run In-Q-Tel. I would split time between Washington, D.C., and Silicon Valley. I had it an office on Sand Hill Road. In-Q-Tel, of course, is the CIA's venture capital company, if you want to put it that way.
Nine out of 10 of these entrepreneurial companies fail, and that is a real statistic. They should fail. They were experiments that tried and did not work. But the ones that succeed become things like Google Earth or other huge successes that become household names.

Well, the benefit for the department and for the U.S. Government more broadly is to be able to tie in on the front end of some of these things, because several of us have talked about how technology today is really pretty instantly available everywhere. Well, we do not want to be behind our adversaries in adopting the technology that we, this Nation, create.

So the earlier we can get into the tech cycle in whatever field and work with those people and bring them into department utility, the quicker we will transition to the field. Well, how do we do that with young companies?

You asked what the barriers were. The barriers are they are small, young companies. They cannot possibly afford the overhead of dealing with the DCAA accounting system. They cannot possibly afford the barriers of dealing with the DCMA for contracts. I mean, it takes a full-time staff of a good-sized company to deal with that.

So we have to have ways of interfacing with them that recognize where they are in the corporate lifecycle. They are not a large prime. If we want to take advantage of what
we can bring, we have to work with them on their terms.

That is what, for example, DIUx strives to do, but DIUx is a few tens of millions of dollars a year.

This is really a cultural issue. We need, across the department, to learn how to become user-friendly in our contracting and financing, so that any piece of our department can work effectively with a new high-tech provider.

Now U.S. Special Operations Command is an artist at this. SOCOM absolutely knows how to do this. DIUx is an excellent idea. I am fully supportive of it. But they are not the only place in the U.S. Government or even in the department that knows how to do this.

These are the kinds of lessons that we need to promulgate.

Senator Ernst: Very good. Thank you. My time is expiring, so, Senator Heinrich?

Senator Heinrich: Secretary, I really appreciate your awareness that so many of these challenges are baked into culture as much as anything else.

I want to give you an opportunity to talk a little bit about directed energy. I know you are passionate about it, as am I. I have a bunch of questions, but at the front end, I just want to provide you an open opportunity to tell me what you are excited about right now, where you think things
are going, and how we are going to finally make that
transition from R&D into procurement.

Dr. Griffin: Thank you, Senator. I do appreciate the
opportunity. So let me answer the last part first.

The way to get from experiments into procurement of
real live weapons systems is to say that is what we are
going to do, appoint people to run those programs, and hold
them accountable for delivery, and ask them every day, "What
is in your way that I can clear out?"

The technology is there or almost there. I used an
elementary example earlier: Let me have 300-kilowatts on an Air Force
tanker so that the tanker can defend itself, because that is
a critical function in our maintenance of air superiority.

And there are others. I am neither picking on the Air
Force nor otherwise. It is just an example.

I do not have a 300-kilowatt laser today. I have been
in the directed energy community, at least on its periphery,
for 3 decades. The people that I talk to who are domain
experts today, and from my own background, I can tell you
that if we can persist for 5 or 6 years, we can have that
laser. If we can persist for 10 years and maintain our
focus, we can have the megawatt class space laser that I
want. If I can persist for just a few years, I can have the
laser that goes on an Army combat vehicle.

You will notice that the key word there is "persist."
We have to set our goals and move toward them and weed out the funding for interesting ideas but which are not on the mainline of development and have people stick.

So that is what it takes. That is the cultural behavior that it takes to get things to the field.

I have already alluded to what level of performance we can have. Today, we have two very promising approaches, diode-pumped alkali laser that are being developed at Lawrence Livermore lab by the DOE. I keep talking about across government. It is not just the department. The DOE is our ally in this. And we have fiber combined lasers being developed both by industry and by government laboratories. In particular, Lincoln labs has demonstrated 35 kilowatts of controlled power.

You are getting very close there to something that will allow us to defend our forces.

So we have good technology paths. We have good laboratories. We have a good industrial base. And you have somebody with me who wants to bring that to our troops.

When I interviewed for this job with the Secretary, there was a comment he made that, until I either die or get Alzheimer's, I will not forget. He said to me, he said, when I was in theater, I never had to have a fair fight. And he said, you are in charge of making sure that the future force never has to have a fair fight.
To me, directed energy weapons are one of those ways that we do not have to have our guys, our partners, our allies have a fair fight.

Senator Heinrich: That is right. This is the third offset, in terms of technology.

As you identify those obstacles in the way, make sure that we know, so that we can help remove those obstacles.

Dr. Griffin: You can count on it, Senator. Thank you.

Senator Heinrich: In a related question, I want to ask you about the role of requirement setting.

To put it simply, I think that the current requirements process is not designed for new ideas or new weapons systems. It is almost designed to impede the movement from well-established systems to the next step. So talk to me about that a little bit.

I guess I am running out of time.

Senator Ernst: Go ahead.

Senator Heinrich: How do you think the current process actually works? To me, it seems like it slows down our progress into these new systems. How do we fix that?

Dr. Griffin: Well, from an engineer's point of view, we have requirements and capabilities backwards.

If you are in the DOD acquisition cycle, the DOD Directive 5000, et cetera, you have to have requirements before you can put out an RFP, before you can, before you
can, before you can, move down the road. But the reality is that engineers really do not know what the requirements ought to be until they have built and tested something. Frankly, whether it is a piece of software or a new combat vehicle or a new pistol or whatever, you have to build it and try it out and fool around with it a little. I am sorry to be so colloquial, but that is how engineers really work in the real world.

You are an engineer by training. I know you know what I mean.

When I know about what the capabilities are that the current generation of technology will allow me to have, and when I have tried it out with a real operator, then I can sit down for you and write some requirements. But if I have to write the requirements first -- despite what some think, I am not actually stupid. I am never, ever going to write a requirement for something that I do not already know I can do. Why would I do that? I am going to write a requirement for something I cannot get? That is just insane.

So the requirements before capabilities process, what that does to you is it constrains your ability to innovate, to get anything that you do not already have, because you must be so conservative in your process. That is at the root of our difficulties.

Senator Ernst: Mr. Secretary, we will do one more
round. We have a couple more questions.

We have talked about some of our adversaries, near-peer adversaries, and the technology that they have developed over the course of the last several decades. What can we as the United States be doing to make sure that we are tracking the advancements in technology that they have, as well as developing our own?

What we really need to see is that the United States is, again, staying ahead of our near-peer adversaries. You just stated that we do not want to see our warfighters in a fair fight. So what can we do to make sure that we are outpacing our adversaries?

Dr. Griffin: Well, certainly, our intelligence-gathering apparatus is critical to that. I met yesterday with some of my Title 50 colleagues. We need to take a whole-of-government approach on this.

Within the USD(R&E), we have a group who are focused on protecting our own technology, making sure that foreign acquisitions are appropriately vetted against strategic considerations. We have to protect what we have while not impeding our ability to have our companies compete in the real world, because we cannot wall ourselves off and stay inside. We have to be prepared to compete. At the same time, we have to protect ourselves, and we have to do that in balance.
But if you ask what we need to do to regain and maintain a technological advantage on our adversaries, frankly, we have to work harder; we have to run faster; we have to have more focus on what we want to do.

No adversary of ours at present has directed energy systems of the type of which I was just speaking. We should be the first. We should be putting them in a position to catch up with us.

I have mentioned you can find in public literature many references to the Chinese hypersonics capability development. Frankly, we were the leaders in that 10 and 15 years ago, and we just let it drop. We need to get started again.

We need to shorten our test cycle timelines. I referred yesterday to an experiment called Flight Experiment-1 that the Navy did, a long-range conventional prompt strike experiment. It was, frankly, an experiment. It is not a weapons system yet. They did a brilliant job with it. I mean, I will not quote numbers, but I will just say that the impact accuracy was quite impressive.

So in chatting with my colleagues at the senior levels of the Navy, I said, well, when can I have FE-2? When can I have FE-3? Why not next August? Why not this August? I mean, we need to finish the development of these systems, and it cannot be done at a leisurely pace, because
our adversaries are not working at a leisurely pace. As much as anything else, it is the sense of urgency, Senator, that we really must get to this.

Senator Ernst: Very good. I will just make a brief comment. I think we have talked a little bit about some of the issues, and what we have described as the Valley of death, actually taking that technology and getting it fielded for our warfighters. It seems like the overarching theme seems to be the persistence and funding.

Would you state that that is accurate?

Dr. Griffin: Senator, absolutely. Persistence in reaching the goals, knowable funding to reach the goals.

I can deal with budget cuts. What I cannot deal with is surprises. Or I can, but the surprises become very expensive for you and insert delays for me.

The other thing that I guess I would offer is we have to regain a cultural awareness that we have, as the National Defense Strategy states, global superpower competition again.

I was once labeled by a political adversary as an unreconstructed cold warrior. I took that as a compliment, actually, though it was not meant that way. Much of my early career was in the Cold War. We understood for decades that we had an existential threat from a peer competitor, and Democrats, Republicans, did not matter, did not matter
which presidential administration, we had for decades a united policy across government that we were going to contain the Soviet Union and we were going to win. And if we can restore that kind of thinking to a renewed global power competition, then we will actually never have to fight, because our adversaries will not want to take us on. So that is the kind of culture, those are the kinds of comments that I hear coming out of my leadership, which I would like to promulgate as well.

Senator Ernst: Thank you. I appreciate it.

Senator Heinrich?

Senator Heinrich: Thank you for bringing a sense of urgency to all of this, because I very much agree that has oftentimes been the missing piece to all of this. I wanted to follow on to the question that Senator Perdue asked you. You did a really good job of articulating why testing is so important, and why you want to do testing very early in the process and not after you have a product that is supposed to work perfectly for folks in the field. Can you talk a little bit, too, just about how early and effective developmental testing also speeds up acquisition by discovering challenges early in the lifecycle and not after the fact?

Dr. Griffin: Sir, I think you have pretty much done it for me. The truth of the matter is -- Senator Ernst was
just asking about persistence and funding, and how to get through the valley of death. My quick answer to that is, take your prototypes up to the level of being operational prototypes, not something I am going to produce but something a real operator can work with and help wring out the bugs so that I know what I want to produce.

The more quickly that I can do that, and I will say outside the acquisition cycle -- although, of course, it still is Federal acquisition of stuff with taxpayer money, but it is not in the production cycle. The quicker I can do that and figure out what I really want, then the speedier the whole acquisition process will be.

The most expensive and time-consuming place to discover a mistake is after I have delivered a weapons system to the field.

So when one has spent the most enjoyable part of one's life as an actual engineer, you become humbled by the fact that you just almost never do anything right the first time. It is a bit embarrassing because there are very few stupid engineers around, and all of us have advanced education, and you would like to believe that you can get something right the first time. You just cannot.

Senator Heinrich: Experience does not support that.

Dr. Griffin: Yes. So wring the mistakes out as early as possible. Work with us. Talk with us. Call us up to
the Hill frequently and say, "Hey, how are you doing on that
Flight Experiment-2 that you just talked about with the
Navy? How is that coming along?"

Senator Heinrich: You mentioned a laser that DOE is
developing. Before we let you go, is it easy enough to work
across government? If DOE or the NNSA, the national
security labs, are developing something that has direct
application in DOD, do the authorities and the current ways
of interfacing, do they support being able to work together?
Or are there things that we need to change in the NDAA to
make it easier to do that kind of work?

Dr. Griffin: Senator, if I come across something that
should go in the NDAA, that would enhance our ability to
work across government, I and the department will come to
you with a legislative proposal. I have spent decades in
various agencies working with other agencies, to include at
various times in various places NASA, National
Reconnaissance Office, DOE, CIA, DOD, of course, working in
and with these various components of the government. When
you get below the very political level and you start dealing
with people whose focus is on the mission, I have never had
any trouble at all.

Senator Heinrich: That is good to hear.

Dr. Griffin: It works well. I am not saying there are
not stumbling blocks. It is always difficult for people to
work together. But my experiences have been good ones, I will just say that, over the years.

Senator Ernst: Thank you so much, Mr. Secretary. It has been a pleasure to have you in front of the committee. We appreciate you taking on these challenges for our men and women, whether they are on the frontlines or working in various places around the globe.

We look forward to utilizing your expertise in the upcoming years, and I am anxious to see some of the great developments that will come through your work.

Dr. Griffin: Well, you have given us a wonderful budget, and you have given us good regulatory authorities, and we have a great team. It is on us, and we hope to deliver.

Senator Ernst: Outstanding. Thank you. This concludes the Emerging Threats and Capabilities Subcommittee.

[The information referred to follows:]

[SUBCOMMITTEE INSERT]
[Whereupon, at 3:30 p.m., the hearing was adjourned.]