

Stenographic Transcript
Before the

Subcommittee on Emerging Threats and Capabilities

COMMITTEE ON
ARMED SERVICES

UNITED STATES SENATE

HEARING TO RECEIVE TESTIMONY ON THE
STRATEGY AND IMPLEMENTATION OF THE
DEPARTMENT OF DEFENSE'S TECHNOLOGY
OFFSETS INITIATIVE IN REVIEW OF THE DEFENSE
AUTHORIZATION REQUEST FOR FISCAL YEAR
2017 AND THE FUTURE YEARS DEFENSE
PROGRAM

Tuesday, April 12, 2016

Washington, D.C.

ALDERSON COURT REPORTING
1155 CONNECTICUT AVENUE, NW
SUITE 200
WASHINGTON, D.C. 20036
(202) 289-2260
www.aldersonreporting.com

1 HEARING TO RECEIVE TESTIMONY ON THE STRATEGY AND
2 IMPLEMENTATION OF THE DEPARTMENT OF DEFENSE'S TECHNOLOGY
3 OFFSETS INITIATIVE IN REVIEW OF THE DEFENSE AUTHORIZATION
4 REQUEST FOR FISCAL YEAR 2017 AND THE FUTURE YEARS DEFENSE
5 PROGRAM

6

7 Tuesday, April 12, 2016

8

9 U.S. Senate
10 Subcommittee on Emerging Threats
11 and Capabilities
12 Committee on Armed Services
13 Washington, D.C.

14

15 The subcommittee met, pursuant to notice, at 2:36 p.m.
16 in Room SR-222, Russell Senate Office Building, Hon. Deb
17 Fischer, chairman of the subcommittee, presiding.

18 Members Present: Senators Fischer [presiding], Cotton,
19 Tillis, Nelson, Manchin, Kaine, and Heinrich.

20

21

22

23

24

25

1 OPENING STATEMENT OF HON. DEB FISCHER, U.S. SENATOR
2 FROM NEBRASKA

3 Senator Fischer: Good afternoon. The Subcommittee on
4 Emerging Threats and Capabilities meets today to receive
5 testimony on the Department of Defense's third offset
6 strategy.

7 In 2014, Under Secretary Kendall provided this
8 subcommittee with a classified briefing on U.S.
9 technological superiority. And in November of that year,
10 then-Secretary of Defense Hagel announced the start of what
11 he referred to as, quote, "a game-changing third offset
12 strategy," end quote.

13 Since this announcement, many senior leaders in the
14 Department of Defense, including Secretary and Deputy
15 Secretary, have spoken at length about our military's
16 eroding technological edge and the significance of the third
17 offset strategy. However, these discussions tend to broadly
18 focus on abstract ideas and the general importance of
19 innovation. The purpose of today's hearing is to explore
20 the concrete details beneath the notional concepts.

21 I look forward to hearing from our witnesses today
22 about what activities make up the third offset strategy and
23 the extent to which it represents a change from past
24 practice.

25 Appearing before the subcommittee today, we have Dr.

1 Roper, Director of the Strategic Capabilities Office; Dr.
2 Prabhakar, Director of the Defense Advanced Research
3 Projects Agency, or DARPA; and Secretary Stephen Welby, the
4 Assistant Secretary of Defense for Research and Engineering.

5 I'd like to welcome and thank you all for being here
6 today.

7 And I would turn to my Ranking Member for any opening
8 comments he would like to make.

9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

1 STATEMENT OF HON. BILL NELSON, U.S. SENATOR FROM
2 FLORIDA

3 Senator Nelson: Madam Chairman, thank you.

4 I simply am a big fan of what these folks do. I think
5 we need to support the President's request, and then double
6 it.

7 [Laughter.]

8 Senator Nelson: That's my opening statement.

9 Senator Fischer: Thank you, Senator Nelson.

10 And we will now turn to our witnesses. Your full
11 statements will be made part of the record, and I would ask
12 that you provide us with some brief opening comments, after
13 which we will proceed to 7-minute rounds in our questioning.

14 Secretary Welby.

15

16

17

18

19

20

21

22

23

24

25

1 STATEMENT OF HON. STEPHEN P. WELBY, ASSISTANT
2 SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

3 Mr. Welby: Chairman Fischer, Ranking Member Nelson,
4 members of the committee, Senator Heinrich, thank you. And
5 I'm pleased to have the opportunity to provide testimony on
6 the technological underpinnings of the Department of
7 Defense's third offset strategy. And I join my colleagues
8 from DARPA and the Strategic Capabilities Office in doing
9 so.

10 In my role as Assistant Secretary of Defense for
11 Research and Engineering, I serve as the Chief Technology
12 Officer for the Department of Defense, and I'm responsible
13 for the Department's strategies and supporting plans to
14 develop and leverage technology needed to support continued
15 U.S. technological superiority.

16 For the last 30 years, the U.S. and our allies have had
17 -- been able to count on a set of unique capabilities in
18 combat that no regional adversary could bring to bear. We're
19 now at a pivotal moment in history, where the advanced
20 technical capability and capacity that the Nation has relied
21 upon on the battlefield is now being challenged by military
22 technology investments being made by increasingly capable
23 and assertive powers. As Secretary Carter said during his
24 budget rollout testimony, Russia and China are our most
25 stressing competitors. They have developed and continue to

1 advance military systems that threaten our advantages in
2 specific areas. And, in some cases, they're developing new
3 weapons and ways of war that seek to achieve their
4 objectives rapidly before they hope we can respond.

5 Our Nation has long pursued strategies that leverage
6 U.S. technological advantage as a force multiplier. We need
7 to continue to leverage those advances in technology and in
8 new operational concepts to provide sustained advantage to
9 U.S. forces, shifting the landscape of future national
10 security competition to our advantage by seeking asymmetric
11 opportunities in technological and operational innovation.

12 Merriam-Webster defines an "offset" as something that
13 serves to counterbalance or compensate for something else.
14 An offset strategy is an approach to military competition
15 that seeks to provide an asymmetric advantage to the United
16 States rather than competing head-to-head or tank-for-tank
17 or plane-for-plane in an area where a potential adversary
18 may also possess potential strength. Instead, an offset
19 strategy seeks to shift the axis of competition through the
20 introduction of new operational concepts and technologies
21 towards one in which the U.S. has a significant and
22 sustainable advantage.

23 The U.S. was successful in pursuing two distinct offset
24 strategies during the Cold War:

25 The first of these offset strategies occurred in the

1 1950s, when President Eisenhower sought to overcome the
2 Warsaw Pact's numerical advantage by leveraging U.S. nuclear
3 superiority to introduce battlefield nuclear weapons, which
4 shifted the axis of competition from competing on
5 conventional force numbers to competing in an area where the
6 U.S. had an advantage.

7 A second offset strategy occurred in the 1980s, with
8 the recognition that the Soviet Union had achieved nuclear
9 power -- the United States. The second offset strategy
10 sought to create an enduring advantage by pursuing a brand
11 new approach to joint operations, leveraging the combined
12 effects of near-zero-miss distance weapons, realtime
13 targeting, and joint battle networks to create a new era of
14 conventional precision engagement.

15 This combined suite of technologies gave the U.S. a
16 fundamental advantage that we have sustained for the last 30
17 years, capabilities that provided the U.S. and its allies
18 with an asymmetrical advantage in every fight. Today, we
19 see the emergence of increasing technological symmetry, and
20 that's why the Department is discussing the need for a new
21 offset strategy.

22 Today, the third offset strategy is not a document that
23 you can go find in a drawer somewhere in the Pentagon.
24 Instead, it -- the term really describes the broad nature of
25 capabilities that the Department expects to realize over the

1 coming years by pursuing developments in advanced
2 technologies, by conducting experimentation with prototype
3 systems, through increased emphasis on war-gaming to help us
4 understand new concepts, and by emphasizing the need to
5 innovate across the entire DOD enterprise.

6 In the fiscal 2017 defense budget request, Secretary
7 Carter identified more than \$3.6 billion of investment in
8 FY-2017 and 18 billion in specific investment over the
9 Future Year Defense Plan, focused on spurring research,
10 development, and procurement of advanced capabilities that
11 our military will need to fight and win in high-end
12 conflicts in the future. These investments and others
13 directly support and enable a third offset strategy.

14 The investments in the fiscal 2017 defense budget
15 request include new capabilities that can be fielded rapidly
16 through modifying and upgrading existing systems -- and
17 we'll be happy to talk about some of those here today;
18 material concepts that could enter accelerated development;
19 and, again, something I'd like to talk about, our
20 technology-driven concepts that could have a significant
21 impact on the joint force over a longer term. They -- the
22 investments also emphasized the critical importance of
23 focusing on the cost of weapon systems so that -- to be able
24 to introduce these kind of disruptive capabilities into the
25 joint force at real scale.

1 Deputy Secretary of Defense Work has emphasized, in his
2 remarks, the importance of advanced software-enabled
3 capabilities for a third offset. Emerging capabilities in
4 advanced algorithms and software intelligence offer a
5 significant potential advantage to a joint force, enabling
6 systems to process large quantities of data at a high speed
7 to identify emergent patterns and trends, speeding decision
8 making and enabling faster-than-human reaction time in new
9 and emerging areas of conflicts, such as cyber and
10 electronic warfare, and supporting new models of manned-
11 unmanned combat teaming; and finally, permitting new weapons
12 concepts that can operate in critically challenging cyber
13 and electronic warfare-constrained environments.

14 The Department's goal to sustain and advance our
15 Nation's technological superiority for the 21st century
16 national security environment requires a sound research-and-
17 development investment strategy. The DOD's research and
18 engineering community works to create options for the
19 Department and serves as a novel and agile innovation engine
20 for the Department. The core science and technology efforts
21 of ASDR&E, the service laboratories of DARPA and SCO are
22 focused on creating long-range opportunities for the
23 Department's future material options.

24 As DOD develops the third offset strategy, the
25 Department's research and engineering enterprise is well

1 prepared to develop, shape, and create technology options to
2 inform future operational concepts. Our goal must always be
3 to ensure that our soldiers, sailors, airmen, and marines
4 always have the scientific knowledge, the decisive
5 technology, the advanced systems and tools, and the materiel
6 edge to succeed when called upon. Our research and
7 engineering enterprise measures its success in the security
8 of the Nation and the success of our warfighters.

9 Let me close by thanking the committee for its strong
10 interest in and support of the Department's research and
11 engineering efforts as we work to discover, design, and
12 deliver the technology capabilities our warfighters will
13 need in the future.

14 Thank you.

15 [The prepared statement of Mr. Welby follows:]

16
17
18
19
20
21
22
23
24
25

1 Senator Fischer: Thank you very much.

2 Dr. Prabhakar, please.

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

1 STATEMENT OF ARATI PRABHAKAR, DIRECTOR, DEFENSE
2 ADVANCED RESEARCH PROJECTS AGENCY

3 Dr. Prabhakar: Thank you. Chairwoman Fischer and
4 Senator Nelson, members of the subcommittee, it's a great
5 pleasure to be here with my colleagues today.

6 DARPA is part of the Defense Department, and we also
7 work with defense companies and commercial companies, with
8 universities and labs of all sorts, so we are very much part
9 of a very large ecosystem. Within that ecosystem, DARPA has
10 one particular mission, and that is to make the pivotal
11 early investments in breakthrough technologies for national
12 security. We do this work to change what's possible so that
13 the Department can revolutionize our military capabilities.

14 Now, today's hearing is about the third offset
15 strategy, and I want to just spend a little bit of time to
16 tell you what it means for DARPA.

17 You know, DARPA's work is always -- has always focused
18 on technologies to offset our adversaries' capabilities, so
19 the third offset strategy hasn't significantly changed the
20 way we start our programs, which range from radically new
21 military systems to artificial intelligence to biological
22 technologies. What is starting to shift, I think, in a very
23 productive way is the kind of pull that we're getting from
24 the Department to transition those technologies. And I'll
25 contrast what's going on today to the environment we were in

1 5 or 10 years ago. If you look in that period of time, most
2 of DARPA's significant transition successes were direct to
3 theater. We were tracking insurgents' pickup trucks from
4 the air. We were helping to analyze data so that we could
5 help commanders in the field understand the effectiveness of
6 stability operations. And we're very proud of the
7 contributions that we were able to make in that environment.
8 But, in that period of -- and in a really intense focus, of
9 course, on the ground war on counterinsurgency -- in that
10 period of time, we found that there was a very limited
11 appetite in the Department to move ahead with the kinds of
12 technologies that are going to be necessary to deter and
13 defeat a very sophisticated nation-state adversary. And
14 that's what I think has really shifted today.

15 So, today, when you look at what's happening across the
16 Department, fresh thinking in many ways across the
17 Department, including, of course, the third offset strategy.
18 What that means today for DARPA is that many more of our
19 transitions are working directly with the services in
20 partnerships where we're exploring and experimenting and
21 demonstrating what our technologies can do to counter,
22 again, a very sophisticated adversary, a very capable
23 opponent.

24 Just to give you one simple example, last week we had
25 the great pleasure of christening a new ship. It's called

1 the Sea Hunter. This ship will be the first -- the world's
2 first ship that's able to leave the pier to navigate
3 thousands of miles across open seas without a single sailor
4 onboard. And what that means is that it'll be able to do
5 some maritime missions for a tiny fraction of today's
6 operating costs, which is good, but, even beyond that, this
7 is the kind of new capability -- this kind of unmanned ship
8 now allows us to invent whole new ways to exercise influence
9 across the vastness of the oceans. And that's exactly what
10 we're now doing with the Navy, a series of experiments that
11 we're launching on -- launching into with them. And that's
12 a partnership that I deeply value in this particular project
13 with the Navy. It's a partnership I don't take for granted,
14 however, because, when we started that program, originally
15 called the Active Program, many years ago now at DARPA,
16 starting in the early part of this decade, at that time we
17 were going it alone, for a couple of reasons. Obviously,
18 because, at that time, the technology was very new and
19 unproven, but also partly because the Navy's priority at
20 that time, as was the whole Department's -- their focus was
21 on the battle at hand.

22 And today, very much in contrast to that, the Sea
23 Hunter Project is actually only one of a growing set of
24 partnerships that we have, transition relationships that
25 we're building with the services. And those cover every

1 kind of operational domain. I mentioned maritime, but also
2 work in the air, space, and ground domains, also work to
3 control the electromagnetic spectrum in cyber, and in the
4 information domain. And at DARPA, we see these partnerships
5 as absolutely essential if we're going to get these DARPA
6 technologies from wild new idea to robust operational
7 capability.

8 Let me just conclude this afternoon by touching on two
9 pillars of your support that make it possible for DARPA to
10 do this work:

11 One is, of course, the budget. And your support in --
12 of the budget over the last few years has been vital in the
13 relative stability that we've enjoyed. And I'll ask you
14 again for your full support of the President's budget
15 request.

16 The second is people. And I want to give a special
17 thanks to this committee for, first, creating and then many
18 -- over many years, supporting a special hiring authority,
19 the 1101 hiring authority. This is one of the big reasons
20 that DARPA is able to move fast and to hire exceptional
21 people.

22 So, those are the two elements: great people and the
23 trust that you place in us. This is why DARPA is able to
24 create breakthrough technologies for national security.

25 Thank you. And I'll look forward to your questions.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

[The prepared statement of Dr. Prabhakar follows:]

1 Senator Fischer: Thank you.

2 Dr. Roper.

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

1 STATEMENT OF WILLIAM B. ROPER, JR., DIRECTOR,
2 STRATEGIC CAPABILITIES OFFICE

3 Dr. Roper: Chairman Fischer, Ranking Member Nelson,
4 and members of the committee, thank you for your interest in
5 the third offset. Thank you for your interest in the
6 Department's return to great-power competition. Thank you
7 for your interest in the Strategic Capabilities Office, or
8 SCO. It's an honor to be here with colleagues from the
9 research-and-development arm of the Department who are
10 striving to maintain our technology edge against a world of
11 threats.

12 As mentioned earlier, these threats now span a space
13 from nonstate terrorism all the way up through great-power
14 competition. And the third offset is really trying to
15 return a greater focus of our Department's effort, including
16 the budget, to those highly sophisticated adversaries. In
17 2012, the SCO was created by Secretary Carter as one piece
18 of this broader strategy; specifically, a near-term piece
19 that is focused on trying to regain advantage. So, I would
20 like to discuss the way that we frame immediate challenges,
21 our process for prototyping solutions, and how we're working
22 to do these prototypes in a partnership with the services.
23 This will be the focus of my remarks today.

24 Though daunting in many respects, we interpret our
25 immediate challenges via a fairly simple analogy, but an

1 instructive one, that the U.S. military is akin to a
2 football team that has run a very successful playbook, but
3 for a bit too long. As in football, where opponents watch
4 film to try to find weaknesses to exploit them, 20 years of
5 operations in the Middle East have given great powers a lot
6 of valuable game film to roll right into their weapons
7 development. So, SCO's response to this is to do what
8 football teams do. Great teams often find themselves
9 overanalyzed and exploited, but they don't throw away their
10 playbooks. They use this vulnerability and turn it into
11 opportunity by creating trick plays. They start running in
12 their pass formations, passing in their run formations.
13 They reimagine their strengths rather than playing to their
14 opponents. And like fashion, we can rejuvenate our military
15 playbook if we can reimagine its strengths: ships,
16 aircraft, submarines, things we're familiar with. If we
17 start using them in unforeseen and unexpected ways, we can
18 hope to buy back some of the competitive edge that we're
19 losing to great powers. SCO was created to do precisely
20 this.

21 Though our strategy often has advantages of lower cost
22 and rapidity, its core tenet, which is our need to change,
23 is anchored in our greatest advantage of all: experienced
24 operators who can do the unparalleled with today's systems
25 and can rapidly master any unconventional tactic we throw at

1 them. This strategy also will provide healthy connective
2 tissue between our past and future efforts; the past, by
3 keeping taxpayer investments for as viable -- viable for as
4 long as possible; and the future, by trying to buy time for
5 these future technologies, future systems, the leap-aheads,
6 to field. Because of this, we were tapped to be a near-term
7 component of the broader offset strategy, and our goal is a
8 simple one: to try to enhance our current deterrence,
9 backed by an arsenal of surprises, using systems that we
10 have today.

11 Our process for achieving this is, itself, innovative,
12 because it flows in reverse from the normal one, from
13 operational needs to systems -- actually, from systems to
14 operational needs, rather than vice versa. Living within
15 the constraints of existing hardware and software focuses
16 ideas early on. It encourages cost domain thinking, and
17 necessitates close partnerships with the services to pull
18 off these high-risk prototypes. In 3 and a half years of
19 practice, we've done 23 capabilities, working with the
20 services. Six of them will transition by the end of this
21 year. And none have failed to transition, thus far.

22 These projects, which are really our versions of trick
23 plays, take on one of three forms: repurposing a system for
24 a new mission it wasn't designed to do; integrating systems
25 into a team that can perform the function together, but not

1 separately; and including or incorporating enabling
2 commercial technology. I'm sure we'll cover some examples
3 today, but let me highlight three of them:

4 Unconventional weapons. Standard Missile 6 was
5 originally designed to defend our ships. We've partnered
6 with the Navy to give it an offensive antiship role. You
7 can also do unconventional defense. Army howitzers, Navy
8 projectiles, Air Force radars weren't designed to be a
9 defensive system, but we're partnering to Frankenstein these
10 into a low-cost supersonic missile defense shield.

11 Could also do unconventional teams, or kill chains.
12 Stealth fighters were originally designed to use their
13 organic weapons. We're partnering with the Air Force to
14 team them with large standoff arsenal planes so that they
15 don't have to go land and resupply during a fight.

16 Our third i-program is taking this even further,
17 connecting disparate sensors and shooters from across the
18 joint force.

19 The rest and best of our details necessarily remain
20 classified, but I hope these few examples give you a sense
21 of how broad the applications could be. We should really
22 let no facet of future conflict be predictable or be as it
23 seems.

24 As one of the bellwethers for the return to great-power
25 competition, I'm pleased say that SCO is making significant

1 progress in making current systems count towards a future
2 that's shaped by us, and not for us. I really appreciate
3 your interest in this topic, appreciate this hearing today.
4 I look forward to any questions you might have.

5 [The prepared statement of Dr. Roper follows:]

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

1 Senator Fischer: Thank you very much.

2 And again, welcome to all of you. I think this is
3 going to be a fascinating hearing.

4 Secretary Welby, if I could begin, a factsheet that was
5 provided by the OSD states that realizing the third offset
6 strategy will require the right combination of bottom-up
7 innovation and experimentation to push the technical and
8 operational envelope and senior-leader top-down direction to
9 initiate major programmatic, operational, and organizational
10 change. So, I'd like to ask you about that last part. What
11 the major programmatic, operational, and organization
12 changes are being made as part of that offset strategy or --
13 basically, what's the Department proposing to do differently
14 in this budget request with regards to the offset strategy?

15 Mr. Welby: Chairman, the -- if I -- if you look to the
16 investments that are in the '17 budget, there are some very
17 significant muscle movements that you can see in that
18 budget. I'll point to a couple of key technology areas
19 first: a major reinvestment in hypersonic capabilities, an
20 increase in the number of systems that we're carrying to the
21 range in the hypersonics weapon regime by 50 percent, an
22 increase in the investment in our ranges to increase our
23 hypersonic capabilities, and investments in our laboratories
24 in industry to take those systems from being technology
25 demonstrators to being no-kidding weapons that we could

1 actually think about deploying with our force.

2 In the undersea arena, you see a significant
3 reinvestment in unmanned undersea vehicles as an augment to
4 our manned undersea force as a significant force multiplier,
5 as a key experimental asset for the future of the Navy. You
6 can see within that budget significant investments looking
7 at a variety of novel weapons concepts that might have
8 significant application to the future force.

9 And, over the last year, you've seen the Department
10 really open its aperture to all sources of potential
11 innovation, to include engaging the defense industrial base,
12 in terms of ensuring transparency on their IRAD investments
13 so we can work forward -- march forward together
14 collectively against these kind of challenges, understanding
15 what they're investing in, understanding what we're
16 investing in. And you've seen the Department engaging the
17 innovative commercial sector through outreach efforts like
18 -- EWACS on the West Coast and the Secretary's continuous
19 engagement with the commercial sector, trying to find ways
20 to bring both people and ideas back into -- reinvigorate our
21 activities.

22 We are reemphasizing the importance of the DOD
23 laboratories to this initiative. The laboratories in the
24 individual services and our engagement with partner
25 laboratories in DOE, as well as innovation engines that can

1 help drive the future of the Department. And we are
2 emphasizing the need for speed from laboratory to fleet. The
3 recognition that there's enormous innovation that has
4 continued within the laboratories even while the Department
5 may have reduced its focus on fielding that capability, but
6 that store of novel ideas needs to be taken to the test
7 ranges and experimented with.

8 Finally, I want to point to the focus on prototyping
9 and experimentation. When you look to the second offset
10 that occurred in the '80s, the ideas for that -- for those
11 technologies emerged in the mid-'70s. And in '79 and '80,
12 the Department conducted a series of major experiments on
13 the western ranges, where we put together precision weapons,
14 long-range ISR platforms, the first flights of what became
15 Joint STARS, the first systems of what became the Army
16 ATACAMS, early flights of Apache Longbow, and many other
17 capabilities. And across the range, in the classified
18 portfolio at that time, we were flying the F-117 and
19 experimenting with the emergence of real stealth
20 capabilities. That incredible innovative energy that
21 occurred at the operational level, not simply doing
22 laboratory experiments, but putting it into the hands of
23 operators and letting them understand how they might fight
24 those capabilities, is what enabled the set of capabilities
25 that in the '80s, as the Reagan defense buildup, we didn't

1 buy the same things; we bought an entire new generation of
2 capabilities. But, we didn't buy it blind. We bought it
3 with the knowledge that came from those exercises. The
4 Department is now preparing for another series of
5 investments in prototyping and experimentation. We want to
6 get our ranges busy again. We want to get new systems out
7 on those ranges. Whether we procure them all, or not, we
8 want to learn from those systems and inform what we need in
9 the future. And so --

10 Senator Fischer: Right.

11 Mr. Welby: -- making the Department smart for its
12 future choices.

13 Senator Fischer: And in the budget's 3.6 billion,
14 funding specifically related to the offset strategy, can you
15 provide the committee with a breakdown of this funding?
16 Will you get that information to us, please, by programs?

17 Mr. Welby: I'd be happy to provide you detail. Some
18 of those remain classified.

19 Senator Fischer: You've mentioned a lot of them, but
20 can you get us the detail, by program, for that --

21 Mr. Welby: I'd be happy to do that.

22 Senator Fischer: -- for that spending? Thank you.

23 [The information referred to follows:]

24 [SUBCOMMITTEE INSERT]

25

1 Senator Fischer: Also, we're going to have a change of
2 administration in January, and what sort of things do you
3 want to have accomplished by that time to demonstrate that
4 this effort is on the right path?

5 Mr. Welby: I'm sure that any transition team that --
6 for any administration to come is going to face the same set
7 of challenges that we face today. The pull here is the
8 recognition of the need to address U.S. strengths in a
9 future competitive national security environment. That's an
10 external pull. This is not -- while this is Dr. Carter's
11 initiative, it's the Deputy's initiative, while I'm trying
12 to drive this, it's not driven by personality; it's driven
13 by the Nation's need to refresh our technology --

14 Senator Fischer: Right. And how -- and what are you
15 going to point to that you've accomplished? I think you
16 have a lot of support on this committee. We understand the
17 importance of where we're headed with technology in order to
18 change warfighting so that we continue to defend this
19 country. So, how are we going to make sure this moves
20 forward?

21 Mr. Welby: We're not going to stop for the next 9
22 months of running to make sure that the next administration
23 has a running start to these problems. We've completed,
24 recently, the Long-Range Research and Development Planning
25 Program, an 18-month study that looked at details and laid

1 out a series of opportunities for the Nation, going forward.
2 All that material, we're trying to harness across the
3 laboratory complex today to make sure we're ready for what
4 comes next. And so, I think that we -- that this budget and
5 the initiatives we have ongoing prepare for that future in
6 an important way and lay ground for the next administration.

7 Senator Fischer: Okay. Thank you very much.

8 Senator Nelson.

9 Senator Nelson: Thank you, Madam Chairman.

10 Mr. Secretary, thank you for your public service.

11 Dr. Prabhakar and Dr. Roper, given the fact that I've
12 already spent a great deal of time with both of you, asking
13 a lot of questions, and given the fact that our enemies'
14 spies are listening to what you say today, I really don't
15 want to ask you any questions in an open session. And I
16 would invite the members of this subcommittee to get in a
17 classified setting to figure out some of the gee-whiz stuff
18 that these folks are doing. But, since it's an open
19 setting, I'm just going to leave it to you. Say whatever
20 you'd like. And that's all I'm going to say.

21 Dr. Prabhakar: Well, it's hard to resist an invitation
22 like that. Thank you very much, Senator Nelson.

23 You know, I think, absolutely, the details of the
24 programs that we think can be very impactful here do need to
25 remain classified. And, of course, we're happy to provide

1 classified briefing to any of you who would like to come do
2 that. We'd be very pleased to do it.

3 I actually think the most interesting aspect of what
4 we're all working on in the third offset strategy and these
5 technologies -- really, the question, as a technologist,
6 that I see is -- in a world in which we no longer get to
7 have all the toys and nobody else gets to have any
8 technology capability -- that was an unusual period, after
9 the second World War, when we had that enormous
10 technological advantage over the rest of the world -- that's
11 not the world anymore, and we all know that technology,
12 wherever it originates, it flows. We know that many other
13 countries now have amazing engineers and scientists and
14 laboratory facilities. And, by the way, all of that is
15 really good for the world. It's actually -- it's elevated
16 living standards. It's connected us in new ways. So, most
17 of that is good news.

18 The challenge, of course, that this is all about is the
19 fact that we still have to come up with a technological edge
20 for national security, despite a more and more level playing
21 field of initial technologies. And I actually think the
22 success here is going to come from something that's a deeply
23 American way of approaching the problem. And I -- you know,
24 a lot of what we do at DARPA is about this idea that we're
25 going to -- we're willing to take risk to reach for high

1 payoff, and we are willing to try things that might fail.
2 But, in combining these commercial technologies, accessing
3 leading-edge commercial technology and then combining it
4 with places where we do have an edge and where we can
5 protect the technology, at least for some period of time, if
6 we can learn to do that and move faster than anyone else
7 around the planet, I'm actually quite confident that we are
8 still going to be able to win in this competition.

9 Dr. Roper: Senator Nelson, I think it's an important
10 point that you raise, is that a lot of the technology edges
11 that we're going to develop are developing, and will be
12 moving to testing very soon, are surprises. They're things
13 that are intended to deal us back into the game. They're
14 intended to project power in different ways that we haven't
15 before. And there's going to be a very difficult calculus
16 that we're starting to begin as part of the third offset
17 effort, which is, Is it a surprise that we want to tuck
18 behind our locked doors and save to be able to win a war?
19 We have to be able to so that. That's our job, as the
20 Department. But, if we were to put every surprise that we
21 develop behind the door, we would be biasing our portfolio
22 towards a go-to-war posture, as opposed to a deterrent
23 posture.

24 So, one of the challenges we're going to have is, we're
25 back into a deterrent mode, as the Department. But, as

1 opposed to the Cold War, it's not a monopolar deterrent
2 posture. We've got to do it in a bipolar way. Must be able
3 to think about China and Russia while we continue to focus
4 on the Middle East, continue to focus on North Korea.

5 So, there's no easy math for deciding whether or not to
6 show a capability, or not. We've started putting some of
7 our capabilities public now from Strategic Capabilities
8 Office. We have had almost no public face for 3 and a half
9 years. As you were able to see yesterday, quite a lot of
10 our portfolio is behind the door, and deeply so. But, if we
11 put everything there, we'll be doing the country a
12 disservice, in the long run.

13 Senator Nelson: Thanks.

14 Thanks, Madam Chair. That's it.

15 Senator Fischer: Thank you.

16 Senator Tillis.

17 Senator Tillis: Thank you, Madam Chair.

18 Thank you all for being here. And I look forward to
19 future briefings in a classified setting. I appreciate the
20 work that you all have done.

21 I'm going to go to the more, maybe, boring side of the
22 equation, and it has to do with actually getting good ideas
23 fielded and in use. So, that gets to procurement,
24 acquisition, specification, partnering with the private
25 sector, where it's appropriate. Can you give me some idea

1 of where you all think we are and where we need to focus,
2 perhaps even as a matter of public policy changes to remove
3 constraints and try and compress idea-to-fielding timelines
4 over what we have today?

5 We'll start with the Secretary.

6 Mr. Welby: Senator, I -- we're emphasizing, in every
7 engagement, speed. In -- as we enter a more competitive
8 future, where we're all drawing off a globally accessible
9 technology base, we're going to need to close our
10 acquisition OODA loop, if you will, faster than our
11 adversaries. We have to turn quickly. We need to think
12 about time to market, like folks do in the commercial
13 sector. And we've been engaging our laboratories in a
14 discussion about how quickly we can move ideas from our tech
15 base to the field. There's no way to rush discovery. I
16 mean, science takes the time it takes. But, we ought to be
17 thinking, even as we're exploring new areas, about that
18 application and how we can prime the pump for that
19 application.

20 On the acquisition side, we've been challenging
21 ourselves to be able to move faster, especially at that
22 cutting edge of new technologies. We've been looking for
23 ways to be able to engage new partners in timelines that
24 might be measured in weeks, rather than months and often a
25 year, to contract. Especially since we're dealing with

1 fast-moving technology areas, people aren't willing to wait
2 for a year for the Department to get involved. It --
3 there's no return on that. They'd rather focus on
4 commercial-sector engagements.

5 And so, we've been exploring new means to much more
6 rapidly get -- bring folks on to contract, to use
7 competitive vehicles in commercial acquisition, and to think
8 about new ways to bring technology into platforms and
9 systems, leveraging modular architecture approaches, for or
10 persistent architecture approaches for example, be able to
11 plug-and-play technologies into our existing systems to
12 speed the upgrade cycle.

13 So, I think that, through the S&T initiatives, through
14 the formal acquisition initiatives, the Department's better
15 buying power, 3.0 activities, which have a large focus on
16 modularity and tech insertion, I think that we are trying to
17 move much faster as we go forward.

18 I think, in the future, we won't see 30-year
19 development programs in anything. And adversaries will have
20 countermeasures prepared for a decade before we field
21 something, if that's the case. And so, we need to up our
22 game, in terms of speed.

23 And I don't know if anybody else has anything you want
24 to add.

25 Dr. Prabhakar: I would just add, first of all, that,

1 in the work that we do at DARPA, of course, we live in the
2 science and technology part of the portfolio. And so, I
3 want to be very clear that our task in developing
4 technologies is not as onerous as procuring systems that our
5 warfighters, you know, need to be confident in and they can
6 trust under extreme circumstances.

7 Having said that, we've had the opportunity, over the
8 last many decades now at DARPA, to experiment with some
9 novel procurement mechanisms that your committee invented
10 and authorized over numbers of years. One example is other
11 transactions authority. That's an example of a capability
12 that we and others in the Department have. We've used it to
13 great effect, essentially to do business with companies on
14 commercial terms. It -- we comply with the law, but we are
15 able, under other transactions authority, to set aside the
16 Federal acquisition regulations along -- and part of that,
17 of course, means that we -- we're not forcing companies to
18 do government accounting systems and to have that burden.
19 So, especially for commercial companies, it's a particularly
20 good way to be able to move faster, and sometimes it just
21 enables them to be willing to do business with us in the
22 first place.

23 So, I think there are some practices like that, that I
24 think we've been able to pilot that we hope can be expanded.

25 Senator Tillis: Dr. Roper?

1 Dr. Roper: Senator, I think, you know, our piece
2 within SCO is really trying to complete the circle on the
3 acquisition process. So, we currently flow from an
4 operational need to a future system that we field. And, as
5 Secretary Welby pointed out, there are lots of efforts
6 underway to try to speed that cycle up. But, wherever we
7 can find ways to take things that have come out of that
8 pipeline and bring them back to the beginning, solve
9 additional operational needs, whether they're within that
10 service or outside of it, then we're producing lower-cost
11 options that will allow that service to build budgets, where
12 there's more innovation in them.

13 The biggest issue that service programmers bring up to
14 me is that they want to innovate. And I can attest, from
15 the programs we do with them, there is incredible innovation
16 potential in the services. It's resident in every
17 partnership we build with them. When they build a budget,
18 if their readiness, the fight-tonight capability, is put at
19 risk, the first thing that has to go is the innovation side
20 of it. So, wherever we can buy them flexibility and
21 breathing room to keep that innovation in play, we're doing
22 a good thing, not just for them, but for the country. So,
23 we've got to make stuff that our taxpayers have already
24 invested in do more and stay viable longer if we're going to
25 free up funds to go for the big-win technology leap-aheads.

1 Senator Tillis: Yeah. And I think your point about
2 turning defensive weapons into -- transforming them into
3 offensive capabilities, and vice versa, is very good. The
4 -- because I'm assuming that the time to field that
5 capability is far less than an all-new platform, and that's
6 why it's important that we squeeze everything we can.

7 In my remaining time -- you touched on something, Dr.
8 Roper, that I was going to ask. And I know that Secretary
9 Carter has announced a program engaging -- trying to expand
10 our engagement with Silicon Valley in partnering with some
11 of the major tech firms. But, in my experience -- I'm from
12 North Carolina, and down in and around Fort Bragg, there's a
13 lot of small businesses that come from people who have
14 battlefield experience. They're coming out, they're
15 perfecting things that have extraordinary potential, more
16 often than not because they had to put the first iteration
17 together with duct tape and Super Glue, they had to use
18 commercially available products.

19 To what extent does your area of focus focus on
20 sometimes -- you know, sometimes you need \$100 saddle
21 because you've got \$100 horse. But, sometimes you've got a
22 \$10-horse problem you want solve, which is what I've seen a
23 lot of these folks doing down here. And it seems like every
24 once in a while, DOD wants to put \$100 saddle even on a \$10
25 horse. So, how are we getting some of that applied small-

1 business feedback into the mix as a key part of the
2 innovation loop?

3 Mr. Welby: Maybe two quick responses.

4 First is that I'm frustrated that a lot of the
5 discussion around engaging the innovation ecosystem has used
6 Silicon Valley as the term of art, but, quite frankly, there
7 is remarkable work going on from Boston to Austin to Silicon
8 Valley, Research Triangle -- I've gotten right back to that
9 one --

10 [Laughter.]

11 Mr. Welby: But -- and I'll touch everybody in the room
12 -- but, look, it's -- and I think that there's really
13 interesting things going on in the small-business side. The
14 Direct to Phase II piece, for example, on our civil work, is
15 now -- we've now identified new mechanisms by which we can
16 reach out and touch small businesses, not just at the hey-
17 do-a-study-for-us scale, but the no-kidding-rapidly-moving-
18 to-a-prototype-so-we-can-try-it -- to get at those folks who
19 have near-immediate solutions and put them into test and
20 evaluation.

21 I -- as the Secretary has pointed out, the Department
22 needs to focus on porosity, our openness to ideas, wherever
23 they come. We need to take the blinders off and not just to
24 be -- look to the defense industrial base as the only
25 source. It's an important source, but it's not the only

1 source of ideas. And we're trying to reach out anywhere we
2 can.

3 Senator Fischer: Thank you, Senator Tillis.

4 Senator Heinrich.

5 Senator Heinrich: Secretary Welby, this committee,
6 last year, showed really strong bipartisan support for
7 directed energy weapon systems in the NDAA, and we asked
8 that the Department look at that as part of the third offset
9 approach. How much of the 100 million provided by Congress
10 last year within this effort has gone towards directed
11 energy?

12 Mr. Welby: Thank you, Senator. We have not -- the
13 language in the report last year for the offset technology
14 initiative requested that we go out and survey the services,
15 looking for competitive ideas, survey the COCOMs, looking
16 for ideas. We have completed that. I have -- we have a
17 stack of proposals that we're going through now, and we're
18 allocating resources against them, expect to be able to
19 provide the details of what we fund from that list here in
20 the next week or two. I am certain that, in that stack of
21 proposals, there will be directed energy. They are at --
22 they are near the top of the list of things we want to do.
23 I'm expecting that, of the list of things, order of 20
24 percent would be focused on directed energy. But, we're
25 still trying to finalize both the list and ensuring we've

1 got the right budgets for those projects. We want to make
2 sure that the things we do fund with that activity are
3 robust and are not underfunded.

4 Senator Heinrich: I agree wholeheartedly with that
5 approach. And just to sort of follow up on that, I'm
6 curious about -- it seems to me that this technology --
7 directed energy, in particular -- could be one of those
8 places where we really do provide an offset. It's --
9 doesn't have a peer-relatable equivalent in other military
10 spaces. And I actually introduced legislation this morning
11 with Senator Inhofe to look at granting rapid acquisition
12 authorities for directed-energy weapon systems. And I'm
13 curious -- and this could be for any of you, actually -- in
14 your opinions, is this an area where the Department is
15 moving fast enough to transition the technology, or are we
16 sort of stuck in an endless R&D loop, where it's always
17 easier to chase the perfect instead of field what is quite
18 applicable today?

19 Mr. Welby: Senator, I participated in the Directed
20 Energy Professional Society Symposium at the Pentagon today.
21 We have over --

22 Senator Heinrich: Good timing.

23 Mr. Welby: -- we have 20 folks sitting in the
24 courtyard of the Pentagon today, demonstrating next-
25 generation laser capabilities and high-power microwave

1 capabilities. As you know, I've spent a good portion of my
2 career working in this space. And I remain convinced that
3 we are now at the point where we're moving out of the labs
4 and into application space with those kind of systems. I
5 saw some remarkable technology on display today. And we're
6 encouraging folks to think about how we can accelerate those
7 into real applications.

8 So, I think that directed energy has suffered from
9 being -- from always being just 25 years off. I think we're
10 now not 25 years off. I think there are real applications
11 in the near term, and opportunities to grow those
12 applications in the mid-term. And so, I'm excited about the
13 space.

14 Senator Heinrich: I appreciate you mentioning
15 microwaves to somebody who used to work at Air Force
16 Research Labs on microwaves as well as lasers. Sometimes we
17 forget that application. And when you look at things like
18 CHAMP and other applications, it is substantial.

19 For, really, any of you, one of the things I'm
20 concerned about -- with the possible exception of DARPA,
21 actually -- I think there's been a real risk averseness,
22 generally, within the R&D approach of the Department of
23 Defense, at times. And I -- you know, in looking at our
24 nuclear labs, one of the things that has worked there to get
25 around an obvious -- you know, it's easy to be risk-inverse

1 in this environment. You've seen huge advances, for
2 example, on -- in energy, with things like solar technology,
3 prices plummeting, but one Solyndra can become a political
4 issue. And it's easy to accept that same sort of mindset
5 within defense research.

6 LDRD, laboratory-directed research and development, has
7 been one of the places where, within the nuclear labs, it
8 really has seemed to be a high-risk but high-reward endeavor
9 that is incredibly valuable, for one, in attracting the
10 right talent into the pool in the first place.

11 So, I'm curious how the Department views that balance
12 between risk and reward, and what steps are needed to ensure
13 that researchers have the leeway and the flexibility to
14 pursue something that is truly innovative.

15 Mr. Welby: Senator, across the laboratory complex, we
16 have to recognize that there's a number of constituents we
17 try to service.

18 Senator Heinrich: Sure.

19 Mr. Welby: There are near-term transitions into
20 programs of record. There are those medium-term
21 capabilities that seek to be able to demonstrate capability
22 to drive the next program of record. And then there are
23 activities that are further to the left that are really
24 trying to be disruptive. And we have been focusing the
25 laboratories, over the last year, on trying to be explicit

1 about how we manage those three portfolios, how we think
2 about those things that are near-term and in service of
3 programs of record, how we think about those things that are
4 shaping, kind of, the next program, and those things that
5 are much more foundational.

6 Just a couple of examples of things that we're doing.
7 We -- in -- across laboratories, we've now created resources
8 available to the laboratories out of the OSD-level budgets,
9 where we've asked the laboratories to compete -- to compete
10 on ideas for who has the greatest game-changer. And we've
11 offered to amplify service budgets in areas where we can see
12 that real impact. Internal competitions, right? But, to
13 get teams challenged and thinking about competing with each
14 other, kind of, across laboratory complexes.

15 The trick is, of course, at the end, we tend to team
16 those folks together to get all the best and brightest of
17 the ideas across, because we're really in one game, but it's
18 encouraged folks to think differently.

19 And, within the services, as well, each of the services
20 has been trying to drive more innovation through their own
21 long-term S&T pools. And I'm very excited about how that's
22 taking place.

23 Senator Heinrich: Doctor?

24 Dr. Prabhakar: Maybe just to tag onto that. DARPA's
25 very much in the high-risk, high-payoff business.

1 Senator Heinrich: Sure.

2 Dr. Prabhakar: And I never take for granted the room
3 that we get to do that, starting with our bosses, starting
4 with Steve, but all the way up to the Secretary, and
5 definitely from Congress. And that -- you know, I think --
6 I feel very privileged to lead an organization that has
7 delivered on that mission for long enough that you all give
8 us rope. All we have to do is come up with the next
9 revolutionary capability.

10 But, within the agency, as well, I don't take for
11 granted how we nurture that. And Steve's exactly right
12 that, you know, you do need to manage a high-risk
13 organization in a very different way.

14 Senator Heinrich: Right.

15 Dr. Prabhakar: But, continually nurturing that
16 culture, making sure that our business processes reflect the
17 mission and that culture, it's everything from the
18 conversations I have with my program managers when I walk by
19 their offices to the way that they work to get their
20 programs approved. So, I think it's something that needs
21 concerted focus, but --

22 Senator Heinrich: Yeah.

23 Dr. Prabhakar: -- I think we know how to do it, and I
24 think it's a -- it is an essential ingredient in the mix.

25 Senator Heinrich: Great.

1 Senator Fischer: Thank you, Senator Heinrich.

2 Senator Manchin.

3 Senator Manchin: Thank you, Madam Chairman.

4 And thank you all.

5 I'd like to ask -- I think this is to Mr. Welby, if I
6 may, Secretary. Secretary Carter recently announced a major
7 initiative for outreach to high-tech companies in Silicon
8 Valley, as you know. DOD has -- also has a small business
9 innovation research program that taps into technology
10 innovations from all around the country. The SBIR program
11 helps small business compete to bring value-added products
12 and services to our military. This program is extremely
13 helpful for the economy of West Virginia, because we have a
14 corridor which really participates in that. So, I'd like to
15 ask, How are we coordinating efforts of engaging these small
16 companies to work with DOE? And my reason for saying that,
17 some of them get into the procurement process, they have to
18 tag along with a large major in order to get any pittance of
19 a little bit of work and become subservient to that. Is
20 there any method of getting them directly into the flow, if
21 you will?

22 Mr. Welby: Senator, I also highly value the small
23 business innovative research activities. I think that my
24 experience working with companies in the small business
25 innovative research area has allowed them to grow rapidly

1 and actually contribute in important ways to major --

2 Senator Manchin: Right.

3 Mr. Welby: -- defense acquisition programs.

4 I mentioned earlier the Direct to Phase II activities,
5 which all us to make initial grants to companies at a much
6 larger scale than simply, "Here's 100K to kind of -- to go
7 develop a proposal," the very early study grants that SBIR
8 has typically worked through to cut a year off the time to
9 get people up to scale and to be really playing with real --
10 at real working levels, up to a million dollars for an
11 initial grant, which is a lot for a small company, initial
12 space.

13 The -- one thing I should -- I want to point out about
14 the kind of engagements we have with this Defense Innovation
15 Unit Experimental, for example, is, again, it's not
16 geographically tied. We want them to be engaged over a
17 broader portion of the country. And we've not given them
18 acquisition authority. That organization is really intended
19 to help shepherd small companies through the process, make
20 introductions to help them understand the process, to, if
21 you will, act as a shepherd to kind of help them work their
22 way through the system. We're experimenting with that idea
23 that getting small companies, getting the kind of core
24 innovation drivers that we see in small business through our
25 system is a contact sport and requires significant help,

1 folks who speak their language, who understand the
2 innovation ecosystem, understand companies' commercial
3 ambitions, as well, and can still talk DOD to them. And so,
4 we're trying to understand how that works. That's the
5 experimental portion of DIUX. It really is an experiment to
6 see how we can gauge better.

7 But, we are trying to find new opportunities to
8 introduce small-business work throughout our enterprise.
9 We're continuously reinforcing our small-business
10 participation objectives in all of our programs.

11 Senator Manchin: You all go out and solicit this? I
12 mean, go talk to some of the areas, where they're -- not
13 just Silicon Valley, but, I mean, other --

14 Mr. Welby: I do. And our team does. And we are
15 thinking hard about --

16 Senator Manchin: Can we get you down to West Virginia?
17 Can I get you down?

18 Mr. Welby: Sir, I'd love the opportunity to come
19 visit. And I'd --

20 Senator Manchin: Hey, Rick, sign him up.

21 [Laughter.]

22 Senator Manchin: We'll get you down there. It's not
23 that far away.

24 To Dr. Prabhakar, one of the joys of being a Senator is
25 being able to nominate some of the best and brightest to our

1 military academies. It's really, really something special,
2 when you see these young, bright people coming from all over
3 the country and getting this opportunity. So, I would ask
4 -- DARPA regularly engages with civilian universities, which
5 we're very appreciative of that, too, for the advanced
6 research efforts. So, how -- what's the percentage of how
7 you all engage with our military academies versus the
8 private? Because we know it's going to be used -- and I'm
9 understanding that, basically, they do a senior project, all
10 the military academies, to participate in cutting-edge
11 defense research. These are people not only that are
12 participating, but going to be fulfilling them. So, do you
13 put more of an emphasis on academies than you do private?

14 Dr. Prabhakar: Senator, our starting point with
15 everything that we do at DARPA is to go out and find the
16 technical talents that are going to have the ideas and the
17 ability to go execute on them. And through that, we work
18 with universities of all sorts, but also, of course, a lot
19 with companies of all --

20 Senator Manchin: You all pay --

21 Dr. Prabhakar: -- sizes.

22 Senator Manchin: You pay, right?

23 Dr. Prabhakar: Our -- we fund those projects and those
24 companies. We're actually only --

25 Senator Manchin: But, you're already funding -- we

1 already fund the military academies. We already paid once.

2 Dr. Prabhakar: And I -- I think it's a great question
3 you've raised, because I think about the people who are
4 attending those military academies --

5 Senator Manchin: Yeah.

6 Dr. Prabhakar: -- frequently. They are going to be
7 the warfighters who use the --

8 Senator Manchin: That's exactly right.

9 Dr. Prabhakar: -- technologies that we are brewing.
10 And so, we reach out to them in a variety of ways. In
11 recent years, as an example, we conducted a competition
12 among the academies in the cyber arena. That's one, in
13 particular, where the -- you know, there's a lot of
14 interest, but also a great need to continue to educate
15 warfighters that are going to be adept in the cyber
16 environment. So --

17 Senator Manchin: Could I --

18 Dr. Prabhakar: -- they are very much part of our
19 community.

20 Senator Manchin: Would it be possible to get a report,
21 basically, on the amount of money that you all do put out in
22 doing these -- engaging in these research --

23 Dr. Prabhakar: Yeah, I'd be happy to look into that.

24 Senator Manchin: -- versus --

25 Dr. Prabhakar: Just to set your --

1 Senator Manchin: -- versus the academies.

2 Dr. Prabhakar: I just -- I'd be happy to get you that
3 data.

4 Just to set your expectation, the amount of research
5 that's done of the sort that we typically fund at the
6 academies is fairly limited, because their focus, of course,
7 is educating these young folks who are going to become our
8 future warfighters. So, I would be happy to get you that
9 data.

10 [The information referred to follows:]

11 [SUBCOMMITTEE INSERT]

12

13

14

15

16

17

18

19

20

21

22

23

24

25

1 Senator Manchin: But, what you're going --

2 Dr. Prabhakar: But, that's now where the research --

3 Senator Manchin: -- you're going to --

4 Dr. Prabhakar: -- is typically done.

5 Senator Manchin: So, you're telling me right now, you

6 don't put much in the academies.

7 Dr. Prabhakar: I don't think you'll find a significant

8 amount of money flowing there. But, again --

9 Senator Manchin: Let me ask you this --

10 Dr. Prabhakar: -- their role is different --

11 Senator Manchin: Cadets and --

12 Dr. Prabhakar: -- from what we do.

13 Senator Manchin: -- midshipmen start their senior

14 project, they have -- they have to have a senior project.

15 Dr. Prabhakar: Yup.

16 Senator Manchin: Okay? Do they know there is a

17 pathway that they could take something of high cutting-edge,

18 such as what you all are looking for? I mean, to me, I --

19 maybe I'm wrong, I don't know. I just believe that we've

20 got some outstanding -- you know, I'm not saying

21 universities -- I mean, we have research, WV and all of

22 them.

23 Dr. Prabhakar: Yup.

24 Senator Manchin: But, I'm saying, we already own this.

25 We -- this belongs to us. And those are 4- to 5-year

1 employments afterwards, so we know they're going to be the
2 ones who are going to be implementing everything we're
3 doing.

4 Dr. Prabhakar: Yes, I agree that they are an important
5 part. But, again, DARPA'S role --

6 Senator Manchin: I know.

7 Dr. Prabhakar: -- is about research; it's not really
8 the education of that part of -- you know, that critical
9 part of our workforce.

10 Senator Manchin: I gotcha.

11 That's -- no further questions,

12 Senator Fischer: Thank you, Senator Manchin.

13 I think it's safe to say that the goal of this
14 initiative is to preserve and enhance our technology-based
15 military superiority. And that's part of the meaning of the
16 term "offset." We're not going to be fighting our
17 adversaries tank-to-tank anymore. And so, technology does
18 provide us that advantage and the offset to -- with
19 capabilities for others.

20 Dr. Roper, you know, I'm concerned that we become so
21 reliant upon technology that that reliance can be exploited,
22 and it can be exploited very cheaply, in some instances.
23 And I think space is a good example for us to look at in
24 that regard. Our adversaries can jeopardize our
25 constellation for a lot less money than developing new

1 technology for us to build here and take advantage of that.
2 So, how do you ensure that the greater incorporation of
3 technology doesn't turn into a dependence? And how do you
4 ensure that we don't allow our adversaries this opportunity
5 to be able to undermine what we're trying to do in a really
6 -- basically, a cheap way?

7 And, Dr. Prabhakar, I'd like to ask you that, as well.

8 Dr. Roper: Thank you, Senator. It's a great question.
9 And so, I'll address the space component of it, but I'd like
10 to then broaden to the bigger question --

11 Senator Fischer: Yes.

12 Dr. Roper: -- of, you know, where is -- where does
13 technology end and other advantages begin?

14 So, I think, as indicated by a lot of the discussion
15 this morning, we're moving into a regime where relative
16 technology advantage is going to be lowering amongst the
17 great powers in the world. So, the U.S., China, Russia --

18 Senator Fischer: Our adversaries are catching up to
19 us.

20 Dr. Roper: Catching up. And we're also living in a
21 world where technology is speeding up, so the impact of
22 commercially available technologies is going to be large.
23 It's also going to be available to everyone. And so, this
24 is going to force the Department, as well as our adversaries
25 and competitors -- it's going to force us to become fast

1 adapters. So, when we look at areas where the environment's
2 going to be contested -- and space is one of those --
3 there's obviously the disadvantage of not having the legacy
4 way that we've projected power be something that can be
5 continued into the future, but we'll be moving into a future
6 where there is hope for us. It's very likely that we'll
7 start having distributed space architectures and future
8 where maybe individual satellites are contestable, but the
9 architecture, as a whole, isn't. That'll force us to start
10 using statistics as a metric, where you're not -- you can't
11 calculate the reliability of a single thing, but you're
12 doing it in aggregate. That's something very common for
13 many industries. The cellular companies that sell to us are
14 used to having a statistical approach to their availability,
15 as opposed to a singular one.

16 What I think this means is that warfighting is going to
17 be messy. We're not going to be able to go in and have very
18 simple mathematics and physics help us calculate the margin
19 of battle. Things are going to be constantly changing.
20 Satellites that are available won't be. Networks that are
21 available won't be. And if we're wise, we'll have
22 architectures in place where we hop between different assets
23 that are available.

24 I think that's where we actually get off the stage with
25 our biggest advantage. That's a messy environment. Not

1 every country is going to be able to get their operators
2 ready to deal with it. So, the greatest advantage we have,
3 and the reason I think we'll pull this offset off, is that
4 we're coming out of 20 years of operational experience that
5 no one in the world can match. And so, we're saying to the
6 world, we're going to change, we're going to go into this
7 messy environment with our eyes open, and we're going to
8 dominate in it. And that's based on giving operators, one,
9 the technology to be able to adapt in that environment, but
10 trusting them to be able to use it and master it.

11 So, I think the biggest ill that we could do, as a
12 Department, is to have all the shiny bells and whistles in
13 the technology world, which are important, override what's
14 underwriting it, which is our human operator foundation.

15 Senator Fischer: Thank you.

16 Dr. Prabhakar.

17 Dr. Prabhakar: Yeah, I think Will's completely correct
18 with what his -- especially his concluding point. I often
19 think about how reliant, even in our civilian lives, we've
20 all become on GPS, where I only will just follow that blue
21 dot or listen to those instructions. And, of course, that's
22 a great example of needing to remember that technology is a
23 very powerful tool, but it doesn't allow you to suspend
24 judgment. And we're seeing some examples where that's
25 really gone wrong.

1 Technology is, of course, only going to be one
2 component in the solutions that we're talking about here. We
3 very much see part of our job, of course, driving the
4 technology, but also thinking in terms of, How do we make it
5 secure and reliable? Cybersecurity is a very big part of
6 that. And, of course, we have a significant portfolio that
7 focuses on that.

8 But, at the end of the day, it really is about how
9 humans use the technology. And I think, as we have moved
10 from more of a gadget focus to, "How do you think about
11 winning the war?" it has really driven our thinking to
12 rarely think about the whole system of how humans and
13 machines are going to interact together. And that's a much
14 harder problem and a much richer problem, but I think it's
15 going to be important to getting to solutions that really do
16 work.

17 Senator Fischer: And, Mr. Welby, I've seen a factsheet
18 that was put out by the Department, and it discusses those
19 investments that I believe the Doctor was just talking
20 about, with the human and the machine collaboration that's
21 going on. It states all of these components will be
22 connected to a cyber-hardened human-machine command-and-
23 control network. You know, we're not really good at keeping
24 adversaries out of our networks. Let me rephrase that. We
25 are good at it, at keeping them out, but they still get in.

1 So, how are we going to have confidence that we have the
2 ability to build this cyber-hardened network? And do you
3 think that the network should come before we think about the
4 pieces that rely upon it? Should we make sure we have the
5 security there before we get the bells and the whistles that
6 depend upon it?

7 Mr. Welby: Senator, I believe that there's a real
8 opportunity here to codesign these capabilities in ways we
9 have not in the past. One of the really interesting things
10 that's going on is this notion of autonomous systems,
11 systems that I can give direction to, and that I can have
12 confidence that they're going to have certain behavior and
13 then check back in with me at some future point. And that
14 offers a way to think about how systems can actually operate
15 on -- even on unreliable networks. By reducing the
16 bandwidth required to, for example, tell the operate system;
17 by having the ability to have systems interact with humans
18 by exception, just as I would with -- send a soldier up a
19 hill, call me if you see something that you need assistance
20 with -- I can start to think about machines that might be
21 able to do that.

22 We -- we're talking about manned-unmanned teaming and
23 trying to understand how that works, what kind of bandwidth
24 is required, where and when systems need to interact. I
25 think it's very important in scoping the networks required

1 to support those.

2 We did some recent studies, where we looked at just how
3 little bandwidth was required to ensure control over -- in a
4 simulated environment or some notional unmanned-manned
5 system concepts. And we were very enthusiastic about the
6 ability to shrink that amount of bandwidth required in very
7 interesting ways. It -- the smaller the pipe, the easier it
8 is to protect. And so, we're thinking about very novel
9 ideas in that space.

10 Senator Fischer: There's a discussion going on in the
11 Commerce Committee about spectrum, since you're talking
12 about bandwidth. You said you're shrinking bandwidth that's
13 necessary for the Department of Defense. Would you say you
14 don't need all that you have? Put you on the spot here.

15 Mr. Welby: Today, I think we need all we have, and
16 more.

17 Senator Fischer: You need it all.

18 Mr. Welby: We need it all. And particularly for radar
19 is really one of the critical things. Our large-bandwidth
20 sensors are really a challenge. Spectrum auction has caused
21 the Department to have to shift in very complex ways, and
22 we're continuing to work through that. Comma, with my
23 technology hat on, I am very excited about agile spectral
24 use in the future and ways we can start to think about the
25 technologies that will help shift, not just the military

1 sector, but maybe in -- on someday, the commercial sector to
2 be much more efficient users of spectrum. And I am
3 enormously excited about the initiatives that DARPA has
4 started here in the last 2 weeks to set up prizes associated
5 with very novel use of the spectrum, an arena to challenge
6 folks to come in with entirely new concepts for agile radio
7 development, and to think about new ways that we can
8 architect our commercial and military systems to be really
9 efficient users locally, regionally, and globally to make
10 the most use of the spectrum we have. The demand for
11 spectrum is only going in one direction. Wide bandwidth
12 applications on the commercial side, wide width applications
13 on the military side are going to grow. But, in the fight,
14 which is what we were talking about a moment ago, we're
15 going to want to be able to -- if we lose that spectrum, to
16 still be able to fight through. And we think there's very
17 interesting ways we can do that.

18 And if, Arati, you want to say a word about the
19 spectrum challenge.

20 Dr. Prabhakar: You can tell Steve is a DARPA alum,
21 because he summarized our new DARPA program perfectly.

22 Senator Fischer: I was going to say, because we have
23 such a truly limited amount -- a finite amount of spectrum
24 that's out there, and to find a more efficient way to use it
25 would be beneficial, Of course, for our national security,

1 but also for our businesses that are out there, as well.

2 Thank you.

3 Senator Kaine.

4 Senator Kaine: Thank you, Madam Chair.

5 And I apologize for being late. Was at another
6 subcommittee hearing, so I may ask questions that you've
7 already covered. But, it's good to be with you, and thank
8 you for your service.

9 I'm interested in the interface between the DOD
10 requirements and commercial requirements in a very -- you
11 know, complex commercial environments. Generally, the
12 security requirements of the DOD exceed the commercial
13 space, or will -- or, in many ways, is the commercial sector
14 market develop the industry and some of the security ahead
15 of the DOD mean?

16 Dr. Prabhakar: I'll take a stab at that. You know, if
17 you peel apart what DOD needs, in terms of information
18 security, cyber security in particular, we need everything
19 that the commercial sector needs, because we use commercial
20 networks and computers and systems for all of our
21 operations, and we have cybersecurity needs for our very
22 sophisticated electronics and computing that's embedded in
23 every -- you know, every missile, every aircraft, every
24 ship, et cetera. And so, I -- across DOD, I think we have
25 the challenge of adopting, as quickly as we can, the leading

1 edge of commercial cybertechnologies, and we continue to
2 press -- you know, the Department continues to press forward
3 on that. Conversely, in some areas where we are able to
4 drive cybersecurity research because of DOD's embedded
5 computing needs, I think there are places where -- and, for
6 example, in some of the DARPA programs, we have focused on
7 this question of, Can you build a cyber retrofit, for
8 example --

9 Senator Kaine: Yeah.

10 Dr. Prabhakar: -- for a system that goes on an
11 unmanned aircraft? And we've just had some very good
12 research success in that area. That's an example of
13 research that I think at this point is leading-edge around
14 the world. Eventually, I think it will become an important
15 part of a better foundation of cybersecurity for DOD
16 systems. But, it's the same technology that will also
17 provide a secure way for the Internet of Things to grow.
18 And, you know, the Internet of Things is either going to be
19 awesome, if we can figure out security, or it's going to be
20 a nightmare. And I think -- you know, I think that's an
21 example of a technology area driven for DOD that we can also
22 actually contribute to the broader set of --

23 Senator Kaine: Sort of -- it's a good segue to the
24 follow up question I wanted to ask. So, if some of the
25 particular requirements we have in the DOD space will really

1 be driven by our own research, then we obviously need to be
2 robust in funding research. But, to the extent that some of
3 it is going to be commercial capacity that we purchased,
4 then that says something about acquisition and the
5 acquisition workforce. As I deal with folks in the, kind
6 of, private sector, they are quite concerned about, Is the
7 acquisition workforce up to the job? They actually really
8 kind of sympathize with an acquisition workforce. They feel
9 like the DOD, and maybe the Federal, generally, acquisition
10 workforce got hammered pretty hard by furloughs, sequesters,
11 layoffs, and that that may have hurt the acquisition
12 workforce expertise pretty significantly. And so, if we're
13 talking about really cutting-edge, you know, technology to
14 help us with this third offset strategy, and some of it
15 we're going to be acquiring, that's going to put a lot on
16 the shoulders of the acquisition workforce to make wise
17 decisions. Do we have -- you know, DOD-wide, do we have the
18 workforce we need to make the sophisticated acquisition
19 decisions as we purchase these technologies?

20 Mr. Welby: Senator, across the -- enterprise, working
21 for Under Secretary Kendall, we review, kind of, our
22 workforce metrics continuously. We have a senior steering
23 group that meets monthly, and we review it at the senior
24 level quarterly, to ensure that we have -- that we are --
25 understand what's happening to the health of that workforce

1 -- hiring, retention, departures, the overall shape of the
2 workforce. But, increasingly, the thing that concerns me is
3 not numbers, but talent. And specific talent in areas like
4 cybersecurity in areas like robotics --

5 Senator Kaine: Where competition is pretty tough --

6 Mr. Welby: Where --

7 Senator King: -- so other opportunities are out there.

8 Mr. Welby: I note that last week Google announced --
9 and I believe the number was 20-percent raise across the
10 board for everybody at Google who had "cyber" in their
11 title. Not that they were being recruited, but just as a
12 preemptive retention bonus. You know, our folks haven't
13 seen, kind of, a 20-percent number, you know, ever, right?
14 And I don't think folks fully appreciate that, in some of
15 the areas that were focused on -- artificial intelligence,
16 the cutting-edge computer-science work in cyber, in
17 synthetic biology, in a number of other areas -- we are
18 getting great people because they love our mission, they
19 love our capability. But, really, they're often giving up,
20 kind of, integer multiples on compensation. And certainly
21 over the course of their career, it becomes harder and
22 harder, as folks try to get families, to think through how
23 they can make that work.

24 I'm very appreciative for the great people who are
25 working for us every day, but I worry about our ability to

1 compete for talent in the future. And it suggests we may
2 have to think about other models for how we can recruit,
3 retain, or engage those folks. If the government can't have
4 them internal to our organization, how do we engage them
5 outside? How do we ensure that we've got the right set of
6 knowledge on our side of the table on the acquisition
7 process? How do we have the right set of folks in our lab,
8 thinking about the future for us? I think we're going to be
9 in competition, not only for national security, but in the
10 competition for talent, as our -- as the commercial
11 opportunities grow, as our Nation's vibrant innovation
12 sector on the commercial side competes with the Department
13 of Defense for talent. We're now mining the same spaces,
14 and we're going to have to be creative as we go forward.

15 Senator Kaine: Let me ask a question. It kind of goes
16 in a different direction on the third offset strategy. So
17 -- and it's really doctrinal or conceptual. Earlier defense
18 strategies -- it's been easier for me to conceptualize how
19 we integrate our allies into our strategies, you know,
20 dealing with the Truman doctrine of the Cold War or even
21 some of what we're doing right now, vis-a-vis engagements in
22 Iraq and Syria. As we think about a third offset strategy
23 that's heavily focused on novel technologies that are
24 unique, swarm capacities, et cetera, how do we conceive of
25 alliances and sharing of information? Or is the sharing of

1 information, by definition, going to jeopardize your edge in
2 a way that we can't do it? I mean, and that's a pretty
3 broad question, but I've been wondering how we think about
4 alliances and partners in connection with a third offset
5 strategy.

6 Mr. Welby: Just very quickly, for the sake of time.
7 Allies and partners are going to be enormously important in
8 almost everything we do. As we think about how we go to
9 war, we always go with partners. And we do not see that
10 changing in the future. Much of what we're doing is
11 thinking about how we have the right kind of discussions so
12 that they can contribute and help shape that future. And
13 today we're also looking at our allies and partners as
14 partners, no kidding, in terms of the technology development
15 itself, and how we start to begin to engage early on in
16 capturing their benefit, as well.

17 I want to give Will a second to this -- on this.

18 Dr. Roper: I'll be very brief. It's very important,
19 in the near-term response in the offset, to realize that we
20 have two advantages that go back to more of the human side
21 of the equation. One, we've been a preferred partner in the
22 world. And a lot of our allies and partners use the same
23 equipment that we currently train with. We train with them
24 on a routine yearly basis. It's a huge part of our
25 readiness posture. So, as we start reimagining how we use

1 our systems, there's a great potential to bring in allies
2 and partners, and have that cross-pollinate so that
3 adversaries aren't just facing a U.S. -- a, you know, U.S.
4 adversary, but they're facing a whole coalition approach.

5 Two is what you mentioned before. There's going to be
6 commercial technology that's going to be cut into the mix
7 alongside traditional military technology. Because it's
8 commercially-based, it would be much more readily available
9 to work on with allies and partners if we don't let
10 exquisite requirements start pushing up what we try to get
11 out of it, from a military capability. Cost is going to be
12 a very important metric in the offset. It's not just red
13 cost, it's going to be blue cost, as well. What are we
14 spending, what are they spending? And then what do we think
15 the refresh rate of that technology will be? So, if we're
16 wise, we will try to find capabilities in the commercial
17 world where we're getting good bang for the buck, and keep
18 an eye, Is it something we can share with allies and
19 partners? If we can, then our coalitions that we build up
20 play for us and not against us.

21 Senator Tillis: Thank you, Madam Chair.

22 Dr. Prabhakar, I just -- I was going to comment, if
23 Senator Manchin had been here. I think probably the biggest
24 distinction that you're dealing with between, say, the
25 service academies and some of the other institutions is the

1 nature of their research and investments that are being made
2 by the Federal Government in the private sector. They
3 create a different group of people that I assume you're
4 collaborating with. So, I think I understand why there
5 would be, necessarily, a different focus and different
6 relationship with the service academies.

7 Dr. Prabhakar: Just a comment on that. If you look at
8 all academic institutions broadly, of course there are many
9 that focus on teaching and some that focus on research. And
10 our natural partners for the research funding that we --
11 especially the basic research work that we're doing, tend to
12 be those research universities rather than --

13 Senator Tillis: Yeah.

14 Dr. Prabhakar: -- those focused on --

15 Senator Tillis: Yeah.

16 Dr. Prabhakar: -- education, which is more where the
17 academies have been. And that doesn't preclude -- there
18 are, in fact, some very good things that we've done there.
19 I just didn't want to leave the impression that that was a
20 major focus --

21 Senator Tillis: Yeah.

22 Dr. Prabhakar: -- for us.

23 Senator Tillis: Yeah. And I under -- so, I just --
24 and I think -- I understood it; I just wanted to make that
25 point.

1 And, Dr. Roper, and really for anyone on the panel, the
2 -- and it -- when the Chair talked about "We're not really
3 fighting tank-to-tank anymore," that's completely true. You
4 know, our Air Force, our air capabilities will need to
5 continue to evolve. And I think we can build and iterate on
6 our offensive and defensive capabilities. And probably the
7 same is true for the Navy. But, for the people on the
8 ground, like the folks I have at Fort Bragg and Camp
9 Lejeune, they're being deployed in very different ways. And
10 I think Dr. Welby talked a little bit about the way that we
11 will equip them, the way that they and the equipment and
12 materials they're using could be semi-autonomous, tethered
13 or loosely tethered, or untethered. I kind of understand
14 how that would operate. But, at the end of the day, it's
15 because we're going to have a dispersed group of smaller
16 units on the field. So, the question then becomes, the --
17 some of -- many of your innovations are likely not to be
18 these big, shiny ships and new missile systems that are
19 going to be deployed on the battlefield, but they're going
20 to be things that are very much connected to the humans and
21 in the environments that we find ourselves fighting now.
22 So, could you talk a little bit about that, and also talk
23 about the research that you're doing that has less to do
24 with offensive and defensive capabilities, but just pure-
25 play force protection for the operators on the field?

1 Dr. Roper: Sure. Thanks, Senator Tillis.

2 It's -- there's going to be some, I think, amazing
3 things that we'll be able to do with ground forces, given
4 the commercial technology revolution that's going around us.
5 So, interpersonalwise, we're all carrying around fairly
6 sophisticated high-processing, low-weight electronics that
7 are massively networked and are completely enabled by cloud-
8 based services. The military analog of this is obvious. If
9 we can smartly find a way to transition this over and be
10 able to do secure processing, and not have cyber
11 vulnerabilities be a bigger headache than they are, the
12 enabling capability from the technology themselves. We are
13 working very closely this year with the Army and with SOCOM,
14 some of the folks in your neck of the woods at Fort Bragg,
15 on trying to find the balance between using commercial
16 technology on the battlefield. I think there's a lot of
17 promise there. One example that I'd like to highlight is
18 work that we're doing with the Marine Corps on big data and
19 analytics. So, you can imagine that all of these
20 distributed systems that are going to be spread out over the
21 battlefield are going to be producing data. That data is
22 going to be pooled in a disaggregated way, but eventually
23 pooled centrally. Understanding it, being able to give
24 commanders that leading edge of decision authority is going
25 to be important.

1 So, the Marine Corps right now is doing experiments
2 with us currently, today, in the Philippines at the
3 Balikatan Exercise, pulling in lots of information that
4 supports that exercise, and synthesizing it using
5 commercially-based big-data tools, something very new for
6 us, and it's new for them. But, taking advantage, as
7 Secretary Welby mentioned, of experimentation and
8 prototyping, especially when the core of the systems we're
9 using are commercially based, is going to be a very prudent
10 way for us to get out and get the human side of the
11 technology alongside, you know, the technology side. So, I
12 see a lot of promise, but we're going to have to move into
13 more of a rapid test-it, modify-it, retest-it in order to
14 stay on top.

15 Mr. Welby: Quickly. We often focus on those flashy
16 pieces. We talk about tanks and missiles and aircraft.
17 But, just last week, the Secretary announced the new
18 Manufacturing Innovation Institute for Revolutionary Fibers
19 and Textiles, a major initiative that's -- crosses five
20 State initiatives, that incorporates work going on around
21 the country, thinking about fibers in a fundamentally
22 different way. As an Active component in fabrics that might
23 have woven-in electronics, might be able to serve, not just
24 as protective gear, but as part of an ensemble -- an active
25 part of an ensemble to support warfighters, a kit, and with

1 enormous applications to first responders and to medicare
2 care and to an enormous number -- another set of
3 capabilities. We're not just thinking about how, you know,
4 robots and new weapons kind of enable this future, but also
5 thinking about how we make the individual warfighter more
6 effective. And I think there's a lot happening in that
7 space, be it augmented reality kind of capabilities, be it
8 soldier-borne compute, be it novel textiles and rethinking
9 what a uniform means, thinking about how folks can be more
10 effective, distributed for survivability, and then massing
11 for effect, even if they don't actually come together, but
12 to be able to mass their effects. These are real
13 opportunities to rethink the future of land combat. We're
14 encouraging the Army and Marine Corps to help us think
15 through that future in new ways.

16 Senator Tillis: Thank you.

17 Dr. Prabhakar: May I just tag onto these excellent
18 comments?

19 The nature of ground conflict, of course, continues to
20 change. And if you look at what's happening today and into
21 the future, that environment is one in which we see -- if
22 you watch the Russians, if you watch what's happening on the
23 ground with ISIL, you see this mix of kinetic effects, but,
24 of course, also cyber effects. You see the use of the
25 information domain. And that used to mean dropping

1 pamphlets or saying things on the radio. Of course, now
2 it's social media. You see a different kind of use of the
3 electromagnetic spectrum and jamming that we've not seen
4 before. And the integrated ability to bring all of that to
5 bear is what our ground troops now will need to be able to
6 deal with. And so, a lot of our work is really thinking
7 about how -- for example, how do you enable a squad to not
8 only survive in that environment, but actually exercise
9 greater influence and have a larger footprint than it does
10 today by leaping ahead of the kinds of things that are
11 coming at us?

12 Dr. Roper: One last point, Senator. That goes back to
13 where we've -- what we've touched on several times. The
14 military that will be able to push the most amount of trust
15 to the edge, assuming the enabling technology is there, is
16 likely to win. It's an area where we have a significant
17 advantage.

18 Senator Tillis: Thank you.

19 Senator Fischer: Thank you, Senator Tillis.

20 Senator Kaine, did you have other questions?

21 Senator Kaine: Just one.

22 Can you explain that last point you just made?

23 Dr. Roper: It's a important point. So, you know, in
24 -- I think we envision --

25 Senator Kaine: And repeat it. It -- about the edge.

1 So, repeat that point.

2 Dr. Roper: So, as we push, you know, where -- there's
3 always a desire, where you can, to do things in a
4 centralized fashion. I want to have all the data flowing to
5 the brain in the center, and then the commands will push out
6 to the edge. As we discussed today, we're living in a
7 complicated world. We're going to face cyber, we're going
8 to face spectrum denial, we're going to face information
9 operations, as Dr. Prabhakar mentioned. All of that is
10 going to contest various nodes in that network. Data is not
11 going to flow the way we want it to. So, the military that
12 is able to have the most trust to interpret commanders'
13 intent and the technology to allow them to back it up at the
14 edge is going to have a significant advantage in the
15 rapidity of their response. So, if we can move and enable
16 that, we have an advantage over militaries who can't.

17 Well, when I go around and talk about with our
18 operators, which is my great privilege to do so, and I
19 contrast that with what I see in the rest of the world, I
20 think we have an advantage in the level of trust in our
21 chain of command. And if we put the technology in the hands
22 of soldiers that have our trust, then we're already a step
23 ahead of the game. And a lot of the technologies that
24 you've heard discussed today are about trying to flow that
25 enabling capability out to the edge of conflict, to the edge

1 of the battlefield.

2 Senator Kaine: Great. Thank you very much.

3 Thanks, Madam Chair.

4 Senator Cotton: Sorry. I was coming over from an
5 Intelligence Committee meeting. But, I know it's been an
6 interesting hearing, just based on the written testimony
7 that was submitted.

8 Secretary Welby, I want to talk about DCGS-A. In your
9 testimony, one of the areas you highlight are technologies
10 and concepts that enable faster and better decisionmaking
11 and coordinated operations at range and across the
12 battlespace. Do you think the Department or the services
13 should continue to develop major automated information
14 systems?

15 Mr. Welby: Senator, I believe that major automated
16 information systems, there are places where the Department
17 needs to be developing military-unique capabilities that
18 don't exist anywhere else. I think where the Department is
19 leveraging capabilities that are available from the
20 commercial sector, we should not be in the business, and
21 should be leveraging commercial innovation to the greatest
22 extent possible. We see this in areas such as electronic
23 health records, where we've shifted our focus to leverage
24 commercial to the greatest degree. We see it in some of our
25 log systems, where we had those kind of capabilities. I

1 think we're seeing it increasingly in intelligence and data-
2 fusion systems, where we can leverage commercial to a
3 greater degree.

4 Senator Cotton: DCGS-A has been developed since the
5 late 1990s, and it's been beset by cost overruns and
6 schedule delays. Do you think this is one of those areas
7 where we should perhaps move to commercial or private-sector
8 solutions?

9 Mr. Welby: Senator, I'm not fully fluent in the Army's
10 current approach to that. I know they are reconsidering
11 their strategy, in terms of that program.

12 Senator Cotton: Dr. Roper, do you have a opinion on
13 this matter?

14 Dr. Roper: On the DCGS-A, as a whole, no, Senator. I
15 will say that, for the information tools that we're
16 developing to leverage big data and analytics, we're relying
17 heavily upon commercial tools, as well as those developed by
18 our government DOD laboratories, as well as those developed
19 by DARPA. I think developing architectures that enable as
20 much of a rapid refresh of commercially-based tools would be
21 wise, given the pace of development in the world.

22 Senator Cotton: An 80 or 85-percent solution would be
23 acceptable today?

24 Dr. Roper: It is for our operators, sir.

25 Senator Cotton: I think it was Patton, maybe

1 MacArthur, who said, in a -- something that was quoted in
2 Infantry Field Manual 7-8, that a good plan today is better
3 than a perfect plan tomorrow.

4 Dr. Roper: To your point, Senator, the marines who are
5 using our tools right now -- and I'm getting feedback from
6 them each day -- we've never had this ability to coordinate
7 on the information front, so they're learning, they're
8 writing the training manual as we go. So, if we strive for
9 exquisite solutions ahead of the operators' ability to use
10 them to their fullest intent, we may have 100-percent
11 solution that's actually clocking at 80 percent on the
12 battlefield. So, we have to balance the technology leap as
13 well as the operator leap.

14 Senator Cotton: Do you think it make -- would make
15 sense to develop a program that had 120 different apps?

16 Dr. Roper: It's appealing, given how enabling that is
17 for us in our personal lives. That's very similar to how
18 the tool I referenced works. It's called a -- an
19 Information Common Operation Picture, or ICOP, and it does
20 work based on an app-based approach, where no one single
21 piece of software developed, in most cases, by small
22 businesses, provides operators precisely what they want.
23 So, on the government side, we developed the integrating
24 architecture and a display so that you can change out things
25 behind the hood, but it looks the same way to operators on

1 their screen. Now, that's for one particular application
2 for looking at large amounts of publicly available
3 information and making sense of it. How well those
4 extrapolate to bigger architectures, including warfighting
5 architectures, is a question I'm not able to comment on
6 well.

7 Senator Cotton: Would it surprise you that the project
8 manager found that, of the 120 apps, commanders and soldiers
9 used, on average, 5 of them?

10 Dr. Roper: I think it would, Senator.

11 Senator Cotton: And why is that?

12 Dr. Roper: Well, just seeing how many apps I use in my
13 own life, we tend to find -- if it's useful, we tend to
14 apply them personally. So, the reason for that is not one
15 that I can comment on, but it does surprise me.

16 Senator Cotton: I mean, I'm sure, if we put a video
17 game and an ESPN app on there, that soldiers would find a
18 way to use those. But, if it's just the mission in front of
19 them, I have to say I'm not terribly surprised that they're
20 going for the simple route, since that's usually the best
21 way to success in the Army.

22 I'm reminded of a story I heard once about Booker T.
23 Washington when he was building his university. It may be
24 apocryphal, but it's one of those stories that's too good to
25 check, because it has an important lesson. That he built

1 the buildings, everything was ready to go, students were
2 ready to report, and someone pointed out to him they didn't
3 have sidewalks. And they said, "Are you going to build the
4 sidewalks?" And he said, "One day I might." And about 6
5 weeks in, he took the engineers and the designers out and
6 pointed out where all the grass was dead, and said, "Build
7 the sidewalks there" rather than trying to force the
8 students and the faculty to walk on sidewalks where he
9 thought they should be designed and placed. I think that
10 that probably could carry a good lesson for when we're
11 designing this kind of system.

12 Thank you all for your testimony. And thank you for
13 your answers to these questions. They're an important
14 matter, and I'm sure the committee is going to be taking it
15 up.

16 Senator Fischer: Thank you, Senator Cotton.

17 I'd like to once again thank the panel. This was a
18 fascinating discussion. I thank you for your work. It's
19 important work. As I said earlier, we've always given you
20 good support with this committee because of the support that
21 you give our warfighters.

22 Thank you.

23 We are adjourned.

24 [Whereupon, at 4:02 p.m., the hearing was adjourned.]

25