



May 17, 2017

Military Space Organization, Policy, and Programs

Subcommittee on Strategic Forces, Committee on Armed Services, United
States Senate, One Hundred Fifteenth Congress, First Session

HEARING CONTENTS:

Member Statements

Deb Fischer

[View Statement](#)

Joe Donnelly

[View Statement](#)

Witnesses

Heather A. Wilson

Secretary

Air Force

[View Testimony](#)

David L. Goldfein

USAF Chief of Staff

Air Force

[View Testimony](#)

John W. Raymond

USAF Commander

Air Force Space Command

[View Testimony](#)

Samuel A. Greaves

USAF Commander

Space and Missile Systems Center, Air Force Space Command

[View Testimony](#)

** Please Note: External links included in this compilation were functional at the time of its creation but are not maintained thereafter.*

*This hearing compilation was prepared by the Homeland Security Digital Library,
Naval Postgraduate School, Center for Homeland Defense and Security.*



Cristina T. Chaplain
Director
Acquisition and Sourcing Management, Government Accountability Office
[View Testimony](#)

Available Webcast(s)*:

Full Subcommittee Hearing:

Military Space Organization, Policy, and Programs

Compiled From*:

<https://www.armed-services.senate.gov/hearings/17-05-17-military-space-organization-policy-and-programs>

** Please Note: External links included in this compilation were functional at the time of its creation but are not maintained thereafter.*

*This hearing compilation was prepared by the Homeland Security Digital Library,
Naval Postgraduate School, Center for Homeland Defense and Security.*

Stenographic Transcript
Before the

Subcommittee on Strategic Forces

COMMITTEE ON
ARMED SERVICES

UNITED STATES SENATE

MILITARY SPACE ORGANIZATION, POLICY, AND PROGRAMS

Wednesday, May 17, 2017

Washington, D.C.

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

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

MILITARY SPACE ORGANIZATION, POLICY, AND PROGRAMS

Wednesday, May 17, 2017

U.S. Senate
Subcommittee on Strategic
Forces
Committee on Armed Services
Washington, D.C.

The subcommittee met, pursuant to notice, at 2:00 p.m. in Room SR-222, Russell Senate Office Building, Hon. Deb Fischer, chairman of the subcommittee, presiding.

Present: Senators Fischer [presiding], Cotton, Sullivan, Cruz, Rounds, Donnelly, Heinrich, Warren, and Peters.

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

3 Senator Fischer: Good afternoon and welcome. The
4 hearing will come to order.

5 The committee meets today to receive testimony on space
6 organization, policy, and programs. I would like to thank
7 the very distinguished panel of witnesses for agreeing to
8 testify before us today.

9 Space-based capabilities are integral to the way our
10 military operates and our society functions. As previous
11 hearings in this subcommittee have documented, our
12 adversaries are developing increasingly sophisticated ways
13 to attack U.S. space assets and exploit the domain for their
14 own purposes.

15 General Hyten, General Raymond's predecessor and the
16 current STRATCOM Commander, told us just last month that
17 space is a warfighting domain just like air, ground,
18 maritime, and cyber, and we must normalize how we plan and
19 operate in space.

20 This new environment requires a flexible and an
21 innovative military space enterprise capable of overcoming
22 an ever-changing threat picture and rapidly delivering
23 capabilities to the warfighter. However, the work of
24 numerous reviews and commissions suggests there is a deep
25 gap between the space enterprise that we need and the one

1 that we have.

2 For example, the Rumsfeld commission concluded in 2001
3 that the Department of Defense is not yet arranged or
4 focused to meet the National Security Space needs of the
5 21st century. More recently, a study by the GAO directed by
6 this subcommittee in 2015 concluded that DOD space
7 leadership responsibilities are fragmented and spread across
8 approximately 60 stakeholder organizations from DOD to the
9 Executive Office of the President to the intelligence
10 community and civilian agencies. Eight of the 60
11 stakeholders have acquisition responsibilities, 11 are
12 responsible for oversight, and six are involved in setting
13 requirements for defense space programs.

14 I question whether such an arrangement can meet the
15 Nation's needs in space, and I look forward to hearing our
16 witnesses' views on how the current architecture can be
17 improved.

18 As we examine the organizational structure of the space
19 enterprise, it is equally important that we ensure it
20 receives the necessary personnel and resources. A recent
21 study by the Department of Defense Office of Cost Assessment
22 and Program Evaluation, or CAPE, noted that funding for
23 space procurement and research and development are both at
24 or near 30-year lows.

25 Additionally, my colleague on the House Armed Services

1 Committee, Congressman Rogers, has noted that out of the 37
2 nominees in March on the Air Force promotion list, from
3 colonels to one-star generals, none of the nominees were
4 career space professionals, like General Hyten, General
5 Raymond, and Lieutenant General Greaves were at that point
6 in their career. Both of these statements call into
7 question whether the department is appropriately
8 prioritizing space.

9 Let me again thank the witnesses for their service and
10 for testifying today.

11 I now recognize the ranking member, Senator Donnelly,
12 for any opening remarks he would like to make.

13 Senator Donnelly?
14
15
16
17
18
19
20
21
22
23
24
25

1 STATEMENT OF HON. JOE DONNELLY, U.S. SENATOR FROM
2 INDIANA

3 Senator Donnelly: Thank you, Madam Chair.

4 I want to start by thanking all of our witnesses for
5 being here today, and thanking you for calling this hearing
6 on such an important subject.

7 Secretary Wilson and General Goldfein, your presence
8 here today sends a powerful message on the importance of
9 these issues to our national security. Thanks for joining
10 us and for your leadership on defense space issues.

11 General Raymond, this is your first time before the
12 committee, and I welcome and look forward to your input.

13 And, General Greaves, I understand that this will be
14 your last appearance as director of the Space and Missile
15 System Center. Let me thank you for your service and
16 leadership. I know you will miss us immensely over here at
17 the hearing rooms. You will soon lead the Missile Defense
18 Agency, so we will be seeing more of you before the
19 subcommittee.

20 Ms. Chaplain, as always, you and your team are critical
21 to the work of the subcommittee. We rely heavily on you,
22 and we are thankful for the advice you give us on space
23 issues. It is critically important.

24 Today's hearing will focus on two issues. How can the
25 Air Force and the department improve the way we conduct

1 space missions? And how can we acquire space systems
2 rapidly to meet mission requirements?

3 Freedom of navigation in space cannot be taken for
4 granted these days. Any conflict on the ground will quickly
5 spread to space, and today's space systems are fragile.

6 Prior thinking on how we perform our space mission
7 needs to change and quickly, as General Hyten noted. Our
8 disconnected operations, acquisition efforts, and resourcing
9 hamper us today both in Air Force and DOD as a whole. I
10 hope we can change that sooner rather than later.

11 I look forward to your views today in helping this
12 subcommittee address these pressing issues.

13 Thank you.

14 Senator Fischer: Thank you, Senator Donnelly.

15 We will now turn to our witnesses for their opening
16 statements, and your full remarks will be put into the
17 record.

18 I would like to welcome Secretary Wilson. This is your
19 first official hearing, and we appreciate you being here
20 today. Welcome.

21

22

23

24

25

1 STATEMENT OF HON. HEATHER A. WILSON, SECRETARY OF THE
2 AIR FORCE, ACCOMPANIED BY GENERAL DAVID L. GOLDFEIN, USAF,
3 CHIEF OF STAFF OF THE AIR FORCE; GENERAL JOHN W. RAYMOND,
4 USAF, COMMANDER, AIR FORCE SPACE COMMAND; LIEUTENANT GENERAL
5 SAMUEL A. GREAVES, USAF, COMMANDER, SPACE AND MISSILE
6 SYSTEMS CENTER, AIR FORCE SPACE COMMAND; CRISTINA T.
7 CHAPLAIN, DIRECTOR OF ACQUISITION AND SOURCING MANAGEMENT,
8 GOVERNMENT ACCOUNTABILITY OFFICE

9 Ms. Wilson: Thank you, Madam Chairman, and thank you
10 for putting our statement in the record. General Goldfein
11 and I will highlight a few key points, and then we look
12 forward to taking your questions.

13 It is obvious but it is probably worth repeating that
14 the U.S. is heavily dependent upon space, and our
15 adversaries know it, and they know it is a vulnerability.
16 In any conflict, space will be contested.

17 We have not always assumed that in the past, and so
18 there is really underway, and has been for some time now,
19 certainly since 2007, a change in culture, a change in
20 planning and training going on in the United States military
21 because we cannot take space dominance for granted.

22 The second major thing is that since this is now less
23 than 24 hours since I was sworn into office, but over the
24 last week since the United States Senate voted on my
25 confirmation, I have been rolling up my sleeves pretty

1 seriously every day and getting reacquainted with the space
2 programs, which I had not been read into since serving on
3 the Intelligence Committee in the House.

4 While there is a lot more to do, I will tell you that I
5 have been initially pleased by some of the things I see on
6 what the Air Force is doing to improve training, to identify
7 gaps, to experiment with new concepts of operations,
8 particularly in the last 18 to 24 months. There is a great
9 deal that is going on with respect to addressing the needs
10 of the Nation to be able to prevail in space. So I think
11 you should know that from me, coming back into the national
12 security business.

13 With respect to acquisition, we also have a lot of
14 equipment and services that are going to be bought for space
15 in the next few years. It is a very heavy agenda, a very
16 heavy menu that we are going to have to go through.

17 And I wanted to personally thank you for giving
18 authority back to the Air Force for acquisition, because we
19 do need to clean these things up. I think it is going to
20 help, and we are working in the Department of Defense to
21 implement the changes which you authorized, so we can get
22 the capabilities that we need on time and on budget.

23 Those changes are not yet fully implemented, and it is
24 one of the priorities with respect to organizing the mission
25 in the Air Force and getting those things done.

1 Finally, timing is not exactly ideal for this hearing
2 in the sense that the full budget rollout will be next week,
3 but I expect an increase in space expenditure from fiscal
4 year 2017, and what we cannot accommodate will, of course,
5 appear on the unfunded priorities list.

6 One of the great things about being a new Secretary
7 with an interest in space is that it is a team that gets
8 things done. I am pleased to be here today with an
9 exceptional team of leaders in space, and that starts out
10 with an exceptional chief of staff, and I turn it over to
11 General Goldfein.

12 [The prepared statement of Ms. Wilson follows:]

13
14
15
16
17
18
19
20
21
22
23
24
25

1 Senator Fischer: Thank you, Madam Secretary.

2 General?

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 GENERAL DAVID L. GOLDFEIN, USAF, CHIEF OF
2 STAFF OF THE AIR FORCE

3 General Goldfein: Thanks, Chairwoman Fischer and
4 Ranking Member Donnelly. Thanks for holding this important
5 and timely hearing.

6 I cannot tell you what an honor it is to sit here with
7 Dr. Wilson, our 24th Secretary of the Air Force, 24 hours
8 after she was sworn in. I will just tell you that she gives
9 new meaning to one of my favorite quotes: The fight is on.

10 Along with General Raymond and Lieutenant General
11 Greaves, we really appreciate you holding this hearing.

12 As the air component commander in Central Command some
13 years ago, one of my assigned missions from the combatant
14 commander, who at the time as General Jim Mattis, was to be
15 his space coordinating authority.

16 It was my responsibility to first understand his space
17 requirements and those of my fellow component commanders
18 from the Navy, the Army, the Marines, the SOF, the Coast
19 Guard, and our interagency and allied partners across the
20 region and to ensure their mission needs were being covered
21 by capabilities provided by 14th Air Force and U.S.
22 Strategic Command. It was a natural fit because I had the
23 only headquarters in the region with the ability to
24 coordinate space activity in support of combatant command
25 and commander operations.

1 Today's air component commanders in all of our COCOMs
2 are performing this space coordinating authority duty from
3 their air and space operations centers. So it is this
4 experience employing space capabilities in combat that
5 frames how I see my responsibilities today first as a member
6 of the Joint Chiefs and also as a service chief.

7 As a joint chief, I have a responsibility to work with
8 the chairman, my fellow joint chiefs, and our interagency
9 partners to understand their requirements and ensure they
10 are appropriately represented in all space activities. As
11 the service chief with responsibility for over 90 percent of
12 the space enterprise, I have an obligation to work with
13 Secretary Wilson to organize, train, equip, and present
14 ready forces to the combatant commander, General John Hyten,
15 so he can fight should a war either start or extend into
16 space.

17 Space superiority, like air superiority, is not an
18 American birthright. It requires vigilance and action. We
19 have many more steps ahead of us, but America's airmen
20 remain committed to evolving our space organization,
21 strategy, requirements, architecture, and forces to adapt to
22 the new reality that you laid out and ensure we gain and
23 maintain air and space superiority.

24 As Secretary Wilson has stated, we have accomplished a
25 great deal in the last few years. The Air Force has

1 streamlined decision-making for the space enterprise. We
2 are normalizing, integrating, and elevating space, building
3 on over 60 years of space operations experience. However,
4 there is much more work to be done, and we look forward to
5 working with this committee and our interagency partners to
6 strengthen our competitive advantage in this critical
7 domain.

8 Our legacy includes Benny Schriever, the father of Air
9 Force Space; Thomas White, our fourth Chief of Staff; Jerome
10 O'Malley, the leader most responsible for Space Command; Tom
11 Moorman; Kevin Chilton; Bob Kehler; Susan Helms; John Hyten
12 -- all space giants. This has been our business since 1954.
13 We will own the high ground.

14 Thank you again for holding this hearing, and I look
15 forward to your questions.

16 [The prepared statement of General Goldfein follows:]

17
18
19
20
21
22
23
24
25

1 Senator Fischer: Before we begin, General, I would
2 like to thank you for your recent column on our nuclear
3 modernization. It was needed, and it is something that
4 Senator Donnelly and I believe is very, very important. So
5 thank you for putting that out.

6 We will begin the first round of questioning, please.
7 I would address this to the entire panel.

8 How do each of you characterize the problems that we
9 face with the organization of the National Security Space
10 enterprise?

11 Madam Secretary, why don't you begin?

12 Ms. Wilson: Madam Chairman, as the Secretary of the
13 Air Force, I am the principal adviser to the Secretary of
14 Defense with respect with respect to space. I take that
15 obligation very seriously.

16 There are some recommendations that the staff has been
17 working on with respect to how to organize within the Air
18 Force on space. There actually has been quite a bit of
19 staff work done to make sure we are structured properly. I
20 want to make sure that I review that well and get this right
21 without signing something on day one. But I think there is
22 a review underway of organization.

23 In general, I think the Air Force has been doing this
24 for 60 years, and that 80 percent of what the Defense
25 Department does in space is the United States Air Force. So

1 we take the mission as a core mission.

2 Senator Fischer: Thank you.

3 General?

4 General Goldfein: Ma'am, I would say that, right now,
5 we are in a strategic shift from treating space as a benign
6 domain from which we monitor, sense, and report into a
7 warfighting domain from which we fight should a war start in
8 space or extend into space.

9 So where we are focused as a service and as the
10 department is in four key areas that we are looking at. All
11 of them are linked when you look at the enterprise as we go
12 forward.

13 The first element we are focused on is how we ensure
14 that we have good, solid strategy and policy that we get
15 that we then as a service can act upon and we as joint
16 chiefs can act upon. From good strategy and policy, how
17 does that actually then derive into a concept of operations
18 a warfighting ConOps, if you will, that is written in the
19 business of joint warfighting that is not unique and
20 different because it is space, but it is actually integrated
21 and normalized because we actually know how to fight in all
22 of these domains.

23 From that ConOps derives solid requirements. With
24 those requirements, we then have to acquire a pace that will
25 allow us to be faster than our adversaries who are all

1 investing in ways of taking away our advantage.

2 The final element that we are focused on is how we
3 organize, train, equip, and present ready forces to the
4 combatant commander so that that combatant commander,
5 General John Hyten in this case, can fight should a war
6 extend into space.

7 So this is about looking at each of those elements,
8 looking at the entire space enterprise, and looking at how
9 we move it forward in an integrated way as we shift to a
10 warfighting domain.

11 Senator Fischer: Thank you.

12 General Raymond?

13 General Raymond: Thank you. I would just add that I
14 agree with the framework that General Goldfein laid out.

15 I think, operationally, we are very sound. We are the
16 best space force, and that should not be lost on anybody. I
17 do think, though, with what we see with the domain becoming
18 a contested domain, we have to have the ability to move
19 fast. That is where my focus has been, to make sure that we
20 have both the operational policies, processes, and
21 procedures and the acquisition capabilities to move fast.

22 Senator Fischer: Thank you.

23 Ms. Chaplain?

24 Ms. Chaplain: Yes, as you know, I look at things from
25 an acquisition perspective, so I might have a different

1 point of view. But for acquisition, that is all about
2 staying ahead of the curve, being agile, and being as fast
3 as you can to delivery.

4 In that regard, we do see a lot of organizational
5 challenges that need to be addressed. There is
6 fragmentation in leadership for space acquisitions, no clear
7 point of accountability or authority when it comes to very
8 complex efforts like the GPS system. You have the military
9 services involved. You have the Air Force involved in
10 delivering a satellite. You have ground systems.

11 It is an extremely complex situation where you need a
12 clear line of authority to prioritize systems, lay out clear
13 plans, and we do not have that yet. As a result, you have
14 pretty big gaps between the delivery of satellites and the
15 delivery to ground. You essentially waste capability in
16 space when you do that, so the fragmentation is a big issue
17 in terms of our ability to stay ahead of the curve.

18 Within that structure, we often hear that there are too
19 many people down the acquisition line who can say no and
20 that the process is not streamlined enough. Some of those
21 issues are common to all weapons systems, but they are very
22 particularly evident in space because you actually have more
23 players involved in a space system and more players involved
24 in the acquisition process.

25 Senator Fischer: Thank you.

1 General Greaves?

2 General Greaves: Madam Chairwoman, in addition to what
3 Secretary Wilson and Chief of Staff Goldfein and General
4 Raymond commented on, I would only like to add that our
5 decision-making process is what we are currently addressing
6 to ensure that we can streamline it and make decisions
7 affecting the acquisition timeline in a quicker manner.

8 Thank you.

9 Senator Fischer: I would put this question out to any
10 of you who would like to respond. Do you feel that there
11 are criticisms that are being made on the structure that you
12 think are unjustified?

13 General Goldfein?

14 General Goldfein: Ma'am, I would not say that they are
15 unjustified. I will tell you this, that right now, as we
16 make this transition from a benign to a warfighting
17 environment, I would just offer to you that any move that
18 actually ends up separating space as opposed to integrating
19 space I would argue is a move in the wrong direction,
20 because if I was the Chief of Naval Operations, the Chief of
21 Staff of the Army and my fellow joint chiefs and I were
22 sitting here, I would tell you for all of the missions that
23 we as joint chiefs do in the business of combined arms
24 against an enemy, space is absolutely essential to every one
25 of our missions.

1 So the last thing we want to do is actually separate
2 space into something unique and different with its own
3 unique lexicon. Right now, where we are focused is how you
4 further integrate it and how you take the tried-and-true
5 methods of joint warfighting, apply them to the space
6 domain, and ensure that it is normalized across all of these
7 mission sets.

8 So it is not really that it is an unjustified
9 criticism. I just want to make sure that we are moving the
10 Nation in the right direction, which is to integrate space.

11 Senator Fischer: And do any of you feel that there
12 have been any issues in prior studies, like the Rumsfeld
13 commission, that may have been missed, overlooked, left out?

14 Madam Secretary?

15 Ms. Wilson: Madam Chairman, some of the
16 recommendations for action in these different reports are
17 actually contrary to each other. The structure of
18 acquisition and operations that currently exist with space
19 was a recommendation of the Rumsfeld commission, which was
20 then implemented. Some of the other recommendations are not
21 consensus recommendations.

22 So these are controversial and difficult issues. I do
23 not think we should shy away from that. We should analyze
24 them clearly and try to look at what the enterprise needs
25 now and structure in order to achieve that.

1 I think General Goldfein is right. We need to make
2 sure that space is fully integrated and rapidly available.

3 Think about this, what happened last weekend. This
4 country had between 5 minutes and 8 minutes to identify and
5 characterize a launch from North Korea and then decide what
6 to do about it. That has to be integrated, and we have to
7 do this along the lines we have done joint warfighting since
8 Goldwater-Nichols.

9 Senator Fischer: Thank you very much.

10 Senator Donnelly?

11 Senator Donnelly: Thank you, Madam Chair.

12 Secretary Wilson, Air Force Space Command is
13 responsible for training and equipping our airmen to perform
14 the Air Force's space mission, but the command does not have
15 authority for setting requirements and overseeing
16 acquisition related to their mission. Is that a problem?

17 Ms. Wilson: Senator, I do not think the current
18 structure is a problem. It is a result of one of the
19 recommendations of the Rumsfeld commission that was
20 implemented in the Air Force.

21 That said, you constantly review organizational
22 structures based on the needs at the time. Perhaps General
23 Greaves or General Raymond might have something to add to
24 that.

25 Senator Donnelly: Great.

1 General Greaves: Senator, I would add that having the
2 acquisition element within Air Force Space Command is a
3 great advantage, and having my position report directly to
4 the four-star Air Force Space Command is a great advantage,
5 because by working for him, the requirements that are
6 generated at Air Force Space Command immediately flow down
7 to the Space and Missile Systems Center, which we then work
8 with the command to turn into contracts to produce
9 capability while working with Headquarters Air Force, so I
10 see that as an advantage.

11 Senator Donnelly: Okay.

12 General Raymond: I would pile on. I do have
13 requirements, responsibility on the requirements officer, if
14 you will, for Air Force Space Command, and working through
15 the Chief is the Air Force requirements officer. I provide
16 General Greaves with those requirements. I provide him with
17 resources. I provide him with manpower. And I have a
18 pretty strong voice in that chain.

19 Although I am not in the acquisition chain or machine,
20 if you will, I influence that pretty significantly and have
21 been able to do so on several big programs over the first 7
22 months of my time in command.

23 Senator Donnelly: Okay. Thank you.

24 General Goldfein, some space advocates these days are
25 calling for space corps, something like the structure of the

1 Marines within the Navy. Do you support that or do you
2 think we should take a pass?

3 General Goldfein: Sir, I do not support it at this
4 time in our history based on where we are in this transition
5 from a benign environment to a warfighting domain.

6 I will tell you that my sense is that we have an
7 opportunity being placed in front of us right now to take a
8 look at what is the way we fight in the air, on land, at
9 sea, and we know how to do this business, and how we take
10 those processes, procedures, tactics, techniques, and
11 actually apply them across the space domain. So right now,
12 to get focused on a large organizational change would
13 actually slow us down right now.

14 Whether there is a time in our future when we want to
15 take a look at this again, I would say that we probably
16 ought to keep that dialogue open. But right now, I think it
17 would actually move us in the wrong direction and slow us
18 down from where we need to go.

19 Senator Donnelly: General Greaves, one of the lesser-
20 known space missions for the Air Force is providing unique
21 weather data for military needs. For the past several
22 years, this committee has expressed concerns about the Air
23 Force's impending gaps in EOIR sensing data for cloud cover
24 and theater weather imagery, particularly over the CENTCOM
25 area of responsibility in the Indian Ocean.

1 The plan seems to change every year. What is it
2 currently?

3 General Greaves: Thank you, Senator. As part of the
4 acquisition responsibilities at SMC, we have a range of
5 authorities that we can draw on. We have listened to the
6 feedback from the Congress. Working with General Hyten at
7 STRATCOM, we have developed a plan to use one of the
8 authorities that fall under SMC, operationally responsive
9 space, ORS, to use those authorities to speed the delivery
10 of an interim capability to address gaps one and two,
11 theater weather imagery and cloud cover. That is in the
12 works as we speak.

13 Senator Donnelly: It is my understanding that the
14 available GOES assets are aging, and that they will provide
15 a short-term solution right now to the problem. Do Air
16 Force acquisition plans include a longer term solution to
17 meet CENTCOM's needs, something along the lines of 10 to 15
18 years or more?

19 General Greaves: That is correct.

20 Senator Donnelly: Okay. Thank you.

21 Ms. Chaplain, what have your findings been on the Air
22 Force's long-term weather acquisition plan?

23 Ms. Chaplain: Weather is actually a good illustration
24 of some of these problems we talk about with fragmentation.
25 They have been very slow to actually study what is ahead for

1 weather. Some of that study process was hampered by the
2 lack of coordination with agencies, principally NOAA. That
3 led to an incorrect assumption about the availability of
4 European satellites. It slowed the study process down
5 further. So we have 2 to 3 years of study before we can
6 even start a new program. There is still a lot of
7 uncertainty ahead.

8 That is where we are at. We are just waiting to see
9 what they do. The decision-making process has been very
10 slow.

11 Senator Donnelly: General Raymond, do you believe
12 Space Command should become a functional component of the
13 U.S. Strategic Command so that the Air Force Space mission
14 is part of the warfighting responsibility of STRATCOM?

15 General Raymond: I absolutely do. That is part of a
16 larger command and control restructure at STRATCOM.

17 I served previously at STRATCOM. General Hyten is the
18 STRATCOM commander. Today, he has about 18 different
19 component commands, ranging from an O-6 to a four-star
20 general. This is going to streamline that. It is going to
21 elevate the operational commander from a three-star for
22 space, from a three-star to four-star, align that with me,
23 align the service component responsibilities with the forces
24 component responsibilities, strengthens my voice in joint
25 requirements, and I am fully supportive.

1 Senator Donnelly: Thank you.

2 Thank you, Madam Chair.

3 Senator Fischer: Thank you, Senator.

4 Senator Rounds?

5 Senator Rounds: Thank you, Madam Chair.

6 First of all, thank you all for your service to our
7 country.

8 Secretary Wilson, welcome aboard. It is great to see
9 you at our first hearing. This is special.

10 I have a couple questions. First of all, I agree,
11 General Goldfein, that, clearly, we will have basically a
12 contested domain in space. I am just curious, the GPS, Next
13 Generation Operational Control System is an item I think --
14 or at least the GPS system we have today is clearly at risk
15 and would be an item to be targeted by any of our
16 adversaries.

17 Thinking of GPS and other data-gathering or
18 transmission systems that are in space today, we use them
19 almost like infrastructure today. If someone attacks or
20 could attack, and we talk about this being basically an area
21 where we could fight a war, clearly, we have individual
22 nations in mind. Who are our closest adversaries with
23 regard to having a battleground in space?

24 General Goldfein: So right now, in terms of who we are
25 watching and what their investment is, clearly, those who

1 are furthest ahead are China and Russia. So they have been
2 watching since Desert Storm. They have seen how we use
3 capabilities from space. They have studied our reliance on
4 space. They are clearly investing in ways to take away that
5 advantage.

6 Beyond that, Senator, I would love to get on your
7 schedule to give you a classified briefing on a little bit
8 more detail of what we are seeing.

9 Senator Rounds: I think why I ask it now is because it
10 has to be made very clear that we have resources in space
11 that what they would try to deny us. One of the reasons we
12 have talked about it is that we are in the process, in fact,
13 in a very challenging process, with the GPS Next Generation
14 Operational Control System. It is probably, as suggested by
15 GAO, perhaps the most problematic Air Force program that we
16 have.

17 A little over a year ago, General Greaves called it the
18 number one troubled program within the Department of
19 Defense. The program is nearly \$2 billion over budget, and
20 at least 4 years behind schedule. In October 2016, the
21 department completed a Nunn-McCurdy review and certified to
22 Congress that the OCX was essential to national security,
23 which I think you are reinforcing here today, no alternative
24 would provide acceptable capability at less cost, and that
25 program's revised cost estimates were reasonable.

1 I understand that the assessment from the most recent
2 government review is that the program is making acceptable
3 progress, but it is by no means out of the woods.

4 Is the OCX program too big to fail?

5 General Goldfein: Sir, if I could, because you have
6 raised some great issues here about space resiliency, if I
7 could take a minute and talk about just basic defense of our
8 systems, and then turn it over to General Raymond and
9 General Greaves on the specifics associated with GPS and
10 OCX.

11 We actually as a service know how to do layered defense
12 of critical infrastructure. If you were to walk to Bagram
13 Air Force Base today, you would see a commander who can walk
14 into a headquarters and have situational awareness on things
15 that are going on out to 100 miles from that base and
16 various layered defenses that we put in place all the way up
17 to, at the wire, and inside the wire.

18 That is the same mindset that we have to apply toward
19 layered defense of our critical space systems. That is
20 where we are moving now, to look at not only that layering
21 but at also how we build resiliency and, perhaps as
22 important, how we ensure that we train this force so that if
23 a portion of that enterprise is denied or taken away, we can
24 still fight and operate, and we do that every day. So this
25 is about resiliency in the overall space architecture.

1 Finally, I would say that you captured this right, in
2 that as you look at any space constellation, there are three
3 elements that we have to look at how we defend in a layered
4 way. First of all is what is actually in space and what
5 orbit we have to defend. Then you have to look at what has
6 been integrated on various platforms that use that
7 information -- some that fly, some that run, some that
8 steam, some that submerge. Then you have to look at the
9 ground control stations that receive that data, and all of
10 those have vulnerabilities that we have to protect.

11 Senator Rounds: So it is fair to say that it is too
12 big to fail?

13 General Raymond: I would say no program is too big to
14 fail. I would tell you the mission is too big to fail. The
15 importance of being able to access GPS III, and the
16 resiliency that that provides, is too big to fail.

17 We have programmatically built off-ramps to be able to
18 go a different direction, if this were not to continue to
19 progress. I will not be comfortable until that capability
20 is operational on an ops floor. But it is a very important
21 mission, and I will tell you we are laser-focused on it to
22 make sure that it materializes and then have alternative
23 paths if not. And General Greaves can talk to you more
24 about those alternative paths.

25 General Greaves: Yes, Senator, this program is

1 absolutely not too big to fail. In fact, when we looked at
2 it as a department within the Department of Defense late
3 2014, early 2015, we understood that this GPS III
4 operational control ground segment was the first information
5 assured, really hardened capability that we were going to
6 deploy to protect against both the outside and inside
7 threats. So we knew that.

8 We also knew that as we looked at the criticality of
9 this system, we needed to build off-ramps. General Raymond
10 mentioned some of those. We had milestone-driven off-ramps.
11 So we looked at whether or not, if the system was delayed or
12 we had to cancel the program, whether or not we would have
13 control over the new GPS satellites. So we entered into a
14 contract with industry to develop a contingency ops
15 capability, which will allow us to fly the GPS III
16 satellites as legacy satellites. So that was one milestone
17 that we made a decision on.

18 We also had a decision to make on whether or not the
19 block zero of OCX, which is used to launch and check out the
20 satellites initially, whether or not that would remain on
21 track. That has remained on track. It is going through
22 final testing now, and it is going to be ready to support
23 the first launch next year.

24 We also looked at our military code, whether or not the
25 delays in OCX would impact the deployment of M-code. We

1 also let a contract to start that effort to ensure that
2 would be in place.

3 Senator Rounds: If I could, I do not mean to cut you
4 off, I am going to run out of time and I want to be careful
5 of that.

6 I think the critical part here is that we have a GPS
7 system, which we rely on today, which I believe you would
8 say is at risk. What we are trying to do is find a way to
9 protect it. This is one of those tools that is necessary in
10 order to create our ability to respond and fight the war
11 that we have become used to over the last 25 to 30 years.
12 Fair enough?

13 General Greaves: Yes, sir.

14 Ms. Wilson: Senator, fair enough. And we are not out
15 of the woods on OCX yet, which is one of the reasons why
16 there is a quarterly review at the Secretary of Air Force
17 level to make sure that this program stays back on track, so
18 it has a very high level of visibility of oversight within
19 the Air Force to get it to his ops floor.

20 Senator Rounds: Thank you.

21 Thank you, Madam Chair.

22 Senator Fischer: Thank you, Senator.

23 Senator Peters?

24 Senator Peters: Thank you, Madam Chair.

25 Thank you to each of our panelists for being here

1 today.

2 I will join my colleagues in congratulating Secretary
3 Wilson on her appointment. We look forward to working with
4 you. It is great to have you here. I will extend once
5 again the invitation that I extended to you when I had the
6 opportunity to meet with you in my office, to come to
7 Michigan to Selfridge Air National Guard Base, in
8 particular, given the fact your father served at Selfridge.
9 We would love to have you back.

10 Just to put it out there, they are celebrating their
11 100th anniversary this August, so we will talk to your
12 scheduler about a visit, which would be really wonderful.
13 And I am proud to say the Air Force Thunderbirds will be
14 performing that day as well. So hopefully, you can be
15 there.

16 I want to talk a little bit about some other threats
17 that we face from space, in addition to some of the military
18 threats we have talked about. That deals with space
19 weather. We have heard about weather forecasting on Earth,
20 but threats that come from space, from the sun particularly,
21 solar flares and potentially mass coronal ejections that can
22 have a devastating impact on the Earth.

23 The Senate unanimously passed legislation that I worked
24 on with my colleague Senator Gardner in a bipartisan way to
25 coordinate the various agencies that have oversight of this

1 potential problem from NOAA to NASA, to the Science
2 Foundation, the Department of Defense, and FAA. This has a
3 big impact from the Department of Defense perspective for
4 situational awareness as well as mission planning. And we
5 know that it is just a matter of time before a very big
6 storm occurs. I am happy to say the University of Michigan
7 is one of the leading institutions studying heliophysics and
8 the potential threat that this has.

9 Whoever would like to comment about the importance to
10 the Air Force of having some accurate space weather
11 forecast, where do you see us in that regard? Are you
12 concerned?

13 I have been told that our space weather forecasting
14 ability is equivalent to our hurricane forecasting ability
15 in the 1930s, which was not that good in 1930. If it is
16 that way for us here today, particularly given the
17 interconnectedness that we have and the fact that the
18 electrical grid could be wiped out through a large part of
19 the United States should the storm hit, what should we be
20 thinking about? And does the Air Force have the resources
21 that you need? And should we be thinking about adding to
22 those, if not?

23 General Raymond: First of all, I would just say thanks
24 for the question.

25 Space weather is very important to our operations, both

1 in space and in the air and all the domains. We take this
2 very seriously.

3 I would have a slightly different characterization of
4 where we are in relation to hurricanes in 1930s. We have
5 space weather experts in our Air Force that sit right on the
6 ops floor that we operate. They provide us very timely
7 information on space. We provide that warning across our
8 forces.

9 When I was deployed, and General Goldfein talked about
10 when he was at SEAFAC, when I was deployed as the director
11 of Space Forces, we had space weather folks there as well
12 that could help us shape operations to be able to operate
13 and continue operations in that environment.

14 As you know, space weather goes through cyclical
15 periods. The current period that we are in now is not all
16 that high. But as you said, there will be periods where we
17 will get increased solar activity.

18 General Greaves: Senator, let me add that the Air
19 Force is very serious about this. We have been directed,
20 for every new space system that we are deploying, to have
21 energized charged particle sensors on board to help
22 characterize the environment that those spacecraft will fly,
23 which will then help with the modeling that we have to do on
24 the ground to do predictions.

25 Senator Peters: Thank you. I will look forward to

1 continuing to work with you. I think the forecasting, the
2 analogy to hurricane forecast is a very large impact like we
3 had back in 1859. Folks at the University of Michigan and
4 others have talked about that catastrophic impact.

5 Lloyd's of London has made a risk assessment that, if a
6 storm of that magnitude hits, it would be over a \$2 trillion
7 impact to the U.S. economy. Apparently, we missed one by
8 just a few days just a few years ago. So that is the area
9 where we are concerned about and why this legislation has
10 been moving forward, to work with you on that.

11 General Raymond: I totally agree with the criticality
12 of being able to do that right.

13 Senator Peters: Thank you.

14 The other thing, and, General Goldfein, you talked
15 about how the domain that we are dealing with now is
16 different from what we thought about it in the past. This
17 is a contested domain that we have to harden our satellites.
18 We have to harden our assets that the Air Force has.

19 The question came up from Senator Rounds and others
20 about the GPS system. But that leads to a broader question.
21 We have an awful lot of commercial satellites in space as
22 well that are critical infrastructure. Those would be
23 considered particularly soft targets, I would expect, that
24 an adversary could target.

25 How do you think about hardening our space systems, not

1 just from the DOD assets but understanding that significant
2 civilian assets also could potentially pose a real threat to
3 our country, if they are targeted?

4 General Goldfein: Yes, sir. I think the first
5 important step is to make sure that we acknowledge that this
6 is truly a partnership and that there are those who are
7 operating in space beyond the traditional state actors that
8 we were growing up with perhaps earlier in our careers, and
9 especially as commercial gets more and more interest in
10 space and is launching more of the smaller satellites. When
11 we talk about it being more of a contested and congested
12 place, that is probably what contributes as much as anything
13 to it being more congested as we operate.

14 And there is a question of whether it is more challenge
15 or opportunity. I would offer to you that as we see space,
16 as we see commercial entities getting more and more in the
17 space business, there are probably more opportunities than
18 challenges as we work with them in public-private
19 partnerships looking at potential for other launch
20 capabilities, looking for the smaller digitization of
21 satellites that allow us to actually get capability,
22 actually leveraging what they are doing commercially that
23 could actually contribute to military operations.

24 All of those things are ongoing. As the Chief of Staff
25 of the Air Force, and as a joint chief, I look at the

1 public-private partnership opportunities ahead as we go
2 forward, in terms of continuing to normalize how we operate.

3 Senator Peters: If I may pick up on the comment that
4 you made regarding crowded space, the crowded place up there
5 with all the satellites, my understanding is that India
6 recently launched 104 satellites from one rocket -- 101 of
7 them were smaller nanosatellites, including 96 from various
8 U.S. companies and commercial enterprises.

9 I understand it took a significant amount of time to
10 track and find these objects, to keep track of them. That
11 leaves the question of space debris, all sorts of things
12 that are happening.

13 Could you give me a sense of where we are in dealing
14 with that issue? The Air Force I know has taken primary
15 responsibility in tracking a lot of these objects. Should
16 we continue to do that? Is there something else we should
17 be thinking about? Because this will likely accelerate in
18 the years ahead.

19 General Raymond: That is another great question.

20 Space is clearly a congested domain. We track about
21 23,000 objects each and every day, 24/7. We take about
22 400,000 observations a day to keep track of that. About
23 1,400 of those objects are satellites. About 75 percent of
24 those are maneuverable.

25 This is a CubeSat. You talked about the 109 that were

1 launched on the one rocket from India. We are seeing trends
2 of smaller satellites. This satellite goes 17,500 miles an
3 hour in orbit.

4 We work very hard to be that space traffic control, if
5 you will, to keep the domain safe for all.

6 On average, about once every 3 days, a satellite
7 repositions to keep from hitting either a piece of debris or
8 another satellite. On average, about three times a year,
9 the International Space Station maneuvers to keep from
10 hitting a piece of debris. It is something we take very,
11 very seriously.

12 I will tell you the airmen and joint forces that are
13 assigned to the Joint Space Operations Center out at
14 Vandenberg do that work each and every day and keep the
15 domain safe for the world.

16 Senator Peters: Thank you.

17 Senator Fischer: Senator Peters, did you return that
18 satellite?

19 Senator Peters: Yes, I did.

20 Senator Fischer: We do not need another one, right?

21 Senator Sullivan?

22 Senator Sullivan: Thank you, Madam Chair.

23 I want to thank the panel. It is a very impressive
24 group of public servants and military officers.

25 Secretary Wilson, welcome. We are all glad to see you

1 here in your position. And I think you always hear this
2 from different Senators, like Senator Peters. I look
3 forward to you coming up to Alaska. You will see that we
4 are the hub of air combat power for the Asia-Pacific and the
5 Arctic and training with JPARC.

6 And the young men and women in the Air Force in my
7 State, as you know, have been very busy with five F-22
8 intercepts of Russian Bear bombers just within the last
9 month. So they are doing a good job protecting American
10 sovereignty and airspace.

11 So thank you for the great leadership all of you are
12 doing with regard to the young men and women who are doing
13 such a great job.

14 We are also a cornerstone of our Nation's missile
15 defense up in Alaska. I want to talk a little bit about
16 missile defense and what we can be doing better on that.

17 It has become very clear, and you were talking about
18 the test by North Korea this past weekend, but all the
19 public testimony is it is not a matter of if but when Kim
20 Jong Un is going to be able to range the United States, and
21 it is not just Alaska and Hawaii but the lower 48, with an
22 intercontinental ballistic nuclear missile. That is going
23 to happen at some point. He is going to have that
24 capability.

25 I think that we need to do more to be able to protect

1 the homeland, to be able to say that, if you launch one, or
2 two, or three of these missiles, that we will have a 99
3 percent chance of shooting them down, and then we will
4 massively retaliate against you, which I think will keep
5 even a crazy guy even a little bit more sane, in terms of
6 trying to do something like that.

7 But I do not think we are there yet, so I think we need
8 to do more, and I am going to be introducing a bill that we
9 have been working on for months with some of the experts in
10 Washington and other places on increasing our missile
11 defense capability. I am certainly going to look to make
12 that a strong bipartisan bill.

13 One element, actually a key element of that bill,
14 relates to the topic we are talking about here, and that is
15 space and space sensors with regard to our missile defense.

16 General Goldfein, you articulated well the idea of an
17 integrated and layered defense. But, as you know, it is not
18 just Bagram Air Base. It is also our missile defense that
19 we need to do that.

20 So General Hyten has stated in testimony that, "The
21 deployment of a global space-based sensor system with
22 discrimination capability will be a critical component to
23 improving the effectiveness of our deployed missile defense
24 interceptors." That is his testimony.

25 Admiral Syring similarly stated, "From a missile

1 defense perspective, we have to develop a future operational
2 space layer. Given where the threat is going with
3 hypersonics and more ICBMs, this persistent tracking and
4 discrimination capability from space is a must for our
5 missile defense."

6 So I would like to ask the whole panel -- maybe,
7 General Raymond, starting with you -- how would space-based
8 sensors benefit our missile defense system, help with a
9 layered and integrated defense, whether it is GBIs in Alaska
10 or THAAD throughout the world, South Korea, or Aegis Ashore,
11 Patriot? How is that important?

12 Would that give us the persistent, unblinking eye and a
13 stronger ability to have layered missile defense, which in
14 my view we need today? We need it today, and we do not have
15 it. How critical are space sensors in that regard?

16 General Raymond: I think it is very critical. I would
17 agree with the previous testimony that you cited. I think
18 space, if you look at the little handout that we provided
19 and you look at the orbits, space provides persistence.
20 Space provides that unblinking eye. Space provides the
21 ability to discriminate, especially for maneuvering targets.

22 We have a great partnership with MDA. In your State,
23 Senator, we have a missile warning radar. We are in
24 partnership as we speak with MDA to modify that to be a more
25 capable missile defense capability, so we have a long

1 partnership both on the ground. We have capabilities in
2 space today with our space-based infrared satellites and
3 with our defense support program satellites, DSP and SBIRS,
4 that provide utility to the Missile Defense Agency.

5 But the layer that you talked about I think would be
6 important. It would give you persistence, field-of-view,
7 and the ability to discriminate.

8 Senator Sullivan: Anyone else want to comment?

9 General Greaves?

10 General Greaves: Senator, I will agree entirely with
11 General Raymond. Space and Missile Systems Center has been
12 in very close contact with the Missile Defense Agency over
13 the past few years, understanding where we can partner and
14 where space can benefit.

15 Space offers the opportunity from its vantage point for
16 the promise of birth-to-death tracking, which aids in the
17 discrimination problem that is at the central core of the
18 efficient use of our interceptors. We have been working,
19 some of it is classified, with MDA to hopefully jointly
20 determine what would benefit the missile defense mission as
21 well as the space surveillance mission within the Air Force,
22 so that work is ongoing.

23 Senator Sullivan: Great. I think you will like -- I
24 am not going to presume that you will support this bill, but
25 from the testimony, I think you will appreciate what we are

1 trying to do here in the Senate.

2 Ms. Chaplain?

3 Ms. Chaplain: Yes, I also oversee our missile defense
4 work. The capability that you are talking about, there has
5 been a requirement for that since the 1990s. There have
6 been several attempts to actually build that constellation.
7 One issue is it is very expensive to get that capability
8 because it is usually in low-Earth orbit and you have to put
9 up more satellites.

10 One issue that has sort of been recurring --

11 Senator Sullivan: Just to make a point on that, we
12 have been looking at some of the costs, and my view is,
13 buying insurance with regard to a nutcase who wants to try
14 to nuke Chicago at some point, or threaten to do it, the
15 expense should not be our first priority. Defending the
16 Nation should be our first priority.

17 I understand we have the capability to do it, and I
18 think, as you have been talking about, we have been talking
19 about it since the 1990s. This bill is meant to say let's
20 do it. Enough talk. We have a threat. We have a threat, a
21 real threat right now, a madman possibly could be
22 threatening 300 million people in the next year or 2 with an
23 intercontinental nuclear ballistic missile.

24 So I just get a little tired of the discussion of,
25 "Well, it is going to cost a little bit more." I think the

1 average American would take that insurance policy in a
2 heartbeat to say we have a 99 percent chance of shooting
3 down a missile when right now we do not.

4 I do not know exactly what you believe the number is in
5 terms of our chances, but we need to up the chances and the
6 probability of being ready to take out any threat that this
7 guy daily -- daily -- threatens our country with. We should
8 not take those threats lightly.

9 Ms. Chaplain: I think, given the expense, though, you
10 can maximize that satellite's use by bringing in other
11 requirements. One up for discussion is base situational
12 awareness. The same satellite can serve different
13 communities. It helps you be able to pay for that mission
14 even more.

15 General Raymond: And we are working very closely with
16 Missile Defense Agency toward that end.

17 Senator Sullivan: Madam Secretary, any comments?

18 Ms. Wilson: Senator, I would just say one thing. You
19 have highlighted the need to do more. All of these things
20 and other missions for the Air Force, we are not going to
21 meet the needs of the Nation unless we figure out a way to
22 get beyond the Budget Control Act. That is going to require
23 a lot of work between the Congress and the administration to
24 figure that out.

25 Senator Sullivan: Thank you.

1 Senator Fischer: Thank you, Senator.

2 Senator Heinrich?

3 Senator Heinrich: Thank you, Madam Chair.

4 Secretary Wilson, General Goldfein, in your
5 testimonies, you state that current policy does not fully
6 address space deterrence requirements for action in the 21st
7 century. Given the reliance we have today, and it has been
8 discussed by a number of you, for space, for secure
9 communications, intelligence collection, missile defense,
10 GPS, and many other missions, what are your thoughts on
11 whether it is time for the United States to engage in an
12 international conversation about an international space code
13 of conduct and whether we should be negotiating with other
14 nation-states on such a thing?

15 Secretary?

16 Ms. Wilson: Senator, that is probably a policy issue
17 far beyond the Air Force. The Air Force's role will be to
18 be ready to defend what we believe will be a contested
19 environment irrespective of any international norms of
20 behavior. I think the Air Force intends to and does comply
21 with national norms of behavior and, in fact, enables a lot
22 of those norms by providing information on where debris is
23 and so on and so forth. But we must --

24 Senator Heinrich: Do you have thoughts on potential
25 pitfalls or potential advantages of having such a code of

1 conduct in place?

2 Ms. Wilson: Senator, I have to say that from an Air
3 Force perspective, I think what we have to do is to be able
4 to prevail in what will inevitably be a contested
5 environment irrespective of consensus on international
6 norms, because there will be players who do not abide by
7 those norms.

8 Senator Heinrich: Yes. It is about risk mitigation
9 more than anything else. That is why I asked the question.

10 General?

11 General Goldfein: Thanks, Senator. In some ways, the
12 intent of the National Space Defense Center when it began
13 was to actually take a look at how we coordinate our
14 activity beyond just the Department of Defense for other
15 operations that are taking place in space.

16 Right now, it is centered on defense and intelligence
17 and taking a look at not so much who commands and who
18 controls but actually at how we coordinate our activity.
19 And an international set of norms relative to how we
20 coordinate activity beyond defense and intelligence is
21 probably a reasonable dialogue to have.

22 But I am with the Secretary here. That is probably a
23 policy-level discussion.

24 Senator Heinrich: So one of the GAO's recommendations
25 is to delegate decision-making to the lowest level

1 practical. Do each of you agree with that recommendation?
2 Do you think that this extends to the hiring of qualified
3 individuals and the issuance of contracts?

4 I will give you a little background. The reason why I
5 am bringing this up is that in addition to the delays in
6 issuing contracts, I have heard a lot from recent graduates
7 about significant delays, sometimes over a year, in terms of
8 extending a job offer.

9 Just last week, a number of my colleagues and I sent a
10 letter to Secretary Mattis about direct hire authorities,
11 urging that each of you help implement those authorities
12 across-the-board within the Air Force but particularly
13 concerned about AFRL.

14 So I just wanted to get your sense for how you view
15 that recommendation and how far you think it extends.

16 Ms. Wilson: Senator, in general, yes. The decision-
17 making should be at the lowest practical level. In that
18 regard, I would highlight the acquisition authority that was
19 just recently returned to the Air Force. We are working
20 that through with the Department of Defense now.

21 With respect to hiring, I am not sure what the cause
22 was behind what you identify. But remember we also just
23 went through a hiring freeze and also an uncertain budget
24 situation. Sometimes those decisions are based on the fact
25 that we just have no certainty with respect to the budget,

1 and budget certainty does affect managers' decisions.

2 Senator Heinrich: Absolutely. My understanding is
3 that was not the case, but we will get you those details, so
4 you fully understand the situation.

5 General Goldfein: Sir, I will let General Greaves and
6 General Raymond talk to the specifics on acquisition and
7 decision speed and decision authority.

8 What I would like to highlight for you is the
9 importance of looking at this from both requirements and
10 acquisition, because to acquire, you have to start with a
11 very firm set of requirements. Here is where I think we
12 have to get to. The analogy that I would offer you is that
13 today we are building a tanker called the KC-46. We are not
14 building that for the United States Air Force. We are
15 building that for the joint force because anybody who needs
16 airborne refueling is going to use the KC-46, to include our
17 allies and partners.

18 The chief requirements officer for the KC-46 is the
19 Chief of Staff of the Air Force. If anybody wants to change
20 the requirements, they have to come to me to change those
21 requirements.

22 We have to get to the same level of decision authority
23 and deliberate oversight of requirements in the space
24 business the same way that we acquire others. So as we work
25 our way through decision authority in acquisition, there is

1 an equivalent discussion we need to have about decision
2 authority for holding requirements firm.

3 General Raymond: I would pile onto that. I think
4 strengthening requirements at all levels is important. I
5 think the other piece of this that is important is making
6 sure that we have the analytical rigor to inform those
7 requirements. When we have that analytical rigor, we have
8 been able to move pretty rapidly. Then I would also add
9 that we are also focused on using rapid acquisition
10 authorities more broadly than what we have done in the past.

11 Senator, in your State, we have the Operationally
12 Responsive Space Office, and we are working hard to use
13 those authorities more broadly.

14 Senator Heinrich: Great.

15 General Greaves: Senator, as the Commander of SMC, I
16 think the single biggest improvement we can make you have
17 already provided language for. But as Secretary Wilson
18 said, moving the milestone decision authority back to the
19 services, and as the Secretary said, we are working within
20 the department to execute that.

21 As far as contracts, I know specifically with our
22 advisory and assistance contracts, our support contracts, 3
23 or 4 years ago, there was a problem with those contracts.
24 Within the last 3 years, we optimized and consolidated the
25 requirements process that generates those contract awards.

1 We have seen a drastic reduction in the time needed to award
2 those contracts, so we are addressing those.

3 Thank you.

4 Senator Heinrich: Thank you, General.

5 Senator Fischer: Thank you, Senator.

6 Senator Warren?

7 Senator Warren: Thank you very much, Madam Chair.

8 Thank you all for being here.

9 Secretary Wilson, it is good to see you here. I hope
10 we are going to get to see you in Massachusetts as well.
11 You have a standing invitation to come visit our bases. I
12 want to make sure we get our plug in too for Massachusetts.

13 I want to talk about where we are right now with the
14 commercial sector. The commercial sector seems to be
15 charging ahead in space. One area where commercial advances
16 have been astounding has been in imagery. Today's
17 commercial satellite imagery is often very high quality.
18 They are even taking HD video from space.

19 Meanwhile, our intelligence surveillance and
20 reconnaissance is what I understand the Pentagon calls a
21 high-demand, low-density asset, which means everybody wants
22 it and there is not enough to go around.

23 So let me start, General Goldfein, if I could, how is
24 the department incorporating commercial imagery as a service
25 into its approach? And conversely, how do you think about

1 the risks that the wide availability of imagery pose for the
2 United States?

3 General Goldfein: Yes, ma'am. The reality is we sense
4 the globe in domains: air, land, sea, space, cyber. Then
5 someone has to take all those ones and zeros and turn it
6 into decision quality information to allow us to achieve
7 decision speed. Much of that falls on the Air Force. We
8 are continually looking at ways to integrate nontraditional
9 means of intelligence into that sensing so that we can fuse
10 that into this common operational picture.

11 I will tell you that we are using commercial imagery.
12 We are using other sources that can bring -- we are using
13 social media in ways that we have not before, so this is a
14 broader discussion about how you leverage public-private
15 partnerships and the commercial industry to be able to
16 increase your decision speed and your ability to get that
17 common operational picture.

18 Senator Warren: So let me then just follow up on that
19 a little bit, General. Our satellite programs are
20 incredibly complex. They are also incredibly expensive.
21 Oftentimes, a single satellite can cost billions of dollars.
22 Meanwhile, the advances in technology on the commercial side
23 are making sophisticated technology smaller, lighter,
24 cheaper, every day.

25 A little startup company in Massachusetts can buy a

1 small, lightweight CubeSat -- I think you said you have one
2 of those here -- for less than \$10,000, and it does not cost
3 much more than that to launch it into space.

4 I get it, that a CubeSat obviously does not have the
5 same capabilities as the next generation GPS, but it seems
6 like there are some missions that a smaller or less
7 technically sophisticated satellite would do just as well.

8 Maybe I could include you in this, General Greaves.
9 How do you assess the tradeoffs between large, technically
10 sophisticated satellites and smaller but potentially less
11 powerful constellations? How do you think about that?

12 General Greaves: Senator, we actually think about that
13 daily, and it is part of our acquisition strategies that we
14 develop.

15 Just one example, one vignette, for the space-based
16 infrared system that flies out of Colorado, we are setting
17 up a data framework consortium to essentially go after
18 commercial capability to integrate into our tools,
19 applications, and processing lab to essentially ingest
20 commercial data, whether it is imagery or OPIR or other
21 sensors, and combine that with what SBIRS produces, as an
22 example, and exploit that and fuse it and send it out to
23 users. That is just one example.

24 Senator Warren: I have to say, I am really glad that
25 you are thinking about this and you think about the ways

1 that you can integrate.

2 It seems to me that a high-low mix of advanced and more
3 basic capabilities in our satellite inventory would be a
4 good way to think about it, kind of the same way we think
5 about aircraft in this area. Capitalizing in advances,
6 though, in technology is possible only if we can afford to
7 do it.

8 But, Ms. Chaplain, a lot of our space acquisitions seem
9 to remain bogged down. Last year, the GAO reported that
10 several of the department's most critical space programs
11 remain overbudget and behind schedule. So, Ms. Chaplain,
12 could you say a word about how the department, what it
13 should be doing to stay on schedule and to rein in costs in
14 this area?

15 Ms. Chaplain: I think a two-pronged approach is
16 needed.

17 One, you really need to focus on the acquisition
18 fundamentals. In recent reports, we are hearing issues
19 about systems engineering, contractor performance, lots of
20 management and oversight issues that seem to persist. So
21 those really need to be addressed.

22 And then on the second-pronged approach, really looking
23 at the fragmentation and leadership so that we can speed up
24 decision-making, be more agile, get agreements early on.
25 That does not really happen as much as it should on space.

1 And I agree with you about the commercial suppliers,
2 and can they be brought in to offer a mix of approaches?
3 For years, commercial suppliers have always felt like it is
4 "talk to the hand" when it comes time to deal with the
5 Department of Defense. Maybe you have heard of that. There
6 is also a lack of contracting mechanisms to help them engage
7 with defense, especially when it comes to things like buying
8 bandwidth or something like that.

9 DOD has been trying some prototype efforts to be able
10 to buy services better, but I think a lot more can be done
11 to bring in that kind of innovation.

12 Senator Warren: Good. I am very glad to hear this.
13 Obviously, the cost growth in the satellites is limiting our
14 capacity to buy what it is that we need to buy. We owe it
15 to the taxpayer, we owe it to our national security, to get
16 these costs down to a place that we can get the full range
17 of response that we need.

18 So thank you all very much. I appreciate it.

19 Thank you, Madam Chair.

20 Senator Fischer: Thank you, Senator Warren.

21 I believe we have some time left in the hearing. There
22 might be other Senators who are going to be coming to ask
23 questions, so we will begin just a short second round, if
24 Senators have a follow-up question.

25 I would recognize Senator Sullivan.

1 Senator Sullivan: Thank you, Madam Chair.

2 General Goldfein, I just want to follow real quick on a
3 statement you made about the KC-46 and your authority on the
4 requirements change.

5 Was that as a result of the NDAA amendments just 2
6 years ago on acquisition reform to give the service chiefs
7 more authority on acquisition?

8 General Goldfein: Actually, it did strengthen the
9 authority of the chiefs. And actually, I would argue, it
10 also strengthened the accountability of the chiefs for
11 having responsibility for assigning milestone decision
12 authorities.

13 However, the responsibility of the chief of staff of a
14 service to hold requirements firm actually did not change
15 with --

16 Senator Sullivan: That had previously existed?

17 General Goldfein: Yes, sir.

18 Senator Sullivan: Okay. Thank you.

19 I want to go back to the missile defense discussion we
20 were having. General Raymond, I was talking a lot about
21 space-based sensors, but given your experience -- and again,
22 I would open us up to the panel -- and given the threat that
23 is heightened that we are all acknowledging, particularly
24 from North Korea, can you talk about why some of the ground-
25 based radars like Cobra Dane and the upgraded early warning

1 radar and the LRDR radar that we are implementing now are
2 also very important with regard to our layered, integrated,
3 and strategic missile defense?

4 General Raymond: I think as you just ended the
5 question, layered defense, that is really what this is.
6 This is a network or a system of systems. Every piece of
7 that architecture provides advantages. From the space
8 capabilities, as we talked about, you get the persistence,
9 you get the field of view. From the ground-based radars,
10 you get discrimination, better discrimination capabilities.

11 So there are a host of sensors that are positioned
12 around the globe to be able to do that. They come together
13 as a network to be able to fuse that information into a
14 timely decision and be able to respond as a Nation in order
15 to do so.

16 But it is not just one capability. It is the mixture
17 of those capabilities that provides the national missile
18 defense capability that we need.

19 Senator Sullivan: So Cobra Dane, is that in good
20 shape? How important is that to tracking North Korean
21 missiles right now?

22 General Raymond: Cobra Dane, let me just say, I am not
23 responsible for missile defense mission. However, I will
24 say that it is a very important missile defense capability.
25 I would also tell you that we use that capability pretty

1 significantly to do space situational awareness as well. I
2 talked about earlier the thousands of objects that we are
3 tracking. We use that capability for that mission as well.

4 Senator Sullivan: Anyone else want to comment on this
5 ground-based -- General Greaves?

6 General Greaves: Senator, I would offer that the
7 discriminating radar that is going into Clear, Alaska, is
8 key to the future of effective missile defense. I believe
9 that is why Admiral Syring proposed that it be positioned
10 there, because it is a mix of, if you add the SPX floating,
11 X-Band Radar, mix of phenomenology that is used to
12 characterize the threat versus decoys, and radars are
13 critical to that.

14 Senator Sullivan: Thank you.

15 General Raymond: The other piece of this is that you
16 also need, as we talked about earlier, when there is a
17 launch, you have to determine really quickly, is it a
18 regional threat? Is it a threat to our homeland? Or is it
19 a threat to space? Or is it a space launch?

20 So those capabilities, wherever they are around the
21 world, help us discriminate against that and then provide us
22 the -- help support the supporting relationships to handle
23 those.

24 Senator Sullivan: Did you have a comment, General
25 Goldfein?

1 General Goldfein: Sir, I was just going to say, in my
2 role as the air defense commander in Central Command and
3 responsible for defending the Arabian Gulf from potential
4 Iranian missiles, one of the things that we have not talked
5 about in this discussion is the importance of attribution
6 and ensuring that not only do we characterize the missile
7 very quickly so we can defend, but also so we can have
8 irrefutable evidence that we can present that said it came
9 from this country.

10 Senator Sullivan: Right.

11 Let me just ask one final question, Madam Secretary, if
12 I may, just since the two leaders of the Air Force are here.
13 How is morale with our young men and women in the Air Force,
14 for both Madam Secretary and General Goldfein?

15 Ms. Wilson: Senator, I am probably not able to comment
16 on that yet in any detail, because I have not been out in
17 the field. But I have a rule that any day out of the office
18 and in the field is a good day, and I hope to be out doing
19 things and spending time with airmen.

20 I think my first opportunity to do that will be next
21 week, and I have a number of engagements in Colorado next
22 week.

23 Senator Sullivan: Great.

24 General Goldfein: Senator, I will tell you my belief
25 is that readiness and morale are inextricably linked. Where

1 we have high readiness, we have high morale. If you walk
2 the line today at Bagram and if you walk the line today at
3 Kunshan in Korea, you are going to find high morale, because
4 they have people, they have parts, they have what they need.
5 They are flying at a high rate, and we keep them at a very
6 high level of readiness. So their morale is very high.

7 There is a bill payer to get that level of readiness,
8 and that is against all the bases now who have to contribute
9 forces -- personnel, supplies, equipment, and often aircraft
10 -- to be able to get that high level of readiness forward to
11 fight tonight. Their readiness is at a lower level. eThat
12 concerns me because that is the force we are going to rely
13 on if a contingency kicks off.

14 So where you have lower levels of readiness, you are
15 going to find low morale, because a pilot who does not fly,
16 and air traffic controller who does not control, a
17 maintainer who does not maintain, is not going to stay in
18 this business, because we are not giving them the
19 opportunity to be the best they can be in their business.

20 Senator Sullivan: Thank you.

21 Senator Fischer: Thank you, Senator.

22 Senator Heinrich?

23 Senator Heinrich: General Greaves, back to the issue
24 of contracts for just a minute, I have spoken quite a bit in
25 recent years about the significant amount of time that it

1 takes to award contracts to small satellite businesses. In
2 New Mexico, the delays have sometimes extended to one or
3 more years before receiving approval. You and your team at
4 SMC recently announced a space enterprise consortium that
5 would use other transaction authorities to will help speed
6 up that process.

7 How would you describe the industry response so far to
8 the consortium RFI? How will the consortium accelerate the
9 solicitation-to-award timeline?

10 And finally, I just want to say thank you to you and
11 Colonel Anttonen for your leadership on this issue.

12 General Greaves: Thank you, Senator.

13 The response of industry has been enthusiastic. By
14 using the other transaction authority as we have done
15 recently with our rocket propulsion system work, industry
16 sees, as you mentioned, reduced timeline, increased
17 responsiveness, and ability to execute their business case.

18 As far as timelines, the final coordination on the
19 consortium direction is going through headquarters Air Force
20 today. We expect to release it in 30 days and, by the end
21 of July, to reward our first contract. That contract will
22 be supporting development of tactics, techniques, and
23 procedures in support of the space warfighting construct.

24 Senator Heinrich: Thank you.

25 Senator Fischer: Thank you, Senator.

1 Senator Cotton?

2 Senator Cotton: Thank you, Madam Chair. I apologize
3 for my tardiness. I had presiding officer duty. It is very
4 much a duty, not an honor, which blue suiters know, it is
5 like staff duty when you are a lieutenant.

6 I understand, General Goldfein, that, in your opening
7 statement, you spoke about the space corps, which is one of
8 the approaches the GAO reported could resolve the
9 fragmentation within the DOD, the separate space force. You
10 said you do not support it at this time.

11 Could you elaborate a little bit on the reasons for
12 that?

13 General Goldfein: Yes, sir, because, right now, we are
14 at this point in our history relative to the criticality of
15 space that we are evolving from treating space as a domain
16 that is relatively benign from which we report, sense, and
17 monitor, to a domain that we have to fight in should a war
18 extend or start -- extend into space or start in space.

19 So as we make this transition right now and we look at
20 our operating construct and normalize joint warfighting, I
21 would not recommend to this committee that we would go to a
22 corps right now, because anything that separates space and
23 makes it unique and different relative to all of the
24 warfighting missions that we perform that are reliant on
25 space, I do not believe that will move us in the right

1 direction at this time.

2 Senator Cotton: Ms. Chaplain, would you care to
3 provide any thoughts?

4 Ms. Chaplain: Yes, I understand that point of view.
5 In our report, we laid out options. We did not make a
6 particular recommendation, because we think how it affects
7 operations needs to be taken into account.

8 But I will say that the solutions tried to date that do
9 not separate space as people think it should be separated
10 have not worked very well. The reasons that people in these
11 prior studies and even today believe that there needs to be
12 some kind of segmentation is to protect the space budget, is
13 to leverage expertise for the work force, and is to really
14 clearly designate who is in charge. So if it is not going
15 to be that, it needs to be some kind of solution that does
16 those things.

17 Senator Cotton: Thank you.

18 General Goldfein, you mentioned the difference between
19 the benign environment that we are used to and increasing in
20 a warfighting environment, which your joint statement from
21 all the witnesses says right there on page 2.

22 What exactly is the risk that we face in space now, in
23 layman's terms, so the ordinary American can understand it?
24 Because I think most ordinary Americans do believe that
25 space is a benign environment.

1 General Goldfein: Well, again, to the average American
2 who goes to an ATM and pulls money out of that ATM, the
3 timing signal that ATM relies on comes from GPS satellites
4 that are flown and managed by the United States Air Force.
5 You want to take a look at not only how many activities are
6 dependent -- you can look at the transportation industry,
7 whether you want to talk airlines or trains, it is dependent
8 on that signal.

9 So just from a GPS constellation standpoint, I would
10 argue that, globally, this is a constellation that we have
11 to ensure that we are monitoring and protecting.

12 So when we call it a joint warfighting domain, the idea
13 here is that we actually now how to fight on land, at sea,
14 in the air, and we have tried and true tactics, techniques,
15 and procedures. So now is the time for us to apply those to
16 the space domain so it becomes further integrated and
17 normalized across how we fight.

18 So that is why anything that actually talks about the
19 business of separating and space in the same sentence I
20 submit to you is moving us in the wrong direction. Anything
21 that talks about integrating and normalizing space is moving
22 us in the right direction.

23 Senator Cotton: The threat to normal Americans about
24 their ATM machine sounds pretty dangerous. Who would do
25 such a thing? What countries or what adversaries would be

1 able to disable satellite constellations?

2 General Goldfein: Without going into -- I can get on
3 your schedule for more of a classified --

4 Senator Cotton: No, no, I know who they are. I was
5 just wondering if you wanted to say who they are.

6 General Goldfein: So right now, in terms of who we are
7 watching that is investing most in taking away our
8 advantages in space, the two countries that are making the
9 most investment in this area are China and Russia.

10 Senator Cotton: And the asymmetry that we face is just
11 inherent in our geopolitical situation? We sit here in the
12 new world and we try to project power in the old world
13 across the vast domains, and, therefore, we are inherently
14 going to rely more on the space constellation than any old
15 world power like Russia or China will?

16 Secretary Wilson, you look like you want to respond.

17 Ms. Wilson: Senator, let me take that one. It is not
18 just our role in the world. It is that we are really good
19 at it, and, hence, we have become heavily dependent on upon
20 it. When it was uncontested, that was a nice place to be,
21 but our adversaries know it, that we are heavily dependent
22 upon it and very good at it, and, hence, they see the
23 vulnerability.

24 So in any conflict, space is going to be contested. We
25 see the capabilities, and the folks can come up and brief

1 you in a classified way, but it is also their declaratory
2 policy. The Russians have publicly stated that this is part
3 of their declaratory policy, to develop capabilities to deny
4 us the use of space in any conflict.

5 Senator Cotton: Thank you all.

6 Senator Fischer: Thank you, Senator.

7 Senator Cruz?

8 Senator Cruz: Thank you, Madam Chairman.

9 Welcome, everyone. Thank you for being here
10 testifying.

11 Secretary Wilson, congratulations on your confirmation
12 and being sworn in. Thank you for your service once again.

13 Just a minute ago, you were visiting with Senator
14 Cotton about the threats from Russia and China in space and,
15 indeed, a couple of instances of potential conflict.

16 Russia's Kosmos-2499, a kamikaze satellite fashioned to
17 destroy American satellites, and China's Shiyang, a grappling
18 arm-equipped satellite that could remove U.S. assets from
19 their orbit, how serious do you estimate this threat is?
20 And what can be done to protect our assets from potential
21 hostile activity in space?

22 General Goldfein: Sir, I will tell you that we as the
23 service responsible for flying all 12 constellations and 90
24 percent of the architecture, we take this very seriously.
25 Without going into any kind of a classified discussion, I

1 will just tell you that layering our defenses and ensuring
2 that we truly understand and can characterize the threat,
3 and then perhaps just as importantly as the constellations
4 themselves, the command and control architecture that we are
5 building in to first characterize and then be able to get
6 the decision speed we need to respond quickly are all part
7 of the space operating construct that we are working toward.

8 Then I would like to turn it over to General Raymond as
9 well who is really the operational warfighter in this
10 business, because a significant portion of our effort is
11 actually also transitioning the space mission force into a
12 force that has been focused primarily on monitoring and
13 reporting and actually focused on fighting.

14 Senator Cruz: General Raymond?

15 General Raymond: Thank you, Senator.

16 As I look at it, I have four imperatives, and in any
17 warfighting domain, and I would characterize space as a
18 warfighting domains just like air, land, and sea, in any of
19 those warfighting domains, you have to have the ability to
20 command and control forces in that domain. You have to have
21 the ability to have space situational awareness or
22 situational awareness in that domain. You have to have an
23 architecture that is defendable. And you have to have, as
24 the chief just mentioned, professionally developed airmen
25 that can fight and be joint warfighters.

1 Those four areas are where I am focused. We have made
2 some pretty significant strides in battle management
3 command-and-control. We are working hard in partnership
4 with the National Reconnaissance Office in space situational
5 awareness, and with other partners, including commercial
6 space in developing ConOps on how we go about disaggregating
7 that architecture and coming up with architecture. We work
8 that very closely with national reconnaissance as well.

9 Then on the space professional development piece, we
10 are making sure that our airmen have the ability to
11 participate in exercises, wargames, go to the right
12 training, the right schools, to be joined warfighters.

13 Senator Cruz: What vulnerability would we have to a
14 nuclear device in a satellite? And what could be the
15 potential harms to the homeland if a nuclear device were
16 detonated in orbit?

17 General Raymond: So, Senator, I would say that there
18 is a spectrum of threats that we would be concerned about.
19 They would go from anything from the low end of reversible
20 jamming of communication satellites and GPS satellites, for
21 example, up through directed energy, up through what we saw
22 demonstrated in 2007 by the Chinese with the direct-ascent
23 ASAT. Then I would put at the far end of that spectrum
24 nuclear devices detonated in space, which would have very
25 significant impacts across our constellations.

1 General Greaves: Senator, I would add that our most
2 critical satellites with those capabilities, they have been
3 designed to operate through the environment you just
4 mentioned. In this forum, that is all I can say.

5 Senator Cruz: And what would the risks be of an EMP
6 from a nuclear device detonated in orbit?

7 General Greaves: Senator, again, it would depend on
8 the type of satellite systems. Our big data pipe, wide-band
9 global satcom would be less protected than our most critical
10 -- satellites that are in the nuclear chain of command,
11 those would be able to fight through that sort of
12 environment.

13 Senator Cruz: But we do have -- it is correct that
14 North Korea has satellites orbiting right now?

15 General Raymond: They have one satellite. I call it a
16 piece of debris. It is not very useful. It is more of a
17 statement that they have been able to put something in
18 orbit, which is concerning. But I do not consider it a
19 capability that provides them benefit.

20 Senator Cruz: What are the most vital steps necessary
21 to protect our assets in space, to prevent the space
22 architecture from being taken down?

23 General Raymond: I think there are a couple things you
24 have to do.

25 First of all, our plans are to make the capabilities

1 that we have today more defensible. So one thing you might
2 do is add some maneuverability capability to allow it to be
3 more agile. The other thing that we are working through is
4 looking at an architecture perspective.

5 How might you disaggregate, diversify? We had good
6 conversations earlier about the role of commercial space,
7 the role of our allies. How do you build that architecture
8 that puts you in a position day-to-day to be more
9 defendable?

10 Senator Cruz: Thank you.

11 Senator Fischer: Thank you, Senator Cruz.

12 I thank you all for coming today and being able to
13 present and discuss this very important topic with us.

14 Thank you all for your service to this country.

15 With that, we are adjourned.

16 [Whereupon, at 3:25 p.m., the hearing was adjourned.]

17

18

19

20

21

22

23

24

25

**DEPARTMENT OF THE AIR FORCE
PRESENTATION TO THE SUBCOMMITTEE ON STRATEGIC FORCES
UNITED STATES SENATE**

SUBJECT: MILITARY SPACE POLICY

**STATEMENT OF: THE HONORABLE HEATHER A. WILSON
SECRETARY OF THE AIR FORCE
GENERAL DAVID L. GOLDFEIN
CHIEF OF STAFF OF THE AIR FORCE
GENERAL JOHN W. RAYMOND
COMMANDER, US AIR FORCE SPACE COMMAND
LIEUTENANT GENERAL SAMUEL A. GREAVES
COMMANDER, SPACE AND MISSILE SYSTEMS CENTER**

17 MAY, 2017

**NOT FOR PUBLICATION UNTIL RELEASED BY
THE SUBCOMMITTEE ON STRATEGIC FORCES
UNITED STATES SENATE**

INTRODUCTION

Chairwoman Fischer, Ranking Member Donnelly, and distinguished Members of the Strategic Forces Subcommittee, thank you for the opportunity to discuss the challenges America faces in space and how the United States Air Force (USAF) will meet those challenges.

SPACE WILL BE CONTESTED ... IT IS NOW WARFIGHTING DOMAIN

For decades the United States has enjoyed unimpeded freedom of action in space. This benign environment allowed us to operate satellites for intelligence collection, missile warning, weather monitoring, communications, and precision positioning, navigation, and timing in support of all military operations for all of the services, without thinking about how to protect these systems. That environment no longer exists. Space will be contested in any conflict. Our potential adversaries understand the advantage we derive from space and view our reliance on space as a vulnerability they can exploit. Near-peer competitors will offset any U.S. military advantage derived from our space systems and continue to pursue capabilities to degrade or destroy them.

Clearly, freedom to operate in space is not guaranteed. In fact, space is now a warfighting domain, similar to the more familiar air, land, and maritime domains our men and women are fighting in today. We must ensure the reliability of our current systems and we must modernize. Our modernization will focus on our ability to deter potential adversaries, and to fight in a contested, degraded, and operationally limited environment should deterrence fail.

SPACE SUPERIORITY

Maintaining Space Superiority (freedom from attack and the freedom to maneuver and attack) is a core USAF mission. It is not just operationally important, it is also a strategic imperative for protecting U.S. and allied capabilities throughout a crisis or conflict.

The Air Force is the lead service for space. Our space systems, including our ground elements, could be the first system attacked in a high-end fight. We are committed to gaining a full understanding of space operations in a contested environment. We have dedicated time and resources to ensure our satellites have the proper mission assurance in order to survive and be available for any operational mission conducted by the Department of Defense or the Intelligence Community. Our adversaries understand that orbits can be changed, sensors can be blinded, and data can be corrupted. Space systems allow U.S. global operations to be executed with precision on a daily, worldwide basis, with reduced resources for our joint partners, allowing them to deploy fewer troops, lower casualties on the battle front, and decrease collateral damage. Space Superiority empowers both our forces and those of our allies to win faster.

U.S. GOVERNMENT ACCOUNTABILITY OFFICE (GAO) 2016 REPORT

In July of 2016, the U.S. GAO released a report, “*DEFENSE SPACE ACQUISITIONS: Too Early to Determine If Recent Changes Will Resolve Persistent Fragmentation in Management and Oversight*” (GAO Code 100289). In response, the Fiscal Year 2017 National Defense Authorization Act (FY17 NDAA) directed the Secretary of Defense and the Office of Management and Budget to provide

recommendations by June 23, 2017 on how to strengthen space organization and management.

To accomplish this, the Department of Defense (DoD) initiated a review of governance, strategy, budgeting, organization, concepts of operation (CONOPS) and acquisitions for space. The results of Air Force efforts thus far, as well as DoD-wide governance recommendations, will be reported to Congress later this summer.

USAF ORGANIZATION, POLICY, AND STRATEGY

1. Sharpen Warfighting Strategy and Policy Development.

The space enterprise is no longer simply an “enabler and force enhancer”... it is an *essential military capability* and a key component of joint warfare. When coupled with the rapidity and seriousness of the threat, we’re faced with gaps in U.S. space capabilities, as well as gaps in strategy and space policy.

While the Air Force has made progress on mission assurance and resilient capabilities in operations, current policy does not fully address deterrence and requirements for action in the 21st century. The DoD must also continue to develop a 21st century deterrence strategy which clearly addresses the recklessness of a war extending to space, while ensuring our space enterprise is postured to successfully fight and win, should deterrence fail. Space strategy and policy must be agile, able to establish and foster a joint, combined, and multi-domain warfighting construct, and adapt to meet Combatant Commander integrated priorities.

The Air Force must be able to pursue, adapt, and evolve strategy and policy to ensure unique technologies, innovative exploitation techniques, and diverse applications afford a strategic advantage in space. The proper authorities must be

appropriately placed in the hands of space enterprise commanders and officials. Those authorities must be pushed as far down as possible to ensure timely execution aligned with commander's intent. In the face of continuously adapting adversaries, evolving threats, and increased requirements for operational agility, space strategy and policy must guide decisive action to preserve the operational environment, and promote the responsible and safe use of space.

2. Strengthen CONOPS and Requirements Development.

Space is no longer a sanctuary. Most on-orbit capabilities are now vulnerable to our most challenging potential adversaries. The Air Force must prepare to survive and fight in space so that other joint forces can deploy and achieve their objectives within a complex and dynamic battlespace.

A contested space domain is a relatively new and dynamic problem set, and the USAF is updating its warfighting construct for the space joint warfighting domain to ensure freedom of action, and freedom from attack, against the spectrum of threats that range from near-peer adversaries to individual actors. The space mission force, who operate space systems 24/7/365, are training with a warfighting mindset to effectively "fight" against threats to their systems in a conflict that extends to space. This enhanced space warfighting syllabus strengthens CONOPs that define how the space enterprise will operate through all phases of conflict. It also identifies and prioritizes needs and capabilities required by joint commanders,

While there are obvious differences due to the physics of the domain, space warfighting is consistent with operations in the air—for which the Air Force has well-developed command and control and operational doctrine. Like other warfighting

domains, space effects span the globe and require centralized control and decentralized execution. Thwarting the enemy's objectives is best accomplished if actions are taken well in advance of the end-game, elevating the need for integrated courses of action in all domains. Accordingly, the Air Force is moving towards a Multi-Domain Command and Control approach that accelerates decision-making across all warfighting domains in ways that will overwhelm the adversary.

The DoD, in concert with the joint community, is also strengthening concepts of operation by developing Joint Counter-Space doctrine and publishing guidance in Joint Publications, such as Joint Pub 3-14 *Space Operations*. In addition, these CONOPS will drive future systems requirements. The Joint Staff has agreed with the Air Force's proposal to improve development of joint space requirements by adding full time USAF manpower to the Joint Staff dedicated to developing joint space requirements in coordination with U.S. Strategic Command (USSTRATCOM) and Air Force Space Command (AFSPC). The Space Requirements Integration Initiative (SRII), under the Joint Staff Deputy Director of Requirements (JS/DDR), will provide early insight into Air Force space requirements development and Air Force and Joint staffing processes. The effort will achieve Initial Operating Capability this month. In doing so, the joint space community will assist in developing and streamlining space requirements and reduce overall management time. This will ensure the DoD is able to: coordinate and integrate all space-related capability requirements; ensure requirements are identified and documented properly and to avoid the "re-litigation" of previously validated requirements; and institute the interactions with other portfolio management processes, such as the Capability Gap Assessment, Program and

Budget Review, and Capability Portfolio Management Review.

3. Accelerate Acquisition to Stay Ahead of Adversaries.

In order to align space acquisition authorities with Department roles and responsibilities, the Air Force is, first and foremost, taking action to regain Milestone Decision Authority (MDA) on multiple major space acquisition programs. These actions include the February 27, 2017 MDA reversion request and the MDA delegation requests to the Office of the Secretary of Defense. The intent is to implement and comply with Section 825 of the Fiscal Year 2016 National Defense Authorization Act (FY16 NDAA).

Most authorities essential to space acquisition improvement and success exist today, and the Air Force need only use these authorities to streamline current acquisition execution. For instance, the rapid acquisition authorities granted to the Operationally Responsive Space (ORS) program and the Air Force Rapid Capabilities Office (AFRCO) already allow execution of rapid prototyping and fielding of residual operational capability. Those authorities are supported by DoD instructions and overarching acquisition regulations that provide clear direction on alternative acquisition models, tailoring, and how to leverage rapid acquisition approaches. The USAF will exercise these authorities to the fullest extent possible, create strategies that remove potential obstacles and adapt current practices, while crafting new and improved approaches within these authorities. We must take immediate action to change the culture in our acquisition organizations to focus on speed, innovation, and risk acceptance.

4. Strengthen Joint Warfighting Organizations.

Today, every joint operation is enhanced with the integration of space capabilities. To succeed in the maritime, ground, and air domains to the degree warfighters have become accustomed, the DoD must be able to leverage the space domain similarly, which means effectively protecting and defending space capabilities for the joint fight. While current and potential enemies continue to develop space capabilities of their own, as well as systems to attack, degrade, and defeat allied space systems, the DoD must ensure our space systems and space forces are prepared to preserve the enormous investment in the space domain. Therefore, the DoD must begin shifting its organizational and training structures to normalize warfighting concepts for the space domain.

In alignment with Congressional direction to have a senior space coordination official, in accordance with H.R. 1745, Section 1602, the Secretary of Defense designated the Secretary of the Air Force to serve as Principal DoD Space Advisor (PDSA). The PDSA provides oversight of policy, resources, personnel and acquisitions and technology related to the DoD space enterprise. The PDSA also integrates the space control expertise and perspectives of appropriate organizational entities of the Office of the Secretary of Defense, the Joint Staff, the military departments, the Defense Agencies, and the Combatant Commands. The PDSA is also responsible for recommendations to the Secretary of Defense and Deputy Secretary of Defense to monitor and oversee the performance of the entire DoD space portfolio and provides cogent and analytically supported programmatic recommendations to DoD leadership. Finally, the PDSA advises on space issues

including policy and strategy formulation, international engagement, industrial base support and commercial partnerships. The PDSA construct is under review as part of the DoD response to the FY17 NDAA language on space governance. To better mitigate the threat to our space enterprise, the USAF is evolving the processes used to program, budget, develop, acquire, and field space systems in order to organize, train, and equip our forces to be successful in a contested domain, defend systems from adversary action, and to ensure space missions throughout the spectrum of conflict.

Another key aspect of this normalization of the space domain is the requirement to institutionalize the mechanisms for training and equipping a combat capable force. USAF best practices learned from operating in the air domain can serve as a basis for developing corresponding mechanisms for addressing threats in space. These include understanding the capabilities, limitations, and vulnerabilities of effective weapon systems, operational testing and tactics development for those systems, basic qualification training, and advanced training for space crews. The, Space Mission Force (SMF) construct, recently implemented by AFSPC, affords space operators the opportunity to receive advanced training. It establishes a deployment period for space crews to perform Combatant Command missions, followed by a reconstitution period to focus on advanced training requirements.

Expert training must be conducted at the unit level and also at the aggregate space domain level to ensure the force is prepared to fight their weapon systems in a threat environment. To date, by design, space operators have been trained primarily in the basic operation of space systems for the purpose of delivering space effects to

warfighters from a benign space environment. As a result, AFSPC has begun focusing on the threats in order to develop better understanding of how an adversary will operate to employ those capabilities. Leveraging the best practices of the air domain, space training must evolve to include robust development of tactics, techniques, and procedures (TTPs) for overcoming space threats, and include the entire joint team. The development of these TTPs will require the fielding of an Operational Training Infrastructure (OTI) for space systems.

HQ USAF DEPUTY CHIEF OF STAFF, SPACE OPERATIONS (AF/A11) & AFSPC

The Air Force Chief of Staff is the Joint Chief responsible for presenting space capabilities for the Joint Force and maintaining control of operational requirements. A key initiative in our efforts to strengthen our space organization is the stand up of a 3-star Deputy Chief of Staff for Space Operations position (AF/A11), who is directly accountable to the Secretary and Chief of Staff of the Air force. AF/A11 will actively posture our senior USAF leaders with the appropriate expertise to treat space as a warfighting domain and increase the speed of headquarters' decision-making. AF/A11 will also streamline operations and requirements decision making through the CSAF and the Joint Staff (vice OSD) to meet the demands of a warfighting domain.

Furthermore, as a service component to USSTRATCOM, AFSPC provides the Combatant Commander with the preponderance of its space power. In light of this, and in parallel with the stand-up of AF/A11, AFSPC/CC has been elevated to the Joint Force Component Commander for Space (JFCC Space) ... in essence a 4-star Air Force commander focused on the joint fight. Additionally, the Joint Interagency Space Operations Center (JICSpOC) has transitioned to a National Space Defense Center

(NSDC), effectively transforming the focus, resources, and energy from one of experimentation to warfighting operations.

NEAR TERM JOINT WARFIGHTING IMPERATIVES

The National Space Defense Center was placed under USSTRATCOM to better reflect its purpose, which is to defend and secure the space domain. Responsibility for the NSDC officially transferred from AFSPC and the Space Security and Defense Program (SSDP) to Joint Functional Component Command for Space under USSTRATCOM in fiscal year 2016. Funding through FY 2016 was accomplished using the unfunded requirements process, and in FY 2017 the NSDC was included in the FY 2017's President's Budget. This organization entered its initial phase of operations in November 2016 following a series of experiments and exercises designed to explore, develop, and refine operational concepts and tactics, techniques, and procedures. In strong partnership with the Intelligence Community, the team has made great strides for the nation. The USAF has shouldered the preponderance of the resource responsibility in establishing the NSDC by freeing up facility space at Schriever Air Force Base, using USAF dollars and manpower to outfit those spaces, and providing the leadership that allowed for the execution of the experimentation phase. Furthering our commitment, we are now expanding the existing NSDC floor space, upgrading the underlying infrastructure, outfitting the information systems, providing a large portion of the manpower to establish an around-the-clock operational capability that will play a key role in deterring any adversary that might consider extending a conflict to space, and to ensure critical space capabilities for our forces should deterrence fail.

CONCLUSION

Space is no longer the sole province of world powers or a sanctuary for the U.S. It is a domain where barriers to access are rapidly disappearing. In the last decade, space has become more competitive, more congested and more contested, with potential adversary capabilities growing in number and sophistication.

In response to increasing challenges in the space domain, the Air Force is fully committed to increasing resilience and deterrence as we retain our competitive advantage over our strategic competitors. We have made tremendous advancements towards unifying efforts for efficiency as a resilient and responsive leader in the space domain—but admittedly, much work remains. In 2017, your Air Force will finalize our family of space warfighting Concepts of Operations, identify our capability gaps, continue our posture transition to increase deterrence, and ensure our force can fight and win a conflict that either starts or extends into space, and strengthen our support to Combatant Commanders. We are cognizant that the decisive advantage that space brings to military operations has been the deciding factor in every military operation conducted in recent years. Your Air Force remains committed to leading the space enterprise to ensure our joint warfighters can fight and win in every domain.

We thank the Subcommittee members for their support and look forward to our continued partnership to provide resilient, capable, and affordable space capabilities for the joint force and the nation.



Testimony

Before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

For Release on Delivery
Expected at 2:00 p.m. ET
Wednesday, May 17, 2017

SPACE ACQUISITIONS

DOD Continues to Face Challenges of Delayed Delivery of Critical Space Capabilities and Fragmented Leadership

Statement of Cristina T. Chaplain, Director,
Acquisition and Sourcing Management

GAO Highlights

Highlights of [GAO-17-619T](#), a testimony before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

Why GAO Did This Study

DOD's space systems provide critical capabilities that support military and other government operations and can take a long time to develop, produce, and launch. These systems can also be expensive to acquire and field, amounting to billions of dollars each year. Given the time and resource demands of DOD's space systems and the need to ensure taxpayer dollars are used effectively, especially in light of today's constrained government budget environment, it is essential that DOD manage system acquisitions carefully and avoid repeating past problems.

This statement focuses on (1) the current status and cost of major DOD space system acquisitions, (2) GPS, which is the only large DOD satellite program with systems currently in the development cycle, and (3) leadership for space acquisitions.

This statement highlights the results of GAO's work on space acquisitions over the past 8 years and presents preliminary observations from ongoing work on the Global Positioning System. For the ongoing work, GAO analyzed program documents and interviewed DOD and contractor officials.

What GAO Recommends

Past GAO reports have generally recommended that DOD adopt acquisition best practices to help ensure cost and schedule goals are met. DOD has generally agreed and taken some actions to address space acquisition problems; however, additional actions are still needed.

View [GAO-17-619T](#). For more information, contact Cristina Chaplain at (202) 512-4841 or chaplainc@gao.gov.

May 17, 2017

SPACE ACQUISITIONS

DOD Continues to Face Challenges of Delayed Delivery of Critical Space Capabilities and Fragmented Leadership

What GAO Found

Many major Department of Defense (DOD) space programs GAO reviewed have experienced cost and schedule increases. For example, costs for the Advanced Extremely High Frequency satellite program grew 118 percent and its first satellite was launched more than 3.5 years late. Costs for the Space Based Infrared System grew nearly 300 percent and its scheduled launch was delayed roughly 9 years. Both programs are now in the production phase during which fewer technical problems tend to surface. Satellite ground systems have also been challenged by cost and schedule growth. In fact, ground system delays have been so lengthy that satellites sometimes spend years in orbit before key capabilities can be fully utilized. The table below provides some examples of program status.

<p>Advanced Extremely High Frequency</p> <p>\$6.9 billion Original cost</p> <p>\$15.0 billion Current cost</p>	<p>Schedule: The first, second, and third launches occurred in August 2010, May 2012, and September 2013, respectively. The fourth satellite, currently in production, is scheduled to be launched in October 2017.</p>
<p>Global Positioning System Next Generation Operational Control System</p> <p>\$3.6 billion Original cost</p> <p>\$5.5 billion Current cost</p>	<p>Schedule: Because of poor program cost and schedule performance, the Air Force expects to establish new cost and schedule baselines for the program by June 2017.</p>
<p>Space Based Infrared System</p> <p>\$5.0 billion Original cost</p> <p>\$19.2 billion Current cost</p>	<p>Schedule: The third geosynchronous Earth orbit satellite launched in January 2017. The fourth satellite is to launch in November 2017. The fifth and sixth satellites are to be available for launch in 2021 and 2022.</p>

Source: GAO analysis of Department of Defense information. | GAO-17-619T

GAO's preliminary results from an ongoing review of the Global Positioning System (GPS) show that the satellites, ground systems, and user equipment continue to be on a high-risk path. The launch of the first GPS satellite has been delayed almost 4 years because of technical problems. Additionally, development challenges for the satellite's ground system have resulted in delays so significant that the Air Force has started two other ground system efforts as workarounds to mitigate risk of delayed GPS capability. Additionally, it remains unclear how DOD will overcome a number of challenges that create high risk to the timely fielding of upgraded GPS user equipment for the warfighter.

GAO has reported over the years that DOD's culture has generally been resistant to changes in space acquisition approaches and that fragmented responsibilities have made it difficult to coordinate and deliver interdependent systems. Although some changes in leadership have been made, such as providing the Secretary of the Air Force with additional space responsibilities, it is too early to gauge whether these changes are sufficient to provide leadership for balancing needs against wants, ensure coordination among the many organizations involved with space, and ensure that resources are directed where they are most needed. Given the long-standing fragmentation in space leadership and consequent challenges DOD faces in synchronizing its extensive space enterprise, discussions with DOD officials and experts indicate further-reaching changes, ranging from establishing a space acquisition agency to instituting a new military department for space, may deserve a closer look.

Chairman Fischer, Ranking Member Donnelly, and Members of the Subcommittee:

I am pleased to have the opportunity to comment on the Department of Defense's (DOD) space system acquisitions. DOD's space systems provide critical capabilities that support military and other government operations and can take a long time to develop, produce, and launch. These systems can also be expensive to acquire and field, amounting to billions of dollars each year. Given the time and resource demands of DOD's space systems and the need to ensure taxpayer dollars are used effectively, especially in light of today's constrained government budget environment, it is essential that DOD manage system acquisitions carefully and avoid repeating past problems.

My statement will focus on (1) the current status and cost of major DOD space system acquisitions, (2) the Global Positioning System, which is the only large DOD satellite program with systems currently in the development cycle, and (3) leadership for space acquisitions.

This statement is based on GAO reports on space programs issued over the past 8 years and recent work performed in support of our annual weapon systems assessments. It is also based on space-related work in support of our 2017 annual report on duplication, overlap, and fragmentation across the federal government; and GAO updates on cost increases, investment trends, and improvements in the last year. More information on our objectives, scope, and methodology is available in our related products.¹

In addition, the statement includes preliminary observations from our ongoing work on the Global Positioning System (GPS). For this work, we analyzed Air Force GPS quarterly reports, program acquisition baselines, integrated master schedules, acquisition strategies, software development plans, test plans, and other documents for GPS III, Next Generation Operational Control System (OCX), Military GPS User Equipment (MGUE), Contingency Operations (COPs), and M-code Early Use (MCEU) programs. We compared program acquisition strategies against GAO's criteria for best practices in systems development. We also interviewed officials from the GPS III, OCX, MGUE, and COPs programs; the prime contractors for these four programs; the Defense

¹See list of related GAO products at the end of this statement.

Contract Management Agency monitoring the programs; and where applicable officials from the Office of Cost Assessment and Program Evaluation; the Office of the Director, Operational Test and Evaluation; each of the military services involved with the planning and procurement of the MGUE program; and Air Force Space Command. DOD provided technical comments on the preliminary findings contained in this statement, which were incorporated as appropriate.

We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. The ongoing work on which this statement is, in part, based is being conducted in accordance with generally accepted government auditing standards.

Status of Major Defense Space Programs

DOD space systems support and provide a wide range of capabilities to a large number of users, including the military services, the intelligence community, civil agencies, and others. These capabilities include positioning, navigation, and timing; meteorology; missile warning; and secure communications, among others. Space systems can take a long time to develop and often consist of multiple components, including satellites, ground control stations, terminals, and user equipment. DOD satellite systems are also expensive to acquire. Unit costs for current DOD satellites can range from \$500 million to over \$3 billion. The ground systems can cost as much as \$5.5 billion and the cost to launch a satellite can climb to well over \$100 million.

Many major DOD space programs have experienced significant cost and schedule increases. For instance, program costs for the Advanced Extremely High Frequency (AEHF) satellite program, a protected satellite communications system, had grown 118 percent since its first estimate as of our March 2017 review and its first satellite was launched over 3.5 years late.² For the Space Based Infrared System (SBIRS), a missile warning satellite program, costs grew nearly 300 percent and the launch

²GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, GAO-17-333SP (Washington, D.C.: Mar. 30, 2017).

of the first satellite was delayed roughly 9 years. Both programs are now in the production phase where fewer problems tend to surface, and where there is typically less risk of cost and schedule growth. The only major satellite program with systems in the development phase is the Global Positioning System (GPS), which has seen an almost 4-year delay and unit cost growth of 9 percent due to technical issues.

Cost and schedule growth has also been a challenge for satellites and their ground systems. In fact, delays with ground systems have been so lengthy, that satellites sometimes spend years in orbit before key capabilities can be fully exploited. For example, as discussed below, the command and control system for GPS III satellites, known as the Next Generation Operational Control System, or OCX, is at least 5 years behind schedule.³ Because of these delays, the Air Force has had to start two separate back-up efforts to ensure the continuity of GPS capabilities and to make anti-jamming capabilities available via Military Code, or M-code, until OCX is delivered. Additionally, over 90 percent of the capabilities to be provided by Mobile User Objective System communications satellites—the first of which launched in 2012 and with five satellites now in orbit—are being underutilized because of problems with integrating the space, ground, and terminal segments and delays in fielding compatible user terminals. Figure 1 provides more details on the current status of DOD's major space programs.

³GAO-17-333SP.

Figure 1: Status of Major Department of Defense (DOD) Space Acquisitions

<p>Advanced Extremely High Frequency (AEHF) (satellite communications)</p> <p>Mission: AEHF satellites will replenish the existing Milstar system with higher-capacity, survivable, jam-resistant, worldwide, secure communication capabilities for strategic and tactical warfighters.</p>	<p>Acquisition phase:</p>  Production	<p>Original total program cost: \$6.9 billion</p> <p>Current total program cost: \$15.0 billion</p> <p>Original quantity: 5 Current quantity: 6</p>	<p>Schedule: The first, second, and third launches, occurred in August 2010, May 2012, and September 2013, respectively. The fourth satellite, currently in production, is scheduled to be launched in October 2017.</p>
<p>Enhanced Polar System (EPS) (satellite communications)</p> <p>Mission: EPS is expected to provide next-generation protected extremely high frequency satellite communications in the polar region.</p>	<p>Acquisition phase:</p>  Development  Production	<p>Original total program cost: \$1.4 billion</p> <p>Current total program cost: \$1.4 billion</p> <p>Original quantity: 2 Current quantity: 2</p>	<p>Schedule: The first EPS payload became available for on-orbit testing in March 2015. The Control and Planning Segment (CAPS) completed software development in October 2015 and is proceeding with testing. However, due to a delay in implementing the cybersecurity baseline, CAPS delivery has also been delayed. Inter-segment testing, which will test all elements together, was expected to be completed in August 2016, but will now be delayed until after June 2017 because of the CAPS delivery delay.</p>
<p>Evolved Expendable Launch Vehicle (EELV) (launch)</p> <p>Mission: EELV program provides critical spacelift support for DOD, national security, and other government missions using three families of launch vehicles—Atlas V, Delta IV, and Falcon 9.</p>	<p>Acquisition phase:</p>  Production	<p>Original total program cost: \$18.8 billion</p> <p>Current total program cost: \$59.6 billion</p> <p>Original quantity: 181 Current quantity: 161</p>	<p>Schedule: In March 2017, the Air Force awarded a competitively sourced contract to SpaceX to launch the third GPS III satellite in February 2019, and has multiple contracts, both competitive and sole-source, depending on launch requirements, to be awarded in the next few years. EELV is working with industry partners to certify additional launch systems for national security space missions.</p>
<p>Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) Command Post Terminals (CPT) (satellite communications terminals)</p> <p>Mission: FAB-T is expected to provide a family of satellite communications terminals for airborne and ground-based users to replace many program-unique terminals. The subprogram is expected to provide voice and data communications over military satellite networks for nuclear and conventional forces through ground command posts and E-6 and E-4 aircraft. Another subprogram, expected to provide force element capabilities on B-2, B-52, and RC-135 aircraft, is undergoing analysis and not yet funded.</p>	<p>Acquisition phase:</p>  Production	<p>Original total program cost: \$1.7 billion</p> <p>Current total program cost: \$1.8 billion</p> <p>Original quantity: 95 Current quantity: 109</p>	<p>Schedule: The program began production of terminals in September 2015 and first deliveries are expected in spring 2017. The program expects to meet initial operational capability in December 2019.</p>

<p>Global Positioning System (GPS) III (positioning, navigation, and timing)</p> <p>Mission: GPS III is to supplement and eventually replace a constellation of multiple generations of GPS satellites that provide global positioning, navigation, and timing capability to both military and civil users worldwide.</p>	<p>Acquisition phase:</p>  Production	<p>Original total program cost: \$4.3 billion</p> <p>Current total program cost: \$5.8 billion</p> <p>Original quantity: 8 Current quantity: 10</p>	<p>Schedule: The first satellite was originally expected to be available for launch in April 2014; however, due to technical issues this date has been further delayed, and the Air Force has not set a new available for launch date, pending completion of a review of the satellite's propulsion system.</p>
<p>Global Positioning System Next Generation Operational Control System (GPS OCX) (command and control system for GPS III satellites)</p> <p>Mission: GPS OCX is to replace the current ground control system in order to operate current and new GPS III satellites.</p>	<p>Acquisition phase:</p>  Development	<p>Original total program cost: \$3.6 billion</p> <p>Current total program cost: \$5.5 billion</p> <p>Original quantity: 1 Current quantity: 1</p>	<p>Schedule: On June 30, 2016, DOD reached a critical Nunn-McCurdy breach. As part of the Nunn-McCurdy certification, DOD rescinded the program's Milestone B approval and program baselines. The Air Force is to submit a new request for Milestone B approval by June 2017.</p>
<p>Joint Space Operations Center Mission System (JMS), Increment 2 (command and control system for space)</p> <p>Mission: The JMS program is to provide applications, net-centric services and databases, and dedicated hardware to improve space situational awareness and command and control of space.</p>	<p>Acquisition phase:</p>  Development  Integration  Test	<p>Original total program cost: \$320.0 million</p> <p>Current total program cost: \$469.9 million</p> <p>Original quantity: 1 Current quantity: 1</p>	<p>Schedule: The JMS program plans to deliver capability in 2 increments. Increment 1 was completed and deemed fully deployed in April 2013. Increment 2—which is concurrently conducting development and testing—reported cost and schedule breaches last year resulting in a program restructure that deferred some capabilities. The substantial schedule delays and development cost increases are due to an aggressive schedule with significant concurrency, funding and manpower issues, development and testing challenges, and contract management. The program has delayed the full deployment decision by almost 3 years, to between May 2019 and November 2019.</p>
<p>Military GPS User Equipment (MGUE), Increment 1 (GPS receivers)</p> <p>Mission: The MGUE program is expected to develop modernized GPS receivers to provide users with enhanced positioning, navigation, and timing capabilities, while protecting the system from such threats as jamming.</p>	<p>Acquisition phase:</p>  Development	<p>Original total program cost: NA</p> <p>Current total program cost: \$1.1 billion</p> <p>Original quantity: NA Current quantity: NA</p>	<p>Schedule: In January 2017, the program received Milestone B approval. Operational testing on the four lead platforms is planned for completion between fiscal year 2019 and fiscal year 2020.</p>
<p>Mobile User Objective System (MUOS) (satellite communications)</p> <p>Mission: MUOS is expected to provide a worldwide, multiservice population of mobile and fixed-site terminal users with increased narrowband communications capacity and improved availability for small terminal users.</p>	<p>Acquisition phase:</p>  Production	<p>Original total program cost: \$7.3 billion</p> <p>Current total program cost: \$7.4 billion</p> <p>Original quantity: 6 Current quantity: 6</p>	<p>Schedule: MUOS has launched five satellites. The fourth satellite became operational in August 2016. The fifth satellite, an on-orbit spare, is undergoing acceptance testing, which is planned for completion in September 2017. Full operational capability, previously planned for fiscal year 2017, has been delayed to fiscal year 2020 primarily due to delays in successful operational testing of the new MUOS waveform.</p>

Space Based Infrared System (SBIRS)

(missile warning, infrared intelligence, surveillance, and reconnaissance)

Mission: SBIRS is being developed to replace the Defense Support Program and perform a range of missile warning, missile defense, technical intelligence, and battlespace awareness missions. SBIRS is to consist of four GEO satellites, two sensors on host satellites in highly elliptical orbit, two replenishment satellites and sensors, and fixed and mobile ground stations.

Acquisition phase:



Production

Original total program cost:

\$5.0 billion

Current total program cost:

\$19.2 billion

Original quantity: 5

Current quantity: 6

Schedule: The third geosynchronous Earth orbit (GEO) satellite launched in January 2017. The fourth satellite is to launch in November 2017. The fifth and sixth satellites are to be available for launch in 2021 and 2022.

Space Fence Ground-Based Radar System Increment 1

(space object detection)

Mission: Space Fence is to use a radar to detect and track objects in low and medium Earth orbit in support of DOD's space surveillance network.

Acquisition phase:



Development



Production

Original total program cost:

\$1.6 billion

Current total program cost:

\$1.6 billion

Original quantity: 1

Current quantity: 1

Schedule: The program began testing its design on an integrated testbed prototype in early 2016. The program's software development was completed in October 2016.

Wideband Global SATCOM (WGS)

(satellite communications)

Mission: WGS provides worldwide communications services to U.S. warfighters, allies, and other special users.

Acquisition phase:



Production

Original total program cost:

\$1.3 billion

Current total program cost:

\$4.3 billion

Original quantity: 3

Current quantity: 10 (includes 2 satellites funded by international partners)

Schedule: WGS reached full operational capability in May 2014, although it was initially expected in December 2005. Nine satellites are on orbit. Follow-on satellite 8 launched in December 2016, and 9 launched in March 2017. Satellite 10 is anticipated for launch in fiscal year 2018.

Source: GAO analysis of Department of Defense information. | GAO-17-619T

Note: Dollar figures are rounded to the nearest tenth and reported in fiscal year 2017 dollars based on the programs' original and most recent Selected Acquisition Reports or program office updates.

Cost and schedule growth in DOD's space programs is sometimes driven by the inherent risks associated with developing complex space technology; however, over the past 8 years we have identified a number of other management and oversight problems that can worsen the situation. These include making overly optimistic cost and schedule estimates, pushing programs forward without sufficient knowledge about technology and design, and experiencing problems in overseeing and managing contractors, among others. Some of DOD's programs in operation, such as SBIRS, were also exceedingly ambitious, which in turn increased technology, design, and engineering risks. While satellite programs have provided users with important and useful capabilities, their cost growth has significantly limited the department's buying power—at a time when more resources may be needed to protect space systems and to recapitalize the space portfolio.

Our work—which is largely based on best practices in the commercial sector—has recommended numerous actions that can be taken to address the problems we have identified.

As shown in table 1, our previous work on weapons acquisitions in general, and space programs in particular, identified best practices for developing complex systems, such as developing more realistic estimates and ensuring technologies can work as intended before moving them into more complicated phases of the acquisition process.

Table 1: Summary of Best Practices GAO Has Identified to Address Space and Weapon Acquisition Problems

Before undertaking new programs
Prioritize investments so that projects can be fully funded and it is clear where projects stand in relation to the overall portfolio.
Follow an evolutionary path toward meeting mission needs rather than attempting to satisfy all needs in a single step.
Match requirements to resources—that is time, money, technology, and people—before undertaking new development efforts.
Research and define requirements before starting programs and limit changes after they are started.
Ensure that cost estimates are complete, accurate, and updated regularly. Commit to fully fund projects before they begin.
Ensure that critical technologies are proven to work as intended before programs begin. Assign more ambitious technology development efforts to research departments until they are ready to be added to future generations (or increments) of a product.
Use systems engineering to close gaps between resources and requirements before launching the development process.
During program development
Use quantifiable data and demonstrable knowledge to make decisions to proceed, covering critical facets of the program such as cost, schedule, technology readiness, design readiness, production readiness, and relationships with suppliers.
Do not allow development to proceed until certain thresholds are met—for example, a high proportion of engineering drawings completed or production processes under statistical control.
Empower program managers to make decisions on the direction of the program and to resolve problems and implement solutions.
Hold program managers accountable for their choices.
Require program managers to stay with a project to its end.
Encourage program managers to share bad news, and encourage collaboration and communication.
Hold suppliers accountable for delivering high-quality parts for their products through activities including regular supplier audits and performance evaluations of quality and delivery.

Source: GAO. | GAO-17-619T

In 2016, we testified that DOD had implemented actions to address space acquisition problems, and most of its major space programs had transitioned into the production phase where fewer problems tend to occur.⁴ These range from improvements to cost estimating practices and

⁴GAO, *Space Acquisitions: Challenges Facing DOD as it Changes Approaches to Space Acquisitions*, [GAO-16-471T](#) (Washington, D.C.: Mar. 9, 2016).

development testing to improvements in oversight and leadership, such as the November 2010 addition of the Defense Space Council, designed to bring together senior leaders on important issues facing space. DOD had also started fewer new programs and even those were less ambitious than prior efforts, which helped to reduce the risk of cost and schedule growth. Given the problems we have identified in the GPS program, however, it is clear that more needs to be done to improve the management of space acquisitions.

Ongoing Work Shows GPS Acquisitions Are Still High Risk

In 2015, we reported that the Air Force was experiencing significant difficulties developing the GPS ground system, OCX, and consistently overstated its progress to the Office of the Secretary of Defense (OSD). At the time of our 2015 work, the program needed \$1.1 billion and 4 years more than planned to deliver OCX due to poor acquisition decisions and a slow recognition of development problems. The Air Force began OCX development in 2010 prior to completing preliminary development reviews in contrast with best acquisition practices. It accelerated OCX development in 2012 to meet optimistic GPS III satellite launch timeframes even as OCX development problems and costs grew, and then paused development in 2013 to address problems and resolve what it believed were root causes. After a rebaseline to the schedule in late 2015, further evidence that OCX still had unaddressed problems surfaced in 2016 when the Air Force informed Congress the OCX program had breached a Nunn-McCurdy unit cost threshold.⁵ We are continuing to monitor OCX's progress and challenges to determine if it is on the right track as part of our ongoing GPS review.

In 2015, we also looked at the Air Force's military GPS user equipment (MGUE) program to develop for the military services GPS receiver cards capable of receiving the M-code signal. M-code is a stronger and

⁵Section 2433 of title 10 of the United States Code, commonly referred to as Nunn-McCurdy, requires DOD to notify Congress whenever a major defense acquisition program's unit cost experiences cost growth that exceeds certain thresholds. This is commonly referred to as a Nunn-McCurdy breach. Significant breaches occur when the program acquisition unit cost or procurement unit cost increases by at least 15 percent over the current baseline estimate or at least 30 percent over the original estimate. For critical breaches, when these unit costs increase at least 25 percent over the current baseline estimate or at least 50 percent over the original, DOD is required to take additional steps, including conducting an in-depth review of the program. Programs with critical breaches must be terminated unless the Secretary of Defense certifies to certain facts related to the programs and takes other actions, including restructuring the programs. 10 U.S.C. § 2433a.

encrypted, military-specific GPS signal which can help users operate in jamming environments. We found that the Air Force had revised MGUE's acquisition strategy several times. Even so, the military services were unlikely to have sufficient knowledge to make informed procurement decisions starting in fiscal year 2018, because operational testing that provides valuable information about MGUE performance would not be complete until fiscal year 2019.

On a positive note, at the time of our 2015 review, the current GPS constellation was proving to be much more reliable than the Air Force predicted when we last reported on it in 2010, giving the Air Force some relief in dealing with the delays with new GPS satellites. However, we found that OCX contingency plans were still necessary for sustaining the GPS constellation. We also found that initial M-code broadcast capability would not be available until the current ground system, the Operational Control System, or OCS, was modified in late-2019 at the earliest to make up for OCX delays. Full M-code capability—which includes both the ability to broadcast a signal via satellites and a ground system and user equipment to receive the signal—will take at least a decade once the services are able to deploy MGUE receivers in sufficient numbers.

Preliminary results from our ongoing review of GPS shows that the satellites, ground systems, and user equipment are all still on a high risk path; though satellite delays are still somewhat mitigated by the longer than anticipated performance of older GPS satellites. More specifically, the first GPS satellite is planned for launch in March 2018, over 3 years before OCX Block 1 is scheduled to become operational. Block 1 is needed to command and control the current and new generation of GPS satellites, bring M-code into operations, and provide enhanced cybersecurity capabilities. In light of delays with OCX, the Air Force has spawned two additional development efforts—one to ensure continuity in the ability to process GPS satellite positioning, navigation, and timing signals (known as Contingency Operations or COps) and another to help mitigate the delay in the ability to process the M-code signal (known as M-Code Early Use or MCEU). However, these efforts will have limited capabilities. Moreover, more than 11 years after launching the first M-code capable satellites, DOD has yet to deliver M-code capable MGUE receivers. DOD will not have a full M-code capability until receivers are deployed on sufficient numbers of weapons platforms and munitions to support the warfighter, yet it is following a high risk path to deliver them. Based on our preliminary results, risks specific to each GPS segment are described below.

-
-
- **Satellites:** Since our 2015 report, the satellite program has encountered technical issues that have further delayed the first launch, which is almost 4 years later than the original estimate. Issues with failed and damaged capacitors have been a recent driver for the delays to the first satellite. Capacitors are components used to store and release electrical charges. According to program officials, each satellite has over 500 capacitors of the same design that experienced failures. The program discovered that a subcontractor had not qualified the capacitors for use in the GPS satellites and in response the program conducted qualification and reliability testing. However, the reliability testing was conducted using an incorrect circuit board, invalidating the test. The capacitor design was successfully qualified in December 2016. The Air Force decided to assume the risk of capacitor failure and proceed with the first satellite as-is, fitted with capacitors mostly from the questionable lot. The program replaced the suspect capacitors in the second and third satellites, the only other satellites that had the suspect parts.
 - **OCX:** The contractor's performance over the past year suggests a 2-year extended schedule approved in 2015 is insufficient. The contractor has experienced code growth and high defect rates, and is operating under significant schedule compression and concurrency, with minimal schedule reserve to account for acquisition risk. Moreover, the contractor's current schedule estimates assume efficiencies from software engineering improvements, such as increased testing automation, that have not yet been demonstrated. These new processes have required the contractor to manage cultural changes. Additionally, the contractor almost doubled its staff to over 1,000 people to achieve the extension. According to Air Force officials, the 2-year extension will likely be extended by an additional 6 months.
 - **MGUE Receivers:** In view of the importance of M-code to warfighting, statute generally prohibits DOD from obligating or expending funds for GPS user equipment after fiscal year 2017 unless that equipment is capable of receiving military code.⁶ In February 2017, the services submitted implementation plans that identified systems they want to upgrade with M-code, but these plans do not identify full resource needs. As a result, it is still unclear when M-code capable receivers will be fielded and at what cost. Though other weapon programs would normally have a production decision scheduled by this point in the development cycle, there is no scheduled production decision for the first increment of

⁶National Defense Authorization Act for Fiscal Year 2011, Pub. L. No. 111-383, § 913, the Secretary of Defense may waive this limitation under certain circumstances, or certain exceptions may apply.

receivers and there are only tentative implementation plans as receiver cards are being verified by testing. Even after the MGUE program ends with limited operational testing on test articles on four initial weapons systems, the services may each have to conduct additional development both on those systems and any other systems. As a result of this uncertainty, the military services report that they have begun requesting waivers for the statutory requirement. In addition, in March 2016 the Army identified 25 functional gaps and technical issues that would hinder its ability to adopt MGUE technology. In September 2016, the Air Force responded with plans to address some of these functional gaps. However, Army officials are concerned that not all gaps have been addressed or will be addressed, which could impact its ability to field the receiver cards. Total development and procurement costs across all services remain unknown.

Fragmented Space Leadership Exacerbates Acquisition Problems

We have reported over the years that DOD's culture has generally been resistant to changes in space acquisition approaches and that fragmented responsibilities have made it difficult to coordinate and deliver interdependent systems. For example, in 2012 we found that although some improvements in leadership have been made, there was no single person or organization held accountable for balancing acquisition needs against wants, ensuring coordination among the many organizations involved with space systems acquisitions, and ensuring that resources are directed where they are most needed.⁷ In October 2015, DOD re-designated the Executive Agent for Space role as the Principal DOD Space Advisor (PDSA). In 2016 we determined it was too early to gauge whether the PDSA has sufficient authority to consolidate space leadership responsibilities.⁸

Some examples of leadership and coordination issues we have identified in our prior and ongoing work include:

- In a February 2012 report, we found that the National Polar-orbiting Operational Environmental Satellite System (NPOESS), which attempted to converge defense and civil environmental monitoring requirements and

⁷GAO, *2012 Annual Report: Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings, and Enhance Revenue*, [GAO-12-342SP](#) (Washington, D.C.: Feb. 28, 2012).

⁸GAO, *Defense Space Acquisitions: Too Early to Determine if Recent Changes Will Resolve Persistent Fragmentation in Management and Oversight*, [GAO-16-592R](#) (Washington, D.C.: July 27, 2016).

avoid duplication through a tri-agency program office, was canceled in 2010, in part, because there was no single authority in charge of resolving conflicts or setting priorities.⁹

- In a March 2016 report we found that, in assessing alternatives for future weather systems, DOD consulted with a wide range of DOD stakeholders in conducting the analysis of alternatives (AOA), but it did not effectively coordinate with the National Oceanic and Atmospheric Administration (NOAA) (on a case-by-case basis, NOAA represents DOD's interests with international partners regarding space-based environmental monitoring data).¹⁰ NOAA was not involved in reviews of the AOA or regular discussions with AOA study leadership. Without NOAA's input, the AOA study determined that the likelihood a critical gap would not be filled was low, based on historical trends. As a result, DOD did not fully assess solutions for cloud characterization and theater weather imagery data needs. As of August 2016, DOD was still assessing what to do about these gaps and the Air Force recently signed a memorandum of agreement with NOAA that enables a broad range of mutually beneficial support activities.
- In our ongoing work on the Global Positioning System, Army officials have also observed that the lack of a central point of authority and accountability is hampering coordination on GPS user equipment. It is unclear who is in charge of coordinating and prioritizing fielding efforts or setting criteria for M-code waivers—be it the DOD Chief Information Officer, Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)), or the Council on Oversight of the Department of Defense Positioning, Navigation and Timing Enterprise (PNT Oversight Council). This is significant because of the risk of duplicated efforts—and rising costs— between services; and the lack of leadership influences when and if services are pushed to procure M-code user equipment and thus realize DOD's goals for anti-jamming GPS capabilities.
- In a July 2016 report, expert space officials told us that because programs experience too much bureaucracy, it can take a minimum of 3 years to develop an acquisition strategy, issue a request for proposal, conduct source selection, and award a contract.¹¹ By then, technologies

⁹[GAO-12-342SP](#).

¹⁰GAO, *Defense Weather Satellites: Analysis of Alternatives is Useful for Certain Capabilities, but Ineffective Coordination Limited Assessment of Two Critical Capabilities*, [GAO-16-252R](#) (Washington, D.C.: Mar. 10, 2016).

¹¹[GAO-16-592R](#).

and requirements can be obsolete. For example, one contractor told us that it took over a year for the Air Force to develop a request for proposal for a low-dollar, \$2 million study. While USD(AT&L) officials emphasized that DOD's acquisition policy is very tailorable and that programs can take advantage of its flexibility, Air Force officials said that this does not play out in practice. They told us that oversight entities are reluctant to waive or change steps out of fear they will be blamed later.

- In a July 2016 report, we reported that space officials believe USD(AT&L) is the only real decision-making authority for space-related topics.¹² Some senior officials report that this can have unexpected effects, such as the Under Secretary having to make broader space architecture decisions, which are larger issues that fall outside his responsibility. Officials noted that such decisions fall to the Under Secretary by default because there is no space-specific authority.¹³

In Senate Report 114-49 accompanying S.1376, a bill for the National Defense Authorization Act for Fiscal Year 2016, the Senate Armed Services Committee included a provision for GAO to review the effectiveness of the current DOD space acquisition and oversight model and to evaluate what changes, if any, could be considered to improve the governance of space system acquisitions and operations. In 2016, we found that DOD space leadership responsibilities are fragmented among a number of organizations.¹⁴ We identified approximately 60 stakeholder organizations across DOD, the Executive Office of the President, the Intelligence Community, and civilian agencies. Of these, 8 organizations have space acquisition management responsibilities; 11 have oversight responsibilities; and 6 are involved in setting requirements for defense space programs.

In October 2015, the Deputy Secretary of Defense designated the Secretary of the Air Force as the Principal DOD Space Advisor (PDSA). The PDSA, supported by an advisory body called the Defense Space Council (DSC), is responsible for promoting a unified approach to space issues, including acquisitions; overseeing the entire DOD space portfolio, including all space policies, strategies, and plans across DOD; and serving as an independent advisor on all space matters to top DOD

¹²[GAO-16-592R](#).

¹³The National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, § 901 eliminates the position of USD(AT&L). This provision is effective in February 2018.

¹⁴[GAO-16-592R](#).

officials. PDSA officials stated that the PDSA role is expected to have new responsibilities that will help it effectively consolidate space leadership. Some of these responsibilities include reviewing all service budgets for conformity with national security space policy, and giving independent assessments and recommendations to top DOD officials when there is no DSC consensus. However, because the position is relatively new, it remains to be seen whether the PDSA will be effective in unifying space leadership and authority.

The organization of space acquisitions and oversight has been studied in depth over the last 20 years; however, DOD has not made some of the significant changes to space leadership that were recommended by the four most relevant studies that we identified in our July 2016 report.¹⁵ For example, these studies made recommendations such as combining the National Reconnaissance Office (NRO) and Air Force space acquisition functions into a unified organization or establishing an Under Secretary of Defense-level official with responsibility for planning and executing national security space programs.¹⁶ Some of the acquisition problems identified in past studies and GAO reports persist, such as insufficient program manager empowerment and excessive reviews, which contribute to inefficiencies. As we reported in July 2016, officials and experts we spoke with stated that the challenges are magnified in space programs because space technologies are frequently obsolete by the time they are deployed. The officials and experts also stated that DOD space acquisitions generally take too long due to fragmented leadership, a redundant oversight bureaucracy, and difficulty coordinating among numerous stakeholders. Many officials and experts stated that no one seems to be in charge of space acquisitions and many remain skeptical that the recently designated PDSA will have sufficient decision-making authority to address these concerns. However, others—including from the PDSA—stated a strong belief that the position will be able to effectively consolidate fragmented leadership responsibilities.

¹⁵*Report of the Commission to Assess US National Security Space Management and Organization*; Hon. Donald H. Rumsfeld, Chairman (2001); *Joint Task Force on Acquisition of National Security Space Programs*, Defense Science Board and Air Force Scientific Advisory Board (2003); *Leadership, Management, and Organization for National Security Space Report*, Institute for Defense Analyses (2008); and *Report on Challenges and Recommendations for United States Overhead Architecture*, House Permanent Select Committee on Intelligence (2008).

¹⁶The NRO develops Intelligence Community space systems. These systems can be very challenging to develop and expensive to acquire and field.

In conclusion, given the long-standing fragmentation in space leadership and consequent challenges faced by DOD in synchronizing its extensive space enterprise, other, more significant reform measures may deserve a closer look. Our past work has identified some suggested themes for reform that include: (1) streamlining reviews; (2) delegating more decision-making authority to lower levels; (3) increasing unity of national security space decisions between DOD and the NRO; (4) achieving lasting change that cannot be quickly undone and to allow time for the changes to work; and (5) providing sufficient acquisition, execution, and budget authority. Our work has also identified and examined several potential approaches to reforming DOD space acquisitions that were suggested and supported by DOD and expert officials. They include allowing time for the recent PDSA change to work; combining military space functions into one agency; combining Air Force and NRO space acquisition functions into a space acquisition agency; and creating a new military department for the space domain - a Space Force. Except for the first option, these would likely involve significant short-term disruption to DOD's space organizational structure, roles, and responsibilities. Moreover, their consequences would extend far beyond the acquisition arena. Careful consideration of any such changes is therefore essential for helping to ensure a better track record of providing warfighters with the capabilities they need on time and within costs.

Chairman Fischer, Ranking Member Donnelly, and Members of the Subcommittee this concludes my statement. I am happy to answer any questions you have.

GAO Contacts

For further information about this statement, please contact Cristina Chaplain at (202) 512-4841 or chaplainc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement.

Staff Acknowledgments

Individuals who made key contributions to this statement include Rich Horiuchi, Assistant Director; Dr. Nabajyoti Barkakati, Chief Technologist; Erin Cohen; Emily Bond; Jill Lacey; Katherine Lenane; Kristin Van Wychen; Alyssa Weir; and Robin Wilson. Key contributors for the previous work on which this statement is based are listed in the products cited. Key contributors to related ongoing work include Dave Best, Assistant Director; Patrick Breiding; Erin Carson; and Jonathan Mulcare.

Related GAO Products

Defense Acquisitions: Assessments of Selected Weapon Programs. [GAO-17-333SP](#). Washington, D.C.: March 30, 2017.

Global Positioning System: Observations on Quarterly Reports from the Air Force. [GAO-17-162R](#). Washington, D.C.: October 17, 2016.

Defense Space Acquisitions: Too Early to Determine if Recent Changes Will Resolve Persistent Fragmentation in Management and Oversight. [GAO-16-592R](#). Washington, D.C.: July 27, 2016.

Defense Weather Satellites: DOD Faces Acquisition Challenges for Addressing Capability Needs. [GAO-16-769T](#). Washington, D.C.: July 7, 2016.

Defense Weather Satellites: Analysis of Alternatives is Useful for Certain Capabilities, but Ineffective Coordination Limited Assessment of Two Critical Capabilities. [GAO-16-252R](#). Washington, D.C.: March 10, 2016.

Space Acquisitions: Challenges Facing DOD as it Changes Approaches to Space Acquisitions. [GAO-16-471T](#). Washington, D.C.: March 9, 2016.

Space Acquisitions: GAO Assessment of DOD Responsive Launch Report. [GAO-16-156R](#). Washington, D.C.: October 29, 2015.

Space Situational Awareness: Status of Efforts and Planned Budgets. [GAO-16-6R](#). Washington, D.C.: October 8, 2015.

GPS: Actions Needed to Address Ground System Development Problems and User Equipment Production Readiness. [GAO-15-657](#). Washington, D.C.: September 9, 2015.

Evolved Expendable Launch Vehicle: The Air Force Needs to Adopt an Incremental Approach to Future Acquisition Planning to Enable Incorporation of Lessons Learned. [GAO-15-623](#). Washington, D.C.: August 11, 2015.

Defense Satellite Communications: DOD Needs Additional Information to Improve Procurements. [GAO-15-459](#). Washington, D.C.: July 17, 2015.

Space Acquisitions: Some Programs Have Overcome Past Problems, but Challenges and Uncertainty Remain for the Future. [GAO-15-492T](#). Washington, D.C.: April 29, 2015.

Space Acquisitions: Space Based Infrared System Could Benefit from Technology Insertion Planning. [GAO-15-366](#). Washington, D.C.: April 2, 2015.

Defense Acquisitions: Assessments of Selected Weapon Programs. [GAO-15-342SP](#). Washington, D.C.: March 12, 2015.

Defense Major Automated Information Systems: Cost and Schedule Commitments Need to Be Established Earlier. [GAO-15-282](#). Washington, D.C.: February 26, 2015.

DOD Space Systems: Additional Knowledge Would Better Support Decisions about Disaggregating Large Satellites. [GAO-15-7](#). Washington, D.C.: October 30, 2014.

Space Acquisitions: Acquisition Management Continues to Improve but Challenges Persist for Current and Future Programs. [GAO-14-382T](#). Washington, D.C.: March 12, 2014.

U.S. Launch Enterprise: Acquisition Best Practices Can Benefit Future Efforts. [GAO-14-776T](#). Washington, D.C.: July 16, 2014.

Evolved Expendable Launch Vehicle: Introducing Competition into National Security Space Launch Acquisitions. [GAO-14-259T](#). Washington, D.C.: March 5, 2014.

The Air Force's Evolved Expendable Launch Vehicle Competitive Procurement. [GAO-14-377R](#). Washington, D.C.: March 4, 2014.

2014 Annual Report: Additional Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits. [GAO-14-343SP](#). Washington, D.C.: April 8, 2014.

Defense Acquisitions: Assessments of Selected Weapon Programs. [GAO-14-340SP](#). Washington, D.C.: March 31, 2014.

Space Acquisitions: Assessment of Overhead Persistent Infrared Technology Report. [GAO-14-287R](#). Washington, D.C.: January 13, 2014.

Space: Defense and Civilian Agencies Request Significant Funding for Launch-Related Activities. [GAO-13-802R](#). Washington, D.C.: September 9, 2013.

Global Positioning System: A Comprehensive Assessment of Potential Options and Related Costs is Needed. [GAO-13-729](#). Washington, D.C.: September 9, 2013.

Space Acquisitions: DOD Is Overcoming Long-Standing Problems, but Faces Challenges to Ensuring Its Investments are Optimized. [GAO-13-508T](#). Washington, D.C.: April 24, 2013.

Launch Services New Entrant Certification Guide. [GAO-13-317R](#). Washington, D.C.: February 7, 2013.

Satellite Control: Long-Term Planning and Adoption of Commercial Practices Could Improve DOD's Operations. [GAO-13-315](#). Washington, D.C.: April 18, 2013.

Defense Acquisitions: Assessments of Selected Weapon Programs. [GAO-13-294SP](#). Washington, D.C.: March 28, 2013.

Evolved Expendable Launch Vehicle: DOD Is Addressing Knowledge Gaps in Its New Acquisition Strategy. [GAO-12-822](#). Washington, D.C.: July 26, 2012.

Space Acquisitions: DOD Faces Challenges in Fully Realizing Benefits of Satellite Acquisition Improvements. [GAO-12-563T](#). Washington, D.C.: March 21, 2012.

Space Acquisitions: DOD Delivering New Generations of Satellites, but Space System Acquisition Challenges Remain. [GAO-11-590T](#). Washington, D.C.: May 11, 2011.

Space Acquisitions: Development and Oversight Challenges in Delivering Improved Space Situational Awareness Capabilities. [GAO-11-545](#). Washington, D.C.: May 27, 2011.

Space and Missile Defense Acquisitions: Periodic Assessment Needed to Correct Parts Quality Problems in Major Programs. [GAO-11-404](#). Washington, D.C.: June 24, 2011.

Global Positioning System: Challenges in Sustaining and Upgrading Capabilities Persist. [GAO-10-636](#). Washington, D.C.: September 15, 2010.

Defense Acquisitions: Challenges in Aligning Space System Components. [GAO-10-55](#). Washington D.C.: October 29, 2009.

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on [Facebook](#), [Flickr](#), [LinkedIn](#), [Twitter](#), and [YouTube](#). Subscribe to our [RSS Feeds](#) or [E-mail Updates](#). Listen to our [Podcasts](#). Visit GAO on the web at www.gao.gov and read [The Watchblog](#).

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Katherine Siggerud, Managing Director, siggerudk@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800, U.S. Government Accountability Office, 441 G Street NW, Room 7149, Washington, DC 20548

Strategic Planning and External Liaison

James-Christian Blockwood, Managing Director, spel@gao.gov, (202) 512-4707, U.S. Government Accountability Office, 441 G Street NW, Room 7814, Washington, DC 20548

